8th Asian Wetland Symposium

— Wetlands for Sustainable Life —

7–11 November 2017, Saga, Japan

PROCEEDINGS

AWS2017

Edited by
Yukihiro Shimatani, Yoshihiro Natori, Reiko Nakamura

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Contact:
Asian Wetland Symposium 2017 Executive Committee Secretariat
c/o Wetlands International Japan
2F Jono Building 2, 17-1 Nihonbashi-Odenmacho, Chuo-ku,
Tokyo 103-0011, Japan
tel: +81-3-5614-2150 fax: +81-3-6806-4187
E-mail: info@aws2017.org
http://aws2017.org/

Organization of AWS2017

Title
8th Asian Wetland Symposium (AWS2017) —*Wetlands for Sustainable Life*—

Date
7–11 November 2017

Venue
Hotel Grande Hagakure, Saga, Japan

Organizers
Ministry of the Environment of Japan
Wetlands International Japan
Ramsar Center Japan
Japan Wetland Society

Co-organizers
Saga Prefecture
Kumamoto Prefecture
Saga City
Kashima City
Arao City
Ramsar Regional Center - East Asia
International Lake Environment Committee Foundation
Wetland Link International Asia

Supporters
Ministry of Foreign Affairs of Japan
Ministry of Agriculture, Forestry and Fisheries of Japan
Ministry of Land, Infrastructure, Transport and Tourism of Japan

Collaborators
Ramsar Convention Secretariat
UNEP Regional Office for Asia and the Pacific
IUCN Asia Regional Office
Keidanren Committee on Nature Conservation
Domestic Committee for Ramsar Sites related Municipalities in Japan
Youth Ramsar Japan
Institute of Decision Science for a Sustainable Society of Kyushu University

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Asian Wetland Symposium 2017 Executive Committee Secretariat
Chief of Secretariat: Emiko Nagakura
Deputy Chief: Reiko Nakamura

c/o Wetlands International Japan
2F Jono Building 2, 17-1 Nihonbashi-Odenmacho, Chuo-ku,
Tokyo 103-0011, Japan
tel: +81-3-5614-2150 fax: +81-3-6806-4187
E-mail: info@aws2017.org
http://aws2017.org/

Introduction

Yukihiro Shimatani
President, Asian Wetland Symposium 2017 Executive Committee

The Asian Wetland Symposium (AWS) 2017 with a theme "Wetlands for Sustainable Life" was held in Saga, Japan from 7 to 11 November 2017. The organizers were the Ministry of the Environment of Japan, Wetlands International Japan, Ramsar Center Japan, and Japan Wetland Society. The co-organizers were Saga Prefecture, Kumamoto Prefecture, Saga City, Kashima City, Arao City, Ramsar Regional Center – East Asia, International Lake Environment Committee Foundation, and Wetland Link International Asia. There were approximately 470 participants including about 150 overseas participants from 27 predominantly Asian countries and regions.

This book compiles the results of the symposium.

Following the first AWS that was held in Otsu and Kushiro, Japan in October 1992, the symposium has been held in Malaysia, India, Vietnam, China, and Cambodia, and this AWS Saga 2017 was the 8th meeting of the symposium. Also, the year 2017 marks the 25th anniversary of the first AWS.

The first AWS was co-organized by NGOs and the government of Japan. It was an epoch-making experiment at that time. The NGO Ramsar Center Japan planned to organize a symposium in order to increase the number of Contracting Parities to the Ramsar Convention in Asia. The Environment Agency (Now the Ministry of the Environment) invited 5th Meeting of the Conference of the Contracting Parties (COP5) of the Convention held in Kushiro, 1993 and planned the Pre-COP5 Meeting in 1992. Therefore, the Secretary General of the Convention recommended that the Environment Agency and Ramsar Center Japan jointly organize the symposium.

A Conference of the Contracting Parties (COP) is an intergovernmental meeting. Compared with COP, AWS is a regional forum that provides opportunities to diverse target groups such as policymakers, managers, NGOs, donors, promoters, academicians, researchers, practitioners and students, to share and learn knowledge, wisdom and practical experience on conservation, sustainable management and wise use of wetlands in Asia. Its usefulness was also recognized in the Resolution IX.19: "The importance of the regional wetland symposia in effectively implementing the Ramsar Convention" and it endorsed the continuation of the periodic Asian Wetland Symposia.

In the past 25 years, the number of Ramsar Sites was increased from 9 to 50 in Japan. The number of NGOs engaging with conservation of local wetlands and their biodiversity has been increased. There is progress in activities by municipalities related to Ramsar Sites in Japan. The wetland environmental education targeting the next generation was also implemented, and on the academic side the Japan Wetlands Society was established. In Asia, the number of the Contracting Parties to the Ramsar Convention was increased from 11 countries to 33 countries, and collaboration among parties is also progressing.

On the other hand, conservation and wise use of wetlands, participation of relevant stakeholders, and concrete planning and management have not achieved sufficient results. In addition, issues such as climate change, sea level rise, intensification of natural disasters, etc.: which were not well recognized 25 years ago, became a big problem. The function of wetlands to contribute to disaster risk reduction has been drawing attention.

Based on this background, the overall objective of AWS 2017 was to review achievements, practices, progress, and challenges related to conservation and wise use of wetlands in Asia in the past quarter century, and consider what should be done: looking towards the next quarter century and beyond, to mainstream conservation and wise use of wetlands in order to contribute to the Ramsar Strategic Plan 2016 – 2024, the Aichi Biodiversity Targets and the Sustainable Development Goals (SDGs).

In nine sessions, a total of 68 oral presentations and questions and answer sessions were held. There were also 109 presentations in total in the poster sessions, and those poster presentations were conducted interactively and with active involvement by participants. Topics of sessions were as follows: Wetlands and Disaster Risk Reduction / Climate Change, Wetlands and Policy / Changes / International Cooperation, Wetlands and Use of Natural Resources / Agriculture / Fisheries / Food Security, Urban Wetlands / Wetland City / Natural Infrastructure, Wetlands and Youth, Wetlands and Sustainable Tourism, Wetlands and Culture, Wetlands and CEPA (Communication, Capacity building, Education, Participation and Awareness) / ESD (Education for Sustainable Development), and Wetlands and Biodiversity / Restoration / Reintroduction.v

In the afternoon of the first day, "Ariake Sea Session" had 9 presentations on how the nature and people around the Ariake Sea are related and people received benefits from the sea. In addition, the Mayors Roundtable was held among three local city mayors with tidal flats Ramsar Sites along the Ariake Sea and the Suncheon City Mayor of the Republic of Korea.

Three field visits of the Saga course, Kashima course, and Arao course were held on the third day.

In the afternoon on the fourth day, the "Saga Statement" was adopted after discussions with the participants. On 11th November, a public symposium was held and AWS 2017 was closed. In order to avoid the Saga Statement becoming too long, the text describes only the most important points of all sessions, and the points discussed at each session were included in the Annex.

The results of AWS 2017 including the Saga statement were input to the Ramsar Pre-COP13 Asia Regional Meeting held in Sri Lanka in February 2018, and will be input to the COP13 to be held in Dubai in October 2018.

The Japan Wetland Society, which is in the 10th year since its establishment, became an organizer as an initiative to start international efforts, and it was an opportunity for the academic society to gain good experience. Also, it seems that it was a good experience for the youth to train themselves to plan and organize the "Wetlands and Youth" session to cultivate young people who will be responsible for the next generation. In addition, the cooperation among the three municipalities and stakeholders of Ramsar Sites along the Ariake Sea, Higashiyoka-higata, Hizen Kashima-higata, and Arao-higata were further strengthened.

Finally, AWS 2017 became very fruitful, in large part through the local cooperation with Saga Prefecture, Saga City, Kashima City, Arao City, Kyushu University, Saga University, and several NGOs. They are members of the Local Organizing Committee and worked together with the Executive Committee. I would like to express my sincere gratitude for their hard work and hospitality.

Saga Statement

Asian Wetland Symposium
Saga, Japan
7 to 11 November 2017

Introduction

1. RECOGNIZING the 25 years of Asian Wetland Symposiums (AWS) held in Japan, Malaysia, India, Vietnam, China, and Cambodia, that have contributed to understanding wetlands in Asia, influencing national and international wetland policies and plans, and promoting conservation and wise use of wetlands. Additionally ACKNOWLEDGING the statements from the previous seven AWS and the publication of the history of the AWS in the period 1992–2017;
2. ACKNOWLEDGING the importance of AWS 2017 in Saga City, Japan from 7th to 11th November, with the theme "Wetlands for Sustainable Life", with the overall objective to review achievements, practices, progress, and challenges faced related to conservation of wetlands in Asia and consider what should be done to mainstream conservation and wise use of wetlands. The AWS hosted 470 participants from 27 countries and regions;
3. NOTING Saga City faces the Ariake Sea, Kyushu encompassing the tidal flats i.e. Arao-higata, Hizen Kashima-higata, Higashiyoka-higata, that have been designated as Ramsar Sites, where the water systems provide valuable ecosystem services and have been traditionally used by local people, leading to the adoption of the Saga Water Statement (Saga Mizu Sengen) in 2003;
4. RECOGNIZING the increasing severe impacts of disasters being accelerated by climate change, and the fact that Asia is the most disaster prone region in the world, and the damage caused by floods that occurred very recently in northern Kyushu in July 2017;
5. RECALLING the Aichi Biodiversity Targets, the Sendai Framework on Disaster Risk Reduction 2015–2030, Sustainable Development Goals and other relevant international treaties such as the Convention on Wetlands, the Convention on Biological Diversity and the Paris Agreement of the United Nations Framework Convention on Climate Change;
6. AWARE OF the keynote presentations, nine oral sessions and field visits to the Ariake Sea and important tidal flats including Ramsar Sites. Innovative sessions at the AWS included Ariake Sea Session, Youth Session, Mayor's Roundtable, Participatory Poster Sessions, which were highlighted as that accelerated proactive communication among different stakeholders and generations; and
7. RECOGNIZING the usefulness of interactive and participatory poster sessions not only to promote effective peer-learning that can overcome barriers among various generations, stakeholders, cultures and academic backgrounds, but also to support future actions on the ground.

We, the participants of this symposium, declare as follows;

1. Enhance Networking and Collaboration among wetland sites

We affirm the recommendation of the Mayor's Roundtable on the importance of cooperation and collaboration (local, national and international) between Ramsar Sites and other wetlands with common characteristics and context for effective conservation and wise use inspired by champions at each site, and informed by both good and poor practices.

2. Ensure a Holistic Approach to Conserve Coastal Wetland Ecosystems

We have learned from the history and ongoing research of Ariake Sea including the serious damages caused by large scale developments at other coastal sites across the region, we must take a holistic approach at landscape level. We also need to work at appropriate scales to conserve, restore coastal wetland ecosystems throughout Asia.

3. Implement Ecosystem-based Disaster Risk Reduction (Eco-DRR)

We recognize the importance of Eco-DRR actions on the ground by combining with traditional practices and scientific knowledge, quantifying its effectiveness through research, and pursue its incorporation into policies, legal frameworks or administrative measures at national and local levels.

4. Conserve and Revive Urban Wetlands

We recognize the important role of urban as well as peri-urban wetlands in providing ecosystem services and in sustaining and re-establishing the connection between humans and nature. Therefore we call for urban wetlands to be incorporated into urban land use planning and legal frameworks, CEPA for urban decision makers, private developers to be encouraged to adopt good practices so that they can be conserved and restored as healthy ecosystems.

5. Encourage Responsible Wetland Tourism

We highlight that conserving wetland ecosystems can serve as the foundation for successful implementation of responsible tourism (e.g. Suncheon Bay (R.O. Korea) and Chilika Lake (India)), which can be a model to achieve economic development and wetland conservation.

6. Enhance Local Production Initiatives in Wetlands

We learn from many best practices introduced by various participants, e.g. by appropriate branding such as Ramsar Logo, which demonstrate that sustainable agriculture, fishery or forestry could not only revitalize local communities by providing added-values to local economies, but also maintain and rehabilitate wetlands.

7. Ensure Youth Leadership in Wetland Conservation

We recognize the capacity of youth to exchange ideas between various stakeholders, build networks, andactively participate in various wetland conservation actions. We expect youth leadership to enable the AWS to continue its vital contribution to effective wetlands management.

8. Deliver CEPA Programs that lead to Direct Conservation Actions

We acknowledge the importance of structured, targeted and long-term approach supported by sustainable finance and skilled staff to deliver CEPA program which leads to positive conservation outcomes on the ground. We need to replicate and disseminate those good practice across the region through existing structures and partnerships.

We urge all Contracting Parties to the Convention on Wetlands, organizations, participants and concerned citizens to build upon the first 25 years of the AWS to ensure the AWS continues to fill its vital role into the future.

Lastly, thanking the Government of Japan, Saga Prefecture, Kumamoto Prefecture and Saga City, Kashima City, Arao City, Ramsar Regional Center-East Asia and all sponsors and supporters for their generosity and hospitality in successfully hosting the Asian Wetland Symposium in Saga, from 7th to 11th November 2017.

And that the organizers seek the support and assistance of the Government of Japan to convey this statement to the forthcoming Asian Regional Meeting on the Convention on Wetlands, the 13th Meeting of the Conference of the Contracting Parties to the Convention to be held in Dubai in October 2018.

Saga, 10 November 2017

Annex

The Saga Statement highlights the most significant messages extracted from all the sessions of the AWS 2017. This Annex illustrates the key discussion points and specific examples that are not included in the Saga Statement, but are considered to be particularly important.

Ariake Sea (including Field Visits)

1. Tidal flats ("Higata" in Japanese) nurture not only numerous living organisms but also a variety of culture that was born through wise use of wetlands. In order to pursue a truly sustainable society, we must make efforts to hand over both rich biodiversity and the culture derived from tidal flats to our future generations.
2. Three courses of field visits, namely the Saga Course, Kashima Course and Arao Course were organized in and around the three Ramsar Sites in Ariake Sea. In Saga Course, we recognized the potential of attractive eco-tourism program in Saga, where tourists can enjoy and learn about wetlands comprehensively, not only on the ecosystems of river and tidal flats, but also on wise use and cultural values of wetlands. In Kashima Course, we acknowledged that wetlands play an important role in purifying water, realizing the growth of Sake (Japanese rice wine) industry, which now serves as a main pillar of the local community's economy. In Arao course, we understood that we should not rely on a single income source from tourism alone; it is better to pursue multiple income sources for a more sustainable economy. Since Ariake Sea is blessed with rich wetland products such as crabs, fish and seaweeds, combining tourism with such wetland based industries would enable the region to promote sustainable economic development. Another important finding was that a traditional land reclamation method used in Japan for four hundred years may serve as a low cost and an environmentally-friendly technique, compared to the modern technology.

Wetlands and Disaster Risk Reduction / Climate Change

1. Recognizing the increasing impacts of disasters accelerated by climate change particularly in the Asian region, and confirming the wetland's huge potential for ecosystem-based disaster risk reduction (Eco-DRR) and climate change mitigation and adaptation, we should further strengthen international partnerships to promote sharing of knowledge (including scientific, traditional, local knowledge and good/poor practices).

2. Recognizing the huge carbon stock of mangroves and sea grass beds (i.e. Blue Carbon), peatlands and soil, we should further promote research and effective countermeasures to reduce the carbon emissions from wetlands and watersheds. Check dams that may prevent soil erosion, and prevention of peatland fire through introduction of non-burning agriculture techniques were discussed as some of the countermeasures for climate change mitigation.
3. Recognizing the rapid change of the socio-economic and environmental status of each region, local self-governance should be strengthened to enable community-based adaptive management. In order to strengthen local self-governance, we should provide sufficient opportunities for the local, vulnerable communities to participate in decision making processes (e.g. develop village action plans) through effective facilitation.

Wetlands and Policy / Change / International Cooperation

1. Recognizing the fact that a significant number of wetlands in the Asia-Pacific is transboundary, we recommend that monitoring data should be shared through an international network, and such data should be effectively utilized in identifying the issues and in promoting collaborative actions for wetland conservation through regional and international cooperation in the Asia-Pacific.
2. Learning from the experience of conserving Black-faced Spoonbills, usage of attractive and/or daily accessible tools (e.g. fashion goods and social networking services) is recommended to connect various stakeholders in different generations, which can form a basis of regional and international cooperation.

Wetlands and Use of Natural Resources / Agriculture / Fisheries / Food Security

1. Recognizing the increasing impacts of climate change on the livelihoods of vulnerable communities, we recommend to develop and disseminate climate-resilient sustainable agriculture/fisheries techniques (e.g. water saving agriculture) throughout the Asia-Pacific region.
2. The experience of the Locally Managed Marine Areas (LMMA) in Fiji is considered as a form of Satoumi. Community-driven wetland management based on traditional governance systems involving traditional knowledge, customary tenure and resource access, traditional decision making processes, traditional social networks are capable of enhancing pride, ownership, adaptive capacity, and collective community efforts in sustainably managing the wetlands.
3. Learning from the good practices in producing the White Stork's Rice, more efforts should be made to develop and extend techniques that can restore wildlife habitats in the landscapes of agriculture/fisheries (e.g. maintaining water for a longer period in rice paddies).

Urban Wetlands / Wetland City / Natural Infrastructure

All the key messages from this session were included in the Saga Statement.

Wetlands and Youth

1. We, the youth, should make further efforts in conducting a wide variety of attractive activities such as singing, dancing, cooking, drawing, making exhibits in festivals etc. particularly in public institutions including schools, community centers, hospitals, nursing homes, etc. in order to promote CEPA among people with low environmental awareness.
2. We, the youth recognize the necessity to brush up our knowledge and skills in order to make more contributions in the future. We would like to make further efforts not only to obtain scientific knowledge but also to train our communication / presentation / facilitation skills from professionals through actively participating in volunteer activities or internships related to wetland conservation.

Wetlands and Sustainable Tourism

1. Based on the past experiences, we learned that local communities with abundant knowledge on local natural resources have a potential to play a significant role in alleviating the negative impacts of tourisms on natural ecosystems. Involvement of local communities should therefore be further promoted in order to pursue responsible tourism.
2. Recalling the Ramsar Convention on Wetlands, we recommend to provide tourists with on-the-site experience at wetland sites (e.g. enjoying food directly harvested from wetlands), so that the connection between tourists and wetlands will become stronger, and the tourists' motivation toward wetland conservation and wise use will be enhanced.
3. Entry fees, Crab Banks (increasing crab population and utilize the crabs as tourism resources) and utilization of payment for ecosystem services are considered as good practices to simultaneously realize wetland conservation and income generation through sustainable tourism. In addition, appropriate regulatory control and environmental monitoring should also be conducted to ensure responsible tourism.
4. Recognizing the fact that the correct definition of "sustainable tourism" under the World Tourism Organization is not being utilized properly, more efforts should be made to disseminate the proper definition.

Wetlands and Culture

1. Cultures do not derive from unused and forgotten wetlands. Since wetland cultures need many years to develop, having wetland culture is a synonym that wetland has been wisely used.
2. Among the major ecosystem services (functions for provision, control and culture), it should be noted that provision function including supply of food, water, housing, clothes are all deeply connected with culture.
3. Wetlands have site-specific, symbolic values for local people. These values have potential to serve as the most powerful driving force for wetland conservation from a bottom-up approach.
4. Not only nature with limitation of seasonality, but also culture is an indispensable part of sustainable tourism to invite more visitors.
5. To clarify the characteristics of Asian wetland cultures, comparison with those of other regions would be beneficial in the next step.

Wetlands and CEPA / Education for Sustainable Development

1. Wetland centers are places where people and wildlife interact and when any activity related to communication, capacity building, education, participation, and awareness (CEPA) occurs that contribute to wetland conservation. The Ramsar Convention on Wetlands recognizes wetland centers as key places for learning about the conservation and wise use of wetlands through CEPA interventions, and as catalysts for activities that support the implementation of the Fourth Ramsar Strategic Plan 2016-2024 (Ramsar COP12 Resolution XII.9). Wetland centers are important vehicles that convey messages and encourage behavior change and actions for wetland advocates and stakeholders.
2. Wetland centers can maximize their impact by joining a network of wetland centers. Through the network, expertise, resources, experience and best practices are shared among the members of the network. Wetland centers can be linked at the sub-national, national and international levels. Wetland Link International (WLI) is a global network of wetland centers that supports the development of new and enhancement of existing wetland centers. WLI - Asia facilitates the coordination among members in Asia. The Ramsar Regional Center - East Asia (RRC-EA) currently acts as the Secretariat of WLI-Asia.

Wetlands and Biodiversity / Restoration / Reintroduction

1. Confirming the research outcomes that indicate a higher productivity in sites with higher biodiversity, we recognize that maintaining ecosystem services derived from biodiversity can serve as the foundation for improved agriculture and fisheries practices in the long run.
2. Learning from the experiences of Nakaumi Lake, movements by local communities can play a key role in preventing negative impacts from development projects, and promoting designation of wetlands as Ramsar Sites. However, due to lack of coordination among stakeholders, community-based management alone is not sufficient to prevent wetland degradation. Comprehensive strategy combining political, economic, social and technological approach would be necessary to conserve wetlands in the long term.

Program (6–11 November 2017)

6 (Mon) November		
9:00 – 18:00	**6th Wetland Link Internatioanl-Asia Conference**	Flower Hall C (2nd Floor)
14:00 – 18:00	**On-site registration of AWS2017**	In front of Flower Hall (2nd Floor)

7 (Tue) November		
8:30 –	**On-site registration**	Entrance Lobby (1st Floor)
9:30	**Opening of AWS2017**	Flower Hall (2nd Floor)
9:30 – 10:00	**Opening Ceremony**	
10:00 – 11:40	**Plenary keynote presentations**	
10:00 – 10:25	**The Ramsar Convention on Wetlands towards the Sustainable Development Goals** Lew Young, Senior Regional Advisor for Asia – Oceania, the Ramsar Convention Secretariat	
10:25 – 10:50	**Conservation Strategy on Wetlands and Biodiversity of Japan** Naohisa Okuda, Biodiversity Policy Division, Nature Conservation Bureau, Ministry of the Environment, Japan	
10:50 – 11:15	**The 25th Anniversary of AWS and the Prospects for the Next 25 Years** Hiroji Isozaki, Visiting Professor of Sophia University	
11:15 – 11:40	**Restoration of Chilika Lake: A Journey from Montreux Record to Ramsar Wetland Conservation Award, and the Way forward** Ajit K. Pattnaik, Vice President, Wetlands International South Asia	
11:40 – 13:30	**Lunch Break**	
12:00 – 13:00	**Side Event: Commemorating 25th Anniversary of Asian Wetland Symposium** *Organizer:* Ramsar Center Japan	Flower Hall (2nd Floor)
13:30 – 16:00	**Ariake Sea Session** *Convener:* Gunji Aramaki / Yasuhisa Henmi / Yuichi Hayami	Flower Hall (2nd Floor)
13:30 – 16:00	**Characteristics of the Marine Environment in Ariake Sea** Yuichi Hayami, Saga University	
	Animals and Plants in Tidal Flat of Ariake Sea Yasuhisa Henmi, Kumamoto University	
	Reproduction of Mudskippers: Aerial Embryos Developing in a Mudflat Burrow Atsushi Ishimatsu, Nagasaki University	
	Wild Birds in Ariake Sea (Past, Present, and Future) Akiyuki Miyahara, Wild Bird Society of Japan, Saga	
	Toward Restoration of Ariake Sea by Means of an Integrated Studies "CoHHO" Collaborated with Its Relevant Social Movement "The Sea is Longing for the Forest" Masaru Tanaka, Kyoto University	
	Efforts toward Revitalization and Creation of Ariake Sea Yoshiyuki Kawakami, Ariake Bay Rehabilitation Organization	
	Traditional Fisheries of Ariake Sea Kango Nakao, MAE-UMI Citizens' Association, independent photographer	
	Festival and Culture in Ariake Sea Coastal Area Gunji Aramaki, Specified Nonprofit Corporation, Ariakekai Gururin Net	
	The History of Nori Farming in Tokyo Bay and Trial to Pass Down It to Later Generation Fumihiro Koyama, Nori no furusato kai (Omori Nori Museum)	
16:00 – 16:10	**Introduction of National Geographic Society – Asia** Jay Lee, National Geographic Society – Asia	
16:10 – 16:15	**Introduction of Nagao Natural Environment Foundation and Its Research Grant** Tomoko Oizumi, Nagao Natural Environment Foundation	
16:15 – 16:40	**Break**	
16:40 – 18:10	**Mayors Roundtable: Conservation and Wise Use of the Ramsar Sites** *Coordinator:* Yukihiro Shimatani	Flower Hall (2nd Floor)
16:40 – 18:10	*Presentation by* **Toshihiko Asada,** Mayor of Arao City *Presentation by* **Hisatoshi Higuchi,** Mayor of Kashima City *Presentation by* **Yasumori Mikuriya,** Deputy Mayor of Saga City *Presentation by* **Choong Hoon Cho,** Mayor of Suncheon City, Korea **Discussion**	
18:10 – 18:30	**Break**	
18:30 – 20:30	**Welcome Reception**	Harmony Hall (1st Floor)

8 (Wed) November		
8:30 –	**On-site registration**	In front of Flower Hall (2nd Floor)
9:00 – 11:30	**Session 1: Wetlands and Disaster Risk Reduction / Climate Change**	Flower Hall B and C (2nd Floor)
9:00 – 9:25	***Keynote:*** **The Role of Wetlands for Disaster Risk Reduction** Naoya Furuta, Taisho University / IUCN	

9:25 – 9:40	**Carbon Retention in Sediment by Check Dams in Phayao Province, Thailand** Chotiwut Techakijvej, Chiang Mai University	Flower Hall B and C (2nd Floor)
9:40 – 9:55	**Evaluating the Impacts of Hydrological Variations on Carbon Fluxes in Tropical Peatlands** Chandrashekhar Deshmukh, Asia Pacific Resources International Limited (APRIL)	
9:55 – 10:10	**Lessons Learned in Building Community Resilience: 100 Villages on the Bank of 3rd Largest River System of Peninsula of India in 5 years** Saswata Kumar Mohapatra, NET – COAST	
10:10 – 10:25	**Impact of Climate Change on the Wetlands of Bangladesh** Sanowar Hossain, Bangladesh POUSH	
10:25 – 10:40	**Reducing Fire on Peatlands in Indonesia – Experiences and Lessons Learnt from an International Cooperation Project in West Kalimantan,Indonesia** Yuki Arai, University of Tokyo / Japan Wetlands Society	
10:40 – 10:55	**Interventions for Wetland Conservation in the Pampanga River Basin and Candaba Wetlands, Philippines** Minerva J Martinez, Department of Environment and Natural Resources, Philippines	
10:55 – 11:10	**Huge Water Channel Construction Project with Nature and Human Friendly Approach in the Sendai River** Kiyofumi Kobayashi, Kyushu University Graduate School of Engineering	
11:10 – 11:25	**Wetlands for a Disaster Resilient Asia: Legal Agenda** Amado Jr. Samala Tolentino, Ramsar Center Japan	
9:00 – 11:30	**Session 2: Wetlands and Policy / Changes / International Cooperation**	Flower Hall A (2nd Floor)
9:00 – 9:25	***Keynote:* China's New National Policy on the System of Wetland Conservation and Restoration** Yan Fang, State Forestry Administration, China	
9:25 – 9:40	**Ramsar COP as a Turning Point of Awareness and the Present Activities: Some Cases to Promote Local Awareness through International Collaboration and Understanding Impressing with the Concept of Wise Use** Yoshikatsu Kikuchi, Kushiro International Wetland Centre	
9:40 – 9:55	**Spoon – billed Sandpiper Conservation in the Internationally Importance Wetland Gulf of Mottama** Pyae Phyo Aung, Biodiversity And Nature Conservation Association (BANCA)	
9:55 – 10:10	**The Montreux Record under the Ramsar Convention: An Eeffective Mechanism for Promoting State Party Compliance?** Evan Hamman, Queensland University of Technology	
10:10 – 10:25	**The Establishment of Southeast Asian Limnological Society Network SEAL – Net** Mashhor Mansor, Universiti Sains Malaysia	
10:25 – 10:40	**Team SPOON: Creating Connection of People and Nature for Sustainable Society and East Asia Peace** Akane Tokorodani, Tokyo Institute of Technology and Team SPOON	
10:40 – 10:55	**Yellow Sea Region Coordinated Waterbird Survey** Kelin Chen, Wetlands International – China	
10:55 – 11:10	**Opportunities to Promote Cooperation on the Conservation and Wise Use of Wetlands between Asia and the Pacific** Solongo Khurelbaatar, Ramsar Convention on Wetlands	
11:30 – 13:30	**Lunch Break**	
11:30 – 12:00	**Core time for Poster Session I** *During this core time, each poster presenter is required to stand at the front of his/her poster to explain to and discuss with the audience	Symphony Hall (2nd Floor)
11:30 – 13:30	**Session 5 -1: Wetlands and Youth – Part 1**	Ariake Room (3rd floor)
11:30 – 13:30	***Keynote:* The Environmental Activities of Youth Ramsar Japan (YRJ), NGO Organized by Students Ranging from Junior High School Students to Graduate Students** Takuma Satoh, Youth Ramsar Japan	
	Fundamental Study on Conservation and Restoration of River Estuaries Habitat - Classification of Estuary and Their Transitions since 1900s Atsushi Tanabe, Kumamoto University	
	The Value of Wetlands and What We Students Should Do for It — Take Hengshuihu Wetlands for Example Yiqing Hu, Wetlands International-China	
	My Observation of Satus of Wetland Wenling Kou, Beijing University Affiliated High School	
	Obligation to the Wetland Conservation of the Youth Ruichen Zhang, Beijing No. 14 High School	
	The Youth Frontier Transforming Waste to Wealth – A Case of Novel Efforts by Young Entrepreneurs towards the Struggle for Depolluting the Holy River Ganges Sreeya Patnaik, Xavier Institute of Management	
	Can youth help wetlands? Fumi Kasahara and Ibuki Kurumatuka, Osaki Ikimono club	
	CEPA activities of Taishi High School Science Club Takahiro Fukushima, Kumamoto Prefectural Taishi High School	

11:30 – 13:30	**Activities of Yonago Waterbird Sanctuary Jr.Ranger Club to Foster Mind for Protecting Wonderful Our Local Nature to the Next Generation** Hiromi Hayashi, Yonago waterbird sanctuary, Ranger Club	Ariake Room (3rd floor)
	Youth-in-Action for Ecosystem-based Disaster Risk Reduction (Eco-DRR) and Ecosystem-based Adaptation (EbA) Darry Shel Malla Estorba, Society for the Conservation of Philippine Wetlands, Inc	
	The Study of Grey Water Footprint of Inorganic-Rice Cultivation for The Lower Central Plain Management in Thailand: Case Study in Nakhonchaisi District, Nakhon pathom Province Nichakant Kerdnamchai, Mahidol University	
	River Continuum Concept and Ecological Health Monitoring of Loei River, North-Eastern Thailand Thanayaporn Katesuja, Chiang Mai University	
12:00 – 13:00	***Side Event:* Population Decline of Migratory Waterbirds and Habitat Changes – Shorebirds as Indicators** *Organizers:* EAAFP Secretariat / Ramsar Network Japan / BirdLife International Tokyo	Flower Hall A (2nd Floor)
12:00 – 13:00	***Side Event:* Why Otters Are Recovering Elsewhere in the World?** *Organizers:* Otter Research Group Japan / Ramsar Center Japan	Flower Hall B and C (2nd Floor)
13:30 – 15:30	**Session 3: Wetlands and Use of Natural Resources / Agriculture / Fisheries / Food Security**	Flower Hall B and C (2nd Floor)
13:30 – 13:55	***Keynote:* Living in Harmony with Nature** Muneharu Nakagai, Toyooka City	
13:55 – 14:10	**Lake Urmia Restoration via Local Community Participation in Sustainable Agriculture** Neda Asad Falsafi Zadeh, Iran Department of Environment	
14:10 – 14:25	**Response of Freshwater Farmers to the Environmental Changes: a Case Study of Thailand** Suvaluck Satumanatpan, Mahidol University	
14:25 – 14:40	**National Reclamation Project and "Ariake Sea Disaster": "Open – gate Survey" for the Harmony of Healthy Fishery and Agriculture** Tamotsu Sugenami, The Ariake Sea Network of Fishermen and Citizens	
14:40 – 14:55	**Locally Managed Marine Areas (LMMAs) – A Pathway to Holistic and Integrated Island Management and Sustainable Development: A Fiji Case Example** Alifereti Tawake, Network International, Fiji	
14:55 – 15:10	**New Forest Commons towards Solving the Underuse of Satoyama from Fishers' Initiatives in Japan** Shimpei Iwasaki, Fukuoka Women's University	
13:30 – 15:30	**Session 4: Urban Wetlands / Wetland City / Natural Infrastructure**	Flower Hall A (2nd Floor)
13:30 – 13:55	***Keynote:* Urban Wetlands and Governance Challenges in the Two Indian Mega Cities of Chennai and Bengaluru** Sandhya Chandrasekharan, Centre for Biodiversity Policy and Law CEBPOL of the National Biodiversity Authority	
13:55 – 14:10	**Making a Wooden Footbridge Connecting Nature and People in an Artificial Wetland** Akihiko Higuchi, Kyushu University	
14:25 – 14:40	**Conservation of Karang Mumus River and Swamps di North Samarinda: Efforts by Clean Karang Mumus River Movement and Stakeholders' Responses** Martinus Nanang, Mulawarman University	
14:40 – 14:55	**Horseshoe Crab Habitat Conservation and Coastal Zone Management in Japan** Satoquo Seino, Kyushu University	
14:55 – 15:10	**Urban Wetlands and Mosquito Born Disease Problem in Chiang Mai, Thailand** Panida Rahong, Chiang Mai University	
15:10 – 15:25	**Wetland Services for Elementary Urban Planning: Perspective from Bangladesh** Abu Jubayer, Local Government Engineering Department (LGED)	
15:30 – 16:00	**Break**	
16:00 – 18:00	**Session 5-2: Wetlands and Youth – Part 2** Discussion based session among young particpants on the theme of "What kind of activities can youth do for the conservation and wise use of wetlands in the future?"	Flower Hall B and C (2nd Floor)
16:00 – 18:00	**Session 6: Wetlands and Sustainable Tourism**	Flower Hall A (2nd Floor)
16:00 – 16:25	***Keynote:* Entry Fees for Environmental Services in Community Based Ecotourism: An Experience from Bishazaari Wetland of Nepal** Maheshwar Dhakal, Ministry of Forests and Soil Conservation, Nepal	
16:25 – 16:40	**To Bring Awareness of Appreciation for the Culture & Environment by Providing Low Impact Activities that Promote Conservation & Preservation through Socially Responsible and Environmentally Sensitive Interaction with People, Landscape and Ecosystems** Kasimiro Talemaivatuwiri Taukeinikoro, Rivers Fiji Ltd	
16:40 – 16:55	**Promoting the Implementation of Environmental Treaties for Sustainable Tourism: In the Light of the Ramsar Convention** Shiina Suzuki, Sophia University Graduate School of Global Environment	Flower Hall A (2nd Floor)
16:55 – 17:10	**Biodiversity Value of Meinmahla Kyun Wildlife Sanctuary Ramsar Site and Development of Ecotourism for the Communities** Zau Lunn, Fauna & Flora International – Myanmar	
17:10 – 17:25	**Initiative by the Reformed Bird Hunters of Mangalajodi Marsh, Chilika Lake, India for Successful Conservation of Biodiversity and Sustainable Tourism** Ajit Kumar Pattnaik, Wetlands International South Asia	
17:25 – 17:40	**Integration of Visits to Crab Banks in Sustainable Tourism** Sansanee Choowaew, Mahidol University	

18:00 – 18:30	**Break**	
18:00 – 18:30	**Core Time for Poster Session II** *During this core time, each poster presenter is required to stand at the front of his/her poster to explain to and discuss with the audience	Symphony Hall (2nd Floor)
18:30 – 20:30	**Session 7: Wetlands and Culture**	Flower Hall A (2nd Floor)
18:30 – 18:55	***Ketonte:* Wetland Culture in Conservation: Meaning, Concept & Application** Bishnu B. Bhandari, Nepal Wetlands Society	
18:55 – 19:10	**Bio – cultural Diversity and Flood Control in the Kameoka Basin Floodplain** Katsue Fukamachi, Kyoto University	
19:10 – 19:25	**People's Perception towards Wetland Culture** Puspa Lal Pokhrel, Tribhuvan University	
19:25 – 19:40	**Influence of Wetland in the Culture of Bangladesh** Tapas Ranjan Chakraborty, Jahangirnagar University	
18:30 – 19:30	***Side Event:* Learning about Wetlands through Wetland Education Centers** *Organizer:* Ramsar Regional Center -East Asia (RRC-EA)	Flower Hall B and C (2nd Floor)

9 (Thu) November: Filed visits

8:00 – 18:30	**Arao Course**
7:45	Getting together at the entrance hall of Hotel Grande Hagakure
8:00	Bus starting from the hotel (punctually) – 9:40 Isahaya Reclamation Project Site – 11:20 Port Taira – (by ferry) – 12:50 Port Nagasu -13:10 Lunch at Hotel Verde – 14:30 Manda-ko Miike Mining Herigtage – 16:00 Arao -higata Ramsar Site – 18:30 Hotel Grande Hagakure
8:30 – 17:00	**Saga Course**
8:15	Getting together at the entrance hall of Hotel Grande Hagakure
8:30	Bus starting from the hotel (punctually) – 8:50 Saga Eco Plaza – 10:15 Saga Water History Museium - 11:30 Lunch at a local restaurant – 12:15 Higashiyoka-higata Ramsar Site – 14:20 Mietsu Naval Dock Heritage Site – Saga Baloon Museum – 17:00 Hotel Grande Hagakure
9:00 – 17:00	**Kashima Course**
8:45	Getting together at the entrance hall of Hotel Grande Hagakure
9:00	Bus starting from the hotel (punctually) – 10:00 Hizen Kashima-higata Ramsar Site – 11:20 Yutoku Inari Shrine and Lunch – 13:30 Hamayado Historical Walk – 15:00 Michi no Eki and Higata Museum Center – 17:00 Hotel Grande Hagakure

10 (Fri) November

8:30 –	**On-site registration**	In front of Flower Hall (2nd Floor)
9:00 – 11:30	**Session 8: Wetlands and CEPA (Communication, Capacity building, Education, Participation and Awareness) / ESD (Education for Sustainable Development)**	Flower Hall B and C (2nd Floor)
9:00 – 9:25	***Keynote:* Localizing ESD Best Practice for Wetland Conservation- From Mai Po Nature Reserve to South China Region** Lydia Lee, WWF-Hong Kong	
9:25 – 9:40	**Building Capacity of the Local Communities Towards Conservation and Wise Use of Wetlands through CEPA Approach in Eastern Part of India** Durga Prasad Dash, Pallishree	
9:40 – 9:55	**Penang Seagrass Project – An Environmental Education Project to Encourage Volunteerism & Field Educatio** Hong Jing Ng, Nature Classroom, Malaysia	
9:55 – 10:10	**How to Promote Flyway-wide Activities and Involve Key National Stakeholders** Tomoko Ichikawa, East Asian-Australasian Flyway Partnership	
10:10 – 10:25	**Adventure Time in Shezi Island, Tamsui River: Explore Our Hometown** Szu Ting Hsu, Guandu Nature Park	
10:25 – 10:40	**Efforts and Challenges for Coastal Stability and Conservation with Proper Natural Resources Management in Sundarbans Region, Bangladesh** Hideki Sato, Japan Environmental Education Forum (JEEF)	
10:40 – 10:55	**BioBlitz in Hong Kong: Best Practice Sharing in Wetlands CEPA** Jenna Ho Marris, Tai Tam Tuk Eco Education Centre	
10:55 – 11:10	**Development of Wetland School in China** Xiuzhi Yang, Wetlands International-China	Flower Hall B and C (2nd Floor)
9:00 – 11:30	**Session 9: Wetlands and Biodiversity / Restoration / Reintroduction**	Flower Hall A (2nd Floor)
9:00 – 9:25	***Keynote:* Present status and future prospects of the nature restoration in coastal lagoon Lake Nakaumi, Japan** Hidenobu Kunii, The Nature Restoration Committee of Lake Nakaumi	
9:25 – 9:40	**Haor of Bangladesh and Present Scenario** Md Golam Rabbi, Nature Conservation Society	
9:40 – 9:55	**Threats to the Biodiversity Rich Henoko/Oura bay – Ramsar Candidate Site** Mariko Abe, The Nature Conservation Society of Japan	Flower Hall A (2nd Floor)

9:55 – 10:10	**Introduction to Configuration Concept of Aquatic Acrophytes in Lake Ecological Restoration - An Example of Ecological Restoration in Gonghu Bay** Li Yan Qi, Research Association of Wuxi Wetland Protection and Construction	Flower Hall A (2nd Floor)
10:10 – 10:25	**Anthropogenic Decline of the Mudflat-Specific Fauna and Flora in Japan: Significance of the Restoration of the Estuary in Isahaya Bay in the Ariake Sea** Masanori Sato, Kagoshima University	
10:25 – 10:40	**Re-establishment of the Eurasian Otter in South Korea** Sungwon Hong, Pusan National University	
10:40 – 10:55	**Securing Management Measures of Wild Deer in Kushiro Marsh, the First Ramsar Site in Japan** Satoshi Kobayashi, Kushiro Public University	
10:55 – 11:10	**Linking Wetland Bird Ecology with Human Activities in Multiple-Use Wetlands in India** Shivona Suneel Bhojwani, Wildlife Conservation Society-India	
11:30 – 13:30	**Lunch Break**	
11:30 – 12:00	**Core Time for Poster Session III** *During this core time, each poster presenter is required to stand at the front of his/her poster to explain to and discuss with the audience	Symphony Hall (2nd Floor)
13:30 – 16:30	**Plenary Session**	Flower Hall A and B (2nd Floor)
13:30 – 14:15	**Summary of Sessions** *Moderator:* Emiko Nagakura	
14:15 – 15:30	**Discussion on Saga Statement**	
15:30 – 16:00	**Break**	
16:00 – 16:30	**Closing Ceremony** Awarding Ceremony for AWS2017 Poster Award Adoption of Saga Statement	Flower Hall A and B (2nd Floor)
16:30	**Closing of AWS2017**	

11 (Sat) November		
10:00 – 12:30	**Public Symposium in Saga** The symposium aims at sharing the outputs of AWS2017 with local citizens including children and youth activity involved in conservation of wetlands along the Ariale Sea coast. *Working language of this public symposium is Japanese	Higashiyoka Cultural Hall

Poster Session

8 (Wed) November		
9:00 – 12:00	**Poster Session I**	Symphony Hall (2nd Floor)
11:30 – 12:00	**Core Time** *During this core time, each poster presenter is required to stand at the front of his/her poster to explain to and discuss with the audience	
	Presenters of Poster Session I Jitendriya Naik (India) / Xin Qian (China) / Zheng Zang (Cnina) / Maria Retchie Pagliawan (Philippines) / Yukio Nagahama (Japan) / Kengo Kurata (Japan) / Misuzu Aoki (Japan) / Ranjana UK Piyadasa (Sri Lanka) / Tapas Ranjan Chakraborty (Bangladesh) / Choon Beng How (Singapore) / Teruki Hamada (Japan) / Fumiko Taura (Japan) / Prava Pandey (Nepal) / Yasuhiko Takeshita (Japan) / Eriko Takeuchi (Japan) / Eldar Rustamov (Kazakhstan) / Kimihiko Maekawa (Japan) / Kunihito Otonari (Japan) / Naoki Fujii (Japan) / Miho Hiruma (Japan) / Yuji Morimoto (Japan) / Liangzhong Chen (China) / Md Golam Rabbi (Bangladesh) / Asaduzzaman Miah (Bangladesh) / Wardi Kasinath (India) / Hye-Ji Oh (Korea) / Shigeya Nagayama (Japan) / Rika Fukumoto (Japan) / Natsumi Shimada (Japan) / Ryoichi Watanabe (Japan) / Toshihisa Asano (Japan) / Nobumichi Kurosawa (Japan) / Masayuki Takada (Japan)	
13:30 – 18:30	**Poster Session II**	Symphony Hall (2nd Floor)
18:00 – 18:30	**Core Time** *During this core time, each poster presenter is required to stand at the front of his/her poster to explain to and discuss with the audience	
	Presenters of Poster Session II Kiyofumi Kobayashi (Japan) / Muneyuki Nakaji (Japan) / Neda Asad Falsafi Zadeh (Iran) / Hiroshi Tomida (Japan) / Takuji Arai (Japan) / Yoshiyasu Fujimura (Japan) / Muzzalifah Abd Hamid (Malaysia) / Haramaini Arifin (Malaysia) / Tatsuya Shibahara (Japan) / Soichi Okayama (Japan) / Chotika Ya-anan (Thailand) / Chindanai Jaitamart (Thailand) / Thakdanai Paotajai (Thailand) / Anastasia Volkova (Russia) / Yuki Ozaki (Japan) / Haruki Kume (Japan) / Taiyou Kiyota (Japan) / Takuma Ezoe (Japan) / Takahiro Araragi (Japan) / Gea-Jae Joo (Korea) / Joy M. Navarro (Philippines) / Yi-Fen Jan (China [Taiwan]) / Amy M. Lecciones (Philippines) / Eui-Jeong Ko (Korea) / Shigekazu Ichiki (Japan) / Masumi Kimoto (Japan) / Kantaro Tabiraki (Japan) / Hiroshi Matsuura (Japan) / Naoki Fujii (Japan) / Siti Norasikin Ismail (Malaysia) / László Bozó (Hungary) / Po-Hsiu Kuo (China [Taiwan]) / Tomoko Minagawa (Japan) / Takio Sano (Japan) / Rasuna Mishima (Japan) / Sakura Maesaki (Japan) / Takuya Ishibashi (Japan) / Takuma Ono (Japan) / Min Thiha Zaw (Myanmar)	

10 (Fri) November		
9:00 – 12:00	**Poster Session III**	Symphony Hall (2nd Floor)
11:30 – 12:00	**Core Time** *During this core time, each poster presenter is required to stand at the front of his/her poster to explain to and discuss with the audience	
	Presenters of Poster Session III Jun Teramura (Japan) / Ji Yoon Kim (Korea) / Daria Mathew Abullah (Malaysia) / Minoru Kashiwagi (Japan) / Hisashi Takahashi (Japan) / Masayuki Kurechi (Japan) / Norichika Matsuo (Japan) / Kyohei Takizawa (Japan) / Tomoki Takebayashi (Japan) / Satya Prakash Mehra (India) / Takehisa Yamakita (Japan) / Hiroki Mori (Japan) / Yun Yun Wong (Malaysia) / Injun Son (Korea) / Geng Shuyuan (Japan) / Hironori Hayashi (Japan) / Takashi Shimoyamada (Japan) / Acharya Chinmaya Mishra (India) / Irina Ivanovna Volkova (Russia) / Pin-Hsiu Lisa Chou (China [Taiwan]) / Prayitno Goenarto (Indonesia) / Muhammad Iqbal (Indonesia) / Lucita Jasmin (Indonesia) / Wing-Sun Chow (China [Hong Kong]) / Sivasothi N. (Singapore) / Kana Takeyama (Japan) / Kazuki Kanno (Japan) / Kengo Saito (Japan) / Jinen Kita (Japan) / Hiroki Iyooka (Japan) / Masao Nagasaka (Japan) / Mitsuhiro Aizu (Japan) / Takehiro Watanabe (Japan) / Kiwamu Kawaguchi (Japan) / Yuuko Iizuka (Japan)	

Side Event

7 (Tue) November		
12:00 – 13:00	**Commemorating of the 25th Anniversary of Asian Wetland Symposium** Ramsar Center Japan The Special Side Event on the Silver Jubilee Celebration of AWS including a presentation of reviewing report on achievement of AWS titled “Commemorating the 25thAnniversary of Asian Wetland Symposium”and a panel discussion by several key participants who have continoutsly supported the organization of AWS since 1992.	Flower Hall (2nd Floor)
8 (Wed) November		
12:00 – 13:00	**Population Decline of Migratory Waterbirds and Habitat Changes – Shorebirds as Indicators** EAAFP Secretariat / Ramsar Network Japan / BirdLife International Tokyo Japanese wetlands, especially tidal flats, act as significant staging sites for migratory waterbirds of the East Asian-Australasian Flyway.The purpose of this side event is to set an opportunity to share the past and current situation of tidal flats, humans and migratory birds in Japan among different age groups and stakeholders from different regions and countries. It also aims to discuss how we can work together to save existing coastal wetlands in Asia.	Flower Hall A (2nd Floor)
12:00 – 13:00	**Why otters are recovering elsewhere in the world?** Otter Research Group Japan / Ramsar Center Japan The Japanese otter has been red-listed as extinct since 2012. In February 2017, however, an otter was photographed at Tsushima Island, Japan. In Korea, distribution of the Eurasian otter is steadily expanding even in urban environments. In Singapore, during these five years, the smooth-coated otter has settled in modern urban areas and co-existing peacefully with human. Why this wetlands ambassador started to recover elsewhere in the world?	Flower Hall B and C (2nd Floor)
18:30 – 19:30	**Learning about Wetlands through Wetland Education Centers** Ramsar Regional Center – East Asia (RRC-EA) Not many people are aware of the benefits that wetlands offer. Wetlands provide services in the form of water filtration and flood protection, inter alia, and also serve as habitat for a variety of flora and fauna. Thus, raising the awareness of the general public on this topic is important and needs to be carried out through effective ways. Wetland education centers provide a platform to promote and maximize learning about wetlands. This side event intends to highlight good practices being applied by selected wetland education centers in Asia that are members of Wetland Link International (WLI).	Flower Hall B and C (2nd Floor)

Session 4: *Urban Wetlands / Wetland City / Natural Infrastructure*

Session 5: *Wetlands and Youth*

Session 6: *Wetlands and Sustainable Tourism*

Session 7: *Wetlands and Culture*

Session 8: *Wetlands and CEPA (Communication, Capacity building, Education, Participation, Awareness) / ESD (Education for Sustainable Development)*

Session 9: *Wetlands and Biodiversity / Restoration / Reintroduction*

Poster Session I

Poster Session II

Poster Session III

Side Event

Keynote Presentation

The Ramsar Convention on Wetlands towards the Sustainable Development Goals

Lew Young
Secretariat, Ramsar Convention on Wetlands

INTRODUCTION

Today, water is becoming an increasingly important part of our lives, with governments working to ensure that there is sufficient quantity and quality for households, farms and industry to use. A lack of water causes droughts and too much water at the wrong time causes floods. In fact, some 90% of natural disasters are water-related with the majority being in Asia due to the regions many river basins, flood plains and high densities of people in disaster-prone areas (UNISDR-CRED 2015).

As water availability becomes more unpredictable and unevenly distributed due climate change, it also becomes an increasingly valuable resource. Water users are trying to store or extract as much as they can from sources such as rivers for their own uses, without consideration of the needs of those downstream. This results in tensions between countries along transboundary river basins, e.g. the Tigris-Euphrates River Basin and Mekong River Basin, between provinces, e.g. around Lake Urmia (I.R. Iran) and at the site level, such as around the Azraq Oasis (Jordan) with local people illegally construct wells.

Water is stored and delivered by wetlands which can be defined simply as natural ecosystems where water meets land, on a permanent, seasonal or temporary basis. The wise (or sustainable) use of wetlands will help to ensure a regular supple of water as well as maintaining the range of services and benefits that they provide.

WHY ARE WETLANDS IMPORTANT?

Wetlands can be found from the mountain to the coast, and include rivers, marshes, lakes, reservoirs, rice fields, fish ponds, mangroves, tidal flats and coral reefs.

They provide a range of important ecosystem services for people and the environment, including 1), provisioning services such as food and water 2), regulating services such as regulation of floods, drought, atmospheric carbon storage and disease 3), supporting services such as soil formation and nutrient cycling and 4), cultural services such as recreational, spiritual, religious, and other nonmaterial benefits (Millennium Ecosystem Assessment 2005).

Economic value of wetlands

A study by Costanza *et al* (2014) on the economic value of different ecosystem types found that wetlands, especially coastal wetlands, have a higher value than either forests, woodlands or grasslands. For example, tidal marshes and mangroves were estimated to be worth around $194,000/ha/year for their service in storm protection, erosion control and waste treatment. Coral reefs were valued higher, at $352,000/ha/year due to their values for storm protection, erosion control and recreation.

Wetlands are important carbon stores

Wetlands have been found to be effective in carbon sequestration, taking carbon form the atmosphere and storing it, so mitigating the impacts from climate change.

Coastal wetlands, such as mangroves, tidal flats and sea grass beds are known as 'blue carbon ecosystems' because of their important carbon storage. It has been calculated that the average annual carbon sequestration rate for mangroves averages between 6 to 8 Mg CO_2e/ha (tons of CO_2 equivalent per hectare) which is about two to four times greater than that found in mature tropical forests.

Similarly for seagrass beds, they account for less than 0.2% of the world's oceans but they sequester approximately 10% of the carbon buried in ocean sediment annually (27.4Tg of carbon per year). Per hectare, seagrasses can store up to twice as much carbon than terrestrial forests (The Blue Carbon Initiative 2018).

Peatlands are another wetland type that is an important carbon store. Although only covering some 3% of the Earth's surface, they can accumulate as much as twice the amount of carbon stored by all the world's forests (Biello 2009).

... BUT WETLANDS ARE BEING LOST

It has only been in recent decades that there has bene growing awareness about the important services that wetlands provide. In the past, wetlands were considered as wasteland that can be reclaimed or converted for other uses. As a result, it has been estimated the world has lost 64-71% % of its wetlands since 1900, with the rate of loss of coastal and inland natural wetlands being particularly high (Davidson 2014). The rate of loss of wetlands in Asia is particularly high due to the high pressure on land for development. For example, some 50-80% of the tidal flats around the Yellow Sea have been reclaimed for coastal development in the past 50 years (Murray *et al*. 2015).

As wetlands are lost, then the wetland species that depend upon them are also lost. In the case of the Yellow Sea, the loss of the tidal flats is said to caused annual declines of up to 8% per year of seven out of ten taxa of shorebirds studied that used the Yellow Sea as a migration stopover site and which winter in Australia (Studds et al. 2017).

In general, the loss of wetlands has affected wetland species overall. From 1970 to 2012, WWF calculated that the abundance of freshwater species populations declined by 81%, at an average annual rate of 3.9% mainly due to habitat loss and degradation (WWF 2016).

THE RAMSAR CONVENTION ON WETLANDS

Concern about the loss of wetlands was first raised in Europe in the 1960s and as a result, a group of countries and conservationists began to work to find a way to conserve these habitats. They began to hold a series of international meeting to look into the problem and this culminated with a meeting in February 1971, at the Iranian coastal town of Ramsar by the Caspian Sea. There, they agreed on the text of the Convention on Wetlands which was signed by 18 countries and the Convention came into force in 1975. Today, the Ramsar Convention has 169 Contracting Parties, with 34 in Asia and eight in Oceania.

The founders of the Ramsar Convention were forward thinkers for their time since in the Convention text, they recognized the range of services that wetlands provided by stating that

"… wetlands constitute a resource of great economic, cultural, scientific, and recreational value, the loss of which would be irreparable…". They also used the phrase 'wise use' and stated that Contracting Parties "… shall formulate and implement their planning so as to promote … as far as possible the wise use of wetlands in their territory." The term 'wise use' is now synonymous with the term 'sustainable use' and has at its heart the conservation and sustainable use of wetlands and their resources, for the benefit of people and nature. The concept of the wise, or sustainable use of the world's wetlands has since been further built into the work of the Convention through the Mission Statement developed in 1996 at the 6th Meeting of the Conference of the Contracting Parties (COP6). This is to promote:

Conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world

Thus the linkage between the wise use of wetlands and sustainable development was made and continues today in the work of the Convention.

The wise use of wetlands is now one of the three 'pillars' of the Ramsar Convention with the other two being the designation of wetlands as Wetlands of International Importance ('Ramsar Site') and to ensure their conservation, and international cooperation for shared wetlands and wetland species (Ramsar Convention 2016).

WETLANDS OF INTERNATIONAL IMPORTANCE (RAMSAR SITES)

At the time of writing, Ramsar Contracting Parties have designated 2,293 Ramsar Sites worldwide, covering an area of some 225 million hectares, equivalent to an area larger than Algeria. In Asia, there are currently 319 (14%) Ramsar Sites, with China (49) and Japan (50) having the most number of Sites.

Ecosystem services provided by Asia's Ramsar Sites

Wetlands are designated as Ramsar Sites based on a series of nine criteria which are based on the representative or uniqueness of the wetland being designated and the biodiversity importance of the site. However, when Contacting Parties designate these sites, they also recognize the importance of the site for the other ecosystem services that they provide.

Information on the world's Ramsar Sites and the ecosystem services they provide can be found on the Convention's Ramsar Site Information Service (SIS) website (https://rsis.ramsar.org/).

Cultural services are the most commonly reported service provided by Ramsar Sites in Asia. These include the services for recreation and tourism (71% of Sites), for scientific research and education (69%) and for their spiritual and inspiration values (50%).

Provisioning services are also recognized, such as in providing food for people (51%), wetland related non-food products (51%) and freshwater (49%). The most commonly reported regulating services was in hazard reduction (54%). Therefore, Ramsar Sites should not be seen as being sites to be managed mainly for biodiversity conservation but also, they should be managed to maintain the services that they provide to people living in and around the wetland. In addition, indigenous peoples and local communities should be involved in the designation and management of Ramsar Sites and that Ramsar Site managers are monitoring the condition of their Sites, that they should also consider the socio-economic status of the people inside the Site (Ramsar Convention 2015).

If the Mission of the Ramsar Convention is the conservation and wise use of wetlands as a contribution towards sustainable development, then so should the management of Ramsar Site. In fact, Ramsar Sites could be managed as model sites for sustainable development.

WETLAND CONSERVATION AND THE SUSTAINABLE DEVELOPMENT GOALS

In September 2015, the United Nations adopted the Sustainable Development Goals (SDGs), officially known as "Transforming our world: the 2030 Agenda for Sustainable Development". This is a set of 17 Global Goals" covering a broad range of social and economic development issues for both 'developed' and 'developing' countries.

The conservation and wise use of wetland has an important role to play in achieving many of the SDGs and this is discussed below.

SDG1 No Poverty / SDG2 Zero Hunger

It is estimated that 44 million people are engaged in fishing and aquaculture to generate income and to provide food for their families. Fish provide 2.9 billion people with 15% of their protein and rice is the staple diet for around 3.5 billion people.

SDG4 Quality Education

Promoting greater awareness of the importance of wetlands across all sectors of society is one of the key activities under the wise use of wetlands. Many Ramsar Sites and other wetlands have established community education and awareness programs, including the construction of facilities such as boardwalks and education centres for visitors.

SDG5 Gender Equality

In Africa, it is estimated that 90% of the work of gather wood and water is done by women and that women and girls spend up to six hours each day collecting water. Therefore, the efficient management of wetlands will allow water sources to be more accessible and so make water collection easier, so allowing time for other productive activities, e.g. education, farming etc.

SDG6 Clean Water and Sanitation

Although wetlands provide water and nutrition for people, they can also be sources of disease-causing microorganisms and invertebrates that can threaten human health. In fact, water-related diseases kill a child every eight seconds, and are responsible for 80% of all illnesses and deaths in the developing world. It is therefore important to maintain our wetlands in a good condition, particularly for the health of those people who live close and are dependent or exposed to them. Safe water, sanitation and personal hygiene (WASH) are crucial preconditions for the prevention of disease transmission.

SDG8 Decent Work and Economic Growth

It is estimated that half of all international tourists travel to wetlands, especially to the coast and spending around US$ 925 billion per year. Such on wetland-related tourism can sometimes be key to the economy of a region which otherwise may have few other opportunities for revenue generation and employment. In the Everglades (USA), in the United

States, this amounts to around US$ 450 million in direct and indirect expenditures by tourists and from employment in the tourism sector (Ramsar Convention - WTO 2012).

Coral reef tourism is particularly valuable. It has been calculated that some 30% of the world's coral reefs are of value for tourism, with a total value of nearly US$36 billion (Spalding et al 2017).

However, tourism needs to be carefully planned so as to minimize any impact on local communities and the environment but also, to ensure that local communities receive a share of the benefits from the tourism.

SDG3 Good Health and Well-Being for people / SDG11 Sustainable Cities and Communities

In 1950, some 30% of the world's population was calculated to have been living in urban areas. By 2014, this percentage had increased to 54% and by 2050, it is estimated that the percentage further increase to 66% (UNDESA 2014). Apart from living, studying and working in a faster paced and stressful environment, people are also losing touch with nature and the countryside.

There is growing evidence to show the importance of urban parks and wetlands in reducing air pollution, noise, chronic stress and increase physical activity. This reduces the health risks and promotes the health of city dwellers (WHO 2016). Such areas can also play an importance role in nature education, bringing the natural environment close to students and the community. These area include Yatsu-higata (Tokyo, Japan) and Bang-pu (Bangkok, Thailand).

The importance of providing urban wetland areas for recreation and education is especially developed in China which presently has 58 National Urban Wetland Parks (managed by the Ministry of Housing and Urban-Rural Development) and 836 National Wetland Parks (managed by the State Forestry Administration).

SDG13 Climate Change

The role of wetlands, especially peatlands and blue carbon ecosystems in carbon storage and climate change mitigation has been discussed above already. However, wetlands also have an important role to play in climate change adaptation. For example, the high altitude Ruoergai marshes on the Tibetan plateau (China) helps to regulate the flow of the Yellow River, by reducing the impacts from extreme rainfall and in dry periods, slowly release water to downstream communities.

Coastal wetlands are also known for protecting coastal villages during storms. For example, 100m of mangroves can reduce wave height by between 13% and 66% (McIvor 2012). Similarly, coral reefs can reduce wave energy by an average of 97% which is comparable to the benefits reported by artificial defenses such as breakwaters (Ferrario 2014). The conservation and restoration of mangrove and reef ecosystems should be seen as a first line in coastal defense against storms.

SDG14 Life Below Water / SDG15 Life on Land

Coastal ecosystems, including mangroves, tidal flats, sea grass beds and coral reefs, are one of the most biodiverse and productive on the planet. They are also of significant economic and social value (see above).

As for inland freshwater wetlands, although they only covers about 0.8% of the Earth's surface but they provide a habitat for almost 10% of the world's known species (WWF 2016).

These are just some examples of how the conservation and wise use of wetlands can contribute towards achievement of the sustainable development goals and therefore, the Mission of the Ramsar Convention. A more detailed analysis would be useful.

MAINSTREAMING WETLAND CONSERVATION INTO NATIONAL POLICIES

Within the past decade, governments around the world have adopted a number of global commitments on environmental conservation and sustainable development. In many cases, the conservation and wise use of wetlands can contribute towards achievement of these commitments, goals and targets.

Strategic Plan for Biodiversity

The first of these is the Strategic Plan for Biodiversity 2011-2020, including the 20 Aichi Biodiversity Targets which were agreed in 2010. For example, under Target 5, countries are expected to at least halve the rate of loss of all natural habitats by 2020 and where feasible brought close to zero, as well as significantly reducing habitat degradation and fragmentation.

Countries are also expected to prepare National Biodiversity Strategy and Action Plans (NBSAPs) which outline their actions to achieve the Targets. According to China's NBSAP (2010), one of the country's priorities is to "strengthen the conservation of the coastal wetlands of Bohai Sea and the tidal flat wetlands of the Yellow Sea". The DPRK's NBSAP (2007) has identified a number of wetlands along the west coast for priority action for ecosystem conservation while the ROK's National Biodiversity Strategy (2014) mentions "implementing and monitoring the restoration project of tidal flats" and "increasing supports for tidal flat ecological park, tidal flat eco-center and visiting routes of tidal flat" as outcomes from previous NBSAPs.

Sustainable Development Goals

The conservation and wise use of wetlands is also relevant to achievement of the 17 Sustainable Development Goals (SDGs) that were adopted in 2015 under the 2030 Agenda for Sustainable Development. This has been described above The conservation and wise use of wetlands thus needs to be included in the national strategies for sustainable development of the Yellow Sea countries which are in the process of being prepared.

Nationally Determined Contributions

Lastly, under the Paris Agreement on climate change adopted in 2015, governments are expected to draft national plans (Nationally Determined Contributions) on steps they would take to reduce their country's carbon emissions and adapt to the impacts of climate change.

Wetlands have already been discussed above as being able to play an important role in climate change mitigation through carbon storage. Some countries in their NDCs, have already included the role of wetlands, such as peatlands (CIFOR 2017) and blue carbon ecosystems (Herr and Landis 2016). However, many countries have still not included wetlands in their NDCs.

SUMMARY

Wetlands comprise a diversity of water-related ecosystem types that can be found from the mountain to the coast, and they provide a range of important ecosystem services for people and the environment. Despite international mechanism such as the Ramsar Convention on Wetlands that promotes the conservation and wise use of wetlands, there is still not enough awareness about the value of wetland at all levels of society, from decision makers, private sector, media, general public and local community members. As a result, valuable wetlands are still being lost and degraded.

In view of the fact that the conservation and wise use of wetlands provides a variety of services and benefit areas such as biodiversity conservation, sustainable development and climate change mitigation and adaptation. It is therefore important to mainstream wetlands into those other area of work of governments, such as through inclusion in the NBSAPs, national strategies for sustainable development, and NDCs.

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Conservation Strategy on Wetlands and Biodiversity of Japan (abstract)

Naohisa Okuda
Director, Biodiversity Policy Division, Nature Conservation Bureau, Ministry of the Environment, Japan

As the islands of Japan stretches from the subarctic to the subtropics with its geographical features extending from the south to north, there are various types of wetlands. Japanese people have long lived in harmony with nature, so wetlands are deeply rooted in our lives. However in the rapid economic growth period from the 1950s to the first half of the 1970s, many wetlands were converted into other land uses and their area had been significantly reduced.

In 1980, Japan joined the Ramsar Convention and Kushiro-Shitsugen (Marsh) in Hokkaido was designated as the Japan's first wetland of international importance under the Convention. In 1987, Kushiro-Shitsugen was designated as a national park, too. In the 1990s, the first Asian Wetlands Symposium in Otsu and Kushiro (1992) as well as the 5th Meeting of the Conference of the Parties (COP5) to the Ramsar Convention in Kushiro (1993) were held in Japan. Consequently, it was widely recognized in Japan that wetlands must be conserved as a significant ecosystem.

In the 2000s, Japan and Republic of Korea jointly proposed the Rice Paddy Resolution and it was adopted at the Ramsar COP10 (2009) and endorsed at the CBD-COP10 (2010). In addition, the International Partnership on SATOYAMA Initiative was launched based on a proposal by Japan during the CBD-COP10. Through these propositions, Japan has been sending a message on the relationship between humans and wetlands with the concept of "living in harmony with nature" to the World as a country of the Asian region.

Japan has made some progress in conservation of wetlands while accumulating experience and knowledge on that, and thus we have 50 Ramsar wetlands in Japan now. However, we have still a lot of issues to be tackled including new issues such as problems caused by invasive alien species. Taking the opportunity of holding AWS2017 in Saga along the Ariake sea which has a vast tidal flat, we hope that the measures for biodiversity conservation to tie humans and wetlands will be further promoted, as manifested in the word "wise use".

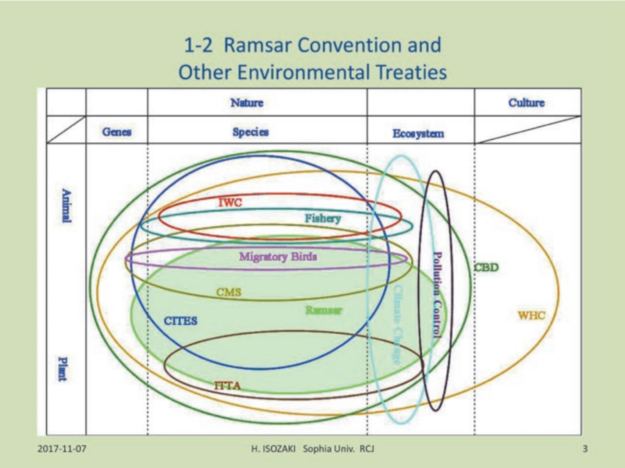
The 25th Anniversary of AWS and the Prospects for the Next 25 Years

Hiroji Isozaki
Visiting Professor, Sophia University
Vice President, Ramsar Center Japan

1. Changes in 25 years

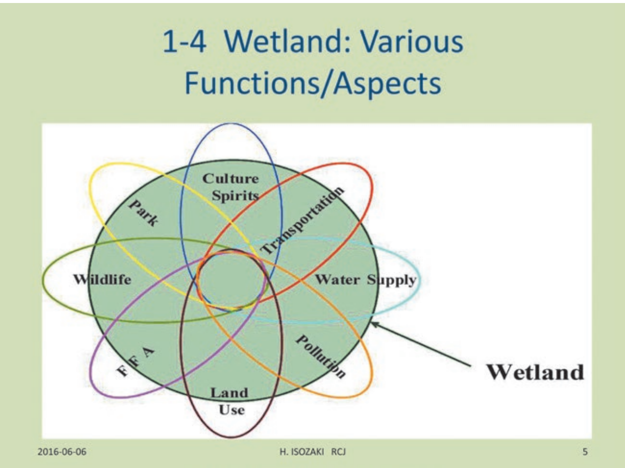
In these 25 years, the world witnessed great changes in economy and society, as well as climate change and environmental disruption. In response to those changes, international treaties on the nature and biodiversity, such as the Convention on Biodiversity (CBD) and the Ramsar Convention on wetlands, have developed sets of principles, criteria, methods and procedures for conservation and management of the natural ecosystem. Those response efforts have greatly contributed to the improvement of conservation and management of biodiversity, and the Asian Wetland Symposium (AWS) has played a part in those response activities.

Slide 1-2



Slide 1-2 shows international treaties on environmental conservation with their extent of coverage. Ramsar Convention, indicated as a green colored circle, covers a broad area and occupies an important position in the legal framework for conservation of the nature and culture. Such broad coverage of the Ramsar Convention derives from a wide variety of natural functions performed and ecological services provided by wetlands, as shown in Slide 1-4.

Slide 1-4



2. CBD and the Ramsar Convention

The Aichi Biodiversity Targets adopted at the 10th Meeting of the Conference of the Contracting Parties (COP) to CBD held in 2010 in Nagoya City, Aichi Prefecture, Japan, requires the mainstreaming of biodiversity into broader national and global agendas, social and economic agendas, throughout government and society, through communication, education and awareness, appropriate incentive measures, and institutional changes. It is notable that the Aichi Target referred to "communication, education and awareness."

Similarly the Ramsar Convention puts forward the mainstreaming of wetland, and requires to incorporate the conservation and wise use of wetland and their resources into economic and resource development activities. The advocacy of mainstreaming of wetland is fairly reasonable, because the Ramsar Convention covers a broad area as shown in Slides 1-2 and 1-4 above.

For the effective implementation of treaty provisions, CBD and the Ramsar Convention attach importance to CEPA (communication, capacity building, education, participation and awareness), a part of which was mentioned in the Aichi Targets. Both Conventions have developed and adopted a series of guidelines and handbooks on CEPA.

3. National laws in the Asian region

In these 25 years, environmental laws and administrations of the countries in Asia have also made considerable progress. Some countries have the constitutions that contain provisions on environmental conservation. And some countries have laws and regulations on pollution control, on nature protection, on natural resource utilization control, on environmental impact assessment, or environmental basic laws. One of a notable legal improvement is a law on environmental public interest litigation, as enacted in China. In addition, a remarkable improvement, compared with 25 years ago, has occurred in laws and regulations on empowerment and participation of local people and local community.

4. Roles and activities of AWS

AWS has gathered a wide range of stakeholders including national and local governments, international organizations, the private sectors, NGOs, local communities, academia, wetland managers, researchers, practitioners and others. With such participants, it aims to build bridges between international society and local society, international treaty and national/local law, and technical research and local practice, through support for necessary information and for a suitable local participation, paying a special attention to local languages.

Thus AWS has focused on local people from the viewpoint of CEPA, because the conservation and wise use of wetlands depends on active, well-informed and responsible participation of local residence. One of the satellite meetings of AWS was held in 1995 at Narashino City, Chiba Prefecture, Japan and produced the Narashino Statement for active and informed participation by local people and community in wetland management that was translated into relevant local languages of the Asian region. The Ramsar Resolution VII.8 adopted in 1999 referred to the Narashino Statement as one of the preceding regional contributions. Thus, AWS shows a part of the good examples of CEPA practice in the Ramsar regime.

In addition to the Resolution VII.8, AWS activities in general came into international recognition when the Resolution IX.19 was adopted in 2005, which encouraged all Asian countries to give full recognition to AWS as an effective forum, and requested to facilitate the support to and participation in AWS. Such contribution of AWS has been highlighted by the Ramsar Awards. Five members of the Steering Committee of AWS have been granted the Award: Mr. Ajit Pattnaik (Chilika Development Authority), India (2002), Ms. Reiko Nakamura, Japan (2005), Dr. Sansanee Choowaew, Thailand (2008), Prof. Tatsuichi Tsujii, Japan (2012) and Prof. Gea Jae Joo, South Korea (2015).

5. Statements adopted by AWS

Based on those research and study by experts and experiences reported by wetland managers, including questions, comments and discussions, each AWS has adopted statements or recommendations on actions to be taken and on policy and law to be revised, in order to improve the status of wetlands in Asia, addressed to relevant governments, organizations, local communities or international society. Having reviewed those statements and recommendations, there are found that some subjects have been repeatedly taken up. It may be necessary and useful to repeat important recommendations addressed to relevant stakeholders. However, if repeated and attained no improvement, that may be nonsensical and need to take another approach.

Actually, a similar review study was carried out by the Ramsar Center Japan (RCJ) and presented at the Penang AWS in 2001, which report was published. Following that report, RCJ has completed another review study in 2017, based on analysis and examination of each subject of statements, whether it is improved or not improved. The 2017 review report, "Commemorating the 25th Anniversary of Asian Wetland Symposium" is published and distributed at the RCJ lunch time side event on the first day of AWS 2017.

6. Way forward: Next 25 years

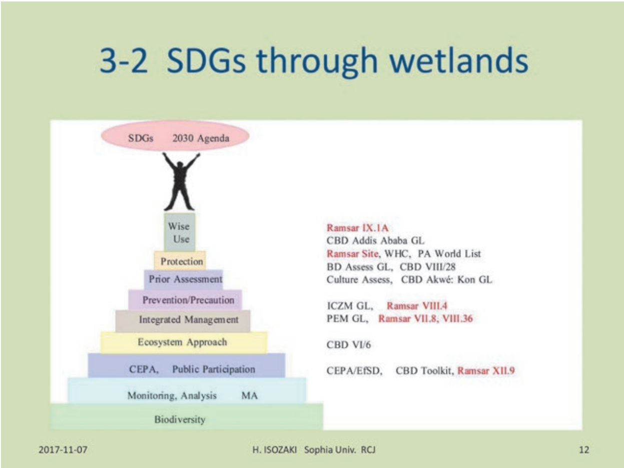
It is reported that 64% of the world's wetlands have disappeared in the last century. In the Asian region, as for a major threat, about 60% of the Ramsar sites face the problem of natural system modifications. Other problems faced are exploitation of biological resources, pollution from the surrounding areas and intensive use for agriculture or for aquaculture.

Then, how to improve wetlands status in Asia? It needs to identify main obstacles to the effective implementation of the Ramsar Convention and to decide necessary counter measures to each obstacle. For that purpose, such measures should be developed and judged based on relevant provisions of the Ramsar Convention.

7. Useful Articles and principles

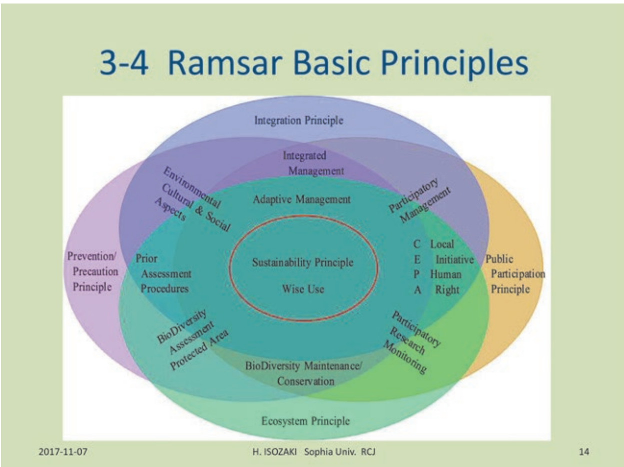
Regarding the conservation and wise use of the Ramsar sites, Article 3-1 requires the Contracting Parties to formulate and implement national plan, and Article 3-2 requires informing of the change of ecological character to the Secretariat. Article 4-1 requires the Contracting Parties to promote the conservation of wetlands, both registered and not registered, through protected area management and to provide adequately for their wardening. Besides, Article 6-3 requires the Contracting Parties to ensure that wetland managers shall be informed of and they shall take into consideration relevant COP recommendations. Thus, the Parties need to provide necessary legal framework, formulate plan, and to monitor, observe, analyze, and take measures for the Ramsar sites within their territory, and to give notice to wetland managers on relevant recommendations adopted.

Slide 3-2



In addition, basic principles, criteria and procedures set out by international society should be used as the basis for examination and judgement. Such principles, criteria and procedures include the Sustainable Development Goals (SDGs) and those set out by the Ramsar Convention, as well as similar ones set out by national laws and systems. SDGs are well attained through effective wetland management, as shown in Slide 3-2, because important and useful guidelines have been developed by the Ramsar Convention. Concerning to those principles and management procedures developed by the Ramsar Convention, each location and their mutual relation can be indicated as shown in Slide 3-4.

Slide 3-4



It sure is CEPA on which the future AWS should base. For effective CEPA operation, it is encouraged to utilize the Ramsar resolutions VII.8 or XII.9 as a comparison sheet in order to check whether all necessary conditions are met.

Restoration of Chilika Lake: A Journey from Montreux Record to Ramsar Wetland Conservation Award, and the Way forward

A.K.Pattnaik
Vice President, WISA

The Chilika lake is the largest brackish water lake situated along the east coast of India and the 1st Ramsar site of the country. The lake is a unique assemblage of marine; brackish and freshwater eco-systems with estuarine characters. It is a hotspot of biodiversity and a wintering ground for more than one million migratory birds. The lake basin and coastal process are integral factors determining the ecological integrity of this coastal wetland. The freshwater inflows drive the temporal and spatial salinity dynamics of the lake, which contributes to the mosaic of aquatic habitats for different plant and animal species, and the various life cycle requirements of these species. It is primarily this dynamic salinity regime that enables the lake to support high biodiversity and a productive fishery. The highly productive ecosystem of Chilika lake sustains the livelihood of 0.2 million fishers and 0.8 million lake basin community. The lake encountered a combination of increased siltation due to changes in the land use pattern and degradation of the lake basin, as well as the partial closure of the inlet connecting the sea during 1980-1999. The decrease in salinity caused proliferation of invasive species, increased turbidity, shrinkage of the water-spread area, loss of biodiversity, and drastic depletion of fishery resources. The plummeting fish production adversely affected the livelihood of the local communities. Due to changes in its ecological character, it was included in the Montreux Record, maintained by Ramsar Bureau, in 1993.

In response to the action by the Ramsar Convention, Chilika Development Authority (CDA) was created for the restoration of the lake based on the Ramsar Guidelines and wise use principles by the Government of Odisha. CDA initiated an integrated adaptive management process to address the complex ecological and socio-economic issues of the Chilika lake based on the Ramsar guidelines. There was an assessment of the causes of degradation with the objective to identify appropriate and effective measures to restore the lake to its former healthy state. CDA commissioned the services of premier institutes of the country to trace the root-cause of degradation through targeted scientific studies and extensive stakeholders' and expert consultation.

Intensive studies of the coastal processes showed that the tidal influx into the lake was adversely affected by the shoal formation along the lead channel and continuous shifting of the mouth due to littoral drift. This had been negatively impacting the natural recruitment of species through the mouth opening to the sea. To address this problem based on the outcome of the rigorous modelling, opening of a new mouth was recommended. Before going for such significant major intervention, CDA looked for cases where similar interventions are made for restoration of hydrological regime. During this crucial moment, Ramsar Center Japan (RCJ) connected CDA to Lake Saroma, Japan where similar intervention was made to re-connect the lake to the sea. With the exchange of knowledge and expertise from Lake Saroma, CDA made a straight cut based on numerical model studies, bringing the inlet closer to the lake by 16 kilometers. After this intervention, there has been a significant improvement of fishery resources due to auto-recruitment, increase of the tidal and salinity flux into the lake resulting in achieving desired salinity gradient, flushing out of sediment to the sea, the decrease of freshwater invasive species, and overall improvement of lake ecosystem and biodiversity. It is a perfect example of how the restoration of a wetland with most appropriate strategy can not only restore the ecological integrity of the wetland but also, can contribute significantly towards the improvement of livelihood of the local community due to increase in the productivity. Strong indicators of improvement in the lake ecosystem are the increase in population of the Irrawady dolphin, a flagship species, from 80 to 150, reappearance of the native fish species,re-sighting of the limbless skink (Barkudia insularis), an endemic species, after 72 years of its discovery, reduction in the extent of invasive water hyacinth, and a significant increase in the extent of ecologically valuable sea grass meadows in the lake.

Ninety percent fin fish and shell fish of Chilika Lake maintain a phased life cycle and are migratory in nature, part of their life cycle takes place in the lake and the part in the sea. The opening of the mouth facilitating successful breeding migration and auto-recruitment of juveniles. This has resulted in significant enhancement of the fish production from a paltry 2000 metric ton pre-restoration to 14000 metric ton post restoration. The valuation of the enhanced fish production post restoration at the average weighted price stands at 16.19 million US$ per annum. In spite of significant improvement of the fish catch, it was observed that the economic conditions of the fishers were not improving. The fishers were under severe debt trap and victims of overexploitation by the money lenders. As a solution to this chronic problem, Primary Fishermen Co-operative Societies were federated. A Central Fishermen Co-operative Society was constituted, and Government provided institutional financing, which immensely benefited the fishers in getting out of the debt trap. Now their per annual family income is increased by more than 1000 US $. The population of the Irrawaddy dolphin a flag ship species of the lake also increased due to increase of the prey base i.e. fish. This created another vista of opportunity for the local fishers by way of conducting tourist for dolphin watching. CDA extended necessary support by way of the capacity development of the fishers and created minimum visitors amenities facilities at the gateways in to the lake. This has immensely benefitted fishers from16 villages who have adopted dolphin watching nature tourism, as a viable alternate livelihood. This is also helping in reducing pressure on lake fishery. For holistic management of the lake an integrated lake basin management approach is adopted following the 6 pillars principles, promoted by ILEC Foundation Japan. For sustainable management of lake basin, the micro-watershed is treated as the basic ecological functional unit. An innovative participatory micro-watershed management concept is adopted with a "sustainable livelihood" approach for holistic management of natural resources of lake basin. This resulted in improvement of the soil moisture regime and increase in the production of the agriculture crop, which is benefiting the lake basin communities. At the same time, due to arrest of the silt by the effective soil conservation measures in the micro watershed, silt flow in to the lake is also reduced significantly.

Considering the complex and dynamic ecosystem of the lake, a well-researched monitoring protocol is followed for close monitoring of the lake ecosystem. To make it more robust, sensors are deployed at strategic locations, for real time monitoring of the lake water quality. A state-of-the art wetland research and training center is developed for conducting research on lake ecosystem. In collaboration with the Maryland University, USA an “ecosystem health report card” is developed for critical assessment of the lake ecosystem and dissemination to the wide audience. The lake ecosystem is successfully restored and its resilience was also put to the test, post severe cyclonic storm Phailin in 2013. The Lake turned out to an entirely freshwater putting severe pressure on the biodiversity and ecosystem. However, within six months the ecosystem fully recovered, testifying it’s fantastic resilience.

Management steps by CDA, are widely debated, researched and implemented. This extensive consultative approach has contributed significantly to the success of the management actions undertaken. Another strong attribute of the restoration initiative is “good governance” that encompasses ideal procedural aspects of planning and management as well as concepts of legitimacy, fairness, wisdom, acceptability, transparency and accountability. A broad understanding of the physical, chemical and biological processes occurring; long-term goals supported from the highest political level to the local communities; and comprehensive, long-term plans. The management philosophy of CDA is pragmatic and outcome-focused, implemented by innovative leadership and a strong and committed core team. The restoration initiatives adopted derives its uniqueness from the building of strong institution at multilevel, strong participation by local communities, linkage with various national and international institutions, and close monitoring and assessment of the lake ecosystem. The successful restoration of the lake demonstrates how investing in multiple knowledge base systems to benefit from cutting edge science as well as traditional knowledge through participatory research, helps in connecting ecosystem to the communities and facilitate resource efficient and inclusive management. (informed stake holders translating outcome of research findings into practice).The empowerment of the fishers achieved through federation, to promote responsible fishery, community-based ecotourism and alternative livelihood. As a follow up of recommendation by Ramsar advisory mission, a wetland research and training center is established for dissemination of exemplary good-practice case study of the application of the various Ramsar guidelines, and the use of the Convention's tools and approaches, to address complex site and catchment management issues. A long term comprehensive management plan is also formulated based on Ramsar guidelines.The most important achievement of the steps taken by CDA for management of the lake is the sustainability. Looking at the benefit from the restored lake the state government is providing funds for the recurring expenditure on long term basis.

It is an exemplary good-practice local action of the application of the various Ramsar guidelines, and the use of the Convention's tools and approaches, to address complex issues with an ecosystem approach. It is also a perfect example of how the restoration of a wetland with ecosystem approach can not only result in ecological integrity of the wetland but also, can contribute significantly towards the improvement of livelihood of the local community. This local action is a good demonstration how various guidelines and tools of the Ramsar convention have been successfully translated into action. In particular, this example could assist the Convention to develop further guidance in support of the whole ecosystem approach to wetland management and provide an example of adaptive management practices for wetlands as practised in Chilika after restoration for achieving sustainability.

To accomplish the post-restoration sustainability a long-term integrated management plan outlining the management strategy to identify the management objectives is formulated based on the Ramsar guidelines in 2012. To promote responsible fishery and wise use of the lake resources extensive CEPA activities were carried out in collaboration with local NGOs and CBOs. Ramsar Center Japan provided significant support for successful implementation of the CEPA activities both pre and post-restoration phase. Experience from successful management of wetland has shown that devolving decision making power over the use and management of natural resources to local communities can yield tangible benefits regarding livelihood and food security, new and more equitable power relationships (including for women) and better environmental stewardship and sustainability. So, for post-restoration sustainability steps were taken to secure rights of the local communities to wetland resources, as well as access to environmental information, markets, and decision-making, to enhance their capacity to do *wise use of the wetland resources*.

There are some management gaps which remains to be bridged. There is an urgent need for regulation of resource use to prevent overexploitation resulting in severe resource depletion. A draft legislation is pending for quite some time with the Government and is under their active consideration for some time, for regulation of fishing in the lake ,which needs to be expedited. There is urgent need to completely curb the illegal shrimp culture which is detrimental to the lake ecosystem.

The restoration strategy adopted by CDA derives its uniqueness from the firm participation by local communities, linkage with various national and international institutions including RCJ, and intensive monitoring and assessment of the system and its global relevance. Chilika Lake was removed from the Montreux Record (first from Asia) in 2002, and Chilika Development Authority received the prestigious **Ramsar Wetland Conservation Award** for the successful restoration of the wetland.

Ariake Sea Session

Animals and Plants in Tidal Flat of Ariake Sea

Yasuhisa Henmi
Center for Water Cycle, Marine Environment, and Disaster Management, Kumamoto University

The Ariake Sea (1,700 km^2) is an enclosed bay located on the west coast of the Kyushu, Japan (Fig. 1a) with large tidal amplitudes of more than 6 m in the innermost areas during spring tides. In the Ariake Sea, huge tidal flats (188 km^2) develop mainly in the estuarine areas of large rivers, and many salt marshes (halophytic plant areas) are located in the upper intertidal zones of riverine and seashore areas (Henmi et al., 2017).

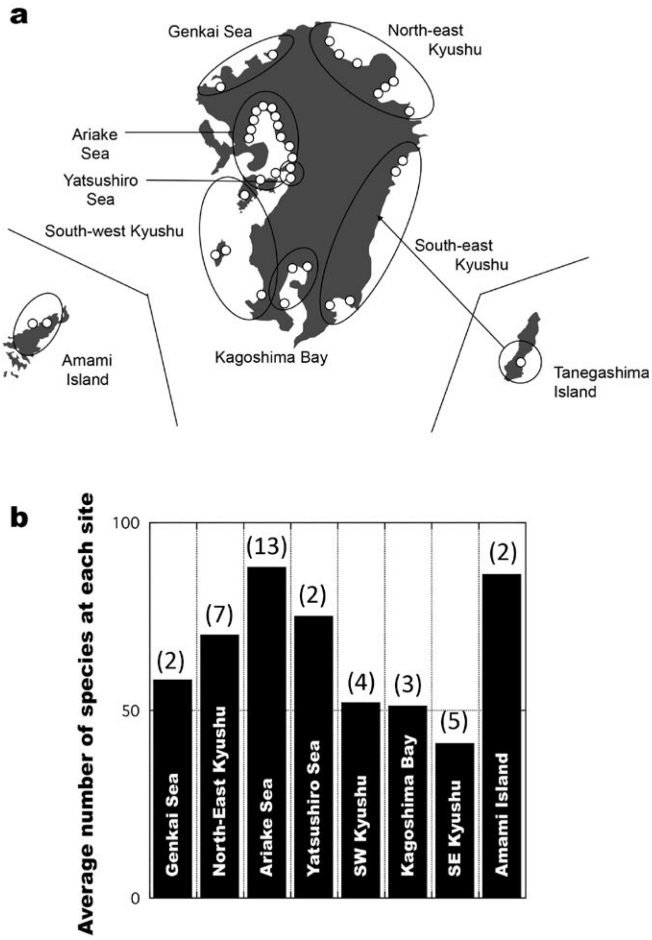
Tidal flats in the Ariake Sea are very large and 5-7 km tidal flats appear in spring low tides at the mouths of large rivers (e.g. Rokkaku-R, Chikugo-R, Yabe-R). Even though these tidal flats - largely devoid of vegetation - initially look as if they had no life, they are teeming with organisms (Miththapala, 2013). Tidal flats support a large number of invertebrates, mainly benthos such as crustaceans, bivalves, snails, worms, seaweed and seagrass – most are important for food. In the Ariake Sea, moreover, many salt marshes are located in the upper intertidal zones of estuarine and riverine areas. Salt marshes are coastal ecosystems that dominate large areas of intertidal zones in temperate regions, and are found mainly along foreshores, lagoons, and tidal rivers where freshwater mixes with seawater. Salt marshes form a transitional area between aquatic and terrestrial ecosystems and raise many peculiar species.

Tidal flats and salt marshes are important to coastal ecosystems as high biodiversity zone, sustaining zone of coastal fisheries, nursery grounds for the juveniles of many marine animals, transitional zones with high primary productivity, enriching zone of coastal nutrients, buffers against wind and tidal current along the shoreline, nutrient and pollutant filters between marine and freshwater ecosystems, and carbon sink zone and cultural zone for recreation. The Ariake Sea is known as "Houjo no Umi" (the Sea of Fertility) because of its high productivity. Nori (edible seaweed of red algae, *Pyropia yezoensis*, mainly sold as a paper-thin, black, dried sheet) and Asari (Japanese littleneck clam, *Ruditapes philippinarum*) are major fishery products in the Ariake Sea.

Tidal flats and salt marshes in the Ariake Sea have very high biodiversity and many endangered and endemic species inhabit there (Japanese Association of Benthology 2012). From 2002 to 2004, Ministry of the Environment Japan organized a benthos research project and many researchers surveyed benthic fauna at 157 tidal flats throughout Japan (Iijima, 2007). In Kyushu, the survey at 38 tidal flats, including 13 tidal flats in the Ariake Sea, were conducted (Fig. 1a), and the most species was record in the Ariake Sea (average 88.3 species), almost equal to that in Amami Island in the subtropical region of Japan (Fig. 1b).

Different types of tidal flats are observed in various places of the Ariake Sea, and animals and plants segregate habitats mainly by the sediment type (soft mud - pebble). In the northern (inner) part of the Ariake Sea (Isahaya -Yanagawa region), tidal flats are huge and composed of very fine mud (soft bottom), and Mutsugoro (mudskipper, *Boleophthalmus pectinirostris*), Sarubou (ark clam, *Scapharca kagoshimensis*), Shiomaneki (mud fiddler crab, *Tubuca arcuata*), and Shichimenso (Chenopodiaceae plant, *Suaeda japonica*) etc. can be observed. In the middle part (Arao - Uto region), many tidal flats are middle-sized and mud-sandy, and Asari, Hamaguri (hard clam, *Meretrix lusoria*) and Hamamatsuna (Chenopodiaceae plant, *Suaeda* maritina) etc. can be observed. In the southern part (mouth of the bay: Shimabara Peninsula and Amakusa Islands), the substrate of most seashore is composed of stones (pebble, cobble and boulder) and bedrock, and small sandy tidal flats are found in inner parts of inlets, and Mategai (razor clam, *Solen strictus*), Hakusen-shiomaneki (sand fiddler crab, *Austruca lactea*), and Hamasaji (autumn statice, *Limonium tetragonum*) etc. can be observed. Many dolphins (Minami-handoiruka, Indo-Pacific bottlenose dolphin, *Tursiops aduncus*), over 200 individuals, inhabit and forage for fish on the sea of Amakusa Islands.

Fig. 1 A: Study sites in Kyushu in Iijima (2007), B: Average number of species per site recorded in each sea area, with number of study sites in parentheses.



In Ariake Sea, many animals and plants are continental relicts, e.g. Oo-syamisengai (*Lingula adamsi*), Umi-maimai (air-breathing snail, *Salinator takii*), Haragukure-chigogani (dotillid crab, *Ilyoplax deschampsi*), Etu (Japanese grenadier anchovy, *Coilia nasus*), and Mutsugoro, and in the geological history of Japan, they have lived around 'Old Yellow River' 20,000 years ago. Now, the same species are found along the Yellow Sea, though the distribution of these species is restricted to the Ariake and Yatsushiro seas in Japan. In the present day, for example, Haragukure-chigogani (the small mud crab) widely distributed on muddy tidal flats from Japan to China, but it appear only on the innermost areas of the Ariake Sea in Japan.

Like other coastal environments in the world, tidal flats in the Ariake Sea face high levels of destruction, due mainly to anthropogenic activities. Also in Japan, most people lives in coastal regions, making coastlines highly vulnerable to human impacts. In addition, human activities affect tidal flats directly and indirectly through grazing, dredging, development, dumping of chemicals into water systems and overfishing. In the Ariake Sea, fortunately, many healthy tidal flats and salt marshes still persist with relatively high biodiversity, having many endangered and endemic species (Japanese Association of Benthology 2012), unlike other regions in Japan. But enough information is not available on the flora and fauna that inhabit tidal flats and salt marshes. To clarify the community structure in the salt marsh, and to conserve salt marsh ecosystems, more detailed studies are required.

In the past three decades, fishery products in the Ariake Sea have greatly declined. Nori product is unstable and Asari product suddenly decreased since 1980s. Moreover, unfortunately, other commercially important fishery species, Hamaguri, Tairagi (pen shell, *Atrina* spp.), Agemaki (Chinese razor clam, *Sinonovacula constricta*), Haigai (granulated ark clam, *Tegillarca granosa*), Kuruma-ebi (Japanese tiger prawn, *Marsupenaeus japonicus*) etc., were also greatly decreased and some of them become even endangered species. For example, Kumamoto Prefecture is the largest in Japan in the amount of Hamaguri (*Meretrix lusoria*) production, and the estuarine area of the Midorikawa River is the largest production area. But the production is greatly decreased since 1980s. The major causes of the decrease of Hamaguri resource are thought to be sand/gravel-digging in the river, construction of dam and overfishing. The sand/gravel-digging and dam construction changed the bottom of river mouth from sand to mud, which the Hamaguri juveniles dislike. Thus, the change of coastal environment gives serious influences on animals and plants in the coast areas.

Moreover, invasive alien species, Karamushiro (Nassarius snail, *Nassarius sinarus*), Shimamenou-funegai (onyx slipper snail, *Crepidula onyx*), Higata-ashi (saltmarsh cordgrass, *Spartina alterniflora*) etc., represent a major threat to native animals and plants in tidal flats and salt marshes in the Ariake Sea. Finally, tidal flats are also exposed to the threat of a global rise in sea levels. Because of the environmental destruction like above, coastal biodiversity and the services to it underpins are greatly lost. Henmi (2017) suggested the following seven factors as the causes of coastal environment degradation in the Ariake Sea: (1) land reclamation, (2) increase of mud content (sludging) in the sea-bottom caused by sand mining from river and sea, and by the construction of dams containing erosion control dams, (3) inflow and accumulation of harmful chemicals and eutrophic materials, (4) appearance of anoxic water mass, (5) global climate change, especially increases of water temperature during winter, (6) overfishing, and (7) loss of network system among local populations in benthos. Though it is not easy to remove these aggravating factors, we must start what we can without a moment's delay, e.g. discontinuation of land declamation and/or dissolution of overfishing (sustainable fisheries).

The Ariake Sea – it has many serious problems, but is really wonderful area as ever, and you can find signs of recovery.

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The History of Nori Farming in Tokyo Bay and Trial to Pass It Down to Later Generarion

Fumihiro Koyama

Omori Nori Museum (Nori no Furusato kai)

Nori is one of the most popular traditional foods in Japan. It's used for SUSHI roll, ONIGIRI and so on. It's a kind of seaweeds. Ariake Sea is the main Nori-producing center at the present time. Tokyo Bay was once the main Nori-producing center. But now, no one has the right to farm Nori in the inner part of Tokyo Bay (Tokyo Prefecture). I introduce the history of Nori farming in Tokyo Bay and trial to pass it down.

People have gathered wild Nori off rocks and sticks for thousands of years. Farming of Nori on the seaside of the inner part of Tokyo became active around 300 years ago (especially Omori area). Sticks of wood or bamboo were put up in shallow waters in autumn. Nori farmers picked up Nori grown on the sticks to make thin sheets like paper in winter. The area had shallow sea, brackish water and gentle wave which were suitable for Nori growing. Omori became a major producing center soon. Also, Nori farming technology spread across all over the country from there.

However, Nori farmers agreed to reclaim farming places, and Nori farming in the inner part of Tokyo Bay was finished in 1962. There were two main reasons, pollution and reclamation. Economic growth caused serious sea pollution. Reclamation was needed for economic growth. A local preservation group started collecting and preserving their tools soon.

1950's aerial photograph

Most of shallow sea was reclaimed. 20% area in Tokyo Bay was reclaimed. Wetland's area decreased to 12.5%. (1950–2017)

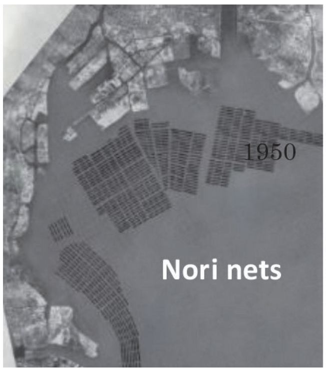
Nori farmers never forgot their lives which had been with the sea. Although many years went by, Omori Nori Museum was opened by Ota Ward government on April 6th 2008. With thanks to passions of local people. Management of the museum is entrusted to the NPO (Nori no Furusato kai).

The museum has more than 1,000 Nori manufacturing tools, 881 of which were designated as the national important properties of folk culture under the name of "Nori Manufacturing Tools of Omori and surrounding area". Lots of different tools including 13-meter-long nori boat are exhibited. It's located near the Haneda airport, and next to the regenerated beach. 100,000 visitors come every year.

The museum has two main themes.

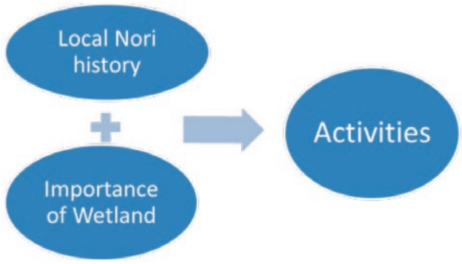
1. Local Nori manufacturing history
2. Importance of wetland (shallow sea)

Tokyo Bay in 1950



Current Tokyo Bay in 2017

1st floor, 2nd floor

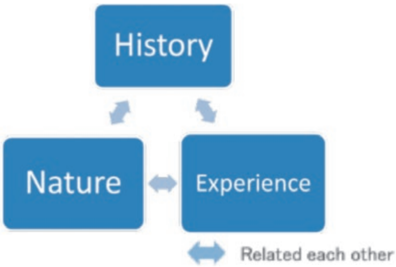


We make our activities based on these.
And our activities consist of three elements.

1. History
2. Nature
3. Experience

1. History

We explain about history, tools, and so on to the visitors. Lots of elementary schools come for learning their local history. Of course, all generations come.



2. Nature

The most important thing of nori farming is to understand the function of wetland and sea. We need to learn them even now. So we offer natural environmental programs about fishes, benthos and so on.

3. Experience

The museum's most popular program is a hands-on event that offers visitors a chance to mold dried Nori in the old way. Former Nori farmers teach us practically. It's very valuable because they're over 80-year-old.

Experience is the most effective way to learn something. The traditional way usually includes wisdom which is forgotten now.

We actually try to cultivate nori by using with bamboo sticks and nets in the sea (regenerated beach) every winter. Our purposes are technical succession and reproduction of the former sea scene.

Our goal is to pass down the local Nori history and the importance of wetlands to later generation. And we'd like to give the later generation opportunities to think about the relationship between human and wetland. This leads to Wise Use of Wetlands.

Information

Usage Guide

◆Admission: Free
◆Opening hours: 9:00 ~ 17:00 (From June to August, 9:00 ~ 19:00)
◆Closed: 3rd Monday (In case the 3rd Monday is a public holiday, the Museum will be closed on the next day) and New Year's holiday (December 29th ~ January 3rd)

Access

◆15-minutes walk from Heiwajima sta.on Keihin Kyuko Line
◆3-minutes walk from Heiwajima-5-chome stop on Heiwajima-Junkan bus departing from Omori sta. on JR Keihin Tohoku Line
◆15-minutes walk from Ryutsu Center sta. on Tokyo Monorail
◆Parking Cost: 100 yen per 30 minutes

Characteristics of the Marine Environment in Ariake Sea (abstract)

Yuichi Hayami
Saga University

Ariake Sea is a semi-enclosed embayment located in western Kyushu. It has a length of 96 km, mean width of 18 km and mean depth of 20 m. It has a large tidal amplitude up to 6 m of tidal range in the bay head. Because of the shallow topography and large tidal amplitude, there are widespread of tidal flat which is about 40% of the total tidal flat area in Japan. The Chikugo River which is the biggest river in Kyushu discharges into the bay head. The area northward of the line connecting Takesaki Island and the Miike Port is called as the inner area of Ariake Sea. High concentration of suspended clay and silt in the Chikugo River water, shallow depth and large tidal amplitude generate high turbidity in the inner area of Ariake Sea. Most of the tidal flats in this area are soft mudflats. The typical ones are Higasiyoka-higata and Hizen Kashima-higata. Here "higata" means tidal flat. On the other hand, there are sandy mud or sandy tidal flats located along the eastern coast of Ariake Sea including Arao-higata. Ariake Sea has unique biota; for example, Mutsugorou (goggle-eyed goby) and Etsu (grenadier anchovy). There are 23 species which distribute only in Ariake Sea in Japan. Most of them are mainly distributed in the inner area of Ariake Sea. From October to April, many laver cultures are conducted in the inner area of Ariake Sea using the shallow topography and abundant nutrient supply form the rivers and mudflats. It is the biggest commercial fishing in Ariake Sea (About 99% of the gross fisheries production in Ariake Sea in Saga Prefecture). However, many environmental and fisheries problems are occurring in Ariake Sea now, e,g., the decrease of bivalves and demersal fish, increase of red tide and the formation of the hypoxic water mass (oxygen depleted water) in summer. More than 30 years ago, the inner area of Ariake Sea was the biggest production area of Tairagi (pen shell) in Japan. Its production sometimes exceeded ten thousand t/year. But its population size became very small now and its fishing has been closed for 5 years since 2012. In the sandy mud or sandy tidal flats, the decrease of the production of Asari (manila clam) became a problem. From the mid 70s to the early 80s the Asari production in Ariake Sea exceeded 50 thousand t/year. It was a half of the total production in Japan. But it was less than 1 thousand t/year in 2014. There are two types of red tide problems in Ariake Sea. One is the toxic phytoplankton bloom in summer, e.g. Chattonella sp. The other one is the phytoplankton bloom mainly diatoms in autumn and winter. Usually they are not toxic. However, as the excess phytoplankton production consumes a lot of nutrients in water, the discoloration of the cultured laver is induced by the nutrient depletion. The formation of the hypoxic water mass is a serious problem since it induces the decrease in benthos and disappearance of fish. The bottom water in the inner area of Ariake Sea easily became hypoxic from the 1970s to the early 90s and the hypoxic water mass (less than 3 mg/L in Dissolved Oxygen) formed every summer since 2004. The main reasons for these problems remain unclear now. But many fishermen insist that the Isahaya Sea dike construction affected. In 1997, the inner 1/3 of Isahaya Bay was shut off by the dike and a fresh water reservoir and reclaimed land were constructed. Now the conflict related to the Isahaya dike construction became a big social problem.

Reproduction of Mudskippers: Aerial Embryos Developing in a Mudflat Burrow (abstract)

Atsushi Ishimatsu
Institute for East China Sea Research, Nagasaki University

Intertidal mudflats are highly productive ecosystems that impose severe environmental challenges on their occupants due to tidal oscillations and extreme shifts in habitat conditions. Reproduction on mudflats requires protection of developing eggs from thermal and salinity extremes, O2 shortage, dislodgement by currents, siltation and predation. Mudskippers are air-breathing, amphibious fishes, and one of few vertebrates that reside on mudflats. There are five species of mudskippers in Japan, and two in the Ariake Sea (*Boleophthalmus pectinirostris* and *Periophthalmus modestus*). All the mudskippers so far studied lay their eggs in mud burrows containing extremely hypoxic water. If submerged in the water contained in the burrows, the eggs will perish within 48 hours due to suffocation. Therefore, the question of how the eggs survive had been an enigma to fish biologists. Through our 10-year field work in Saga, Japan, we found that the Japanese mudskipper *Periophthalmus modestus* deposits its eggs on the walls of an air-filled chamber within its burrow. To ensure adequate O_2 for egg development, the burrow-guarding male mudskipper deposits mouthfuls of fresh air into the egg chamber during each low tide. As a result, the O_2 concentration of egg-chamber will become high enough to satisfy O_2 requirement of the developing embryos during the subsequent high tide period, when the mudflat was covered by tidal water and the male did not add air. An artificial reduction of egg-chamber O_2 concentration revealed that the male sensed the hypoxia and recovered the O_2 concentration rapidly before the next mudflat inundation. When egg development is complete, the male, on a nocturnal rising tide, removes the egg-chamber air and releases it outside the burrow. This floods the egg chamber and induces egg hatching. Video records showed that flooding the chamber required the removal of an average of 103±42 air gulps, which gave an almost exact volume of total egg-chamber air (47ml) based on the buccal-branchial capacity of *P. modestus* (0.46ml in an average-sized (2.6g) fish). Thus, *P. modestus* has developed a reproductive strategy that allows it to nurture eggs in this severe habitat rather than migrating away from the mudflat.

Data on the reproductive strategy of *Boleophthalmus pectinirostris* is fragmentary, largely because of more complex and variable configuration of their burrows. Nonetheless, the measurement of redox potential indicated that the egg chamber is exposed to much higher O_2 conditions than the other parts of the burrows. Observations of burrow-guarding male and the laboratory experiments of egg incubation in air and hypoxic water also agree with the assumption that *B. pectinirostris* eggs develop in air filled in an egg chamber.

The reproductive strategy of mudskippers requires that the eggs be specialized to develop in air and that the air-breathing capacity of the egg-guarding male be integrated in a complex behavioral repertoire that includes egg guarding, ferrying air to and from the egg chamber, and sensing O_2 levels therein, all in concert with the tidal cycle. Compared with the reproductive modes of other fishes that spawn at the interface between air and water, mudskippers have evolved the most sophisticated, but also the most energy demanding reproductive strategy, which probably reflects the most formidable nature of their habitat.

Wild birds in Ariake Sea (past, present, and future) (abstract)

Akiyuki Miyahara
Wild Bird Society of Japan Saga

I've heard that a lot of Anas formosa flied above Ariake sea flapping their wings before the war from the first branch chief of Wild Bird Society of Japan 25 years ago.

After that, there is the World War II, and recovery from the war, and rapid economic growth. During that, the coastlines in Japan were concreted. The tild flats were 80,000 ha in 1945 but 51,433 in 2006, namely disappeared 36% in 60 years.

Now the tild flats that remain in Japan or 19,206 ha are in Ariake sea. From this figure we can understand how important the tild flats in Ariake sea are. But in Ariake sea the sluice gate of Isahaya bay was closed. Formally Isahaya by was the number one landing zone. Now the number of Anas formosa landing decreases. Anas formosa became rare bird.

The birds like Anas formosa continued to decrease but still a lot of birds go through Ariake sea. Ariake sea is the place where 33% of shorebirds come to Japan. This figure is derived from the maximum number of individuals in the survey moniter-ing-site 1000.

The site is consist of Core site (Arao Higata, Higasiyoka Higata, Kasimasinkago Kaigan) and General site (Rokkaku-gawa Kako, Hayatue-gawa Kako , Onoshima). The tild flats in Ariake sea is the important one and in addition to shorebirds a various kind of birds (Ducks, Gulls, Herons) come there.

Chroicocephalus saundersi is the endangered specie, and 45% of the bird in Japan come to Ariake sea and pass the wi nter. 20% of Platalea minor and 71% of Tadorna tadorna use there. A lot of Caldris alpine, Pluvialis squatarola, Charadrius alexandrinus use there not as a stopping point but also as a wintering spot.

38% of Caldris alpine 21% of Charadrius alexandrinus that pass the winter in Japan use the tild flat of Ariake sea. Also 42%Numenius madagascarienisis and 36% of Limosa lapponica supplement nutrition and pass there.

From these datas you can understand that Ariake sea is No.1. Especially Higasiyoka Higata is remarkable. Higasiyoka Higat is an indispensable place to birds.

The reason why a lot of birds come there is that there are much food for example, Bristle worms, Crustaceas, fishs and also their foods microbes, plankton.

That Ariake sea is sick now.

Every time I hear about the reduction of fishery resources, I am very sad.

We can not make the environment worse any further. Arao Higata, Higasiyoka Kaigan, and kasima shingomori Kaigan(the wetlands of international importance that are protected) constitute only 5% of the entire Ariake sea. We must link to the future to enjoy watching birds rest on this place, to arrest the deterioration of the environment. It is up to us enrich the sea and also impoverish the sea.

Toward Restoration of Ariake Sea by Means of Integrated Studies "CoHHO" Collaborated with Its Relevant Social Movement "The Sea is Longing for the Forest" (abstract)

Masaru Tanaka
Kyoto University

The Ariake Sea previously showed the highest bioproductivity and biodiversity in Japanese coastal waters, being characterised by existence of many unique species of which distribution is resricted there. However both trends have been lost in recent years primarily due to accumulation of large-scale human impacts on the environment. Although there were many human impacts, following three problems appear to be the most serious impacts on the Ariake Sea ecosysytem. 1) Disembarking huge amount of sand from the bottom of the Chikugo River which is the largest river inflowing to the Ariake Sea during the later half of 20th century. 2) Chikugo Ohzeki construction in 1985 at the lower reach of the Chikugo river in order to supply drinking water for Fukuoka city. 3) 7km sea dyke construction in 1997 to reclamate the wide tidal flat area in the innermost part of Isahaya bay.

Each of those human impacts on itself is serious, but we should make sure of the essence common to these problems. That must be human-dividing land (forest) sysytem and sea system which originally connect each other. We could easily undersatand that tidal flat which needs continuous supply of mud and sand from land mainly by rivesrs; tidal flat appears to be deteriorated if its contiuous supply was disturbed, causing resultnat reduction of bio-purification ability by benthic organisms.

Japan has a unique natural strcucture characterised by combination od rich forest ecosystem with its coverage of 67 % and highly diversified marine ecosystem which is connected by more than 30 thousands rivers. This is recognised as positive connectivity in which forest ecosystem enhances marine bioproductivity by suppling nutrients and minute elements. However increased human population along riverside has destroyed it and chaged to negative connectivity. This could be typically found in Ariake Sea surrounded by many volcanic mountains like Unzen, Tara, Seburi, Kuju and Aso. Present critical situation of Ariake Sea is derived from destroying the forest-sea connectivity during the last 50 years.

In 1989 oyster-culture fishermen initiated tree-planting activity in order to restore the coastal marine ecosystem under a catch-phrase"The sea is longing for the forest"in Kesennuma, Miyagi prefecture. This grass-root social movement becomes to be nation-wide movement and has recently been got attention from ovesrseas countries as a Japanese wisdom. Followed this social movement (Mori-Umi movement), an integerated studies covering from the forest to the ocean was proposed by Kyoto University in 2003, being named as CoHHO studies (Connectivity of Hills, Humans and Oceans).

We have tryed to introduce the Mori-Umi movement and CoHHO studies to Ariake Sea for restoration, particularly tidal flat restoration since 2010. In order to disseminate the idea we have hold annual symposium entitled "Ariake Sea restoration" in Fukuoka, Oita, Saga and Kumamoto prefecture. Combined with idea dissemination we have established a non-profit organization to start practical tidal-flat restoration experiment. One of the important our practices has been conducted in Tara, Saga prefecture under collaboration fishermen, citizens and researchers since 2011. This experiment has been carried out using an environmental restoring substance named as Chilate Marine (CM) composed of iran, baboo chachole and chelate substance. This will be done under collaboration of young and senior generations as well as collaboration of local and urban people. Recent our particular concern is how we could invite school children into such field activities.

Efforts toward Revitalization and Creation of Ariake Sea (abstract)

Yoshiyuki Kawakami
Ariake Bay Rehabilitation Organization

The Specified Nonprofit Corporation, Ariake Sea Revitalization Organization was established with the aim of contributing to the revitalization and creation of the Ariake Sea through "survey and research" and "NPO activities", etc. mainly by university researchers in June 2005. Based on this, we have provided information widely through symposiums and lectures for citizens, and have been thinking about Ariake Sea together. In addition, we have also worked on the "Research Master Plan" showing a roadmap for a future survey and a research for the revitalization of Ariake sea.

We submitted "urgent proposal leading to future of Ariake Sea" to the related organizations of government and prefecture, and also actively participated in the problem of opening the Isahaya Bay reclamation project and strove for social contribution from scientific standpoint.

Today, we are gathering together with a common goal for "revitalizing and creating Ariake Sea", and aiming to establish "Association to consider the revitalization and creation of Ariake Sea and its coastal areas (tentative name)" composed by the administration of government and Saga prefecture, fisheries, researchers, NPO members etc. who cooperate toward this goal and implement concrete efforts.

In addition, we will recruit technology seeds for revitalizing Ariake Sea widely from all fields to discover new technology seeds, and will hold a workshop for technological suggestion. We will play a platform role for revitalization of Ariake Sea.

Traditional Fisheries of Ariake Sea (abstract)

Kango Nakao
MAE-UMI Citizens' Association, independent photographer

At least until ca 1950s, there were many traditional fishing existed in Ariake Sea. The numbers of the traditional fishing methods were about 100 including fishing boat fisheries and fishing activities on the tidal flat. However, their numbers fell to about one-half due to the degradation of marine environment and the decrease of the fisheries resources. The examples of the traditional fishing boat fisheries are the "Ankou-ami", the "Umitake-neji" and the helmet diving fishing of pen shell. The Ankou-ami fishing is conducted by a boat anchoring at the bay head area off the river mouth. The Ankou-ami is a fixed bag net with a width of about 20m which traps the fish and shrimp flowing into it by strong tidal current. It still can be seen off the mouths of the Hayatsue River and the Rokkaku River now. The Umitake-neji is a fishing to catch the bivalve Barnea dilatata (in Japanese "Umitake") which has long siphon and living in the bottom sediment using a long rod with an iron hock from a fishing boat. Now this fishing has been closed because of the decrease of the population. The helmet diving fishing of pen shell (in Japanese "Tairagi") is one of the typical fisheries in Ariake Sea but the history of it was not so old. It started in the Taisho era, at first by the divers form Jeju Island, Korea. This fishing is also closed now because of the decrease of population. The examples of the traditional fishing activities on the tidal flat are the "Mutsukake", the "Subokaki" and the "Takappo". The Mutsukake is a fishing of the goggle-eyed goby (in Japanese "Mutsugorou"). The Mutsukake fishermen sneaks up to a goggle-eyed goby on the mudflat and catch it by whipping with a long fishing rod. There are about 10 fishermen who are conducting the Mustukake in Hama, Kashima City and so on. The Subokaki is a fishing to catch the goby Odontamblyopus lacepedii (in Japanese "Warasubo") in the mud using a rod with an iron hock. The Mutsukake and the Subokaki fishermen use the Oshi-ita to move on the mudflat. The Oshi-ita is just like a snowboard or a wake board, but instead of zipping over snow or water, they slide over mud. The Takappo is a fishing of the goggle-eyed goby hiding in the burrow using traps made of bamboos or PVC pipes. Other than them, there are fishing methods using setnets or fishing weirs. The "Sukui", also known as the "Ishihibi" is a stone tidal weir. The Sukui fishing catch fish trapped in it using the sea level change caused by the tide. In the Meiji era, there were about 200 Sukuis along the coasts of Ariake Sea. However, there is only one is remaining now. It is located in Isahaya Bay and designated as a cultural property of Isahaya City. The other fishing method which is under threat of disappearance is the Takehaze. The Takehaze is the biggest setnet in Ariake Sea. It is a V or W shaped structure with a length of about 200 m in one side constructed with many bamboos and one or a few nets in shallow water. Just after the World War II, there were at least 100 Takehazes in Ariake Sea. But there are only one is remaining off Omuta City now. The traditional fishing methods disappeared in this 70 years after the World War II is more than 10.

Festival and Culture in Ariake Sea Coastal Area (abstract)

Gunji Aramaki
Specified Nonprofit Corporation, Ariakekai Gururin Net

Japanese people believe that “God” is inhabited in every nature, such as the sun, moon, water, ocean, forest. Okinoshima Island and Munakata Taisha Shrine where registration was decided to be a World Heritage this year, is celebrating the god of water and the famous Hurougu shrine, Koura Taisha shrine, Yodohime shrine in this area are celebrating the gods of sea and water.

“Hurougu Shrine Sea God Festival”, a festival that sets up an altar on the tidal flat that the tide has drawn at low tides and prays for God the grace and peace of the sea, conveys the relation between the ocean and people. The “Umihiko Yamahiko Legend” written in “Kojiki”, the oldest historical book in Japan, can not be established unless the background difference is large difference in the Ariake Sea. This strongly suggests that the origin of Japanese courtroom was in the coastal area of Ariake Sea.

150 years ago, the Saga clan was in charge of security at Nagasaki Port which was opened to a foreign country in Japan. The Saga clan who touched advanced Western science and technology had learned much from many foreigners and books and succeeded in making cannon and steamship with their own power. The former site of Mie Tsu Navy site which completed the first steamship in Japan was registered as “World Modernization Heritage” together with “Manda pit” (coal mining) in Arao City in 2015.

People in the coastal area of the Ariake Sea inherit the ancient festivals and at the same time create new festivals such as the “Kashima Gatalympics” and “Hot-air Balloon Festival” and deepen their relationship with nature. Kashima citizen came up with the idea to compete on tideland to widely advertise the flats’ charm. Competitions are prepared such as how far you can fly with the rope and how fast you can run on a thin plate with a bicycle not on the brake. The smiling face of muddy children in the “Kashima Goatalympics” shows that the mud deposited in Ariake Sea is clean and fun.

Saga plain has a mild climate, paddy field where hot air balloon can land, road runs horizontally and sideways. This natural condition makes it possible to hold hot balloon competitions. In “Hot-air Balloon Festival”, people can feel that the direction of the wind blowing in the Saga plain changes delicately because the balloon which can be steered only up and down moves in different directions.

Let’s think about the festivals and culture people have raised and inherited in the coastal area of the Ariake Sea.

Session 1

Wetlands and Disaster Risk Reduction / Climate Change

The Role of Wetlands for Disaster Risk Reduction

Naoya Furuta
IUCN (International Union for Conservation of Nature) / Taisho University

IUCN started to work on the issue of Disaster Risk Reduction since 2004 when the Western Indian Ocean earthquake and tsunami occurred. After this tragic event, there were many observations reported that impacts of tsunami were significantly reduced in areas where natural defence such as mangrove forests or sand dunes existed. For example, one of the coastal resort in Sri Lanka that was built behind the coastal dunes and vegetation was not affected by the tsunami and only 5 cm high of wave reached to the resort.

On the other hand in the close area to that, the whole coastal resort was destroyed by the tsunami and 27 people lost their lives. The reason for this tragedy was this resort destroyed sand dunes and vegetation and was built in from of the sea to have a good ocean view for the visitors. And Tsunami hit directly to the resort. Based on these observation at the Indian Western Indian Ocean Tsunami in 2004, IUCN experts in CEM (Commission on Ecosystem Management) started to discuss the important role of ecosystem management for Disaster Risk Reduction and coined the new term Ecosystem-based Disaster Risk Reduction or Eco-DRR in short [1].

The number of disasters events have increased significantly since 1980s, mainly those events due to either meteorological, hydrological or climatological reasons. Of course we would immediately assume that this rise is due to climate change impacts but the answer is also that there are more people living in areas that are impacted by such hazard events, such as coastal areas and river beds. And those areas are also important for wetlands. Here we can see the very close linkage between wetlands conservation and disaster risk reduction. At the same time, in terms of distributions of the disasters around the world Asia has been consistently the most affected region, followed by the Americas and Africa from the view point of number of disaster events, disaster mortality and economic loss caused by disasters.

We tend to use the term "natural disaster". However it is questioned by many experts recently as disaster is not a natural phenomenon. According to the UNISDR, a disaster is defined as "a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources" [2]. This means disaster is not a natural phenomenon by itself but rather the ability of human society to cope with matters.

Disaster risk refers to the potential disaster losses – in lives, assets, livelihoods, etc. – which could occur to a particular community or society over some specified future time period [2]. We often express risk in terms of three factors: hazard (cyclone, tsunami); vulnerability and exposure. It is important to distinguish between these three elements as they require different sets of policies and remedies in order to reduce disaster risk. Thus it is important to stress that disaster risk cannot only attribute to the hazard that is a natural phenomenon but more depends on vulnerability and exposer that relate to human activities.

There is a growing recognition on Ecosystem-based Disaster Risk Reduction (Eco-DRR) in the past few years. Eco-DRR is defined as "the sustainable management, conservation, and restoration to reduce disaster risk, with the aim of achieving sustainable and resilient development" [3].

In 2008, a global partnership of organizations called PEDRR (Partnership for Ecosystems and Disaster Risk Reduction) was organized and has been jointly promoting Eco-DRR, collecting relevant information and providing capacity development since then [4]. Because of this joint efforts, in the past few years Eco-DRR was successfully integrated into both conservation policy and DRR, Climate Change and Sustainable Development frameworks.

For example, at the CBD COP12 in Korea in 2014, a decision on Biodiversity and Climate Change and Disaster Risk Reduction was adopted with a support from the Government of Japan and other countries. This decision gave a strong mandate for the CBD secretariat and also IUCN to work on this issue under the CBD process. Based on this decision, IUCN is now implementing a capacity development project on Eco-DRR at the global level called RELIEF kit (Resilience through Investing in Ecosystems - knowledge, innovation and transformation of risk management) funded by Japan Biodiversity Fund [5].

At the Sydney World Parks Congress in 2014, a series of sessions were devoted for the DRR and protected areas. And the role of protected areas for DRR was recognized in the outcome document of the Sydney World Parks Congress for the first time in the history of the World Parks Congress. And at the Ramsar COP12 in 2015, a decision on Wetlands and disaster risk reduction was adopted with a strong support from the Philippine government after the hurricane Hyen.

The 3rd World Conference on DRR took place in Sendai in 2015 and adopted Sendai Framework for Disaster Risk Reduction 2015-2030. Ecosystem-based approaches were also strongly embedded into this strategy. The Paris Agreement on Climate Change also recognized the role of ecosystem approaches for climate change mitigation and adaptation and many countries already incorporated ecosystem-based measures within their INDCs. There are also many entry points for ecosystem approaches for the SDGs and investing in nature based solutions for DRR can help achieve a number of these goals.

In the academic world, there has been also a growing evidence to support the role of Eco-DRR in major scientific journals in the past few years. And interestingly many of them are focusing on coastal ecosystems that are closely linked to the wetlands [6][7][8][9][10][11][12]. Those studies argued the ability of coral reefs to reduce wave energy, oyster reefs to grow in height for the rise etc. Sutton-Grier et.al. reviewed various types of Eco-DRR approaches in the coastal areas and compared pros and cons of different approaches – natural, built and hybrid approaches and concluded that there is a huge research potential for the hybrid approaches [13].

When we look at the practice, there is also an increasing implementation practices on the ground by using Eco-DRR approaches in various places around the world. For instance, US experienced Hurricane Sandy in 2012 and it brought a huge impacts in the north east coast of the USA such as New York. The US federal government developed Hurricane Sandy Rebuilding Strategy in 2013 and the Strategy integrates a lot of green approaches in it [14]. Based on this strategy, an innovative international competition called Rebuild by Design was conducted and 10 final plans were selected [15]. All these plans integrated ecosystem approaches.

Examples can also be found in other continents such as the Room for the River project in the Netherlands that creates more "rooms" for rivers including creating wetlands instead of increasing the heights of the river banks to prepare for the climate change in the future [16]. Another example in the Netherlands called Building with Nature initiative led by a consortium of private companies, research institutions, NGO such as Wetlands International and the government [17]. This initiative has been testing a wide range of innovative coastal management techniques in and outside of the Netherlands. That includes mangrove restoration in Indonesia.

European Commission is also supporting this kind of innovative research and development activities through its Horizon 2020 research grant programme [18]. In developing countries, also many initiative are underway such as Mangrove for the Future that is a mangrove restoration initiative implemented in various Asian countries initiated by IUCN [19]. More recently, a global initiative on mangrove restoration called Global Mangrove Alliance was launched in collaboration with CI, IUCN, TNC, WI and WWF. This initiative aims to expand mangrove habitat 20% by 2030 globally [20].

With these active implementation on the ground based on the similar concepts and terminology, IUCN recently coined the concept called Nature-based Solutions to incorporate all these similar ecosystem-based approaches to address various challenges in our society [21].

In summary, there has been a rapid increasing recognition on Eco-DRR at global and national policy in the past few years. At the same time, scientific evidences and on-the-ground experiences also being accumulated.

In this background, it is also recognized "Wetlands" has a huge potential for Eco-DRR as the Climate Change proceeds. Asian countries have common challenges and opportunities for mutual leaning in this field.

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Carbon Retention in Sediment by Check Dams in Phayao Province, Thailand

Chotiwut Techakijvej[1], Jaroon Jakmunee[2] and Chitchol Phalaraksh[1,3*v]

[1] Environmental Science Program, Faculty of Science, Chiang Mai University, Chiang Mai, 50200, Thailand
[2] Department of Chemistry, Faculty of Science, Chiang Mai University, Chiang Mai, 50200, Thailand
[3] Department of Biology, Faculty of Science, Chiang Mai University, Chiang Mai, 50200, Thailand
*Corresponding author, E-mail: chitcholp@gmail.com

Introduction

Human activities have an important influence in the global climate change by using of fossil fuels and land use change altered the global carbon cycle (IPCC, 2007). One of significant factor in carbon cycle is soil that can reduce the atmospheric CO_2 by storage carbon from photosynthesized which is accumulated as soil organic carbon (SOC) (Tippayachan, 2006).

Soil erosion is one of the important process impacts on soil carbon pool and global carbon cycle (Lal, 2003). This process was accelerated by land use change such as deforestation, overgrazing and non-sustainable agriculture (Zapata et al., 2003). In Thailand, the office of research and development for land management estimated the carbon losses from soil water erosion about 10.07 - 11.20 million tons C/year this is the highest carbon losses from soil compare to other process (Anuluxtipun et al., 2013).

To mitigate the negative environmental impacts of soil erosion, many method of soil and water conservation, check dams is one (Valentin et al., 2005). Over 150,000 check dams in many types have been built in Thailand (1994 – 2007) for water resource preservation, soil conservation, and development for the rural communities (Office of RDPB, 2007). Furthermore, check dams can store significant proportion of the eroded soil carbon along with the effects of sediment retention (Boix-Fayos et al., 2009; LÜ, 2012). This show the implications of check dams as functional landscape units for carbon retention that effect to the terrestrial carbon cycling, however, is short of study in the present scientific literature.

Objective

1. To compare the potential of the sediment carbon retention by each type of check dams.
2. To classify the carbon retention effectiveness in each sub watershed by using Integrative carbon retention effectiveness index (ICREI).

Method

Study area

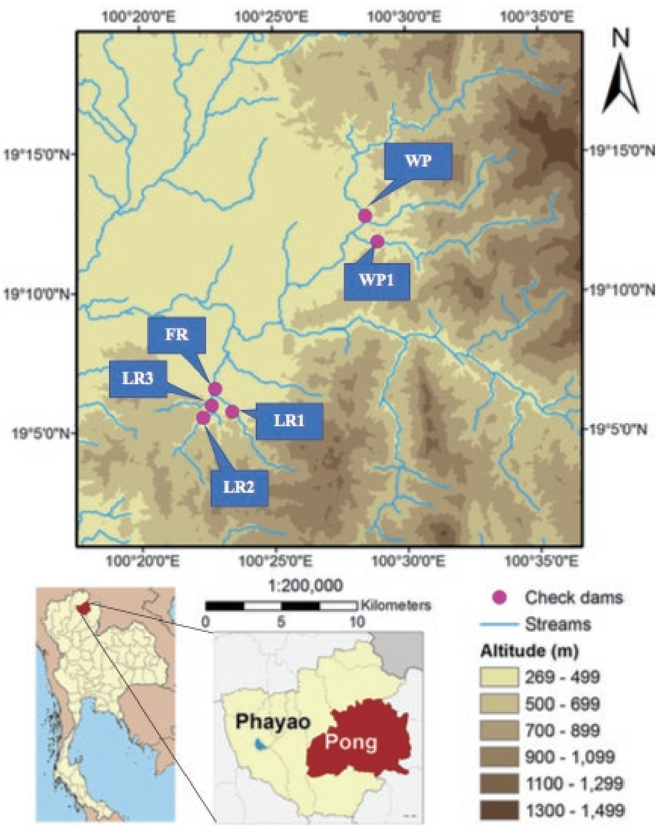
The data and samples was collected between June 2014 to April 2015. Three sub-watersheds Nam Kham, Nam Pook and Nam Sala were selected as the study areas in Pong District, Phayao Province, Thailand (Figure 1). In Nam Kham sub-watershed, there are two check dam types including ferro-concrete (1 dam; sampling point: FR) and loose rock (3 dams; sampling point: LR1, LR2 and LR3). Whereas in Nam Pook and Nam Sala sub-watershed, there are one type of wooden pole check dams in each sub-watershed (sampling point: WP; WP1) (Figure 1).

Data collection and sampling

The data included watershed topography (total number of check dams controlled, watershed areas, mean slope gradient and land use/land cover areas) and check dam characteristics (geographic locations, check dam types, check dam sizes (high and width), time of construct completion and areas (km^2) of watershed that controlled by the check dams were collected.

The volume of sediments (m^3) were estimated assuming by the sediment wedge in the form of a prismatic channel with a rectangular section (Castillo et al. 2007). The two replicate of sediment samples was collected by core sampler from two positions at front (close to the check dam wall) and end (at the end of the sediment wedge upstream).

Figure 1



Sample analysis

To calculate mass of carbon in sediment by using bulk densities were determined for all sediment samples. Samples were dried for 24 hours at 110 oC. Aliquot samples were taken in know volume (cm3) of plastic boxes and weighted then calculated to bulk sediment density (g cm^{-3}).

To analyze organic carbon (g/kg), all sediment samples were dried, grounded and sieved at <0.5 mm. and determined by Walkley-Black method.

Estimation of the carbon retention in sediment by check dam was calculated as the product of bulk density (BD) of the sediments (tons/m3), average soil organic carbon content (SOC) in the deposited sediments (%) and volume of sediment deposited (SD) (m3) as equation below.

Carbon retention in sediment (tons) = BD × SOC × SD

Identify influencing factors to the check dam carbon retention, statistic correlations were detected between the amounts of carbon retention by check dams and the data including the height, total volume, years after construction complete of check dams as well as the watershed areas controlled by check dams.

Integrative carbon retention effectiveness index (ICREI) equation (Lü, 2012) was used to considering the effectiveness of carbon retention by check dams at watershed- level.

Identify influencing factors to the check dam carbon retention at the watershed-level, land use types, number of check dams in watershed areas and topographic characteristics were analyzed.

Result and Discussion

Carbon retention by check dams

Check dams carbon retention in sediment were showed in table 1. The estimated amount of carbon retention by all check dams equaled to be about 652.9 tons. The highest ability of check dams to retained carbon was 263.7 tons of carbon in WP check dam.

Table 1

Check dam	Dams volume (m^3)	Sediment accumulated (t)	Bulk densities ($t\ m^{-3}$)	SOC (%)	Carbon retention (t)
LR1	55.1	67.1	1.24 ± 0.24	0.53 ± 0.03	35.5
LR2	40.5	59.3	1.50 ± 0.04	0.54 ± 0.00	32.0
LR3	16.7	11.5	1.56 ± 0.07	0.95 ± 0.37	11.0
FR	690.0	807.3	1.56 ± 0.07	0.32 ± 0.15	258.3
WP	337.5	376.7	1.24 ± 0.24	0.70 ± 0.12	263.7
WP1	151.9	187.1	1.40 ± 0.16	0.28 ± 0.01	52.4

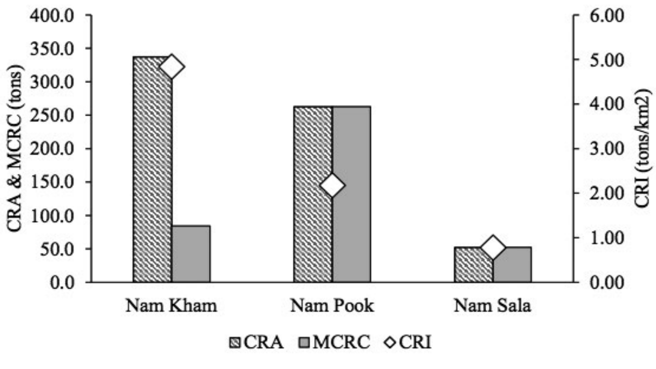
Form correlation analysis between carbon retention and check dam characteristics. Dam volume was shown positive correlations with carbon retention (0.893, $p<0.01$). Therefore, the dam volume was the factors that most positive influence on carbon retention in sediment. In the same direction of LÜ et al. (2012) high of carbon retention amounts was found that total volume of check dams is the most important factor for carbon retention. Carbon retention and controlled watershed was shown significantly positive correlation (0.816, $p<0.05$). In the same result with Boix-Fayos et al. (2009), found that the highest SOC buried in check dam sediments appears in the largest catchment.

In this study, check dam types were not affect to the carbon retention potential. However, %SOC showed high values in first check dams position of stream or in upstream (LR1, LR3 and WP). In erosion process, most of SOC was losses by mineralization of C to CO2 in the transport process (Wang et al., 2014). This result can be concluded that upstream is suitable position to build the check dams.

Carbon retention by check dams at the watershed-level

Carbon retention amount (CRA), carbon retention intensity (CRI) and mean carbon retention capacity (MCRC) data were show in figure 2.

Figure 2



The highest CRA (337.5 tons) and CRI (4.84 t km^{-2}) were found in Nan Kham sub watershed. Because, Nan Kham sub watershed was got high in number of check dams in small sub watershed. The highest MCRC was found in Nam Pook sub watershed (262.9 tons). Because, Nam Pook sub watershed was got high carbon retention but only one check dam. Nam Sala sub watershed was got lowest CRA, CRI and MCRC. Because, Nam Sala sub watershed was got low carbon retention and only one check dam.

CRA and CRI were detected to be positively correlated to the number and total volume of check dams as well as the urban area ratio and agricultural area ratio, but correlated negatively with mean slope, disturbed forest and forest area ratio area ratio. Because the urban area accessibility to gullies and agricultural area implied high vulnerability to soil erosion (Wang et al., 2006). That cause of more carbon in sediment can transport to the stream and check dams.

The integrative carbon retention effectiveness index (ICREI) to identify the check dam carbon retention potential at watershed scale. ICRE in 3 sub-watersheds were show in figure 3.

The highest integrative carbon retention effectiveness index (ICREI) was found in Nan Kham sub watershed (0.74). Because of Nam kham sub watershed was high a number of check dams in small sub watershed lead to highest carbon storage Nam Sala watershed area has only one small check dam lead to the resulting in the lowest ICREI.

Conclusion

The estimated amount of carbon retention by all check dams equaled to be about 652.9 tons that equal around soil organic carbon in 3.3 hectare of forests. From check dams carbon retention result shown that check dams are multifunctional landscape units that can trap amount of carbon in sediments. The ICREI shown that check dams in Nam Kham and Nam Pook sub watershed have effective to retain the carbon in watershed. In contrast, Nam Sala sub watershed has less effective to retain the carbon. This can be used as important decision for planning of new check dams in this sub watershed for more carbon retention capacity.

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Lessons Learned in Building Community Resilience: 100 Villages on the Bank of 3rd Largest River System of Peninsula of India in 5 Years

Saswata Kumar Mohapatra

NETCOAST/ SPANDAN, Odisha, India

River Mahanadi is the largest river system of State of Odisha and the 3rd largest river system of peninsula of India. It drains an area of around 141,600 square kilometers and has a total course of 858 kilometers through 3 states of India. The communities living along the bank of the river are highly dependent on the river system. Each year the river brings flood which affects the lives and livelihoods of these communities.

Project titled 'Partner's for Resilience (PfR)' was launched in the year 2011, with its primary focus on Disaster Risk Reduction (DRR), Ecosystem Restoration & Management (ERM) and Climate Change Adaptation (CCA) frameworks. The project was lead by Wetland International South Asia through its New Delhi Office. The other partner INGOs were CORD AID, Red Cross Climate Centre and CARE, Netherlands. The project was implemented in Odisha through NETCOAST, a network of local NGOs working in different districts.

There was selection of 100 villages across the Mahanandi river system of Odisha. Following Eco-system management principles as the core strategy, these target villages were segregated in to 3 zones based on the landscape pattern and geographical locations, viz. i) Delta head zone, ii) Central zone and iii) Coastal zones.

Participatory Risk Analysis (PRA) was conducted in each of those 100 villages. The analysis included among many other variables, the village's most evident problems, the extent of vulnerabilities, the available human & financial resources and the community capacities. This has final led to development of 'micro-plans for building resilience' for each of the villages. The activity plan thus prepared envisaged mobilization of resources from Govt. and other local stakeholders of the areas. The key challenge of this process was the difference of approach of these stakeholders who did not traditionally work together. Apart from measures to respond village specific issues, these plans also included some of the activities due to its location in the respective zones, which ultimately influence the ecosystems of the other two zones.

Followings are some of the lessons learned from the field as the outcomes of the project.

1) Water logging issue mitigation *(inlet -outlet clearing of the canals/ drainage and other chocked water ways…)*: One successful example from the project is 'finding out local solutions to the issue of water logging'. The project has supported an activity called 'inlet/outlet clearing of Canal' in the Central Zone villages targeting the issue of 'water logging'. This eventually reduced the water logging days in the crop fields which was affecting across 113 acres of land in 12 villages, near River Rajua at Kanas, Puri. This further contributed in the introduction of timely crop management in the zone. The de-siltation of the bed of the canal has helped to work as buffer for drainage of rain water to the river. At the same time, during the summer, it helped excellently for irrigation of those crop lands. Inspired by the success, Gopinathpur Grampanchayat PRI members could mobilize resources from the Irrigation Department for de-siltation & cleaning of another adjacent canal, thus restoring another 108 acres of land. The direct investment of Rs. 80,000 (INR) from the project could pulled another investment of Rs.1,00,000 (INR) from Govt. This ultimately helped to gain Rs. 3, 00,000 (INR) of additional income from their crop land per year and recharge of 3 village ponds for fisher activities. This is one of the small but wonderful practical success stories.

2) Local Self Governance involvement- *(Resilience agenda carried forward…):-* Another successful outcome of the project was the "inclusion of Local Self Governance/ Panchayat Raj Institution (PRI) systems" in the process. DRR/ ERM or CCA has never been in the agenda for PRI. The village level plans thus developed during this project were passed in the Pallisabha/ Gramsabha planning meetings with formal resolutions. Thus these agendas are now carried forward to the PRI/ Local Self Governance to take up further. Therefore, even the project was ended in 2015 the actions/ activities are still ongoing.

3) Clearing of River Mouth (stagnant water get released to the sea and crop fields saved from saline water surges): This worked for the Coastal zone villages. The youth volunteers from the adjacent villages get together and used to go to clear the water hyacinths and other obstacles on mouth areas, which were hindering the passage and flow of river water to the sea. The project successfully mobilized participation of the communities of all adjacent areas to resolve the issue jointly.

4) Introduction of stress tolerance variety of crop-

The crop fields in different zones were facing issues like water logging in the Central zone, salinity in the Coastal zone and water scarcity in the Delta head zones. The project helped bringing Scientists from the local Krushi Vigyan Kendra. After soil & water testing, they recommended seeds. We facilitated the process further and results were successful. Viz. Swarna Sub-1 for central zone, Sukha Samarat for Delta head zone.

5) Micro enterprise promotion for the women of the community as the alterative livelihood measures- pond pisciculture promotion: The water bodies and the ponds were remained unused for several reasons. The project facilitated bringing the Fishery Scientists from the local Krushi Vigyan Kendra. After soil and water testing, they recommended measures to renovate the ponds and advices on the fishing practice. We facilitated the process further. The final results are amazing. Integrated Coastal Zone Management Project (ICZMP) has extended further supports to make the processes sustainable and gainful for the women.

6) Community disaster preparedness enhanced- Task Force developed and worked effectively: In the process of building the capacity of the community towards disaster, the project facilitated formation and training of Task Forces at different villages. These youth Task Force volunteers have started working effectively. Their responses to the last Phailin Cyclone in 2013 and Hud-Hud Cyclone in 2014 has illustrated their relevance and the enhanced efficiencies.

7) Plantation to stop soil, embankment erosion, saline wind: The project facilitated community participation in the process of restoration and growth of forests in and around the villages. Of course the plantation as a EMR measures used for different purposes at different zones. But it has helped to meet the objectives and communities are getting benefits from this. Viz.- i) in the Delta head zones, the plantations were used to stop soil erosion, ii) in the Central Zone villages, it was used as a measure to stop embankment erosion, iii) in the Coastal zones , it was used as a measure to stop saline wind flow from the sea coast.

8) Community managed Mangrove Forests as the natural shield to cyclone: This was facilitated in the Coastal Zone villages. The communities are taking the stewardship of these forests. There were further supports extended from ICZMP project to scale up the activities further in those areas.

9) Insurance promotion as the risk transfer mechanism: Insurance promotion has been carried out in all the zones. Both Life and Asset insurance was promoted. Of course there are still challenges to cover all the assets under schemes. But the successful part of the story envisaged that the communities are now self motivated to update insurances regularly with fisher department. Women are taking more interest in this sphere.

The project during the last 5 years has left behind a group of stakeholders with both the motivation and ability to work together to promote practical approaches towards better community resilience building. Both the success and the failure stories have left behind as *foot prints*. The documentation and sharing of such cases stories provides enormous inspirations to mobilise other communities, Govt. departments and other stakeholder's joint initiatives to resolve issues locally and having impacts on a broader scale.

First line of water on the canal after de-siltation work

New crops, new hope for the farmers, Agrl. Officer testing the ground nuts, date- 23-12-2013, Nuasahi Paschima, Kanas, Pur

KVK recommend the advcanced finglings of Chandi breeds, Malisahi, Kanas, Dt. 24-12-2013

water passage clearing by women SHG members

Impact of Climate Change on the Wetlands of Bangladesh

Sanowar Hossain

Bangladesh POUSH, 11/8 Iqbal Road, Block-A, Mohammadpur, Dhaka-1207, Bangladesh

Email: sanowarpoush@gmail.com

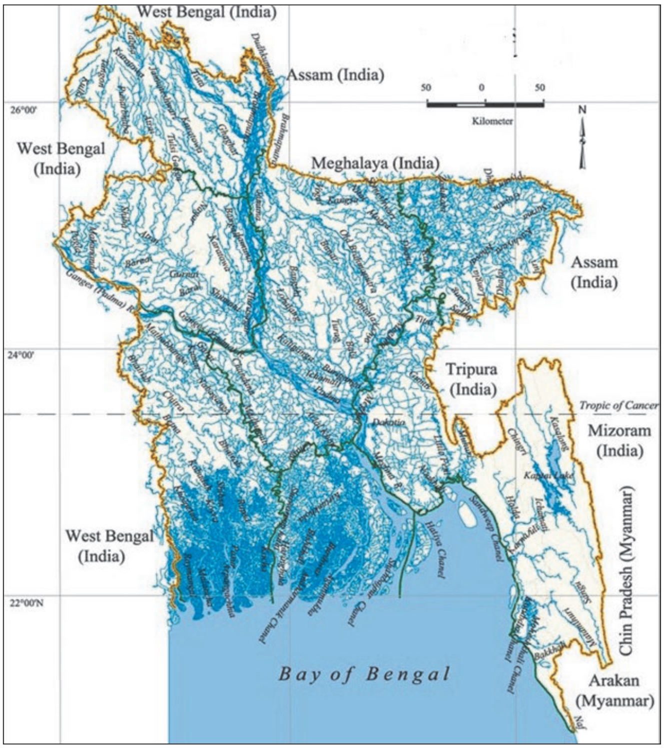
Abstract

Bangladesh is a land of wetlands, around 50% of the country is occupied by different types of wetlands. Due to climate change the wetland ecosystems area under treats. There are changes in rainfall and seasonal calendar that interferes the productivity of the wetlands. The inland wetlands which are the breeding ground of fisheries and the habitat for resident and migratory birds' area being affected by extreme climate events and morphological changes due to climate change. Community has been working for climate action with different adaptation practices. In the wetlands, the adaptive action by the community in agriculture and natural resource management is both proactive and planned. The ecosystem based adaptation is highly recommended action for the protection of live and environment for the wetlands. The changes in the agriculture and fisheries, the main occupation of the wetland inhibitors of the country are significant. Community is practicing diversification of the agriculture. Short duration and early varieties are more popular to cope with the extreme weather. Climate smart agriculture is the main scope of adaptation action in and agrarian community. The paddy cultivation in wetland ecosystem is causing a risk of over harvesting of water for the irrigation that has consequences on the biodiversity of the wetlands. The wetlands in north-east fold plain basin are characterized to unique vegetation and the coastal wetland area habitat for migratory waders and sandbar vegetation. Climate change consequence on those wetlands is causing loss of vegetation which results fragmentation of the habitat. The conservation action requires more attention on the vegetation regeneration. Bangladesh POUSH along with the communities in the coastal wetlands is working for participatory habitat development. For the climate action government has taken number of actions. The nationally determined contribution has identified climate action which also works for the environmental wellbeing of the wetland habitat. Technology, legislation, educational knowledge, action plan strategy, conservation practices are required to manage wetlands. Bangladesh now needs a comprehensive approaches, strategy and integrated system combining political, economic, social, technological and institutional supports to address sustainable wetland conservation and the newly added crisis, climate change. To cope with the climate change in wetlands knowledge management is an urgent. Climate change is a reality and the community, development actors, practitioners and policymakers need to work in a comprehensive way with the knowledge from different intervention action taken and practiced. Wetland protection and conservation plans require identifying the climate impact and the vulnerability caused by the climate change. Ecosystem based Adaptation is the best option to make the wetland communities climate smart.

Introduction

Bangladesh lies between latitudes 20°34'N and 26°38'N and longitudes 88°0l'E and 92°41'E. It is bounded by India in the west and north, by India and Myanmar in the east, and by the Bay of Bengal in the south. As the Himalaya is on the north and Bay of Bengal in the south the country has own many rivers and tributaries. The total area of wetlands in Bangladesh has been variously estimated at between seven and eight million hectares, i.e. about 50% of the total land surface. This includes at least 480,000 ha of permanent rivers and streams, 610,000 ha of estuaries and mangrove swamps, between 120,000 and 290,000 ha of haors, baors and beels, over 90,000 ha of large water storage reservoirs, 150,000-180,000 ha of small tanks and fish ponds, 90,000-115,000 ha of shrimp ponds, and some 5,770,000 ha of land which is seasonally inundated to a depth of 30 cm or more.

Fig: wetland map of Bangladesh



Wetlands of Bangladesh:

Wetlands	Area (in Km²)	Major climatic extremes
Open water body		
Rivers	7,497	Mountain snowfields and glaciers melting, sea level rise, subsidence, flood, riverbank erosion, drought, salinity intrusion, flashflood, storm surges, higher water temperatures, precipitation anomalies, coastal cyclones.
Estuaries and mangrove swamps	6,102	
Beels and haors	1,142	
Inundable floodplains	54,866	
Kaptai Lake	688	
Closed water body		
Ponds	1,469	Rainfall scarcity, flood and inundation, storm surges, cyclone, soil erosion, salinity intrusion etc.
Baors (Oxbow Lakes)	55	
Brackish-water farms	1,080	

Wetland Biodiversity in Bangladesh:

Wetlands of Bangladesh are rich with biodiversity. Over 300 plant species, 400 vertebrate species, and 260 freshwater fish species are dependent on wetlands of Bangladesh. Around 11 amphibians, 34 reptiles (6 turtles, 7 lizards and 21 snakes), 206 birds and 31 mammals occurs. Some wetlands of Bangladesh are of national and international significance such as Tanguar haor (Ramsar site and an Ecologically Critical Area), Hakaluki haor (Ecologically Critical Area), Sundarbans (Ramsar and UNESCO World Heritage Site and Ecologically Critical Area), and St. Martin's Coral Island (Ecologically Critical Area). About two-thirds of people in Bangladesh depend on wetlands for a variety of purposes including water (drinking, irrigation), food production (agriculture, aquaculture), fishing, livestock grazing, bird hunting, fire-/fuelwoods, medicinal plants, wild food, honey, waterway transportation, harvesting grasses and seaweeds, and tourism/recreational business. Some poorest of the poor in the vicinity depend totally on the goods and services of the wetland for livelihood.

Socio-economic values of wetland

Services	Examples
1. Provisioning	
Food	Production of fish, wild game, fruits and grains.
Fresh water	Storage and retention of water for domestic, industrial and agricultural uses.
Fiber and fuel	Production of logs, fuel woods, peat, fodder.
Biochemical	Extraction of medicines and other materials from biota.
Genetic materials	Genes for resistance to plant pathogens, ornamental species etc.
2. Regulating	
Climate regulation	Source of sink for greenhouse gases (footnote); influence local and regional temperature, precipitation, humidity, and other climatic processes.
Water regulation (hydrological flows)	Ground water recharge/ discharge.
Water purification and waste treatment	Retention, recovery and removal of excess nutrients and other pollutants.
Erosion regulation	Retention of soil and sediments.
Natural hazards regulation	Flood control, storm protection.
Pollination	Habitat for pollination.
3. Supporting	
Soil formation	Sediment retention and accommodation of organic matter.
Nutrient cycle	Storage, recycling-reduce-reuse, processing and acquisition of nutrients.

Legislation on wetlands:

Bangladesh has ratified the 1971 Ramsar Convention (Convention on Wetlands of International Importance, especially as Waterfowl Habitat) and designated two wetlands (Sundarbans and Tanguar Haor), which has strengthened conservation efforts there (and led to Tanguar being taken out of commercial leasing). The Convention addresses to protect the threatened wetlands, to improve resources, to conserve and enhance the wetlands.

The Bangladesh Environmental Conservation Act (1995) established the Department of Environment (DoE) and specifies a move towards ecosystem approaches and regulation of developments harmful to those ecosystems, particularly pollution control and mitigation and requirements for Environmental Impact Assessments. The Act includes provisions for declaring Ecologically Critical Areas (ECAs) to restrict potentially harmful activities in these areas. The Act recognizes the Polluter pays principle as it puts the provision of compensation.

The Water Act, 2013 Another important Act named as Bangladesh Water Act, 2013 has been made for the improvement, management, collection, distribution, usage, protection and preservation of the water. The Act recognizes the significance for managing all forms of water resources in the context of natural flow of surface water and recharge of groundwater. The private landowners will be able to use the surface water inside their property for all purposes in accordance with the Act. No individuals or organizations will be allowed to extract, distribute, use, develop, protect, and conserve water resources, nor will they be allowed to build any structure that would impede the natural flow of rivers and creeks. Conservation of wetlands as grazing ground and sanctuary of the migratory birds has been given much importance while conservation of ponds as a source of pure drinking water in critical areas has been abandoned.

National Fisheries Strategy and Inland Capture Fisheries Strategy (2006) set out a framework for community management of inland fisheries based on leasing at nominal rates, widespread conservation measures, and precautionary development of aquaculture in floodplains.

The Jalmohal Management Policy (2009) allows for fisher organizations to lease water bodies without competitive bidding, and mentions sanctuaries and swamp forest. The importance in the above instruments merely goes for the wetlands for fisheries, agriculture and the resources over there. But the importance of keeping water bodies on earth is very much helpful for the ecological balance.

Climate Change Impact:

1. Cyclone intensity and frequency have been increased: The intensity of the cyclone has increased; it is reported that cyclone frequency in the coastal Bangladesh has increased three times. The strength and number of major cyclones may be increasing because of higher sea surface temperatures associated with global warming. The cyclone resulting storm surge by which the water in wetlands being getting saline. The storm surge also creating water logging.
2. Salinity intuition: Salinity is penetrating far inland through Meghna estuarine river system. An environmental terrible circumstance caused by salinity intrusion is a major problem in southwest coast. Huge lands are not cultivable now. The shallow coastal aquifers have high salinity.
4. Changes in seasonal calendar: The characteristics of the typical months and season have already been changed. Three seasons exist instead of 6; summer and rainy season becoming longer and the winter is significantly short.
5. Rainfall erratic: Though no significant changes in total rainfall reported but short duration heavy rain has increased. There is also no-rain situation.

Effect of climate vulnerabilities on wetlands:

Problem	Causes	Effect
Flash flood in Haor and Hill area	• Rain the upstream has increased significantly • Rainy season shifted and became earlier starting from mid-April which now has shifted from early April	• Loss of crops • Erosion • Loss of livelihoods • Increasing poverty
Riverine flooding is uncertain	• Over rain is upstream • The catchment area of 3 major Bangladeshi rivers is 11 times bigger than Bangladesh • Siltation in rive bed • Frequent Storm surge in Bay of Bangle	• Loss of life and livelihoods • Crop and culture fisheries loss • Environmental pollution
Less water in monsoon	• Control from up stream	• Loss of biodiversity • No irrigation • Fish migration interfered • Seasonal poverty resulting advance sale of labour
Frequent cyclone and storm surge	• Sea temperature increase	• Loss of life and livelihoods

Climate Change impacts of wetland ecology and biodiversity:

- Increase in water temperature causing reduce of dissolved oxygen in water
- Extreme flood and rainfall increase run-off of contamination of water

- Flood causes loss and damage of property and lives
- Loss /shift of natural breeding ground of fisheries and wildlife

Climate change impacts on livelihoods:
Breeding season of fish interfered → no egg
Flash flood → Crop loss
No seed in rice → Crop loss
Less cultivable land → Crop loss
More weed → Navigation interfered
Habitat loss → Biodiversity loss
Reduced working hours → Less earning

Climate change impacts on livelihoods:
Flooding → contamination of water → Toxicity
Flooding → more fertile water → over growth of vegetation
Temperature → water temperature → less dissolved Oxygen
Land erosion → land loss → less of swamp forest
Siltation → Habitat loss → Biodiversity loss

Impact of Climate Change on the Mangrove wetlands:

Climate change resulting in sea level rise would cause severe environmental impact on the living resources including people and biodiversity in the affected areas. There are so many coast line associated islets and islands in the Bay of Bengal in the southern part of Bangladesh, e.g. Sandwip of Chittagong, Shahpari and St. Martin of Teknaf, Kutubdia, Moheshkhali and Sonadia of Cox's Bazar and islands like Nijhumdip, Char Kukrimukri, Char Dale, Char Fashon, etc of Patuakhali, Barguna and Bhola districts. Thousands of poor and homeless people live in these areas. Sea level rising 0.5-1m there will be catastrophic for these affected areas and people. Sundarbans, the biggest mangrove forest in the world consisting 6200km^2 of forest and riverine areas lies there. It has been listed as World Heritage Site and is the most important ecosystem and protective natural barrier against the calamities like tidal surge, cyclone etc. This gift of nature would simply be submerged by the rising sea.

Community Adaptation Intervention:

- Early varieties / crops cultivation
- Floating cultivation
- Dry seed bed
- Diversification of livelihoods
- Plantation to reduce flood and storm surge risk

Experience of Bangladesh POUSH in climate action in coastal Wetland:

Bangladesh POUSH undertakes interventions in sustainable livelihood through participatory natural resource management, biodiversity conservation, participatory afforestation & nursery development, environmental education, human resource development, partnership & gender development, conservation of cultural heritage, research & publication that contributing to the protection of coastal wetland and wetland people from the adverse effect of climate change.

Biodiversity Conservation through Ecosystem based Adaptation Involving the Local community at Gorakghata, Maheshkhali of Cox's Bazar was done with Japan Fund for Global Environment (JFGE), Japan in association with RCJ, Japan. The project aimed capacity building of the community on adaptation to climate change. 200 families have been directly benefited through different capacity building training and awareness building activities.

Homestead Planting in Coastal Villages to Mitigate the Climate Change Impact was supported by Climate change trust of Bangladesh government since 2013. The project is being implemented in the coast households of Moheshkhali. A total of 200000 sampling planted at 20000 household with different tree species in an around homestead.

Key lesson learnt in climate action for wetlands:

Bangladesh POUSH believes to make community managing own natural resource very specifically the coastal resources planning and designing needs to be done by the community. The geo-context particularly the state of disaster risk is a vital for the project success and sustainability.

- Project design needs to be a community participatory process allowing in-built flexibility and enable community based resource management institutions to respond to local situations. Government and donors need to give an enabling framework.
- More consideration should be given to post project sustainability at the design stage of project.
- Building capacity of communities, by means of organizing them in groups (any form) and imparting trainings by applying participatory rapid appraisal (PRA) tools towards enhancing understanding and ability to anticipate impacts of climate change and risks of disasters so that they may safeguard their assets, diversify their economic activities towards climate-/disaster-safe activities and they may access goods and services to withstand shock and/or to bounce back following shocks.

Action to cope with climate impact in wetlands

- Involve local community in management (through PAPD)
- Ensuring Access to existing resource and Investment
- Explore scopes from exiting legislations rather than having new law
- Involve/Establish a community institution for monitoring
- Making conservation/protection economically valuable to community
- Respecting and Integrating Indigenous Knowledge
- Practice a culture of sharing benefit among the stakeholders
- Mass awareness and education on the practiced management through significant number of tools/event
- Ensure involvement of Government in every stage

Climate Change, an additional consideration of planning coastal biodiversity conservation:

Bangladesh is the most vulnerable country to climate change. Within the country, the coast is the most vulnerable because of its location and livelihood pattern. The coast is in topography very plain and is of sea level and the livelihood is musty agrarian and costal fisheries based.

1. Cyclone intensity and frequency have been increased: The intensity of the cyclone has increased; it is reported that cyclone frequency in the coastal Bangladesh has increased three times. The strength and number of major cyclones may be increasing because of higher sea surface temperatures associated with global warming. Cyclone Sidr (November 2007) and Cyclone Aila (May 2009) provide recent examples of devastating storm-surge in Bangladesh. In 2007, Cyclone Sidr, a 10-year return period cyclone with an average wind speed of 223 km per hour resulted in 4,234 casualties and 55,282 injuries. Livelihoods of 8.9 million people were affected and damages and losses from Cyclone Sidr totalled US$1.67 billion. In 2009, Cyclone Aila, a 1.2-year return period cyclone with an average wind speed of 95 lm per hour caused 190 deaths, 7,103 injuries and affected 3.9 million people. The estimated damage of assets from Aila

is US$270 million.

2. Salinity intuition: Salinity is penetrating far inland through Meghna estuarine river system. An environmental terrible circumstance caused by salinity intrusion is a major problem in southwest coast. Huge lands are not cultivable now. The shallow coastal aquifers have high salinity.
4. Changes in seasonal calendar: The characteristics of the typical months and season have already been changed. Three seasons exist instead of 6; summer and rainy season becoming longer and the winter is significantly short.
5. Rainfall erratic: Though no significant changes in total rainfall reported but short duration heavy rain has increased. There is also no-rain situation.
6. Migration happening: Climate change is resulting huge migration; it was reported that after the Aila around 36,000 people has migrated to other urban areas including capital Dhaka from a a coastal sub-distinct Shyamnager Upazila. The scenario is same in every locality of coast.

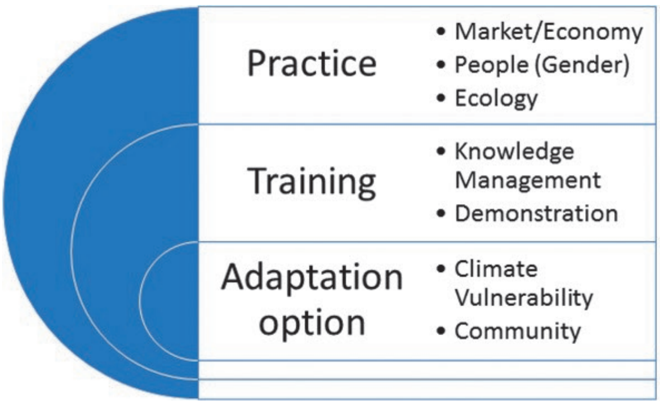
Ecosystem based Adaptation in a coastal wetland:

Introduction of saline tolerant, energy efficient and water conservation agriculture technologies and practices and brackish water fisheries; the action research will pilot test various technologies with economic, environmental and social comparison (with existing non-organic and input-intensive agricultural production).

Identified potential technologies area:

- Salinity-tolerant crop varieties,
- Early-harvesting crop varieties,
- Rice-paddy,
- Early warning system,
- Reserving surface water,
- Non-agronomy farming,
- Aquifer management,
- Zero tillage.

Figure: EbA action process followed by POUSH



Way forward:

To the Government of Bangladesh, NGOs, policymakers, planners and other interested parties it is important to measure and monitor present issues and to predict the future impacts of climate change. Knowledge based participatory plan can help the government and the development actors identify the right climate action for the wetlands.

Reducing Fire on Peatlands through Community Participation: An Experience from West Kalimantan, Indonesia

Yuki Arai
Graduate School of Agricultural and Life Sciences, The University of Tokyo / Japan Wetland Society

1. Fire on Indonesia's Tropical Peatlands

Tropical peatlands are considered to be one of the largest reserves of terrestrial organic carbon on earth (Page *et al.* 2002). Indonesia is known as a country with the largest share of tropical peatlands in the world (Page *et al.* 2010). Tropical peatlands occur in areas where dead trees are not decomposed due to abundant rainfall. In such environment, because dead trees are always kept under water, they are not easily decomposed, and thus they accumulate and form a storage of carbon. In some areas, the depth of peat can reach over twenty meters, which makes peatlands a huge carbon sink (Page *et al.* 2002).

However, due to government's policies and private companies' agriculture and forestry practices, huge areas of peatlands were drained and trees were cut down during the past few decades (Siegert *et al.* 2001). When peat swamp forests are logged and drained, the ground water level drops; as a result, peatlands become susceptible to fires (Takahashi *et al.* 2001). In order to develop oil palm and pulp plantations, large areas of peatlands have been drained and burnt. In addition, local farmers have a custom to burn the land in order to reduce pests and undesirable plants, and to improve productivity in a short term. Fire is a cheap, fast, and easy method for land clearing for agricultural purposes (Varkkey 2013). When fire is used on drained peatlands, these fires often burn out of control and expand to become huge fires on peatlands (Usup *et al.* 2004). Once huge fire occurs, peatlands releases an enormous amount of greenhouse gasses (GHG) into the atmosphere, making Indonesia one of the countries with the largest GHG emissions in the world (Page *et al.* 2002).

2. "Village Facilitation Team Approach" for Reducing Fire on Peatlands

In order to tackle the issue of GHG emissions from peatlands in Indonesia, the Japan International Cooperation Agency (JICA) together with the Ministry of Environment and Forestry of Indonesia (MOEF) initiated a technical cooperation project entitled the "Program of Community Development of Fires Control in Peat Land Area" (FCP), which was implemented from 2010-2015, mainly in the sixteen pilot villages in the Benkayang and Kubu Raya District in the West Kalimantan Province.

The project's major objective was to develop a community-based peatland fire prevention methodology. In order to achieve this goal, the project formulated a team of six members called the "Village Facilitation Team" that mainly consisted of district government officers, firefighters hired by the MOEF, and village representatives who are mostly farmers. In order to enable the team members to serve as facilitators, the project provided an intensive facilitation training program to the team members. The training was held in about two weeks, and it had abundant opportunities not only for lectures and group discussions, but also for field exercises in actual villages. All the team members had to actually facilitate the meetings with farmers, where they trained their practical communication and facilitation skills. In addition, the team members obtained knowledge and skills on land-use mapping method, non-burning agriculture techniques, and policies and regulations on land burning. After receiving this training, the team members who were trained to become facilitators, visited the sixteen pilot villages, and facilitated the villagers' meetings with an aim to reduce fire through a community-based approach.

Following is the typical process of the discussions held among the villagers and the facilitators. First, the facilitators started the discussions with topics related to land use and livelihoods. Usually, the facilitators asked the villagers to create a land use map, which is a map that illustrates the villagers' agriculture/forestry practices and land ownership/land use boundaries. Second, using those maps, the facilitators had the villagers identify issues concerning land use practices, and let them discuss how they can improve the situation. For example in one village, villagers discussed how to produce value-added products (e.g. banana cake) in order to generate more income. During these discussions, there were occasions when villagers mentioned about usage of fire in their agricultural practices. In such occasions, the facilitators gradually shared information on the risks of fire usage. In fact, there are some legal punishments against usage of fire; in case police finds out some villagers using fire, the villager can be arrested and imposed a huge amount of penalty fee. Though the facilitators never forced the villagers to stop using fire, they gently shared the information for their reference.

When the villagers become aware of such legal punishments, villagers started to discuss how to cope with the risks of using fire, perhaps because they wanted to avoid being punished. In many cases, the top priority for villagers is their livelihood and income generation. Because fire used to be a very important part of their farming practices, it was not an easy task for them to suddenly stop using fire. Thus, they had to think about how they can simultaneously realize reduction of fire usage and livelihood improvement.

As a result, villagers come to request the facilitators (including district government officers with expertise in agriculture) to provide some training for non-burning agriculture techniques. When receiving requests from the villagers, district government officers (who are also facilitators) provided trainings on non-burning agriculture (e.g. techniques to make organic fertilizers/pesticides, agriculture/forestry products that can grow well without usage of fire etc.), based on an expectation that villagers could substitute these techniques for usage of fire. In addition, villagers in most pilot villages started to develop self-rules on fire usage, which eventually became official village regulations. Thus, the villagers strived to prevent themselves from receiving legal punishments, while they also tried to figure out how to sustain their livelihoods.

Here are some of the examples of land use practices without extensive land burning. Organic fertilizers/pesticides can be produced easily with low cost, and they can improve productivity or reduce pests without using fire (Figure 1). Jabon (*Anthocephalus spp.*) is a fast-growing tree species that can grow on peat soils, with high demand in the market as materials for furniture. Aloe can also grow on peat soils, and has a high potential for income generation (Figure 2). Recently in West Kalimantan, aloe juice and aloe candies are becoming popular souvenirs, and are sold in many souvenir shops. These are some of the examples of farming practices that can generate income without extensive land burning practices.

Figure 1: Pepper Farm using Organic Fertilizer (Sungai Jaga A Village)

Figure 2: Aloe Farm on Peatland (Limbung Village)

As a result, the number of villagers who use fire was largely reduced in most of the pilot villages. After project intervention, the number of local farmers who use fire on peatlands reduced from 62.4% to 30.2% in the Benkayang District and from 69.7% to 41.3% in the Kubu Raya District (University of Tanjungpura 2015). Although there are still villagers who did not completely stop land burning practices, most villagers at least introduced "controlled-burning" (using fire in a very limited area just to produce minimum amount of ash to neutralize peat soil), which contributed to the reduction of fire as a whole. In April 2015, following these achievements, the project's community-based peatland fire prevention approach was officially adopted as a part of the national policy of the Government of Indonesia.

3. Why did Villagers Reduce Land Burning Practices?

Based on the semi-structured interviews conducted to fifty project participants randomly selected from the four pilot villages that represent the socio-economic characteristics of the region (Limbung Village, Rasau Jaya II Village, Sungai Jaga A Village, and Sungai Duri Village), I would like to discuss why villagers decided to change their behaviors and reduced their land burning practices, although further research is necessary to verify these assumptions.

First, the facilitators provided the villagers with opportunities to deepen understandings about the risks of using fire, particularly regarding the legal punishments including penalty fee. Before, the majority of villagers did not even consider land burning as an issue; it was just a part of their custom or daily life. However, through the meetings with the facilitators, more people come to recognize that land burning may cause serious risks to themselves. This might have influenced the villagers' mindset and behaviors.

Second, I assume it was important that villagers themselves discussed and developed village rules with their own initiatives. Literature suggests that sufficient participation in the process of rule-making is one of the important factors that motivates people to comply with the rules and to take collective action (Sapkota *et al.* 2015). Since the villagers actively joined or even initiated the discussions to develop the village rules, I assume that they almost fully understood and agreed with the contents of the rules. Thus, they had less difficulties in following the regulations.

Third, it can be inferred that mutual trust was strengthened through the meetings with the facilitators. In many villages, the meetings were organized two or three times a month, and the meetings continued for one or two years. Through these meetings, villagers may have strengthened their trustworthy relationships with the other villagers and facilitators, which might have promoted their collective action toward fire prevention. Since they had abundant opportunities to discuss how to prevent fire, it would be a betrayal to the other villagers if they burn the land. The villagers may have tried to reduce usage of fire in order to maintain sound relationships with the other community members.

Fourth, clarification of land use boundaries might have also contributed to reduce land burning. According to the literature, people tend to practice land burning when land use boundaries are unclear, since it can be an effective way to claim their land use rights (Rona *et al.* 2005). If nobody knows who owns the land, one can assert that the land belongs to him/her, by burning and cultivating the land. In this project, land use mapping activities have helped the villagers to clarify the land use boundaries, which may have contributed to reduce villagers' motivation to claim their rights through burning.

Last but not least, introduction of non-burning agriculture techniques can be also considered as one of the factors that helped the villagers to reduce fire usage. Since land burning was an important part of farming practices for villagers to maintain their livelihoods, it must not be easy to suddenly quit usage of fire. Even though non-burning agriculture techniques might not be as easy as land burning, at least they could provide an alternative approach to sustain their living with less usage of fire.

Although further research is recommended for verification, the above points can be inferred as some of the major reasons that facilitated the villagers' behavioral change, based on the interviews and the existing literature.

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Interventions for Wetland Conservation in the Pampanga River Basin and Candaba Wetlands

Joy M. Navarro[1], Minerva J. Martinez[2], Lea Ivy O. Manzanero[3] and Daniel S. Torres[4]

[1] Biodiversity Management Bureau, Department of Environment and Natural Resources;

[3] Philippine Extractive Industries Transparency Initiative, Department of Finance; [4] Independent researcher

The Philippines is a megadiversity country with 7,000+ islands. Using evolutionary geology, species assemblages and distribution patterns, there are at least sixteen (16) terrestrial and six (6) marine biogeographic regions (Ong et al. 2002). The Pampanga River Basin and Candaba Wetlands are located in the Luzon Biogeographic Province.

The Biodiversity Management Bureau of the Department of Environment and Natural Resources (BMB-DENR, 2016) in its Atlas of Philippine Inland Wetlands and Classified Caves, listed 314 inland wetlands, composed of 221 lakes, 9 peatlands and 14 marshes/swamps, including the Candaba marshland. The country has 2,487 rivers and river systems.

This paper focuses on the Candaba Wetlands which to date has not yet been recognized for its international significance. It is important to note that the 32,000 hectare Candaba Wetlands are a prominent feature within the Pampanga River Basin. These wetlands include ponds, swamps, and marshes with surrounding areas of seasonally alternating flooded grasslands and arable lands on a vast alluvial plain.

The Candaba Wetlands are surrounded by the towns of Bacolor, Porac, Sta. Rita and Guagua. One of the barangays located within the Candaba Wetlands is Sitio Simang, Barangay Vizal San Pablo.

Exemplary values of the Candaba Wetlands include regulating ecosystem services, floodwater management and calamity mitigation. Supporting ecosystem services include biodiversity while provisioning services include supply of water.

Although drying up from November to May, several rivers overflow during the June to October wet season. The Candaba wetlands function as a natural flood retention basin for these overflows.

One important exemplary value is the high abundance of birds, thus the Candaba Wetlands is designated as a bird counting site hosting 122 species of birds with a total abundance reaching 10,000 waterfowl. Bird records since 1940 indicate there are about 54 resident bird species and about 68 migratory species.

One of us (Martinez) observed that the abundance and species richness has been declining due to land conversion and climate change where the longer period of wet season have forced the birds to move somewhere else. Additionally, there are now more birds in Sasmuan, Pampanga and other areas where fishponds are abundant (*e.g.* coastal areas).

Among the endangered species are the Streaked reed warbler (*Acrocephalus sorghophilus*), Philippine duck (*Anas luzonica*), Black-faced spoonbill (*Platalea minor*), and previously, the near-threatened Spot-bill pelican (*Pelecanus philippensis*). Such avian diversity supports local and visiting birdwatchers and nature lovers.

With its critical values for avian diversity and ecosystem services, Candaba Wetlands was identified as a candidate site to be included as an Important bird area and potential candidate Ramsar site in Asia under criteria 2, 4, 5 and 6 as well as part of the East Asian-Australasian Flyway Site Network.

The Pampanga River Basin, in which the Candaba Wetlands are located, has a catchment area of 10,434 square kilometers covering the administrative provinces of Pampanga, Tarlac, Nueva Ecija, and Bulacan. It is the 4th largest river basin in the Philippines and the 2nd largest in Luzon Island, next to the Cagayan River Basin. The longest channel within the Pampanga River Basin is the Pampanga River that spans of 265 km.

In terms of provisioning services, Pampanga River Basin has the potential to supply 18.34 million cubic meters of water per day. The dependable surface water supply of 8.91 million cubic meters is used for industrial, commercial, domestic, drinking water, hydro-electric power, and irrigation of 363,246 hectares. This irrigated land produced 62.8 million metric tons of rice amounting to 16% of the Philippine total rice production for 2016.

However, the Pampanga River Basin is vulnerable to increased rainfall, typhoon, flooding, siltation, and volcanic eruption. Additionally, unplanned man-made structures aggravate the flooding problem.

Large scale flooding is one of the main challenges. The Pampanga River Basin Flood Forecasting and Warning Center reports that in the 12 years from 1994-2006, 43 floods occurred in the Pampanga River Basin. From 2003 to 2006, the series of typhoons of increasing frequency and severity caused flood damage to the surrounding provinces of Bulacan, Pampanga and Nueva Ecija.

Taken together with increased rainfall due to climate change, the flooding problem may worsen in future years.

Unplanned man-made structures used for industrial development, such as warehouses and reclamation of peripheral areas, may alter natural flow of floods; in some cases, shifting floodwaters to areas which are not usually flooded.

The interventions for the Candaba Wetlands conservation include infrastructure and non-infrastructure approaches.

Over the past 25 years, numerous infrastructure-based interventions have been constructed within the Pampanga River Basin designed to address flooding. Examples of such infrastructure include: the Pantabangan Dam holding 2,996 million cubic meters, the Angat Dam holding 850 million cubic meters, the San Luis levee, and the Candaba Floodway.

One of the major infrastructure-based interventions is the 1993 JICA-funded Pampanga Delta Development Project (Phase 1) that constructed a 14-kilometer floodway from the river mouth in Manila Bay to upriver Masantol resulting in an increase of channel flow capacity from 500 to 4,300 cubic meters per second.

The 1991 Mt. Pinatubo eruption deposited ashfall resulting in shallower drainage networks. Voluminous sediments from the eruption blocked off river drainage systems feeding into the Pampanga Delta.

Starting from earthen dikes to clear the 1995 lahar breakout, the Php 900 million Megadike project constructed concrete riverbank armoring to prevent Pinatubo-eruption related material from covering the towns of Bacolor, Porac, Sta. Rita, and Guagua in Pampanga.

Non-infrastructure interventions include nature-based approaches, land use policies, and community-based technologies.

An example of land use policy is the Sangguniang Bayan (SB) Resolution No. 51, series of 2004 which declared the entire Candaba town as a bird sanctuary, thereby banning hunting of all kinds of wild birds. A similar policy intervention was the adoption by the Pampanga Mayors League of a province-wide campaign against illegal hunting of birds.

In support of SB Resolution 51, a privately-initiated 72-ha Candaba Swamp Wildlife Reserve was established in Sitio Simang, Barangay Vizal San Pablo. Migratory and endemic birds flock and thrive in the Wildlife Reserve that has an Observatory Deck and a 4-kilometer perimeter-dike walk-trail. However, since the Reserve is private property, one possible risk is if the owner opts to sell, the new owner may decide not to continue the Wildlife Reserve status.

Another non-infrastructure Intervention is the Community-based Flood Forecasting and Warning System-Disaster Risk Reduction. This was established by the Pampanga River Basin Flood Forecasting and Warning Center. The system components involve monitoring tools, community members, and communication equipment to forecast floods and plan appropriate actions ahead of time.

After the very destructive 1972 flood, the Government of Japan helped the Philippines form the pilot Flood Forecasting and Warning System (FFWS) for Pampanga River Basin in 1973. This office has effectively observed the hydrological situation in the Pampanga River Basin then gave flood forecasts and warnings, thus saving many lives. Now this office is named as the Pampanga River Basin Flood Forecasting and Warning Center (also known as PRFFWC or PRBFFWC) under the Philippine Atmospheric, Geophysical & Astronomical Services Administration (PAGASA) of the Department of Science & Technology (DOST).

Other non-infrastructure interventions are the adaptation strategies to alternating flooding and dry season exhibited by rice cropping pattern and wild fish catch. The Philippine Food Security Information System shows two rice crops in Pampanga; one in the dry season, another in the wet season. There are two types of rice production, the irrigated and non-irrigated (rain-fed). The irrigated rice production is done both during the dry and wet season cropping times and constitute 96% of rice production in Pampanga.

On the other hand, rainfed rice is planted only once, i.e. during the start of wet/flood season (June/July, 3rd Quarter) then harvested after about 150 days in the end of the wet season (October) or start of the dry season (November, 4th Quarter). From 2008 to 2016, this synchronizes with the high catches of wild carp and tilapia in the 3rd and 4th quarter.

There are many potential actions for the future, both in terms of infrastructure and non-infrastructure interventions.

For the future, plans for flood mitigation include river channel improvement along the downstream of Pampanga River using science-based dredging. This includes the construction of flood retarding basins in the Candaba and San Antonio swamps. However, more studies are needed to determine natural capacity to store floodwater.

Riparian stabilization by planting of native species will need studies on the best species to stabilize the soil and produce protective cover.

With its vulnerabilities and exemplary values, the Candaba wetlands, in particular, and the Pampanga River Basin, in general, could provide a perfect setting to showcase the multiple benefits of adopting ecosystem-based approaches to disaster risk reduction (DRR) and climate change adaptation (CCA).

In conclusion, a mix of infrastructure and non-infrastructure interventions using ecosystem-based approaches will be necessary to maintain the unique biodiversity value, while taking advantage of the wetland ecosystem services for communities to be able to mitigate disaster risks and adapt to the impacts of the changing climate.

Finally, this paper hopes to encourage further discourse on the conservation of the Candaba wetlands.

Wetlands for a Disaster Resilient Asia: Legal Agenda

Amado S. Tolentino Jr.
Ramsar Center Japan

The 2004 Indian Ocean tsunami originating in an earthquake in the sea off Sumatra (Indonesia) devastated 12 countries including Indonesia, Thailand and Sri Lanka. As an immediate response, AWS 2005 held in India, recommended among others, "Prioritize the natural coastal defenses through greenbelt/coastal "bioshield" development………" In connection therewith, the Sendai Framework for Disaster Risk Reduction (2015) identified as one of four priorities the matter of "investing in disaster risk reduction for resilience."

Not to be missed is the ASEAN Agreement on Disaster Management and Emergency Response (AADMER), which came into force in 2009 with the intention of providing "effective regional mechanisms to mitigate impacts of natural disasters…..through concerted national efforts and intensified regional cooperation."

In the light of scientific information that natural disasters are projected to intensify in Asia, the AADMER mentioned above could be utilized for disaster prevention and mitigation purposes even if the Agreement leans heavily on disaster preparedness, emergency response and rehabilitation, i.e. faster movement of relief goods, better utilization of civilian and military response, etc., In short, it could serve as the foundation for Asia's active role at disaster risk reduction by incorporating effective wetlands' management strategies in their legal agenda for climate change resilience.

Disaster risk reduction according to AADMER means "a framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks to avoid, through prevention or, to limit, through mitigation and preparedness, the adverse impacts of hazards within the broad context of sustainable development." On the other hand, resilience according to the UN Office for Disaster Reduction is the ability of a system, community or a society exposed to natural disasters to resist, absorb, accommodate, adapt to, transform and recover from the effects of that disaster.

In recent years, wetlands have been acknowledged to be among the world's most valuable ecosystems providing so much benefits to people. As defense fortifications, wetlands, particularly mangroves, proved excellent defenses against the onslaught of typhoons and tsunamis as proven by the earthquake occurrence mentioned above. Scientists explained the roots of vegetation in Asian mangroves and other forest wetlands helped to hold the sediments in place against the impact of strong winds and waves.

AADMER is replete with provisions which could be used by Asian countries in refuting the claims that while emergency response is almost well attended to from the local to the national government level, much remains to be done in regard to (i) cooperation in developing and putting into effect solutions to reduce disaster impacts; (ii) development of strategies to identify, prevent or reduce disaster risks and losses; (iii) prevention and mitigation legislation, regulations, policies, plans, programs and strategies; and (iv) raising public awareness about disaster prevention and mitigation.

Disaster Resilience in the Legal Agenda

In pursuance thereof, Asian countries could very well incorporate wetlands wise use and other innovative ways for disaster risk reduction and build resilience in their legal system. The legal agenda may include, but is not limited to:

(1) *Planting of mangrove saplings in rules or regulations. -* The strategy of planting mangrove saplings could be a continuing year-round activity in the long and extensive coastlines of Asia pursuant to applicable laws on forestry or land use, i.e. implementing rules or regulations.. The same is true in regard to massive planting of high quality and commercially productive variety of bamboo which could be introduced in riverbanks/river basins and lakeshores as a technique not only for protection but also to preserve and rehabilitate fishwater sources and lakes and provide added source of income to people.

(2) *Reforms in Building Codes.-* Reforms in Building Codes could be pursued as infrastructure solutions, by introducing a shift in disaster risk reduction approach through build back better infrastructures, increasing buffer capacity of the wetland landscape to absorb shocks and long term changes. This includes, but is not limited to, building better hurricane resilient houses with stable and stronger base; retro-fitting structures e.g. existing government buildings, for extra use as evacuation centers in times of calamities. This presupposes sharing technology to come up with hurricane resilient houses and, in general, improve critical infrastructures in coastal communities. This would necessitate amendment and strict implementation of existing national building codes.

(3) *Inclusion of climate adaptation projects in the national budget or appropriations law.-* Developing and financing adaptation projects is an excellent way of building up a country's resilience to disasters. In this regard, adaptation means enhancing resilience, policies and programs against the impacts of climate change. The Philippine General Appropriations Act (2018) have calamity and environment provisions to make our budget a climate budget with special provisions on adaptation such as establishment of multi-hazard early warning system, rain harvesting, seed banks, rooftop gardens and practice drills for response and preparedness. An Adaptation Summit is planned next year to showcase best practices and launch a mentoring process for small vulnerable communities in the country.

(4) *National Resilience Council.-*In the Philippines, consolidation of resilience endeavors was adopted with the recent launch of a National Resilience Council (NRC) in response to the Sendai Framework on Disaster Risk Reduction call to align and integrate various endeavors (science and technology, CSOs, private sector(business), government) in strengthening disaster reduction governance and investing in resilience, in effect integrating all resilience efforts on the same track.

With partnership among government, private sector, CSOs and other organizations with clearly defined roles in disaster response, recovery and rehabilitation, the National Resilience Council is jointly chaired by the Secretary of National Defense and the representative of the business (private) sector. Four vice-chairs were appointed to represent science/academe, CSOs, government and the private sector.

Aside from consolidating the resilience efforts in the country, the NRC aims to localize the pre-existing and potential exposure to vulnerability of the economy, environment and communities to disasters and to focus on building needed capacities through multi-stakeholder cooperation.

In close coordination with the Department (Ministry) of Local Governments, the NRC will look at developing a Philippine Disaster Resilience Scoreboard for local governments and the Leadership Resiliency Program for the local chief executives (LCE) and other local government officials. All of this is designed to reward success and help participant cities adopt best global disaster risk reduction and resilience practices. Capacity building training will be required for LCEs and other officials. The success of the resilience scoreboard will depend on how the LCEs practice what they learn.

The first public-private partnership (PPP) for disaster resilience was launched in the Philippines last October 2017. Dubbed Resilient Cities/Municipalities Leadership Program for Local Chief Executives, it brings together for the first time the government and big private business for disaster resilience. Big businesses like SM and Zuellig Family Foundation along with Arise Philippines with SMs Mr Hans Sy, Disaster Risk Reduction Foundation of Mr. Manny Pangilinan and Mr. Jaime Augusto Zobel de Ayala, the Makati Business Club and the Philippine Chamber of Commerce and Industry, to mention a few, are actually giving time, effort and expertise in helping communities with emergencies to save lives and protect properties. As a leading Filipino environmentalist said, "There should be increased investment in disaster preparedness, conduct and sharing of risk assessment, establishment of multi-hazard early warning system, protection of ecosystems and mangrove reforestation, among others.

(5) *Innovative insurance program to boost disaster reduction management.*-Last August 2017, a disaster risk insurance to help the Philippines better respond to losses from climate and disaster risks was also launched with the support of the World Bank. The program provides US $206 million in coverage against losses from severe typhoons and earthquakes to national government assets and to participating provinces.

Briefly, under the program, the Philippine Government Service Insurance System (GSIS) provides the government and the 25 participating provinces with disaster risk insurance. The World Bank acts as an intermediary to transfer GSISs risk to a panel of international reinsurers e.g., Hanover RE, Munich RE, Swiss RE, which were selected through a competitive bidding process.

The new insurance program illustrates how the World Bank can leverage capital from the market to help governments receive fast cash injections for emergency response and to sustain essential services in times of crisis empowering local governments to more effectively assist their constituents.

The program bolsters the government efforts at resilience by developing an innovate financial solution to mitigate the financial impacts of extreme climate and weather-related events as well as major earthquakes.

Conclusion

Actually, disaster resilience maybe considered a breakthrough in the area of environmental law implementation which from the beginning suffers from lack of implementation or delayed or lingering implementation efforts. Take for example the matter of control of air pollution caused by emission from motor vehicles. No one dies or immediately contracts lung disease with the inhalation of polluted air. Disasters are different. Results are sudden deaths, physical injuries and loss or damage to properties. Disaster resilience is now a leading concern in the whole world and people should be made aware of the immediacy of action against disasters.

It should always be borne in mind, however, that building a disaster resilient Asia needs partnerships among government, private sector, CSOs, local government units (LGUs) and other institutions with clearly defined roles not only in disaster response but in disaster prevention, response, mitigation and adaptation as well, integrating in the process all resilience endeavors on the same track. To begin with, a program on the values and functions of wetlands for disaster risk reduction and onwards to consolidating resilience endeavors among Asian countries on the same track could be embarked on. Disaster resilience is a matter that deserves priority along with food security, poverty alleviation, population control, among others.

Hopefully, the recommendation is realized soon because Asia remains vulnerable to natural disasters. But through multi-stakeholder engagement, improvements can be made at a much faster pace so the region can have its much needed disaster resilient system.

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Evaluating the Impacts of Hydrological Variations on Carbon Fluxes in Tropical Peatlands (abstract)

Chandrashekhar Deshmukh, Dony Julius, Nardi, Adly Firma

Asia Pacific Resources International Limited (APRIL)

Tropical peatlands are complex and poorly understood ecosystems with largely unknown biogeochemical and hydrological regimes. In these ecosystems, waterlogged-anaerobic conditions slow down the decomposition of organic matter (OM) and favor their accumulation. Most of the tropical peatlands are typically ombrotrophic, where ground water table generally follows rainfall pattern. Increased frequency and intensity of climate extremes like El Niño and land-use change modify hydrology and thereby affecting biogeochemistry of these ecosystems. Over the last few decades, there have been increasing efforts to investigate carbon dynamics and water vapor fluxes in these ecosystems. Nevertheless, carbon and water balances in these ecosystems are still subjected to large uncertainties mainly due to the scarcity of the direct and continuous long-term measurements, particularly in Southeast Asia. To improve assessment of the role of tropical peatlands in global carbon balance, there is a clear and urgent need for more measurements and a better understanding of carbon and water balances in these ecosystems.

In this context, we have established a long-term direct monitoring network to quantify net ecosystem exchanges of carbon dioxide, methane and water vapor between the ecosystem and the atmosphere at ecosystem level using Eddy Covariance (EC) technique. Direct micrometeorological methods like Eddy Covariance (EC) provide measurements over large areas (typically more than few hectares), that can be analogous to ecosystem scale. Short and quasi-continuous integration intervals (e.g. 30 min), typical for the EC technique, are beneficial to capture temporal variability related to biological and physical processes underlying carbon and water vapor exchange. Although several studies have reported EC measurements at several agricultural sites, the EC measurements of carbon and water fluxes over tropical peatlands are lacking, particularly in Southeast Asia.

In the context, we have installed EC towers in three major ecosystems distinguished by land-use in tropical peatlands of the Kampar Peninsula of Sumatra, Indonesia; (1) plantation forestry (PF); (2) mixed land cover (ML) that includes partly burnt degraded peatland forest and shrubland; and (3) restoration forest (ER). The EC instruments are installed on top of the towers at 43, 43 and 51 m above ground surface at the PF, ML and ER sites respectively. This offers much larger flux footprint area of more than 200 ha. In addition, automated soil CO_2 chambers are placed directly onto the peat surface to measure CO_2 emissions resulting from microbial decomposition of peat soil. Moreover, rainfall, ground water table, soil moisture, soil temperature, net solar radiation, photosynthetically active radiation (PAR), relative humidity, atmospheric pressure, wind direction and wind speed are being recorded at 30 min averages. Measurements have been started at the PF and ML sites since September 2016 and at the ER site since May 2017. The outcomes of this project shall allow a better estimation of regional carbon and water balance and help scientists and policymakers better understand how hydrological variations due to climate change and land use change affect carbon dynamics. This presentation will discuss the sampling strategy and preliminary results.

Huge Water Channel Construction Project with Nature and Human Friendly Approach in the Sendai River (abstract)

[1]Kiyofumi Kobayashi, [2]Hironori Hayashi, [2]Yukihiro Shimatani

[1]Kyushu University Graduate School of Engineering, Daishin Co.,Ltd, [2]Kyushu University Faculty of Engineering

In the Sendai River basin which flows in Kagoshima prefecture, there was recordable heavy rain mainly in the northern part of the Satsuma region from July 19th to July 23th 2006. Total rainfall for 5 days exceeded 1000 mm at rainfall observatory. In particular, the damage of Satsuma Town was enormous. There were one person dead and three minor injuries, 214 completely destroyed buildings, 367 semi-collapsed buildings and 232 inundated buildings. This flood damage was mainly caused by unprecedented heavy rain. In the downstream part of the Satsuma Town Torai area, there was a narrowed section where the river channel was curved large. It was pointed out that rising of the water level of this greatly curved river channel part is one of the factors which caused the damage to be expanded.

On the other hand, similar floods had occurred in the area in 1972. As a result, the residents had a strong distrust against river administrators (MLIT: Ministry of Land, Infrastructure, transportation and Tourism). This project was accompanied by a remarkably large scale renovation that cuts waterways of about 250 m in extension, 65 m in average channel width and 700 thousand m3 of excavated sediment. In addition, the project site is adjacent to shopping districts and residential area in the Satsuma town. For this reason, we had to fully consider the impact of river improvement project extending to an extension of 2.0 km on the lives of the local residents. For that reason, it was necessary to inherit the history and culture of the area, to mitigate the impact on natural landscapes and ecosystems, and to fully consider the utilization methods after the reconstruction in advance.

In this paper, we introduce the Sendai River improvement project which was carried out by participating residents in this Torai area. Specifically, the concept of planning

design, the landscape hydraulic model experiment used to evaluate the flood effect and the natural environment accompanying the division channel opening, the consensus formation process with the local residents, the maintenance management after the completion and the utilization. In the project site, floods occurred two weeks after the completion of the channel construction, but the water level observation station supports the safety of the region, such as a water level drop of 0.8 m is confirmed. Six years have elapsed after completion, flooding flows repeatedly from 3 to 5 times each year into the channel, and now a new wetland space that work as a habitat of aquatic organisms is also created. In the construction section close to the residential area, masonry bank protection utilizing construction generating rocks and a waterfront walking path incorporating universal design are in place. In view of the river environment, riffle and pool habitats and vegetation which are important for aquatic organisms were restored. In the Torai area, there are numerous regional event held by local residents and NPOs. Taking this opportunity, community development that connects the waterfront and daily lives of residents, tourism projects of nature experience, etc. are actively undertaken in the Sendai River basin.

Session 2

Wetlands and Policy / Changes / International Cooperation

China's New National Strategy on Wetland Conservation and Restoration

Fang Yan

Wetland Conservation and Management Office, State Forestry Administration, People's Republic of China

The presentation addresses how Chinese government is moving forward the role of wetlands in conservation and sustainable development, particular in recent 5 years.

According to the second national wetland inventory, the total wetland area in China is accounting for 5.58% of its territory, with a per-capita wetland of one fifth of the world average level. From this perspective, the wetland in China is not rich enough. In order to conserve such valuable nature asset, China has established a relative sound wetland conservation network. The network is mainly consisting of national parks, nature reserves, supplemented by wetland parks as well as other forms of wetland protected areas. The national park is a newly nature conservation method established last year, to expect better fitting together with biodiversity conservation and sustainable use. By the end of 2016, China has established over 600 wetland nature reserves and more than 1,000 wetland parks, among of them, 49 RS were designated. By the comparison of the first and second national wetland inventory, the area of protected wetlands achieved more than 13 percentage increase in the past decade indicates that Chinese government has been taking action on the ground to accomplish realistic and practical conservation and wise use of wetlands for sustainable development.

As far as to the China's wetland administrative system, governments at all levels dominate wetland conservation. There are approximately 50,000 employees of government directly engaged in wetland conservation and management, formulating a 3-level vertical administrative system. At the national level, State Forestry Administration is the executive agency for wetland management. However, wetland is a complicated and comprehensive ecosystem, cannot be isolated from other elements in terms of water, wildlife, and soil in nature. Similarity, the wetland management can never be separated from other sectors that are responsible for water resource, agriculture, finance as well. Local level is divided into several levels subject to China's government administrative system. The bottom is the site level. Majority sites have their own agencies to manage site issues.

Despite of many years efforts and achieved a lot, China is still facing some problems that the wetlands continue to be in serious trouble, and their capacity to deliver all benefits to people is declining. The survey uncovered that the wetland area in China was decreasing about 340,000 ha each year from 2003 to 2013, equivalent a medium size county in China. The survey also sorted major threats and problems by the degree of the impact on wetland degradation. The finding suggested that the management is the first cause, following by pollution, reclamation, infrastructural development, over-grazing, over-fishing, and the invasion of alien species. Although the above following causes are common facing globally, still in certain connection with the deficiency in the management. Therefore, there is a need for China to further define what are considered to be key issues in the process of country's development, and to identify in a strategic manner how to help people meet the goals and objectives of "beauty China". Chinese government attached unprecedented high priority to the ecological protection especially from 2012. Since then, a series of national policies and strategy launched to strengthen wetland conservation.

The most important strategy amongst is the Wetland Conservation and Restoration Programme, which was issued by the State Council in last November. It was the first time that Chinese top governors made a powerful decision on wetland conservation, aiming to solve existing problems in the management aspects. The policy is and will be guiding China's wetland conservation in following years. The significance of the implementation of the policy will benefit rather to China itself but to the globe. The program includes seven areas in terms of a general requirement and 6 support mechanisms. The general requirement was proposed with a clear target. By 2020, the total wetland area should be kept no less than 53.6 million ha that is the current quantity of total wetland area in China. In other words, the target is expected to conserve all wetland identified by the national wetland inventory. In addition, an extra 200,000 ha area increase and half amount of total wetland under the protection, integrated into the general goal as well.

To ensure the accomplishment of the general goal, 6 mechanisms addressed in the program that can split to more than 50 specific actions. The first is wetland classification management. Wetland in China is going to be classified into three ranks: national important wetlands (including Ramsar sites), local important wetlands and general wetlands. The management of each rank is applied to the corresponding rules and standards. For example, the national and local important wetlands theoretically are limited for use, while the general wetlands are utilizable but the compensation in advance. The second is the accountability system. The central government designates some regions with the most importance and weakness in ecological functions enclosing in the ecological protection redline, forbidden to be occupied or convert to other use. Furthermore, the central government defines the target of wetland area to be conserved at national and provincial levels, and implements target by levels as well. To be specifically, the central government decentralizes the total wetland area of the whole country to 31 provinces and then allocated to 2800 counties as the beneath goal of the country. In the case, the government at each level holds a specific number of wetland areas to be maintained.

Apart from target on wetland area, by 2020, 80% major rivers and lakes will reach the national standard of water quality; no less than 35% coastline will maintain in nature status, water bird population will not decrease. To achieve above goals, a permanent reward and punishment mechanism established to monitor government officials taking responsibilities for wetland conservation and management in and after their terms. The third one is related to wise use wetland. China holds the concept of wetland for wise use although always regarding conservation as the priority. The program regulates how to use wetland in a sustainable way by listing some activities prohibited to conduct in wetland. For instance, to occupy wetlands or convert to other use without approval, reclaim (convert), cut or blocks wetland water sources permanently, and any actions tend to damage wetlands and their ecological services are in the list. The forth one-restoration is a core issue addressed by the program to help keep wetland no net loss and restore degraded wetland. One solution is the compensation ahead of the occupation. As for those wetlands that are approved to be occupied or converted to other uses, the land users should be responsible for the restoration or rehabilitation with the same quantity and ecological functions before used. In addition, some restoration projects funding by central and local governments, have been carried out in a pilot phase in China for a few years and will be promoting nationwide as the requirement of the program. The major such projects include converting farmland to wetland and the ecological benefit compensation. The fifth mechanism related to the wetland monitoring and assessment, the third national wetland inventory could be the most important technical support in this regard. The related preparation work will start next year. The survey may take 6 years to be finalized. Of course, the monitoring and assessment on wetland ecological status will be continuing conduct on national and local wetland importance. The final one is the safeguarding mechanism stressing multi sector collaboration, legislation, sustainable funding, science and technical support, and CEPA, is essential to secure the program performing well and I will not give further introduction.

The Montreux Record under the Ramsar Convention: A Valuable Tool for Securing Compliance?

Evan Hamman, Tess Van Geelen

Dr Evan Hamman is a Lecturer at Queensland University of Technology (QUT) School of Law in Brisbane, Australia
Ms Tess Van Geelen is a Research Associate at QUT
Ms Van Geelen was recently awarded Australian Government funding to undertake environmental law research in China and Mongolia

Introduction

The world's wetlands are in decline. In Asia, and South-East Asia in particular, scientists estimate up to 50% of wetlands have been lost over the last one hundred years.[1] Much of the degradation has been due to land reclamation, intensive agriculture, urban development and industrial pollution. Wetland decline in China's Yellow Sea region has been particularly catastrophic, despite the existence of over a dozen important Ramsar-Listed sites in both China and South Korea.[2] With the escalation of the impacts of climate change, the changing ecological character of wetlands is emerging as a key concern for decision-makers world-wide.

This paper presents the results of a mixed method analysis of the Montreux Record (MR) under the Ramsar Convention on Wetlands of International importance – one of the main tools for addressing the deterioration of sites. The MR is essentially a list of Ramsar sites which have undergone negative ecological change, due, for example, to excessive development, eutrophication or industrial pollution. The MR is maintained as part of the Ramsar List. Importantly, states must apply (i.e. give their consent) for the inclusion of their sites on the MR. Such a requirement is unsurprising in international law, and is consistent with the principle of State Sovereignty which continues to permeate many aspects of global environmental governance. This research has relevance for our understanding of compliance mechanisms under the Ramsar Convention as well how states can use the tools of Ramsar to help restore their degraded sites.

Method

The guiding research question in this study was:

> What is the value of the Montreux Record in terms of securing compliance from States with the goals of the Ramsar Convention?

The term 'compliance' is a broad and multi-faceted one, and the substantive objectives of the Ramsar Convention (framework) are dynamic and open to debate.[3] Nonetheless, it is suggested that valuable insights can be gained from this research question which are relevant to scholars investigating the implementation of the Ramsar Convention, as well as 'voluntary' non-compliance tools like the MR which also appear in other treaties.

The method adopted to answer the research question was mixed.[4] In mixed-method research, one or more approaches to gathering data are combined.[5] In this research we used a basic quantitative approach and coupled it with a common legal method known as 'doctrinal research' (essentially the collection, analysis and critique of legal and quasi-legal material). Quantitative research involves the collection or manipulation of statistical data. It emphasizes 'objective measurements' and the 'mathematical or numerical analysis of data' to help understand a phenomenon.[6] Quantitative research has benefit in piecing together large populations of information with a view to making generalizations and 'comparisons across categories and over time.'[7]

In this research we compiled statistical data on sites which had been included or removed from the MR by using the Ramsar Sites Information Service (RSIS). RSIS currently hosts information on 2,284 Ramsar sites covering 220,673,362 ha.[8] RSIS also contains primary information on the 48 Ramsar Sites which are currently listed on the MR (covering 3,414,295 ha). From RSIS we compiled a general picture of:

- when sites had been added to the MR;
- which states/regions had engaged with the MR;
- the length of time sites had remained on the MR.

To further inform the research we looked at various Ramsar Advisory Mission (RAM) reports which are available on the Secretariat's website. RAM reports were helpful in explaining why some Ramsar sites had been added to or removed from the MR.

For the doctrinal component of the research, we analyzed legal and policy material related to Ramsar and the topics of compliance and international environmental law. Some of this material included: COP decisions and Secretariat guidance documents as well as the original Ramsar Convention text itself.[9] The doctrinal component of the research was useful for making a connection between the statistical data from RSIS and its normative relevance (or 'compliance value') under the Convention framework. The doctrinal component also allowed the researchers to support the normative arguments as well as inform a more general discussion about the MR included at the end of this paper.

Coding and Analysis

The data in this study was analyzed using basic content analysis. Content analysis is a quantitative research technique that has a long history in the social sciences and is increasingly applying to disciplines like the law.[10] It involves extracting information from text-based sources and drawing inferences about the significance, patterns and context of its

1 N. C. Davidson, 'How Much Wetland Has the World Lost? Long-Term and Recent Trends in Global Wetland Area' (2014) 65 Marine and Freshwater Research, pp. 934–41.

2 Murray, N. J., Clemens, R. S., Phinn, S. R., Possingham, H. P., & Fuller, R. A. (2014). Tracking the rapid loss of tidal wetlands in the Yellow Sea. Frontiers in Ecology and the Environment, 12(5), 267-272.

3 On compliance with international environmental law see for example Cameron, J., Werksman, J., & Roderick, P. (1998). Improving compliance with international environmental law; and Mitchell, R. B. (2003). International environmental agreements: a survey of their features, formation, and effects. Annual Review of Environment and Resources, 28(1), 429-461.

4 Creswell, J. W. (2014). A concise introduction to mixed methods research. Sage Publications.

5 See Hunter A., and Brewer J., 'Multimethod research in sociology' in Tashakkori, A., and Teddlie, C., (eds) Handbook of Mixed Methods in Social & Behavioural Research (Sage, 2003), 577

6 Babbie, Earl R. The Practice of Social Research. 12th ed. Belmont, CA: Wadsworth Cengage, 2010; Muijs, Daniel. Doing Quantitative Research in Education with SPSS. 2nd edition. London: SAGE Publications, 2010.

7 Babbie, ibid; Brians, Craig Leonard et al. Empirical Political Analysis: Quantitative and Qualitative Research Methods. 8th ed. Boston, MA: Longman, 2011; McNabb, David E. Research Methods in Public Administration and Nonprofit Management: Quantitative and Qualitative Approaches. 2nd ed. Armonk, NY: M.E. Sharpe, 2008; Singh, Kultar. Quantitative Social Research Methods. Los Angeles, CA: Sage, 2007.

8 Ramsar Site Information Service (RSIS) <https://rsis.ramsar.org/>

9 For an example of guideline material see: Ramsar Secretariat, 'Guidelines for operation of the Montreux Record' (1996) <http://archive.ramsar.org/cda/en/ramsar-documents-montreux-guidelines-for-operation-20983/main/ramsar/1-31-118%5E20983_4000_0__>

10 Neuendorf, K. A. (2016). The content analysis guidebook. Sage, xv.

use.[11] A major component of content analysis is its ability to allow the researcher to summarize information rather than report all the detail of a statistical set.[12] Analytical coding was also used in this research. Analytical coding involves 'thinking up' from the data and conducting a preliminary analysis at the same time as patterns revealed themselves in the data.

Coding was done manually in this research and not with the assistance of any software. The practice of coding allows for the extraction of general themes or ideas from the data and their respective grouping. For example, after reviewing the RSIS and RAM reports, we collated 'the reasons of MR listing' into 12 separate categories set out in the table below.

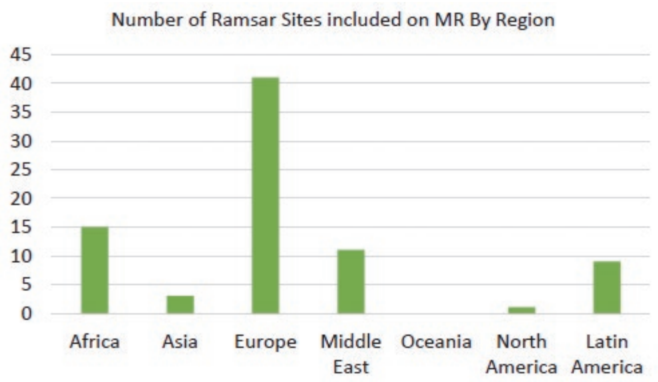
Area Loss	Land reclamation, drainage works, or urban or agricultural encroachment
Water Loss	Water diversion or overuse; damming; unsustainable irrigation for agricultural, domestic, mining, or industrial purposes; over-exploitation of underground aquifers
Population Stress	Over-fishing, over-grazing, or unsustainable hunting or poaching
Invasive Species	Plant or animal species that are introduced or taking over areas due to changing ecological character
Pollution	Agricultural pesticides or fertilizers, or effluent from industry, mining, or sewage
Eutrophication	Due to excessive nutrient enrichment
Vegetation Loss	Deforestation or vegetation succession
Extractive Industries	Oil extraction or mining
Infrastructure	Ports, shipping channels, roads, or other construction
Tourism Impacts	Disruptive impact of construction or recreation
Climate	Drought, flooding, or increased frequency of fires, for example
Conflict	Damage or pollution due to conflict, such as disruption to conservation projects, un-mapped mine sites, or increases in illegal activities like logging and poaching

These categories appeared to us based on the text used in the states original MR application documents (known as 'questionnaires') and were validated on occasion by the RAM reports and/or general media searches. In addition, we also created further measures of the statistical data to determine: (1) where the sites were located (including the region – Asia, Europe, North America etc.) and (2) how long sites remained on the MR.

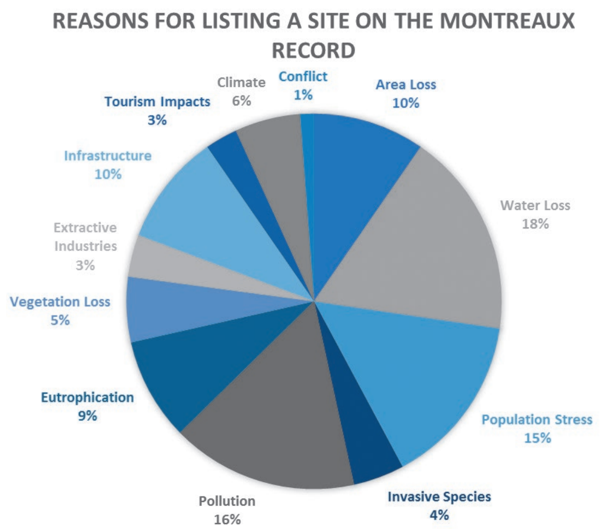
Results

There are currently 47 sites on the MR. A total of 80 sites have been included since the MR was first established, and 33 of those have since been removed. Over half of all sites (42) were added to the MR in the first year of its creation (1990) with an additional 23 sites added in 1993. After 1993, only 1 or 2 sites have been added each year, and not in all years. Among the sites that have been removed from the MR list, the average time spent on the MR is 9 years.

In terms of geographical regions and their use of the MR, Europe appeared to be significantly overrepresented in the data. In Asia and the Pacific (Oceania) region, where many of the world's wetland sites are now in steep decline, there has been very little use of MR. This suggests many states either don't know about the MR mechanism, or, perhaps more likely, they are unwilling to use it as a mechanism for restoration. The number of sites included on the MR by breakdown of geographical region are presented in the figure below.



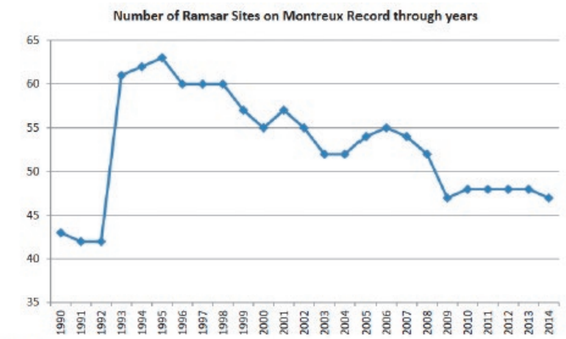
In terms of the reasons for inclusion of sites on the MR, the vast majority of sites were included for agricultural and/or other developmental concerns related to pollution and urban sprawl. Over half of all sites, for example, were recorded on the MR as a result of population stress, eutrophication (from agricultural activities) or water loss (often also from agricultural activities). The reasons for listing a site on the MR are depicted in the figure below.



In terms of the overall use of the MR over time the results showed there was an initial spike of sites included on the list in the early 1990s when the MR was first established. Since about 1993, however, far fewer states have seen value in nominating their sites for inclusion on the MR. Our findings correlate with recent statistics compiled by the Ramsar Secretariat.[13] The Ramsar Secretariat has made public its concerns about the diminishing importance of the MR. It has, for example, recently highlighted the need to reinvigorate the MR mechanism and align it with other state party reporting obligations under the Convention, including the notification obligations under article 3.2. The figure below shows the declining importance and use of the MR since the 1990s. It has been reproduced from the Secretariat's report, though our findings were identical.[14]

11 Ibid., 17.
12 Ibid., 23.

13 Ramsar Secretariat, Report of the Secretary General pursuant to Article 8.2 concerning the List of Wetlands of International Importance <http://www.ramsar.org/sites/default/files/documents/library/cop12_doc07_article_8_2_report_e_0.pdf> at 8.
14 Ibid.



Source:
http://www.ramsar.org/sites/default/files/documents/library/cop12_doc07_article_8_2_report_e_0.pdf
page 8.

Discussion

The MR was first established at the Fourth Conference of the Contracting Parties (COP4) in Montreux, Switzerland in July 1990 although the list was not known formally as the MR until 1993. Specifically, the MR was established by way of recommendation 4.8 of the COP.[15] Formally, the MR was intended to be a register of wetland sites on the List of Wetlands of International Importance (i.e. Ramsar sites) whereby:

> changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference.[16]

The MR mirrors the obligations in article 3.2 of the Convention which requires states to report on those sites were have undergone negative ecological change. Article 3.2 is, however, essentially a notification tool under the Ramsar framework. There is no additional requirement to include article 3.2 sites on the MR. In fact, there is a mismatch between those sites which have been included on the MR and those Ramsar sites which have been notified under article 3.2 of the Convention. For example, out of the over 100 sites which have been reported under article 3.2 of Ramsar, less than half appear on the MR.[17]This suggests that states are willing to report the negative ecological change at their sites, but not engage with the public nature of an MR listing for the purposes of restoration.

Moreover, whilst the MR was initially established as a means to collaborate and cooperate on wetland management, the use of the MR has virtually halted in recent years. Our research shows that no Ramsar site has been added to or removed from the MR since 2010. This is despite the fact that many states continue to notify the Secretariat that they indeed have Ramsar sites which are at ecological risk as required by article 3.2.[18] Various non-state actors (environmental NGOs for example) also notify the Secretariat from time to time of changes to the ecological value of Ramsar Sites in their jurisdictions.[19]

From this we might hypothesize that states are willing to report at least some (but not all) of the declining values at their Ramsar sites, but that the MR as a tool for addressing declines has had withering importance. We are left with important governance questions:

- Why might this be the case?
- What reasons could there be for states to resist engagement with the MR?
- How and why do states view the MR in the way that they do?

In the past, there have been relatively high profile and successful examples of states using the MR as a means for collaboration and support in wetland management. The Chilika Lake Ramsar Site, for example in India (the largest lagoon in Asia), was first placed on the MR in the early 1990s. The site was removed from the MR December 2001 after a successful collaboration between the lake's management and Japanese wetland conservation experts.[20] In such a case the MR was used as a positive rallying cry (or 'alarm system') for effective collaborative restoration techniques. The Chilika Lake authority was also presented with a Ramsar achievement award for their efforts at the site. In another publicized example, Iran's Alagol, Ulmagol and Ajigol lake complex (1400ha) was placed on the MR in 1993 but removed in 2009 due to positive long term conservation commitments by the Iranian Government. The 2009 RAM for the site reported:

> [Success] has been achieved through the national and provincial budgets of the [Government] and an increasingly high level of cooperation with other governmental stakeholders, and with the local communities and NGOs.[21]

One possible reason for the increasingly low engagement with the MR other states is that they may see the MR as 'a naming and shaming list', in a similar way that some countries under the UNESCO World Heritage Convention can view the World Heritage In Danger List.[22] Inclusion on the list for wealthier states like Australia, the United States, Germany and others might be seen as a form of additional accountability and shame for the domestic implementation arrangements in place (or not in place). This however doesn't explain the lack of engagement in the MR in the poorer regions of South East Asia and central and South America. It is likely that states are likely also to be weary of further reporting under Ramsar, and increased instances of accountability from the Secretariat (and other states and NGOs) which can or might conflict with their particular domestic circumstances. In any event, it is difficult to conclude that the MR is an effective non-compliance tool. Under the 'Guidelines for Operation' of the MR, it was intended to be:

> the principal tool of the [Ramsar] Convention for highlighting those sites where an adverse change in ecological character has occurred, is occurring, or is likely to occur, and which are therefore in need of priority conservation attention.[23]

The data presented in this study contradicts this statement. The principal tool seems to have become the article 3.2 notification which as noted above is applied twice as often as the MR. Fortunately, the Secretariat appears to be aware of the incongruence between MR listings and article 3.2 obligations. At COP 12 in Uruguay in 2015, for instance, the Secretariat reported:

> Since the Parties are not apparently deploying the [MR] as in the past, and no new entries have been registered since 2010, and only one Site has been cleared from the Record for four years, the Secretariat intends to request parties to provide information at each Standing Committee meeting on all open Article 3.2 files including [MR sites], so that there is more consistency of approach with all Sites that are at risk of loss of ecological character.[24]

Moreover, there are indications from the Fourth Ramsar

15 Ramsar Convention, Proceedings of the 6TH Meeting of the Conference of the Contracting Parties (Brisbane, Australia, 19-27 March 1996), Resolution VI.1 < https://www.ramsar.org/sites/default/files/documents/pdf/res/key_res_vi.01e.pdf>

16 Ramsar Secretariat, 'The Montreux Record' <http://ramsar.rgis.ch/cda/en/ramsar-documents-montreux/main/ramsar/1-31-118_4000_0__>

17 See Ramsar Secretariat, above n 13, at annex 4a.

18 Ibid., pp 4-5 and annex 4a and 4b.

19 Ibid., annex 4b.

20 The results of that collaboration were presented at this symposium.

21 Report on the Ramsar Advisory Mission No. 60 (2009) <https://www.ramsar.org/sites/default/files/documents/library/ram60e_iran_2009.pdf>, 1.

22 See for example Battini S., 'The procedural side of legal globalization: The case of the World Heritage Convention' 2011 9(2) International Journal of Constitutional Law, pp. 340-368.

23 Ramsar Secretariat, n 9 above.

24 See Ramsar Secretariat, above n 13, at 6.

Strategic Plan (2016-2024) that the Ramsar administering bodies seeks to further address this. The Strategic Plan makes reference to the need to utilize the MR mechanism to improve Ramsar Convention implementation issues at particular sites.[25] In addition, the Ramsar Scientific Review Panel has been explicitly asked to examine the 'utility of the [MR] as a tool for Ramsar Sites.'[26] These are positive moves, though they are likely to increase the administrative burden on states to not only report but to commit to explicit restoration efforts at distinct sites.

Suggestions to improve the MR

From the preliminary results of this study we have developed five broad points which we suggest might enhance the operation of the MR:

In the absence of a unilateral determination of an MR listing against a states' wishes (as occurs, for example under the World Heritage Convention In Danger List) countries need to see a positive value in the MR in terms of: financial assistance; technical expertise and/or future collaborations. Whilst a RAM tends to follow an MR listing in about 60% of all instances (in some cases two RAMs), there also needs to be more robust planning involving other states and non-states as to how the site will be removed from the MR. The In Danger List under the World Heritage Convention, for example, is very clear about what steps need to be followed including: (i) the requirement for a 'desired state of conservation for the [eventual] removal of the property from the List, and (ii) a programme for corrective measures.[27]

Successful cases studies like the Chilika Lake example (mentioned above) need to be further promoted to states for the collaborative benefits MR listing can include. There have also been several other states which have been successful at removing MR-listed sites which could provide good case studies for cross-promotion including; Italy (5 sites removed) and Greece, Algeria and the Ukraine (3 sites removed each). Questions should be asked about what it was that occurred in these states that made restoration – and the use of the MR – so effective, and how these lessons can be translated to other sites around the world. One suggestion is to have a mentoring, 'sister-system' or buddying system between states in the hope of extracting and sharing these valuable conservation lessons.

The MR data on RSIS needs to be improved to allow for greater transparency in the reasons why sites are included and removed from the MR. This can, of course, be problematic as often the Ramsar Secretariat (under-funded as it is) is often awaiting information from individual states on their sites.[28] That said, the problems don't simply exist in the amount of information which is made available to the public. For example, existing information on MR sites is often only available in PDF format which makes research and analysis time-consuming and inefficient. Supporting information on the ongoing operation of the MR (i.e. formal decisions for inclusion) is also difficult to find. This is in contrast to the World Heritage Convention which publishes decisions on sites added to the World Heritage In Danger List. It is no surprise, therefore, that there is very little academic commentary addressing the MR as a compliance tool. Most of the information which does exist tends to raise the MR in only passing within the context of a general discussion of the operation of the Ramsar Convention.[29]

As the Secretariat has recently suggested, the MR and article 3.2 obligations might be more tightly aligned. Reporting duplication should be removed and MR could be upgraded to become a mandatory consideration for all 'changed sites' which have been reported under article 3.2. This might be achieved by 'nudging' existing procedural requirements. For example, the pro-forma document for existing national reporting under article 3.1 (which occurs 'triennially') might be amended to prompt states as to why article 3.2 sites should not be included on the MR as well. At this juncture, a dialogue of open communication could be established to enhance collaboration between state and non-state stakeholders and to highlight the benefits of an MR listing. The identified problems at sites could possibly be put 'out for tender' for the global conservation community to resolve. Corporate, philanthropic and other epistemological support (universities, research institutions etc.) could also be sought at this point.

As a final point, if the MR as a (non)-compliance tool is to be effectively used, its status and reputation must be considerably lifted. Non-compliance procedures under international law are mostly about altering the behaviour of states so that they align with the rules of the regime. Where this cannot be done through publishment and deterrence, it must be achieved through incentives and collaboration. The brand of the MR must therefore be reconsidered. This might include, for example, the governing bodies of Ramsar taking time to consider whether the MR is best positioned as a 'naming and shaming tool' a or an 'alarm bell'.

Conclusion

The MR was established in the early 1990s as a means of addressing the declining ecological character of Ramsar sites. Since that time, as this study shows, the MR has attracted declining importance amongst states although the reasons are not entirely clear. There are, in fact, several examples of successful case studies - that is, sites which have been added to the MR and subsequently removed. However, for the most part, countries in Asia have declined to list their sites on the MR despite clear scientific evidence of wetland decline. Accordingly, questions remain over the real 'compliance value' of the MR including: Can the MR be better aligned with existing article 3.2 reporting? And, can the MR process be reinvigorated so that states actually engage with it in a positive way? This study has presented the results of a preliminary analysis into the MR using both quantitative and doctrinal methods. Further work is now needed on how and why states view the MR in the way that they do.

25 Ramsar Convention, 4th Strategic Plan 2016-2024, <http://www.ramsar.org/sites/default/files/documents/library/4th_strategic_plan_2016_2024_e.pdf>, p 6.

26 Ramsar Convention, 'Scientific and Technical Review Panel (STRP) Work Plan 2016-2018 <http://www.ramsar.org/sites/default/files/documents/library/strp_work_plan_2016_18_e.pdf> p 8.

27 UNESCO World Heritage Centre, Operational Guidelines for the Implementation of the World Heritage Convention (2017), para 183.

28 See Ramsar Secretariat, above n 13, at 5.

29 See for example: C Finlayson, 'Forty years of wetland conservation and wise use' (2012) 22(2) Aquatic Conservation: Marine and Freshwater Ecosystems: 139-143.

Yellow Sea Region Coordinated Waterbird Survey

Chen Qi[1], Chen Kelin[2],Yang Xiuzhi[2]

[1] Beijing Biodiversity Conservation and Research Center, [2] Wetlands International-China

The Yellow Sea-Bohai Sea wetlands are amongst the most important stopover areas for migratory waterbirds in the world and are used by millions of waterbirds for feeding and resting during the both northward and southward migration along the East Asian - Australasian Flyway (Barter et al. 2002, Mac Kinnon et al. 2012). Waterbirds breeding in the Far East of Russia and Alaska, Mongolia and northeast and northern China migrate along the coastlines of the Yellow Sea - Bohai Sea region to spend the northern winter in the Yangtze River floodplains and southern China, while many others continue their journeys to south to Southeast (and South) Asia, Australia and New Zealand where they spend the non-breeding period. The coastal wetlands of the Yellow Sea also serve a very important purpose for shorebirds of the East Asian - Australasian Flyway, especially as the northern coast is the last stopover site for many species of shorebirds before they get to their breeding grounds (Melville et al 2016).

With support of the Ministry of the Environmental Protection of China and The State Forestry Administration, a Yellow Sea Region (China site) Coordinated Waterbird Survey in April 2016 was organized jointly by the Wetlands International-China, The China Wildlife Conservation Association, The Northeast Institute of Geography and Agricultural Ecology of the Chinese Academy of Sciences and the Beijing Biodiversity Conservation and Research Center. Approximately 34 partners from institutions related to environmental protection, forestry, wetland reserves in the marine sector, wetland parks, universities and research institutes along the Yellow Sea Region (China site) worked together to undertake the survey. Altogether, 154 professional and technical personnel and volunteers along with international waterbird experts from Australia, New Zealand, the United Kingdom and the Netherlands participated in the survey. The survey was conducted from 18-24 April and lasted one whole week.

The total length of survey area stretches about 6500 km, from the Yalu River estuary in the northeast (adjoining North Korea), along the sea coast to south of the Yangtze River estuary, covering six provinces and municipalities including Liaoning, Hebei, Tianjin, Shandong and Shanghai and Hangzhou bay in Zhejiang.The sites covered included 11 National Nature Reserves, namely Liaoning Yalu River Estuary Wetland National Nature Reserve, Liaoning Snake Island National Nature Reserve, Liaoning Liaohe River Estuary National Nature Reserve, Tianjin Beidagang National Nature Reserve, Shandong Binzhou Beikedidao National Nature Reserve, Shandong Chang Island National Nature Reserve, Shandong Yellow River Delta National Nature Reserve, Jiangsu Yancheng Zhenqin National Nature Reserve, Jiangsu Dafeng Milu National Nature Reserve, Shanghai Chongming Dongtan Bird National Nature Reserve, Shanghai Jiuduansha National Nature Reserve and Hebei Beidaihe National Wetland Park, and three unprotected wetlands, namely, Yingkou, Liaoning – Dalian, Jiangsu Rudong and Ningbo Hangzhou Bay. Many of these designated wetlands held over 20,000 waterbirds. Of the three unprotected areas, Rudong and Ningbo Hangzhou Bay also held around 20,000 waterbirds and would qualify as wetlands of international importance in accordance of the Ramsar Convention on Wetlands criterion 5 that states: “a wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds”. All three sites meet the staging criteria of international importance for the East Asian – Australasian Flyway Site Network.

The survey recorded a total of nearly 80,7000 waterbirds of 119 species in 18 major sites along the Yellow Sea-Bohai Region (China site). The count was dominated by shorebirds, with about 656,830 recorded (81.4% of the total), followed by 54,727 (6.8%) gulls and terns, 22,999 (2.7%) swans, geese and ducks, 17,114 (2.1%) herons (Ardeidae), 3560 (0.4%) coot and gallinules and 2990 (0.4%) other species, mainly cormorant, grebes, ibis, spoonbill, stork, crane and pelican. Around 49,459 (6.1%) waterbirds were not identified to species level.

Sixteen species on the “Chinese National Important Protected Wildlife List” of 2000 that is produced by the State Forestry Administration were recorded; Four species of the first level: Oriental White Stork, Relict Gull, Siberian Crane, Red-crowned Crane and 12 species of the second level: Great Crested Grebe, Dalmatian Pelican, Pelagic Cormorant, Chinese Egret, White Spoonbill, Black-faced Spoonbill, Mute Swan, Mandarin Duck, White-naped Crane, Little Curlew, Spotted Greenshank and Caspian Tern.

According to the global IUCN Red List of Threatened Species (2015), the survey recorded three Critically Endangered species, namely Baer’s Pochard, Siberian Crane and Spoon-billed Sandpiper, six Endangered species: Oriental Stork, Black-faced Spoonbill, Red-crowned Crane, Far Eastern Curlew, Spotted Greenshank, and Great Knot, and seven Vulnerable species: Dalmatian Pelican, Chinese Egret, Swan Goose, Common Pochard, White-naped Crane, Relict Gull and Saunders’s Gull. In addition, 11 Near Threatened species were reported, Falcated Teal, Ferruginous Duck, Eurasian Oystercatcher, Northern Lapwing, Black-tailed Godwit, Bar-tailed Godwit, Eurasian Curlew, Red Knot, Red-necked Stint, Curlew Sandpiper and Asian Dowitcher.

Fourteen survey sites have been found to meet the criteria of wetlands of international importance in accordance of the Ramsar Convention on Wetlands criterion 6 that states: ”if a wetland regularly support 1% of the individuals of a waterbird species or subspecies”, or staging site criterion of the East Asian – Australasian Flyway Site Network that “a staging site should be considered internationally important if it regularly supports 0.25% of individuals in a population of one species or subspecies of waterbirds on migration.” The survey found a total of 35 waterbird species reached these criteria of international importance.

Eight survey sites have been found to meet the criteria of Wetlands of International Importance in accordance of the Ramsar Convention on Wetlands Criterion 5 that states: ”if a wetland regularly supports 20,000 or more waterbirds, the site can be listed as a Ramsar wetland”.

The 2016 survey has recorded significantly larger number of waterbirds and additional species because of expanded coverage compared to the series of waterbird surveys undertaken between 1995 and 2005 in the Yellow Sea-Bohai region by the Wetlands International - China Office and which that served to identify important areas for shorebirds (Barter et al. 2002).

With support of the Ministry of the Environmental Protection of China and The State Forestry Administration, the Yellow Sea-Bohai Region Coordinated Waterbird Survey 2017 was organized jointly by the Wetlands International-China Office, China Wildlife Conservation Association, Northeast Institute of Geography and Agricultural Ecology of the Chinese Academy of Sciences and the Beijing Biodiversity Conservation and Research Center. The survey was conducted from 21-30 April 2017 and lasted 10 days.

The survey recorded a total of nearly 896,984 waterbirds of 118 species in 18 major sites along the Yellow Sea-Bohai Region. The count was dominated by shorebirds, with about 730,842 recorded (81.48% of the total), followed by 87,778 (9.79%) gulls and terns, 41,205 (4.59%) herons and bitterns (Ardeidae), 21,037 (2.35%) swans, geese and ducks, 6,666 (0.74%) coots and gallinules, and 9,456 (1.05%) other species, mainly cormorant, grebes, spoonbill, stork, crane. The largest number of waterbird species recorded in the survey is Dunlin (199,430, 22.23%). The other nine species with the largest number followed by Bar-tailed Godwit, Great Knot, Grey Plover, Black-tailed Godwit, Red-necked Stint, Black-tailed Gull, Far Eastern Curlew, Chinese Night Heron and Eurasian Curlew. The total of these ten species is 630,739, accounting for 70.32% of the total number of counting waterbirds.

According to the IUCN Red List of Threatened Species (2015), the survey recorded three Critically Endangered species, namely Baer's Pochard, Siberian Crane and Spoon-billed Sandpiper, six Endangered species: Oriental Stork, Black-faced Spoonbill, Red-crowned Crane, Far Eastern Curlew, Spotted Greenshank, and Great Knot, and five Vulnerable species: Chinese Egret, Swan Goose, Common Pochard, Relict Gull and Saunders's Gull. In addition, 11 Near Threatened species were counted, Falcated Teal, Ferruginous Duck, Eurasian Oystercatcher, Northern Lapwing, Blacktailed Godwit, Bar-tailed Godwit, Eurasian Curlew, Red Knot, Red-necked Stint, Curlew Sandpiperand Asian Dowitcher.

Fifteen species on the "Chinese National Important Protected Wildlife List" of 2000 that is produced by the State Forestry Administration were recorded; Four species of the first level: Oriental White Stork, Relict Gull, Siberian Crane, Red-crowned Crane and 11 species of the second level: Pelagic Cormorant, Chinese Egret, White Spoonbill, Black-faced Spoonbill, Common Crane, Mute Swan, Whooper Swan, Tundra Swan, Greater White-fronted Goose Little Curlew, Spotted Greenshank.

Compared with the results of the Yellow Sea-Bohai Region Waterbird Survey in April 2016, the number of waterbird recorded by this survey increased more than 90,000, and counting species reduced one species. Compared with the survey in April 2016, fourteen species of waterbirds were added, namely Yellow Bittern, Whooper Swan, Tundra Swan, Greater White-fronted Goose, Gadwall, Baikal Teal, Red-crested Pochard, Smew, Common Crane, Water Rail, White-breasted Water Hen, Temminck's Stint, Pallas's Gull and White-winged Tern. But there are fifteen species no recorded by this survey, including Black-necked Grebe, Dalmatian Pelican, Greater Flamingo, Mandarin Duck, White-napped Crane, Watercock, Painted Snipe, Ringed Plover, Long-billed Ringed Plover, Oriental Plover, Asian Dowitcher, Little Stint, Red-necked Phalarope, Black-legged Kittiwake and Roseate Tern.

Nine wetlands have been found to meet the criteria of Wetlands of International Importance in accordance of the Ramsar Convention on Wetlands Criterion 5. Sixteen wetlands have been found to meet the criteria of wetlands of international importance in accordance of the Ramsar Convention on Wetlands criterion 6 or staging site criterion of the East Asian – Australasian Flyway Site Network. The survey found a total of 40 waterbird species reached the international importance of standards.

The results of the 2016 and 2017 Yellow Sea-Bohai Region Waterbird Coordinated Survey highlight that wetlands of Yellow Sea Region China site remain crucially important for migratory waterbirds during their northward migration. However, the survey reinforces other recent studies that have shown that the region is facing threats including severe degradation and loss of wetlands due to rapid economic development across the region (MacKinnon et al 2012, Melville et al. 2016). This is resulting in further loss of migratory waterbird habitats that lead to loss of safe feeding and roosting areas for birds that are of crucial importance during their migration.

In the new Chinese national strategy for strengthening the construction of an ecological civilization, it is particularly urgent and extremely important to protect wetlands and their biodiversity in the Yellow Sea- Bohai region. This reinforces the significance of the current surveys that Wetlands International has organized across the Yellow Sea-Bohai Region after a gap of over a decade.

It is proposed by the organisers that such surveys need to be carried out regularly during different seasons to monitor the importance of these wetlands and to inform decisions for their improved management. The survey provided a unique opportunity to identify conservation issues for waterbirds and wetlands in the Yellow Sea and offers recommendations as follows: to strengthen policy system and capacity building on wetland conservation; to continue increase survey scope in space and time; strengthening water birds and their habitat protection and management, priority should be given to establishing natural reserves in areas that meet the criteria of Wetlands of International Importance; to strengthen the scientific research on the protection and sustainable utilization of coastal wetlands; to reduce human disturbance; to enhance the training on waterbird survey and monitoring; to guide relevant departments to make rational use of wetland resources by eco-tourism and birdwatching; to strengthen coordinated protection actions among the regions and departments of the Yellow Sea-Bohai Region; to encourage and support international cooperation on waterbirds protection and research in the Yellow Sea-Bohai Region; to regularly organize workshop and training course on wetland and waterbirds in the region to improve the ability on waterbirds protection of relevant personnel at all levels; to conduct public awareness education activities.

Opportunities to promote cooperation on the conservation and wise use of wetlands between Asia and the Pacific

Solongo Khurelbaatar

Regional Officer for Oceania, Secretariat of the Ramsar Convention on Wetlands

The Pacific region comprises of 23 small island nations and territories spreading across expansive seascapes. Out of 12 independent states, 6 are the Contracting Parties to the Ramsar Convention on Wetlands (the Convention). Vanuatu is nearing the completion of the accession to the Convention. With the exception of Papua New Guinea who joined the Convention in 1993 the Contracting Parties in the Pacific are relatively young members having completed their accessions since 2003 (Table 1).

Table 1: The accession timeline by the 6 Contracting Parties in the Pacific region

Contracting Party	Year of accession
Papua New Guinea	1993
Republic of the Marshall Islands	2004
Palau	2003
Samoa	2005
Fiji	2006
Kiribati	2013

Although the Pacific region is isolated and significantly different from Asia in many aspects there are similarities hence opportunities to promote cooperation on the conservation and wise use of wetlands between the Pacific region and Asia, in particular, with the long-standing members of the Convention in littoral regions of East and Southeast Asia that have accumulated a great deal of good practices and lessons learnt in implementing the Ramsar Convention.

Coral reefs as a wetland type:

One of the principal types of wetlands throughout the Pacific region is coral reefs. Although the Convention's definition of a term "wetland" includes areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters (Ramsar Convention Secretariat 2016) typical wetland inventories tend to exclude coral reefs as a type of wetlands unless they form an integral part of a site containing more typical wetland habitats. This is evident in the flagship publication of 1993, 'A Directory of Wetlands in Oceania' that described many of the important wetlands throughout the Pacific region including those likely to meet the criteria for the Wetlands of International Importance ('Ramsar Sites') while intentionally excluding coral reefs and other exclusively marine ecosystems except in so far they form an integral part of a site containing more typical wetland habitats (Scott 1993). The subsequent efforts to develop national directories of wetlands in the Pacific followed the suit and focused on the typical wetland habitats such as lakes, rivers, marshes, mangroves, lagoons and tidal flats. However, there have been attempts to include coral reefs where they occur contiguous with or adjacent to existing important sites. For example, many of the sites in the Directory of Wetlands in Oceania (1993) which focus on mangroves have extensive fringing-reef flats, patch-reefs and enclosed or surrounding shallow marine lagoons. In the wetland directories for Palau (2014) and Vanuatu (2014), where appropriate, the boundaries of such sites have been redefined to extend seawards and include these marine ecosystems (Michael & Jaensch 2014; Kalfatak & Jaensch 2014). In some parts of the Pacific, this approach is consistent with customary ownership of land and resources which extends to the outer seaward edge of the reefs. It is also consistent with an integrated approach to coastal zone management.

To strengthen its implementation in the Pacific, the Ramsar Convention needs to re-brand the coral reefs as a type of wetland and reinforce the vital connectivity of coral reefs with the health other types of wetland such as mangroves, rivers and streams, and tidal flats. One of the ways to do so is to work on the Coral Triangle. The 'Coral Triangle' is an area encompassing over 10 million square kilometers of ocean and coastal waters in Southeast Asia and the Pacific surrounding Indonesia, Malaysia, Papua New Guinea, the Philippines, Timor Leste, and the Solomon Islands. The Coral Triangle comprises the highest coral diversity in the world (76% or 605 of the 798 coral species recorded) and the highest diversity of coral reef fishes in the world (37% or 2228 of the 6000 coral reef fish species recorded) (The Coral Triangle Atlas 2018). Regarded as the global epicenter of marine biodiversity the resources of the Coral Triangle directly sustain the lives of more than 120 million people living within this area, and benefit millions more worldwide (Allen 2007, The Coral Triangle Atlas 2018).

The Coral Triangle as a global priority for conservation attracts an array of conservation, fisheries and food security initiatives. However, there still are opportunities for the Ramsar Convention to complement the existing efforts with its tools, mechanisms and guidelines, in particular, by promoting the integrated management of adjacent and/or interdependent wetland types (e.g. mangroves and coral reefs) along the total coastline of 132,636 kilometres of the Coral Triangle. This is particularly relevant for addressing the threats to the Coral Triangle that are caused by land-based activities such as coastal development, pollution and sedimentation. In doing so, the Ramsar Convention would build regional capacity and foster closer cooperation among the Asia and Pacific countries within the Coral Triangle.

Moreover, the 'wise use' concept of the Convention that recognizes and strengthens the central role the local communities play in wetland resource management could be helpful in alleviating the threats to the Coral Triangle associated with overfishing. There are opportunities for the Ramsar Convention to facilitate exchange of good practices and lessons learnt in fisheries among the local communities in Asia and the Pacific within the Coral Triangle.

By enabling close cooperation between the Coral Triangle countries on the conservation and wise use of wetlands, the Convention would also have an opportunity to facilitate experience sharing among Asian countries such as the Philippines or Indonesia who manage some of their coral reefs as Ramsar Sites and Papua New Guinea where the existing Ramsar Sites are primarily terrestrial wetlands. The Coral Triangle could serve as an entry point to engage with and introduce to the Solomon Islands and Timor Leste the Ramsar tools, mechanisms, and guidelines.

Sustainable coastal fisheries and local communities:
The coastal areas of the Asia and the Pacific region are highly overfished and the fish stocks depleted (Macusi et al. 2011 in UNEP 2016). Apart from overfishing, threats to coastal fisheries include habitat degradation, pollution, invasive species and climate change impact (UNEP 2016).

The indigenous peoples and local communities in the Asia-Pacific Region hold rich indigenous and local knowledge, customary laws and practices that have allowed them to develop, over generations, sustainable ways to live with nature. However, this has been increasingly threatened in the face of population growth and economic pressures leading to overuse hence degradation of ecosystems and their resources. Many countries in Southeast and East Asia such as Japan, Indonesia, Philippines, South Korea and Thailand have been working with local communities who are resource owners of the biodiverse and important coastal wetlands to manage their natural resources as Ramsar Sites. There are a total of 81 Ramsar Sites in Asia that are entirely or partly coastal ecosystems important for local livelihoods because of fisheries out of which 14 are in Japan, 8 in Thailand, 6 in Indonesia, 5 in South Korea and 4 in the Philippines (Ramsar Sites Information Service 2018). In addition, many case studies show indigenous and local values being integrated, adapted and enhanced with scientific knowledge and tools.

As a result, these countries have developed a great deal of good practices and lessons learnt on involving and empowering local communities so they take the initiatives to ensure the sustainable use of their resources in the long term without outside help. The Ramsar Convention could facilitate stronger forums to transfer good practices of engaging local communities in the sustainable use of coastal resources as well as the ways to enhance traditional knowledge and practices through the application of science and innovation to the Pacific region. This is particularly relevant as in most countries customary ownership of the land (as well as adjacent coastal water and reefs) accounts for more than 80 per cent of the total land area (AusAID 2008). Any intervention to regulate the use of natural resources needs to have thorough consultation with and consent from the resource owners.

There exist a number of efforts to promote community-based conservation of fisheries resources including Fiji Locally Managed Marine Area Network and Reimaanlok process in Marshall Islands. Therefore, the Ramsar Convention could strengthen these existing initiatives via transfer of knowledge and successful initiatives to work with local communities from the countries in Asia where the coastal wetlands are the lifeline for local communities.

Another area of collaboration is helping the member states in the Pacific designate important coastal wetlands under customary tenure as Ramsar Sites and support the effective management of the resources through appropriate local community-led actions.

Wetland education centers and programmes
The global extent of wetlands is estimated to have declined between 64-71% in the 20th century, and wetland losses and degradation continue worldwide. Wetland benefits are severely under-recognized despite the provision of multiple ecosystem services the monetary value of which well exceeds that of forests, for example (Gardner et al, 2015; Russi et al. 2013).

Wetland education and awareness-raising is one of the implementing pillars of the Ramsar Convention's work. The Convention encourages the establishment of centers for promoting wetland education, recognizing their value in connecting people with nature and raising their awareness of wetland values and sustainable lifestyles.

Out of the 9 Ramsar Sites in the Pacific, 4 have small buildings that are used or can be used as wetland education centers. The visitor center at Upper Navua Ramsar Site in Fiji serves primarily as a base for the rafting trips on the river. There is a community resource center at Lake Kutubu Ramsar Site in Papua New Guinea. The Lake Ngardok Ramsar Site in Palau and the second Ramsar Site of Samoa, O Le Pupu Pue, designated in 2017 have a visitor enter each. The Kiribati Environment Youth Club Education and Information Center on Kiritimati Island provides information on wetlands (National Reports for Ramsar COP11 and COP12).

On the contrary, there are 30 wetland education centers in Japan, 29 in Thailand, 12 in South Korea, 11 in Indonesia and 5 in the Philippines (National Reports for Ramsar COP11 and COP12).

While it might not be feasible to set up new wetland education centers in the Pacific region because of resource availability and remoteness of the Ramsar Sites the Ramsar Convention could facilitate exchange of resources and activities on communication, education and public awareness (CEPA) among the Parties in Asia and the Pacific. More specific opportunities include supporting the existing centers and reinforcing their CEPA programmes, helping the Parties in the Pacific develop and publish education materials on the conservation of wetlands and facilitating study tours to wetland education centers in Asia for the personnel working on wetlands in the Pacific. In addition, the NGOs are well placed to carry out effective CEPA programmes; hence the cooperation on wetland education centers and CEPA programmes should be encouraged between capable environmental NGOs in the two regions.

These are the examples of the areas of the Ramsar Convention's implementation that could significantly benefit from increased collaboration and knowledge sharing between the Ramsar Parties in the Pacific and littoral countries in Asia, in particular, those in East and Southeast Asia. The collaboration may take a bilateral form or a regional approach depending on resource availability, geographical distance, and socio-political factors. Collaboration in other areas such as wetland policy, designation and management of Ramsar Sites, wetlands and climate change impacts should be encouraged among the interested countries in Asia and the Pacific too.

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Ramsar COP as a Turning Point of Awareness and the Present Activities: Some Cases to Promote Local Awareness through International Collaboration and Understanding Impressing with the Concept of Wise Use (abstract)

Yoshikatsu Kikuchi

Kushiro International Wetland Centre

Kushiro Shitsugen is Japan's largest wetland. It was listed under the Ramsar Convention in 1980 when the first COP of Ramsar was held in Cagliari, Italy. Kushiro Shitsugen became the first Ramsar site in Japan. But with the exception of some experts and administrations, people's interest to the wetland was still limited.

Kushiro Shitsugen is located in the eastern part of Hokkaido. The history of cultivation in this island was comparatively new, because after Meiji Restoration of 1868, the new government placed great emphasis on Hokkaido's economic development, encouraging settlers to come from other other parts of Japan. But the scale and speed of cultivation were fortunately not larger, because of harsh environments and small population. So people thought there would be no crisis by destruction of the environment in their abundant and inexhaustible land. So as in Kushiro area. The wetland was left mostly untouched without large-scale developments, but open seams on the fort of nature have been growing as human behavior and the improvement of living standards has extended.

Kushiro Shitsugen has a rich habitat for a variety of precious flora and fauna, including the Red-crowned Crane. After it was listed as a national park of Japan in 1987,

Kushiro Shitsugen has known far and wide in the country, but it was still not enough to draw many people's interest to its eco-system. One of the reasons why wetlands didn't contribute to raise awareness to the importance of the wetlands in the past was that local people have regarded the wetland as barren or useless land from the old times of their ancestors. They preferred to live staying out of wetlands and they had no intention to evaluate their land's value, the importance of wetlands.

In 1993, COP5 of Ramsar Convention was held in Kushiro. It was the first Ramsar COP held in Asia. Many people worked and hosted the meeting as volunteers. A lot of NGOs and nature-related organizations and groups gathered from all over Japan and they joined at the meeting and held many events. Then COP5 made them to recognize the important of wetlands in the area after the meeting, and many of nature-related organizations and NGO groups went home with enthusiasm of their activities. The time of COP5 in Kushiro turned to the turning point for many people to move to the next phase for wetlands.

After Ramsar COP5, Kushiro International Wetland Centre (KIWC) was established with the support of local areas. It aims at a network acting vigorously with members including national government agencies, wetland-related local governments, local universities and NGOs, experts and individuals. To enhance local people's awareness to nature and conservation of wetlands, we always arrange lectures, tours, environmental surveys and various other events to communicate the appeal and share the significance of wetlands are very effective. We attach weight to the wise use of wetlands - a concept by which all wetlands are treated as valuable local assets whose blessings are used to enrich people's lives and passed on the wetland to future generations. We actively promote international cooperation to advance the preservation and wise use of wetlands. Related work includes the organization of training programs (of JICA) and workshops for developing countries and the dispatch of experts to such nations. We also collect, exchange and provide up-to-date information on wetland conservation and biodiversity, and works to extend its international cooperative network. In the presentation I introduce some cases of our attempts to enhance the awareness of local people to conserve the environment being aware of international collaboration.

Spoon-billed Sandpiper Conservation in the Internationally Importance Wetland Gulf of Mottama (abstract)

Pyae Phyo Aung

Biodiversity And Nature Conservation Association (BANCA)

The Spoon-billed Sandpiper (*Calidris pygmaea*) is a long distance migrant, breeding in Russia and it regularly migrates more than 8,000 km passing through 14 countries and wintering in South and South-east Asia, South along the East-Asian Australasian Flyway, including major staging posts in the Yellow Sea, with approximately half of the global population is understood to winter in Myanmar. This species is categorized as globally Critically Endangered on the Red List of the International Union for the Conservation of Nature (IUCN), which is the highest category of extinction threat for any species still present in the wild. The current population decline could lead to its extinction within a decade. The population is declining by 26% per year, with a global population estimate of approximately 100 pairs. If the current rate of decline continues then the species will be extinct within a decade. The Gulf of Mottama(GoM) is one of the most dynamic estuaries and famous intertidal mudflat ecosystems in the world. The Gulf is bell-shaped and has dynamic estuary ecosystems. The Gulf is one of the world's most important wintering areas for the critically endangered Spoon-billed Sandpiper, hosting probably more than half of the remaining global population.

The local communities use the site for fishing, grazing, duck-rearing and paddy farming. However, the Gulf of Mottama is a vulnerable and changing environment where communities have lived by adapting to change over time. Surrounding the coastal area of Gulf of Mottama has 180 villages in this area and nearly two hundred thousands of people live there. Their main livelihood is fishing. The standard of their education is low and the condition of their health is still poor. The gulf of Mottama will be demarcated as one of the biggest Ramsar site in Asia. But due the different administrative government structure, Northern part of Mottama Gulf was designated as fourth Ramsar site in 10 May 2017. The designation of this Ramsar site is of special significance because it is the first in Myanmar that is outside a legally-designated protected area. It therefore sets an important precedent for Myanmar's many other wetlands of global importance that merit Ramsar status. The Gulf of Mottama is meets six out of nine Ramsar criteria, a comparatively high proportion. On the other hand, the Gulf of Mottama is suffering. Fish catch has declined by 50-90% over the past 10 years as a result of overfishing, often due to use of illegal nets to harvest fish of all sizes, even juveniles. Small-scale fisher folk are being forced to either look for work in other sectors or migrate. The local fishermen catch the fish excessively by using drag nets which is also called wire mesh. So the fish stock is rapidly depleting in this area. The local people said that it has affected their livelihoods. Community involvement and management plan is crucial role for further sustainable of natural resources in Gulf of Mottama. Community-led Coastal Management Gulf of Mottama Project is pioneer project in Myanmar for enhancing coastal wetlands conservation.

The Establishment of Southeast Asian Limnological Society Network (SEAL-Net) (abstract)

Mashhor Mansor, Luki, S., Wan Maznah, W.O., Muzzalifah, A. H. and Siti Norasikin, I.

School of Biological Sciences, Universiti Sains Malaysia

During the 16th World Lake Conference which was held at Kartika Plaza Hotel, Bali, from 7th to 11th November 2016, the Southeast Asian Limnological Society Network or SEAL-Net was established. It should be noted that this historical event had taken place on the 10th November 2016 with 30 participations form various Asian countries. This is mainly due to a close political cooperation between the 10 ASEAN nations. The current geopolitical situation in the 10 nations is encouraging and moving fast in becoming the economic power in the global economic arena. Perhaps it is undeniable that the ASEAN nations are not only rich in biodiversity, but also rich in freshwater ecosystems.

For example; the Mekong River which flows through seven countries is the 12th longest river in the world and the 7th longest in Asia, passing through China, Myanmar, Thailand, Lao PDR, Cambodia and Vietnam. In addition there are several unique lakes such as Tonle Sap, Cambodia, Moeyungyi Lake, Myanmar, Toba and Matano Lakes in Indonesia. One of the widely recorded species in this region is the Irrawaddy Dolphin (Orcaella brevirostris). The populations are also thrive in coastal zones. Concurrently with the Bali declaration, the SEAL-Net was official adapted and recognized. Among the items insert were the sustainable usage of the river basins and lakes. The global water systems from tropical countries should be widely recognized. The scientists are urged to establish a common platform for sharing either globally or regionally.

International networking focusing on data requirement on river basins and lakes management are encourage. Unique complex issues facing nations should be addressed accordingly. The conference offered several solutions based on policies, scientific data gathering and crucial information were heighted. Therefore, at this junction SEAL-Net is looking forward for further international cooperation with other agencies all over the world. Perhaps the tropical ecoregion is relatively different from other ecoregions such the temperate and polar zones. Based on the cooperation between Universiti Sains Malaysia (USM) and Lembaga Ilmu Pengetahuan Indonesia (LIPI), it is very encouraging and timely that a book entitled 'Lake Ecosystem & Services: Temengor Reservoir, Malaysia and Selected Indonesia Lakes' was published. Several issues on Malaysian and Indonesian Lakes are addressed. This book offers a strong guideline for further studies in the lakes ecosystems of Indonesia and Malaysia. It is interesting to note that Temengor Reservoir was morphometry studied in detail. The bathymetry mapping method based on acoustic findings was used in order to obtain a model on the surface topography and bottom water. This bathymetric survey apparently is the pioneer study on the deep and dark zone of a tropic. To date, there are 22 university networking among the universities in Mekong Delta. The cooperation between ASEAN universities, seems to be very encouraging. Most of the lakes in Myanmar, Thailand, Loa PDR, Cambodia and Vietnam have been surveyed by this team. The Limnological studies on deep lakes in Indonesia are initiated by LIPI. Meanwhile, the USM team is focusing on the biodiversity of the lake ecosystem. The detail information could be surfed; http:// www.sealnet.forum.org

Team SPOON: Creating Connection of People and Nature for Sustainable Society and East Asia Peace (abstract)

Akane Tokorodani, Akihumi Shimada, Dai Machida, Masato Dohi

Tokyo Institute of Technology and Team SPOON

In wetlands, and especially tidelands, rich nature has fostered diverse cultures. However, there is history that such rich nature has been decreasing due to urbanization. At the same time, this also means that the relationship between the people and the wetland has been disappearing. On the other hand, there are still many great wetlands around the world, and they have diverse cultures. Especially wetlands in East Asia have many common aspects in its features and the relationship between the people and the wetlands. In other words, cultivated culture in a certain wetland would be a hint to solve other wetland issues. In order to achieve conservation and wise use of wetlands, it is necessary to bridge the gap between people and nature, cities and nature that has been growing due to modernization, and cooperate with East Asian regions that have common climate and culture.

In this context, we are engaged in activities to build peaceful foundations in East Asia by connecting people and nature, cities and nature, and at the same time connecting people across countries. This paper introduces our activities, Team SPOON.

Team SPOON is working with the Black-faced Spoonbill as a symbol of our activities. The Black-faced Spoonbill is an endangered species which are only about 3,900 birds around the world, and it is a migratory bird across East Asia such as Taiwan, Korea, Japan, and China. Some individuals of this bird are put a foot-ring to identify individuals for research, and Team SPOON makes a ring which is the same design of this foot ring for visualizing the connection between people and the Black-faced Spoonbill individuals. Additionally, Team SPOON is sending daily news of the Black-faced Spoonbills ("Daily Black-faced Spoonbill Times") on Facebook or E-mail to our members.

In the daily news, we report observation data of the Black-faced Spoonbill, and introduce the relationship people and the Black-faced Spoonbill, people and wetlands such as mural paintings and songs about the Black-faced Spoonbill, lifestyle related to wetlands like fishery, sightseeing and foods, and events related to the Black-faced Spoonbill held in various places of its flyway. Since members can freely make comments and questions on the daily news, not only does it connects people with the Black-faced Spoonbill individuals, but plays the role of connecting people.

Team SPOON was established in January 2015. Currently, SPOON members are 254 people, mostly living in urban areas of Japan. SPOON plans to extend these activities to East Asia which is the flyway of the Black-faced Spoonbill. From June 26 to 30, 2017, we are going to visit Korea and spread these activities. Furthermore, we are going to research good examples of culture and wisdom produced by the relationship between people and wetlands in Korea, and plan to build a system that people thinking about the Black-faced Spoonbill in various regions can access and exchange such experiences. Through the Black-faced Spoonbill, people in East Asia are connected across countries to exchange the culture and wisdom cultivated in various places of its flyway for preserving habitats and protecting local communities culturally and economically. It will contribute to not only building diverse regions where people and nature coexist but leading to peace in East Asia.

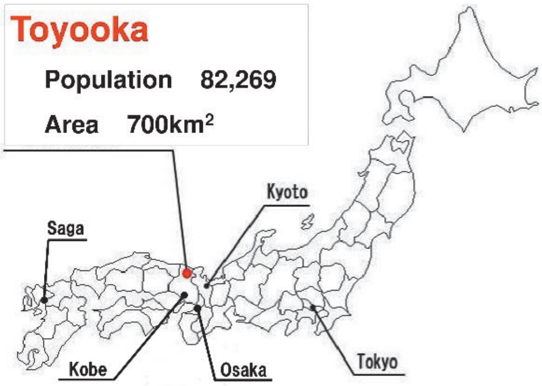
Session 3

Wetlands and Use of Natural Resources / Agriculture / Fisheries / Food Security

Living in Harmony with Nature

Muneharu Nakagai
Toyooka City

I'll tell you a story regarding the extinction and restoration of Oriental White Storks in Japan. The main stage of the story is Toyooka.



The Maruyama River runs through the middle of Toyooka city. The gradient of the river is very gentle, with an inclination of only one ten-thousandth. These are paddy fields containing water. The surface of the river is as beautiful and calm as a mirror when there is no wind. However, there are challenges to this gentle river. The gentle inclination means that once it gets flooded, the water is less like to withdraw.

In 2004, Toyooka was hit by Typhoon 23. The flooding of the river caused severe damages in wide areas.

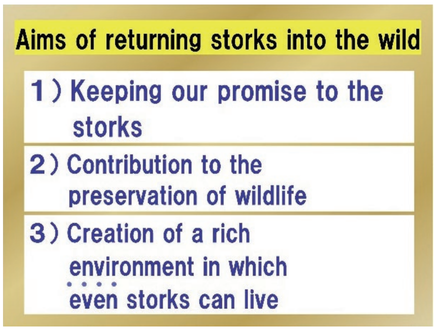
Over the years, the people in Toyooka have been suffering from flooding. This landscape is inconvenient for human beings at times but it is the ideal habitat for the species that live in wetland-like environments like wetland.

A typical example is the Oriental White Stork. The stork is a fully carnivorous big bird with a 2-meter wingspan. Wetlands and paddy fields are its favorite feeding grounds. In the past, the Oriental White Storks were common in Japanese Satoyama. Satoyama is the area between mountain foothills and arable flat lands. Storks made their nests on pine trees and would eat the creatures in the paddy fields and the irrigation channels.

However, from the 19th century, the number of Storks decreased drastically due to multiple factors. The first reason was hunting. Secondly, during the Second World War, a lot of pine trees were destroyed, causing the storks to lose their home. Thirdly, after the Second World War, the wetlands disappeared due to large river wall construction. Further, the modernization of agriculture cut off the Maruyama River from the irrigation channels and paddy fields reducing the numbers of living creatures. Finally, the use of chemical pesticide gave a final blow to the wild stock of this species. In 1971 when the last wild Stork died, the Japanese Stork's population in the wild became extinct.

A few years before this extinction, the Hyogo Prefectural government and the Toyooka municipal government started an ex-situ conservation program via artificial breeding. Despite the people efforts, for 24years no chick hatched. During this period criticisms and hopelessness spread. However, people continued the artificial breeding. After a long struggle, the first chick hatched in 1989. After this first chick, the number of storks in Toyooka kept on growing. Currently there are 108 storks flying in Toyooka and 96 storks are under captive breeding.

Bringing back storks to the wild required enormous energy and cost. And we are willing to pay this cost in the future as well. Why should we pursue the reintroduction of storks?



We have three reasons; firstly, when we captured the wild storks 52 years ago, we made a promise to the storks that we will bring them back to the wild. We have to keep our promise to them. Secondly, the global population of storks is only around 3,000. In other words, it is on the verge of extinction. We need to make a global contribution by conserving this bird species. Thirdly, the most significant reason is that we need to restore a healthy environment which embraces a big carnivorous bird like the Oriental White Stork can live. The rich environment is not just beneficial for the bird but it is also beneficial for humans as well.

Further our goal is not just to enrich our environment but also our culture. Even if we enrich our environment, if there is not culture to cherish this bird species, what is the point? So under the slogan of "Let's bring back Storks to the sky of Toyooka", we aim to restore a rich culture as well as a rich environment.

In order to achieve these goals, we have been working hard. In 1999, Hyogo prefecture established "The Homeland for the Oriental White Stork". This facility, which is part of Hyogo Prefectural University, is a center for research as well as the center for implementation of the restoration of Oriental White Storks. Moreover, the Toyooka Municipal government has established "the Eco-museum Center for the Oriental White Stork" in order to raise awareness. In this facility, citizens and visitors can watch the birds from close by.

The Oriental White Stork stands at the top of the food chain. So in order for this bird to survive, we need to restore a rich wetland ecosystem. And the key to achieving this is in the paddy fields, waterways, rivers and their network.

For example, in Toyooka, fallowed paddy fields are used as biotopes. These paddy fields are watered all year-round with some weed control measures. As the creatures increase in these paddy fields, the feeding grounds for Storks increase as well. There are currently 24 biotopes (12.6ha) in Toyooka city.

The other example is the "Stork-Friendly Farming" method. In conventional farming method, the paddy fields are not watered during winter. However, with this method, the farmers need to water their paddy fields even during winter. This is to increase the frog population which lays eggs in the watered paddy fields from February to March. Also under the conventional farming in Toyooka, the paddy fields used to be dried in June. We now ask farmers to delay the drainage until tadpoles grow their legs, and can escape. There are 407.1ha of paddy fields that cultivate rice with "Stork-Friendly Farming" method.

We are establishing fish ladders between paddy fields and waterways. It allows fishes to pass through by reconnecting the creeks and the rice paddies that were separated due to the modernization of agriculture. There are 141 fish ladders installed in Toyooka.

In the Maruyama River, a wetland restoration project has been implemented by the Ministry of Land, Infrastructure, Transportation and Tourism. So far, 66.5ha of land has been converted into wetlands.

Thanks these efforts, Toyooka has experienced a historical moment in September 2005. We were able to release the Oriental White Storks to the wild. After 34 years, Storks came back to the Japanese sky. In 2007, the first chicks hatched after 43 years of absence and flew out of their nest. In 2012, the third generation of wild Storks hatched.

As an international recognition of these efforts, in 2012, "Lower Maruyama River and the surrounding rice paddies" was recognized as part of Ramsar Wetland. There are many visitors and researchers visiting this area leading to regional regeneration.

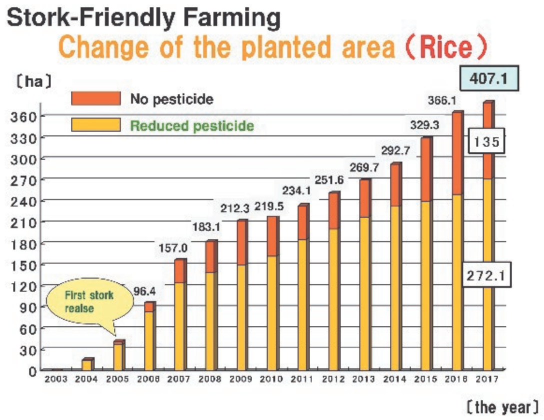
Storks started to fly out of Toyooka and visit all over places in Japan.

On March 18th 2014, a stork born in Toyooka was found in South Korea. The stork stopped over at Nagato City, the home town of Japan's prime-minister Shinzo Abe, having said "Hello", and then flew to South Korea. Afterward a summit meeting of Japan, South Korea and the U.S. was held.

And now, we are moving on to the next step, enhancing connections between the environment and the economy. Many people believe that there's a strong conflict between the environment and the economy. We strive to create a sustainable city, Toyooka Eco-Valley where activities for the conservation of the environment boost the local economy and vice versa. The keyword is "resonance" between the environment and the economy.

10 years ago, Toyooka city invited a factory to product solar batteries. Currently there is a strong demand to install solar batteries to reduce CO2 emissions. The company is making a good profit. Toyooka has built a facility with Mega Solar panels. We have been, also, supporting various environmentally friendly projects.

Of course the Agricultural sector in Toyooka is very important. The final blow to the Oriental White Storks came from agricultural activities. So we have been promoting the "Stork-Friendly Farming" method which does not depend on chemical pesticides and fertilizers. Currently there are 135ha of rice paddy fields that conduct rice farming without any use of chemical pesticides and fertilizers; as well as 272.1ha of rice paddy fields that conduct rice farming with reduced use of chemical pesticides and fertilizers. This rice is sold at a premiere price which is 70% to 200% higher than rice produced under conventional farming method.



Through numerous efforts, many living things such as frogs, fishes, insects, snakes and Oriental White Storks have returned to the paddy fields. However, what we feel the most proud about the positive change brought to the paddy fields is children. Children have returned to the paddy fields.

After Typhoon NO.23 hit, some students at Nitta school formed a group which goal was to study the relationship between humans and nature. They decided to learn more about the stork friendly farming as well as the reintroduction program. They discovered that the more the farming increases, the better the environment becomes. But how could they spread the farming? They started to think that maybe increased consumption could do that. They went to a convenience store near their school to try to convince the staff to use stork rice for the rice balls sold at the store. Unfortunately, their dream did not come true because the shop master did not have the authority to take that decision.

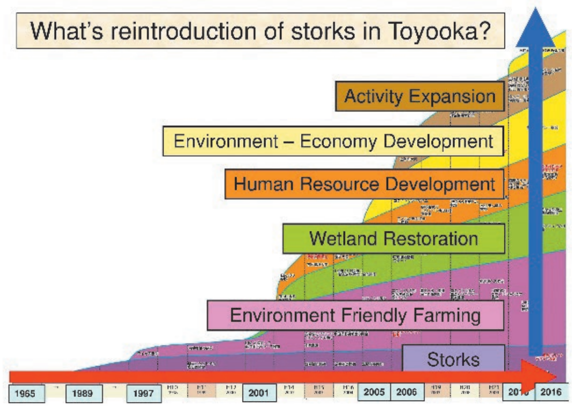
But they did not give up. One day in 2007 some elementary school students and junior-high school students visited my office to ask me to provide "Stork-Friendly rice" for school lunches. They insisted that more consumption will lead to more production. And increased production will make the environment better for both storks and humans. I was so surprised by their action and reasonable logic that I promised them to do so. Now we provide the Stork-Friendly rice for school lunches 5 times a week. The children's action itself has made the consumption of stork-friendly rice increased by 1.4million bowls, or 102t per year.

In 2011,there was a terrible earthquake and tsunami in the Tohoku District. Students at Nitta elementary school gathered other elementary schools that were cultivating rice. Fourteen elementary school came together and decided to send rice to the area hit by the earthquake. But they did not know how and where they should send the rice to. So they came to my office for advice. I was surprised again with their action and praised them. But instead of giving them an advice, I told them to do something by themselves. There were things yet to be done. For example, in order to send rice, there are shipment cost as well as cost for rice bags. So I told them to raise fund to cover these miscellaneous cost. So the children went to the shipping company and asked the shipping cost, which was 30,000 JPY. Then they visited the Agricultural association to check the cost of bags, it was 30 JPY per bag leading to 100,000 JPY. So in total the miscellaneous cost was 130,000 JPY. They raised 117,000 JPY from the general public and from selling recyclable cans. And the children had harvest. The rice was sent to children in Minami-Sanriku with the messages of encouragement.

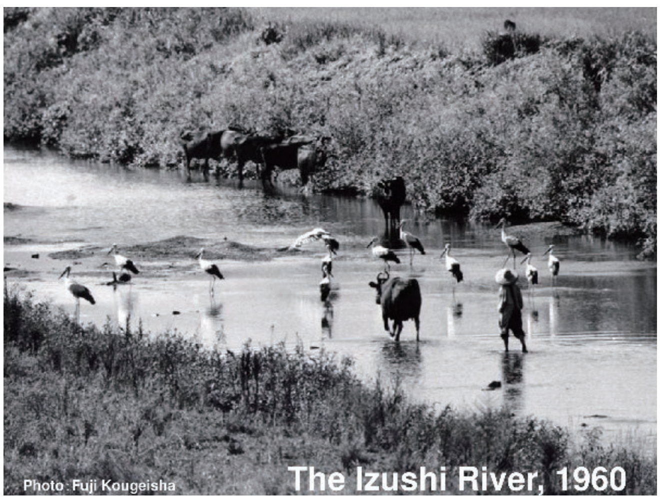
Often, there is a great gap between thinking about doing something and really doing it. Taking the first step is important but sometimes it is difficult to do. However, these children were able to fill this gap and took the first step without hesitations. I am very proud of them.

But what about the difference between the 130,000 JPY they needed and the 117,000 JPY that they collected? The adults gave them a discount.

Now let's review the process of the reintroduction of storks in Toyooka. Time is on the horizontal axis, from 1965 to 2016. The number of storks has increased like this. Environment-Friendly Farming, Wetland Restoration, Human Resource Development, Environment-Economy Development, and many other activities. All these activities are part of the Stork restoration process.



This is a photograph taken in Toyooka 57 years ago. It shows the back of a female farmer who died 7 years ago at the age of 99, seven Tajima cows and twelve storks. They are close to each other. About 20 years ago, we searched for this lady and interviewed her. During the interview she recalled "I'm not sure if it's me from the back only. But it should be, because the cow next to the figure was mine." She didn't mention the storks, but continued to talk about the cows. In the end, she said, "We were rich at heart in those days."



This photograph is the symbol of what we have lost, and what we are going to restore. And this photograph, together with that of the terrible flood in 2004, seems to pose us a question, “How should we live in harmony with nature?” We, in Toyooka want to find the answer to this question. Now, 12years after their reintroduction back into the wild, the storks have established themselves as a part of Toyooka’s landscape once again.

When we started the conservation and reintroduction of storks, there were so many different values among people in Toyooka. However storks taught us that through dialogue and communication, we, can recognize each other’s differences, we can create unity amongst us, and we can share the same dream.

Lake Urmia Restoration via Local Community Participation in Sustainable Agriculture

Neda Asad Falsafi Zadeh, Abolfazl Abesht, Mehri Asnaashari, Hamid Soltani

Iran Department of Environment, Government of Japan, United Nations Development Program (UNDP)

Abstract:

With an area of 5000 km^2, Lake Urmia (LU) is one of the largest inland lakes situated in North West of Iran. This vast hyper-saline lake which is a Ramsar Site, a UNESCO Biosphere Reserve and a National Park, has for long contributed to the biodiversity of the area, as well as livelihoods of local communities around it. There are more than 5 million inhabitants living in the basin and drying of this Lake will have tremendous impacts on their daily livelihoods.

Over the past decade, Lake Urmia has been affected by severe droughts and increasing pressures of over-extraction of water which have disturbed the inflow-outflow balance of the lake. Despite the fact that in the past two years, the situation of Lake Urmia has been stabilized to a certain level, but the Lake still faces the threat of an irreversible drought where the dimension of its impacts would gradually spread from biodiversity to socioeconomic, affecting livelihood and health of the surrounding communities. According to aforementioned points and considering the agriculture sector share of wetland basin water resources, "modelling public participation in Lake Urmia restoration through establishment of sustainable agriculture" project is being implemented in pilot villages of East and West Azerbaijan provinces from 2014 with the aim of reduction in water consumption.

In 2014, the high-level arrangements between the governments of Iran and Japan led to allocation of one million USD by the Government of Japan (GoJ) to address the issues of the critically endangered LU. Therefore, the "Contribution to Restoration of Lake Urmia via Local Community Participation in Sustainable Agriculture and Biodiversity Conservation" project was added to Conservation of Iranian Wetlands Project as a new outcome. Implementation of the first phase in 41 villages resulted in successful achievements in water saving, awareness raising and biodiversity conservation which led to allocation of two million USD to institutionalize the process in 41 villages and scaling it to 49 new pilots in three further years until now.

The next phases of the project was developed based on the capacity built and lessons learnt from the previous phases of the project and effectively contributed to restoration of LU through local community and farmers engagement to bring together the pieces of the puzzle (promotion of sustainable agriculture and effective reduction of water consumption at farm level which would lead to increase of inflow to the lake, social mobilization and public awareness campaign, local water network initiatives, alternative livelihood practices aiming at water saving).

During implementation of the three phases, application of Sustainable Agriculture Techniques in 90 villages has been welcomed by more than 10000 local farmers, successfully covering 30% of villages located in the LU ecological zone encompassing 250 villages. The results of monitoring water consumption at project pilots for autumn/spring crops and orchards has shown significant water saving (by an average of 39.5%) as well as 40% saving of chemical agricultural inputs (Fertilizers and Pesticides) in treatment farms as compared to control farms.

During this period 200 local experts mainly in the form of local cooperatives were employed and trained on socioeconomic as well as technical aspects of Sustainable Agriculture, 150,000 local communities were targeted in the awareness raising campaign and 800 local communities were involved in applying new tools and mechanisms as complementary elements of sustainable agriculture.

Introduction:

Iran is situated in a geographically unique area, with diverse climatic conditions and rich biodiversity. This situation has made 41 wetland types available in Iran out of a total of 42 which could be observed all over the world. Encompassing 24 Ramsar sites, Iran has got the highest number of wetlands designated in Ramsar Convention in the Middle East. But these diverse resources are not immune to the pressures of over-exploitation and mismanagement, maximized by scarcity of water and climate change. Paired with non-sustainable development and massive agricultural schemes, these are the main causes known to affect most of wetlands in Iran, and Lake Urmia, the largest wetland of the country is not an exception.

During the last decade, considerable efforts have been made to improve the management of wetlands across the country, recognizing that significant pressures arising from human activities were degrading wetland resources. The conservation of Iranian wetlands Project (CIWP) is an example of these efforts focusing on ecosystem-based management and establishment of integrated participatory management plans for important wetlands, including Lake Urmia.

Conservation of Iranian Wetland Project

As mentioned above, conservation of Iranian wetlands Project (CIWP) which was launched in 2005 with support of United Nations Development Program (UNDP), the Global Environment Facility (GEF) and Department of Environment (DoE) of Iran, is an example of efforts for improving wetlands management in Iran which focuses on establishment of ecosystem management at local and national levels, appropriate context for participation of stakeholders, and development and implementation of management plans. These management plans are developed in a participatory process with the aim of synergy among development projects and conservation measures in wetlands' basin, and determine the responsibilities of governmental and non-governmental organizations in conservation of wetlands along with sustainable development in the basin. In this process besides considering the issues such as biodiversity conservation, local communities' livelihood, awareness raising, management of water and soil resources is specifically taken into account with the aim of determining wetlands water right. Considering the agriculture sector consumption of basin water resources (87%), modeling public participation and establishing sustainable agriculture (SA) in wetland areas via an intersectoral collaboration among ministry of Jihad-Agriculture (MoJA), Local Water Management Authorities, DoE, Local NGOs, private sector and the local community itself became one of CIWP major activities.

Modeling Local Community Participation in Lake Urmia Restoration

Capacity building and education are the main tools of participatory-development projects. As ecosystem approach has a specific emphasis on engagement of all stakeholders, this tool makes the optimum participation of representatives from other organizations and related stakeholders possible to achieve the goals. On the other hand, considering the different potential and capacity of stakeholders, necessary training and capacity building plan should be developed and implemented for them. The following diagram illustrates different dimensions of participatory approach and its development.

The whole process is based on participation. During the last 3 years CIWP has done its best to move towards the ideal situation in the spectrum with highest level of participation.

Diagram 1: Dimensions of participatory approach in participatory-development projects

As the main part of local communities' livelihood depends on the wetland and on the other hand allocation of wetland's water right depends on agricultural activities, this participatory model has formed based on sustainable agriculture.

The Historical and Implementation Process of the Project

Results of a few SA pilots previously demonstrated by CIWP and MoJA along with the first 2 phases of this project supported by Goverment of Japan, revealed that applying participatory SA techniques will not only increase the water efficiency, but will also reduce the application of chemical materials without compromising farmer's net income. On the other hand the participatory approach of this project during planning and implementation processes of the project indicates the importance of local communities' involvement and social mobilization for restoration of the Lake.

The main outputs of the project were derived from the management objectives of LU Integrated Management Plan which was developed by CIWP and adopted by the cabinet in 2008. The mentioned management objectives are summarized below:

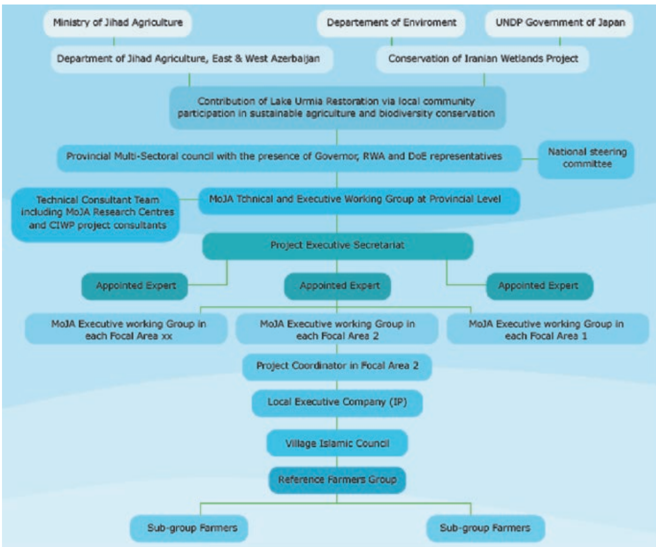
- Sustainable management of water resources and agricultural land use
- To raise awareness on ecosystem services of the Lake and its Satellite Wetlands in order to enhance public participation in their management.
- Biodiversity conservation and sustainable use of wetland resources.

The Process of Local Community Engagement in SA Practices

The project aims to revolutionize the behavior of local communities and farmers towards sustainable development mainly in the area of agricultural practices. In this regard, SA techniques are developed based on participatory approaches, bringing together farmers, agriculture research centers and professional facilitators aiming at water saving at farm level to help meet part of the lake water rights without compromising farmers' net income. Implementation of SA practices at LU basin follows below steps:

Project Management Structure

The project is supported by an Integrated Inter-sectoral Structure which links farmers with local agricultural cooperatives, research centers, provincial administration officials and the national coordination body (Figure 1). This structure provides an excellent cooperation platform for LU restoration related stakeholders encompassing local communities and farmers, NGOs, private sector, government organizations to work together synergically.



"Contribution to Lake Urmia Restoration via local community participation in sustainable agriculture and biodiversity conservation" project is implemented with collaboration of Department of Environment (DoE) and Ministry of Jihad-Agriculture (MoJA) in East/West Azerbaijan as well as Conservation of Iranian Wetlands Project (CIWP) and other stakeholders. Water authorities have also been involved in the project as one of the key stakeholders in charge of management of water resources with revival of traditional water management groups at local level.

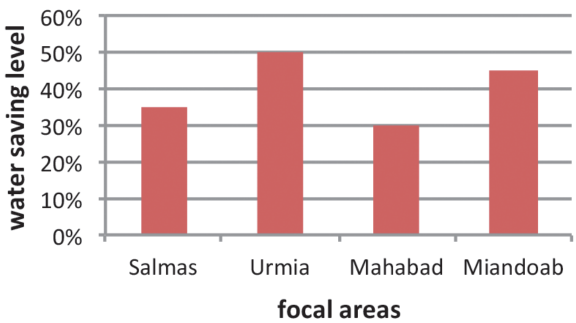
Location of Pilot Sites

The project is implemented in 12 focal areas with total number of 90 pilots, out of which 62 are located in West and 28 in East Azerbaijan. The following map shows the location area of pilot sites in East and West Azerbaijan.

The main agricultural crops covered in the project includes but are not limited to wheat, barley, sugar beet, alfalfa, sunflower, vegetables apple, grapes, peach and apricot.

Key achievements and activities

- Significant promotion of inter sectoral cooperation in Lake Urmia Basin (Department of Environment, Jihad Agriculture, Regional Water Authority, local NGOs and private sector)
- Promotion of social responsibility for restoration of Lake Urmia
- More than 60 capacity building workshops were held for the experts of Jihad Agriculture Organization and executive companies(or implementing partners)
- The experts of executive companies were trained through participating in more than 60 training workshops
- More than 600 trust building workshops were conducted at local level
- More than 250 participatory situation analysts workshops were held for local communities at local level
- More than 120 introductory exhibitions on SA techniques were conducted
- More than 8000 participatory action plans were developed at local level
- More than 50 technical/training workshops on introduction of SA techniques were conducted to Jihad Agriculture and executive companies' expert
- Two documentary films on participation of local communities in establishment of SA and restoration of Lake Urmia were produced
- More than 600 training posters in the villages and cities of the region were distributed
- Capacity building workshops were held for clergies and religious leaders to convey the message of religious teachings on environmental protection to local communities
- 4 training manual with a circulation of 3000 copies were published and disseminated at the villages of the region
- More than 4700 students and 380 teachers were trained on the role of local communities in Lake Urmia restoration
- More than 500 rural women were trained on their role in Lake Urmia restoration
- Number of local farmers involved = 10,000
- Resource persons local experts/farmers = 2000
- Irrigation water saved at farm level = 40%
- Agricultural chemical inputs (fertilizers and pesticides) substituted by biological practices = 40%



- National/local implementing partners = 20
- National/local NGOs = 12
- Employment = 200 local expert

New Forest Commons Towards Solving the Underuse of Satoyama from Fishers' Initiatives in Japan

Shimpei Iwasaki

Department of Environmental Science, International College of Arts and Sciences, Fukuoka Women's University

1. Backgrounds

Satoyama is commonly described as secondary forests nearby human settlements, and represents the socio-ecological production landscape. It used to be fundamental to the environment, people and living organisms so that the local people had been able to maintain the productiveness in its biodiversity by themselves. Governing forests in Satoyama can be referred to conventional forest commons where the local people used to maintain their own forests in a collective manner. The ecosystem service from Satoyama covers not only the forestry and agricultural sectors in the area but also the fisheries sector even in coastal areas. Related to the fisheries, the soundness of Satoyama landscape is expected to play significant roles in providing environmental functions such as nutrient supply, and soil protection. Although the scientific relationship between forests and fish productivity has not been sufficiently understood, fishers in many parts of Japan had a special interest in environmental functions of forests. Historically, coastal forests which are surrounding by fishing grounds have been believed to contribute to stable fish production among the fishers in Japan. To maintain costa forests sustainably, the fishers in specific areas of Japan initiated to preserve forests over the hundreds of years dating back to the 17th century at least, called as fish-breeding forests or '*Uo-tsuki-rin*' in Japanese.

Contrary to overuse of forest resources in the past, underuse of Satoyama have been widely occurred especially in the depopulated areas of Japan. Stagnation of the forestry industry and aging of the population resulted in weakening roles of forests to act as a variety of environmental functions. Furthermore, farmers use chemical fertilizers instead of natural composts while people use gas and electricity instead of firewood. These socio-economic changes accelerated the progress of underuse problem, thereby causing degradation of ecosystem service even in coastal areas. In other words, the local people faced with difficulties in governing their own forests in a collective manner. There is an urgent need to apply an integrated approach to forest conservation with active participation of various stakeholders in the modernized and aging society.

With this recognition, this paper presents a case of new forest commons towards solving the underuse of Satoyama from fishers' initiatives in Japan. The research highlights the historical process of new forest commons by the fishers' initiatives and then summarizes the outputs and challenges of fishers-based forest conservation at the regional and national levels, in terms of places, contents of forest conservation, planted tree species, and so on. Furthermore, the research introduces an innovative case of fishers' initiatives to cope with the underuse of Satoyama at the local level.

2. Historical Process of New Forest Commons by the Fishers' Initiatives

As stated above, loss and deterioration of forests in Satoyama have been widely occurred. As a consequence of forest degradation and its land conversion, there are growing concerns about weakening roles of forests to maintain stable fish production among fishers in specific areas including Hokkaido region, Kesen-numa area, and Tenmei area.

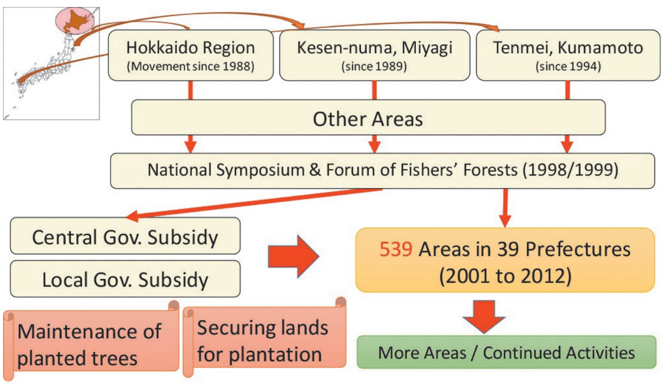
In 1988, coordinated efforts of plantation activities have been done by the initiatives of Hokkaido Association of Fisheries Cooperatives Women's Groups. The initiative was aimed to encourage more incentives of responsible coastal fisheries within EEZ boundaries when 30th memorial foundation of the groups was celebrated. Since then, fisher-wives (around 76 places per year) have continued to plant trees and maintain them in a collective manner.

In Kesen-numa area of Miyagi prefecture, the fishers have started to plant trees since 1989. The initiative was originally triggered by an opposition campaign against a dam construction project which would affect impacts to biological, chemical, and physical properties of rivers and coastal environments, rather forest management itself. It attracted mass-media using fishing boat flags indicating a good catch and a memorable catch-phrased as 'The sea is longing for the forest', to make a public appeal to other stakeholders for participation of plantation activities. Accordingly, the innovative approach has been disseminated to other areas at the national level through the mass-media.

In Tenmei area of Kumamoto prefecture, the fishers started to plant trees in 1994. In those days, the fishers experienced massive reduction of short-neck clams. It is likely that there are several factors affecting the loss of fish catch. Out of them, the fishers realized the loss of environmental functions from a bare mountain causing soil erosion from upstream to downstream. To revitalize forest lands, the fishers initiated to plant trees and maintain them in collaboration with citizen groups and school children.

The above innovative efforts in three cases have contributed to the movement of fishers-based forest conservation initiatives. In 1998 and 1999, national symposium and forum of the initiatives were implemented. Representatives of the fishers shared their experience and then recognized the significance of environmental functions of forests to fisheries sector. Throughout these efforts, local and national policy makers determined funding supports of the initiative across the nation. Accordingly, the number of fishers-based forest conservation initiatives has been increasing at the national level. The historical process of the initiatives is shown in Fig.1.

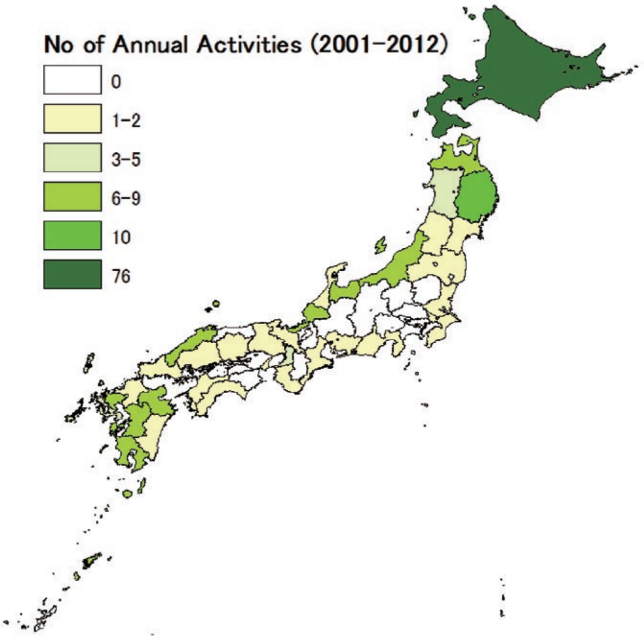
Fig. 1 Historical Process of the Initiatives



3. Outputs and Major Challenges of Fishers-Based Forest Conservation Initiatives

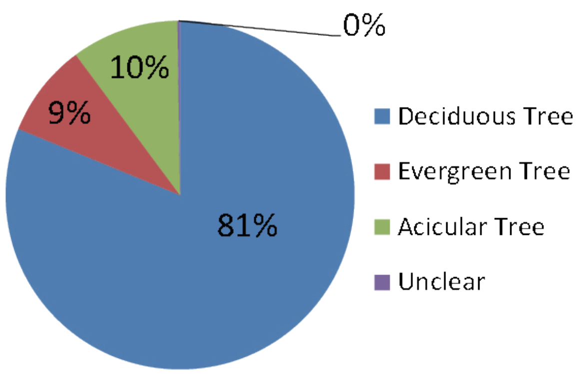
Based on the above process, a large number of fishers-based forest conservation initiatives have been implemented across the nation. The research analyzed the data of the initiatives from all fisheries cooperative societies during the period from 2001 to 2012. The findings revealed that the initiatives were reported in 539 areas of 39 prefectures out of 47 in Japan (see Fig. 2). Hokkaido is the most active region of these activities, amounting to 76 places per year. Main organizers of forest conservation activities vary from place to place, but 56% of the initiatives were hosted by fishers.

Fig. 2 Number of Annual Activities by the Initiatives



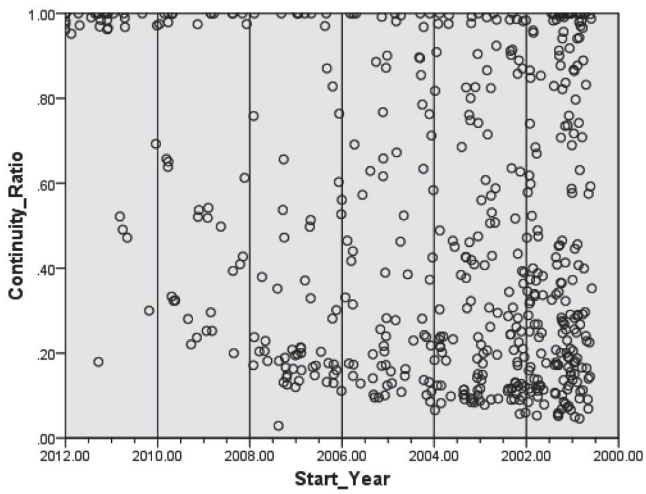
The research identified 14 activities of the initiatives. Out of them, tree plantation was the highest activity. As the years passed, however, the initiatives have been shifted from tree plantation to forest maintenance activities including weeding, and cleaning off grounds. Indeed, the ratio of tree plantation was changed from around 99% in 2001 to around 50% in 2012. It is important to note that tree plantation with multi-tree species at favorable habitat and fertilizable trees have been put into practice. In particular, around 81% of planted tree species was deciduous tree (see Fig. 3), in order to ensure soil and nutrient enhancement, which is expected to contribute to stable fish production in the river and coastal environments.

Fig. 3 Types of Planted Tree Species by the Initiatives



On the other hands, the research also revealed that some of the initiatives stopped forest conservation activities. As for continuity ratio assuming that all initiatives continue to engage in the activities every year since the starting year, the continuity ratio was 48% on average (see Fig. 4). Some of them might not need to take care of well-grown planted trees or plant trees because of ecological restoration. But the others might face with difficulties in maintaining the forests or planting trees due to such constraints as shortage of budget and manpower, maintenance of planted trees, and securing lands for plantation. As for shortage of budget and manpower, a question asking who is in charge of planted trees will be occurred. Without any care, planted trees might not be grown properly so that the initiatives are meaningless towards solving the underuse of Satoyama. In addition, securing lands for plantation is one of major challenges to promote the initiatives. Some mountainous lands are owned by private. Without any permissions from the land owner, the fishers cannot plant trees. Many land owners stopped managing their own forests. Some of them are inherited to their sons or daughter living far areas. Sometimes, it is difficult for them to even communicate with the land owners.

Fig. 4 Continuity Ratio of the Initiatives



4.Case Practice of Tokoro Fishery Cooperative Society, Hokkaido

Under the circumstances, this paper presents a case of Tokoro Fishery Cooperative Society, Hokkaido region, to tackle with underuse of Satoyama. It is important to note that the society has experienced long history of fishers-based forest conservation initiatives since 1961, compared to the coordinated efforts among fisher-wives across Hokkaido region. The initiative was originally tied to enhancement of the land value of real estates which were owned by the society. As the years passed, however, the purpose of forest land acquisition and its management has shifted from economic to environmental incentive. In those days, the fishers experienced severe environmental degradation caused by upstream water pollution and deforestation from Satoyama. As a consequence, the water retention and purification capability of the Satoyama forests were seriously impaired. The fishers soon realized the need for forest conservation so that forest replanting and conservation have taken place since then.

So far, Tokoro Fishery Cooperative Society achieved 7.53 million trees in around 350 ha. The society members were engaged in not only participation of plantation activities, but also provision of their own resources related to the fisheries by building various collaboration with stakeholders. For example, a tourism resort company set up a project regarding tree plantation for the 50th anniversary of its foundation and proposed the activity to the society. The company invited children and their parents to join plantation activities while the society provided the site for plantation. After the trees were planted, participants moved to certain fishing ground to enjoy digging shellfish. The fishing ground is strictly maintained by the society, but only in the event, the participants are specially allowed to pick the shellfish in the ground as shown in Fig. 5. It is good opportunity for them to learn the relationship between forest and sea through the river. Afterwards, seafood soup was provided to the participants with raw material assistance by the society.

Fig. 5 Recreational Clamming after Plantation

5. Towards New Forest Commons by the Fishers' Initiatives

Putting them all together, the research highlighted the historical process of new forest commons by the fishers' initiatives and identified major outputs and challenges of the activities. As stated above, the initiatives have been widely spread throughout the nation. The new forest commons aim to promote multiple environmental functions of forests, rather economic gain from forests. As the years passed, the fishers are more required to engage in forest maintenance after plantation, resulting in increased activities of weeding, clearing off grounds, and environmental maintenance. Related to it, there are growing concerns about the initiatives from the viewpoints of maintenance of planted trees and securing lands for plantation. To tackle with these challenges, the case study of Tokoro Fisheries Cooperative Society showed that the fishers explored building collaborative partnerships among the stakeholders by sharing the advantage of their own resources to cover for each other's weakness. Apart from participation of forest conservation, the fishers are able to play important roles in facilitating forest governance with various stakeholders by taking full advantage of their own resources related to the fisheries such as provision of food service and fishing grounds. The fishers can serve as knowledge transfer as an interpreter between forests and water (sea). Although the initiatives themselves cannot contribute to solving underuse of Satoyama, building multi-level collaborative partnerships among relevant stakeholders is expected to cope with the challenge towards creation of robust new forest commons.

Response of Freshwater Farmers to the Eenvironmental Changes: a Case Study of Thailand (abstract)

Suvaluck Satumanatpan, Kamalaporn Kanongdate, Chumlong Arunlertaree, Anawach Saithong, Poonyawee Srisantear, Thiyada Piyawongnara

Faculty of Environment and Resource Studies, Mahidol University, Thailand

This paper examines factors influencing resilience among Thai aquaculture-farmers in Nakhon Nayok Province located upstream of the Bangpakong Watershed, the inner Gulf of Thailand. The area is defined as freshwater ecosystem but often prone to seawater intrusion. With regard to the aquaculture practice in the study areas, the main two types identified are : 1) Polyculture – this could be more than one species of freshwater fish or several fish species and the Pacific white shrimp or the Pacific white shrimp and the Giant freshwater prawn in one pond; and 2) Monoculture – this could be the Pacific white shrimp alone or one fish species in one pond. Generally, several aquaculture types are found in the area; polyculture of freshwater fish (37.9%), monoculture freshwater fishes (27%), Pacific white shrimp (24.3%), polyculture of freshwater fish and Pacific white shrimp (20.45%), and polyculture of the Pacific white shrimp and the Giant freshwater prawn (18%). On one hand, culturing a selected brackish-species (the Pacific white shrimp) instead of freshwater fish in some areas becomes a strength of freshwater farmers' adaptability to the seawater intrusion. On the other hand, apparently, the vulnerability to seawater intrusion and rising water temperature in Nakhon Nayok River during the dry seasons as well as droughts and floods has adversely impact the aquaculture productivity.

Aquaculture-farmers were randomly sampling for 206 cases and semi-structure face-to-face interviews was applied to the targets. The results revealed that farmers have adaptability to the change of environments in several ways. Changing type of culture from single species-culture comprising the Pacific white shrimp to polyculture of freshwater fish was reported as due to their higher resistance to diseases. Farmers also indicated that they adapted to the physical environment by enhancing farm-facilities. For instance, increasing pond height, storing freshwater, providing shade on water surface, and temporary avoiding culturing during severe environmental conditions. Response to deal with cost effectiveness, improving techniques of cultural practice by adopting multi-species culture such as a polyculture between Pacific white shrimp and Giant freshwater prawn, as well as between polyculture of freshwater fish and the Pacific white shrimp, were also evident in the study area.

In addition to the environmental changes that reflect aquaculture-farmers' resilience in the study areas, we first study measuring how farmers generally response or perceive to the future decline of aquaculture production. The results of principle component analysis revealed that farmers' perception to the future decline of aquaculture production is determined by four key resilience components including: ability to obtain work elsewhere; ability to cope when there is a change; ability to compete; and ability to plan for survival. Based on the results, we hypothesize that farmers' background (such as age, education, years of aquaculture, income), climate change awareness, level of satisfaction with aquaculture, types of aquacultures, and farmers' membership in aquaculture association have influence on farmers' perception of resilience. The findings of this study will contribute to structuring programs appropriate to existing farmers' characteristics, hence, enhancing the livelihood of aquaculture sustainability in Thailand and similar locations. External forces that may influence farmers responses to the changes have been discussed. Enhancing knowledge and stimulate important future research about aspects of adaptability in aquaculture-farming communities specifically with regard to their impact on future policy strategies are suggested.

Locally Managed Marine Areas (LMMAs) – a pathway to holistic and integrated island management and sustainable development: A Fiji case example (abstract)

[1,2]Alifereti Tawake, [2]Margie Tabunakawai, [1]Jovy Cleof, [1]Hugh Govan, [2]Saimoni Waibuta, [2]Roko Sau Josefa Cinavilakeba

[1]LMMA Network International, [2]Fiji LMMA Network

Coastal and wetland resources is the lifeblood and mainstay of most Pacific Island peoples livelihoods. However, its status have been dwindling rapidly over the last several decades. As a result, coastal communities are facing challenges to food security and are increasignly more vulnerable to disasters and climate change impacts.

Creating locally managed marine areas (LMMA) is one such effort to reverse this trend that utilises community based adaptive management (CBAM) process, based on progressive participatory community-driven approaches informed by marrying scientific and traditional knowledge. Local marine management undertaken by communities has often achieved benefits that may have eluded well funded and top-down initiatives.

LMMAs in the Pacific have proliferated since 2000 motivating a growing global movement based on a learning network of communities, managers and practitioners. The approaches are built on a unique feature of the region – customary tenure and resource access – and often making use of traditional governance system. LMMAs in the Pacific are implemented by over 1000 communities spanning 17 independent countries and territories, representing a unique global achievement. Other examples also exist around the world. The spread and endurance of LMMAs is attributable to communities' perceptions that benefits are very likely to be achieved and is a pathway to addressing community aspirations and needs holistically such as water sustainability, adaptation to climate change, improving income, food security and sustainable livelihoods. The main innovation that has supported the proliferation of LMMAs is the operation of clusters of communities supported by islands, regional, national and sub-national umbrellas or social networks. The LMMA Network International includes Fiji, Solomon Islands, Papua New Guinea, Indonesia, Philippines, Palau and Federated States of Micronesia each of which have developed affiliated national and provincial sub-networks.

In Fiji for example, the progress of scaling up LMMAs to national level have reached 466 Fijian communities so far covering 79% of Fiji's customary marine areas. Both empirical and experiential evidences on successes and challenges of LMMAs also resulted in an improved household incomes by as much as 30%, fish catches increased, communities adaptive capacity enhanced, knowledge and attitudes improved and a sense of ocean stewardship, ownership and pride being restored back into communities. LMMAs have also transformed decision making for customary marine areas from a more traditional, autocratic style to a more participatory and democratic process of governance. In addition, social learning motivated by the CBAM approach is clearly evident in the adaptive measures implemented by communities and in policies and legislation put in place by provinces and the national government. In essence, Fiji through FLMMA is taking leadership role globally on the promotion and implementation of locally managed marine areas demonstrating the power of collective community efforts if given the chance. Fiji LMMA Network in ensuring Fish for the Future Generations! is committing to scale up its work to cover 100% effectively managed and governed customary marine areas by 2025.

Key success and challenges facing LMMAs in other countries and their supportive social networks are also discussed. In essence, LMMAs serve as building blocks for integrated island management and sustainable development by communities.

National Reclamation Project and "Ariake Sea Disaster": "Open-gate Survey" for the Harmony of Healthy Fishery and Agriculture (abstract)

Tamotsu Sugenami

The Ariake Sea Network of Fishermen and Citizens

1. Ariake Sea is one of the highest productivity and biodiversity sea area around Japan. Especially, Isahaya Bay was highly important for spawning or growing up of fishes, so we called Isahaya Bay, "the womb" of Ariake Sea. The wide and muddy tidal flat of Isahaya Bay is also important for wintering or resting of migratory birds.

Japan has joined Ramsar Convention in 1980. From these days, Ariake Sea and Isahaya Bay has long been eligible for the criteria of Ramsar site. Now, in Ariake Sea, there are three tidal flat is listed as Ramsar site; Arao (Kumamoto pref. listed in 2012), Hizen-kashima and Higashi-yoka (Saga pref. listed 2015). However, we should have evaluated whole Ariake Sea ecosystem include not only now listed tidal flats, but also Isahaya Bay and other area, and implement "wise use" of Ariake sea.

We think the National Isahaya Bay Reclamation Project is an impediment to comprehensive evaluation and preservation of Ariake Sea.

2. Isahaya Bay Reclamation Project started in 1989 and 7km sea dike has completed in April 1997. The 3,550ha tidal frat and shallow sea was dried up and fresh water reservoir was created by building the sea dike.

The impact of the Reclamation Project for environment and fishery is far above the estimation of EIA. The catch of fishery declined in 1990s, according with the construction of sea dike. After the closing of sea dike in 1997, damage for the environment and fishery became clear. In December 2000, widespread red tide prevailed over middle to northern part of Ariake Sea seriously damaged seaweed vwater culture. Since then, in Ariake Sea, the red tide frequently happens and massive fish-kill because of poor oxygen water in bottom layer occurs almost every year.

The construction of sea dike may have change the tidal strength and direction, then stratification of sea water become stronger. Researchers explain the reason of the situation and call such structural crisis as "Ariake Sea Disaster".

3. We, Ariake Sea Network of Fishermen and Citizens are organized with approximately 600 fishermen from 4 prefectures around Ariake Sea and over 100 citizens which includes many scientists, lawyers and other expert from several fields. We are working for the restoration of Ariake Sea seriously damaged by Isahaya Bay Reclamation Project.

4. Now regarding Ariake / Isahaya issue, the focus is "open-gate survey". According to the court decision, Japanese government planed "open-gate survey". In this survey, government going to open the sluice gate to flow sea water with tidal exchange into the reservoir which is made under the Reclamation Project for agricultural freshwater supply. The purpose of the survey is to investigate the impact of construction of sea dike and reservoir, This is one of the wetland restoration activities implementing in other countries.

5. Actually, some people around Isahaya Bay who care the negative impact of "open- gate" don't agree with the survey, the government is going to give up to operate "open- gate".

However we think "open-gate survey" after impact reduction measures is reasonable and possible. We have been suggesting to make round table discussion with farmers and residents who have concern about the survey and cooperate to find out the way to "open-gate" for the future in which not only the restoration of Ariake Sea ecosystem, but the restoration of local community and economy based on the harmony of healthy fishery and agriculture.

Session 4

Urban Wetlands / Wetland City / Natural Infrastructure

Urban wetlands and Governance challenges in the two Indian mega cities of Chennai and Bengaluru

Sandhya Chandrasekharan

Centre for Biodiversity Policy and Law (CEBPOL), National Biodiversity Authority, Chennai, India

The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) is unique for leveraging the importance of ecosystem services in relation to biodiversity (Diaz et al., 2015). One of the platform's key tools – the conceptual framework (depicted a little later)– also helps to place governance at the centre of the discussion on what is happening to nature and nature's benefits to people across various geographical scales. The IPBES_CF is thus eminently suited to examine the Convention for Biodiversity (CBD) theme of Cities and Biodiversity, with a focus on governance, in relation to India's many and burgeoning urban areas and the governance of key ecosystems and their services within these areas.

This paper is the outcome of a larger CEBPOL study that attempted to do just that, between 2015 and early 2017 in the southern Indian metropolises of Chennai and Bengaluru. These are two-major cities which have population sizes of a few million people. While geographically, both are in the south and less than 500km apart, they are part of two distinct bio-geographic zones. India has 10 distinct bio-geographic zones (Rodgers and Panwar, 1988) and while Bengaluru is in the Deccan Peninsula, Chennai is predominantly Coastal.(Figure 1)

Chennai, the capital city of the federal state of Tamilnadu is one of the oldest and the fourth largest city in the country. In existence as an urban centre for about 400 years, administrative restructuring in 2011 led to the formation of an enlarged Chennai Metropolitan Area (CMA). The extent of CMA is 1189 sq.km and which now extends over three districts of the state. Population projections extrapolating from the 2011 census, estimate the population of the urban agglomeration to have crossed 10mn in 2017.

Bengaluru is in comparison a relatively new entrant to India's league of large urban agglomerations. The capital of the state of Karnataka, and world-renowned as India's IT capital, its transformation from a pleasant cantonment town to the fifth largest city through expansion, migration and population growth (8.4 million in 2011), has been phenomenally rapid, and achieved in over just two decades (Sudhira and Nagendra, 2013).

The key ecosystem service that has been the topic of considerable discussion in recent times in both cities pertains to the quality and quantity of fresh water. The Chennai Metropolitan Area has over 3500 waterbodies in the form of tanks and reservoirs (Janakarajan cited in Laksmi, 2017), and Chennai city alone is reported to have had 650 till a few decades ago, since reduced to only 30. It also has two rivers – the Cooum and Adyar, and the artificially constructed Buckingham Canal. The city gets an average rainfall of 140cm every year, with recorded rainfall of less than 100cm (the anticipated ideal) having occurred only 5-6 times in the last few decades (Laksmi, 2017). As a city on the high-energy coast of the Bay of Bengal, it is also no stranger to extreme climatic events (Jayaram, 2015). From the Indian ocean tsunami in December 2004 to depression-induced heavy rains that caused flooding in the city in December 2015 and a super cyclone in December 2016, the city has seen it all. Delving into the management of its ample waterbodies and the denuded resilience that would otherwise be offered by its original ecosystems presents an interesting case of the story behind a city that is prone to both water stress and urban floods. The combined capacity of the tanks and reservoirs is estimated to be 80 thousand million cubic feet of water (80 tmcft), but their current capacity,

Figure 1: Chennai and Bengaluru in two of India's distinct biogeographical zones

Source: Rodgers and Panwar, 1988

owing to poor maintenance and lack of periodic desilting is only 11 tmcft (Janakarajan cited in Laksmi, 2017). Nearly 300 tmcft of rainwater drained into the sea in the 2015 floods as a result (ibid), leaving in its wake the world's 8th most expensive natural disaster for the year, estimated to have cost a USD 3 billion loss to the economy (article in the Business Standard, 11 Dec 2015) . New and post facto regularised urban infrastructure came sharply under the scanner from sections of academia, media and civil society – a new airport terminal on the floodplains of the River Adyar, a Mass Rapid Transit System constructed almost wholly over the Buckingham Canal and the erstwhile 50square kilometre Pallikaranai marshlands, an Information Technology (IT) corridor and engineering colleges constructed on waterbodies (Jayaram, 2015).

In Bengaluru, the story is not very different. A report by the Indian Institute of Science (IISc) shows that between 1973 and 2013 there has been an estimated 79% decrease in the total area of its many lakes and waterbodies, with over 50% of the area of lakes being built-up in violation of existing laws, and local government agencies being implicated in the same (Sengupta, 2016). The matter was discussed in the state legislature as well (ibid), but neither fixing of responsibility nor remedial action has followed. The city too has witnessed a spate of waterlogging events after regular rainfall, and water shortages and dependence, as in Chennai, on the growing phenomena of private water markets, where private operators truck in water in tankers from peri-urban areas (Nelliyat, 2016).

The wetland transformation in both cities, as a result of area being built-up, is well captured by the following maps.

Figure 2(a): Bengaluru – Waterbodies and landuse change due to built-up area expansion

Source: Centre for Ecological Sciences, Indian Institute of Science, Bangalore

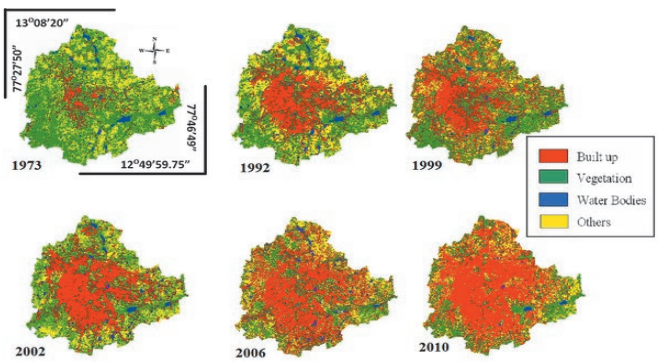
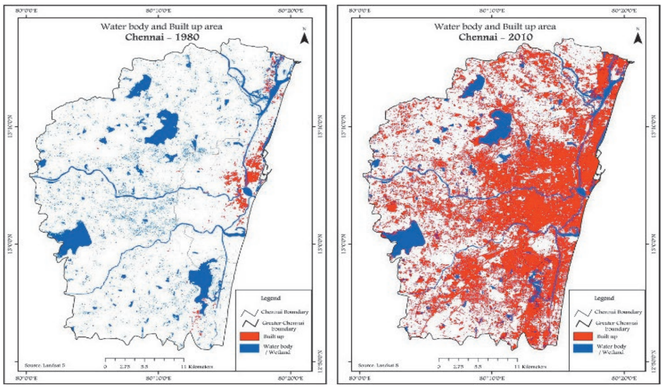


Figure 2(b): Chennai – Water bodies and built-up areas

Source: Care Earth Trust, Chennai



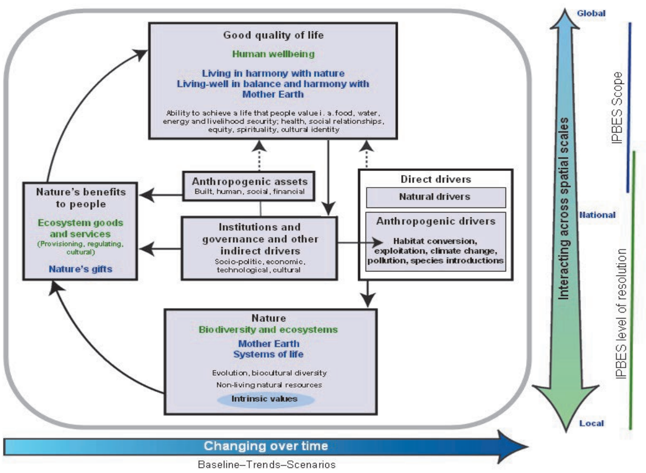
They indicate that landuse transformation by built infrastructure and real estate housing is the main driver of ecosystem-level biodiversity loss that impacted urban wetlands. Also, review of literature indicated the Solid Waste Management (SWM), or lack of it, was also implicated in a big way. These therefore became the points of entry to examine drivers of biodiversity loss in the context of this study and the work of related governance actors.

The Governance of Urban Wetlands – a mosaic of diverse actors

Governance has been accorded a central place in the IPBES_CF schema, as the diagram that follows captures. It places nature at the base, showing it to be the foundation of everything. Moving clockwise to the left, in the context of urban wetlands, nature's benefits to people do coverall the ecosystem services – provisioning of water and wetland related livelihoods, nurturing ecosystems and habitats; regulating services in the water cycle - facilitating rainwater percolation, storm water retention and drainage; as well as cultural and recreational services such as in the form of temple ponds, agricultural tanks and urban lakes. All this very much makes for the good quality of life in urban centres, and in the face of these services being upset, quality of life also suffers. This diminished quality of life if evidenced in Chennai and Bengaluru in the form of water shortages in summer and waterlogging and sometimes urban floods in the rainy season. It is in light of this fact that the central box as per the CF becomes important to examine.

Figure 3: IPBES Conceptual Framework

Source: www.ipbes.net



The questions I began with were: What exactly constitutes governance for biodiversity and ecosystem services in this context? Does it effectively steward natures benefits for people and regulate the drivers of biodiversity loss?

Governance has been referred to in various ways in key IPBES decision documents (eg. Decision IPBES-2/4) notably, has the following references:

1. "Governance systems"are referred to as one of the "drivers of change", or an external factor that affects nature and nature's benefits to people, as well as anthropogenic assets and quality of life.
2. "Institutions and governance systems and other indirect drivers" are the ways in which societies organize themselves, and the resulting influences on other components." They are further described as "key levers for decision making".
3. Governance is specifically highlighted in having a key role in relation to anthropogenic drivers of change.
4. At the national and subnational levels, governance is taken to mean "arrangements in ministries or laws that have *effectively contributed* to the protection, restoration and sustainable management of biodiversity".
5. Further, there is an assimilation and transfer of "good governance" rhetoric of mainstream development institutions like the World Bank and UN agencies , in statements like "Institutions and governance systems and other indirect drivers at the root of the present crisis *can be mobilized* to halt these negative trends…."

Point 2 above especially alludes to what is called the New Institutionalism in the literature on governance,in contrast to old school Public Administration (PA), in that it chooses to conceptualise governance not just as what government does. It is instead, (also) the quality of the relationship that government fosters and nurtures with key stakeholders like citizen's groups, NGOs and the private sector.

Urban Wetland Governance

In relation to the thematic focus of the present paper on 'Urban Wetland Governance',

i) The Government quadrant was conceptualised as a multi-layered and complex one, made up of several institutions and actors. Besides examining relevant legislation and its uptake, an attempt was made to understand the role of various administrative and scientific agencies engaged in the important task of 'governing' wetlands. The institutional architecture and levels of awareness on biodiversity and ecosystem services of key local-government service providers, as well as the synergy or lack thereof, within the local administration of these cities. As the state capitals of their respective states in India's federal structure, relevant state government departments that have a presence in the cities, were also covered. Another set of the 'government actors' were those with a CEPA role, such as India's ENVIS centres.

ii) The Private Sector in relation to governance was studied in the context of the real estate sector for residential buildings, which is a key driver of wetland conversion to built-up land. Governance of this largely private industry is being attempted through voluntary certification and other soft policy approaches which addresses only building characteristics at best, and not the ecosystem level impact of land-use change.

iii) The role of voluntary organisations and citizens was also documented through some of the issues discussed in relation to this actor in the available literature, and examples of their interventions, where available.

Government in relation to Urban Wetlands

1) Legal Frameworks

Wetlands in India, in principle, are influenced by an array of policy and legislative measures. These include those ranging from the first generation of laws like The Indian Fisheries Act – 1897,The Indian Forest Act – 1927,Wildlife (Protection) Act – 1972, 1991 which can be characterised as 'anti-pollution' acts, to another generation of more-consciously Sustainable Development thinking incorporating acts, that covertly or overtly value the ecosystem services of wetlands:ie-Environmental (Protection) Act – 1986, Coastal Zone Regulation Notification – 1991, National Conservation Strategy and Policy Statement on Environment and Development – 1992, National Policy And Macro level Action Strategy on Biodiversity-1999,and most recently, that Wetlands (Conservation and Management) Rules, 2017 replacing the Wetlands (Conservation and Management) Rules, 2010. India is also a signatory to the Ramsar

Convention on Wetlands and the Convention of Biological Diversity and has a dualist as distinct from monist approach to international law, requiring putting in place domestic laws that meet the mandates of international agreements. Changing land use patterns in Chennai and Bengaluru, as captured in the maps, offer proof that these are often not effective.

2) Institutional architecture and levels of awareness, synergy or lack thereof

The study interviewed local urban-body functionaries and those of federal state forest departments with a presence and governance mandates within urban limits.

Most respondent from both cities, showed an awareness of wetlands and waterbodies as ecosystems that was most recently in the news on account of either adverse impacts to these, or a disaster. When asked to identify which ecosystems were present in their city, slightly over 70% of the respondents in Bengaluru opted for 'wetlands', and 100% of those in Chennai for 'sea'. The second most frequently indicated response was 'forests' (47%) in Bengaluru and 'wetlands' (40%) in Chennai. While this awareness was there, a relational-understanding, or engagement with these ecosystems as part of their work was not evident. To the question "According to you, are the biodiversity and ecosystem services, within the city, a key part of your work?", only 35% of the respondents in Bengaluru and 40% of those in Chennai (out of a total of 27 respondents), said "Yes, they form a core part", and here the bias of the response being collected face-to-face by someone associated with an organisation with a biodiversity-related mandate (though with the assurance that it would be collated and reported anonymously) was also a threat to the reliability of the answers. A similar percentage of respondents also stated "Somewhat yes – but I deal with only one aspect – water, or plants or land etc". The latter indicates that 'ecosystem thinking' is not pervasive within the formal institutional governance of cities.

Dumping in and around waterbodies and wetlands remains a problem in both cities, as scientific management of solid waste through segregation at source was not something that the local governments were doing anything proactively about. The Solid Waste Management Rules (2016) were cited as the reason by one official for the same, on the grounds that the act puts the onus on the 'generator of the waste' (ie: households) to separate it out into various streams, and awareness had not been created for the same*. When asked why his/her office could not create the awareness, the answer was predictably lack of funds. In the existing scenario, dumping was just accepted as a 'given' and wetlands more often than not suffered the consequences.

The disjoint between sanctimonious statements made, whether in national level laws/policy proclamations or urban local body plan documents; and their ability to impact change on the ground is evident at the rate at which waterbodies have been compromised in both cities. Statements like 'Environment is crosscutting' in an urban local body master plan, completely contradict other parts of the very same document (as well as national laws) when for instance, maps indicate that a wetland is earmarked to be completely built-up 'lowland'. The reality of the 'government' with regard to the green and blue spaces of cities is that far from being one homogeneous entity, it is a composite of entities, some of which are even working at cross purposes with each other at times.

While Federal StateDepartments of Forests and the Department of Parks were concerned with protecting the green spaces and tree cover in the precincts of the city, the departments that were concerned with ecosystem services / addressing negative impacts on these and biodiversity were those governing SWM and those relating to water supply/sewerage and lake development. While the former have a purview of 'urban biodiversity' and are informed in their work by fairly clear mandates and legal and institutional structures that have a commitment to natural resource stewardship on the whole, the latter were less likely to connect their mandates to healthy ecosystems and the intrinsic value of these, but rather to routine administrative requirements. Water supply and sewerage as well as lake development, were considered technicist and mainly engineering-related matters, where the focus, to take the instance of lake development, was on the walk-way around the lake, the bund, and blocking (if possible, and often with an ambiguous record of success) sewerage pipes being directed to the lakes. The biodiversity of lakes (whether in terms of fauna or fish or waterbirds) was not being monitored, and it was not in the mandate of these departments to do so either.

The case of the Palikarnai marsh in Chennai is an example of government in reality, and contrary to the simplified IPBES schema, being this compositeentity, sometimes working at cross-purposes. The Pallikaranai wetland is currently a significantly diminished 50 square kilometre swamp with a known role in recharging the aquifers of the city. It's current expanse of about 10% of its original size is the result of the Federal State forest department obtaining an injunction to prevent dumping of waste – or in other words, countering the SWM practice of the urban local body (ULB): when the law, in theory, is for everyone and every department; but in reality is violated from within government itself.

In 2007 a substantial portion of the marsh was declared as a Reserve Foresttransferring administrative control from the ULB to the federal state Department of Forest (Oppilli, 2009). In response to an appeal, the High Court had also appointed a high-level Committee to address the issue of dumping municipal solid waste on the marsh by the ULB (ibid).

3) Scientific and research organisations with the mandate of environmental protection

Besides legislation and the uneven levels of appreciation and adherence to this legislation within government departments, scientific and research organisations working to further the mandates of environmental protection are a third aspect of 'government' with regard to environmental stewardship.The Environmental Information System with the acronym ENVIS is a unique network of institutions in this role in the Indian context. Realising the importance of verifiable empirical evidence base and scientific support and expertise to guide and inform decision making, the Government of India, in December, 1982, established ENVIS. ENVIS is a network of research institutions and organisation actively engaged in work relating to different subject areas of environment. Since environment is a broad-ranging, multi-disciplinary subject, a large number of nodes, known as ENVIS Centres, have been linked through the network to cover the broad subject areas of environment with a Focal Point in the Ministry of Environment & Forests. (ENVIS also has broader regional and international linkages – it is the designated National Focal Point (NFP) for INFOTERRA, a global environmental information network of the United Nations Environment Programme (UNEP), and the Regional Service Centre (RSC) of INFOTERRA for the South Asia Sub-Region countries since 1985.) The ENVIS node at the premier Indian Institute of Science, in Bengaluru has been at the forefront of wetlands research in the city and nearby biogeographic zones.They have been instrumental in activating judicial activism through their research based ENVIS reports, and bridging the work of separate ministries such as those engaged with Science andTechnology, and Environment. In one instance, the federal government of Karnataka state (of which Benguluru is the capital) constituted an expert committee to rejuvenate Bellandur and Varthur lakes in the city, including by addressing the issue of wastewater influx (an issue violating several laws)mainly based on an IISc ENVIS report. Their work also informed the National Green Tribunal penalizing violator of Bellandur-Agara wetland with a1.39 billion Indian Rupee penalty (personal communication, Dr.T.V. Ramachandra, IISc).

Real estate housing sector as a driver of wetland loss and the role of private players

The growth of the real estate-housing sector is a concomitant to the growth of the economy and demand for urban and semi-urban accommodations, as well as an investment and wealth-creation strategy given the strong cultural conditioning towards home (and increasingly for the elite, dual and multiple home) ownership. It is also a major driver, along with other sectors of the construction industry of land-use change in these cities. Both Bengaluru and

1 * This in spite of the fact that, the same act, under section (11) makes it the duty of the Secretary–in-charge, Urban Development in the States and Union territories, through the Commissioner or Director of Municipal Administration or Director of local bodies, to prepare a state policy and solid waste management strategy for the state or the union territory through a consultative process, and ensure implementation of provisions of these rules by all local authorities. Central government ministries for Environment and Urban Development have been given the role of overseeing the same.

Chennai figure in the list of 'most favoured property destinations', with Bengaluru in the lead. The housing sector alone contributes 5-6 per cent to the country's GDP, and is expected to witness a 60% growth by 2050. This, inspite of the fact that most housing in the projects of organised private developersis priced beyond the reach of the urban poor (Harish, 2016).

The Ministry of Housing and Urban Poverty Alleviation (MoHUPA), defines 'affordable housing' as 5 times the annual income of a household, and by that criteria, many people in India cannot afford home ownership in cities, though government is attempting to address this issue through directives to the private builders. This comes after a phase, in the preceding decades, when government identified wetlands as wastelands and cheap land that were easily available for social housing projects or slum upgradation efforts. In Tamilnadu for instance, the federal state government housing board declared many among 19 water bodies in and around Chennai as 'defunct' to obtain clearance for social housing projects in the 1990s (Coelho and Raman, 2013).

The manner in which the real estate-housing sector's impacts as a driver of biodiversity loss and ecosystem services are being governed and managed, become pertinent to examine. In the Indian context, it also offers a case of private sector participation in governance. Existing public-private partnership initiatives like the Confederation of Indian-Industry's- India Business and Biodiversity Initiative (CII-IBBI) attempt to impact the nitty-gritties of construction. Governance of this sector amounts to by and large voluntary certification and standards such as CII – India Green Business Council (IGBC) and The Energy and Resources Institute's(TERI) Green Rating for Integrated Habitat Assessment (GRIHA).

On the field, the nature and size of actors in the sector is widely varied, and reliable region/area/city-wise data on the sector on the whole in relation to sustainability-supporting characteristics is not available. Building this data base in itself would be an important first step in better governance.

Two builders out of ten contacted - a fairly small and niche developer in Bengaluru and a more established market leader in Chennai - came forward to open their operations and processes to this researcher's investigations. The others who were contacted and advertised 'sustainability' on their websites or advertising, declined to participate, and this is noteworthy in itself.

Capping land use transformation in general requires addressing the collusion of finance capital and the real estate sector, and the behind-the-scenes process of land-bank creation within land-scarce Indian cities that calls for much stronger governance than just encouraging good practices among builders. (Dr Saravanan from Bonn University, Germany, and formerly of IIT, Madras broached this unaddressed topic of 'Planned Chaos' in his presentation at the "IGCS Exchange on Beyond Disasters in Chennai" organised in the wake of the December 2015 Chennai floods. His presentation was based on two decades of research in a Western Indian city). 'Green buildings' can be only one element of a more comprehensive strategy that has more stringent policies for land transformation, housing unit size (irrespective of ability to pay) and multiple home ownership.

4) NGOs and citizen-science

The Annual Survey of India's City Systems (ASICS) 2016, which examines city systems on the basis of several parameters including 'Urban capacities and resources' and 'Transparency, accountability and participation', reveals that Indian cities have a long road to travel in relation to internationally achieved standards on these. The survey, conducted by aBengaluru-based NGO, argues on the basis of findings, that Indian cities need to strengthen their city systems including quality of laws, policies and institutions to improve service delivery. The literature on good governance in general advocates greater civic participation to address this issue.

Citizen activism in defence ofthe biodiversity and ecosystem services that need to be protected in urban is visible in pockets. Notable academics have demonstrated commitment to their scholarly engagements by matching it with efforts as practitioners and advocates. In Benguluru Harini Nagendra has been instrumental in mobilising neighbourhood watch and lake protection committees, and Professor Janakarajan has been raising public awareness about the vanishing water bodies of Chennai for over a decade. A large number of schools, environmental clubs, volunteer groups and citizens forums do sporadically or more consistently engage with lake clean-up's and such.

Institutional structures that do have the mandate to take care of biodiversity related matters – especially through better SWM and better protection of native biodiversity, besides being made more aware and sensitised to the importance and scope of their role in relation to biodiversity; need to be helped to partner with key stakeholders like citizens groups, NGOs and private sector, given the sheer magnitude of their task; and the mismatch between their staff numbers, capacity and resources of all kinds,and which has not kept pace with the rapid expansion of urban agglomerations. City level governance as a key partner for biodiversity governance, requires reimagining several of the 20th century institutions and their manner of working. The greater autonomy, self-reliance and dynamic leadership in city regions like Curitiba and Johannesburg in other BRICS countries like Brazil and South Africa,that are restructuring governance for greater city-level resilience and sustainable development are worthy of study and possibly, emulation. In India, the NGO Indian Institute of Human Settlements (IIHS) has been empanelled as an agency of MoUD for capacity building under an urban renewal mission scheme launched in June 2015, the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and new positions such as that of City Resilience Officers are being created by Rockefeller Foundation's 100 Resilient Cities Project and piloted in Surat and Chennai (as recently as July 2017). These merit careful study for the manner in which they do impact change on the ground. Accountability as a governance partner needs to be sought and elicited from these actors too. This seems to be a rather unexamined area in 'good governance' literature, and an emerging challenge for developing economies.

Conclusions and Recommendations

On the questions of: What exactly constitutes governance for biodiversity and ecosystem services in the context of Indian mega cities? Does it effectively steward natures benefits for people and regulate the drivers of biodiversity loss? The following are the key observations –

1. The reality of 'government' with regard to the green and blue spaces of cities is that it is far from being one homogeneous entity (as the IPBES_CF depicts). It is a composite of entities, some of which are even working at cross purposes with each other at times. This called for better CEPA (Communication, Education and Participatory Action) for ULBs in the context of urban wetlands, where the content itself needs to go beyond the 'why' of conservation, to the 'how' that straddles political-economy considerations and technical know-how.
2. Conservation and sustainable-use related legislation faces uneven levels of appreciation and adherence from within government departments. Scientific and research organisations working to further the mandates of environmental protection seem more successful, even if their scale of influence and impact is limited, as an aspect of 'government' with regard to environmental stewardship.
3. Built environment as a driver of biodiversity loss needs a more comprehensive strategy to address. 'Green buildings' can be only one element of such a strategy that has more stringent policies for land transformation, housing unit size (irrespective of ability to pay) and multiple home ownership.
4. Accountability as a governance partner needs to be demanded of NGOs too. This seems to be a rather unexamined area in 'good governance' literature, and is an emerging challenge for developing economies for which more sharing of contextually-relevant (such as from other BRICS or South Asian countries, for India) experiences and success stories could be of help.

It is heartening that 'Wetlands for Sustainable Urban Futures' has been chosen as the theme for next years' Asian Wetland Symposium. It would hopefully serve to draw technical and financial assistance to the issues that this paper has attempted to highlight.

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Available on request. Email the author at sandhya.chandrasekharan@gmail.com

Making a Wooden Footbridge Connecting Nature and People in an Artificial Wetland

Akihiko Higuchi[1], Kazuhiko Ito[2]

[1] Kyushu University, [2] TOKEN C. E. E. Consultants Co., Ltd.

The purpose of this paper is to report the epoch-making process of realizing a twenty-five-meter-long wooden footbridge in Karatsu, Japan as a spatial and psychological connecter of Downtown Karatsu and Nishinohama, one thousand meter-long artificial coast.

The bridge is also unique as one of the first examples of newly introduced funding system that is structured by citizen's contribution, municipal funding, and direct financial support from the national government.

Originally, the footbridge was planed and proposed by Karatsu Minatomachidukuri Konwakai, a local community group that had been active in the past decade to promote revitalizing Karatsu's waterfront. The organization argued that the footbridge would dramatically improve citizen's access to the artificial coast.

Many local citizens and organizations granted the value of the proposal, and donated about two million yen, one third of the estimated total cost of the construction of the footbridge.

Another feature of this project is that the bridge construction was mostly done by local citizens rather than by subcontracting construction firms. A design team that includes the authors and a local wood structure specialist carefully designed the bridge in order that amateur weekend carpenters could assemble the bridge easily on the site with saws and drills from their garages.

Regional forest were chosen for structural lumbers of the bridge from an ecological point of view. Sugi has been used as a major shipbuilding material in Japan for its strong and flexible nature. In this regard, the bridge is a green infrastructure that is friendly to the natural environment. To enhance the durability, a latest preservative treatment that was harmless to the nature was applied on lumbers.

Historically, numbers of social infrastructures, such as bridges, ports and canals have been built by funding out from local citizens' pockets and their direct participation in the construction process, particularly in Edo period in Japan. This kind of civic contribution was called "Fushin" in Japanese. Karatsu's footbridge could be regarded as a revival of the Fushin concept in the 21st century.

The revival of Fushin concept in Karatsu is an irony to the contemporary society that tends to believe that the social infrastructure is supposed to be built and managed by the government alone and the society has no responsibility on it.

It is also an alternative approach of vitalizing urban wetland that aids the local government that has been suffering from serious financial difficulty in managing urban wetland due to the long-lasting recession in Japan.

Thanks to the footbridge, the access to the coast is dramatically improved, and numbers of local citizens visit the precious coast through the bridge and enjoy experiencing the nature throughout the year. The city is now in charge of the maintenance work of the bridge. However, because of the long life of the lumber, required maintenance work is very limited. In addition, the simple shape and the texture of the bridge made of local Sugi lumbers fit well as a green infrastructure to the existing originally artificial but now ecologically natural wetland environment.

The authors and the volunteers who participated in assembling the wooden bridge wish that the bridge will be loved and supported by the local community for a long time.

Fig.1 Waterfront of Karatsu

Fig.2 Project site

Fig.3 Existing condition of the project sit

Fig.4 Sugi trees near Karatsu downtown

Fig.5 Citizens building the wooden bridge

Fig.6 The completed wooden bridge

Conservation of Karang Mumus River and Swamps in North Samarinda: Efforts by "Clean Karang Mumus River Movement" and Stakeholders' Responses

Martinus Nanang

Department of Social Development, Mulawarman University

Background

Samarinda, one of the major cities of East Kalimantan Province in Indonesia, is located in lowland area. Its low altitude and very high annual rainfall contribute to the frequent flooding every year; many are massive in scale. One of the main factors contributing to the flooding is the reduction in the size and number of river swamps in and around the city, mostly due to conversion for housing areas. Karang Mumus River, which flows across the city and is badly degraded, urgently needs to be restored and conserved along with the remaining swampy areas as a part of the river ecosystem. The conservation is important as an effort to protect the riverine ecosystem and biodiversity, promote healthy environment and hopefully better livelihood for local residents (e.g. ecotourism, production of rice and other wetland vegetation), and prevent the city from further escalation of the environmental disaster.

It is a movement named *Gerakan Memungut Sehelai Sampah Sungai Karang Mumus* (GMSS-SKM, literally Movement for Collecting a Piece of Garbage from Karang Mumus River) that has initiated a civil society movement to clean the Karang Mumus River and to restore and conserve the river and its surroundings (river space). GMSS-SKM operates an education center called *Sekolah Sungai Karang Mumus* (SeSuKaMu) or Karang Mumus River School. The movement projected and is struggling to get an area as large as 10 hectares in the northern part of the city, the size it believes to be a minimum level necessary to be conserved for the benefit of the entire city. The movement so far enjoys limited (yet growing) support from concerned academia and university students and from the limited number of concerned city government officials as well as local residents. It continues to be very active despite limitation and challenges it encounters. Then the question is: How can the movement survive? How can it achieve the conservation goals?

My presentation explores the GMSS-SKM perspective, strategy and action and responses from related stakeholders to its effort to restored and conserve the river and related surrounding swamps. To put it in a more operational way the particular objectives of the presentation were formulated as follows: (1) To identify the scale of the river degradation as perceived by GMSS-SKM. (2) To analyze the values perspective of GMSS-SKM vis-a-vis the government; (3) To describe the strategy and action of GMSS-SKM, and how it interacts with local authorities, academia, and local residents. (4) To assess and analyze the main challenges of the effort to conserve the river and related swamps.

Overview of Samarinda City

Samarinda is the capital city of East Kalimantan Province, located at the bank of the giant Mahakam River. It has a low altitude of 6 meters above sea level and many swampy areas. Total population was 812.597 in 2015 with growth rate of 1,96%. The population is multi-ethnic and multi-religious. The city is also the economic, education, and political center for Eastern Kalimantan (covering the both East Kalimantan and North Kalimantan provinces). Economy relies on natural resources (mostly coal mining); 70% of city area belong to mining concessions.

It has frequent occasions of flooding. A heavy rain of 30 minutes is enough to create a chaotic traffic situation due to floods.

Research site [see map, figure 1]

The research took place along the working area of GMSS-SKM, that is, about 15 km of the 34,7 km long Karang Mumus river. It includes downtown and suburban areas. Such condition implies certain constraints to the restoration and conservation of the river ecosystem.

River and Swamps Degradation

Thousands of houses invade the river bed and riverine zone for hundreds of years and new building continue to emerge. Tons of various kinds of trash are disposed into the river (directly or indirectly). These include plastics, wood, leaves, grass, animal waste, animal internal organs, household trash, dan many more. Huge loss of swamplands around the river because they are claimed and filled with soil to build new houses. Water contamination reaches level 4 which means it is not safe for consumption. Ironically, however, raw material for city water supply is taken from the river. Loss of river swamps contributes to flooding to the entire area around the river.

Environmental value of GMSS-SKM

Value is an idea about what is good. Based on my interviews I believe that the GMSS-SKM movement holds a naturalist or eco-centric ide or view of nature. Naturalists believe that nature (here river ecosystem) has intrinsic values. Nature is seen as a complex whole, where community of organisms and its environment function as an ecological unit. Such unit is called ecosystem. This is the view of deep ecology as coined by Arne Naess in 1973.

Practical Implications of eco-centric values

For the movement naturalist view is a driver to oppose the building of retaining wall along the river as retaining wall changes river into a mere canal. They also oppose the planting of non-endemic trees and plants along the river. To prevent the river from complete loss of its ecosystem, a special conservation zone is required (at least 10 ha, they sai d). For religiously faithful people, said the movement leader, being religious should mean respect to such kind of nature. This is indeed is a critique of very religious minded population who in fact have little care about the (riverine) environment.

Environmental value of the Government

Based on limited observation I got to know that the government (at least limited number of officials) appears to have more teleological-instrumental view of nature. This view values nature for its usefulness for human beings or that the purpose of nature is for human benefit. Hence it is also called utilitarian view, which holds that care about nature is to support egocentric interests of human beings. The government also has technocratic view of nature, a view that technology can solve ecological problems.

Practical Implications of teleological-instrumental view

Although it may not be the only reason, teleological-instrumental view of nature is believed to be a reason for why the local government has shown very little care about the river ecosystem. No comprehensive policy and strategy have been issued, including delineation of river ecosystem. No serious effort to stop claim of lands and swamplands around the river. Building of retaining walls is an evidence of technocratic solution. So is the dredging the river as a solution to floods.

Strategy of GMSS-SKM

GMSS-SKM's ultimate goal is the change in city population's ecological views, that is, to be more ecologically oriented if not fully naturalist. Such change is beneficial for the entire city and can support restoration/ conservation of other rivers and swamps as well. Immediate goal is restoration of Karang Mumus River and swamps. Ecosystem Approach is the framework for its action.

River ecosystem [see Figure 3].

Restoring river ecosystem means:

Stop claim of land in and around the river. Stop building new houses/building. Relocate residences in and near river bed. They need 10 km2 area in North Samarinda as conservation zone.

Challenges to Ecosystem Approach

Physically the river ecosystem has been mostly occupied by humans. Lack of support from the government. Social engineering: how take local residents to participate in the movement. Government's view of river restoration is different from that of GMSS-SKM. The government prefers to construct retaining walls along the river.

Action

Early actions were considered crazy and futile by local residents. Misman (the leader and initiator) and friends started to pick up trash from the river about 2 years ago. Yet the action continues and receives growing recognition. A landmark activity of the movement is *"Sekolah Sungai Karang Mumus" (SeSuKaMu)* or Karang Mumus River School. It is an informal place to educate and disseminate view and knowledge about river restoration and river ecosystem conservation. Many students and other stakeholders involved. Campaigning using media and social media is also undertaken. Groups of school and university students The school also manages a nursery of endemic river vegetation to be planted along the river (even in individual's private land).

Participation of Stakeholders

Support from the public is growing: every week there are groups of people (mostly students) either attend the river school or collect trash from the river. Coordinated support from the government is considered insufficient. Very low level of support from direct users (local residents) of the river: those who live in houses along the river.

Government Support

So far the movement enjoys personal support from the provincial Governor & City Mayor and other individual government officials. It gets also some support from *Balai Besar Wilayah Sungai* Eastern Kalimantan, a government body accountable for river issues. However, there is a lack of coordinated and strategic support as well as inadequate policy.

Some government officials even build rent house along the river bank.

Final Remarks

A huge challenge lies ahead of the effort to restore and conserve Karang Mumus river ecosystem since it is already so badly degraded. Views of the government and the mass which are not environmental friendly need to be changed and it is not easy to make such change.

Legal and authoritative support from the government is necessary to achieve the restoration and conservation goal. More involvement of local residents needs to be more actively encouraged and facilitated.

As an effort to support the movement, my research will be continued in order to gain more comprehensive understanding about socio-cultural factors accountable for people's behavior toward the river and its environment.

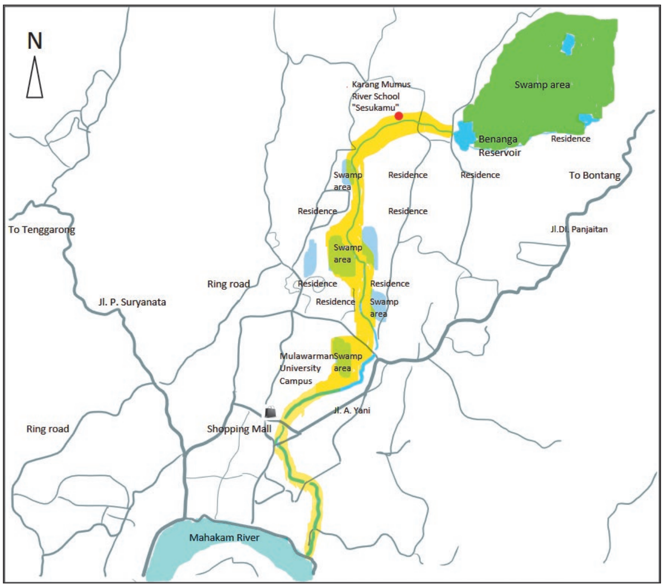

Figure 1. Map

Figure 2. Retaining wall (photo)

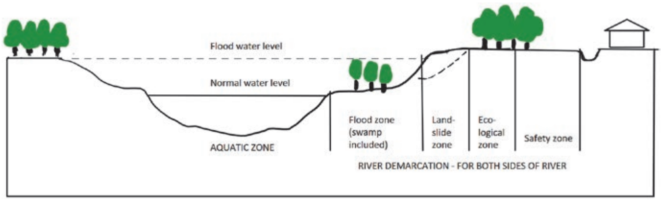

Figure 3. River ecosystem

Horseshoe Crab Habitat Conservation and Coastal Zone Management in Japan

Satoquo Seino

Ecological Engineering Laboratory, Department of Urban and Environmental Engineering,
Graduate School of Engineering, Kyushu University

Introduction

The Horseshoe Crab (HSC) in Japan (*Tachypleus tridentatus*) was designated an endangered species in the 1990s. After World War II, recovery and economic growth pushed large-scale coastal development including reclamation and dredging, inducing water and substrate pollution and habitat loss. HSC habitat shrank to the western edge of its original extent, and is now limited to northern Kyushu.

Interests of researchers have changed. Small beaches as spawning sites were examined. Micro conditions of spawning and embryo development were observed and measured. Next, beach material grain size and distribution were examined.

Conditions in Moriye Bay, Oita included coarse sand (d50: about 0.7mm) and lower silt and clay ratios (about 3%), which ensures enough water circulation around eggs and embryos with tidal changes.

Beach nourishment has been the standard method to restore sandy beach spawning sites, but it proved unsustainable due to erosion and siltation on restored beaches.

Beach morphology and sand transport and sedimentation dynamism were re-examined.

Coastal engineering studies revealed the responses of sandy beach development, and the knowledge was utilized for restoration.

Beach nourishment without predictions of littoral sand flow tended to fail.

Continual supply and adequate natural sand sieving are essential to maintain sandy beaches. Specialists realized that involving enough space to allow influences from waves, currents and other natural external forces is very effective for maintaining sand dynamism.

Awareness of zonation of the coastal zone was keen in the late 1990s, because by 1993, about half of Japanese coasts had become affected by artificial structures. The methodology and philosophy of Japanese coastal public works were criticized by the public, especially naturalists and surfers.

Japanese land use policy was organized to protect the physical line of beaches from erosion and severe outer forces like typhoons. Under the first version of the Seacoast Act, landscape and ecosystems were almost completely ignored. But in 1999, this act was amended to open the door to nature conservation and public participation.

Furthermore, recognition of the importance of topographical continuity from sandy beaches to tidal flats to offshore areas in HSC life history became shared among related sectors and persons. Awareness expansion from point to line to plane was popularized. This evolution of conservation methodology migrated into coastal zone management perspectives.

Beach erosion was worsening and became a pressing problem. Preservation of sandy beach topography demands sufficient, continual supplies of sand flowing from the mountains and moving as littoral drift at the shore. Dams and weirs disturb sand flow. Dredging river beds and coastal zones induces erosion. HSC spawning beaches also suffer from these problems. Thus, not only coastal but watershed management became a hot issue.

Comprehensive sediment management was introduced to sectioned-off administrations.

HSC habitat conservation started with only small-scale beach conditions, but evolved to acquire large-scale and long-term viewpoints which were understood conceptually and promoted step-by-step.

If habitats for all stages of HSC life history are conserved, coastal disasters may be lessened. Coastal geomorphology like tidal flats and foreset slopes are known to have natural disaster prevention functions.

HSC habitats are important buffer zones. Thus, in reconsidering coastal matters in the wake of tsunami damage HSC habitat conservation can symbolize integrated coastal management, especially land use.

Conclusion

Ecological Restoration and Disaster Risk Reduction

SET BACK + Land Use Reconsideration demarcating the boundary of the protected zone to conserve the natural sand bar and salt marsh.

Dynamic SAND Management is necessary.

Ecosystem at the coast and river mouth must be respected.

• Consensus Building
 with farming, industry...

Multi-sectoral Participation.

Acknowledgement

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Urban Wetlands and Mosquito Born Disease Problem in Chiang Mai, Thailand

Panida Rahong[1], Chotiwut Techakijvej[1], Nattawut Sareein[2], Yoen Jae Bae[2] and Chitchol Phalaraksh[1,3]*

[1] Environmental Science Program, Faculty of Science, Chiang Mai University Thailand
[2] Division of Environmental Science and Ecological Engineering, College of Life Sciences and Biotechnology, Korea University, Korea
[3] Department of Biology, Faculty of Science, Chiang Mai University, Thailand
* Corresponding author, E-mail: chitcholp@gmail.com

ABSTRACT

Six observation sites were divided into 3 groups of habitats include natural wetlands with low disturb areas, natural wetlands with high disturb and manmade wetland. Those habitats were recorded water physicochemical data, habitat data, and predator-prey data. Then, all of data were calculated the correlations between mosquito larva and other factors. The relation between predator and mosquito in natural wetlands were analyzed. For the result *Culex quinquefasciatus* was the most common species that found in manmade wetlands. Number of mosquito data were given the negative correlation with dissolved oxygen and habitat quality score. In the natural wetland with low disturb, high diversity of predator and low number of mosquito were found. But the result was different from the predator and prey in natural wetlands with high disturb. Low number of predator, Low diversity and high number of mosquito larva were found in high disturb and manmade wetland. The predator that we found were classified in to two group 1) Dissolved oxygen demand predator such as fish, dragonfly larva (Odonata), diving beetle larva (Dytistidae), water scavenger beetles larva (Hydrophilidae) 2) Low dissolved oxygen predator such as diving beetle (Dytistidae), water scavenger beetles (Hydrophilidae), elephant mosquito (*Toxorynchytes* sp.), *Lutzia* sp. mosquito. In addition, high water velocity from rain storm was effected on the population of mosquito larva.

INTRODUCTION

Water is the most important resource for every living things. On the other hands, water is the one of problem on human life such as flood, storm, low quality of water and disease that coming with water. Mosquito borne disease also comes with water also. Anthropogenic environmental alterations, urbanization, global warming and habitat change that lead to mosquito outbreak and may be contributing to the spread of vector-borne diseases. Mosquito is one of the famous insects group in the order Diptera. Over 3,520 mosquito species that recognized in the world and 459 species in Thailand (Rattanarithikul et al.,2011) Many species of mosquito were transmitted serious disease-causing viruses or parasites.

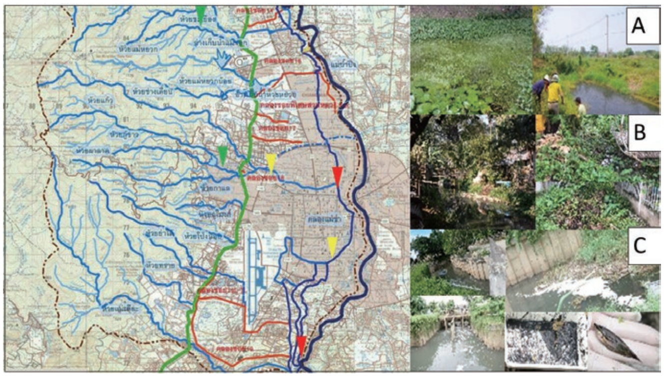
Synthetic chemical insecticides were the main strategies for control mosquito. However, insecticide resistance to chemical insecticides is rising. Successful strategies to control mosquito borne disease require ecological dimensions of vector-borne disease research. The understanding of habitats, ecological role and mosquito position in food web should be study. The relationship between predator and prey is an important factor to be investigated in the relatively new field of eco-epidemiology, which includes aspects of both ecology and epidemiology, the study of how diseases spread (Auger et al., 2009) eco-epidemiology is the conceptual approach combining molecular, societal and population-based aspects to study a health-related problem. John Snow and Joseph Goldberger tried to use the eco - epidemiological thought in analyzing public health concerns (Cholera and Pellagra) during an infectious disease era. They both recognized how social and biological changes could both interact to lead to disease. It is quite apparent that the identification of risk factors will not be sufficient for epidemiologists to confront some of the most pressing public health challenges of our time, such as those emanating from the HIV - AIDS pandemic, social inequalities, and movements of and changes in populations (Bungum, 2005).

In Thailand, Ecology, habitat and natural enemies of mosquito were few studied. The city expansion and urbanization plan were less concerning about the water and the disease. In this work, the ecology of mosquito was studied in term of their habitat, there enemies and the overpopulation problem of mosquito. There are many small wetland, freshwater Lakes, ponds, retention areas and paddy field in Chiang Mai, Thailand. After finished the research, Public education will be used to promote the management wetland and natural enemy method to reduced mosquito in sustainable way.

OBJECTIVE

To investigated the relation between the urbanization and mosquito outbreak in Chiang Mai city. The mosquito's habitat quality, number of mosquito and number of their predator were evaluated.

Figure1: A(green) natural wetland low disturbed, B(yellow) natural wetland with high disturbed and C(red) man made wetland.



METHODOLOGY

Study site

Six observation site around Chiang Mai city were chosen base on fresh water habitat applied from Williams and Feltmate 1994. 1 natural canal and 1 natural pond were represented natural wetland with low disturb, 1 polluted natural canal and 1 natural canal had been blocked by rod were represented natural canal with high disturbed and 2 concrete canal were represented manmade canal (Figure 1)

Data and sampling method

Samples were collected in dry season before the first rain conning in Chiang Mai (18th-19th May 2017). The physico-chemical parameters including water temperature and pH were measured using handheld CONSORT C933 equipment. Dissolved oxygen (DO) was measured by the DO meter EUTECH DO6+. Hydraulic characteristic, water depth and water velocity were measured by measuring tape and velocity meter respectively. Riparian and habitat characteristic (stream bed, aquatic plant, deposits and stream bank) were scored follow by The National Institute of Water and Atmospheric Research (NIWA) New Zealand (Biggs et al.,2002). Macroinvertebrates were collected by kick and pick method (Plafkin et al., 1989) from several habitats of each sampling site. Samples were preserved in 70% ethanol prior to transport to laboratory. After the cleaning and sorting process, macroinvertebrate samples were identified to family level under stereomicroscope.

Analysis

The environment data were used to calculate Habitat score that applied from NIWA organization New Zealand and collected DO value in each site. The macroinvertebrate and other mosquito predator were collected in qualitative sampling method. Macroinvertebrate were identified and No. of individual predator and mosquito were count. Graph were plotted for estimated the relative between each data.

RESULTS AND DISCUSSION

The highest habitat score were found in the low disturb natural wetland, and lower in high natural wetland (Table 1) because low disturb area covered by the riparian plant and aquatic plant that treated water and be the suitable habitat for aquatic organism. In the same result as Dosskey et al., 2010 research show the role of plant in term of chemical uptake, prevent erosion and increase water movement.

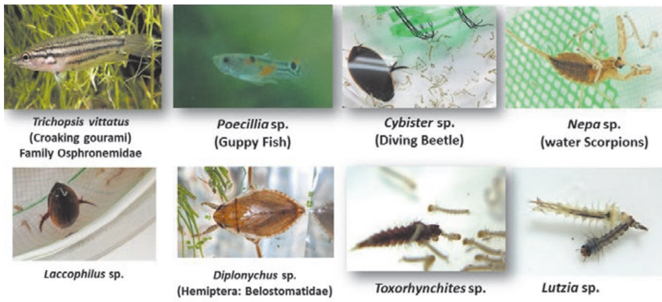
Table 1: The habitat score and biological data of each sampling site

site	Habitat Score (NIWA)	DO (mg/L)	Number of family	predator (Individual)	Mosquito (Individual)
G1	34	6.2	15	12	0
G2	19	5.8	13	7	3
Y1	6	1.8	9	4	10
Y2	-12	0.2	4	1	6
R1	-12	0	2	1	12
R2	-15	3.6	4	3	23

Moreover the number of individual mosquito larva were negative correlation between habitat score, dissolved oxygen (DO), Number of macroinvertebrate family and number of predator. (Figure 2).

Figure 2: Habitat score compare with number of family, individual mosquito predator and Individual mosquito larva

Figure 3: Mosquito predator that found in sampling area



From the correlation result was show the same direction of the Dida et al., 2015 study that study about Presence and distribution of mosquito larvae predators and factors influencing their abundance along the Mara River, Kenya and Tanzania. Main factor that influence mosquito larva was dissolved oxygen, water temperature, turbidity and their predator. Therefore the mosquito predators were found in the sampling area that has some characteristic for living in the same habitat of mosquito (Shaalan and Canyon, 2009)(Figure 3).

When the government sector open the water gate the number of mosquito were decreased as the same experiment of Greenway et al., in 2003 that investigated the mosquito elimination method by using the water flowing type. Water flow increased dissolved oxygen and improving water quality, vegetation and aquatic organism community.

CONCLUSION

The highest number of mosquito larva was found in manmade canals with high disturb. In this area should increase dissolved oxygen in water, improving vegetation of setting stream restoration plan for sustainable management and setting suitable area for mosquito natural enemies.

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Wetland Services for Elementary Urban Planning: Perspective from Bangladesh

Abu Jubayer[1], Md. Sanowar Hossain[2] and Md. Badrul Alam[3]

[1]Environmental Specialist, Local Government and Engineering Department (LGED), Dhaka, Bangladesh. Email: jubayer.buet.bd@gmail.com,
[2]President, Bangladesh POUSH, [3]Core Team Member, CCECR, Stamford University Bangladesh (SUB)

Abstract:

Municipal areas in Bangladesh are dependent on the wetland beyond their city limits, but also get benefit from internal urban wetlands. Major planning of a municipal area is depends on better drainage management plan. This paper is focused on the benefits of wetlands in context of drainage management and impact analysis of mismanagement of urban wetlands. In context of Bangladesh major types of wetland around the municipality are rivers, oxbow lakes, dead hand of river called beel, canal (manmade and natural), pond and some large ditches are common. Due to the detail analysis 13 economically important municipal areas were selected. Field visit with GPS tools, FGD and KII method were used for scrutiny analysis of wetlands in the selected areas. The regular exercise of wetland benefits are attentive to manage consistent rain water surface runoff, storm water management, drainage (primary, secondary and tertiary) management, continuous city household water supply as well as recreational services. Demerits of wetland mismanagement includes water logging (permanent and seasonal), environmental disruption, draw down of ground water table in dry period, disruption of household water supply systems, seasonal economic losses and recreational mega damages. The basic hindrance to wetland conservation and management are focused like illegal encroachments, city extension, unplanned city migration and lack of awareness are prime concerns. Like as drainage system continuation, fishing, grazing and other services along with addressing the importance of wetland in urban areas. By managing urban wetlands more important issues are to resolve the water logging (seasonal and permanent) program, urban household water supply, steady ground water recharge and waste water passing as well as treatment are common every municipal area. On the other hand raising the public awareness by co-management practices by different stakeholder, monthly, half yearly and yearly campaign program and institutional like school, college, university, local government and NGO level program is effective for sustainability. Other local government initiatives kind of law enforcement and systematic announcement can plan a significant role for wetland service continuity. Most of the KII interviewee (70%) result reflect that they need a wetland management master plan according to national and international context and rest of (30%) have large water bodies and they don't have any problem to manage urban services at present. It is revealed that the locally generated wetland services have a substantial impact on the quality-of-life in urban areas and should be addressed in land-use planning.

Key Words: Urban Planning, Urban Wetlands, Land Use, Municipal, Services

Introduction:

Urban wetlands are aquatic ecosystems with plants, animals and soils that are adapted to wet conditions which often require and can survive permanent or periodic inundation. Water in wetlands can be still or flowing; it can be fresh, salty or brackish. Wetlands do not have to be continuously wet; many wetlands in Bangladesh urban areas are remain dry for years at a time. (Thompson and Balasinorwala, 2010). Municipal areas in Bangladesh are dependent on the wetland beyond their city limits, but also get benefit from internal urban wetlands (Bolund and Hunhammar, 1999). But even if humanity is increasingly urban, we are still as dependent on Nature as before. Cities are, for example, dependent on the large hinterlands needed to provide input and take care of output from the city (Folke et al., 1997). Major planning of a municipal area is depends on better drainage management plan. A majority of the people of Bangladesh are critically dependent on wetlands. Policies, strategies, and management plans for sustainable use and conservation of wetlands of Bangladesh must be based on solid knowledge and understanding of their ecological and socioeconomic functions and processes (Byomkesh *et.al.,* 2008).

Study Area

In Bangladesh 322 number of municipal areas are located and some are economically significant. Due to the detail analysis 13 economically important municipal areas (Benapole, Bera, Charghat, Chuadanda, Chatak, Ishwardi, Joypurhat, Kishorgong, Magura, Muktagaccha, Nilphamary, Nougaon and Shahjadpur) in Bangladesh were selected. Different types of wetland are playing important role and these areas are located with different districts in Bangladesh.

Methodology

Field visit with GPS tools, FGD and KII method were used for scrutiny analysis of wetlands in the selected areas.

Direct Service of Urban Wetlands

Urban and peri-urban wetlands in Bangladesh provide a variety of benefits and services to the municipal. Most attractive services are classified into some portions like,

Ecological Services indicates to provide territory for plants and animals, wetlands and associated vegetation can provide a cooling effect to surrounding areas in summer and also moderate strong winds. Near the wetlands vegetated areas contribute to solving massive evaporation problem in several ways. The soft ground of vegetated areas allows water to seep through and the vegetation takes up water and releases it into the air through evapotranspiration.

Urban environmental services specifies wetlands provide water storage, improve water quality and reduce pollution. The regular exercise of wetland management benefits are attentive to manage regular rain water surface runoff, storm water management, drainage (primary, secondary and tertiary) management.

Hazard management service insists of Wetlands also defend against natural hazards, slowing floodwaters, decreasing the risk of fire and protecting against erosion of river banks and coastlines.

Urban services, the built-up structure, with concrete and tarmac covering the ground, results in alterations of water flow compared to an equivalent rural catchment. A higher quantity of rainfall becomes surface-water run-off which results in increased peak flood discharges and degraded water quality through the pick-up of e.g. urban street pollutants (Haughton and Hunter, 1994). The impervious surfaces and high extraction of water cause the groundwater level of many cities to decrease.

Aesthetic Services follows wetlands can also contribute to the well-being of the civic by acting as urban green spaces which provide aesthetic charm, landscape diversity and entertaining prospects. They can also support to cultural heritage, spiritual values and day-to-day living of Native peoples. Additionally, wetlands provide certainly accessible educational opportunities to learn about the environment.

Potential impacts of urban development on wetlands

Development in a developing country is must. Bangladesh faces a rapid development in the last 20 years. Economic growth is high in village, urban and peri-urban areas. The loss of wetlands are visible and their direct as well as indirect impact suffers everyone. Major direct impact follows different risks for human and nature.

Direct biodiversity habitat loss occurs from development of road, drainage systems, building, market and other unplanned urbanizations. In addition land reclamation, roads, in-stream dredging, etc also causing the direct loss of habitat of different natural species. Due to the introduction of exotic species weeds, pests, cultural fishes and domestic pets natural biodiversity is interrupted in a large range. Now-a-days the local fish species are very rare and some of them extinct or red list. Natural birds were available in the areas however now they are not present at that level and some other change their areas or extinct noticed by the local people.

Interrupting water cycle different types of altered water regime (from dams/barriers, stream redirection, hard surfacing, water extraction, etc effect the regular water cycle for the wetland around the urban areas.

Pollution increasing indicates many types of wastes are dumped in to the wetland directly. Like as every selected urban areas have no solid waste management system and they dump the solid waste of total areas into the wetland directly. From garbage, sewage, oil and chemical spills, pesticides, airborne toxins, etc increasing the water pollution, ground water pollution, odor pollution and ultimate environmental disruption ultimately.

Ecosystem modifications affected altered flood Inundation occurs in some parts of the Pourashava due to localized storm that is affecting the drainage system of the Pourashava and creating a worse environment for the residents living in those areas.

Economic indirect loss demonstrate natural soil nutrients, loss of natural water reservoirs and of their resultant benefits, increase in the occurrence of flooding and degeneration of wetland based ecosystems, occupations, socio-economic institutions and cultures.

Urban lifestyle impact shows demerits of wetland mismanagement includes water logging (permanent and seasonal), environmental disruption, seasonal economic losses and recreational mega damages. Urban wetland are threatened by the process of increasing the density of buildings for urban life style radical changes.

Major Causes for Wetland Mismanagement

Causes from different development angle are the basic barrier for wetland management system in Bangladesh. Major sources shows from study view is represents

Illegal encroachments of wetlands from multi-level stakeholder like government, private, local people and others.

City extension for living, market development, institutional expansions and other activities

Unplanned city migration for better living, job opportunity, educational opportunity, natural hazards and modern township trends.

Industrial Impact also contain major causes for wetland management. Their waste management and waste water is directly involved with the wetland. So they are more powerful and use wetlands for own business.

Lack of awareness among all level users of wetlands are the basic hindrance to wetland conservation and management.

Different types of master plan like drainage master plan and urban master plan are under planning, however there is no more wetland master plan is present in these municipal areas. Most of the KII interviewee (70%) result reflect that they need a wetland management master plan according to national and international context and rest of (30%) have large water bodies and they don't have any problem to manage urban services at present.

Way-out to decision-makers

The following principles are recommended for decision-makers developing policies and planning for urban and peri-urban development that may impact on wetlands:

- **Maintain wetlands** and the range of services they provide as vital elements of the supporting infrastructure of towns and cities.
- **Promote the wise use of wetlands** as a means of reaching sustainable urban and peri-urban communities.
- **Where possible, avoid more degradation or loss of wetlands** as a result of urban development or mitigate the impacts. Any residual impacts should be suitably compensated for by balances such as wetland restoration.
- ***Co-management*** including traditional owners, in urban and peri-urban spatial planning and wetland management decisions. A co-management committee can perform into the community and decision making procedures.
- **Consider the role of wetlands** when planning urban protection from extreme events (such as fires and floods) which are expected to increase under climate change scenarios.

Consideration for planners and developers

The following practical measures are recommended for urban developers and wetland managers:

- **Preserve wetlands** – where possible, urban development should avoid abolishing or degrading wetlands through drainage, infill, water diversion, pollution or the introduction of invasive species.
- **Restore and build wetlands** – wetlands should be restored and/or created within urban areas as part of water management infrastructure. Ramsar Convention guidance indicates that restoring existing wetlands should be prioritized ahead of creating new wetlands. However, constructed wetlands also play an important and valuable role in water sensitive urban design.
- **Embrace the value of wetlands** – the costs of wetland loss and degradation and the value wetlands can add should be taken into account when considering urban and infrastructure development.
- **Educate the community** – interpretive materials and education programs can help ensure community understanding of the role of wetlands and their values for the wider community.
- **Engage stakeholders** – decisions on urban planning and wetland management should involve local communities, including Indigenous people.
- **Undertake integrated planning** – Urban wetland management should be integrated into the wider elements of urban spatial planning and development and water resource management expert. Urban development should avoid wetland loss or incorporate spatial zoning to protect wetland resources. Urban planning should explicitly

include wetlands as natural infrastructure for nature conservation, landscape planning and water management (storm water management, water supply and water treatment).

- **Distinguish and address health and safety issues** – wetlands can be associated with mosquito-borne diseases and can pose a drowning risk to children. These issues need to be addressed on a case by case basis. Natural wetlands near urban areas may require specific management to reduce numbers of mosquitoes. Proper wetland management can be designed and managed to minimize mosquito populations.

Concluding Remarks

Urbanization and technological advancement has fostered the conception of an urban society that is gradually disconnected and independent from wetlands. By understanding the value of wetlands, demarking the important wetland in urban areas, raising the public awareness and better local government initiatives can input into wetlands and urban planning. It is revealed that the locally generated wetland services have a substantial impact on the quality-of-life in urban areas and should be addressed in land-use planning.

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Session 5

Wetlands and Youth

The Environmental Activities of Youth Ramsar Japan (YRJ), NGO Organized by Students Ranging from Junior High School Students to Graduate Students

Takuma Satoh, Tatsuya Togari, Atsushi Tanabe, Kohaku Hida, Karin Ishii, Yuma Sato
Youth Ramsar Japan

Youth Ramsar Japan (YRJ) is an NGO organized by young people ranging from junior high school students to graduate students. YRJ refers to young people as "Youth". It was established in 2013.

Our purpose is to strengthen "CEPA" and "Wise Use" of the Ramsar Convention. Our motto is that we are learning about wetlands and planning and conducting the wetlands conservation activities by ourselves. YRJ consists of 38 members. Core members of YRJ are youths who participated in the "KODOMO Ramsar" Wetland Environmental Education program. KODOMO Ramsar has been promoted by Ramsar Center Japan (RCJ) since 2002. It targets elementary school students. "KODOMO Ramsar" has greatly contributed to the wetland conservation activities and network formation of elementary school students. But, until now, there were few opportunities for young people to make a network with people of the same generation. Also, young people did not have an opportunity to conduct capacity building, awareness-rising and communication at the self-mobilization level. Young people are a target group and important stakeholders according to the Ramsar Convention's Programme on CEPA 2016-2024.

So, we decided to establish YRJ for wetland activities by youth.

YRJ has conducted the following activities: (1) "Youth Ramsar CEPA Workshop (CEPA-WS) ". The objective of this activity is to learn about wetlands and gain a wide perspective through communication with other youths; (2) "Youth Research Project (YRP)". The objective of this activity is to research wetlands by youth and offer information on wetlands to the public, (3) Participation and cooperation in environmental events for CEPA.

"Youth Ramsar CEPA-WS"- Activate to revitalize the community and grow youth-

YRJ promoted CEPA-WSs 7times during 2015-2017. To further promote the conservation of wetlands, the CEPA-WSs propose clues to arrange and solve problems each wetland has from a unique perspective of youth through environmental active learning. These events to set up opportunities for youths to conduct communication, and set up places to listen and learn from experts about ESD • ESD-GAP (Global Action Programme on Education for Sustainable Development), interpretation of Ramsar Convention, CEPA etc. In addition, at the preparation-level activity, the program leader participates in the project planning, participates in meetings with local administration and NGOs at the venue, discusses and creates an event. This is done for YRJ to continuously operate by ourselves, and by learning the process of building up the event, it leads to the youth's capacity building.

Characteristic of the CEPA-WS is deciding the theme of what to learn each time the event is held.

1. "The 1st Youth Ramsar Exchange Meeting in Fujimae tidal flat" focused on Environmental Education. It was held at Aichi prefecture in May 2015. The theme was "Environmental Education". At this exchange meeting where 18 youths participated from 6 wetlands nationwide, we held an event to let the general public know the attraction of the Fujimae tidal flat, the "Tideland Festival", planned and prepared by themselves in advance. In addition to participating in the activities, youth participants also gave a lecture on environmental education by inviting Mr. Sonoda Kawashima from Shiga University, an expert on environmental education.

The 1st and 2nd WSs were called "Youth Ramsar Exchange Meeting" and we renamed the events the "CEPA Workshop" since the 3rd WSs.

2, "The 2nd Youth Ramsar Exchange Meeting in Lake Biwa" focused on the Relationship between Lake-Biwa and Human Beings. It was held at Shiga prefecture in September 2015. 11 youths from 3 wetlands nationwide participated. The theme was "Relationship between Lake-Biwa and Human being", learning about the traditional food of Lake-Biwa "Lake fish cuisine (Kokorin)". The activity featured actual fishing of the Biwa trout in Lake-Biwa, eating of the fish of the bough caught in Lake-Biwa, In order to learn about alien species inhabiting Lake-Biwa, we caught a bourogill and examined the contents of the stomach, fried black bass and tasted it.

3, "The 3rd Youth Ramsar CEPA Workshop in Kabukuriuma and its Surrounding Paddy Field" focused on Agriculture. It was held at Miyagi prefecture in June 2016. The theme was "Agriculture". 8 youths from 3 wetlands nationwide participated. We learned how agriculture, the environment and people are involved in paddy fields which are important secondary nature and wetlands. In order to realize the burden of labor that is placed on farmers by the selection of agricultural chemicals and the following the reduced agricultural chemical farming law: activities which are considered to be naturally good, youth entered the paddy fields and experienced weed cutting. Local farmers talk about how much economic benefit is received and how much labor burden is increased by organic agriculture and reduced chemical fertilizer farming agriculture, and how the aging and other serious problems of farmers have developed.

4, "The 4th Youth Ramsar CEPA Workshop in Hamatonbetsu" focused on Tourism / Facilitation. It was held at Hokkaido in August 2016. 17 youths participated from 5 wetlands nationwide. The theme was "wetlands and sightseeing" and "facilitation". In order to learn about the charm of wetlands utilized as sightseeing resources and how to change people's way of engaging with people by being tourism resources, participants visited sightseeing spots that are actually related to wetlands and talked to local people. We went gold dusting on the Utho Tannai River, which is a sightseeing spot for gold dust production, and we had a barbecue for dinner and ate seafood such as local scallops and beef, etc. Then, we took a look at some programs of "KODOMO Ramsar" which was held at the same time, and learned about the facilitation method for elementary school children.

5, "The 5th Youth Ramsar CEPA Workshop in Toyooka" focused on Tourism / Conservation of storks. It was held at Hyogo in July 2017. In Toyooka, 3 youths participated from 3 wetlands from nationwide. At this exchange meeting we learned about conservation of the storks and the attraction of Toyooka. Furthermore, we carried out weeding and waterway maintenance as conservation work at wetlands that local people are developing. In the evening, we held an exchange party with the local people and asked about the current problems that are concerned with the area and wetland conservation. Based on what I learned from this event, I made a presentation to local administrative personnel considering a sightseeing plan based on wetlands.

6, "The 6th Youth Ramsar CEPA Workshop in Tsurui village" focused on Staff training. It was held at Hokkaido in August 2017. 16 youths from 8 wetlands nationwide participated. The theme was staff training. This meeting was held at the same time as "KODOMO Ramsar" organized by RCJ. "KODOMO Ramsar" is an event for elementary school students and it was an opportunity for youth to learn by seeing how to move as a staff and how to interact with children. Also, what I learned at this event was held as a staff training for "KODOMO wetland exchange" sponsored by YRJ to be held in November 2017. While helping with catering and setting up the venue, I learned how the staff attached to the group is in contact with children and what kind of mental attitude.

7, "The 7th Youth Ramsar CEPA Workshop in Arao tideland" focused on Event Management. YRJ planed and managed the "KODOMO Wetland Exchange Meeting in Arao Tideland". It was for elementary school students from November 3-5. This event was planned and managed by only the "Youth" generation. 12 youths from 5 wetlands nationwide participated. The "KODOMO Wetland Exchange Meeting" was the first event for elementary school students organized by YRJ. It was a new challenge to expand the framework of the exchange meeting we had been targeting towards the youth generation and to organize an exchange meeting where primary school students can learn about wetlands. Youth was responsible for most of the staff ranging from the facilitator to the team coordinators. Children observed the Arao Tideland and created "Arao Tidal newspaper" to publicize the charm of Arao Tideland. The results were exhibited at the Asian Wetland Symposium held from November 7th and many people were able to see it.

In addition, at the unofficial exchange meeting of adults and youth that took place during the event, the opportunity was created to make a new partnership by strengthening the ties at the Ramsar site in Kyushu. Through this incident, it was confirmed that the importance of youth playing an important role to connect adults and elementary school students was significant. This new challenge was greatly successful.

As a result of being born through the CEPA workshop, the young people called 'youth' will reconfirm the tasks of the region and the problems in wetland conservation, and youth will enter into the region to revitalize the activities conducted on regional issues. There was an effect made to build a network. For example, in the workshop held in Toyooka City, by proposing a sightseeing plan, it is possible to cast the area's problems from the point of view of the youth, furthermore the program itself has yet to grow from the administrative perspective. There have been discussion that regional sightseeing may be a possible area of cooperation with city departments, for example. The Arao-City regional administration said that he wanted to hold "KODOMO Wetland Exchange Meeting" on a continuous basis. This is the result of YRJ's revitalization of regional and administrative activity and the resultant regional revitalization resulting from the efforts of these youths.

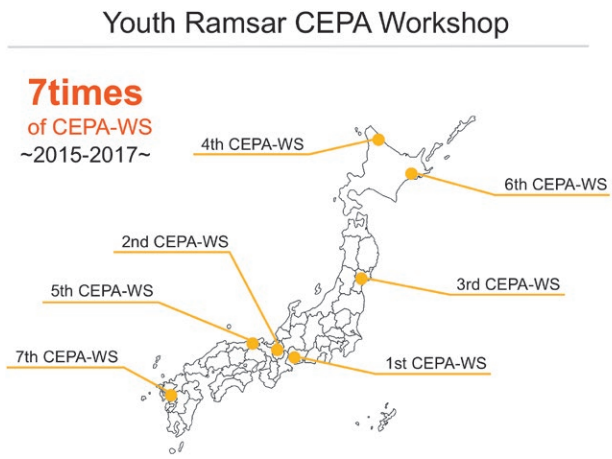
In Youth Research Project (YRP), YRJ members visit wetlands in Japan and find the treasures of wetlands and offer wetlands information. YRP was started from last year. There are various types of wetlands in various parts of Japan, and numerous organizations are engaged in the conservation and dissemination of wetlands. However, there are few things comprehensively summarizing the attractiveness of the various areas centered on wetlands. So, we visited wetlands in various places, and from the viewpoint of youth, through surveys, tours, experiences of wetlands, interviews with active groups, survey of tourism resources in the area, summarizes their charm. Wetland posters have been created. In addition to disseminating information on the YRJ website and posting it at environmental events, we spread information about the appeal of wetlands to citizens.

Through CEPA-WSs, Youth generation have had opportunities to learn about wetlands and communicate with the same generation active in wetlands in Japan.

In YRP, we reviewed the values of wetlands from the perspective of Youth. The vision of the next generation of environmental managers is important.

Our activities were appreciated by the organizing committee of AWS2017. The 1st meeting of the international steering committee of AWS 2017 was held at Suncheon, Korea on Feb 2017. At that time, the organizing committee decided that YRJ will manage the "Wetland and Youth" session.

So literally "Wetlands and Youth" is the session for youth by us.



Total 73 people/times participated in our CEPA-WSs.

Interviewed farmers in 3rd CEPA-WS

Elementary students made Newspaper in "KODOMO Wetlands Exchange Meeting in Arao Tideland"

Fundamental Study on Conservation and Restoration of River Estuaries Habitat
– Classification of Estuary and Their Transitions since 1900s –

Atsushi Tanabe[1], Tomoko Minagawa[2]

[1] Graduate School of Science and Technology, Kumamoto University, [2] Faculty of Advanced Science and Technology, Kumamoto University

Background

Estuaries are places wherein fresh water and seawater combine, creating a unique environment for many creatures that thrive in sand bars and tidal flats[1)]. However, birds, such as shorebirds and the great reed warblers, and benthic organisms have been decreasing[2,3)] because of the estuary reclamation efforts after the Meiji era[4)].

The conservation and restoration of estuary habitats are promoted in Japan[5)]. However, it is necessary to understand the characteristics of each habitat and the relation among habitats when conservation and restoration are conducted. The main estuary habitats are sandbars and tidal flats; these are further classified into river mouth sandbars, lagoons, and river mouth tidal flats[6,7)]. However, the conservation and restoration studies have focused on the topography of estuaries and not on the living organisms inhabiting the estuaries. Furthermore, considering the developments in the areas surrounding estuaries, other studies have focused on factors such as loss and extension of habitats and past conditions. The goal of conservation and restoration should be based on all these factors. The Environment Agency[4)] has identified the loss of 100 m of tidal flats across the country. However, the habitat composition in estuaries has not been studied. In estuaries, birds are more important than small organisms because birds are predators and affect the ecosystems in the same manner as large fish, and as birds move within wide area, it becomes an index of conservation and restoration of whole estuary area[8)]. Nevertheless, our understanding of the avian communities in estuaries is limited.

Purpose

This study focuses on the avian communities, thereby aiming to improve the large-scale conservation and restoration efforts of estuaries. The habitat composition of estuaries in Japan is examined to identify the historical changes and the relation between estuary types and bird communities are studied. Next, the effect of the decrease in estuary areas on the avian population is studied.

Methods

1. Target rivers

We investigated the estuary areas (1-km upstream and downstream from the estuary) of 107 first-class rivers in Japan, excluding the Akawa and Arakawa rivers, which were artificially created in the 1930s.

2. (1) Estuary classification

The classification of estuaries is based on topographic maps (111 maps, 1:50,000 scale), published by the Dainippon land surveying department between 1890 and 1914. From the maps, sandbars are identified by beach map symbol and cross the river, and tidal flats are identified by map symbols of tidal flat (Fig.1). Furthermore, the sandbars were used to outline the lagoons. Tidal flats were found in river channels and offshore.

(2) Historical changes

To comprehend the historical changes, the maps created around 1900 and 2000 were compared at the same 1:50,000 scale. The latter maps are published by the Geospatial Information authority of Japan.

3. Avian communities

The relation between estuary types and bird communities was analyzed. nMDS analysis was performed using the national census on the river environmental bird data[10)], presence or absence of 103 species in five rivers from 2006 to 2014.

Results and Discussion

1. (1) Estuary classification

The estuary habitats are divided into A) river mouth sandbars (43 rivers), B) river mouth sandbars + tidal flats (river channel) (7 rivers), C) river mouth sandbars + tidal flats (river channel and offshore) (12 rivers), D) lagoons (5 rivers), E) lagoons + tidal flats (river channels) (2 rivers), F) tidal flats (river channel) (3 rivers), G) tidal flats (river channel and offshore) (26 rivers), and H) no sandbars and tidal flats (9 rivers) (Table, Fig.2). Type A are the rivers flowing into the Japan Sea and the Tohoku region at the Pacific Ocean, type B are the rivers in southern Shikoku and Kyusyu and Niigata, type C are the rivers near bays, type D are the rivers in inner bays close to urban areas, type E are those in southern Shikoku and Kyusyu, type F are near urban areas of the rivers facing the inner bay, and type G are the rivers facing the innerTokyo Bay, Ise Bay, Seto Inland Sea, and Ariake Sea(Fig.3).

(2) Historical changes

Comparing the estuary areas between 1900 and 2000, type A decreased to 15 rivers and 2.44 km^2, type B decreased to three and 1.73 km^2, type C decreased to four rivers and 6.32 km^2, type D decreased to three rivers and 0.90 km^2, type E comprises two rivers and 0.83 km^2, type F comprises three rivers and 0.16 km^2, and type G decreased to 11 rivers and 18.77 km^2. Type B, D, and E, including lagoons and river channel tidal flats, disappeared in 65% of the rivers and the total area also decreased by 83%. The decrease is caused by large-scale land filling in the 1970s. The average area of each river also decreased to approximately 60%; thus, the area of the estuary habitats in 2000 was smaller than that in 1900.

2. Avian communities

We assessed the habitats of 57 rivers belonging to type A, B, C, D, and G in 2000. The average number of bird species by type is 44.1 species (±18.1) in type A (n = 28), 36.0 species (±7.6) in type B (n = 4), 49.4 species (±4.8) in type C (n = 8), 31.0 species (±5) in type D (n = 2), and 34.5 species (±8.8) in type G (n = 15). Shorebirds and herons are the common species found in all types. The highest number of bird species were found in type C, followed by type G (including shorebirds and waterfowls) and type A (including bunting and kingfisher). In the nMDS analysis, the distance between type A and type G is the highest, types B and C are in the middle, and types D and A overlap. The differences in habitats and the positions of sandbars and tidal flats are well reflected in types B, C, and G and can be used to evaluate the number of bird species in each type. Type C has the highest biological diversity because of the presence of both river mouth sandbars and tidal flats;

and the highest decrease in bird species because of the 65% decrease in estuary habitats between 1900 and 2000. The disappearance of estuary habitats affects species, such as the little ringed plover, great reed warbler, and Chinese little bittern. Therefore, the conservation and restoration of rivers that inhabit these species are important. Type D areas have different bird communities than type A, but no changes were seen within the 100-year period. However, lagoons are separated from the ocean by estuary sandbars and any decrease in type D lagoons may affect species, such as shrike and black-browed reed warbler.

Summary

This study aimed at defining the basic steps in the conservation and restoration of estuary areas. In Japan, the first-class riverine estuaries around 1900 was divided into seven types (A–G) based on habitat types. From 1900 to 2000, sandbars and tidal flats disappeared in approximately 40% of the rivers, particularly, types D and F. In addition, the bird communities in every estuary area in 2000 were different. In particular, because of the high decrease in type D (lagoons) and type F (tidal flats in river channels), it is suggested that the number of birds in these habitats have also decreased.

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Fig. 1 Map symbols of beach and tidal flat10)

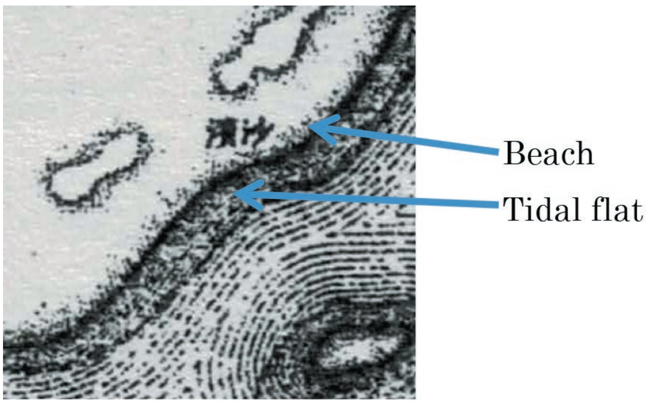


Table: Combination of sandbar and tideland and number of points for each type

Type	Location		No. of site	
	Sandbar	Tidal flat	1900	2000
A: River mouth bar Type	River mouth sandbar	×	43	28
B: River mouth sandbar + Tidal flat (river channel) Type	River mouth sandbar	River channel	7	4
C: River mouth sandbar + Tidal flat (river channel and offshore) type	River mouth sandbar	River channel and offshore	12	8
D: Lagoon type	Lagoon	×	5	2
E: Lagoon + Tidal flat (river channel) type	Lagoon	River channel	2	0
F: Tidal flat (river channel) type	×	River channel	3	0
G: Tidal flat (river channel and offshore) type	×	River channel and offshore	26	15
H: No sandbar and tidal flat type	×	×	9	49

Fig.2: No. of sites in 1900 and 2000

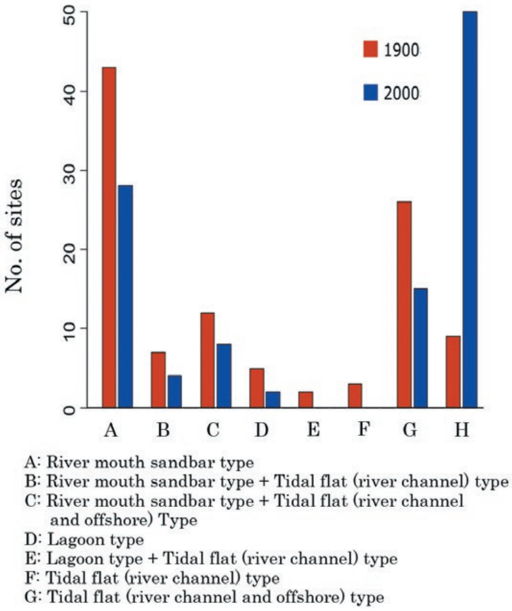
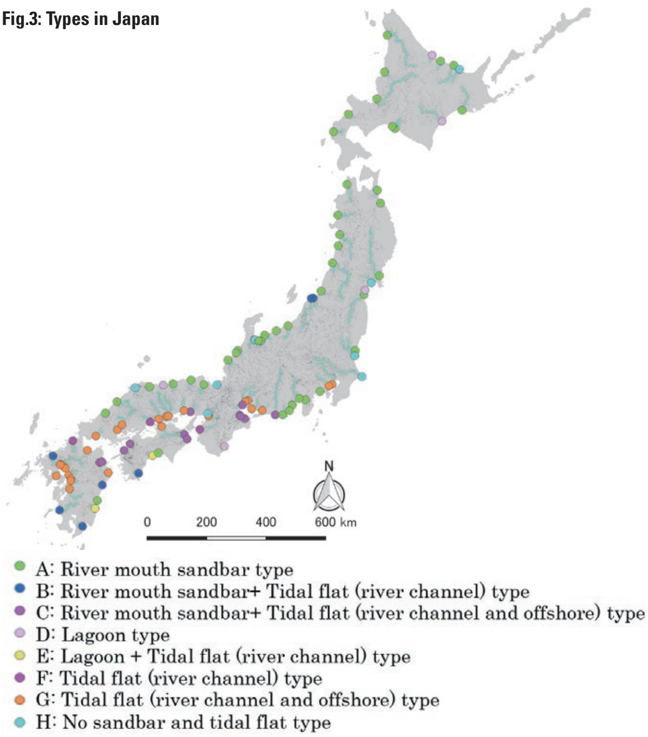


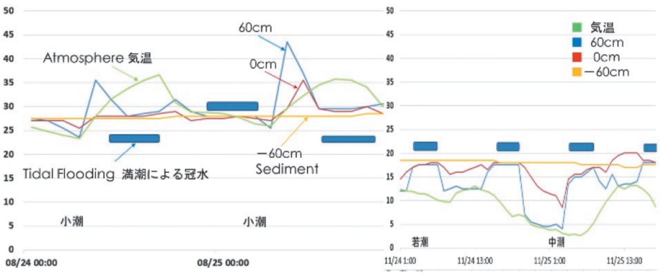
Fig.3: Types in Japan



CEPA Activities of Taishi High School Science Club

Takahiro Fukushima, Kazuki Sakai, Kouki Ishibashi, Fuuta Takasaki, Towaki Ide,
Haruki Kume, Taiyou Kiyota, Yukito Yoshimoto
TAISHI HIGH SCHOOL SCIENCE CLUB

First of all, I will talk about scientific research. We call benthos as benthic organisms. We have recorded the temperature of the Arao tidal flat. We have investigated the relation between benthic organisms and temperature. In addition, since we went to Suncheon Bay in Korea, we would like to refer to research and outreach activities.



This graph shows the temperature change in summer and winter. The vertical axis shows the temperature, the blue graph shows the air, the red graph shows the surface, and the yellow graph shows the sediment. As you can see in this summer and winter the temperature above the surface is reversed. I found out that the tideland is quite harsh environment.

This is a temperature measuring device. Eight small temperature measuring devices were attached to PVC pipes, holes were drilled in tidal flats, and devices were embedded in them. This is the state that it was installed.

This is a part of benthos of the Arao tidal flats. Majac it's — Japanese Mud shrimp which is a fish in Arao City, clams, Yubi Naga Hon Yadokari it's hermit crab, Yamato osagani it's one of crab andAramsiro these are a very large number of creatures.

There are many of living benthos in the Arao tidal flat.

Next, it is outreach activity. The science club has been doing various activities so far. I will introduce some of the activities from now.

First of all, it is education.

Every year we invite elementary school students in Arao City to the school, observe benthos and demonstrate science experiments.

This picture seems to be identifying the living things with the children we participated in the tideland observation meeting.

Then, Ms. Yamashita of Ritsumeikan Asia Pacific University visited us and we learned social science.

Next is participation.

This picture is taken when I participated in the bird watching of the Japan Wild Bird meeting. With this bird watching, we could observe many birds. After that I picked up garbage and cleaned the coast.

This photo is taken at the time of participating in the Arao tidal flat observation meeting. I collected various living things.

I participated in the 7th Ariake Sea Revitalization Symposium. I made a presentation on the importance of Arao tideland and the science club research presentation, and let participants eat Majac in tempura.

Next, it is about awareness activities.

At the cultural festival, we exhibited tideland creatures, opened a mini aquarium, sold Majadok with majac's tempura in bread and introduced Arao tidal flats.

This is the scene where we are receiving TV interviews. And we appealed the importance of Arao tidal flat on TV at the Mizunokuni high school student forum.

Next, it is volunteer activity.

This picture is taken when we participated as an assistant to the tidal flat observation society.

And this is what participated in the coastal cleaning volunteer. I cleaned the coast for wild birds and tideland creatures.

Lastly it is a future prospect.

1 We will tell the importance of the Arao tideland to students.

2 Furthermore, we will study biodiversity of the Arao tidal flat.

3 We will cooperate in the exhibition materials of the Waterfowl and Wetland Center.

Activities of Yonago Waterbird Sanctuary Jr.Ranger Club to Foster Mind for Protecting Wonderful Our Local Nature to the Next Generation

Hiromi Hayashi

Yonago Waterbird Sanctuary Jr.Ranger Club, Yonago city, Tottori prefecture

Yonago Waterbird Sanctuary Jr.Ranger Club(Below JRC)is a volunteer club composed of junior high and high school students working in Yonago Waterbird Sanctuary in Yonago city,-Tottori prefecture with 19 members.

Pic.1 Member of Jr, Ranger Club

We are active once a month, and the contentof the activities will be decided by ourselves inthe discussion done in April.Its content is various,including water quality survey,habitat survey of Great Reed Warbler, making islands for waterbirds ,exchange between wetlands, etc.And all these activiities are based on the desire to protect the environmental surrounding the Yonago Waterbird Sanctuary.

Pic.2 Maintenancce of habitats for waterbirds

The chance for the formation was that the children who graduated from Ramsar club acting as elementary school student's club gathered and wanted to continue activities related to environmental activities in the suburbs of Lake Nakaumi since then.Then we continue the activities, it will be the ninth year in this year. Children who were active earlier have already graduated from this club,going to university,becoming a member of society. Some members are married and buid their families too.And again this year, members with the same thought are participating one after another.

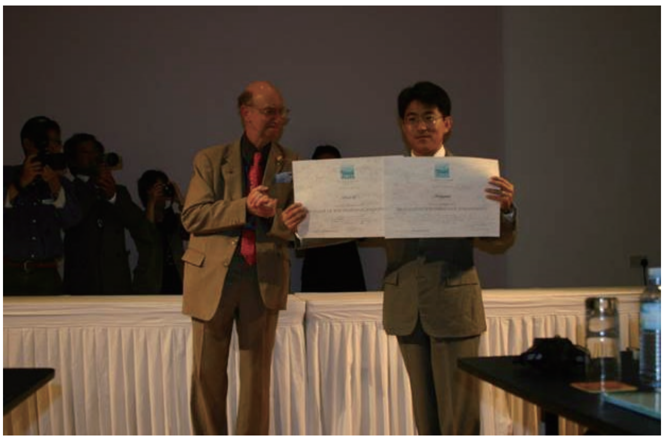
Lake Nakaumi including Yonago Waterbird Sanctuary was the rich brackish lake boasting the fifith largest in Japan. However due to landfill construction that began in earnest in 1970's,its environment was greatlly impaired.And the Tundra Swans that lost their roost one after another got into a form escape to the place the current Yonago Waterbird Sanctuary with shallow water which was made during the reclamation work.However the Yonago citizen who saw situation carried out conservation activities,and as a result,the paradise of Tundra Swans of Lake Nakaumi was to be left as Yonago Waterbird Sanctuary.

And finally, this valuable paradise of Tundra Swans was registered in the wetland of the Ramsar Convention in 2005, and the world recognized the importance as wetland.

Pic.3 Landfill of Lake Nakaumi

Now, Lake Nakaumi where the Yonago Waterbird Sanctuary is located, it is known by many people as the most southern migratory place in Japan for Tundra Swans and also it is wonderful environmental place where many kinds of ducks representing Common Pochard will fly more than 20,000 regulary every year.And many observers come to observe the appearance of wild birds flying to this wonderful environment every year.More recently,as a place to learn environment,many schools have come to visit.

Pic.4 Ceremony for Ramsar Convention certificate



JRC aims to foster a mind to care for local nature by doing activities related to wonderful natural environmental of Lake Nakaumi. What experienced when people were children will never be forgotten even after becoming adults. Because the body is remembering.

We think that we want to increase such are friends as many people as possible who will be able to connect this wonderful nature to the next generation when they became adults. And what is the necessary activity for that? While thinking about it, we will cooperate with my colleagues and continue the activities of JRC in the future.

Pic.5 Scenery from the Yonago Waterbird Sanctuary

In this session, I will introduce you the activities of JRC like this. And by thinking with our colleagues who have the same ideas spreading all over the world, I hope that we can learn better environmental preservation ways and tell local colleagues when I come back to the Lake Nakaumi. I'd like to talk about the wetlands subjects and environmental with the friends of various regions.

Youth-in-Action for Ecosystem-based Disaster Risk Reduction (Eco-DRR) and Ecosystem-based Adaptation (EbA)

Darry Shel M. Estorba, Amy M. Lecciones, Aaron Julius M. Lecciones, Zenaida M. Ugat, Jose Carlo H. Quintos

Society for the Conservation of Philippine Wetlands, Inc

Laguna de Bay is the country's largest lake and one of the biggest inland water body in Southeast Asia where around 100 rivers and streams drain water into the lake. Conservation of Laguna de Bay and its resources has been a long-standing advocacy of government and civil society organizations including the Society for the Conservation of Philippine Wetlands, Inc. (SCPW). In 2003, the SCPW, in partnership with the Laguna Lake Development Authority (LLDA), and Unilever, Philippines embarked on a Youth Ecological Camp to provide an experiential learning venue for lake conservation for High School Students in the Laguna de Bay lakeshore towns. In 2013, the United Nations World Food Programme (UN-WFP) as part of its umbrella program on "Disaster Preparedness and Response Programme" (Building Resilience Against Disasters and Climate Change), recognized the merits of Youth Ecological Camp (YEC) as a vehicle for teaching High School students about disaster risk reduction and preparedness and its link to the integrity of ecosystems, particularly wetlands. It should be noted that more often than not, wetlands are areas where disasters can occur frequently, especially when people are vulnerable and exposed to or are located in places like coastal areas, along rivers, lakes, and in floodplains. The SCPW believes that the long-term program for disaster preparedness should include taking care of the natural environment particularly wetlands because these specific ecosystems provide a natural hedge to climate change impacts. Among the ecosystem services provided by wetlands are water storage to prevent flooding, physical barriers against wave action such as mangroves, and provision of food and livelihood. Recognizing the interlinkages and taking advantage of the Youth Ecological Camp as a platform for engaging the Youth on Disaster Risk Reduction and Management (DRRM) and disaster preparedness, the UN-WFP and the SCPW worked together to develop a curriculum that would deliver this message to the Youth.

The YEC is a 3-day live in curriculum that incorporates concepts on environmental protection and wetlands conservation in relation to disaster risk preparedness and climate change adaptation and mitigation in the local context of a municipality. It employs experiential learning methods and approaches such as knowledge sharing sessions, field exposure visits, role playing, workshops, action planning, games and other activities that make it interactive and full of fun. Moreover, the Eco Campers get actual training in presentation and resource mobilization skills. The curriculum is designed for High School Students, preferably those in 8th and 9th Grade with good leadership potential. The preferred number of participants is from 25 to 35. There should also be a good mix of male and female participants. One or two high school teachers that will act as chaperones should also be invited as required by the Department of Education (DepEd).

There are two (2) themes in conducting the Youth Ecological Camp. First is the original curriculum that focuses on wetlands conservation. The second one is the enhanced curriculum that integrates environmental conservation and Ecosystem-based Adaptation including disaster preparedness and climate change adaptation and mitigation.

The objectives of the Youth Ecological Camp vary based on the theme. For the conservation oriented curriculum, the objectives are:

- To learn about the basic ecological principles and how it applies to wetland conservation;
- To understand issues behind the environmental status of a wetland including the pressures and problems besetting it;
- To apply basic wetland conservation concepts in identifying practical solutions that they can implement at their level; and
- To appreciate the value of camaraderie and partnerships in working towards wetland conservation.

In addition to the above objectives, Theme 2 which integrates Ecosystem-based Adaptation, Disaster Risk Reduction and Management (DRRM) and preparedness and other Climate Change Adaptation and Mitigation (CCAM) aspects aims to:

- Create a venue where the provincial and municipal government can involve the youth sector and other actors at the community level in Disaster preparedness and response and climate change adaptation activities;
- Involve local governments, schools, and other actors in effectively engaging the youth in CCAM, DRRM, and other initiatives;
- Educate the youth on climate change and how this phenomenon may affect the municipalities and their wetlands, and how these problems can be mitigated or altogether avoided; and
- Empower the youth to take a more active role in disaster risk reduction and preparedness, and climate change adaptation.

The first day of the camp is a learning session where resource persons are invited to provide simple technical lectures to share knowledge to the Eco Campers about basic ecological principles, ecological waste management, and DRRM and CCAM, among others. A local resource person from the Local Government Unit (LGU), usually the Municipal Planning and Development Coordinator (MPDC) is also invited to talk about the environmental profile of the municipality/The camp includes a field exposure trip entails rapid wetland profiling and assessment employing methods and activities such as water quality measurements, species identification, and land-use observation. For theme 2, the field exposure activities is called "Disaster Town Watching", where the Eco Campers visit the most vulnerable village and practice mapping of hazards, capacities, risks, and vulnerabilities. This will be the basis for crafting their school-based or community-based projects that they will eventually implement. On the evening of the second day, a Talents Night is held to make the camp a fun experience, integrating the learnings they have acquired through a creative way that showcase their talents. The third day is devoted to action planning and reporting, and a simple graduation ceremony attended by the LGU representatives and school officials.

It is worthy to mention that prior to the Camp, selected teachers are trained on how to conduct the Eco Camp to ensure that the youth will continuously have a pool of trainers who can pass the learning to other sectors of the community. Recently, the SCPW has produced also a Youth Ecological Camp training manual, a guide for conducting the SCPW Youth Ecological Camps for individuals and organization who would like to conduct the Eco Camp specifically designed for High School Students.

Learning does not end at the actual camp but is in fact practiced through implementation of municipal or school-based projects and activities that the Eco Campers craft during planning sessions. After the Eco Camp, the Action Plan and pilot projects or activities are presented by the youth teams in a Community Meeting to solicit the support of the community and their schools in the implementation of the projects of the Eco Campers. With this, the Eco Campers also get actual training in presentation and resource mobilization skills. Among the accomplishments of the Eco Campers include conduct of municipal and school-based Eco Camp, clean-up of rivers and canals back-to-back with information campaigns, Sachet Recovery Project, solid waste management projects, community lake monitoring, and other Communication, Education, Participation, and Education (CEPA) activities. The Eco-Campers also raise funds to support the implementation of their initiatives through various innovative means such as selling personalized and environmentally-themed water tumblers to reduce the use of PET bottles, selling other recyclable materials such as used paper, and many more. These accomplishments, learning, and experiences are being shared by the Youth in the CLEAR Youth Network (CYN) Congress. The CYN Congress is the annual gathering of the CLEAR Youth Network represented by Eco Camp graduates and their groups that were formed in their schools and/or communities as a result of the training camp. Aside from reporting accomplishments, planning of yearly activities is also being conducted in the CYN Congress. Moreover, this event is also a platform for learning so that the youth network will continuously be equipped with new knowledge and practice in lake conservation. It is the mechanism for sustaining the efforts and the active membership of the CLEAR Youth Network. The Congress includes eighteen (18) sets of campers from three (3) provinces which are Laguna, Rizal, and Metro Manila covering the following cities and municipalities: Muntinlupa, Taguig, Pateros, Tanay, Angono, Binangonan, Los Baños, Pangil, Lumban, San Pablo, Siniloan, San Pedro, Sta. Rosa, Mabitac, Rizal, Pila, Morong, Calauan, and Cardona.

This YEC curriculum has been tested as an effective tool for increasing the awareness of the youth in wetlands conservation for the past ten years, and lately, on disaster risk reduction and management, ecosystem-based adaptation, and other climate change-related issues. It has empowered the youth to become an important community actor in wetland conservation and disaster risk reduction, management, and preparedness.

So far, the results of YEC have been outstanding. In more than a decade of conducting YEC, the growing number of the youth continuously doing actions for wetlands conservation branched out with more projects and activities that also aided multi-sectoral involvement and partnership in their schools and communities. To date, 19 Eco Camps have been conducted directly benefitting more than 500 students and almost 100 high schools (see table below) around Laguna de Bay.

Year	No. of Participants	No. of Schools	No. of Camps
2003	15	4	1
2004	20	6	1
2005	38	9	1
2006	44	16	2
2008	24	5	1
2009	115	20	4
2010	79	19	3
2012	25	4	1
2014	105	9	3
2016	20	2	1
2017	24	3	1
Total	509	97	19

The number of students participating in the activities has expanded to more than a thousand and has been organized into a Youth Network. Truly, the YEC is an effective instrument towards engaging youth for the wise of wetlands in the Philippines.

River Continuum Concept and Ecological Health Monitoring of Loei River, North-Eastern Thailand

Thanayaporn Katesuja[1], Panida Rahong[1], Chotiwut Techakijvej[1], Atinut Joradol[2], Rungnapa Tagun[2], Tatporn Kunpradid[2] and Chitchol Phalaraksh[1,3]

[1] Environment Science Program, Faculty of science, Chiang Mai University
[2] Department of Biology, Faculty of science, Chiang Mai Rajabhat University
[3] Department of Biology, Faculty of Science, Chiang Mai University

Introduction

Nowadays, wetlands or water bodies in the world are being threatened by multi-stressor such as human activities, agriculture, and industry. By those activities, load of organic and inorganic pollution has released to aquatic ecosystem and lead to cause water pollution. As the results of this, the biodiversity of macroinvertebrate or aquatic animals are lost or decrease in those natural. So many the local species are risk to go extinct before they are identified and cataloged to conserve in the further.

Loei province is one of important province in Thailand. Due to it located among natural environment as well as the intensive industry such as mineral mine and agricultural products. Therefore, the natural areas on Loei province it have interesting about conservation of nature and organism. And very important factor on conservation is cultivating good moral traits to people and youths.

Consequently, educating the public specially the young on the importance of conservation is the main aim of this project. For share skills, traditional knowledge, techniques and methods, good practices and examples of failures of conservation and wise use of wetlands in Asia.

Objective

To monitor the Ecological Health of the Loei River under the River Continuum Concept (RCC).

Report and exchange the results to the local communities and youths regarding the impact of various activities through workshops for rising of environmental conservation and awareness in the Loei River watershed area.

Material/Method

Chemical, Physical and Biological data

1. We were selected 10 study sites along Loei River.
2. The physical and chemical analysis were obtained in this study such as

Chemical Parameters
- pH
- Water temperature
- Air temperature
- Dissolve solid oxygen (DO)
- Biological oxygen demand (BOD)
- Nutrients (Phosphate, Nitrate-Nitrogen, Ammonia)

Physical Parameters
- Velocity
- Conductivity
- Total dissolve solid (TDS)
- Turbidity
- Lux/Light
- Substrate

3. The bio-indicators (macroinvertebrate) were collected along river and keep in cool box to identify in family level in the laboratory.
4. The chemical, physical and biological parameters were analyzed and interpreted to the results about water quality along Loei River and the river continuum concept (RCC).
5. Report will send to the government and the people who involve this project as well as the people who interested and living in Loei province. The workshop was set to share the result data to the local communities regarding the impact of various activities through workshops.

Workshop

1. We set the workshop where located near Loei River (Loei Rajabhat University) and prepare the data or knowledge to share the people on Loei province.
2. Then we announced the workshop who are interested or involved the workshop such as teacher or students. By this seminar we are extrapolate the number of people of attendees around 70 people more.
3. The main aims of this workshop are to explain and describe about background and signification of the project. The workshop has separated into two parts, the first part is explaining and describing background. The second part is question and answer between advisory board and attendees. So, this part is very important, because this part is to make us to know about the problem and understanding of local people.
4. The last, we have given the questionnaire to attendees for assessment about satisfaction of this seminar for improve and development the seminar on the next time.
5. After seminar we have a special sessiontime to share skill or give the suggestion about how to check water quality monitor by bio-indicator or chemical and physical parameters with simple method.

Result

RCC and Water Quality parts

The RCC based on functional feeding group from macroinvertebrate in 10 study sites along the Loei River from upstream to downstream showed that it followed the RCC theory. From the results of project, it is followed RCC theory about FFGs. The percentile of FFGs on upstream is 49% collectors, 34% grazers, 10% predators and 7% shredders. On midstream percentile of FFGs is 53% collectors, 33% grazers, 11% predators and 3% shredders. And downstream is 86% collectors, 7% grazers, 6% predators and 1% shredders.

The water quality of 10 study sited revealed that there are moderate level based on chemical, physical parameters and biological parameters. In addition, the result of some study site effected from land-use by human activity. Mostly of impact is agriculture. Agriculture is cause of pollution from soil erosion. The nutrients is ingredient in fertilizer, it will flow into the river with rain or water surface. When those nutrient occur to accumulate in the river more, it will risk become to Eutrophication.

Workshop

Workshop for local communities, organization and youth regarding the impact of various activities. The number of attendees were 92 peoples. Mostly attendees were youths from education agency. Youths have interested about bio-indicator for bring to study in the further. Also, Government agencies and private sector, there are interested about impact from industry. They are ask the question to advisory board in Q&A part. Accordingly shown about awareness of attendees and youths. This respond it make us that they need to conservation and they still to love and cherish with Loei River of their.

Conclusion

1. The Ecological Health of Loei River was in the moderate level with impact of land-use.
2. From the workshop, local communities and youths were active and interested in river health with rising of environmental awareness activities are needed from the local government and University.

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The Value of Wetlands and What We Students Should Do for It —Take Hengshuihu Wetlands for Example (abstract)

Yiqing Hu
Wetlands International-China

The importance of Wetlands in the lives and survival of many species of wa-terfowl, as well as humans, are greatly overlooked. When I first viewed a wetland I was ten. Apart from it's lack of civilization and apparent vacancy, nothing else really stuck in my memory. The young me was unable to grasp the importance and crucial role that the wetlands played in the conservation of certain species. Last summer, I was able to visit Hengshuihu wetland reserve in Hebei during an internship with WWF China. The feeling and impression of wetlands was totally different from that of eight years ago. On the surface, the wetlands were just tall blades of grass standing in waist-deep water, with the occasional clearing with a few ducks wallowing in it. However, by taking a stick and parting the grass at the water's surface, my guide and overseer showed me an entirely new way of looking at this ecological marvel. This time, what we (my director and me) saw was not the empty, hollow world on the surface, but a refined ecosystem, overflowing with the quiet energy of life and possibility.

I also learned the sad part of the story—that these alcoves of hidden wonder and life were receding—how they were being demolished in the path of human industrialization. Upon that, I asked myself, and beseech you to ask yourselves: Do we not have enough factories already? Enough sources to pollute our water, poison our air, corrode our soil? Can we pause in our relentless pursuit of domination and glory, simply because we need some place, some time, to take a break? I realized the pressing need for me to take actions after coming back to the city.

- Made presentations at class meeting and association events to raise my peer student awareness and also argue with them the true values of wetlands.
- Reused water for multiple purposes at home, and passed on such knowledge to a larger community for water saving.
- Became very outspoken and advocated about wetland protection.

However, my actions for conservation alone were not sufficient to raise public awareness, but, as in the wetlands, a drop of water can cause a ripple, and that ripple can grow.

At end of my presentation, two suggestions were made for conservation. One is that relate governments should formulate sound policies and provide sufficient funds to wetlands conservation, while international organizations contribute to technical assistance. Second, more researches should be conducted for waterfowl diet.

Therefore, different food should be prepared at various stop points along the flyways. Finally, I also call for environmental protection. Mother earth is our host, and we are simply organisms living in or on it. If we begin to destroy our host, much like viruses in a human body, our host will react accordingly to expunge us. Either the virus kills the host, or the host kills the virus. No matter what, in the end, the virus dies. In order for our survival, and the survival of our future generations, please—don't hurt our earth.

My Observation of Status of Wetland (abstract)

Wenling Kou
Beijing University Affiliated High School

My hometown is in Inner Mongolia, China. Every year, I go back to my hometown and visited beautiful wetlands there. I think that what makes the grassland so beautiful is because of it has a lots of lakes and zigzag rivers moisten it. When I was a tiny little girl, the definition of wetland in my mind is simply water and land mixed together. But when I grown up, I found that wetland is may not just a place, but an important ecosystem. There's a lots of different kind of bird inhabited there. Through my observation, I found that there are thousands of birds inhabit in Inner Mongolia wetlands in Spring and Autumn. So teacher told us that the wetland also called as "The cradle ofbiodiversity."

I grown up in Inner Mongolia where famous with vast and beautiful grassland of thousands of wetlands. I've seen changes of some of the wetland reduced the size and water level is lowered, and some of the beautiful birds reduced the population compared with what I saw in my childhood, thus it really impressed me greatly. Then I decided to do some observation under the guidance of my parent and teachers in the school.

Through my field observation, I found that there are less birds and some of the wetland and riverside covered with garbage and plastic bags. I feel sad and would like tofind out the threats to wetlands in my hometown by observing the wetland during weekend and school vacations with the help of my parent and interview local people in and around the wetland. I found that the main problems that threat the wetlands are as follows:

1. Objectively, the Nino phenomenon leads global warming.
(I have the analysis of the temperature in a wetland nature reserve, It's a broken line graph and I can show in my PPT).
2. Artificial factor:
1) Large area of land reclamation (Not just only wetlands, but also grassland).
2) Over grazing. The amount of livestock in the natural prairie is increasing in recent years by local herdsmen;
3) Mining activities;
4) The construction of the industrial plant, wastewater is discharged into nearby rivers and wetland without proper treatment;
5) Urbanization takes up wetlands
6) There may be lack of proper coordination in different government offices involved with the utilization and management of wetland resources;
7) Conservation of wetlands outside the nature reserve are some what ignored.
(All of the following will be supported by examples and data and all of the data is my own personal interview of local people).

Every year, when I goes back to my hometown, the first thing I am going to do is always cleaning the garbage on the wetland, and talked to local people to explain the importance of protecting wetlands. But I think I should do more, I have some idea about how to do more to protect wetlands by our teenage:

1) Increase the awareness of the publicby informing them the important functions of wetland played for daily life of human livelihood;
2) We will make wetland information connectivity through the Internet.
3) Publicizing the relevant laws and regulations of the protection of the wetlands and strengthening the enforcement.

I believe that when I grow older, I will have more insight of wetlands and I hope I can do more to protect wetlands to make the world a Better place to live!

Obligation to the Wetland Conservation of the Youth (abstract)

Ruichen Zhang

Beijing No. 14 High School

It is a great honor to be here to talk about the significance of protecting the extinct wildlife. My name is Zhang Ruichen. I am a student of Beijing No.14 High School and passionate about field research, which I regard as lifelong ambition.

I've taken part in field researches for 6 times, and have been to many places with the teenage field research expedition teams. Monitoring ecosystem of Tonle Sap Lake was my first experience about such activities. For the first time I felt the difficulties of doing fieldwork, and appallingly, the living condition was worse than I had thought.

One year later, since I accumulate more knowledge and experience, I decided to go to Peruvian Amazon rainforest (flooded forest) in order to assist local scientists there, as Amazon is my dream land since I'm a little kid. During the filed research volunteer expedition I spent on Amazon River, I finally learnt how to co-operate with others as a whole team, and on the other hand I tried to help the scientists as much as I could, also simultaneously learn the knowledge as much as possible. During this expedition, I first seriously consider the field research as my future job.

Last summer, I went to Alaska and it's really a magical place. The indigenous plants the animals and the environment really influenced me from inside to the outside. As we travel along the Dalton high way, we ran into a number of animals and also saw large oil pipes along the whole state, which worries me since the place is supposed to be a habitat of these animals. I wonder what would happen to the place when we don't need these pipes any more. It is nearly impossible to remove these pipes. There is little we can do if the oil leaks out and causes a catastrophic outcome. We also find some proof that our planet is getting warmer and warmer. It was the first time that I realized that how powerful the nature is and how tiny the human are.

If I have to describe the condition of the wildlife protection, I would say it is pessimistic. Dozen of species are dying out every day as result of human activities. For example, the Northern White Rhinoceros is announced to be functional extinction in May 2016. There are less than 30 individual harbor porpoises surviving in this planet. All of these is associated with human illegal capture activities. In another word, monetary motivation.

Some one may disagree with me because you may know that our ancestors, the homo sapiens, also caused massive wildlife extinction. Their action is due to their lack of knowledge and the hunting instinct. But in 21 century, we already know the the consequence if we don't protect those amazing creature which have the same right to live on the planet like every human beings. Some of us slaughter them for huge profit and most of us do not have the consciousness to protect the animals let alone put efforts to change the situation. To make things worse, as a high school student, I know that most school do not pay much attention to such subjects which educate young generation the right concept and conduct to protect the ecosystem. Nowadays majority of students can do nothing but shout out slogans. That is why I believe popularization teenagers' environmental education is vital.

It is only by doing so that our planet can be a better place for human being. It is never too late to save what we still have. Extinction is not eternal.

The Youth Frontier Transforming Waste to Wealth – A Case of Novel Efforts by Young Entrepreneurs towards the Struggle for Depolluting the Holy River Ganges (abstract)

Sreeya Patnaik

Xavier Institute of Management, Bhubaneswar

Wetlands are among the most productive ecosystems on the planet, providing an array of ecosystem services that are vital for survival and wellbeing, hence forming a web of life. Today, the rate of loss and deterioration of wetlands is a matter of concern for all regions of the world. According to Wetlands International, wetlands are on the "front- line" as development pressures increase everywhere. This is likely to intensify in the coming decades due to increased global demand for land and water. The need of the hour is the willingness to make significant contributions to help prevent wetland loss and achieve effective restoration. Inculcating ideas about the importance of wetlands in young minds goes a long way in creating huge differences. Instilling into the students minds, the complexities and consequences of continued unprecedented loss of wetlands shall render deep understanding and collaborative efforts. This will not only encourage them to act as ambassadors for wetland conservation and restoration, but to share their views and knowledge with others in their communities. Today, the motivated youth are becoming responsible environmental stewards through their participation in wetland restoration. It is heartening to see a surge in startup companies driven by young entrepreneurs coming up with innovative ideas for successful wetland restoration. The inspiring endeavor of one such budding young entrepreneur to clean River Ganges is quite commendable. The Ganges, the third largest river in the world in terms of water discharge into sea, is India's holiest river and is deep seated in Indian culture and ethos. It supports the livelihood of more than a massive 500 million and cradles some of the rarest species on the planet including the critically endangered, Gangetic dolphin. Unfortunately, this vibrant River is now considered as the fifth most polluted river in the world, gasping for life. Over the years, the Government of India has been investing in cleaning and restoring the river that serves as a labyrinth of life.

However, this is an onerous task that calls for substantial collaborative efforts over time for its success. Recently, two 26-year-old entrepreneurs have emerged with their innovative and creative solutions to join hands with Government to clean up 80 million tons of floral waste dumped every year in to the river every year by devotees, which is posing serious eutrophication problems. Their startup company "Help Us Green", currently collects about 9.5 tons per month and converts these wastes to wealth. They not only remove the floral waste from the River but process them, to produce incense sticks and manures, while providing employment opportunities for 1,200 rural families at the same time. Inspired by the success, they now plan to scale up the collection and processing of flower waste to 15-20 tons per month by 2019. They are also working on expanding their product line to more products to make the effort more credible and replicable. This case demonstrates a sustainable innovative solution to the restoration of an important wetland ecosystem. There are many other inspiring stories of thriving endeavors towards the Ganges restoration, which truly highlight how the youth are emerging to be the future guardians of our wetlands. Today the youth have been doing wonders through their contribution to wetland and environmental conservation.

Whether we talk about pollution, waste management or eco-tourism, they seem to have solutions for all. With the prodigious growth of urbanization and water scarcity in developing countries like India, these startups can become a much-needed panacea for successful wetland restoration.

Can Youth Help Wetlands? (abstract)

Fumi Kasahara, Ibuki Kurumatuka

Osaki Ikimono club

We were working in Osaki city, Miyagi prefecture. There are 3 Ramsar Convention wetlands in Miyagi prefecture. 2 of them are in Osaki city.

Osaki city has many natural environments such as about 20,000 rice field and vast forest.

We belonged Osaki Ikimono Club.

It belonged to about 200 members, and went to the wetlands and the river and forest ,rice field in the city and was learning about the creatures once a month.

When we are studying plants, we pick and deep-fry edible plants. These experiences were very precious.

We presented what we learned to people living in prefectures other than Miyagi as well as people living abroad and exchange opinions on the matter. We went to many Japanese regions such as Tokyo University and Fujimae mudflat in Aichi prefecture.

The places we went abroad include Thailand and South Korea. We were surprised to learn that some species that are rare in Japan are sometimes common in other countries. In some places abroad, building man-made roads and water channels are forbidden to protect the ecosystem. I was amazed by their strong mindset to protect the ecosystem.

We are doing activities to make biotope near the rice field. We want to increase the number of creatures living around paddy fields and want to help. So we started making biotope. The beginning of that was one of the plans we thought at the workshop held in Toyooka city was the idea of making a biotope.

Before making a biotope, we first discussed what shape a biotope would be. After that, we decided the shape based on our opinion and started to create it. The place to make first grew grass, so we started digging after mowing. Digging the rice paddy under the scorching sun was difficult.

In biotope, we are doing creatures research. It was a glad to see that the types found each time we surveyed increased.

Through making biotopes, I felt that human power is necessary to protect paddy fields and creatures living there. In order to protect paddy fields, I think it is important to investigate and understand the present condition of the rice paddy now. Actually digging the rice paddies and conducting surveys allowed us to feel the rice field closer than ever. I began to think with a sense of realization that we should seriously think about the idea about the environment that was only finished with knowledge. Because rice field is an important place to connect nature with us.

I live on a remote island called Ama in Shimane prefecture. The people of Ama do rice field work, but not many people are interested in learning about animals. Furthermore, there are not many people who are researching the animals in Ama, so there are still many things to do. Thus, I want to utilize what I learned at the damp grounds in Miyagi and present what I learned to the local people of Ama. I want to be able to inform people of the importance of the ecosystem.

The Study of Grey Water Footprint of Inorganic-Rice Cultivation for The Lower Central Plain Management in Thailand: Case Study in Nakhonchaisi District, Nakhon pathom Province (abstract)

Nichakant Kerdnamchai, Werachat Chatpanyacharoen

Faculty of Environment and Resource Studies, Mahidol University

The lower central plain of Thailand is one of the plain areas that suitable for rice cultivation because of the suitability of geography and the productivity of water body. The area used for rice cultivation is approximately 381,856.8 hectares. It is the third or 14.50% of land used in Thailand. (Rice Department, Ministry of Agriculture and Cooperatives, Thailand, 2016-2017)

By the rice cultivation, there are many factors that important for ri growth. One of the essential factors is the plant nutrition which is from natur or the form of fertilizer. A popular type of fertilizer in Thailand is chemic fertilizer. The trend of using them is increasing every year because ri cultivation is required more load of chemical fertilizers than other plan cultivation. Used chemical fertilizer and pesticide are estimated around 312. 375 kilograms/hectare (Department of Agriculture in Thailand). The informatio from Rice Department, Ministry of Agriculture and Cooperatives of Thailan has been shown that imported chemical fertilizers since 2005-2009 added u to 3.3, 3.5, 4.3, 3.7 and 3.8 million tons, respectively. Rice cultivation is one the most agricultural activities that occurred in the lower central plain. Henc there is much more load of pollutants contaminated in the water and drain into the natural water body and widely effect on the area.

This study focuses on the quantity of water, especially the grey wat footprint of inorganic-rice cultivation. The grey water footprint is one of wat footprint types. It is defined as the amount of fresh water required to assimila pollutants to meet specific water quality standard before released to th environment (A.Y.Hoekstra and A.K. Chapagain, 2011). The study area of th research is located in Nakhonchaisi district, Nakhon pathom province which the part of the Thailand's lower central plain.

First of all, the water samples in this area were collected 3 times related to land preparation phase, the first vegetative phase (15-20 days of rice growth), and the second vegetative phase (50-60 days of rice growth), respectively.

Then, all of the water samples were analyzed the concentration of Nitrate-Nitrogen (NO_3) at the laboratory. The Nitrate-Nitrogen concentration and some information that asking from the farmer about the amount of chemical fertilizer used in the cultivation area are 61.125 ton/hectare have been used for the calculation of grey water footprint. After the calculation, the result shows that the calculation of grey water footprint of the inorganic rice cultivation is 193.08 m^3/ton which is rather higher than the standard of Thailand's grey water footprint that is 116 m^3/ ton (A.Y. Hoekstra and A.K. Chapagain, 2010). It shows that chemical fertilizers applied have an effect on the grey water footprint. If the rate of using chemical fertilizer for rice cultivation is rather high, the grey water footprint will increase. It means that the volume of fresh water that used to dilute pollutants is also increasing. By the result, the grey water footprint can be used as the indicator for managing water resources in the lower central plain of Thailand to achieve sustainable water management.

Session 6

Wetlands and Sustainable Tourism

Promoting the Implementation of Environmental Treaties for Sustainable Tourism: In the Light of the Ramsar Convention

Shiina Suzuki

Post-Doctoral Fellow, Sophia University Graduate School of Global Environment

The presenter is post-doctoral fellow of Sophia University in Tokyo, Japan. The research field is international environmental law and one of the research theme is related to effective implementation of environmental treaties, including the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (hereinafter, Ramsar Convention).

My presentation focuses on how the Ramsar Convention recognize and organize "tourism", especially under the "sustainable tourism" in relation to wetland conservation, from legal aspects.

1. Introduction

"Tourism" plays a role of promoting economic growth employment creation, poverty eradication, environmental conservation and mutual understanding, and ultimately it is expected to be effective in multiple fields as a tool leading to peace. International Society has been working and struggle with issues related on tourism for a long time. Interest in tourism in the international community can be seen in the International Union of Official Travel Organizations (IUOTO) established in 1925 to promote international cooperation in the tourism sector. IUOTO was reorganized into the World Tourism Organization in 1975 and became one of the organization of United Nations (UNWTO) in 2003.

Recently, while many international agreements on environmental issues have been concluded, there has been growing interest in the relationship between "wetlands" and "sustainable tourism".

For example, the UN approved the adoption of 2002 as the "International Year of Ecotourism" and 2017 as "International Year of Sustainable Tourism for Development". In 2015 the Fourth Strategic Plan adopted at 12th of Conference of the Contracting Parties to the Ramsar Convention mentioned tourism as one of the sustainable elements for the wise use of all wetlands.

In addition, at the 69th General Assembly of the United Nations in 2017, resolution 69/233 on promoting sustainable tourism, including ecotourism, eradicating poverty and promoting environmental protection was adopted. The resolution recognized the importance of international tourism and recalled the theme of International year of 2017 and pointed out sustainable tourism will contribute to strength world peace.

Furthermore, the World Travel Tourism Council (WTTC) elected Okavango Delta (Ramsar Site in Botswana) as a Destination Award as a case of sustainable tourism in 2017. The reason of election, WTTC evaluated the fact that the Ramsar Site had guaranteed the maximum profit to the local people and at the same time kept it to the minimum impact.

2. Current Situation of International Environmental Treaties

There are no treaties directly targeting tourism. However, in fact, tourism is also an indispensable element to consider environmental problems. For that reason, some environmental treaties have articles related to tourism under the international environmental law.

In order to materialize the article, the related guidelines are adopted by using terms such as "tourism", "ecotourism", "recreation" and so on to achieve compatibility between tourism projects and environmental conservation. When applying the guidelines, it requires the four elements such as (1)nature, (2) economy, (3)society, and (4)culture to be in an appropriate balance.

3. Tourism in Ramsar Convention

The Ramsar Convention covers all the four elements (natural, economic, social and cultural) targets for wetlands and plays a role in connecting the local community and its outsiders, people who are not belong to local community. For example, government, companies, travelers, researchers and so on. It is necessary to consider the four elements of wetlands integrally rather than grasping each factor individually. The effect of combining all the elements, will create unique values of the area, which is necessary factor for sustainable tourism. In order to maintain its value, it is necessary to emphasize the role of the community.

Such recognition can be found in European regional conventions such as the European Landscape Convention and the Faro Convention, which promotes a wider understanding of heritage and its relationship to communities and society. However, recently not only environmental treaties, but also national conservation laws in each country are paying attention.

4. The Role of Local Community

In order to maintain unique wetland value for sustainable tourism, it is necessary to emphasize the role of the local community. For example, there is a relationship with the status of wetlands in tourism. If the wetland is Ramsar Site, the necessary conservation management based on the Convention will be carried out under the domestic laws of each country. Even for the unregistered wetlands sites, the State shall implement necessary conservation management according to the Convention as well. However, if there are tourism activities that cause wetland ecosystems to be adversely affected at unregistered wetlands sites, conservation management by the government may not be handled successfully.

In such a case, the opinions and experiences of local community, who knows what kinds of tourism activities will adversely affect wetland ecosystem is indispensable not only for wetland conservation but also for sustainable tourism (please refer to fig.1). Specifically, it will be possible to propose and pointed out from the local community to the government of that country that appropriate regulatory control should be carried out. This action of local community will build momentum to bring the government to make decisions to change the priority order of actions that they should take promptly, and leads to start various procedures for taking proper measures (please refer to fig.2).

From this aspect, the local community will play a role in leading to more desirable way of tourism. Regarding the point that participation of the local community also contributes to the tourism field, the Ramsar Convention responded and realized under the mechanism of "Communication, Education, Participation, Awareness".

As described above, in order to carry out sustainable tourism, it is indispensable to comprehensively grasp aspects of wetlands to be tourism resources and also participatory wetland management based on local communities is essential.

5. Effective Scheme for Sustainable Tourism

For sustainable tourism, the Ramsar Convention required to the State to give satisfaction to visitors through local special products, scenery which can be only seen in the area or experiences that can only be done in the local place. As previously stated, the active involvement and strengthening of diverse actors including the local community is indispensable, but only the active participation of local people is not enough. The sustainable tourism will need some support from economic aspect as well. Regarding this point, how to make effective use of local products and add the unique value to the local area? Talking about local products, the static products (eg. scenery, landscapes) and the dynamic products (eg. local vegetables, beverage) can be considered. Regarding the former, it is expected that it will raise valuable natural and cultural values by designating it as Ramsar Site or a protected area under domestic law. In Regard to the latter, geographical indication (GI) externally shows the unique value to the local area is one of effective schemes for dynamic products that boost sustainable tourism.

In the case that the GI is permitted under the domestic law, GI is trademarked based on traditional agricultural products and manufacturing methods and related ecological, environmental and traditional knowledge, and it is expected to produce added value. Therefore, the GI has the economic expansion effect, strengthening the production base of local producers and expanding profits, contributing to improvement of living environment of the local community.

However, some issues remain about GI, a question of how to treat products that are GI marked for sustainable tourism.

For example, traditional products, such as local foodstuff like vegetable including GI, clearly shows sacrifice environmental, cultural and economic values as added value and become one of the elements to purposes of tourism. In such a case, it is possible to positively make a GI and to sell at places other than the local (please refer to fig3/right side). On the other hand, there is a way to increase the number of visitors by allowing GI items can be purchased only in that area (please refer to fig3/left side). Which GI utilization is much suitable for sustainable tourism under the Ramsar Convention?

In this point, since the sustainable tourism what Ramsar Convention is supposed to include "bringing beneficial experiences to visitors", the latter, which the unique value to the products and tourist areas including GI as one thing, is regarded to be more appropriate to maintain sustainable tourism.

6. Conclusion

From the above, this presentation focused on how the Ramsar Convention recognize and organize "sustainable tourism" in relation to wetland conservation from legal aspects. There are two main points. The first point is active participation of local communities are indispensable for implementing sustainable tourism. Specially, when the government could not take wetland conservation measures promptly in case of wetland destruction caused by visitors, the experience of local communities will play important role. It will be possible for the local community to propose government for demanding appropriate regulatory control should be done by the government of that country.

The second point is a way to create added value of the area and increase the number of visitors by allowing GI items can be purchased only in that area will be much suitable for sustainable tourism under the Ramsar Convention. It should be noted that, although not elaborated in detail this time, even if the GI is not accepted by domestic laws, by taking advantage of the local community's best knowledge of the use of local products, it is possible to draw out the characteristics of local products, and it will lead to add some value to the product. It can be expected to obtain the similar effect as GI. For sustainable tourism, the way of showing the local items attractively makes similar effect to GI. As you know, local people are the best people who knows how to treat their own unique local items appropriately. They know how the local items, such as traditional local vegetables, should be cooked in delicious way. Even in Japan there are some cases, for example Lotus root in Nagasaki, which is not GI item but showing the local items attractively using the word "Miracle" or "Rare" ("Maboroshi" in Japanese) to describe the outsiders the Lotus root can only be bought in the area and show it high scarcity value.

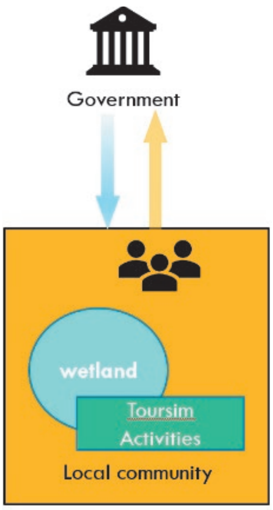

fig1. Outline of relationship among Ramsar Convention, Tourism activities and Local community.

fig2. The essential role of Local Community to boost sustainable tourism.

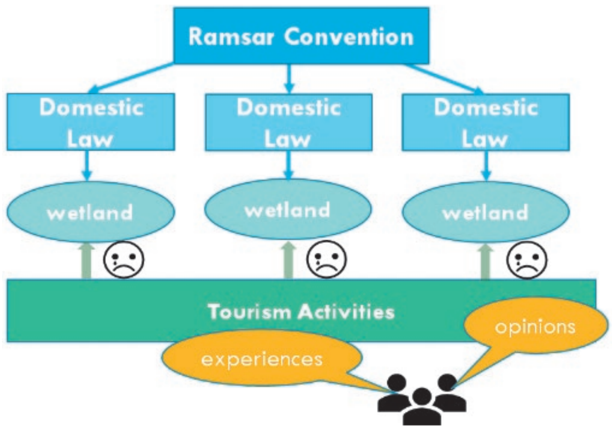

fig3. The suitable ways of using GI item to create suitable tourism.

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Integration of Visits to Crab Banks in Sustainable Tourism

Sansanee Choowaew

Wetlands Management Research and Training Center, Faculty of Environment and Resource Studies, Mahidol University

Crab bank is not a new approach, but has been practiced in many countries in Asia for several decades. This paper provides basic information about crab banks being operated by several coastal communities in Thailand; introduces some good case examples where visits to crab banks have been integrated in mainstream tourism programs; highlights potential contribution of crab bank visits to sustainable tourism; and suggests some other local livelihood activities which may be of visitors' interest and can be also added in tourism programs.

In Thailand, crabs, especially blue swimming crabs and mud crabs, are economic species important for local and national economy. Crab products are one of the important exports. Almost 100% of crab products are derived from natural capture. Along both sides of Thailand's coastline, the Bay of Bengal and the Gulf of Thailand, the decline in fertility of aquatic resources is of great concern. Total catch of blue swimming crabs 43,871 tons in 2000 sharply reduced to 28,296 tons in 2011. Besides the decreased fertility and amount of total catch, the average size of crabs caught was much smaller, reducing from 14 cm to only 8 cm. Major causes of problems are over-harvesting, commercial catch due to higher price of and market demand for egg-bearing crabs, and use of highly effective fishing gears such as collapsible crab traps, crab gill nets, and drag and push nets which can catch crabs of all sizes in large amount at one time.

The crab bank approach was introduced to the eastern coastal fishery communities along the Gulf of Thailand in the late 1970s and to the coastal provinces along the Bay of Bengal in the late 1980s. Since 2002, many crab banks have been established and are now being operated by many coastal communities in more than 13 coastal provinces and become widely well-known for blue swimming crab and mud crab conservation.

Most of crab banks are established and managed by local fishing communities with support from public and private sectors. All crab banks have common aims. Major purposes are restoring and increasing crab population, ensuring the future fertile crab stock, improving crab fisheries and increasing income from crab harvesting. To achieve those common aims, various different techniques and tools have been developed to be used for crab hatcheries, raising and fattening to suit different localities. Crab banks may be operated at different scales and sizes – from small, medium, to large. Designs and patterns of crab banks may be different, depending on locations, sizes, number of members, and availability of budgets. Different crab banks may use different methods and may have different conditions of agreements, rules and guidelines for crab bank members to follow.

In the most natural and effective method, when crab fishers catch egg-bearing crabs, they mark their names or symbols on crabs and release those crabs back to the sea. There will be no recapture, no selling, no buying for those crabs having names or symbols on, leaving them to spawn naturally in the sea and baby crabs grow in the sea, maintaining natural crab stock.

For the so-called crab banks, egg-bearing crabs are collected and donated by crab bank members, and raised in hatcheries of different types, designs and sizes such as floating nets, baskets, pens and cages, tanks and ponds. One female crab may lay 200,000 – 1,000,000 eggs depending on the crab size. After spawning or releasing eggs or brushing eggs off, mother crabs are returned to donors or sold, and the income is used by the crab bank for operating expenses, crab feeds, system maintenance, and common funds for crab bank members. New crabs hatch and baby crabs are raised, fed, and allowed to float back or released back to the sea. Survival rate is around 40 – 60 %. The increase in the juvenile crab population and crab catch rates was reported after crab bank implementation at several sites.

Crab banks have drawn attention of both domestic and foreign visitors. Several crab banks become tourist destinations and are included in tourism programs. Visits to crab banks are promoted by the Tourism Authority of Thailand and Provincial Offices. As part of public relation and tourism promotion activities, there is collaboration between relevant sectors, agencies, and local communities to organize study visits and technical trainings for specific and various groups of visitors, such as journalists, government officials and staffs, school children and youth, leaders and representatives of local communities inside and outside Thailand.

Some good case examples where visits to crab banks have been integrated in mainstream tourism programs are as follows.

The Fish Home and Crab Bank Learning Center, Bangsrakao Sub-District, Laem Singh District, Chanthaburi Province, has been established since 1999. At this Learning Center, there are regular visits of individuals and groups of visitors and tourists such as school children and teachers, community leaders and members, academics and researchers, media and press, and general public. The East Asia Department, Ministry of Foreign Affairs of Thailand ever brought the officials and staffs to visit this Crab Bank Learning Center to learn and to release crabs back to the sea. This Learning Center has developed learning curriculum and offers 2 days technical trainings for those who are interested in crab bank establishment and livelihoods of fisher folks. Visitors can gain at least 7 learning contents including (a) fish home; (b) crab bank; (c) local traditional fishing methods; (d) traditional processes and methods for preservation of aquatic resources; (e) local medicinal plants and herbs; (f) reed matting and handicrafts; and (g) sufficiency economy practices. Here, visitors and local communities have opportunities to share knowledge and exchange experience in crab conservation, crab raising and fattening. Local experts, crab banks leaders and members are resource persons and local guides. Local communities take part in community-based ecotourism management, integrating crab bank visits and other various livelihood activities in tourism programs. A 2-days/1-night study visit and experience sharing costs 600 THB/student from schools and universities and 800 THB/ person for general public. This cost covers hands-on practical experience, home-stay accommodation and meals.

Crab Bank at Kung Krabaen Bay Royal Development Study Center, Klong Khud Sub-District, Tha Mai District, Chanthaburi Province is a popular tourist destination. Many representatives of local communities inside and outside Thailand pay visits to the crab bank at this Study Center for knowledge transfer and experience sharing. Kung Krabaen Bay, a unique-shape bay of the eastern coast of the Gulf of Thailand, used to face with severe problems of continuously deteriorated coastal ecosystems and natural resources. After the Royal Initiative in 1981, the Royal Development Study Center was established and the fertility of ecosystems has been restored. Blue swimming crab, an economic species, has been under threats due to over-intensive harvesting. Crab conservation group and crab bank were established in 2004, under the leadership of active community leaders with collaboration and support from local fisher folks and Kung Krabaen Bay Royal Development Study Center. The purposes of crab bank are to increase crab population, raise awareness of fishers and villagers, and serve as a learning and demonstration site for fishers, villagers and the general public. Due to the high cost of electricity and electricity instability, sometimes baby crabs in hatcheries lack of oxygen and died. With the initial financial support from the Energy Conservation Promotion Fund, crab bank here uses solar cells (1,500 Watts) in order to save energy and cost for aerators in crab hatcheries and to ensure the survival of crabs being raised. Electricity cost saving is around 29,500 THB/year (approx. 33 THB = 1 USD). More importantly, the survival rate of the hatched baby crabs increased and more crabs from hatcheries are released back to the sea maintaining more natural crab stock and bringing more income and better livelihoods from coastal crab fisheries. This model has been shared with and transferred to other fishing communities at other localities in Thailand. The Study Center is a popular visiting site for local and foreign visitors. Educational materials have been developed and distributed for knowledge transfer. Contents include life cycle, biology and ecology of crabs, economic values, importance of and needs for crab banks, crab bank operation and management.

The Crab Bank and Sunthorn Phu Local Fishery Association, Rayong Province, is another site where visitors, tourists, and nearby fishing community members often come to learn and share experience about crab bank operation. The Sunthorn Phu Local Fishery Association was established in 1974 aiming at the conservation of aquatic resources. Due to the increase of crab fisheries, commercial catch of egg-bearing crabs, and the decline of crab fertility, in 1979 traditional fisher folks consulted among themselves, discussed with Fishery Department officers, and decided that crab bank must be established. Common agreement was set up. Crab fishers who caught egg-bearing crabs must donate some mother crabs to the crab bank. Mother crabs are raised in ponds for 1-2 days until eggs are released. After hatching, baby crabs are raised and released back to the sea. Mother crabs are sold and income returns to the crab bank for assisting crab bank members in needs. More than 20 crab catching boats participated as crab bank members. During the crab bank operation, more than 8,000 mother crabs were deposited in the crab bank. On average, a mother crab released 100,000 – 200,000 eggs. Crab bank members estimated that at the lowest rate of survival of only 2 – 3 %, crab population in the sea would increase by several millions. This estimation was confirmed by the increase in crab catching rate of 5 – 10 kg/day/boat. At the market price of 150 – 250 kg, crab fishers earned good income for their families and have better livelihoods. Awareness and participation of local communities in sustainable coastal resource use, conservation and restoration of aquatic resources, responsible fisheries, food security, and strength of community-based management capacity has been raised and developed.

In addition to the 3 crab banks described above, many study visits and study tours have been organized for specific and various groups of visitors and tourists at several other sites. For example, a trip to visit the crab bank of fishery community at Ko Teab Village, Pathiu District, Chumphon Province was organized by Chumphon Provincial Office in collaboration with the Tourism Authority of Thailand, for 30 journalists in Chumphon and other provinces as part of public relation and tourism promotion activities.

Crab banks have the potential contribution to sustainable tourism in various aspects. Crab banks offer attractive ecotourism and educational resources and are included in many coastal tourism programs. Visitors and local communities have opportunities to share knowledge and exchange experience in crab conservation, crab raising and fattening. Local experts, crab banks leaders and members serve as resource persons and local guides. Educational materials in various forms including demonstration models, leaflets and posters have been developed and distributed for knowledge transfer.

Visitors and tourists, not only benefit from knowledge and life experience sharing gained from locally developed methods in crab conservation, crab raising and fattening, but also experience local livelihoods and life style from home-stays and enjoy several delicious Thai dishes cooked from fresh crabs.

Several groups of domestic and foreign fishing community leaders and members visiting crab banks in Thailand have shown their interest and impression, found the trips were knowledgeable and useful, and indicated that they would apply the crab bank concept and techniques for crab raising, fattening, natural stock replenishing back home.

Meanwhile, local stakeholders benefits from knowledge sharing with visitors and their livelihoods is enhanced via the opportunity to improve source of income stemmed from their own biodiversity conservation awareness and efforts. Local communities operating crab banks take part in community-based tourism management, offering the Thai ways of hospitality. Crab bank tourism increases job opportunities and improve sources of income. A trip to a crab bank costs 700 THB/visitor/day – 2,500 THB/visitor/3 days, covering expenses for speedboat (400 THB/visitor), fresh crab (450 – 600 THB/visitor/meal), and home-stay accommodation.

Awareness and participation of visitors, tourists, practitioners, local communities, and public at large has been raised and developed leading to local collective efforts and actions for more sustainable community-based coastal resource conservation and management.

Benefits to visitors, local communities, and the overall ecosystems are based on local stakeholders' own awareness and efforts in biodiversity conservation. Crab bank tourism complies with the definition of '**sustainable tourism**' – tourism that meets economic and social needs while maintaining cultural integrity, essential ecological processes, biodiversity and life support systems. **Crab bank tourism** also complies with the '**sufficiency economy'** philosophy of His Majesty the late King Rama XI of Thailand.

Besides crab bank visits, other local livelihood activities such as rice farming, organic vegetable and fruit farming, animal raising, fisheries, aquaculture, and many others can form agro-tourism. Local wisdom, expertise, life experience, traditions, culture can form health tourism and sport tourism. All these forms of tourism, if are combined, added on, or integrated into the mainstream tourism programs may be of interest of both domestic and international visitors and tourists, increase values to their tourism activities, and can help enhance sustainable tourism, local livelihoods and sufficiency economy.

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Initiative by the Reformed Bird Hunters of Mangalajodi Marsh, Chilika Lake, India for Successful Conservation of Biodiversity and Sustainable Tourism

Ajit Kumar Pattnaik

Vice President, Wetlands International South Asia

Undoubtedly, the sustainable tourism can make a significant contribution to the conservation and maintenance of biodiversity. But, in reality, the success stories are few and are generally isolated covering individual species or relatively small areas of habitats. Successful case studies making comprehensive contribution to conservation of biodiversity on vast geographic areas are rarely found. Nevertheless, a few isolated initiatives taken up by the local communities and individuals showcased herein strongly demonstrate how their actions have led to a win-win situation resulting in successful conservation of biodiversity, adoption of sustainable tourism models and provision of viable livelihood opportunities. Initiative by villagers of Managalajodi located along the fringe of Chilika lake, India is one of such outstanding few example.

Mangalajodi marshes on the Northern fringes of Chilika Lake, a Ramsar site in India, is an excellent habitat for both resident and migratory birds. It has been designated as an Important Bird & Biodiversity Area (IBA). Mangalajodi marsh supports 97 species of water birds and 33 wetland dependent birds that includes 30 species which breed here. Black-tailed godwit Limosa limosa, (near threated as per IUCN Red list) is the flagship species of the marsh. Mangalajodi witnessed a remarkable journey from the indiscriminate poaching of birds to a responsible ecotourism site, steered by the local reformed bird hunters. Once known as an infamous poacher's heaven, Mangalajodi is now transformed in to an endless source of fascination for those, with the inclination to enjoy and appreciate the nature and biodiversity. In early 1990s, local communities used to indiscriminately hunt, eat and sell the meat and eggs of birds and had adopted it as a means of livelihood. 80 defiant professional bird hunters used to rule the area till 1997. With long persuasion of Wild Orissa, a local NGO and Chilika Development Authority(CDA), these reformed bird hunters abandoned poaching and adopted eco-tourism as a means of livelihood. They use non-mechanized small boats with ore, to conduct the tourist in Mangalajodi marshes. Now their earnings are much better than what they used to get out poaching. Most importantly now they live with dignity and left behind their bad image of poachers.

On observing the impact, the Chilka Development Authority adopted a direct action programmes with the Samiti to accelerate change. Membership of the Mahavir Pakshi Surakshya Samiti , grew from 9 to about 25. It holds regular meetings within the Samiti as well as with forest staff of their wildlife range, wildlife warden, water resources department, Chilika Development Authority, on various issues. They co-ordinate meetings with visiting scientists and biologists and also educate school children who take excursions to the bird breeding habitats.

The CDA supported capacity development training, provided binoculars & bird books to local guides and created minimum infrastructure for tourists. For safeguarding the marshes from pollution and disturbances to avian fauna, these reformed bird hunters used small non-mechanized boats with ore to conduct tourists. Most importantly the members can identify the birds with all precession. The income from support activities also enhanced income of the villagers. They realized that the protection of the biodiversity creates a sustainable livelihood. They joined hands with the Forest Department in protecting the area and apprehended poachers.

The case demonstrates how the reformed poachers can play a key role in containing poaching and conservation of biodiversity and create employment opportunity sustainably. The indicator of success has been the increase in bird population from a meagre, 4277 in 90s to 0.15 million in 2016 due to successful protection by the communities. Amazingly it has emerged as one of the best site for the wildlife photography. The average annual income of the local communities increased by 1000 US $ and migration out of the village in search of employment is also significantly reduced. To take this initiative to the next level, Indian Grameen Services(IGS) a NGO facilitated the constitution of Mangalajodi Ecotourism Trust (MET) in 2010. IGS in collaboration with MET developed cottages, dormitories and tented accommodation with dining facility, interpretation centre cum souvenir shop for the eco-tourist which are run by the local communities. For marketing and dissemination of information a website "mangalajodiecotourism.com" is developed. A conservation team involving the boatmen & guides is constituted within MET. The marsh is divided into six zones for regular patrolling and conducting the tourists. During patrolling and birding tours, they also keep a watch on the nesting sites and ensure that the area remain undisturbed.

Mahavir Pakshi Surakhya Samiti, has been the first community based initiative, which could achieve major success not only in containing poaching and conservation of biodiversity but promotion of responsible tourism. The community now clearly understand the connect between biodiversity & livelihood, which is key for sustainability. It is an excellent example, how community led initiative to conserve biodiversity can create huge opportunity for sustainable tourism and create livelihood opportunity for the communities.

Entry Fees for Environmental Services in Community Based Ecotourism: An Experience from Bishazaari Wetland of Nepal (abstract)

[1] Maheshwar Dhakal, [2] Chiranjivi Prasad Pokhrel, [2] Satosh Bhattarai

[1] Ministry of Forests and Soil Conservation, [2] National Trusts for Nature Conservation

Wetlands are the most attractive destination to national and international visitors to observe natural beauty, photography, jungle safari and many others. Wetlands productive ecosystems and produce provisioning, regulating, cultural and supporting services and their importance are wider than other ecosystem. Ramsar listed wetlands have additional values as these sites are combination of social, economical, ecological and cultural services of international importance.

The Bis Hazaari Lake is located in the Chitwan district, adjoining with Chitwan National Park, the oldest national park of Nepal, listed in the Ramsar site in 2003. The local communities largely for irrigation purposes use the wetland water. This wetland provides a habitat to mega fauna like tiger, rhino and elephant, and many national and international tourists visit to the site to observe these species on annually basis.

This paper aims to explore the community-based ecotourism initiated by the local communities at Bis Hazaari Lake in Nepal. Though the Chitwan National Park has a long history of ecotourism, the local communities of Bis Hazaari wetland initiated an separate entry fee to both national and international tourists. The entry fee is collected in the community fund first and used for lake cleaning, security of the tourists, development of observation site, development of foot trail and many others.

As assessment of entry fees, follow of visitors based on the seasons and their main attractions and activities were performed. An interaction with local community members and government officials were made on collection of entry fees as a part of environmental services and its impact on wetland conservation activities. The biodiversity profile and water quality observations are also performed during the study.

After an initiation of entry fee and its use in ecotourism activities, the income and livelihoods of local communities is gradually improved. The job employment opportunities in terms of nature guide, driver, and hotel entrepreneurs are constantly increasing. The National trust for Nature Conservation together with national park authority is provided training and exposure visits to local communities as apart of capacity building activities of ecotourism. Bird watching and jungle drive are the major tourism activities. Similarly, jungle walk along with nature guide is the most attractive activity to the area. The private sector is equally benefited from the wetland conservation activities. In the meantime, allocation of some government funding together with buffer zone activities is observed crux to sustain the ecotourism activities. Higher level of government ownership is in spiral to local communities to increase their participation. However, security of tourists from the wildlife attack is another serious concern to promote the ecotourism activities win the areas. Promotion and advertisement of the site could be another factor to increase the visitors number in the following days. Further study is suggested to understand the satisfaction of the visitors as their satisfaction is fundamental to increase the park entry fees. The coordination with local government agencies, private entrepreneurs, civil society organizations like non-profit organization are equally important and recommended for a long term and sustainable community based ecotourism in and around the wetland area.

To Bring Awareness of Appreciation for the Culture & Environment by Providing Low Impact Activities that Promote Conservation & Preservation through Socially Responsible and Environmentally Sensitive Interaction with People, Landscape and Ecosystems (abstract)

Kasimiro T. Taukeinikoro, Kelly Bricker, Nate Bricker

Rivers Fiji Ltd.

The Upper Navua Conservation Area (UNCA) is the first and only Ramsar Site in Fiji (Ramsar Site no.615). The Upper Navua River cuts a narrow gorge in the central highlands of Viti Levu, the main island of Fiji - the gorge itself is some 75 meters deep and 5 to 25 meters wide. The Ramsar Convention is an intergovernmental treaty and international cooperation it has however, approve to ratify the UNCA as a Ramsar Site despite being owned privately duwe to its importance in the conservation of one of the three largest drainage ecosystems in Fiji.

The UNCA Ramsar Site is 615 hectares and covers 200 meters on either side of the Navua River. It is the home to local and different endangered and vulnerable species of birds, reptiles, freshwater fishes and flora which are endemic to the Upper Navua and Fiji as a whole. A freshwater goby species is altogether new to science and is in the identification and naming process. Fiji has 17 endemic species of birds and 15 are found in Viti Levu and also found in the UNCA. Notable are the vulnerable pink-billed parrotfinch (Erythrura kleinschmidti), Kadavu parrot (Prosopeia splendens) and black- throated shrikebill (Clytorhynchus nigrogularis); near threatened masked shining parrot (Prosopeia personata); and endemic giant forest honey eater (Gymnomyza viridis) etc. The endangered Fiji banded iguana (Brachylophus bulabula) and endangered endemic sago palm (Metroxylon vitiense) are also found in the UNCA. The UNCA plays a critical and vital part in the conservation of biodiversity in Fiji and wider Pacific region. It is indeed a fragile ecosystem that must be handled with absolute care and any unscrupulous management could see the destruction of the environment and the extinction of our very own wildlife.

Rivers Fiji is an ecotourism and rafting venture operating in Fiji since 1996. It aims at combining the protection of the wetlands and the associated ecosystem with sustainable tourism. The company provides the local landowning units financial benefits with minimal impact to the environment. The essence of the company's operation is based on its vision which is "To enhance visitors and indigenous peoples awareness of appreciation for the culture and environment by providing activities that promote conservation & preservation through socially responsible and environmentally sensitive interaction with people, landscape and ecosystems which makes the Fijian Highlands so distinct and unique." Furthermore, the company operates on "leave no trace policy" which means that the impact is bare minimum that visitors never leave visible behind.

In its bid to actively advocate, promote conservation and the preservation of the UNCA Rivers Fiji continues to visit communities and carry out awareness programmes on environment protection among local communities and in schools. It offers river trips to local villages and schools, and carry out community discussions whenever possible.

Every year Rivers Fiji gives cash prizes for drawing competitions, essays and poster making to local schools on topics of conservation and protection the environment.

Rivers Fiji's positive contribution to the environment has impelled the Department of Environment (DOE; Ramsar Administrative Authority) to allow the company to sit in the National Wetlands Steering Committee and the Protected Area Committee which the DOE is the secretariat of.

Currently the landowning units profits from lease monies, and 10% of Rivers Fiji annual gross revenue as payment of land-use fees. Furthermore, Rivers Fiji assists the remote villages through free transportation, free medical evacuation and coordinating community medical clinics. Rivers Fiji continues to search for other low impact recreational, socioeconomic activities which directly and comprehensively contribute to the conservation of Fiji's natural resources and enhance the livelihood of the landowners.

Biodiversity Value of Meinmahla Kyun Wildlife Sanctuary Ramsar Site and Development of Ecotourism for the Communities (abstract)

Zau Lunn

Fauna & Flora International-Myanmar

Meinmahla Kyun Wildlife Sanctuary Ramsar Site, situated in the Ayeyarwaddy Delta Region at the rivermouth of Ayeyarwaddy River of Myanmar is designated as wetland of international importance on 2nd. February 2017 because of its prominant biodiversity values of about 190 species of birds including resident and migratory birds, non-avian species including mammals and mangrove species. The area of Ramsar site is about 50000 hectares including wildlife sanctuary and surrounding water bodies and islands. Wildlife Sanctuary is covered by mangrove forest and surrounded by Bogalay River in the east and Kadon kani River in the west. NgamannThaung and Kadon galay islands situated in the southern part of the Ramsat Site are important habitats for turtle nesting and migratory bird wintering grounds. Because of importance of biodiversity value and habitat, Meinmahla Kyun was announced in 1889 as Reserved Forest anf designated in 1994 as Wildlife Sanctuary anf declared as ASEAN Heritage Park in 2013. According to IUCN list, 13 bird species are threatened species including spoonbilled sandpiper. Among 29 species of mangrove, IUCN global critically endangered species, Sonneratia griffithii and global endangered species, Heritiera fomes can be found in the Ramsar site. 53 types of medicinal plants and 7 kinds of orchid species are surviving in the wildlife sanctuary. Among the mammal species, wild boar, otter, crab eating macaque, wild dog, wild cat are recorded. Irrawaddy dolphin can be seen in the surrounding water bodies. About 100 species of fish, 12 prawn and shrimp species and 9 crab species are recorded around the wildlife sanctuary. The site is only one strong hold area of estuarine crocodile, crocodylus porosus in Myanmar.

The important sacred site for the fishers communities, U Shin Gyi nat shrine and historic pagoda namely Myauk Tayar is also situated on the island. Because of good habitat for spawn and nursery ground for the aquatic organisms, the Ramsar site is also supporting daily income of local communities for fishing and crab trapping around the Ramsar site. Because of good fishing ground, many migrant fishers come and settle tempirarily and fish in the surrounding water bodies. The impoverishment of local communities, some impacts are being happened such as illegal logging in the wildlife sanctuary. To reduce impacts to the Ramsar site, development of livelihood in collaboration with local communities and concerned government departments is very important for the sustainability of biodiversity values, sustainability of livelihood of local communities and management of the Ramsar site. If there is no alternative livelihood develpment option for the local communities, to maintain biodiversity values will be difficult. The site is good potential for the development of ecosystem based tourism because of biodiversity value and accessibilty and included in the plan of development of ecotourism sites in the forest department. For the attraction of tourist, not only biodiversity values, but also daily livelihood of fishers communities is interested product. Kayaking trips can be arranged in the tributaties of wildlife sanctuary.

Therefore, development of ecotourism is very important for the sustainability of biodiversity values of the site and livelihood of local communities and that will support to the sustainable management of Meinmahla Kyun Ramsar Site.

Session 7

Wetlands and Culture

Wetland Culture in Conservation: Its Meaning, Concept & Application

Bishnu B. Bhandari

Nepal Wetlands Society

The primary objective of the paper is to make conceptual clarity on the concept and the meaning of wetland culture in the wise use of wetlands. It also attempts to identify some of its concrete and measurable contribution to the conservation of wetlands and associated resources on the ground. In order to address these issues, the paper has been structured around the following two questions.

1. After all, what do we understand by the phrase "wetland culture"? How is it different from the widely used phrase "culture of wise use"? Why we attach so much importance to wetland culture?
2. What are the existing activities that have led to the positive as well as negative contribution to wetland conservation?

Background: Culture has been frequently used for different purposes, at different times and at different places. It is also a loosely used term. When said loosely, it means imprecise and generalized. In other words, it is neither specific, nor exact. In order to avoid the confusion over the use of the word "culture", we are talking here only about the phrase "wetland culture". Therefore, in the article we are dealing **only with current behaviors** (knowledge, belief, attitude, norms & values, heritage, secular activities, traditional customs). Under no circumstance, are we concerned here with fine arts (music, taste, literature, abstract art, painting, sculpture & poetry), exclusive, popular & privileged cultures and civilization, refined culture, abstract arts, fossil culture, archaeological importance and so forth.

Meaning and concept: Culture means many things to many people and varies from place to place. In reality, it suffers from the lack of a common view. For example, in the context of Asian tradition, it is not uncommon to see examples of degradation in which some people favor conservation or restoration while other favor wise use. Still another group favor for education while some do not care about it at all. All these boil down to the point that there is a lack of consensus on the issue. Subsequently, there is no cooperation on the ground. This is because of variation in the way of life. Thus, is can be said that culture is a composite concept which can be elucidated by the following examples.

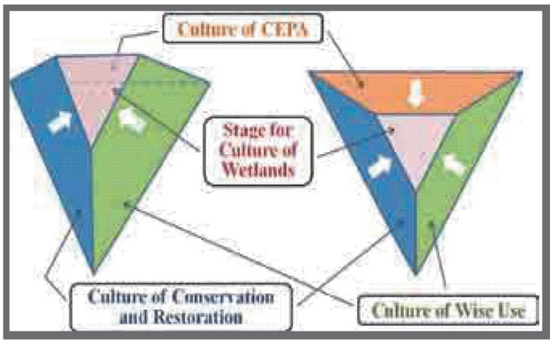
1. Banana is a good sign in Hindu culture. They use banana in all religious activities. But In Indonesia, **Pontianaks** (evil spirits) are said to live in the BANANA tree. If you want to protect yourself from one of these supernatural beings, you must thread a needle with red string and stick it into the banana tree (*Pontianaks: The Blood Sucking Female Vampires of Southeast Asia*. Available at *http://www.cvlt-nation.com/pontianak-the-blood-sucking-female-vampires-of-southeast-asia/.* Retrieved on 10 October 2017).
2. In South Asia, the big tree is considered the abode of ghost while it reified in Hindu culture. In Brunei, an old tree near a Field Studies Center is reported to have housed 400 species of insects.

Human actions produce culture. So, any human action that occurs repeatedly over time is called culture. J. B. Chitamber (1972) in his book titled *Introductory Rural Sociology*. New Delhi: Wiley Eastern Limited articulates that a human action that has been occurring in a wetland for a long time and used by the members of a society becomes culture and that is what we call culture. Therefore, we can say that

1. Culture is the patterns of learned behaviors and their products.
2. Culture is always dynamic or changing.
3. Culture includes products of learned behaviors (attitudes, values, knowledge, materials objects and so forth).
4. Culture is learned & shared by the members of the society.
5. Culture is transmitted among its members.

Therefore, man makes culture and culture makes a man. The lifestyles transmitted & developed by the people in a specific wetland area is called wetland culture. In order to further elucidate the point, the author has adopted here the definition given by Sasagawa *et al*. (2015). And it includes the "culture of conservation & restoration," "culture of wise us" & "culture of CEPA". This has been presented in a schematic framework, which is a conceptual framework for Wetland Culture.

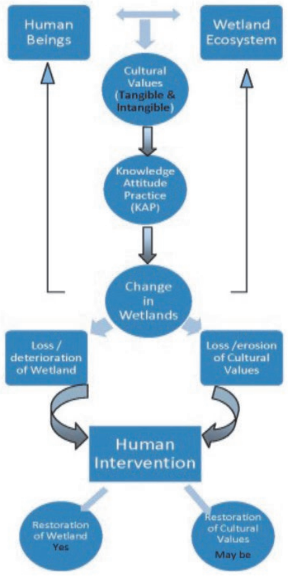
People are generally confused with these terms; therefore, we would like to put emphasis here that wetland culture includes all the culture of wise use, culture of conservation & restoration, culture of education". No need to be confused.



Source: Wetland Culture in East Asia by Sasagawa et. al (2015). Wetlands International.

The culture that occurs in and around a wetland site is called "wetland culture". The paper takes into consideration only the existing knowledge, religious belief, attitude, practice, norms & values, heritage, secular (non-religious) activities and traditional customs. Thus, wetland culture may contribute to both negative as well as positive conservation of the wetland site and associated resources. On the other hand, the "culture of wise use" and "culture of conservation" give rise to the meaning of only positive contribution to the conservation, management and sustainable development of wetlands and associated resources.

Therefore, the phrase "wetland culture" conceptually differs from the phrases "culture of wise use" and "culture of conservation" but intercept with each other as long as the former makes positive contribution to the conservation and sustainable utilization of wetland resources *(Source: Sasagawa, Koichi; Natori Yoshihiro; Joo Gea-Jae; Chen Kelin; Sansanee Choowaew; Sasaki Miki edited Wetland Culture in East Asia: A Lasting Legacy of Skills, Knowledge and Wisdom (2015); published by Wetlands International Japan)* .



Culture is the way of life, lifestyle & livelihood. This can be authenticated by this very example of rice. One dozen styles of rice preparation exist in Nepal. For example, Pulau, rice, latte, Roti, Khir, dahi chamal, Khatte and Lawa and so forth. There exists links between human action, culture & wetland loss (See Chart below). Because of this relationship, a wetland has to be always dealt with holistically, never in isolation. The term "holistically" implies both natural & cultural dimensions. Natural dimension means physical characteristics, adaptation, population, lifecycle, distribution, habitat, ecology, species, food habit, behaviors, reproductive behaviors, etc. Cultural dimension means human activities such as protection from adverse conditions, management, uses, care, raising, treating animals from disease, consumption, etc. In fact, these two perspectives are just like the two sides of a coin. One can't move ahead without the others.

Importance of Wetland Culture: Wetland culture is important because it catalyzes the conservation of wetlands as follows.

1. Creates social and spiritual energy and enthusiasm,
2. Strengthens the identity of the communities living about and around wetlands,
3. Attracts visitors, provide local income and contribute to local economy & conservation.

Example of cultural practices: The existing cultural practices contribute both positively and negatively to the conservation, management and sustainable development of wetlands and associated resources. A few of representative examples are mentioned below.

1. Those practices providing negative contribution to conservation include (1) dredging up of river, (2) inappropriate methods electrification and even poisoning virtually kill every aquatic species available there, (3) religious bathing and dumping of religious remains including idols in wetlands at the end of the festival and (4) Overfishing is worse than we thought. These are the examples of the non-judicious use of wetland culture. Because injudicious use threatens fish stock killing everything there meaning the loss of biological resources, depriving the fishermen of their daily bread & butter, making them without jobs affecting the children with malnourishment and consequently, all this leads to crimes in the society.

2. Those providing positive contribution are (1) sacred pond and people's collective work for protecting its sources at catchment and (2) rice farming like making terraces using stone wall, annually maintaining these terraces to stabilize soils. Below are the some of the examples of the existing culture of a wetland.

1. Urban wetland: Gahana Pokhari is one of the oldest ponds in Kathmandu, Nepal. Its water is used for humans (personal sanitation), animals and fire extinguishing. In the Pokhari, a festival is held once in a year in Nepali New Year. The activities include carrying the Chariot of Goddess Tuladevi for the search of the lost jewelry, worship, religious bath and even swim. Now this Pokhari is protected only for this reason. Otherwise, it would have, long ago, succumbed to encroachment, road widening & others. This tradition is the key to the conservation of the Pokhari, a human-made wetland.

2. Rural wetland: Rural wetlands (or ponds) provide multiple uses in rural areas. They are used for domestic purposes, personal sanitation, fire extinguishing, irrigation & fisheries. Local community do collective fishing, collective cleaning and removing invasive plants annually, fixing its boundaries and water areas when water dries. They also worship the water deity, Barun or Naga as symbolized by a vertical pole in the center of a pond. Rural wetlands are common in the Terai of Nepal.

3. High altitude wetland: Gosainkunda is a high altitude lake located at 4381 m. Almost 40,000 pilgrims thong there to take sacred bath. After the bath the lake is immediately cleaned. The lake is protected only for its sacredness. Now people have realized that it has biological importance such as breeding ground of the bar-headed goose & habitat of an endangered species, the Red Panda,.

4. Confluence of Superstition & Conservation: Kukurmara, a place in Assam, India is the safe heaven for Dolphin. According to the *Telegraph Newspaper* in 1991, a resident of Kukurmara had allegedly killed a Gangetic dolphin in the Kulsi river and upon returning home, he found his son dead under mysterious circumstances. The news had spread like wildfire and since then, the area had become a safe haven for the Gangetic dolphin- a species listed in the IUCN red list. Local fishermen and sand miners are very careful not to harm the dolphin while fishing. (Source: *Confluence of Superstition & Conservation*. Available at https://www.telegraphindia.com/1111027/jsp/northeast/story_14670945.jsp. Retrieved on 15 October 2017).

Bio-cultural Diversity and Flood Control in the Kameoka Basin Floodplain

Katsue Fukamachi
Kyoto University

The Kameoka Basin is located in the floodplain that lies at the entrance of the Hozu Gorge of the Katsura River in Kameoka City, Kyoto. The river flows from upstream areas in the northern mountains to Arashiyama in Kyoto and then on to Osaka Bay (Fig. 1). Under heavy rain, the area is subject to floods when the increased flow of the river hits the narrow bottleneck of the Hozu Gorge, and water flows back and overflows the upstream riverbanks. To counter the flood risk, local people have developed a number of flood control techniques over time. These include the construction of a sunken bridge that can serve during floods, or of intermittent openings in the riverbank through which part of the floodwater can be deflected.

The Hozu area, a place where people have always been making a living based on the close link between village, farmland, woodlands, and the river. The farmland has traditionally served as a flood-retarding basin, while the woodland has been serving as a source of water supply. Land use is closely linked to the local topography. Traditional villages have made good use of the local topography to protect themselves against floods. Villages are built on elevated terraces. Homes are surrounded by stonewalls, and bamboo is planted around villages, which is effective to keep off floods.

The floodplain is used as farmland. Here, water drains well, and the soil is fertile. The land is used in spring to plant rice. After the rice harvest in autumn, it is then used to plant wheat. Wheat from this area has come to be known as 'Hozu wheat.' Villagers maintain rice paddies both in areas next to the river, which are flood-prone, and on terraces that cannot be reached by floods. In this way, they make sure that rice can be harvested at least in one place. After having lived for centuries with both the threat of floods and the blessings of nature, the local people have contributed to the formation of a cultural landscape that is uniquely interconnected with the local river environment.

In the Hozu area of the Katsura River, there are many waterside features such as flats, rapids, and deep pools. Together with fluvial lagoons and links to the adjacent rice paddies, they form a diverse water environment, which has become an ideal habitat for many freshwater fish species. The habitat has become a major freshwater fish habitat even on a national scale. Approximately thirty fish species are found, including *namazu* or catfish, *koi* or carp, and *dojo* or loach. In spring, around the time when irrigation water is let into the paddies, the river fishing season starts. Fish such as *ayu*, *haya*, *funa* and *unagi* or eel are caught using fish baskets and eel traps as fishing tools. The fish are grilled, or dried on skewers and used as preserved food, or used to make fish stock. The riverside is also an important place where local children can play at the waterside and catch fish, thus getting in touch with nature.

Among fish species in the rivers and floodplain of Hozu, a large number of endangered fish species such as *ayumodoki* (Fig. 2), *ichimonjidanago* and *hotokedojo* have been confirmed. In the past, *ayumodoki* were widely distributed in Lake Biwa and in the Yodogawa river system. Today, however, there are only two habitats where they can still be found- one is the Hozu area, and the other habitat is in rivers of Okayama Prefecture. *Ayumodoki* (*Parabotia curta*) are designated by the Ministry of the Environment of Japan as a Critically Endangered species or IA in the Japanese ranking system. They are designated as a national treasure and protected species by the Ministry of Culture, and also figure on the Red List of the International Union for Conservation of Nature as a Critically Endangered Species.

Ayumodoki young fish mostly feed on plankton or algae. When they grow larger, they feed on small benthic organisms. Then, between June and September, they enter areas that are temporarily under water due to water increase in the river or due to irrigation of the rice paddies. Here, the fish spawn. As a strategy to conserve the species, it is necessary to conserve shoreline protective stonewalls in rivers and other waterways to provide grown fish a place to hide, to create trails that facilitate entrance of the fish to the temporary water area where they can spawn, and to construct sideways through which young fish can enter waterways.

Conservation activities are carried out at the local level and by professionals, and administrative policies are implemented by the city, the prefecture and the state. New developments in flood control technology are put to use. For example, the operation of rubber dams allows the formation of a water-covered area that can serve as a spawn ground (Fig. 3). Cooperation with the local farming community is very important. Local cooperation is also needed to deal with invasive species such as black bass, which cause serious damage since they prey on *ayumodoki* fish. Counter-measures are carried out in cooperation with the local scientific educational center and with the environmental education section at schools.

While urbanization has spread all over the Kansai area, the wetland environment of Hozu at the riverside of the Katsura River has up to now mostly preserved its locally unique culture and ecological system. The area is highly valued for having preserved its culture and biodiversity. Even though, lifestyles and the way local people make a living have changed. The number of people who are still involved in farming or forestry has drastically shrunk. Urbanization is advancing, and there are public projects aimed at improving flood security: the riverbed is excavated, and the riverbanks are raised.

Since the year 2010, significant changes have occurred in local land use, and the farmland located on the northern side of Kameoka Station has newly been designated for housing development. In 2017, Kyoto Prefecture decided to build a soccer stadium in the area. Fig. 4 shows the area as it is today. The ground is raised, and land rezoning takes place. The designated area includes rice paddies that are part of the habitat of the critically endangered *ayumodoki* fish. Activities and claims by citizens and professionals who fear that this project will damage flood security and disrupt the conservation of endangered species are still going on.

Already during the planning stage in 2013, a committee of environmental specialists was established with the task to study issues concerning the conservation of the *ayumodoki* species. The committee pointed out that it was important to maintain and continue farming the rice paddies, to improve wintering conditions, and to create new locations for reproduction. It also emphasized the importance of conservation activities by the local community or a conservation group.

Today, the wetland environment of the Hozu area at the riverside of the Katsura River is at a crossroads: Will it become a key location representing the biocultural diversity of Japan? Or will this unique cultural landscape and ecology be lost to urbanization and more public projects?

While we must be open to the changes of our time, we must also strive to find ways so that we do not lose the essence of the traditional wisdom, techniques and systems that have brought about today's precious natural features and the sustainable relationship between people and nature.

Our reaction to today's changes should not be uniform, rushed, or complacent. Instead, it will be good to listen to local people who actually experienced natural disasters, and to find closely fitted measures that can be carefully woven into nature based on scientific knowledge.

Fig1

Fig2

Fig3

Fig4

Influence of Wetland in the Culture of Bangladesh

Tapas Ranjan Chakraborty
PhD Fellow, Department of Environmental Sciences, Jahangirnagar University, Saver, Dhaka-1342, Bangladesh
Email: tchakraborty@oxfam.org.uk

Introduction

Culture is interactive result of ecosystem. Bangladesh is a land of wetlands; here cultural practices have influence of wetland. Presence of wetland is common in native songs of Bangladesh. The Bhatiali is the song of wetland. In the proverbs of Bangladesh presence of wetlands is very common and mostly because of the rapid changing character of it. Good number of names of people, place and institution are also after the name of rivers and other wetlands. Based on current and wave character of the wetlands the gender of the wetland is identified and it has reflection on the name of that wetland. The festivals are very season specific in Bengal culture and are mostly representing of the changing characters of the wetlands. The Hindu and other aborigine culture have god and goddess for the wetlands, the carrier of those god and goddess are wetland species. The communities who are living on fishing believe some traditional norms which have conservation value. In the Medir Haor areas of eastern part of Bangladesh 11 wetland species were found conserved because of the cultural believes. Sacred wetlands and land sacred due to adjustment holy wetlands are helping conservation of biodiversity; around 70 species of biodiversity were recorded from the sacred wetlands of the Medir Haor area. One third of the identified festivals of the country are related to wetlands; almost all the cultural ritual has use of wetlands. There is cultural acknowledgement and religious worship of wetland biodiversity. In the folk rhyme, folk song and folk ritual of the study area the presence of the local wetlands and rivers was found moreover common. Folk medicine of the wetland areas has the use of almost every floating weed and in chant the description of the hazards. The material culture and folk technology of the wetland basin is based on the aquatic biodiversity and are source of livelihood a significant number of inhibitors. The folk festival, belief and superstation of the fisher and the boatman are distinctly different from others; even in some cases the occupational influence is dominant than religious practice. There are sports that are for the celebration of livelihoods of wetlands. The bangle literature is extremely influenced by wetland and livelihoods in this ecosystem; many renowned novels and films are based on the life and livelihoods of wetland community. The character of water in wetlands is also a sign of weather and disaster assumption; climate change and environmental degradation are interfering the accuracy of the traditional knowledge. Some cultural practices also create pollution and over harvesting; also the folk food is a risk to the ecosystem because in some seasons they are over harvested. Wetland influences the folk language. Because to environmental degradation and other challenges wetlands are under threats. The community has been deviated from many norms, economic and social aspects have created many shifting from the norms and believes. Process and the customary way of the transformation of traditional knowledge is interfered.

Wetland in the daily life of a Bangladeshi

Bangladesh lies between latitudes 20°34′N and 26°38′N and longitudes 88°01′E and 92°41′E, lying between Himalaya and Bay of Bangle. The country has a very long history of human settlement, agriculture and water body.

Wetlands in Bangladesh include a wide variety of habitats such as rivers and lakes, mangroves, coral reefs and cost. There are many types of lakes in the country; beel, Haor and baor are large types of lake. Bangladesh wetlands have a wide range of ecological, socio-cultural, economic and commercial importance and values through their natural processes and functions which are known to provide a large range of benefits including provision of food, fiber, fuel, biochemical, flood control, ground water replenishment, shoreline stabilization and storm protection, sediment and nutrient retention export, climate change mitigation, water purification, support to biodiversity, recreation and cultural values.

The song, poem, proverbs, tells, story, novel, and film have presence of wetlands; many of them have are describing the wetland and many others using wetlands analogy and metaphor. The form of song 'Bhatiali' means song of low land. The boatmen sign the songs when on the boat. To fit will the wave action the vocal sound of the song has vibration and mostly the sentences are end with a long word. Many famous novels and films, like Tital Akti Nadir Name (Titas, is a name of river) is based on life and livelihoods of fisher community. Wetland places very important role during the liberation war of the country. Presence of river and large wetland made many communities inaccessible by the Pakistani Armies; that made the presence of wetland a must in the novels, drama, cinema, etc. on the independence of Bangladesh.

The diet of a Bangladeshi is made of the biodiversity of wetland. Rice and fish is the main food of Bangladeshi. The food habit of Bangladeshi is described as 'mache vateche Bangalee' meaning is Bangladeshies are made of rice and fish. There are many food festivals where many fishes or aquatic weeds are the main target item.

Boat race, swimming, etc. are common in monsoon. There are many Folktales festivals and religious festival for the wetlands. In the beel basin of the country there is warship on crocodile. Workshop of Tiger is common all over the country. Those are not associated with any religious form of worship. A group of people collect rice and other vegetables and money from door to door signing songs on tiger and a have picnics. Once Tiger and crocodile was common in whole the country, but now limited in the Sundarbans mangrove forests only.

Folk festival related to wetlands:

- Holy water day fair: The day when all rivers treated as holly as Ganges
- Torch of flower of Elephant Plan
- Cutting water and then feel sorry: Symbolic to the tension of the parents of bride. The parents cat water with a knife and treat water with flower and foods. It's a Hindu folk.
- Boat Race: Both in rural and urban form.
- Eating different herbs in the year ending: Literature refer that it was done to know the weather the next year.
- Crocodile worship: In the south west beel basin close to the Sundarbans

Religion in wetland and influence by wetland

In the religious minorities of Bangladesh, specifically the Hindus and other indigenous community worship wetland and wetland creatures. Biodiversity associated with different God and Goddess are treat as sacred and protected. Worship of those Goddess in other symbols is also common.

Water Goddess Ganga: Worship of net as symbol of Ganga is also common.

Goddess of snake: Its very common in the Haor and Beel basin. The goddess Bishari is also worshiped in form of mud pot having snakes around.

Sacred Plants and Animals and associateed Goddess:

Animal / Plant	God/Goddess/ Folk faith
Dolphin/ Crocodile	Ganga
Cobra	Monasha
Water Lily	Mariguli
Lotus	Durga/ Buddha
Water herb	Garoi
Bhat flower	Protect House
Water hyacinth	Krishna

Behula Laxmindar: Behula continues to fascinate the Bengali mind. She is often seen as the archetypal Bengali woman, full of love and courage. Behula is regarded as the epitome of a loving and loyal wife in the Bengali culture

Logos: Wetland and wetland biodiversity are widely noted in different symbols, signs, and logos. Cattle Egret is symbol of Bangladesh national airline. Bangladesh Police has boat in their logo, symbol of two major political parties of Bangladesh are boat and paddy. Many Public Universities have wetland sign in their logos. Jahangirnagar University has Water Lily flower, Chittagong University has Sampan, a traditional Boat.

National Anthem: the national anthem of Bangladesh has described the beauty of wetlands and also noted the sessional changes occurred in the wetland ecosystem.

Intangible cultural heritage of Bangladesh

Two of five Intangible cultural heritages of Bangladesh are of wetland origin, the Hilsha fish and Sital Pati. Wetland biodiversity specifically fish, aquatic weed and wave are common pattern for the Jamdani Shari. In the Mangol Shobhajatra fish are taken as symbol of good lack.

Hilsha (2017): National Fish of Bangladesh

Mangal Shobhajatra (2016): New year day rally.

Jamdani (2013) is a vividly patterned, sheer cotton fabric, traditionally woven on a handloom by craftspeople and apprentices around Dhaka.

Baul Song (2005): Baul poetry, music, song and dance are devoted to finding humankind's relationship to God, and to achieving spiritual liberation.

Sital Pati (2017): A traditional handcrafted mat produced in the low-lying villages of Sylhet, north-east Bangladesh. The art of making shital pati, which is weaved together with strips of a green cane known as "Murta", is one of the country's traditional practices and practiced generation after generation.

Study Area and Methodology

The assess the influence of wetlands in culture a study was conducted in the Medir Haor, under Nasirnagar sub-district of Brahmanbaria district. Medir Hoar is one of small haor in Bangladesh. Following are information collection methodologies:

- Community Consolation: Four consultations were conducted with the community
- Focus Group Discussions: Two FGDs (Fisher #1, Elderly People #1)
- Festival Calendar
- Key Informant Interview: Four knowledgeable individuals were interviewed.
- Review of literature (District Gazette)

Findings

Norms and believes

- Gangetic Dolphin is the carrier of the river goddess Ganga
- Killing of birds with chick is sin
- Killing the bird brain-fever is sin as the bird cry for sick wife
- Eating fry of snake-head fishes is not right
- Spotted snake-head is holly fish
- Turtle is forbidden for Muslims
- Spider has protected Prophet, and the water spiders are also good
- Skink are the aunty of snakes
- Fish is sign of good news
- No fishing in full moon and no moon

Tradition with local biodiversity

Many traditional things were found made from wetland biodiversity. Dhaincha, *Sesbania sp.* is used to made tradional crowns and ornaments used in marriage ceremony and other ceremony. *Schumannianthus dichotoma* is used to make the mat, Sital Pati. Nokshi Kantha is a type of embroidered quilt. The stitch arts in a nakshi kantha was found mostly the wetland creatures and life in a wetland. The wave and floating herbs are found very common. Alpona refers to colourful motifs, sacred art or painting done with hands and paint which is mainly a paste of rice and flour on auspicious occasions in Bengal. It was found that fish was a must character in the alponas. The fish is also believed as sign of good luck.

Sacred Wetlands and Grove:

Sacred wetlands are associated habitat are free from harvesting. The Anudpurer Mora, is an isolated land from the village, during the monsoon this village mound traded as island. The number of major plants and wildlife found in this place is 70 plus.

Dulkandi, is a holy tree locale in the middle of the wetland. During monsoon, it is the only habitat of snake, lizards and bats.

Conclusion:

Rapid urbanization is causing shifting or drying of wetlands. For many reasons people are losing their norms and believe. Documentation of those traditions and re-aware the community in many cases become urgent. The customary way of knowledge transfer is not enough now as there is a significant gap between the generations causes by the information technology and other technologies.

Scientific analysis of the ecological and economics values of the norms and believes on the wetlands can help community understand the importance and create a drive of re-learning and practice them.

People's Perception towards Wetland Culture: A Case Study of Dhimal Community, Nepal

Puspa Lal Pokhrel

Tribhuvan University, Kirtipur Kathmandu, Nepal

Abstract

Dhimal is an indigenous community of Nepal, whose lifestyle is dependent on wetland. A large number of Dhimal are traditional inhabitants of wetland dominated Jungle area in the vicinity of a popular urban center of Tarai known as Damak. This paper attempts to highlight the linkage between wetlands and cultural practices of Dhimal in Eastern Tarai, Nepal. Likewise, their perceptions towards the wetland have also been studied. Damak was colonized by the Dhimal and Meche community during the 1860s to clear the Jungle. Dhimal communities have unique wetland related culture, rites and rituals. Their culture and way of life have been threatened after the 1950s when Nepal Malaria Eradication Organization was established. Before 1950 pestilence malaria was prevalent in Damak municipality. During that period the people of mountain and hilly region of Eastern Nepal did not dare to colonize Damak by clearing the jungle for cultivation. Until 1965, Damak was opulent and extremely rich in wetlands and wetlands resources. Sufficiency of wetland resources and way of life of Dhimal community had been delightful. In recent years their cultural practices are falling at risk due to shrinking and disappearances of wetlands.

Introduction

Wetlands are the most productive ecosystem on the earth surface. From the beginning of the civilization wetlands resources have been providing a source of income and economic activities for human beings. The indigenous communities of developing countries like Nepal still live close to wetlands and rely on them to meet their needs (Pokhrel, 2017). Wetlands provide habitat for several species of flora and fauna living within different ecosystems. Human culture is guided by physical environment and surrounding natural resources. Natural resources provided economic activities for the local community, which gives various cultures to the people of different climatic region of the world. Wetlands have been and continue to be part of many human cultures in the world. The peoples who live in proximity to wetlands and their culture is linked to them as wetlanders (Coles and Coles, 1989). Distinctive environments influence the behavior and culture of people who live there (Hardesty, 1977; Moran, 1989). A wetland culture is an identifiable human group (either extant or historic) living in a wetland dominated geographic region and using wetland materials for a substantial portion of food supply, shelter materials, fuel or other critical resources (Kiviat, 1991)

Nepal is a small and landlocked country, rising in Asia, which is rich in cultural diversity. Nepal has an outstanding position in the world. Dhimal cast is categorized under the marginalized indigenous groups of Nepal. The Dhimal represents one of the oldest indigenous groups of Eastern Tarai. They have smallest population in our country. They have separate identity, unique language, peculiar dress and culture. They lie mainly in the Jhapa Morang and Sunsari Districts of Nepal. They have their own distinct identity and way of life. They have been sustaining wetland environment since ancient time. According to Malley (1907), Dhimal habitats is the marshy tract, formerly covered by dense malarious Jungle. According to census of Nepal, 2011 total number of Dhimal population is 26,298, which constitutes 0.099 percentage of the total population. Among them, 6572 population are settled in urban area. Remaining populations of 19726 are sheltered in rural area (CBS 2011). They are following nature religion (Prakriti Dharma). In other words, they are worshippers of nature who believes in supernatural powers.

Table 1: Trends of Dhimal population in Eastern Tarai

S.no	year	Population of Dhimal	source
1	1921	505	Record of British Sub-continent
2	1952	5671	Nepal Government on the basis of Mother Tongue
3	1961	8188	census report HMG
4	1972	10016	Members of the Folk-Life Study Team 1972/73
5	1981	13000	Key Informants
6	1991	16781	CBS 1991
7	2001	19537	CBS 2001
8	2011	26298	CBS 2011

Field Survey 2017

Before the establishment of Nepal Malaria Eradication Organization the fertile lands of Jhapa and Morang were popularly known and considered as "Kala Pani" a "deadly" malaria ridden zone where mountain people would definitely & easily die if they remain there for long time in summer seasons. According to Oldfield 1981, the Tarai region of Eastern Nepal, Jhapa and Morang were reported to be "extremely swampy with its pestilent climate, the most malarious and unhealthy districts". Damak also lies in this Malarial Environment. During the time, hilly people feared the malaria and painful and cruel environmental condition of Tarai. While the Tarai indigenous community, Dhimals were surviving the malaria. Jhapa and Morang were ancestral territories of Dhimal community and were "hyper endemic of malaria" until 1950's .

Earlier than the Nepal Malaria Eradication Organization (6 December, 1958), malaria was prevalent in the lowlands of Eastern Tarai, Jhapa and Morang districts. Malaria was the threat for the people who wished to settle in the Tarai. Because of the terrible and life threatening disease of malaria, the people who lived in Mountain and Hilly Region did not dare to establish colony in Tarai through forest land reclamation. Till mid of 1960s outsiders did not dare to exploit the dense forest land of Tarai, because of the presence of the epidemic malaria disease. According to various scholars, Dhimal were nomadic people at the beginning who used to hunt and gather animals and fish for their daily life. Afterwards, there was scarcity of land to hunt animals; they began to settle in specific areas. According to old generation Dhimal people; Rajarani of Northern Morang is the ancient and original settlements of Dhimal community. Before 1981, Dhimal community were concentrated mainly in 14 Village Panchayats of Morang and 13 Village Panchayats of Jhapa. Among them, ancient settlements of Morang District are Haraicha, Kaseni, Dangihat, Bahuni, Keraun, Bayarban, Belbari, Urlabari, Amardaha, Rajghat, Letang, Madhumalla, Babiyabirta, Gobindapur

Village Panchayats. Likewise, antique Dhimal's habitation of Jhapa are Damak, Gauradaha, Topgachhi, Parakhopi, Anarmani, Sanishware, Dhaijan, Duhagadhi, Shantinagar, Nakalbanda, Bahundangi, Jyamirgadhi, Dhulabari Village Panchayats. Dhimal communitty still like to live in traditional villages' mainly compact settlement where 15–30 houses accumulated together. Majority of Dhimal community enjoyed thatched roofed houses. According to rural local elders, thatched roofs are sustainable and environmental friendly credentials. They provide excellent insulation, keeping houses warm in winter season and cool in summer season. Among the Village Panchayats of Jhapa and Morang, Damak Village panchayat was populated and inhabited mainly by Dhimal communities before 1958. According to the old generation people of Dhimal, malaria was the most serious health problem affecting roughly 20% of the households of this area. Popular imagination before 1950 of Tarai as Kalapani and Kala Banjar (barren land) may have been drawn from the history as a malarial environment of Tarai. Dhimal community transformed these outwardly "deadly place or lethal and pernicious places" into their home. Dhimal community imbued Damak with their common cultural histories and identities. They made Damak a habitable dwelling place for all today's dense cultural landscapes. Now, Dhimal population reached 4980 in Damak Municipality.

Damak municipality is situated in the Eastern part of Jhapa district of Nepal. Total area of this municipality is 75.3 square kilometer (7513 hectares). It is located between two rivers Ratuwa in the East and Mawa in the West. Damak lies in Subtropical climatic zone. There are 10 wards including the largest tea garden in the Jhapa Districts. The municipality lies between 98- 232 meter above the sea level.

Methodology

The study has covered the 71 households of surrounding area of Dakini Kharkhare wetland. The wetland was divided into two zones- one within 1 km around the wetland and another of 3 km. Sample size was determined on the basis of statistical norms. According to the rule of thumb, if the size of sample is 30 or more, the distribution becomes normal and statistical test can be performed (Daniel & Terrel, 1995). Following the rule a quota sampling of 35 households in each zone was randomly used for household survey. The study area of 3 km around the wetland was determined by the help of Topographical Map 1991. Purposive sampling technique has been used for qualitative data collection. Households for the interview were selected by the lottery method. Data were collected from different map, Aerial Photo, Census Report, and Booklets. Data was analyzed and filtered as per need of the study. Sometimes, secondary data were supplemented by primary data in conventional and meta form, which is directly collected from field observations, household survey and interviews. Topographical Map Sheet 72 N/ 10, 1959, prepared by Surveyor General of India was used to find out the settlement pattern of Dhimal during the 1950s. Specific objective of the study is to assess the status of wetland related culture and perception of Dhimal communities.

Wetland Related Culture of Dhimal Community

Based on hearsay, the Dhimal castes worship the goddess Shaliwerang and Kaliwerang since immemorial. They believe that the goddess owner own their home. It is believed that by the end of mother sovereignty the goddess took shelter at the homes of Dhimal castes. During the period of shelter, the goddess was satisfied and happy with their support and devotion. The Dhimals were blessed by Shaliwerang goddess for the success on getting large quantity of fish during fishing. Likewise, the goddess Kaliwerang Devi also blessed the Dhimals for enough prey during the hunt and furthers no shortage of hunting. In addition, the goddess blessed them to preserve the wetlands rather than misusing them further. The epithet of goddess during the ancient period denotes that the Eastern Region of Terai is rich in wetlands, wetlands ecosystem, and aquatic biodiversity. Likewise, Dhimal community is found to be fully dependent on food, nourishing element, and economic activities on wetlands resources. The customs, rituals and cultures of Dhimals is based on wetlands and aquatic resources. The Dhimals state that they worship wetlands since the ancient to the present time, during the occasion of Ashare Puja (Dhangdhange fair) and Tihar (national festivals of Nepal or, Festival of lights). Dhangdhange fair is important festival of Dhimal which is celebrated during April, May,June and July (began 14 April Nepali New year and end Mid-July Asar month in Nepali Calander). This fair is celebrated in the local and regional level of Jhapa and Morang in different times and worship wetlands. During the Dhangdhange fair wetlands is worshiped from Tista River to Sapta Koshi River. Local level fairs were concentrated near small wetlands.

The places for bathing of Dhimals were near streams, rivers, ponds and lakes. They were made shallow well at the bank of wetlands. They call it as Chileghate in their Language. During 1970s, most of the Dhimal household members were bathed in Chileghate (bank of wetlands). Dhimal community has been enjoying in subtropical monsoon climatic region, therefore bathing became their daily activity. Women and children's used to bath and wash clothes on Chileghate before 40 years ago. On the other hand, male and boys used to swim on Holies, ponds and lakes. During the hot season of March and April, they used to swim on wetlands likewise, fishing was their hobby. At present, bathing place of wetlands (Chileghate) is seen only in few places. They worship wetland as a holy place. Therefore they cremated dead body in the bank of wetlands.

Table 1: Changing Pattern of Bathing Place (Chileghate) or Swimming

S.No	year	Households Bathing and swimming on wetland (Chileghate)	Time of the Year
1	1970	71	all year round
2	1980	62	all year round
3	1990	39	all year round
4	2000	19	all year round
5	2010	11	only on rainy days
6	2010	6	Only on rainy days

Source: Household Survey 2017

Table 2 shows that till 1971 whole family of Dhimal used to bath on wetlands. Every decade wetlands have been shrinking and their bathing activities also changed. During the period of 1970s there was favorable condition for their daily life

In the past, they use to go for excretion in open places downstream of Chileghate (Bathing places of wetlands). Now majority households have toilet. Dhimal communities were economically, socially, culturally and religiously depended on wetland environment from ancient time. There are many types of matrimony system in the Dhimal society in Damak municipality. They are Supari Bibaha (marriage by offering a betel nut), marriage by force, marriage by elopement and Magi Bibaha (Arranged marriage). Betel nut marriage and marriage by force were common till 1960s. Now days, these two types of marriage ceremony are completely abrogated by Dhimal society. They celebrated marriage ceremonies for one week till 1973 (2030 B. S). On behalf of bridegroom, on last day of marriage ceremony, neighbors go to wetlands for fishing and returned back with cooked fish as well as they request the guest to take fish with beaten rice, roasted gain and alcohol , after that the guests are seen off. This traditional culture clearly shows how the relation of Dhimal people is connected with wetland environment. Now these rites and rituals are forgotten by the new generations, due to depletion of fish fauna, shrinking and disappearing wetlands.

Table 3: Decreasing trends of wetland areas in Damak Municipality

S. N.	year	Wetland covered area (area in square kilometer)	Total area of municipality (area in square kilometer)
1	1959	44.03	75.3
2	1981	41.47	75.3
3	2016	9.05	75.3

Source: Topographical Map Sheet No 72 N/10, Survey of India Offices 1959, Land utilization map, 1982 and Google earth 2016

Wetlands are dynamic in terms of the area and shape. Change in wetlands area between 1954 and 2016 is given in Table 3. Total area of wetland has decreased drastically during the period of 60 years. During the 1950s, 58.67 percent of the total area was under wetlands. Now, 12 percent of the total areas are occupied by wetlands environment. The decrease is about between 1954 and 2016. Per year 8.1 percent wetland area has decreased. The shrinking and disappearing of wetlands has several consequences in fish population. Some species of fish have disappeared. The attributes of wetlands around this urban area have changed, which has changed the economic activities, cultures and food habit of native Dhimal communities. Till 1981 Dhimal people never used to go to the kitchen for lunch or dinner without fish and other edible aquatic fauna. This food habit is still in practice but in lesser extent. Dhimal people prefer fishing, bathing, and enjoying the beauty of wetlands. If they capture more fishes, then the middle and rich family dry or smoke them whereas the poor family surplus capture goes to the local market.

Table 4: Trends of Dhimal Population in Damak Municipality

S.no	Year	Households	Total Population	Remarkable sources
1	1954	305	1925	Aerial Photo 1954, Topographical Map 1959
2	1961	392	2744	KIS and FGD
3	1971	602	4214	KIS and FGD
4	1981	678	4900	KIS and FGD
5	1991	700	4962	KIS and FGD
6	2001	690	50015	KIS and FGD
7	2011	687	4980	Office of Damak Municipality 2017

Field Survey 2074

Table 4 shows the trends of households and population of Dhimal caste. According to old generation of Dhimal community and Key informants Damak was settled by Dhimal and Meche community during the 1860s to clear the vast dense forest. Till 1950 few patch of forest land was cleared for cultivation. Dhimal community concentrated these limited patches of land. Administrators of Jimidari and Patuwari system had long made efforts to settle the area of Damak by people for land reclamation. But endemic prevalence of malaria had discouraged the settlement pattern of Damak. Only Dhimal were surviving that lethal environment. According to Aerial Photograph on March 1954 (2011 BS) there were 416 houses that time. Among them 305 houses were Dhimal communities, remaining households were Kumal, Satar, and Rajbangsi, hilly cast were least in numbers. Since 1954 to 1981 the population of Dhimal has been increased at a faster rate. Then population growth rate has been decreasing. During the 1991 to 2011 Dhimal family migrated outside the municipality.

From 1975, wetlands have been filling and registered in government records as personal property, which is the major reason of shrinking and disappearing of wetlands environment. Similarly, human settlements densely concentrated upwards to the wetlands, which have created pollution of wetland water. Due to polluted water swimming and bathing habit in wetlands is being lost. Old age people, who has been bathing and swimming in Chileghate and wetlands, are suffering from skin diseases.

Food habits of Dhimal communities are also based on wetland resources. Most of Dhimal community has been domiciling on wetlands environment since beginning of their origin. Therefore, the environment determined their test on wetland resources. They prefer to collect different species of fishes, shells, snails, crabs and aquatic birds in their kitchen. Till 1970s, most households of Dhimal had cooked varieties of fishes in their meal. Fish fry, fish gravy and pickle of Sidhra fish were common in their lunch and dinner. During the mid of 1970s, there were limited fish market in surroundings of Damak Municipality. Money was scarce in majority of Dhimal people. But food grains were enough with the households. Fishmonger family who were under the poverty line, exchanged fish with rice to support their family. During the 1970s, 36 households had exchanged fish with rice with the landlords, money lender and wealthy person. Surplus fishes were dried and stored for winter. Every roof and courtyard of Dhimal households was covered with Chelangi (fish drying equipment). New visitors would easily identify the habitation of Dhimal community due to the smell of dry fish from a distance. Wetland cultures show cultural behavior, habit and religious observance that are adaptive and suitable in wetland environments. Following are the scenery of cultural practices:

Plate1: Fishing by hand nets and Groping

Plate 2: Children are swimming on Dalki covered (Paspalidium puctatum) wetlands

Plate 3: The researcher is also involved in fishing

Plate 4: Banner of Ashare Puja

Plate 5: Beating Drum in Ashare Puja

Above Images Plate 1 - 5 shows the real situation of Dhimal ethnic groups towards the wetlands environment. Dhimal community is a female dominated ethnic group. So, they are free to walk and do the work and their role is also supreme in their family. The images clearly show that all the household members are involved in fishing. School and college girls of Dhimal society are also engaged in capturing fish. Nature of resource harvesting is pastime fishing. They made the fish selling income as private money (Pewa) and used the money to lend to others.

Perception of Dhimal Community on Wetlands

Wetlands are identified and classified by the native community, based on soils types, hydrology, abundance of fauna and floral species. Native communities recognize swamps, marshes, oxbow lake, pond, lake, jheel and bogs as wetlands. Cattail marshes, toad rush swamps, Dalki Ghari (*Paspalidium punctatum*), muddy area and sweet flag areas are common images brought to mind by the term "wetland" for many, indigenous communities.

Dhimal community has a feeling that the *areas characterized by the presence of cattail and toad rush marshes, Dalki Ghari, Holi, frequent inundation, grassy area, shallow water above the surface for a sufficient period of time (6-9 months) are wetlands. Dola* is a word (in Dhimal language), which denotes to the permanent water logged area. For them it is the place where men can drawn up to neck height, impossible to plant paddy plough by yoke of oxen (*Bhasland*) and remains water constant. They take such kinds of swampy paddy fields, small ponds, *Holi* as wetland where they find Lesser Adjutant and enough waterfowls. It is that type of muddy land, which is rich in fish fauna and other edible aquatic life all-round the year where they are surviving and enjoying.

Findings and Conclusion

Findings: All the available resources and raw materials that the Dhimal ethnic group use in their life cycle rituals and they offer to the deities are obtained from wetland and the wetland environment. Such culture and rituals have been established as the real culture of Dhimals. In this way the Dhimal, wetlands and Dhimal cultures are integral to each other.

Conclusion: Whenever we observe the ancient settlement pattern of the Dhimal Community, their settlement seems to be settled at and around the wetlands areas. Their custom, culture, rites and rituals and economic activities are also strongly related with wetland environment and wetland resources. If we want to conserve their original fundamental culture, custom, rites, rituals and food habit, we must stop people from encroaching private and public wetlands. The encroached wetlands after 1971 AD must be snatched by the local level executive and it must be under local level control. The modified wetlands by filling them with soil and sand by land traders must be banned as soon as possible. As wetlands are the boons given by the nature, they must be utilized publicly for the maximum human welfare. This study shows wetlands as shrinking and disappearing, their daily life and culture have also been changing in the same way in the same ratio. Wetland cultures (the collective practices of wetland surroundings native community) evince cultural behavior, habit and religious observance that are adaptive and suitable in wetland environments. The Dhimal community of Damak (Jhapa) seems to be much more concerned than other communities regarding wetland conservation against degradation ad disappearing conditions of wetlands and aquatic biodiversity. Therefore for the entire conservation of the wetlands, its conserving responsibility must be given to the concerned Dhimal community.

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Session 8

Wetlands and CEPA
(Communication, Capacity building, Education, Participation, Awareness) **/**

ESD
(Education for Sustainable Development)

Building Capacity of the Local Communities Towards Conservation and Wise Use of Wetlands through CEPA Approach in Eastern part of India

Durga Prasad Dash
PALLISHREE

Bhitarkanika and Chilika lagoon are two important Ramsar sites along Bay of Bengal in the State of Odisha, India having international importance. It has increased vulnerabilities due to anthropogenic pressures and local issues. Along with these important wetlands, there are other national wetlands such as Ansupa in Cuttack District, Kanjia in Khordha, Haripur lake in Ganjam, Bahuda estuary in Ganjam District of Odisha as well as Srikakulam District in Andhra Pradesh, Devi River mouth in Puri District, Odisha, India where PALLISHREE has undertaken different conservation and wise use activities as a part of CEPA approach. Rapid declining of bio-diversity is occurring due to the high scale silting up in wetlands, detrimental practice of fish catch using different nets, massive deforestation in the catchments and very fast shifting of sea mouth. Apart from these, indiscriminate uses of chemical fertilizer and pesticides in the agricultural fields latter drains into the wetlands and thus polluting the water. Illegal construction of shrimp ponds has been increased by demolishing the existing mangrove forests and rice fields by the local community. Dumping garbage, plastics including industrial waste and urban sewage water into the wetlands are the other causes of increased pollutions.

PALLISHREE has mobilized financial support to undertake activities through CEPA approach to address the issues, since the last two decades. Japan based support agencies such as JFGE, KNCF, NALAPO, TOYOTA, AEON and JWF and Ramsar Center Japan has played important role in extending both technical and financial support to implement various programmes.

There was a phase when PALLSIHREE has to face.

financial challenges in continuing its work with the same approach in the same thrust areas, while the other contemporary NGOs has shifted their focus to other issues, which was easy to raise funds for their NGOs at that point of time. But PALLISHREE continued on CEPA as its core focus areas of work. As a result, PALLISHREE got recognition as a state level resource NGO in the sphere of CEPA. Later on, it organized a pioneer network called as NET-COAST involving other local NGOs and Conservationists in the east coast of India.

PALLISHREE has promoted 52 Centers of Environmental Awareness & Education in the local schools. Further it has facilitated building capacity of its students, teachers and other stakeholders. These centers have been acting as the focal points. The messages have been passed by the students to their families and further percolated to the respective communities. The role of women and its participation in the conservation activities has always been given paramount importance in the CEPA approach.

The stakeholders could understand the necessity of conservation of mangrove forests in their area through experience sharing and exposures. The stakeholders have started planting mangroves on the shoreline of the rivers to control erosion. Fifty hectors of mangrove plantation has also been generated in this area. The villagers have also been motivated to regenerate degraded forests through participation. The programme is effective for free watch and ward to save the plants from the local cattle damage as a share of contribution to the project. The demand of mangrove forest creation has been increasing in the locality and people have started planting mangroves in their own lands. Now a day the shoreline of river Hansua is causing massive erosion due to the effect of climate change and causing havoc among the stakeholders. So the local villagers including students have planted Nalia grass (*Myriostachya wightiana*) and mangroves which is a ecosystem-based solution to the problem. Nalia grass is an economically viable grass used in making handicrafts and household articles as a livelihood for the local people. Apart from the 30 hectors of land has been planted in 72 schools and temple campus involving students and teachers in the project area.

The organization used to carry out several fieldbased activities involving different stakeholders under CEPA approach. Some of are as follows.

Communication: Publication of Books on birds, fishes, plants and eco-system in general. The other communication materials are posters, booklets, leaflets and news letter. A quarterly newsletter in local language namely UPAKULA has been published and circulated among the local schools, women groups, youth leaders, natural leaders, Government officials, etc. and the materials for the newsletter have also been generated through experience sharing with them. It has a very good impact as a people's voice in the community as the different case studies, innovative ideas, bio-diversity conservation, and local climate change related issues and the coping mechanism etc. is communicated. Apart from these the wall paintings displays the local issues and its solutions in pictorial form. Wall paintings have played a major role in raising awareness among the local people. Wall paintings are found to be very powerful tool of communication, which attracts the attention of people to the present sensitive issues of climate change. Thrust has been given on the visuals as the colorful painting with very small and catchy slogans. Specific themes depicting climate change education have been painted at prominent and strategic places to generate awareness among the villagers.

Followings are the activities facilitated by PALLISHREE in its CEPA programme in the State of Odisha, India.

Capacity building: Organising various training programmes for the students, women and community leaders. Workshops were also organizing involving different stakeholders, community members and local NGOs/ CBOs periodically. Women SHG members were the integral participants in all these workshops. Besides, it also organise nature camps, through the school children and local youth members get organized to learn about nature/ ecosystems and environment.

Education: Class room education has been provided to the students regarding conservation and wise use of wetlands. The facilitator used to provide sessions four times in each week. The curriculum of SUPW (Social Useful Productive Work) periods was redesigned based on the CEPA programme in these schools. In each targeted school an environmental and education center has been established. The school authority has donated one room for this opening of center in their school. It is a learning center for the students as well as community at large. The following activities are being organized in the center for education and creation of awareness.

The students preserve different species of fish, crab & prawn and kept for display in this center.

The students collect of water & soil samples, seed, different feathers of birds, scales of small creatures from the wetlands and display in the center.

They do water quality monitoring & bird watching in wetlands and record them.

The students prepare and display different models on rain water harvesting, soil conservation methods, conservation of wetland and its watershed etc.

They prepare plant nursery and also planting them in the school and community land.

This center organizes Student rally on environment related issues in the community.

Celebration of different Days like World Environment Day, World Wetlands Day, World Earth Day, World Water Day by the students in the center.

A news letter is also published quarterly.

After orientation, the students could maintain Bio Diversity Register & Climate Change Register in the center.

Resource Books, posters, leaflets and booklets are being printed and distributed by the students. These were also available in the center in the library.

Environmental related Audio songs are also prepared in local language and spread among the community.

National Environment Awareness Campaign is being organized every year by the support of Government.

The herbal garden & plantations are being organised in the school campus by the enter.

Training programmes for the stakeholders are being organized on energy saving lifestyle every year.

Participation: Demonstration activities were carried out in these schools providing ample opportunity for participation of deferent stakeholders. At the community level local fishermen were involved in a similar process. Organic agriculture practice is one of the key components which has played as the preventive and mitigate adaptive measures in climate change scenario. Fortysix women (two from each SHG) have gone under TOT programme and they again imparted training to other 321 members of 23 numbers of women SHGs in 23 villages. They have been practicing organic agriculture through production of preparing compost from water hyacinth, other wastes and bio-mass. Sixty hectors of land have been cultivated by adopting organic agriculture and fetching a good economy.

Short term fish culture practice in the paddy fields have been demonstrated by the community as demonstrations. It is an innovative activity of the project and some villagers come forward to adopt it as pilot basis. This activity is both environment friendly and provision of livelihood support to the rural poor farmers. It has already been replicated in other villages by the community. It has become an additional income to the farmers as rice and fish is being cultivated in same land with same time. Stress tolerant rice varieties such as Lunishree for saline, Sahabhagi for drought and Swarna Sub-1 for flood registrant have been introduced to be resilient in disaster condition.

The villages existing in and around the wetland are with poor communication due to existence of creeks. Mangroves plantation has been organized by the local community in both the sides of the river and creeks.

The electricity is very expensive and risky for use for which all villages are not connected with electricity. A training programme has been organized to build the capacity of using solar energy as an alternative. The participants trained and convinced on the use of alternative energy sources based upon the present climate change scenario. So use of solar energy is widely accepted. Solar lanterns are used by the community and found very useful for the people in home and for the students in study.

Two hundred families have used efficient and smokeless oven as a pilot use in three villages. The activity has become very popular as it protects the women from health hazards by emitting from smokes. This programme is very effective for its popularity as environment friendly which saves plants as less fuel is necessary for this special type of oven and at the same time free from pollution.

Workshops have been organised with an aim to build the capacity of the stakeholders in the community, to enhance the stakeholder's Knowledge, Attitude & Practice of energy saving life style.

The stakeholders were effectively linked with the communities to develop adaptation plans. It has a big impact over the community on behavioral change based upon the climate change adaptive educations. As a result, the villagers are using the available fresh water and waste water judiciously. They have taken steps to manage the rain water in a saline basin through various conservation technologies.

Awareness: We have been organising street play, such as "*Daskathia*" & "*Ghodanach*" which are different forms of the local traditional and cultural street play with song, dance with music. It is amusing, interesting, exciting and at the same time educative. This tool is used to communicate the messages of climate change education blended with entertainment to the audience. The advantage of this street play is that it can be performed at any public place. The script of the street play has covered the root-cause of the climate change issues of the wetlands, conservation measures, education on environment and the wise use of natural resources. A series of *Dasakathia & Ghodanach* (Folk Dances) have been organized in the community with the participation of School children.

Sometimes a special type of mobile stage was made on the top of a van for stage show at public places. The other celebrations such as World Environment Day and World Wetlands Day in which competitions have been organised among the students in local schools of Bhitarkanika & Chilika for writing essay & painting on different themes based upon climate change. The best performers have been selected and awarded with Prizes and certificates in World Wetlands Day (WWD) function every year. This is one of the best way of creation awareness among the students in large number.

World Wetlands Day (WWD) has been organized every year on 2nd February to sensitise the community as well as students and teachers on wetland conservation and wise use. The community takes participation in this function every and raise the local issues on wetland functions and management at their level every year in this meeting.

Other activities are also organized among Students such as rally, painting and essay writing on wetland conservation and issues in the schools.

In order to build the capacity of the key stakeholders of the community, the stakeholders has been imparted training by which they have been well trained on preventive, mitigate, community readiness, individual survivability including eco-system management based upon the present climate change scenario. The risk of disaster has been reduced significantly as no casualty in the severe cyclonic storms. This is the success indicator of this activity in the project area.

Penang Seagrass Project – An Environmental Education Project to Encourage Volunteerism & Field Education

Ng Hong Jing, Wong Yun Yun
Nature Classroom, Malaysia

Most Malaysians do not aware of 'seagrass bed', which is one of the most important tropical marine ecosystems. This near-shore ecosystem helps stabilising sediment, preventing coastal erosion, sustaining high fisheries productivity [1] as well as to work as biological indicator of environmental health [2]. The seagrass bed enhances the diversity and served as feeding and/or breeding ground for threatened species such as sea turtles, dugongs and seahorses [3].

The second largest seagrass bed (Figure 1) of Penisular Malaysia is unfortunately included in the Penang Structure Plan in year 2007 as reclaimable land [4]. To date, there are scientists, researchers and environmentalists spoke out to support the idea of turning the seagrass bed into a protected marine park, instead of sacrificing for mass development [5]. However, lack of public awareness and involvement is always a challenge in handling nature and environmental related issue. Many locals do not know the existence of this natural system nearby their homeland.

Therefore, in order to promote public awareness of the Penang's seagrass bed, we initiated Penang Seagrass Project (PSP, www.facebook.com/penangseagrass/), which is an interest group established under the financial support from Eco-Peace Leadership Centre (EPLC, http://www.eplc.asia/, based at Kangwon National University, South Korea), an organization which help to set up human resources network and leadership training in environmental field.

Since November 2014, we worked with different parties to educate general public, especially younger generation, through volunteer training, site survey & documentation and public education. We averagely conduct 2 field trips (Figure 2) to seagrass bed per month and had organised several successful public events at Penang State of Malaysia. Besides, using the photos and data provided by volunteers and students, we managed to publish a handbook - *Biodiversity of Penang's Seagrass Bed* in July 2015 which served as a guide to organisms that thrive at Penang's seagrass bed (Figure 3).

In September 2016, PSP as the only representative from Malaysia, had secured a second phase funding from EPLC due to our outstanding performance and achievements. While continuing our efforts in conducting exhibitions and expeditions, we reached a new milestone where we assisted 2 education institutions in Malaysia to form "Seagrass Action Team" (Figure 4). The action team from INTI International College Penang had carried out a two days seagrass awareness campaign (21st - 22nd February 2017) in the school and support the WWF Earth Hour official event (25th Mar 2017). Other recent events include the Talk and Exhibition of Penang's Coastal Ecosystem in Aug 2017 & International Green Carnival in Sept 2017.

During the AWS Saga 2017, we shared our experience on the setting up the environmental education project for local communities, involving local schools, teachers and students in volunteering wetland education & conservation as well as creating awareness among general public in an effective way.

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Fig1

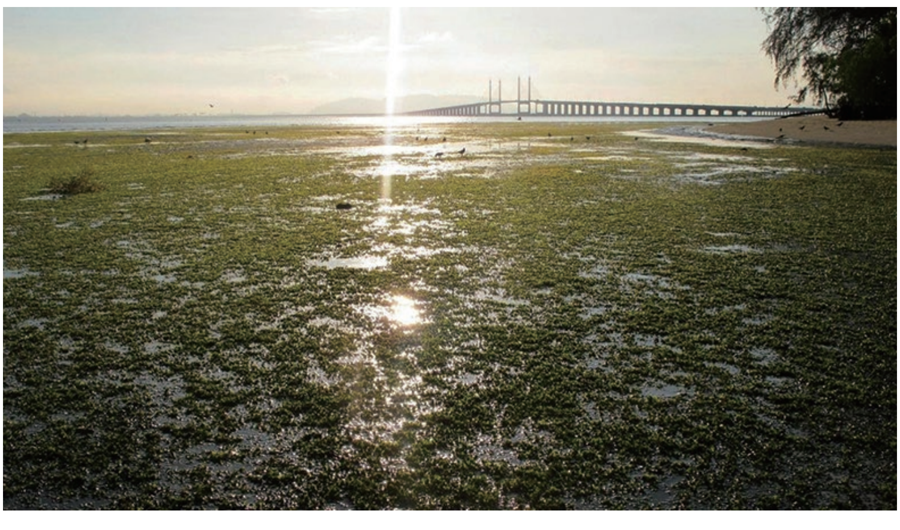


Fig2

Fig3

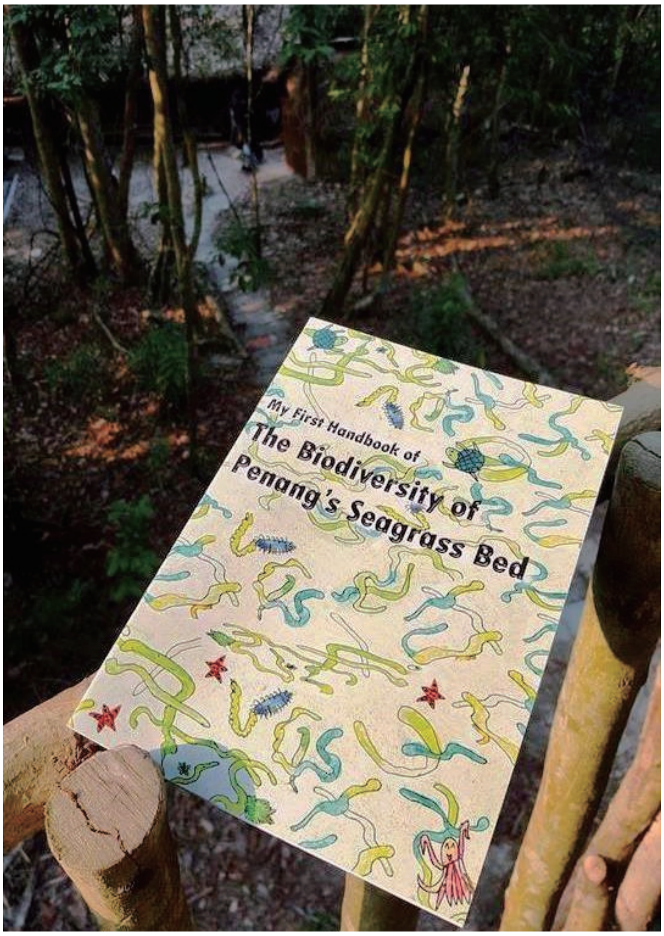


Fig4

How to Promote Flyway-wide Activities and Involve Key National Stakeholders

Tomoko Ichikawa, Eugene Cheah, Minjae Baek
East Asian-Australasian Flyway Partnership

World Migratory Bird Day

The World Migratory Bird Day (WMBD, 10 May, Figure. 1) is an annual global campaign to raise awareness on the conservation of migratory birds. It is organised by two international wildlife treaties administered by the United Nations Environment Programme – the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and the African-Eurasian Migratory Waterbird Agreement (AEWA). The East Asian-Australasian Flyway Partnership (EAAFP) has been one of the main WMBD partners since its launch in 2006, and has been supporting the implementation of WMBD in the East Asian-Australasian Flyway (EAAF).

East Asian-Australasian Flyway

The EAAF is one of the nine major flyways in the world. It stretches from Alaska and Russian Far East, southwards through East Asia and Southeast Asia, to Australia and New Zealand. In this Flyway, habitat loss and degradation are threatening the survival of many migratory waterbird species. The key to reversing this trend is prompt and cooperative actions to raise awareness and the prioritization of waterbird conservation. However, the Flyway includes 22 countries with various social, cultural and economic backgrounds. Also, there are 17 official languages that makes hard to communicate and share information among the countries.

World Migratory Bird Day implementation in EAAF

EAAFP is providing a framework for international cooperation for the conservation of migratory waterbirds and their habitats. The World Migratory Bird Day has been playing an important role for EAAFP's Partners and colleagues to join in and disseminate our messages of conservation, engage with stakeholders, and promote the partnership within each nation. The EAAFP Secretariat has gathered details of the events conducted in the EAAF from the WMBD's global campaign website, EAAFP's website, and from emails that the EAAFP Secretariat has received. There is, however, some data that the Secretariat could not obtain, especially from events held in the early years, but in general, the number of WMBD events conducted in the EAAF has been increasing along with the numbers of the countries joining the WMBD in the last ten years.

In the past ten years, eighteen countries have organised activities, involving around 26,000 individuals (Table. 1), a figure that does not include indirect beneficiaries such as consumers of radio/TV programmes, visitors to exhibitions, people passing by the rallies, etc.

The EAAFP Secretariat has been promoting WMBD by providing and improving Flyway-wide WMBD support in a number of ways:

1. Developing a special webpage to act as an online platform to share information across the Flyway;
2. Developing and providing EAAF specialised materials including flyers and video clips;
3. Providing materials such as posters and flyers in various languages to help overcome language barriers;
4. Collecting and sharing WMBD event ideas to inspire Partners and relevant organisations;
5. Developing materials together with National Focal Points to grow their ownership for WMBD;
6. Communicating with National Focal Point and relevant national NGOs to together promote a national partnership;
7. Providing small grants to encourage the planning of annual WMBD events;
8. Creating Flyway-wide activities that can be applied easily at Flyway Network Sites and visitor centres;
9. Utilizing the growing readership of EAAFP's newsletter and Social Networking Services to disseminate messages.

The WMBD celebration provided opportunities for the conservation leaders to further proceed the conservation activities. The events organised across the Flyway include lectures, exhibitions, contests, discussions, training workshops, media programmes, and field trips. The target audiences include not only local communities and students, but also government officers and media crews.

Some activities were unique to match their social needs, culture and backgrounds. In Bangladesh, the government held a rally with hundreds of participants. In Cambodia, the Ministry of the Environment wrapped their office building with awareness raising banners. An NGO in Myanmar produced a leaflet about EAAF for the first time as a part of their WMBD promotion materials. In Mongolia, students expressed their interest in drawing and traditional craft making. The Secretariat has been encouraging the event organisers to make simple reports to share with other countries to inspire each other through EAAFP website.

Key factors to promote WMBD in EAAF

Through interviews, it was found that materials in local languages were especially welcomed by the Focal Points and NGOs (Figure. 2). Recently many Focal Points and NGOs are helping the translation of the yearly themes – which the Secretariat translated in 2014 when for the first time the Secretariat started providing various language versions of the WMBD poster (Table. 2).

Small grants for funding especially for developing countries have been shown to encourage implementers to plan events and actions. It started in 2014, and a few countries planned and conducted national celebration events using this grant as seed money.

Through such attempts, the Secretariat has discovered some key factors that help implementation at the national level.

1. Active participation and willingness of Focal Points;
2. Good national partnership and key national NGOs that can support the implementation;
3. Suitable methods and timing in each country.

Further challenges

However, there are some issues that make it difficult for some countries and organisations to either join WMBD or continue activities.

1. No birds are visiting the area in May (e.g. Southeast Asian countries);
2. Materials are developed a little bit late to plan something on the local level in advance.

Even there are not many migratory waterbirds in May, the NGOs in Indonesia are still actively trying to promote awareness raising. Also, agencies in Malaysia celebrated the WMBD in other season when many migratory waterbirds were in their country. These could be examples for such countries. As to the timing, it may require some time to be solved – securing a stable funding for the WMBD to start preparation is the key.

Conclusion

The World Migratory Bird Day campaing is a good opportunity to raise awareness and promote the conservation of the migratory waterbirds and their habitats in the East Asian-Australasian Flyway. By communicating with stakeholders and developing methods to engage and mobilise various actors on a regional scale, the EAAFP Secretariat has been promoting the WMBD in the region. The Secretariat would like to encourage suggestions to further expand and ensure the continuity of WMBD in the EAAF.

For more information, visit EAAFP's website at http://www.eaaflyway.net/our-activities/wmbd/.

Figure.1 World Migratory Bird Day logo

Figure.2 Example of the local language version of WMBD poster

Table.1 Number of the WMBD events and participant

	Number of the countries where WMBD events were organised	Number of national event organised	Number of events organised	Minimum number of participants
2006	1		1	13
2007	2		2	NA
2008	1		1	NA
2009	2		2	26
2010	8		8	NA
2011	8		23	95
2012	4		34	1520
2013	13		38	922
2014	11		43	1772
2015	8	1	38	9428
2016	13	7	43	5922
2017	13	6	47	5846

Table 2

	2013	2014	2015	2016	2017
Number of languages	1	12	13	12	12
Bangladesh (Bengali)		Task Force	FP, NGO	FP, NGO	FP, NGO
China (Chinese)		Secretariat	Friend	Friend	
Cambodia (Khmer)		Friend	FP	FP	FP
Indonesia (BI)			FP	NGO	NGO, FP
Japan (Japanese)		Secretariat	FP	FP	FP
Malaysia (BM)		Secretariat	FP	FP	FP, NGO
Mongolia (Mongolian)		Friend	NGO, FP	NGO, FP	NGO, FP
Myanmar (Burmese)		FP	FP	FP	FP, NGO
Philippines (Filipino)				FP, IGO	
RoK (Korean)		Secretariat	Secretariat	Secretariat	FP
Russia (Russian)		NA	FP	FP	Sec
Thailand (Thai)		NA	Friend	NGO	NGO, FP
Vietnam (Vietnamese)		Friend	FP		FP

*Gray colour indicates that the local language version of the WMBD poster was designed by the FP or NGOs in the country, not by the EAAFP Secretariat. (FP= Focal Point, INGO = Inter-governmental organisation, Friend = Secretariat members' personal connections, NA = No available sources to track)

Adventure Time in Shezi Island, Tamsui River: Explore Our Hometown

Szu-Ting Hsu[1*], Iris Hung[2], Clare Wang[1], Nelson Chen[1]
[1] Guandu Nature Park, [2] Bamboo Curtain Studio

In October 2016, Guandu Nature Park (GD Park) collaborated with Bamboo Curtain Studio (Bamboo Studio), took the kids whom living in Shezi Island to discover their homeland with different eyes. This project incorporates environmental education and art education. We lead children use the scientific way to discover the nature in their homeland, and using the artistic way to tell a story about their hope.GD Park, Bamboo Studio, Shezi Island are three beautiful sites where are located in Tamsui River watershed. But this beautiful watershed is face on much pressure on city develop, and polluted by many factors, like wastewaters from factory or ordinary household water. Many people living in this watershed, felt they should protect their "nature" environment. But how to protect? Where needs to protect? Is their homeland being natural environment? Most people do not know. So, we plane this project to call for their heart to rediscover their hometown, and link the beautiful memory between old and young people to love their hometown again. Find the way to protect.

We want to improve an ideal "Nature is everywhere, we did not discover it". Many people fell we have to go mountain, go ocean, go forest to reach nature. But we don't know we can reach Nature nearby our home, so hope we can use this project to improve these ideals. This project combine Environmental Education and art. We lead children use the scientific way to discover the nature in their home land and using the artistic way to tell a story about their hope.

About the environmental part. we use the fore step for this project: observation, Knowledge, Awareness, and action through this project. Therefore, we use part of activities from Project WET. Let students know what is water and water play an important role with our life.

Because in this live with water is their traditional. But now they leave water along.

After Environmental Education, every observation will be followed by an artistic creation. Through Art to reach their heart. Change observation to felling and ideals.

Combine this two education ways, we wanted reach five objective

- Rediscover their hometown,
- Find water in their life.
- Observe the wetland nearby school
- Find anything they want to protect or change.
- Act

Before these lesson, we visited the wetland, elders and the local community group to understand Sheri. The first station is the wetland. Shezi have a long levee divided river and people, let people away from river. Many people never go the wetland nearby their home. Then we visit elders to under the old Shezi. Most of them is local people, the specialist is a grandma. She is 90 years old,

She said, when she was a child, she always went to the wetland to catch fish, clam, plant vegetable. She shared her painting to her stories.

After this visiting, we planning a mail to student from the

Figure 1. This is the draw from grandma's memories.

past. First lessen, they receive a mail from 1963, he is also an elementary school student. He tells them the past environment. He is also living nearby the river, his family fishing in the river, plant rice, vegetable, eat clam in the wetland. He hopes who receive this mail, can tell him the future shezi. So, we tell students what can we do for receive mail, we can draw some map and write a letter for him, to tell him, the newest situation in Sheri. And tell he something news. This is lesson 1.

Every observation will be followed by an artistic creation. So, we use art to build our map in lesson 2. This lesson is teaching by an Indonesia artists team, Ketemu. They use the natural material and the waste from Shezi, to lead children to draw a big map together. In this lesson, they draw many thing they notice, like water gap, common reed, bus station, dogs, cats, old house, chicken.

Figure 2. Children's map.

Lesson 3-4, we guided the children to understand their hometown from different perspectives by taking them to observe the local soil, we go to wetland, to observe wetland soil color, Tough soil, deep a pitfall trap to catch crabs or some invertebrate. And collecting natural objects and learning how to create a blue-print using natural elements. Then lesson 5 we think what is nature or un natural together.

Lesson 1 to 5 is first step, observation their hometown. Lesson 6-9 is Knowledge, Awareness, and Action. Lesson 6 is thinking what they like or unlike. They like the park, the bird,

Figure 3 Their bule-print.

the soil, their school, their home. But they don’t like factory, garbage, the dog it will bite people and leave many poop on the ground. What can we do for keep we like, and change we don’t like. All of them are care about the garbage problem. There is many garbage in mangrove, it is floe by tide. We want to change this situation. So, we started discuss what should we do for this problem. They have many ideals, like they want pick up the garbage which is in river. We decided write a letter to the town councilmen (he also an associate director of ocean university), tell him we want to observe the Tamsui River. because there is our hometown. and ask him to help us.

Figure4. Children like water birds living in wetland.

After this project, we started another project in high school, this school also in Shezi.This is a three years program, we hope through this program to discover shezi, from young to old. To listen the difference between every stage.

If you want to know more about this project

You can visit this website: http://www.guandu-natureart.tw ; or see more in this video:

https://www.youtube.com/watch?v=y396Q9kQjm0

Efforts and Challenges for Coastal Stability and Conservation with Proper Natural Resources Management in Sundarbans Region, Bangladesh

[1] Hideki Sato, [2] Md. Maksudur Rahman

[1] Japan Environmental Education Forum (JEEF), [2] Bangladesh Environment and Development Society (BEDS)

In this symposium, we made a presentation on the activities and suggested the future directions for creating community development with natural symbiosis in Sundarbans, Bangladesh, through the outcomes of efforts and challenges about for five years having been implemented by BEDS and JEEF.

The Sundarbans is the single largest mangrove forest in the world, lies on the delta of the Ganges, Brahmaputra and Meghna rivers on the Bay of Bengal. A total area is 10,000 km2, 60% of the property lies in Bangladesh and the rest in India. Sundarbans in Bangladesh is the UNESCO declared Natural World Heritage as well as RAMASAR Wetland site.

Sundarbans mangrove flagship ecosystem in Bangladesh is the natural safeguard for protecting from natural disasters and livelihood support by providing rich fishing resources for 3.2 million climate vulnerable coastal people. It is the home of various types of species including many rare and endangered flora and fauna such as the critically endangered Royal Bengal Tiger, estuarine crocodile, turtle, dolphin, wild birds, etc. Most of the local people living near Sundarbans are obviously dependent on the nature blessings such as fish, shrimp, honey, tree fruits by producing the rich mangrove forest and wetland on the SATOUMI. However, it is considered that the mangrove forests in this region has been reducing year after year because of human interference by over-exploiting mangrove resources.

In these circumstances, we have to consider two main problems of the Sundarbans coastal communities;

(1) Insufficient of biodiversity conservation education for local people and lack of proper natural resources management due to the unsustainable and overexploitation of its' resources by forest dwellers.
(2) Difficulties in making earnings due to the poverty and lack of alternative livelihood scopes in the limited life environment.

Bangladesh Environment and Development Society (BEDS), and Japan Environmental Education Forum (JEEF) have taken initiatives to mitigate those problems by living good harmony with nature, creating community based organization for ensuring local participation in nature conservation and livelihood improvement, starting from January 2013.

Especially, we have conducted the following main activities focused on the viewpoints of Education for Sustainable Development (ESD) We also have involved multi-stakeholders such as Ministry of Education, Ministry of Environment Forest, Khulna University, Travel companies, IUCN, public elementary and secondary schools, communities, etc.;

(1) Activity-Nature Environment Conservation
   1) Capacity buildings and human resource development on biodiversity conservation to elementary school students, parents and teachers through developing educational materials on Sundarbans nature environment, etc.
   2) Conservation awareness program along coastal and wetland regions including dolphin and turtle, targeting fishermen, primary and secondary students, etc.
   3) Participatory tree planning like mangrove and Moringa, drawing contest on the topic of Sundarbans biodiversity, targeting at fishermen, eco-clubs in schools, etc.
(2) Family gardening efforts for improving nourishment and introduction of improved cooking stove by fishermen, etc.
(3) Challenges on developing and selling Non-Timber Forest Product (NTFP) of natural honey by honey collectors, mangrove pickle by fishermen.
(4) Challenges on developing community-based eco-tourism in Sundarbans through the capacity buildings of the local people.
(5) Holding the multi-stakeholder meetings for building the collaborative networks and exchanging opinions with community people to support Sundarbans effectively.

The main goal of any activities is to conserve Sundarbans mangrove biodiversity and to reduce society based poverty through efforts for harmonizing between nature and human beings properly utilizing natural resources in the area, in order to reduce unsustainable resources harvesting practice and environmental impact on mangrove regeneration process by community people.

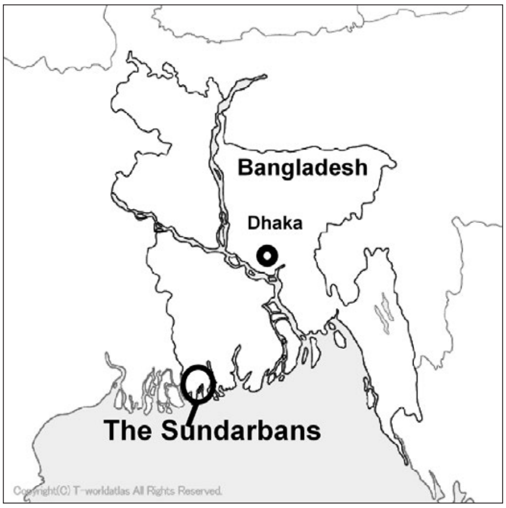
Through these activities, we found some useful lessons on the Wetlands and CEPA / ESD to conduct proper natural resources management from project sites in Sundarbans of Bangladesh:

(1) Introduce approaches with comprehensive and multifaceted viewpoints such as nature environment conservation, living support, livelihood improvement, building collaborative network, etc.
(2) Involve multi-stakeholders like government, company, community people (especially, social vulnerable people such as children, females), university professors, school teachers, NGO, etc.
(3) Provide the opportunities to conduct follow-up trainings for community people continuously.
(4) Encourage community people's initiative by introducing experience-based training.
(5) Institutionalize local people such as cooperative society and eco-club, etc. for sustainable nature environment and livelihood improvement activities.
(6) Find local brand like natural blessings and activate the region by making the most of it.
(7) Community planning and human resource development with co-management of public and private sectors in Sundarbans.
(8) Submit activity reports containing recommendation with real voice of local people after finishing any projects.

Based on some outcomes of our activities, we would like to contribute to realize the following goals in near future.

(1) Vision 2021 is for Bangladesh to become a middle income country where poverty will be completely eradicated by 2021.
(2) Sustainable Development Goals (SDGs)

Finally, we would like to point out that the approach on "Wetlands and CEPA/ESD" are different between developed and developing countries. That is, as we presented it this time, the economic poverty is one of the key issues in developing countries, so we have to create any environmental friendly activities which could directly linked to livelihood and life improvement of local people. Just only environmental preservation efforts in any communities are not always sufficient to raise people's awareness on the wetland conservation. We consider that it would lead the local people to have more their ownership and sustainability by combining with environmental conservation and livelihood & life improvement activities.



Mangrove forest

Fishery

Drawing picture on Sundarbans by a child

Card game on biodiversity

Mangrove tree plantation

Natural honey collection

Production of mangrove fruit pickles

Honey products

Mangrove fruit pickles products

Development of Wetland School in China

Xiuzhi Yang, Kelin Chen
Wetlands International - China

Although wetlands are irreplaceable asset that provide water and food for human being, they have often been sacrificed for industrial development. Low recognition of wetland values in general public is one of the major reasons to this. Nowadays, rapid development is resulting in significant wetland loss and degradation in China, which is one of the rising nations. As a fundamental solution to this problem, environmental education is an urgent task there.

Wetlands International-China (WIC) has been practicing "wetland education" through international exchange events etc. to increase wetland awareness for students and teachers since 2002. Wetland School originated from "Asian Wetlands Week - Children and Wetlands", a regional awareness campaign especially targeted to children, initiated by Ramsar Center Japan (RCJ). Since 2002, a Children and Teacher Wetland Exchange Program-Japan/China/Korea on "Asian Wetland Week (AWW) Celebration Event" has been organized jointly by RCJ, Wetlands Korea (WK) and WI-China with the financial support by the Japan Fund for Global Environment (JFGE). The 1st and 2nd Asian Wetlands Week Celebration events have been held in Japan and Korea respectively. In Dec. 2004, the 3rd Asian Wetland Weeks (AWW) Celebration Event was held in Dafeng, Jiangsu Province, China worked together with Jiangsu Dafeng Milu National Nature Reserve and Dafeng No. 4 Middle School. During this event, the Dafeng No. 4 Middle School was designated as "Wetland Experimental School" by WI-China. The first Wetland School established in China.

In order to further enhance awareness on wetland conservation among children and strengthen exchange information on wetland education and establish the network of wetland experiential school in the Northeast Asian region, a three-year project "China, Japan, Korea Wetland School Programme: Wetland Awareness Campaign for Children and Teachers in three Nations" was approved and funded by JFGE in April 2005 organized by RCJ, Wetlands Korea, WI-China. Zhalong National Nature Reserve, Lanzhou city and Poyang Lake National Nature Reserve were selected as the potential project sites and establishment of wetland experimental schools in cooperation with the nature reserves and local schools by the implementation of a 3-year project. On Aug. 1, 2005, during the 4th Asian Wetland Week Celebration Event, Zhalong Middle School in Qiqihaer City, Heilongjiang Province was designated as Wetland Experimental School. From July 28th to 30th 2006, the 5th Asian Wetland Week Celebration Event held in Lanzhou, Gansu Province. Lanzhou Shuicheyuan Primary School was named as Wetland Experimental School. On Dec. 25th 2007, during the 7th Asian Wetland Week Celebration Event, Jiangxi Nanchang Normal University Affiliation Primary School was named as Wetland Experimental School.

A follow up 3 year project (2008-2010) were proposed to JFGE with the project name of "Wetland School Network Programme Popularized in Asian Countries along the East Asian-Australasian Waterbird Flyway". In December 2008, a wetland school exchange program -"the Eighth Asian Wetland Week celebrations" was organized successfully by WI-China, Japan, Thailand and Malaysia, RCJ, WK as well as Zhanjiang Mangrove National Nature Reserve in Zhanjiang, Guangdong Province. Total of more than 200 teachers, students and wetland managers from Malaysia, Japan, Thailand, South Korea and China, as well as participants from research institutions, the nature reserve, non-governmental organizations, environmental education center, environmental volunteers from 13 provinces and cities in China participated in the wetland school exchange program. A series of activities , including opening ceremony of the wetland school program, seminar on the conservation and management of Mangrove, wetlands schools and cultural exchanges from five countries, planting friendship trees, visit Zhanjiang Wetland Education Center and Study tour to Zhanjiang Mangrove Nature Reserve and Huguangyan wetland park. During the opening ceremony, 5 schools were named as Wetland Experimental School: Zhanjiang No. 1 Middle School, No. 20 Middle School, Tianjiabing Middle School, Potou No. 1 Middle School, Jinshawan School.

In Nov. 2009, an exchange and training program on students and teachers from wetland schools in China for using the education toolkit was organized during the 13th World Lake Conference in Wuhan. During the program, two schools from Wuhan city were established as wetland experimental school: Wuhan Huazhongli Primary School and Honghu No. 1 Primary School. From Dec. 23 -27, Wetlands School Network Exchange Event held in Krabi, Thailand. More than 100 teachers and students from China, Japan, Korea, Thailand and Malaysia participated in the event. Krabi Provincial Government and Krabi Environmental Department were local hosts. Participants had study tour to Krabi Estuary, birdwatching and exchange and training workshop. Ammartpanichnukul School in Krabi became Wetland School.

On Dec. 11th 2010, Wetland School Network Coordinate Committee established in Dafeng during the wetland school exchange. About 100 persons attended the program. Teachers' training, field trip, workshop were organized. Dafeng Senior Middle School and Dafeng No. 6 Primary School were named as Wetland Experimental School.

From 15-19 of March, 2011, wetland school exchange event was organized in Sandakan, Sabah, Malaysia. Participants discovered rainforests, got to know Orang-utans, visited villages along mangrove rivers and knew the culture of Sungai People and they also had great communications in workshops. On Sep. 10th 2011, Liaoning Panjin Liaohe Oilfield Xinglongtai No. 1 Primary School was names as Wetland Experimental School. From Oct. 8-10, 2011, Wetlands and Children Exchange for Sustainable Development held in Wuxi. Children read out a letter on the Opening Ceremony of Asian Wetland Symposium.

From 2012-2014, the 3-year-project "Promotion of Wetland ESD (Education for Sustainable Development) in China focusing on Ramsar Sites and Wetland Parks through Capacity Building for Teachers" was continued conducted supported by JFGE.

From Sep. 14-15 2012, the Wetland School Network Exchange Meeting held in Wuzhong Ninxia Hui Autonomous Region with support from Ningxia Wetland Conservation and Management and Wuzhong Yellow River National Wetland Park from local. Participants from wetland schools, nature reserves, wetland parks, governments, universities, NGOs were invited to the workshop. Experts gave presentations for the workshop and participants also exchange wetland education experience in the workshop. A field study trip was organized to Wuzhong Yellow River National Wetland Park.

2013 Wetland School Network Exchanges Event & Wetland school 10 years ceremony was organized in Wuxi from 8th to 9th of December, 2013, together with Wuxi wetland society. During the event, presentations were given by experts from China, Japan and Korea on wetland education, cultures of wetlands etc. Teachers exchanges and shared their knowledge on wetland education. Participants also visited the primary school in Wuxi and Taihu lake. The draft of teacher's guide book was also discussed. In the opening ceremony, the two new wetland schools, the Primary School affiliated to Wuxi Normal University and Dafeng No.2 Primary School were awarded and all wetland schools were given certification by WIC.

2014 Wetland School Network Exchange Event & Wetland School Network Committee Annual Meeting was held on December 25th to 27th in Shenzhen, Guangdong Province co-organized by Wetlands International-China and Shenzhen Mingde Experimental School, Totally 75 participants attended the event including staff from WIC, WIJ, officials from central, provincial and city level government, experts from China, Japan and Korea and representative from wetland schools, provincial and local NGOs, members from WSNCC, media reporters, etc. Shenzhen Mingde Experimental School was awarded as Wetland School on the opening ceremony.

On March 30th 2015, Fujian Quanzhou Huian No. 5 Middle School was designated as Wetland Experimental School. On March 24th 2016, Qingdao Shuyuanlu Primary School was designated as Wetland Experimental School.

In July 2016, East Asia Youth Meeting for Wetland Conservation held in Ansan, South Korea. Teachers and students from Wetland Schools attended the event and shared their experience on wetland education and conservation.

On Nov. 29th – Dec 1st, 2016, the Wetland School Network exchange event held in Qingdao, Shandong. 16 of the 18 Wetland Experimental Schools updated to Wetland School, and 3 new wetland schools named, they are Anqing Shuangliansi Primary School, Hangzhou Liuxia Primary School, Wuhan Qingfenlu Primary School. 2 Wetland Experimental Schools were removed: Potou No. 1 Middle School in Zhanjiang and Jiangxi Nanchang Normal University Affiliation Primary School.

Through more than 10-year's development, 19 schools have been named as Wetland School in China. These wetland schools spreading over 10 provinces formed a Wetland School Network and growing stronger. Depending on local wetland nature reserves, they guide children and teachers step into and enjoy hands-on experience at wetlands, and take an active part in wetland exchange with wetland schools in East Asia and Southeast Asia. A new wetland environmental education modal with Chinese characteristic has been initially formed.

The implementation of these projects effectively enlarged the influence and demonstration effect of Wetland School in China. We can see that we are making changes on wetland conservation. More and more students and teachers know wetland and they influenced the people around them. The number of Wetland School and member of Wetland School Network steady increased. Teacher's capacity on wetland education enhanced through teacher's training course and national and international education experiences exchange. More and more teaching materials developed and series of wetland conservation and awareness activities conducted by Wetland Schools. Government of different levels, education sectors and schools pay more attention on wetland environmental education. The concept of Wetland ESD is accepted and popular in China. Wetland School has become a famous brand in China and plays a significant role to increase awareness on wetland conservation and wise use among teachers and children even the whole society in China.

From 2016 to 2017, in order to strengthen Wetland School Network development, supported by Shenzhen OCT Hua Club Ecological Environment Protection Foundation, WIC developed Wetland School Construction Guidebook and Wetland School Management Measures. We hope 100 schools join Wetland School Network and each province at least has 1 wetland school.

BioBlitz in Hong Kong: Best Practice Sharing in Wetlands CEPA (abstract)

Jenna Ho Marris, Shaun Martin, Man Yi (Bel) Li
Tai Tam Tuk Eco Education Centre

BioBlitz is a collaborative, open source, citizen science survey of all forms of life in a set area over a set time, popularised in the U.K. by Bristol Natural History Consortium

as national BioBlitz coordinator. In 2015 the Hong Kong Environment and Conservation Fund, Environmental Education and Community Action Projects sponsored Hong Kong's first large scale 30 hour BioBlitz at Tai Tam Bay (Inner Harbour) SSSI, site of the last mangrove forest on Hong Kong island. The authors wish to share achievements, practices, progress and challenges towards better understanding of this CEPA tool adapted for Hong Kong and wider Asia regional contexts.

The author is a Hong Kong registered charity established in 2012 with the aim of educating to inspire action for sustainable development in Hong Kong young people and a registered member of Wetland Link International (WLI)'s network. The author's wetland education programmes were initially developed for UNESCO Hong Kong's Education for Sustainable Development Learning Programme.

While there was considerable interest from schools and outdoor education providers, such approach was found unsatisfactory in terms of level and extent of engagement, as well as lack of long term follow up action. The authors were inspired to try a BioBlitz as an exciting citizen science event with many collaborative partners as proven popular in the U. K., U.S. and elsewhere, such event was successfully concluded late October 2015.

In 30 continuous hours, approximately 300 participating students, teachers, volunteers, and expert naturalists recorded 680 species including two rare endemic species of moth, first sighting of juvenile mangrove horseshoe crabs on Hong Kong island, and first sighting of coral off Hong Kong island. The event brought together 10 environmental NGOs collaborating for the first time including WWF-Hong Kong, Ocean Park Conservation Foundation, Conservancy Association, Hong Kong Birdwatching Society and others, with 20 student groups from diverse schools, for many their first such scientific survey or field training. Surveys included coastal forest, wetland, intertidal, and marine habitats. Thereafter, two university groups won funding and organised BioBlitz events, and another NGO was awarded HK$34.8 million (approximately US$4.5 million) for revitalising a heritage building into a BioBlitz training centre expected to attract 16,000 students a year from 2019.

A condition of the funding was to not allow public participation beyond pre-registered student groups and there were fears expressed during the funding process, that encouraging unsupervised exploration in the survey area would lead to injury and damage of wildlife and participants, that the large apparent number of species would confuse, that unscrupulous participants would decimate local wildlife, that many local species are toxic, poisonous or otherwise hazardous and other concerns.

In 2016 Hong Kong published its first Biodiversity Strategy and Action Plan (BSAP) 2017-2020 fulfilling its obligations under the Convention on Biological Diversity with central aims to ensure public is aware of biodiversity and its values, and also to support China' National BSAP. Towards this aim the Agricultural, Fisheries and Conservation Department of Hong Kong has approved funding for the author to organise another BioBlitz which is planned early November 2017.

In this context, the authors wish to explore BioBlitz as a tool for wider wetland CEPA in Hong Kong and Asian contexts, in particular their collaborative structure, including learnings from the 2017 BioBlitz which it is hoped will be the first coordinated Pearl River Delta BioBlitz.

Localizing ESD Best Practice for Wetland Conservation- from Mai Po Nature Reserve to South China Region (abstract)

Lydia Pang, Yamme Leung
WWF-Hong Kong

WWF-Hong Kong has actively developed ESD programmes for Mai Po Nature Reserve since 1983. Every year, over 10,000 studentsvisit the reserveand participated in immersiveeducationprogrammes, aim to enhance their motivations and skills to conserve wetland and natural resources in theirdaily life. Studentswere equippedsupportthewetland conservation management work, at the same time educators were trained to maximize the efficiency of our efforts on educating the next generation. Mainstreaming ESD in the education system serves as a crucial further step to mobilize the community towards a more sustainable lifestyle.

The experience gained from Hong Kongisreplicated in differentimportantwetland sites in China. The conservation management standard in these sites is raised and public awareness increased. From year 2006 to 2017, WWF-Hong Kong hasestablished 5-yearscooperation projectswith three regionallyimportantprotected wetlandsin South Chinaregion. This article focuses on the key achievements of the ESD works of the three projects. Lesson learnt will be discussed during the presentation.

2005-2010 Zhangjiangkou National Mangrove Nature Reserve, Fujian Province

The Reserve has the largest area of natural mangrove forest in Fujian Province with a wide variety of wildlife and was designated as a Ramsar site on 2 February 2008.

Achievements on ESD work:

Capacity building of reserve staff and educators: Through training courses in Hong Kong and on-site training at local reserve, school teachers and reserve staff were trained on ESD and were aware of the importance of ESD.

Education programmedevelopment and implementation: Over 3,600 students from 11 localpartner schoolsparticipated in the educationactivities; an ESD textbookwasalso publishedaseducationmaterial for secondaryschoolstudents.

Constructionofeducationfacilities: Educationcetnre, birdhideand educationaltrail wereconstructed to support the deliveryof reserve-based education programme.

2006-2012 Haifeng Bird Provincial Nature Reserve, Guangdong Province

Over 20,000 migratory waterbirds use the Reserve as a wintering site, including rare birds such as Dalmatian Pelican, Purple Swamphen, Nordmann's Greenshank and Black-faced Spoonbill. Haifeng wetlands was designated as a Ramsar site on 2nd February 2008.

Achievements on ESD work:

Masterplanning: Local educator and nature reserve staff developed an ESD strategy which is incorporated into the five-year management plan, act as guidance for the reserve on executing ESD work

Capacity building of reserve staff and educators: Through training courses, school teachers and reserve staff were trained on ESD and were aware oftheimportanceof ESD.

Educationprogrammedevelopmentand implementation: Over 3,400 students from 6 localpartnerschools participated in the education activities; small fund was distributed to partner schools for school-based environmental education work enhancement.

Constructionofeducation facilities: Education center and boardwalkwasestablished to support the deliveryofreserve-based education programme.

2012-2017 Minjiang Estuary National Nature Reserve, Fujian Province

The Reserve is home to over 50,000 waterbird individuals and 14 globally threatened bird species, such as critically endangered Chinese Crested Tern and Spoon-billed Sandpiper.

Achievements on ESD work:

Masterplanning: An ESD strategy was developed to act as guidance for the reserve on ESD work, also to act as the directional document for the retrofitting work of the wetland museum.

Capacity building of reserve staff and educators: A working group was established among local educators and reserve staff, a practical educational pack was published with the endorsement of local education bureau to aid the delivery of in-school environmental education in a city-wide level.

Educationprogrammedevelopmentandimplementation: Particulareducationstaff of the reservewas further equipped to design and deliver new reserve-based activities with hands on and citizen science elements.

Session 9

Wetlands and Biodiversity / Restoration / Reintroduction

Present Status and Future Prospects of the Nature Restoration in Coastal Lagoon Lake Nakaumi, Japan

Hidenobu Kunii

Nature Restoration Committee of Lake Nakaumi
114 Tenjin-machi, Matsue 690-0064, Japan

It may be a fate of estuarine and coastal lakes to suffer numerous local and global environmental problems such as eutrophication, land-reclamation, or the sea-level rise. Coastal lagoon Lake Nakaumi, a fifth largest lake in Japan (85.7 km^2), was once a fertile lake with prosperous fishery products and extensive seagrass beds. However, this lagoon lake had been suffered many detrimental effects by human activities, such as sewage effluent, runoff of chemical fertilizers and herbicides, land reclamation, dredging, construction of lock gate and dykes and so on, for more than 40 years since early 1960's. As a result, lake ecosystem had been deteriorated severely and no significant catch had been reported.

In the year 2000, the land reclamation project in Lake Nakaumi was officially discontinued, and shortly thereafter, the desalination project was also terminated. Here we look back the chronology of the Nakaumi reclamation and desalination project. The origin of the project can be traced the time before the WWII. In the 1930's, the Ohashi River connecting Lake Shinji to Lake Nakaumi was dredged to assist flood control in the River Hii system. As a result, higher saline water moved up river, from Lake Nakaumi into Lake Shinji, and the water of Lake Shinji became difficult to use for agriculture. Significant damage to agriculture from irrigating saline water triggered discussion of the desalination of lake water. After defeat in WWII, the Japan's national policy for the expansion of food production and industrial recovery led to a series of large land reclamation projects in various coastal areas. Desalination of lake water adjacent to reclaimed areas was thought to be essential for irrigation of the new farm lands. In this context, the national project for reclamation and desalination of Lake Nakaumi was launched. Though the full scale project started in 1963, the deficiency of food in Japan had been alleviated and policy had changed to that of reducing rice cultivation acreage. Additionally, severe deterioration of water quality had occurred in other reclamation project areas, and local fishermen feared similar environmental problems and launched a campaign to conserve the rich brackish water fishery resources. The prevailing mood in the nation favored a change in national policy that emphasized environment over economics. The Japanese economy entered a period of recession, and financial resources dropped to a critical level and there was no other choice than to cancel several big projects including the reclamation of Lake Nakaumi.

Lake Nakaumi and Lake Shinji survived as coastal lagoons. But, there have been significant damages to the lake system, and many environmental problems remained. In enclosed water bodies such as lakes, reservoirs, inland seas, nutrients and pollutants accumulate easily because of low water turnover rates. This accumulation of nutrients results in eutrophication and the explosive growth of phytoplankton. Eutrophication gives rise to algal blooms, red tides, and blue tides, which lead to anoxic water that is harmful to benthic animals and fish.

The president of Shimane Prefectural Government expressed to designate the lakes for inclusion in the list of wetlands of international importance in July 2003, and Lake Nakaumi was soon after then registered as a 26th Ramsar site in Japan together with its neighboring Lake Shinji in 2005.

The recent events concerning the restoration of Lake Nakaumi are as follows;

- 2002: The New National Biodiversity Strategy was approved.
- 2003: The Promotion of Nature Restoration Project was enforced.
- 2005: Inclusion in the list of wetlands of international importance (Ramsar sites).
- 2006: NPO Nature Restoration Center was founded.
- 2007: Nakaumi Nature Restoration Committee was settled.
- 2008: 'Comprehensive Plan for Nature Restoration of Lake Nakaumi' was developed.
- 2012: Implementation of Nature Restoration Project of Lake Nakaumi started.
- 2017: Review and revision of the Implementation Plan for Nature Restoration of Lake Nakaumi'.

The new national biodiversity strategy of Japan, which was approved on March 2002, proposed the promotion of nature restoration projects in order to actively rehabilitate degraded environments. Nature restoration projects do not simply mean to recreate the natural environment that has been impaired by development, but rather are intended to recover the resilience of local ecosystems, through the careful removal of human influences and the rehabilitation of nature. This long-term project, incorporating good management planning practices, such as adaptive management, fits well with the restoration of Lake Nakaumi in which severe alteration occurred in the past.

To achieve the restoration of Lake Nakaumi, local non-profit organization, named Nature Restoration Center, was established in March 2006 as a voluntary group for the purpose of supporting restoration efforts in accordance with the Law for the Promotion of Nature Restoration. The definitions and basic principles of the Japanese Law for the promotion of Nature Restoration are as follows; nature restoration in this Law means the conservation, restoration or creation, and maintenance of the conditions of various ecosystems, with the participation of various actors in the community, including concerned governmental agencies, concerned municipal governments, local residents, specified nonprofit corporations and individuals with specialized knowledge of the natural environment. Nature restoration shall be carried out appropriately for the purposes of maintaining and passing on a sound and bountiful natural environment to future generations, realizing a society in harmony with nature through the protection of biodiversity, and contributing to the conservation of the global environment. Nature restoration shall be carried out in such a way that, even after a nature restoration project has begun, the state of nature restoration is monitored, the monitoring results are assessed scientifically, and the assessment results are reflected in the project.

Shortly after the foundation of the Center, the Nature Restoration Committee of Lake Nakaumi was launched in 2007 to act upon the Law for the Promotion of Nature Restoration, and the Nature Restoration Committee of Lake Nakaumi drew up the implementation plan for the nature restoration projects in Lake Nakaumi in 2012.

In this plan, final goal of the project is stated as follows: We restore the richer coastal lagoon ecosystem, and we reconstruct the former natural environment and recycling system of resources, under the slogan 'revive richer friendly clean Lake Nakaumi'. In addition, five centerpieces of restoration to promote the restoration projects are also stated in the comprehensive plan; (1) Restoration and conservation of lakeshore and coastal lagoon ecosystem, (2) environmental restoration through the improvement of water and sediment quality, (3) coexistence with waterfowl and wise use, (4) promotion of environmental education for the younger generation who shoulder the future, and (5) creation of sustainable society.

The Nature Restoration Committee of Lake Nakaumi addressed the following four main projects, (1) conservation and restoration of seagrass beds, (2) removal and utilization of sea weeds, (3) conservation and restoration of lakeshores, and (4) rehabilitation of depressed lake bottom resulted from dredging. Five years have passed since the launching of the nature restoration projects and of these third and fourth projects were progressed satisfactory while first and second projects were not. Based on these results, the Nature Restoration Committee of Lake Nakaumi is now drawing up the succeeding implementation plan which encourages not only the conservation of biodiversity but the utilization of ecosystem services of Lake Nakaumi.

Haors in Bangladesh and Present Scenario

Md Golam Rabbi

Joint Secretary, Nature Conservation Society, Bangladesh

Bangladesh is located in the transitional zone between the South and Southeast Asian flora and fauna biomes, which contributed to its historically rich biological diversity. Bangladesh possesses enormous area of wetlands including rivers and streams, freshwater lakes and marshes, haors, baors, beels, water storage reservoirs, fish ponds, flooded cultivated fields and estuarine systems with extensive mangrove swamps. The haors, baors, beels and jheels are of fluvial origin and are commonly identified as freshwater wetlands. These freshwater wetlands occupy four landscape units-floodplains, freshwater marshes, lakes and swamp forests.

Bangladesh possess about 7-8 million hectares of wetlands in different forms for instance, rivers and streams (480,000 hectares), estuarine and mangrove swamps (610,000 hectares), shallow lakes and marshes (120 000-290 000 ha), large reservoirs (90,000ha), small ponds and tanks (150 000-180 000 ha), shrimp ponds (90000-115000 ha) and seasonally submerged flood plains (5,770,000 hectares) (Nishat, 1993). Haors are bowl-shaped depressions between the natural levees of a river subject to monsoon flood every year, are mostly found in the eastern region of the country. There are about 373 haors comprising an area of about 858460 ha. dispersed of Sunamgonj, Sylhet, Moulvibazar, Hobigonj, Netrokona and Kishoreganj district.

District	No of Haor	Area of District (ha.)	Area of Haor (ha.)	% of Haor area per District
Shunamgong	95	367,000	268,531	73.17
Sylhet	105	349,000	189,909	54.42
Hobigong	14	263,700	109,514	41.53
Moulovibazar	03	279,900	47,602	17.01
Kishoregong	97	273,100	133,943	49.05
Netrokona	52	274,400	79,345	28.92
Bramanbaria	07	192,000	29,616	15.37
Total	373	1999,800	858,460	42.93

Beels are comparatively large surface water bodies which accumulate surface runoff water through internal drainage channels; these depressions are mostly topographic lows produced by erosions and are seen all over Bangladesh. There are thousands of beels of different sizes are present in Bangladesh for instance, Chalan beel, Chand Beel, Arial beel, Baikka beel etc.

Baors are oxbow lakes, formed by dead arms of rivers, are situated in the moribund delta of the Ganges in western part of the country. In Bangladesh, oxbow lakes are quite visible in the older flood plains. Locally, the feature is also known as beel, baor, and jheel. Usually, oxbow lakes are deeply flooded during the monsoon, either through local rainfall and runoff water or by river flood. During the monsoon season oxbow lakes act as local water reservoirs, and help to control the local flood level. In some areas, these lakes serve as valuable sources of irrigation during the dry season.

Wetlands always support maximum number of life including wildlife, fisheries, aquatic plants and invertebrates. Most of the wetland in Bangladesh possesses resources for migratory birds especially in the winter season. Around 400 species of migratory birds visited Bangladesh. Huge numbers of migratory birds visit Hakaluki Haor, Hail Haor, Ramsagar and Tangur Haor which is an important Ramsar site.

Tanguar Haor has outstanding conservation value, being a natural freshwater wetland in the country, seasonally harbouring up to 60,000 migratory waterfowl along with many resident birds. Tanguar Haor resources especially reeds and swamps support birds and wildlife. Based on Nishat (1993), Karim (1993), and NERP (1993a), it is estimated that a total of 141 fish species, 11 amphibians, 34 reptiles (6 turtles, 7 lizards and 21 snakes), 206 birds and 31 mammals occur in Tanguar Haor (Gieson and Rashid, 1997). A total of 12 butterfly species have also been identified (DoZ, 1997) from Tanguar Haor. However, the most recent survey (2011) of IUCN has recorded 19 species of mammals, 24 species of reptiles and 8 species of amphibians in this wetland (Alam et al., 2012). Based on Karim (1993) and BNH (1997), it is estimated that a total of 200 wetland plant species occurred in Tanguar Haor. The most recent survey (2011) of IUCN has recorded 104 plant species under 88 genera and 51 families in this wetland (Sobhan et al., 2012). But the floral and faunal diversity of Tanguar Haor is under extensive threat because of unsustainable use of resources.

158 species of wildlife were recorded from the Chanda beel; among them 7 amphibian, 21 reptiles, 111 birds and 19 mammal species (Chakraborty *et. al.*, 2005); among the birds 19 were migratory species. Seven species of snails are found in Chanda beel among them 2 has commercial importance (Khan *et. al.*, 2005).

The rims of the lakes are used for winter (boro) rice cultivation. The flooded fields in the monsoon became rich with minerals and are very fertile. There are also deepwater rice verities. The deepwater rice has submergence toleration and elongation ability. At one time, undivided Bengal had about 15,000 varieties of cultivated rice but the germplasum of most of them is lost leaving only about 6,000 (Khan *et. al.*1994). Lakes are the source of irrigation in winter. Almost every non-rice crops in Bangladesh grow in winter.

A majority of the people of Bangladesh are critically dependent on wetlands. Wetlands play a crucial role in maintaining the ecological balance of ecosystems. Wetland also provides habitat for a variety of resident and migratory waterfowl, a significant number of endangered species, and a large number of commercially important species. Wetlands habitat of Bangladesh is under constant threat due to increase of population, flash flood, intensive agriculture, overfishing, siltation, pollution, ill-planned infrastructures, lack of institutional coordination, lack of awareness, etc which play tremendous impacts on both biotic and abiotic components of wetlands. Additionally, industrialization as well as agriculture has resulted in serious levels of pollution due to ineffective environmental policy and policy implementation. Climate change risks are considered high in Bangladesh due to its limited land level elevation and its geographical location in a cyclone prone area. As a result biodiversity is reducing, many species of flora and fauna are threatened, wetlands-based ecosystem is degenerating, and the living conditions of local people are deteriorating as livelihoods, socioeconomic institutions, and cultural values are affected.

In order to balance human needs and wetlands conservation, a mainly community-based wetlands management approach has been taken in Bangladesh, but this is not enough to prevent the degradation of wetlands. Therefore, Bangladesh now needs a comprehensive strategy combining political, economic, social, and technological approaches to stop further degradation of wetlands. Policies, strategies, and management plans for sustainable use and conservation of wetlands of Bangladesh must be based on solid knowledge and understanding of their ecological and socioeconomic functions and processes.

Threats to the Biodiversity Rich Henoko/Oura bay: Ramsar Candidate Site

Mariko Abe, Chihiro Tsujimura, Tomoko Shimura
The Nature Conservation Society of Japan

The Ryukyu Islands of Japan are located on the northern limit of the coral reefs. Many places were lost by coastal development however healthy coral reef ecosystem remains around Henoko and Oura Bay, located in the northern part of the east coast of Okinawa Island.

Figure 1 The location of Henoko and Oura Bay. The map of Okinawa Island (=Okinawa main land) is shown.

The whole area of Henoko and Oura Bay are the regions with high biodiversity which has been recognized as one of the hot spots of biodiversity in the world. According to the environmental impact assessment report of the Ministry of Defense, 5,334 species have been recorded from the coastal waters, including 262 endangered species. In addition, through subsequent surveys, undescribed species of a huge sea cucumber and many undescribed or unrecorded species of sponges, ctenophores, gorgonians, sea slugs, crabs and so on have been reported one after another.

Henoko and Oura Bay has the largest area of seagrass beds around Okinawa Island.These are used by the dugong (*Dugong dugon*),Japan's Natural Monument (Kasuya& Abe 2014). The dugong is listed as "Critically Endangered" on the Red List of the Ministry of the Environment and as "Vulnerable" on the IUCN Red List. The number of the dugong in Okinawa has been declining to a critical point.

A massive stand of the blue coral (*Heliopora coerulea*) (50m long, 30m wide and 14m high) was discovered in 2007 which is listed as "Vulnerable" on the IUCN Red List.

The value of the biodiversity of Henoko and Oura Bay has been recognized widely. THe Japanese Ministry of the Environment listed the area in its "Ecologically or Biologically Significant marine Areas identified by Japan". It has also listed Oura River and its estuary in the "Ecologically or Biologically Significant wetland Areas identified by Japan." The Okinawa prefectural government designates the coastal area of Henoko and Oura Bay as "Assessment Rank I" (the highest) in its Guidelines on the Conservation of the Natural Environment. The Japanese Ministry of the Environment also listed the area in its list of potential Ramsar Sites in 2010 as it recognized that the wetlands in the area meet the Convention criteria for wetlands of international importance, in 2014, 19 Japanese scientific and academic associations including the Ecological Society of Japan submitted the "Joint Petition by the 19 Society Groups calling for Environmental Conservation of the Highly Remarkable Biodiversity in Oura Bay, Okinawa" to the government of Japan.

Currently a plan to landfill the area to build an US military airfield base (Futenma Replacement Facility) is under way. The project for 160ha reclamation requires 21 million cubic meters of soils and rocks, of which 17 million cubic meters would be exported from outside of Okinawa island which could be a trigger to alien species problems; IUCN had given a recommendation to the government of Japan last year to strengthen pathway management of alien species for the protection of island ecosystems. The process of the Environmental Impact Assessment (EIA) was mired with many issues and problems.

The previous governor of Okinawa prefecture had given the landfill permit to the business operator (Ministry of Defense, Japan) in December 2013. However the present governor argues opposite side of the base construction. He once canceled the landfill permit, but he had to cancel his cancellation for the legal reasons at the end of the last year. For the reason the reclamation project has officially started since April this year.

Now we are facing there three major problems.

1) The environmental impact by the concrete blocks

The first one is more than 400 blocks are buried in the sea bottom of this area. These are made of concrete and used as anchor to make float stable, and size varies from 13 tons to 45 tons. The float is expanded to show the restricted area where anti base citizen can not enter to protest. The usage of the blocks was not written in EIA documents and no assessment for the environments was done. The blocks were placed to avoid corals and seagrasses. However there are creatures which live on rocks, sands, muddy places, so here we already have impacts to the environments.

Also it is possible that the topography would become flat by placing massive blocks and the direction of the currents would

Figure 2 One of the blocks placed at the sea bottom to make the chain of the float stable (photo by Hajime Kanai)

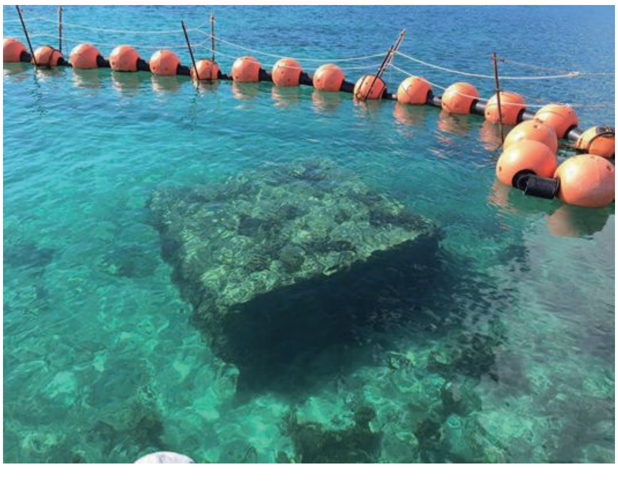
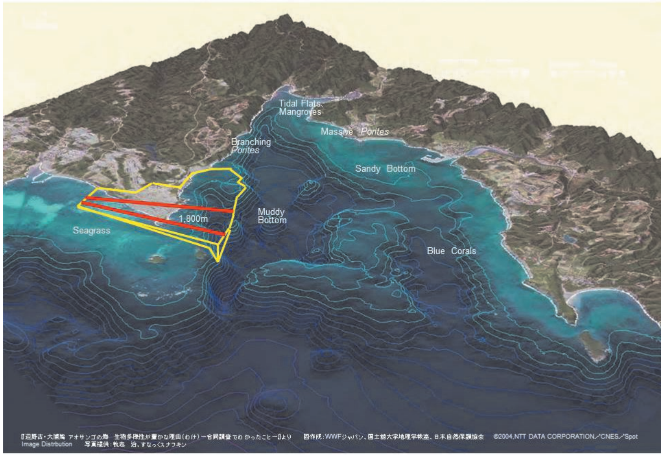


Figure 3 The restricted area of Henoko reclamation

The restricted area of Henoko reclamation



be changed (NACS-J,2009.,NACS-J 2012). These would leads irreversible impacts to the environments.

2) Disappearance of dugongs

Currently it is confirmed that three dugongs live near Okinawa Island, and they have been named Individual A, Individual B, and Individual C (Okinawa Defense Bureau, 2009). It is known that individuals A and C regularly use the seagrass meadow at Kayo, in the northern part of Henoko waters, and that Individual C occasionally goes to Henoko's OuraBay (Okinawa Defense Bureau, 2009). The "Revised Environmental Impact Statement for the Project to Build a Futenma Air Station Replacement Facility" states, "Individual C likely has a broad activity range, mainly using the seagrass meadow in the Kayo area; presumably the possibility is small that it uses the seagrass meadow offshore from the Henoko area." However, the recent survey results show that dugongs are obviously using the marine area, the places in the restricted area, frequently (NACS-J,2014). Although Kayo also has a seagrass meadow, owing to its small 8-ha size, it is likely that the young Individual C has expanded its habitat to this marine area in search of a larger meadow. Henoko's seagrass meadow is the largest of those around Okinawa Island, with a size of 173 ha.

Since August 2014, Individual C has not used this area. Also since March 2015 it stopped using Oura bay as well. We consider there is relationship between disappearance of dugong and the process of the construction works, including pre construction works, and accompanied patrols. Since 2014 the noise from the construction works and the patrol boats notably become large.

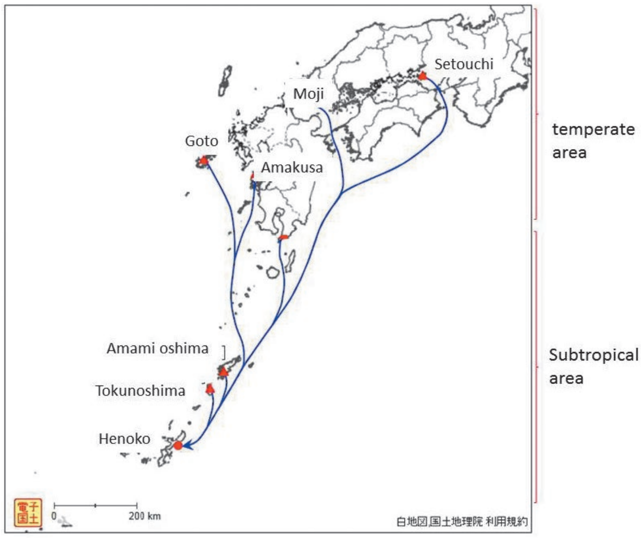
3) Possible invasive alien species problem

To complete this construction 21miliion cubic meters of soils and rocks are required for reclamation. 17million of which will be transported from outside of Okinawa island, wide range of South West part of Japan. And they will be transported to Henoko. It is difficult to avoid contamination of alien species to rocks and soils at quarries. Argentine ant (*Linepithema humile*) contamination is reported in one of the quarries of Setouchi, also Brown widow spider(*Latrodectus geometricus*) and Lance-leaved coreopsis(*Coreopsis lanceolate*) contamination is reported in another quarries of Amami ooshima island. These are listed as the list of invasive alien species in Japan of Ministry of Environment, Japan.

Having these knowledge, GOJ still plan to bring soils and rocks from far locations. IUCN gave recommendation ''Strengthening pathway management of alien species in island ecosystems' to the Government of Japan introduction of alien species beyond a distinct biogeographic region poses a risk of biological invasion even within national jurisdictions, especially across different climate, biogeological zones. Also it states that Okinawa island as well as Aamami ooshima, Tokunoshima is expected to register as World Natural Heritage in the near future, the importance of conservation of nature would be higher.

Therefore urgent measures are needed to be taken before we lose the richness of the irreplaceable coral reef ecosystem forever without many people being aware of its value.

Figure 4 Proposed locations of quarries for Henoko reclamation "proposed locations" of quarries



Reference:

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3)IUCN recommendation (2016) Strengthening pathway management of alien species in island ecosystems http://www.nacsj.or.jp/archive/2016/08/624/

Anthropogenic Decline of the Mudflat-specific Fauna and Flora in Japan: Significance of the Restoration of the Estuary in Isahaya Bay in the Ariake Sea

Masanori Sato

Kagoshima University

1. Present situation of Japanese mudflats

Mudflats are mainly formed in the upper littoral zones in estuaries, especially in the innermost part of macro-tidal embayments (upper reaches of estuaries), providing a habitat for peculiar fauna and flora (Sato, 2017a, b).

Japan is favored geographically by semi-enclosed embayments with various scales of estuarine mudflats (Sato, 2010). Therefore, the mudflats have traditionally been a rich source of food for people, such as bivalves and bottom-dwelling fish, as evidenced by ancient shell mounds. However, estuarine mudflats have been severely damaged by recent anthropogenic coastal developments such as land reclamation and sea-wall construction. About 40% of the total area of intertidal flats on the Japanese coasts were lost between 1945 and 2005 (Hanawa, 2006).

Consequently, the peculiar fauna and flora of estuarine mudflats appear to have been extirpated in many embayments in Japan, and many traditional fishery products have diminished, as various traditional fishery methods have disappeared (Sato, 2010). At present, many mudflat-specific species are designated as endangered species, including the major food species which typically make up part of the traditional Japanese diet (Japanese Association of Benthology, 2012; Ministry of the Environment, 2017).

2. Characteristics of the mudflats in the Ariake Sea

The Ariake Sea (1,700 km^2 in total area, 20 m in average depth) (Fig. 1) is a unique macrotidal embayment with a maximum tidal range of about 6 m in the innermost area, whereas Japanese coasts are generally micro-tidal with ranges of less than 2 m (Sakakura, 2004). In this embayment, vast tidal flats are formed on the northern (innermost) and eastern coasts, where the largest river in Kyushu (Chikugo-gawa) and several other large rivers flow, also supplying large amounts of sand and mud particles (Sato & Takita, 2000). Yokoyama (2007) estimated that 76% of the total particles supplied to the Ariake Sea come from Chikugo-gawa River.

Mud particles deposited on the sea floor of the bay are easily separated from sand particles and re-suspended into the water column by strong tidal currents as floating mud particles. The floating mud particles are transported to the upper littoral zones in a vertical direction, and to the upper reaches of the estuary in a horizontal direction by "flood-ebb current asymmetry" (Sakakura, 2004), and are also displaced counterclockwise by the Coriolis effect (Shimoyama & Nishida, 1999). Consequently, extensive mudflats composed of silt or clay particles are formed in an area from the innermost of the Ariake Sea to Isahaya Bay, fringing the north and northwest coasts of the embayment. Of the whole sediment particles originated from the Chikugo-gawa River, the finest mud particles (clay) are transported farthest, into Isahaya Bay, producing the most typical soft mudflats there before the reclamation (Fujimagari & Makino, 2001).

The Ariake Sea has the greatest variety of mudflat-specific species (Sato & Takita, 2000). Lots of the mudflat-specific species are completely or almost completely restricted to the Ariake Sea in Japan (Ariake Sea indigenous species), although populations of the same or closely related species are distributed along Asian continental coasts, suggesting that they are continental relicts. The Ariake Sea is special in that the original mudflat ecosystem and the traditional fishery have been well preserved, compared with other areas in Japan. With no social attention to this aspect, however, vast mudflats in the inner part of Isahaya Bay, covering up to 29 km^2 at spring tides (Kyushu Agricultural Administration Office, 1991), in the inner part of Ariake Bay, were lost due to the enclosure of the inner bay area (36 km^2) by the construction of a 7-km dike in April 1997 (Fig. 2) (Sato & Takita, 2000; Sato & Koh, 2004; Sato, 2010, 2017a, b).

3. Endangered species remaining in mudflats in the Ariake Sea

At least some of the species now restricted to the Ariake Sea previously had a wide distribution in Japan. This has been well documented in some bivalves. For example, *Tegillarca granosa* (Japanese name: Hai-gai, vulnerable species, VU) was once distributed widely, ranging from Kyushu to Hakodate, in Hokkaido, about 6,000 years ago according to fossil records, and living specimens were recorded in several embayments in central and western Japan as recently as 100 years ago (Sato, 2000). However, at present, its distribution is limited to the innermost part of Ariake Sea and additional small habitats in the Shiranui Sea and Imari Bay in western Kyushu (Japanese Association of Benthology, 2012). The dense population of this species, inhabiting mudflats of Isahaya Bay, was recently extirpated by the reclamation project mentioned above (Fig. 3) (Sato, 2000; Sato & Koh, 2004).

Our recent examinations of old polychaete specimens deposited in Japanese and European museums revealed that the distribution of *Hediste japonica* (Ariake-kawa-gokai, endangered species, EN) formerly extended to central Japan, including the Seto Inland Sea, Ise Bay, and Mikawa Bay at least until 1969 (Fig. 4) (Sato & Nakashima, 2003; Sato & Sattmann, 2009; Sato M, unpublished data). However, all populations of *H. japonica* seem to have been extirpated throughout Japan, except for in the inner part of the Ariake Sea.

Similar reduction of the distribution has also been suggested for the brachiopod known as a "living fossile", *Lingula adamsi* (Oo-shamisen-gai, critically endangered species, CR) (Ministry of the Environment, 2017), and a salt marsh plant, *Suaeda japonica* (Shichimen-so, VU) (Jinno, 2000), both surviving only in the inner part of Ariake Sea in Japan at present.

The reclamation project in Isahaya Bay caused the loss of the most important habitat for many endangered mudflats-specific species (Sato, 2010).

4. High productivity of the mudflat ecosystem

Intertidal mudflats have the highest levels of primary production by benthic microalgae (mainly diatoms), because they are rich in both nutrients and light; fine mud particles can adhere to large numbers of nutrient substances, and the wide surface of mudflats exposed to air around low tides can receive the energy of sunlight efficiently, acting like huge solar panels, so that the blooming of benthic diatoms is promoted on the surface of the mudflats (Fig. 5) (Sato, 2017a, b). The benthic diatoms and detritus deposited on the mudflats are fed on by various macrobenthis invertebrates, fish, and even shore birds. The macrobenthos are fed on by carnivores coming from outside of mudflats. Mudflat-specific endangered species often attain extremely high densities and biomasses in the Ariake Sea. For example, the maximum density of a population of the bivalve *Tegillarca granosa* (3–5 cm in shell length) reached 73 ind. m^{-2} on mudflats in Isahaya Bay at the time of its mass deaths due to the enclosure of the Bay in 1997 (Sato, 2001, see Fig. 3). The maximum biomass of a population of the polychaete *Hediste japonica* was recorded at as much as 1kg m^{-2} in wet weight in an estuary of the Omuta-gawa River (Hanafiah et al., 2006).

Such large biomass of microbenthic invertebrates on mudflats can support the lives of large numbers of carnivores such as shore birds and bottom-dwelling fish. The highest number of migratory shorebirds in Japan (13,500 individuals) was recorded on the mudflats in Isahaya Bay in spring 1988, before the enclosure of the mudflats (Hanawa & Takeishi, 2000).

Traditional local fisheries are also supported by high productivity in the mudflat ecosystem. For example, the estuarine mudflats play a key role for the larval settlement and the following growth of the Japanese eel, *Anguilla japonica* (Nihon-unagi, EN, one of the most important fishery resources in Japan), greatly contributing to maintainance of the natural populations of the eel (Kaifu, 2016). The eel feeds on various macrobenthos on the mudflats (Kan et al., 2016). Traditional eel fishing on the mudflats using various methods (e.g., using a Japanese eel fork "Unagi-kaki") continues to this day in the inner part of the Ariake Sea.

5. Conclusion

From a long-term viewpoint for the next generations, conservation and restoration of Japanese mudflats are desirable in terms of the conservation of many endangered species inhabiting mudflats and the traditional fisheries supported by them. In particular, the restoration of the estuarine mudflats in Isahaya Bay in the inner part of the Ariake Sea is highly desirable, because the inner part of the Ariake Sea is the last remaining habitat in Japan for many endangered species, which the traditional fisheries depend on.

If the tidal currents can be recovered within the regulating reservoir, which was converted from lower estuarine mudflats to a freshwater pond due to the enclosure of Isahaya Bay, the estuarine habitats for many endangered species have the propensity to be restored rapidly, leading to the recovery of the function of the mudflat ecosystem as a water-purifier and nursery ground in Isahaya Bay. Large-scale restoration is expected to improve the recent poor environmental conditions for the traditional fisheries in the inner part of the Ariake Sea.

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Fig.1. A map showing the distribution of tidal flats in the Ariake Sea in western Kyushu in Japan. After Shimoyama & Nishida (1999). The range of tidal flats in Isahaya Bay was modified based on the measurement at the low-tide mark of spring tides at 1983 by the Kyushu Agricultural Administration Office (1991).

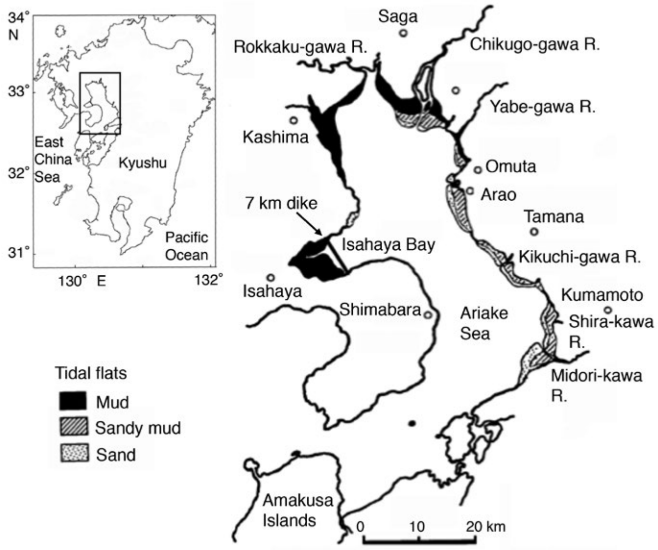


Fig. 2. Reclamation project in Isahaya Bay. (Top) The land-reclamation project in progress in Isahaya Bay in the Ariake Sea in Kyushu, photographed in July 2000. The inner part of Isahaya Bay was completely closed by a 7-km dike (arrow) in 1997. The original tidal flats were changed to dry land in the upper part (A) and to a regulating reservoir in the lower part (B). After Sato (2010). (Middle) Map showing the inner part of present Isahaya Bay, with the lower edge of former mudflats of 2900 ha (dotted lines). Modified from an original figure by Shinichi Sato. Fresh water has been constantly discharged from the regulating reservoir to the sea through the two gates to keep the elevation of the regulating reservoir as -1 m. (Bottom) Schematic diagram of the sectional view of the land reclamation. Average tidal range in spring tides is 5.4 m here. After Sato (2017b).

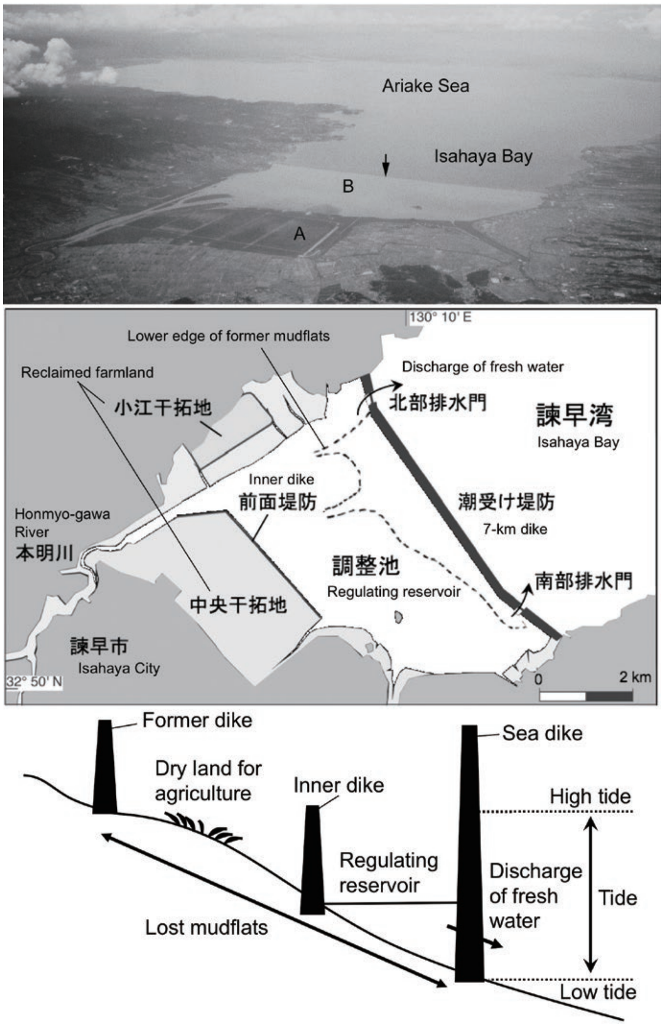


Fig. 3. Mass deaths of the bivalve *Tegillarca granosa* inhabiting mudflats in the inner part of Isahaya Bay in the Ariake Sea in August 1997 (4 months after enclosure of the sea by the dike construction). Photographed by Kenji Tominaga. After Sato & Takita (2000).

Fig. 4. Distribution of *Hediste japonica* in Japan. After Sato (2017b).

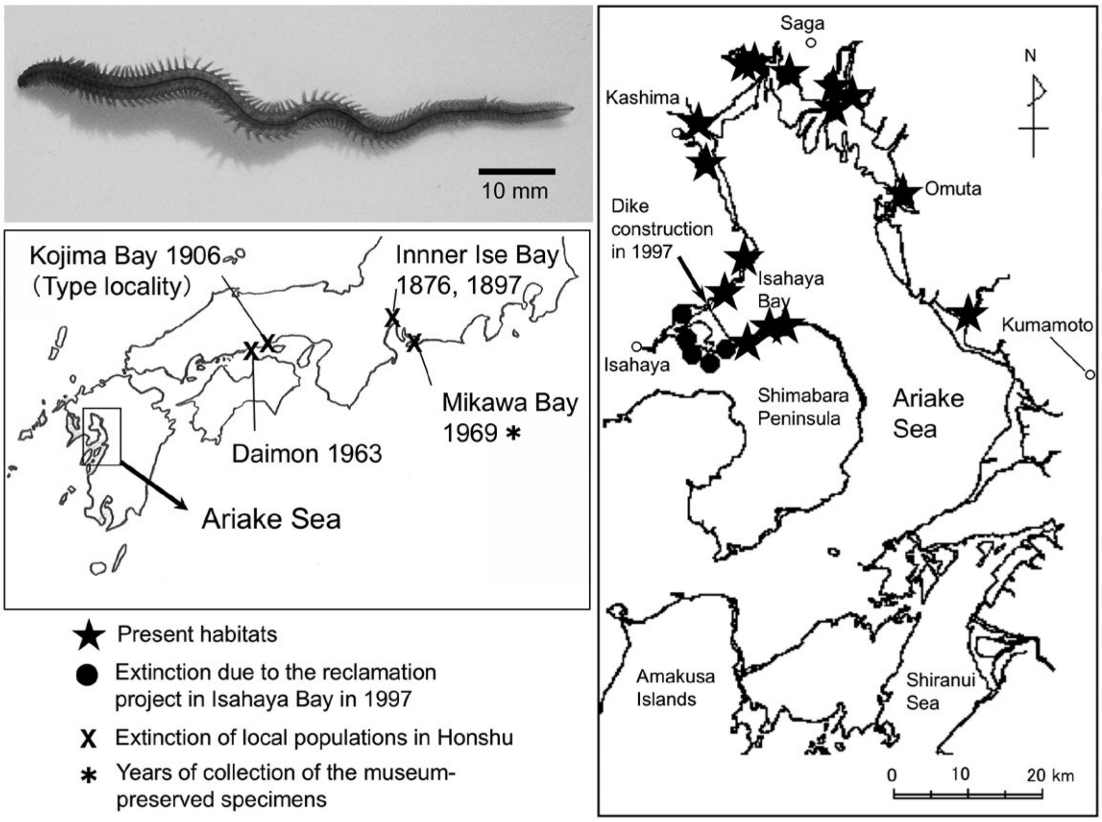
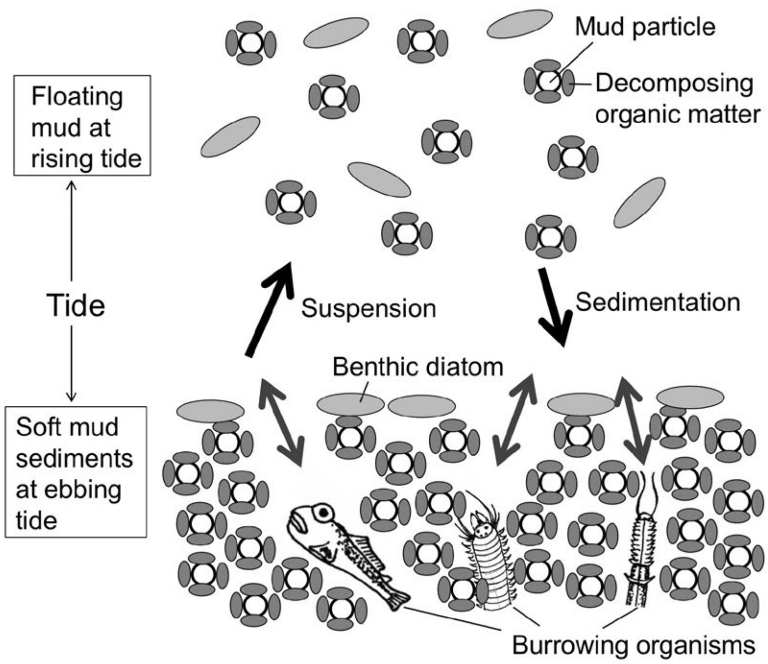


Fig. 5. Schematic diagram of the typical soft mudflats composed of fine mud particles at rising (top) and ebbing (bottom) tides. After Sato (2017b).



Securing Management Measures of Wild Deer in Kushiro Marsh, the First Ramsar Site in Japan

Satoshi Kobayashi [1], T. Yoshida [2], H. Uehara [2], H. Takafumi [2], M. Sarashina [2], H. Uno [3], Y. Inatomi [3], T. Shimamura [3], Y. Osa, M. Ueno [3]

[1] Kushiro Public University, [2] Rakuno Gakuen University, [3] Hokkaido Research Organization

1. The ongoing Wetland Restoration Projects in Kushiro Marsh

The Kushiro Marsh is the largest of remaining marsh areas in Japan. It is located in the eastern part of Hokkaido Island, the northernmost major island of Japanese Archipelago.

When Japan joined the Ramsar Convention in 1980, Kushiro Marsh was designated as the first Ramsar Site, followed by the National Park designation in 1987. The National Park area covers 28,788ha today and the Ramsar Site 7,863ha as the core area of the Park. This year 2017 marks the 30th anniversary of the National Park designation of Kushiro Marsh.

Approximately 2,000 species of wild flora and fauna have been recorded in Kushiro Marsh, including some endangered and rare species such as red-crowned crane (*Grus japonensis*) and Siberian salamander (*Salamandrella keyserlingii*).

Following the introduction of the Law for the Promotion of Nature Restoration in 2003, the Kushiro Wetland Restoration Committee was established. Since the publicizing "the Overall Plan for the Kushiro Marsh Nature Restoration" in early 2005, various wetland restoration projects have been carried out in Kushiro Marsh.

2. The Deer problem in Kushiro Marsh

However, there was no mention of wild deer (*Cervus nippon yesoensis*) in 'General Outlook of Kushiro Marsh' as an introductory chapter of the overall plan although the front page of the similar chapter in its English version published in 2008 featured a photo of both deer and cranes. Again, no mention of damage caused by wild deer in the chapter 'Issues related to Kushiro Marsh and local communities' in the original Japanese version in 2005.

The crop damage together with forestry damage caused by wild deer has been the highest in the Kushiro sub-prefecture among 14 sub-prefectures in Hokkaido Island. Therefore, local government officers, farmers, hunters, people working for the tourism industry and members of local conservation NGOs in 4 municipalities, namely Kushiro City, Kushiro Town, Shibecha Town, and Tsurui Village, surrounding Kushiro Marsh, have basically all agreed with there is a need to reduce the number of wild deer even within the National Park.

The wild deer population seems to be increasing within the National Park boundary, and our research team has confirmed it. The increased deer population is then causing a new problem for the rich diversity of Kushiro Marsh. For example, the Japanese Ministry of the Environment has confirmed that some endangered plant species has been damaged by wild deer.

3. The Deer research in Kushiro Marsh

Our research team, comprising of Rakuno Gakuen University near Sapporo, Hokkaido Research Organization and Kushiro Public University, has carried out 3-year project to understand and analyze the situation on deer and ecosystem in Kushiro Marsh.

Main objectives are:

1) to estimate the number of wintering deer within Kushiro Marsh; 2) to capture some deer for satellite-tracking to understand their daily and seasonal movements; and 3) to collect opinions over wild deer management from various local stakeholders in order to help future management planning.

Our findings are as follows:

1) Some wild deer use the central area of Kushiro Marsh and its surroundings thus considered to be residential, but others move onto further away are as - migratory;
2) The unprecedented concentration of wintering deer has been recognized in some parts of Kushiro Marsh; and
3) Introducing management measures of wild deer within the National Park area is expected to contribute to controlling crop damages caused by wild deer in surrounding farmland.

Possible target areas for deer management have been identified, but it requires further examination to recognize when and how management measures are to be carried out.

4. Conservation issues

On the other hand, consideration is necessary for some endangered species such as red-crowned cranes in the national park area. Dialogues and exchanging information with local conservation NGOs have been therefore initiated, with special focus on cranes and other endangered bird species.

More intensified management measures of deer population in Kushiro Marsh will be introduced in due course based upon the results of the research project, and such measures will be certainly useful and provide further information for similar problems in other Ramsar Sites and wetland protected areas.

5. Cases in U.K.

The research team invited a representative from the Royal Society for the Protection of Birds (RSPB) to Hokkaido in 2015 to share their experiences in Ramsar Sites in U.K.

From the viewpoint of conserving wetland-dependent bird species such as Marsh Harrier (*Circus aeruginosus*), Great Bittern (*Botaurus stellaris*) and Bearded Tit (*Panurus biarmicus*), the management of red deer (*Cervus elephus*) has been initiated by the Society in two Ramsar Sites successfully. One is Leighton Moss (129ha) in northern England and the other is Minsmere-Walberswick (2,019ha) in southeastern England.

The fact that a bird conservation organization has been engaged in culling programs of wild deer so as to protect bird habitats is an eye-opener for many conservationists in Hokkaido.

6. Opportunities with local stakeholders

In addition to the workshops to introduce case studies from U.K., the research team has organized a series of workshops and symposia in Sapporo, Kushiro, Shibecha and Tsurui to report the progress on the research and to exchange opinions on management issues. They have been very useful especially in collecting opinions from local stakeholders.

2014 Initial stage
GPS tracking; Aerial surveys, research on vegetation
collecting information on stakeholders
Symposium in Kushiro to share information on issues and to collect opinions from local stakeholders

2015 interim report
introducing case studies from abroad (U.K.)

2016 Final report/recommendations
reporting workshops in Sapporo and Kushiro

7. Reconsidering people and wildlife

A Chinese delegation came to Kushiro this summer to study the ongoing wetland restoration projects in Kushiro Marsh. They found that distance between people and deer is too close at one of major viewpoints in Kushiro Marsh.

Besides, the winter provisionization for endangered red-crowned cranes has made the distance between people and cranes closer as well.

8. Montreux Record Listing

Combining the ongoing wetland restoration program in Kushiro Marsh for more than 10 years now, and the problem caused by increasing deer within Kushiro Marsh, perhaps it is time to consider the Montreux Record (MR) Listing of Kushiro Marsh together with some other Ramsar Sites in Japan.

Table 1. Top 10 Ramsar Contracting Parties designating the largest number of Ramsar Sites, with their Montreux Record Sites.

CPs	Number of Ramsar Sites	MR Site
1. U.K.	174	2
2. Mexico	142	0
3. Spain	74	1
4. Sweden	68	0
5. Australia	65	0
6. Norway	63	0
7. Italy	54	0
Netherlands	54	0
9. Algeria	50	0
Japan	50	0
794 Sites in total		

The MR is not a black list, it is the trigger for 'let's work together' approach. Table 1 shows the top 10 of the Ramsar Contracting Parties with the largest number of Ramsar Sites designation. These 10 CPs have designated amazing nearly 800 Ramsar Sites, over one third of 2,200 Ramsar Sites all over the world. It is not, however, clear weather only a few Ramsar Sites actually have issues in their ecological characters.

If you have similar problem with deer or other large animals in and around wetland areas, please contact us for sharing information : satoshi@kushiro-pu.ac.hp

With grant fund made available for the research from 2014 to 2016 by the Japanese Ministry of the Environment: Project number 4-1405

Photo 1. Tourists and a doe in Kushiro Marsh

Photo 2. A young crane flying between cars near Kushiro Marsh

Photo 3. A large group of deer in Kushiro City near Kushiro Marsh National Park

Introduction to Configuration Concept of Aquatic Acrophytes in Lake Ecological Restoration —An Example of Ecological Restoration in Gonghu Bay (abstract)

Liyan Qi, Zhongren Xiong, Hongxing Zhang

Research Association of Wuxi Wetland Protection and Construction

Eutrophication is a serious problem in the ecological environment of shallow lakes currently.Ecological restoration by using aquatic macrophytes becomes a good method to solve this problem. This research takes Gonghu Bay in Wuxi as an example, mainly discusses the process of aquatic plant allocation in the process of ecological restoration of shallow lake.We elucidate four stages of aquatic plant restoration including basic ecological restoration-vegetation succession-system improvement and its operation and maintenance and their logical relationships.

Meanwhile we emphasize the advantages of functional plants at different times.In order to provide some theoretical basis and practical guidance for the of aquatic plants in the ecological restoration of shallow lake.

In recent decades, due to human disturbance of the eutrophication of sewage, Strength increase of fishery and water division, many aquatic vegetation degradation, lakes change gradually from the grass type lakes to Algae type lake, aquatic plant is an important part of aquatic ecosystem community, and plays an important role in the aspects of water pollution control, water conservation, water conservation, climate regulation and environment and so on.

The analysis of community configuration process of lake ecological restoration of aquatic plants Indicate that: when using aquatic plants to regulate the water ecological system structure, restore the structure and function of the lake ecosystem, enhance the buffering capacity of anti external interference, it demands full knowledge of aquatic plant performance, life habits and natural environment of lakes, and according to these conditions to formulate the corresponding configuration method of aquatic plant communities; in the configuration process, it demands comprehensive consideration of aquatic plants in ecological and economic benefits, so that the aquatic plants ecological restoration project can play a role in long-term.

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Re-establishment of the Eurasian Otter in South Korea (abstract)

Sungwon Hong, Young Min Kim, Jieun Choi, Eun Song Jeong, Yuno Do, Gea-Jae Joo

Pusan National University

Urbanisation and associated anthropogenic impacts have reduced the distribution of many native mammals globally. In South Korea, where urbanisation and industrial development have been exceptionally rapid, the distribution of native Eurasian otters (Lutra lutra) was severely reduced between the 1950s and the early 1980s. However, we focused on the otter re-establishment based on improved environment and public awareness.The government implemented a policy in the 1980s to promote the coexistence of nature conservation and development. To mitigate the effects of river and stream pollution, the government has invested $1.5 billion (U.S.) to date, and since the 1960s, forest density has increased dramatically from 27.5 to 125.6 trees/ha. Firstly, we hypothesised that these two distinct improvements in the environment could enable the distribution of otters to increase. Secondly, scientific research and public awareness have both facilitated conservation efforts to restore otter populations in South Korea, but how changing public attitudes to conservation have contributed to otter recovery is unknown. Finally, we applied both diffusion kernel method and self-organizing map to analyse the otter diffusion way between 2014 and 2017, more precisely. We collated data from five otter distribution studies from 1987 to 2010 and examined the relationship between changes in otter distribution and environmental variables (biological oxygen demand, forested area and density, and percentile of national park area) across 111 river basins. The otter distribution has increased from 29.7% to 87.4% of river basins. In the early 1980s, otters occurred only on islands, in remote farmlands, and mountainous areas, in addition to a remnant population near the capital city. After the average biological oxygen demand remarkably improved in the 1990s and establishing strict law, water quality was an important factor affecting the otter population. Later, afforestation became a more important factor influencing the otter population. However, the most important reasons for the otter recovery were the implementation of effective conservation laws and their enforcement in the late 1990s. Because historic newspaper articles can reveal such changes, we categorized the 5168 newspaper articles about otters from 1962 to 2010 into five topics (occurrence, ecotourism, conflict, research, and restoration) and geotagged any otter locations mentioned to a 15 x 15 km grid to compare with the otter distribution established by five scientific surveys. Since 2000, the number of newspaper articles about conflicts between otters and urban development, and the roles of otters in encouraging eco-tourism have increased significantly. Using the diffusion kernel estimation, population dispersals were separately identified according to geographic conditions in northern and southern areas. Both populations were observed to disperse eastward although the survey period was relatively short. Whereas the northern population in the upper basin of the Nakdong river decreased in densities and dispersal area during the survey period, the southern population in the downstream area dispersed widely as the time progressed. The Geo-SOM was applied to reveal associations between spraint densities and environmental factors. The northern populations were negatively associated with anthropogenic factors (e.g., distance to residence area) initially in 2014, but associations changed later to show high relations to biotic factors (FAI, BMI, and canopy development) in 2016. The results indicated a possibility of transition in niche preference, reflecting human intervention in the early period during the course of otter population dispersal. In the southern populations, however, spraints were consistently associated with favourable landscape conditions and biotic factors through the survey period. The study suggested that niche preference could be diversely addressed depending upon biological and environmental factors constrained by geographic conditions where the populations reside for dispersal.

Linking Wetland Bird Ecology with Human Activities in Multiple-Use Wetlands in India (abstract)

[1]Shivona Bhojwani, [2]K.S Gopi Sundar, [3]Jagdish Krishnaswamy

[1]National Centre for Biological Sciences,Wildlife Conservation Society-India, Ashoka Trust for Research in Ecology and the Environment

[2]International Crane Foundation, Nature Conservation Foundation, [3]Ashoka Trust for Research in Ecology and the Environment

A one-third decline in the coverage of natural wetlands in South Asia has led to the loss of habitat for many wetland bird species. As natural wetlands declines, the potential use of human made or modified wetlands by wetland birds, needs assessment. A number of such wetlands in India are irrigation tanks embedded within agricultural landscapes, being primarily built for irrigation. They are also used heavily for domestic uses, freshwater aquaculture, and recreational purposes. In spite of this, many wetland bird species, especially waterfowl use these wetlands, especially in the wintering season. A few studies in South Asia have investigated responses of wetland birds to management regimes in coastal wetlands or agricultural landscapes. However, the conditions under which these "multiple-use" wetlands support water bird populations is not well studied. For this purpose, we used aquatic vegetation as a predictor of bird abundances at wetlands as it performs a dual role: a) plant communities are good indicators of eco-hydrological conditions at wetlands b) birds associate closely with vegetation for foraging, roosting or nesting purposes. We also chose to focus on the influence of aquaculture practices on birds as there could be different mechanisms by which they influence bird communities. First, a direct one, where we expected negative influences of human activities on bird abundance. Second, an indirect one, by which we expected management for exotic carp production to influence negatively aquatic vegetation thereby influencing bird abundances. Conversely, we also gained insights on mechanisms by which the ecology of the wetland influences carp production. The study was carried out in 19 agricultural wetlands of Gondia district, Maharashtra, India. Using GIS software and field surveys, we selected wetlands of similar sizes (7 to 12 ha) located in paddy fields, on a gradient of overall wetland vegetation, estimated coarsely before sampling. Birds were counted in each wetland through the wintering season by two observers. We quantified submerged, surface and shore vegetation separately, using a combination of methods. To understand the influence of fishing practices, key informant interviews, group discussions and frequent visits to the sites were made. Bird species were parsed into a few guilds based on their foraging habitat, feeding strategies, diet and size. These guild abundances were used as responses in N-mixture models with fishing and vegetation variables as predictors. We found that the herbivorous guild comprising dabbling and diving ducks, Eurasian Coots, and carnivorous bird guilds that included Egrets, Herons and Little Cormorants, were positively associated with the biomass of submerged vegetation, percent cover of sedges and Nymphaea sp. at these sites. Importantly, these vegetation types were negatively influenced by occurrence desilting in the past ten years, a tank management practice, seasonality and prevalence of exotic carp culture. Vegetation that positively influenced skulking birds like rallids, negatively influenced small shoreline waders like sandpipers and stints. The data collected from interviews did not support the hypothesis that disturbance negatively influences bird guild abundance. We also found that aquaculture production was higher in sites that had greater values for submerged vegetation and bird guild abundance, as compared to the other sites. Insights gained through perceptions of fishermen, based on interview surveys, corroborated with the overall findings of the study. This study not only explores links between agricultural wetlands and bird conservation, but also the link between their ecology and potential to provide ecosystem services. Thus, this study has the potential to provide insights for future bird-friendly management of agricultural wetlands.

Poster Session I

JICA Technical Cooperation Project for Biodiversity Conservation through Implementation of the Papua New Guinea Policy on Protected Area

[1]Yukio Nagahama, [2]Koji Asano

[1] INTEM Consulting, Inc., [2] NIPPON KOEI CO., LTD.

Japan International Cooperation Agency (JICA) is currently implementing in partnership a biodiversity project with Conservation and Environment Protection Authority (CEPA), Papua New Guinea (PNG) to build institutional capacity for protected area management in PNG. CEPA-JICA project duration is from June 2016 to June 2020. One of the outcomes of this project is to develop a model for establishing a new Marine Protected Area (MPA). Bootless Bay (see fig. 1) has been selected as the site for establishing a new MPA because of its rich biodiversity, cultural significance for the local communities and its importance for the general publics.

CEPA-JICA Project is focusing on protecting the major marine habitats, including mangrove forests, seagrass beds and coral reefs, because these habitats support the rich biodiversity in Bootless Bay. Detailed GIS maps of the mangroves including the other critical habitats in Bootless Bay were developed by CEPA-JICA Project. Rapid Marine Biodiversity Survey in Bootless Bay was done in late October to November of 2016 to determine habitat distribution in Bootless Bay (see fig. 2). Three key threats were identified from this survey; 1.) decline of fish resources, 2.) mangrove degradation, and 3.) marine debris. The results were shared with stakeholders of Bootless Bay. A roadmap to establish MPA in PNG was elaborated in December 2016, and shared with stakeholders of Bootless Bay. In the roadmap, CEPA-JICA Project did situation analysis, stakeholder analysis, problem and objective analysis. The roadmap concluded four targeted MPAs include the following: 1.) Central Papua Conference Bautama Tahira Mangrove Conservation MPA. This MPA allows for zonation include bird watching, boardwalks, mangrove conservation areas and education and research mangrove areas, 2.) University of PNG (UPNG) Tahira Mangrove Conservation MPA. This project allows for joint collaboration with UPNG for mangrove conservation, education and research, 3.) Motupore Island MPA. This MPA allows for coral reef, sea grass and mangrove conservation for research and education purposes, and 4.) Aioro (Horse Shoe) Reef MPA. This project allows for coral reef conservation and sustainable management to allow for reef fish species sustainability and coral reef conservation.

Bootless Bay Marine Conservation Initiative (BBMCI) was formulated to establish MPA and to share information regarding activities within Bootless Bay. National government, local government, NGO, local communities and private sectors have participated to BBMCI (see fig. 3 & 4). By-law of BBMCI was approved by the members and chairperson and vice chairperson were selected in April 2017.

From field observation and from reports by local NGO, marine debris in Bootless Bay are increasing. Marine debris can cause problems to marine habitats and animals, discourage tourists, and also hazardous to hygienic safety of local communities. Coastal clean-up event under BBMCI was carried out at Tubuseria Village water front in April 2017. More than one hundred peoples participated to the event and collected 200 plastic bags (50L) of debris in over an hour. Tubuseria community is more aware of solid waste and take up responsibilities to manage waste.

From here on, CEPA-JICA Project will prepare MPA application form based on PNG PPA, consult with stakeholders, draft MPA proposals, submit the proposal and prepare management plan of MPAs.

fig. 1 Marine coastal area map of Bootless Bay

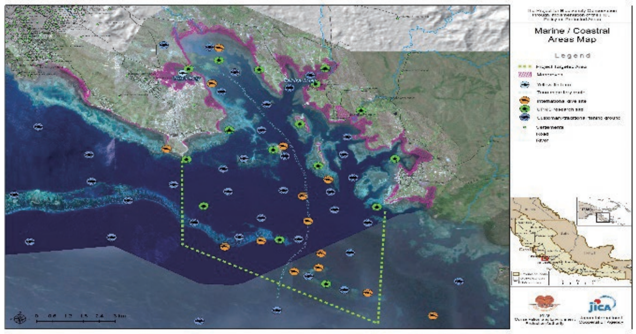


fig. 2 Healthy corals in Bootless Bay

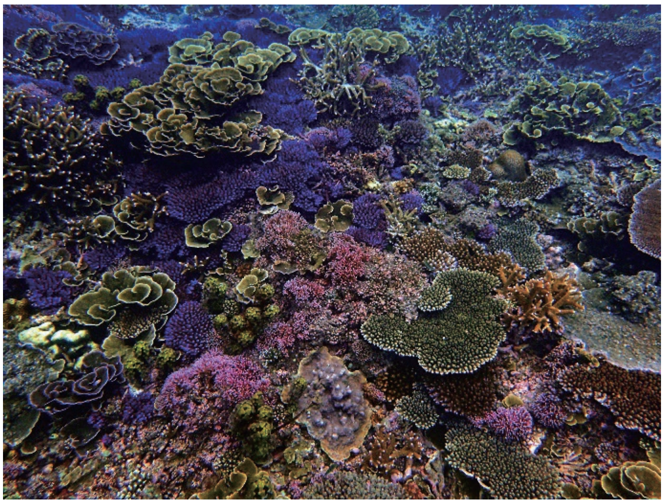


fig. 3 Logo of Bootless Bay Marine Conservation Initiative

fig. 4 Banner of Bootless Bay Marine Conservation Initiative

Wetland Conservation Action by Government and NGOs in Bangladesh and Future Course of Action

Tapas Ranjan Chakraborty [1], Sanowar Hossain [2]

[1.] PhD Fellow, Department of Environmental Sciences, Jahangirnagar University, Saver, Dhaka-1342, Bangladesh, Email: tchakraborty@oxfam.org.uk

[2.] President, Bangladesh POUSH

Around 50% of the area of Bangladesh is wetlands; 13 types of natural wetlands are found in the country. The socio-economic and cultural state of the country are wetland based, it is believed that all most all traditional livelihoods of the country is wetland dependent. Natural resources of the wetlands were harvested by the community as common property resources. As there was over harvesting and rapid degradation of the wetland and its natural resources from 80s government and development actors started initiating the resource management intervention. For different wetlands some attempts were taken, which can be classified in to two major types, (1) Disaster management action and (2) Biodiversity conservation action. In most cases the planning process was participatory and the implementation was done as project intervention. Stakeholder diversity, local power structure and geo-limitations were the main challenges of participatory resource management of the wetland. The conservation interventions by government and development organizations have created model of community based management. In some projects the population growth of species was around double. The tools of Participatory Action Plan Development, Participatory Capacity and Vulnerability Assessment and Community Risk Assessment were participatory process of conversation planning and action. Beside the national Laws, the country is signatory of CBD, Ramsar, CITES, CMS, etc. Tanguar haor is one of two Ramsar sites in Bangladesh. Every winter about 60 species of migratory birds visit Tanguar Haor. Climate change is a threat to wetland and its natural resources, climate change vulnerabilities are contributing to additional challenges of natural resource management of the wetlands. Action to cope with climate change was mostly on livelihood adaptation; for wetlands Ecosystem based Adaptation was recommended. Rapid urbanization and habitat fragmentation are being causing risk to resource management. In Bangladesh, many wetlands are subject to trans-boundary management. Fifty-four rivers of the country are trans-boundary. Fish migration path is intercepted by embankment and other barriers in catchment and in up-stream. There are a few interventions for the trans-boundary wetlands but major challenge is political commitment. In order to address the human needs in the changing climate and rapid urbanization community-based adaptation and climate smart development are essential for every wetland. Therefore, Bangladesh now needs a comprehensive strategy combining political, economic, social, and technological approaches considering environmental and climate change adaptation challenges to manage the natural resources in the wetlands. Climate change adaptation in wetland ecosystem should be incorporated into a system of integrated land and water use and, indeed, into the socioeconomic system of the country. Policies, strategies, and management plans for sustainable use and conservation of wetlands of Bangladesh must be based on solid knowledge and understanding of their ecological and socioeconomic functions and processes and the newly added crisis.

Wetland Development Projects

The development projects in wetlands in Bangladesh can be divided in to two major types:

(1) Disaster Management: Project that are working on infrastructure development and aware community on disaster management. Community capacity building is a major component of those projects. Major projects are on flood and flush flood hazards.

(2) Biodiversity conservation: Those projects are on ecosystem management and or on specifies conservation. Conservation projects are mostly limited in the areas of ecologically important.

Major Assessment and planning tools used

The planning phase of projects by government and non-government actors are well participatory though during implementation phase significant gaps were found.

- Participatory Action Plan Development: Very common tool for government initiated project planning. The presence of the secondary stakeholders and scope from the policies and legislations are well defined.
- Participatory Capacity and Vulnerability Assessment: very popular tool among the non-government actors. There are different forms of this tool. Mostly assessing the capacity and changes of the community who are direct beneficiaries of the implementation.
- Community Risk Assessment and Risk Reduction Action Plan: Tool used by the local government authorities.

All most all the assessment and planning are following the administrative unit as the area of intervention, but the challenges and opportunities are mostly ecosystem specific; very specifically in a wetland country, planning needs to be basin specific for the sustainability of intervention.

Conservation Challenges

In the wetlands of Bangladesh following are the main threat:

- Climate Change
- Urbanisation
- Trans-boundary issues
- Balance in ecosystem

Bangladesh is one of the most vulnerable countries to the impacts of climate change. The people, resources base and various ecosystems are being impacted by multiple climate hazards. Vulnerability denotes a set of conditions of people that derive from the historical contexts and prevailing in social, cultural, economic, environmental, political, and institutional contexts. The poor and women are disproportionately impacted by climate variability and extreme events. Vulnerable groups are not only at risk because they are exposed to climatic hazards, but as a result of marginality, of the everyday patterns of social life, their interactions and organizational linkages, and their access to and control over resources. In wetlands communities who are dependent on the wetland common property resources are poor and marginalized. It is essential to understand how vulnerability is generated, how it increases, and how it builds up through the interactive social process and conditions. More importantly – how the nature and level of vulnerability differ across the social categories due to their lack of capacity, knowledge and action.

Policy Potential

Bangladesh has number of laws that helps the conservation process of wetlands. Laws are on the rights of ecosystem and on people's participation and right on from the conservation action. Following are laws related to wetland conservation:

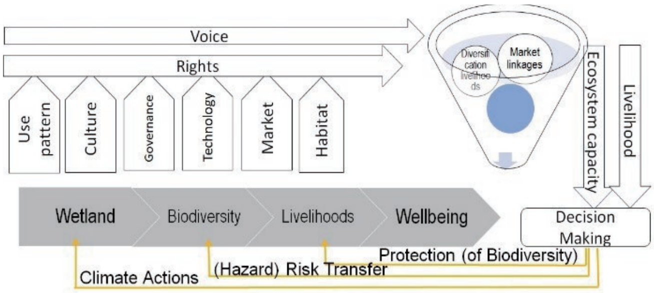
- Acts Haor Development Board Ordinance1997,
- Bangladesh Environmental Conservation Act 199,
- East Bengal Protection and Conservation of Fish Act 1950,
- Bangladesh Wildlife (Preservation) (Amendment) Act 1974,
- East Bengal State Acquisition and Tenancy Act 1950, Land Reform Board Act 1989,
- National Rural Development Policy 2001

There are treaties on Ramsar, Ganges water treaty 1996, CITES, and CMS signed by the country. Bangladesh has to Ramsar sites, the Tanguar Haor and the Sundarbans. There are Ecologically Critical Areas, National Parks, and Sanctuaries to protect important habitats and species.

To protect the fisheries resources there is harvesting ban, no fishing zone, and no Hilsa fishing days follows nationwide.

Response Capacity of Community

For the protection of wetland, the community needs to be responsive. A responsive has well understanding on the values of wetland resources, cultural norms and conservation ecology. There is potential scope of technology use and market linkages for the betterment of the livelihoods. A responsive community can bring their voices in the process of decision making and their rights and entitlements are ensured in the process.



Ecosystem based action

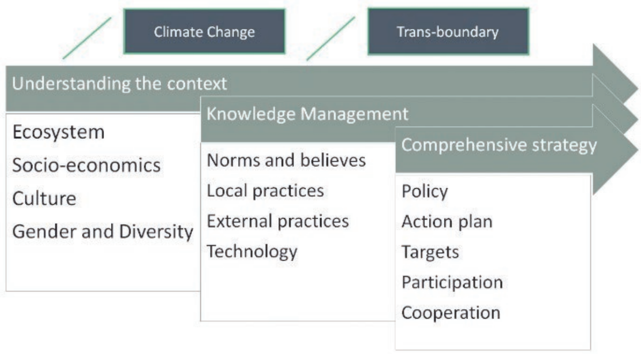
The conservation action taken by taken by different stakeholders in the wetlands are as of the following types:

- Habitat Restoration
- Biodiversity Conservation
- Erosion and siltation management
- Minimum water for ecosystem balance
- Policy and strategy
- Technological capacity
- Alternative livelihoods
- Knowledge management
- Public awareness

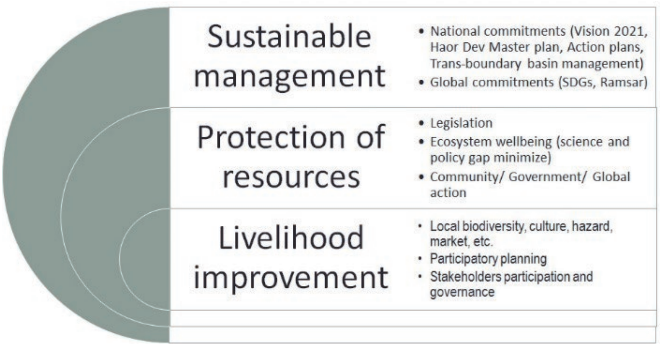
Sustainability

For the sustainability of intervention understanding all the current and emerging challenges and opportunities are the main requirement. In the wetlands of Bangladesh climate change is a major factor that interferes the process of conservation and keeping number of uncertainty and emerging risk. Because of the location of the country the water availability on the wetlands are mostly dependent on the trans-boundary diplomacy.

Future course of Action



To conserve the biodiversity of the wetlands in Bangladesh livelihood improvement, protection of resources and sustainable management are the major action required to following in chronology.



Study on Flood Control Effect of Rainwater Tank with Small Hole and Creation of Wetland Habitat in Urban Area

Teruki Hamada
Fukuoka University

1. Introduction

Generally in Japan, the traditional management of stormwater quickly into the sewer and discharging it to the river is done, but in this urbanized area where the sewer has developed, the peak flow rate of the river is increased and urban flood damage causing.

The method we propose temporarily shuts off from the sewer network and expects that peak flow of river and sewage will decrease by shifting the time to release.

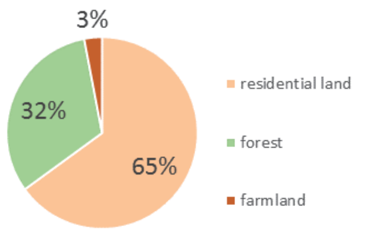
Also, the water discharged from the rain water tank will be caught and held in the rain garden and stormwater wetland located downstream. These are expected to suppress the heat island phenomenon, improve the landscape, create a wetland habitats.

2. Previous studies

2.1 study area

The Hii River in the research field is a city river with an extension of about 13 km and a catchment area of 30km^2 that flows through the western part of Fukuoka city center. In recent years urbanization of watersheds has progressed, and in 1976 residential land was 55%, but in 2006 it has increased to about 65%. The remaining land use is 32% for forest and 3% for agricultural land. Land use classification is shown in Fig.1

Fig.1 land use in the Hii River watershed



Expansion of residential areas, which is a change in land use in this basin, is also causing an increase in impermeable areas such as improvement of roads, house roofs, and home parking lots. In addition, expansion of the impermeable area breaks the conventional water circulation process, decreasing permeation of rainwater into the ground reduces the flow rate at all times due to the decrease in the basal flow rate of the river, and increases the flow rate at the time of flooding. Therefore, forestry and agricultural land are supposed to be preserved as a permeable area, and it is desirable to take measures at residential areas that account for 65% and the majority of catchment area.

2.2 method by storage

In order to improve urban water circulation it is important to return the rainwater to the river or the atmosphere slowly. Penetration and storage are cited as representative methods. As for permeation, it is necessary to continue observation on the relationship with the groundwater level for a longer time, so we will describe here the method by storage.

2.3 Experimental rainwater use housing

In this research, based on the observation data in the experimental rainwater use housing (Photo1) completed in, Fukuoka City in April 2012, to what extent are the effects of rainwater utilization and urban flood damage deterrence in individual housing In addition to checking the basic data for quantitatively grasping the effect of individual storing to achieve watershed flood control, we have accumulated basic data. The greatest feature of Experimental rainwater use housing is to store all the rain that fell on the roof to suppress urban flood damage. Fig.2 shows a tank layout of Experimental rainwater use housing. The underground storage tank installed is divided into three parts, the first is the underground tank which also serves as the foundation of the house, the volume is about 17.3m^3. The rainwater stored in this underground tank is used as water for toilets, baths, washing and garden watering. Here, rainwater at the beginning of saving contains a lot of impurities, so it is structured to cut initial rainwater. The second is a tank buried under the parking lot and the volume is about 22.5m^3. When the underground tank under the house becomes full, the overflowing rainwater flows into the tank under the parking lot. This tank is a tank for temporarily storing rainwater to suppress flood damage, and the stored rainwater slowly penetrates into the underground system. The third tank is a biotope tank and the volume is about 2m^3, and the rainwater accumulated in this tank is used for circulation of the biotope in the garden. The total reservoir capacity of the tank is 41.8m^3. In addition to the tank, there is a penetration bath in the middle of the overflow pipe, and it is structured to penetrate underground also from there.

Photo1 appearance of Experimental rainwater use housing

Fig.2 Plan view of Experimental rainwater use housing

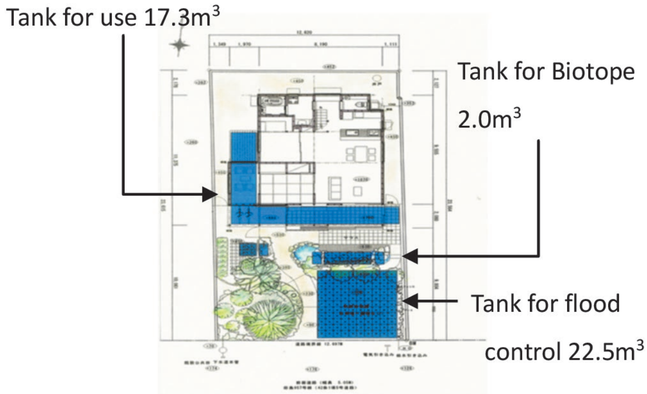
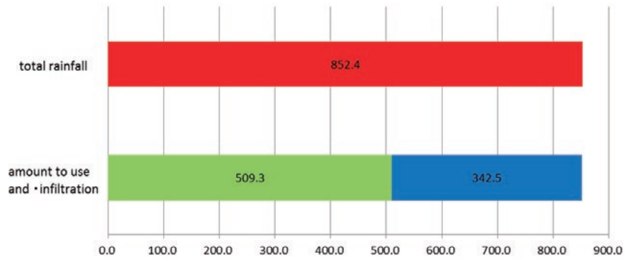


Fig.3 water balance of Experimental rainwater use housing

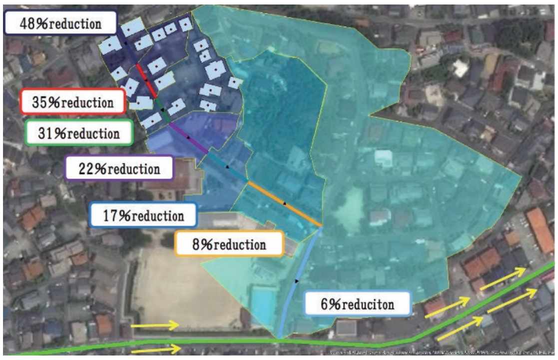


For the total rainfall amount of 852 mm, the sum of the usage amount and the penetration amount is almost equal, and it has been demonstrated that there is an outflow suppression effect.

2.4 Community flood control

Hii River suffered more than 400 flooded floods due to heavy rain with maximum hourly rainfall of 91 mm in 2009. Therefore, we simulated how much damage could be suppressed if the number of houses with the same function as the Experimental rainwater use housing capable of storing 42 m^3 was increased in the surrounding area. It was found that when it was assumed that a facility capable of storing 42m^3 of rainwater was installed in 19 houses at the most upstream end of the catchment,the flow rate flowing into the sewer immediately downstream was able to be suppressed to about half. The effect becomes less visible as it goes down to the downstream, but the outflow suppression effect can be expected. If the residents were able to save water at home or in the area it turned out that it had the effect of preventing the flooding of the area where they live.

Fig.4 Analysis result of community flood control model



3. Experimental facilities

The experimental facilities consists of rainwater tank, rain garden, stormwater wetland. Installation of the rainwater tank completed in November of 2016, water level in the tank and rainfall are observed. stormwater wetland are under construction at present.

1) Rainwataer tank with small hole

Fig.5 Rainwataer tank with small hole

Table1. Roof area and capacity of tank

Container roof	25.0㎡
Pergola roof	16.2㎡
Total roof area	41.2㎡
Flood capacity	3.8㎥
Usable capacity	2.7㎥
Total capacity	6.5㎥

2) Rain garden

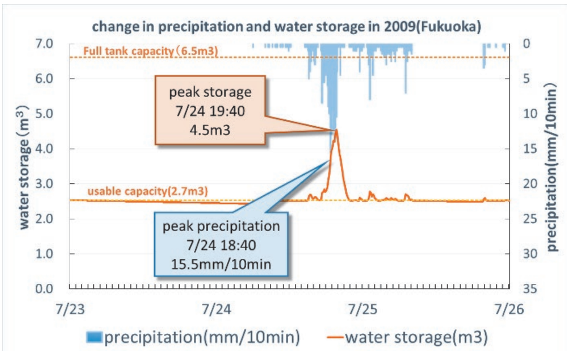
The area of the rain garden is 20 m2 and the condition before construction is a pond covered with concrete. Also, because the soil conditions are extremely low in infiltration rate, concrete is not removed and roofgarden is assumed. Similarly to the rainwater tank, it was assumed that the outflow of 59 mm / h was permitted, the inflow and the rain falling on the spot were temporarily stored as an area of 20 m 2 and a artificial soil thickness of 40 cm (assuming a effective porosity value of 40%).

Photo2 Rain garden located downstream of the rain water storage tank

4. Flood control effect of rainwater tank

Since the rainwater tank has been installed and has not experienced a full rainy season and there is not yet rain enough to cause flooding, the effect will be verified in the future.Therefore, simulation was performed using rainfall damaged in 2009. As a result, it is understood that there is the ability to delay the occurrence time of peak flow rate by 1 hour.

Fig.6 Flood control effect of rainwater tank



5. Creation of a wetland habitat

Creating a habitat is expected by catching rain temporarily in the garden of the house without sending rain directly to the sewer.

Both the rain garden and stormwater wetland are currently in the design stage, but we plan to carry out construction and conduct hydrological investigation such as flood period and frequency. At the same time, we will select vegetation and accumulate knowledge on the creation and maintenance of urban wetland habitat.

A Case Study of Rainwater Society Initiative Projects that Promotes De-Centralized Water Management System

Fumiko Taura*1, Yukihiro Shimatani*1, Sampei Yamashita*2, Ryoichi Watanabe*3, Mayumi Fukunaga*4, Toshiyuki Moriyama*5, Tomoko Minagawa*6, Tomoyasu Yoshitomi*7

*1)Kyushu University Faculty of Engineering, *2)Kyushu Sangyo University Faculty of Engineering, *3)Fukuoka University Faculty of Engineering, *4)University of Tokyo graduate school of Frontier Sciences, *5)Fukuoka Institute of Technology Faculty of Social and Environmental Studies, *6)Kumamoto University Faculty of Advanced Science and Technology, *7)Tokyo Gakugei University Field Studies Institute for Environmental Education

Introduction

Changes of land uses by rapid urbanization change the way of rainwater discharge management system and cause an urban stormwater disaster.

On the other hand, the situation of the shortage of water by a drought climate and the natural disaster occurs frequently. We often see the situation to be poor in water to use for life and the restroom, because of the suspension of water supply or the damage of the sewage system when an earthquake is generated once.

These are problems of a basic water management system. The current water and wastewater management system is intensive and centralized. Vertically segmented administrative system, like the section of the sewer, the river, the reservoir and the agriculture, makes solution difficult.

Due to feature of the current rainwater management system that bury rainwater pipes into the ground shown in fig.1, people cannot recognize how rainwater discharge through their living environment. Therefore it makes difficult to evoke people's interest and understanding about the better rainwater management system. Originally, fig. 2 shows the Japanese ancestors were conscious of the water circulation and organic space of water and green.

In the meantime, de-centralized, self-sustained, and resilient water management sub-system that focuses on rainwater harvesting, storage and infiltration, is visible and possible to be maintained by various community members.

The challenge here is how to promote this sub-system by reliable element technologies of stormwater management and by involving various stakeholders including local municipals, active community groups as well as other citizens.

Research objectives

The objective of this research is to report multi-faceted and multi-layered projects that promote de-centralized water management system done by author's group in Hii River watershed region. Not only for Hii River watershed, but other regions should face the challenge of establishing sustainable watermanagement system.

The authors group established a research group named "LRwS - Labs for Rainwater Society" in 2015. LRwS defines "Rainwater Society" as an organic regional society that under the de-centralized water management system based on appropriate technology and moderate lifestyle shown in fig.3. "Rainwater Society" is a society in which the internal and external parts shown in fig.3 are resonated and fused or located in the middle. In the Rainwater Society, multi-generational people cooperate to store, infiltrate, and harvest rainwater and increase green spaces at everywhere in a watershed region.

De-centralized water management system will be realized as a result of cooperation of individual Rainwater Society.

In Europe and the United States, Green Infrastructure has been introduced as a method of rainwater management aimed at mitigating urban floods and suppressing outflow of surface contamination sources[1]. Green Infrastructure effectiveness verification is being promoted from the recognition that it is expensive to reconstruct pipeline as urban type flood damage measures and alternative measures are necessary. The Rainwater society is in common with the concept of Green Infrastructure. In addition, it is thought to be a concept integrated with internal Japanese way of thinking.

Fig.1 Image of rainwater management system(Separated sewerage)

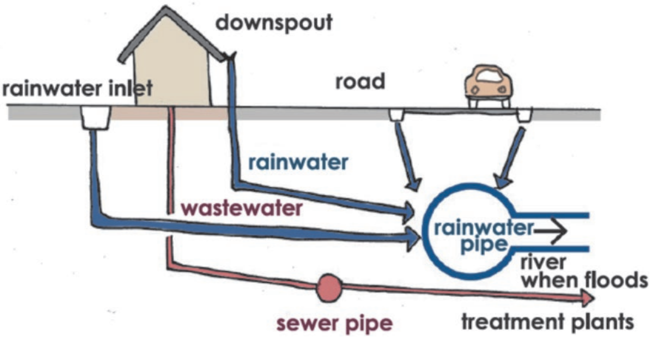


Fig.2 Rain falls from the sky to the sea.

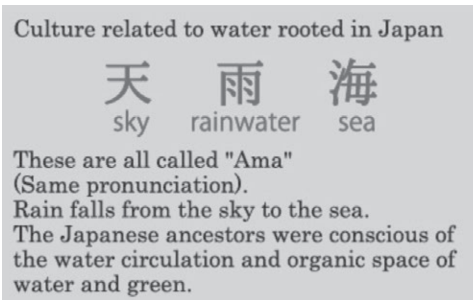
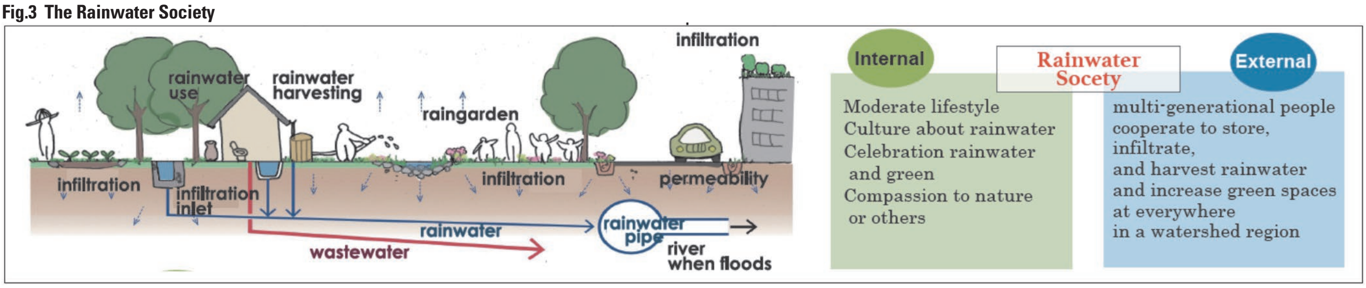


Fig.3 The Rainwater Society



Research Processes

Focusing on water which feature is multi-faceted, LRwS envisions Rainwater Society as a model of modern social problem-solution method. For promoting Rainwater Society, LRwS conducts multi-faceted and multi-layered activities based on four goals; 1) to practice multi-generational co-creation, 2) to design sustainable region with the development of element technology of stormwater management, 3) to establish a community network that connects various stakeholders relate to Rainwater Society, 4) to gather the threads of people's story.

1) To practice multi-generational co-creation includes to find region's social problems, to work on problems, and to educate and spread the concept of Rainwater Society among people. (Opening Rainwater Center /Amamizu rangers/ Environmental education/ Tea party)
2) The development of element technology of stormwater management includes to invent a rainwater tank that combines flood control function, and to invent a handy tool to measure soil infiltration capability. Case studies of implementing technology of rainwater runoff reduction and harvesting based on building-types.
3) To establish a community network "Mizbering Hiikawa (Hii River)" includes an event named "Kampai (Cheers) by a river" and rainwater design workshops.
4) To gather the threads of people's story and make pictorial map of memories

Fig. 4 and 5 show that LRwS have developed multi-faceted and multi-layered activities on rainwater for various generations, residents from upstream to downstream, various stakeholders in Hii River (Fukuoka) shown in fig.6. Also at Zenpukuji River (Tokyo) and Machida city (Tokyo), we held workshops with residents, and shared the concept of "Rainwater Society" and exchanged opinions. By doing activities that encourage sensibility, we made people aware of in their daily lives.

In Fukuoka, there was a big flood along the Hii River in 2009. The inland floods occurred mainly and it flooded on the floor at 172 places. A citizen conference was launched with it as a trigger[2]. It is the place where citizens have advanced steady activities.

The Zenfukuji River flowing down Suginami Ward in Tokyo is a place where urbanization is remarkable like the Hii River. This area is a combined sewerage area.

Water pollution by CSO, Combined Sewer Overflow, is a problem, and it is the place where neighboring elementary and junior high school students, residents are mainly exploring ways to solve the problem.

Machida city, Tokyo, is a bed town and urbanization is remarkable. In recent years, construction of a large-scale rainwater storage facility is planned as a stormwater management in residence area.

Method of introduction

Three different case studies were obtained in a multifaceted and multilayered approach.

1. Inland floods occurring in the community is prevented by community-wide behavior

Fig. 7 shows the diagram of process in this case. In a community in Machida City, Tokyo, a plan to build a large-scale rainwater storage facility by public works was raised. And the residents especially parents with children concerned about deterioration of living environment due to construction. Also a lot of construction vehicles will pass through this area.

Therefore, we held workshops about Rainwater Society and Green Infrastructure. In order to suppress the outflow in the community, they started activities to cut off connection with one sewage pipe of one downspout at one house (external). LRws showed that about 20% of rainwater outflow suppression effect can be obtained from the property of detached houses by disconnecting one downspout. Through that activity, they realized the pleasure and importance of rainwater (internal), and the activities are getting more active. Besides not only disconnecting the downspouts simply, they began to show excitement trying to use rainwater with saving in the

Fig.4 Multi-faced and multi-layered activities

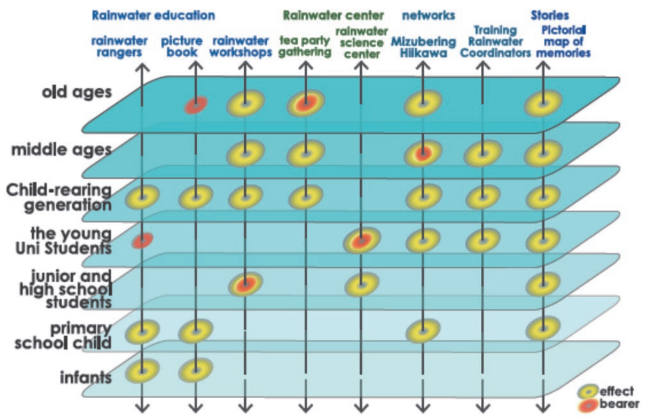


Fig.5 Multi-faceted and multi-layered activities

Fig.6 Research target places

Fig.7 Diagram of process in Machida city

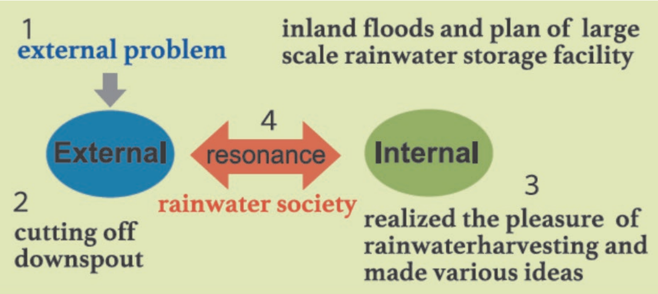


Fig.8 Excitement trying to use rainwater

Fig.9 Diagram of process in existing detached house

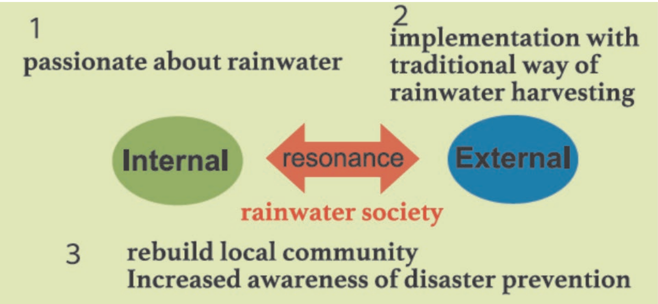


Fig.10 Implementation example at existing detached house (Barrels/Pond/Rainwater footbath/Infiltration to the soil/Gardening)

pots and running water to the aquarium etc. shown in fig.8.

2. Rebuild the local community by Implementation the single house with traditional way of rainwater harvesting and using.

Fig. 9 shows the diagram of the process in this case. Implementation examples at existing detached house. We embodied a passionate about the culture of the landlord (internal), incorporating traditional water use using pots and barrels (external) shown in fig.10. Rain is stored to be used for footbath and watering to planting. In addition, rainwater was allowed to infiltrate to the soil of the garden with high infiltration ability, and the effect of suppressing outflow was aimed. Cooperation of various people in the area from the time of construction, it became implementation by multi-generation co-creation. The landlord opened the ground floor of the building for the area and there was a community room and a study meeting room about rainwater.

It became a place like exhibition hall where people can introduce and experience the rainwater culture.

Various connections such as the landlord and the visitor, the people of the area, etc. are born through tea ceremonies and learning societies, events, observation acceptance to be held. Especially, it was very effective in fostering local communities. Before rebuilding, it was seen that those who had known friends as greetings became able to cooperate with each other, such as assisting the host at the event, cleaning the community space, etc.

3. It starts with small efforts and thoughts

1) The Apartment House

Fig. 11 shows the diagram of process. As the landlord of the apartment house participated in the network group "Mizbering Hiikawa", the awareness of rainwater utilization increased (internal). The landlord began an effort to alter the apartment house to a place full of water and green (external) and set up a rainwater tank in one room of the apartment. He also held workshops for residents and call for participation shown in fig.12.

Fig.11 Diagram of process in the apartment house

Fig.12 Workshops about rainwater harvesting

2) The Junior High School

Fig. 13 shows the diagram of process. Workshops about rainwater and river management in 2016 were held with students at Yusen Junior High School in the Hii River Basin and students working at the Zenpukuji River Basin Tokyo. One student who participated in the meeting made a proposal that "I want to attach a rainwater tank to the school" and the idea developed regular study meeting with some students. We held meetings four times and studied about "Rainwater Society" and Green Infrastructure shown in fig.14. In 2017, the student team planed "Rainwater Society" in school and how to suppress runoff from this school's area. Figure 15 is their plan that has many ideas of rainwater harvesting or storage. They made a presentation in front of all the students and have their plan know widely. Also they started some Implementation in this school. Individual activities are spreading gradually.

Conclusions

The author concluded that multi-faceted and multi-layered projects triggered that affected people in other watershed region started their own activities of stormwater management as well as a foundation of new citizen group in Hii River region.

Fig.13 Diagram of process in the School

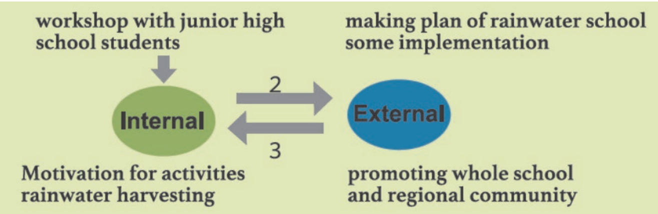
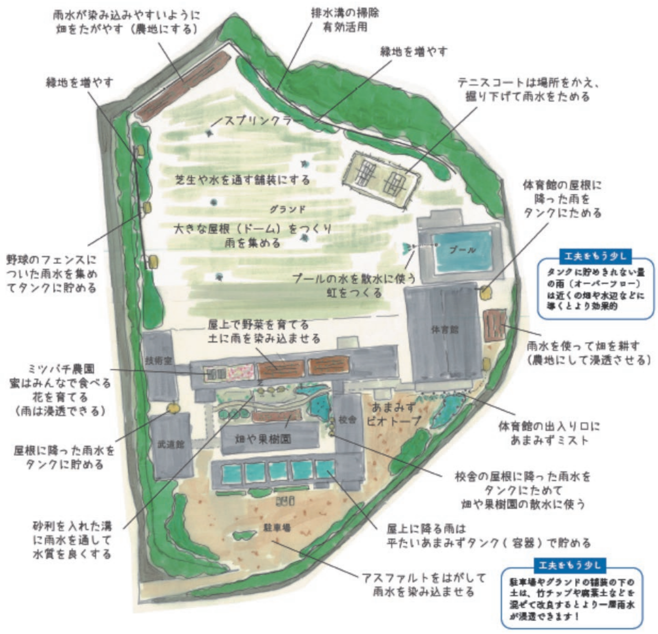


Fig.14 Workshops in the school

Fig.15 Plan of Rainwater School



These outcomes were unexpected important results.

1) The concept of Rainwater Society is simple and easy to communicate.
2) Activities spread rapidly based on some opportunity. For example, the enthusiasm of one person in the internal part and the solution according to the challenges faced in the external part.
3) The way of rainwater harvesting, storage and infiltration has diversity and is pleasant. It have the charm of attracting people.
4) Sustainable activities are realized by resonating the internal and external parts.

Following subjects are needs to be continued; 1) continue to conduct multi-faceted and multi-layered activities and verify its effectiveness, 2) observe the support and circumstances of the activities in the case studies.

Acknowledgement

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Preparation of Lake Conservation Management Plan for Sustainable Tourism in Gaidahawa Lake, Lowland Nepal

Prava Pandey, Lanka Bahadur Shahi

National Lake Conservation Development Committee, Ministry of Culture, Tourism and Civil Aviation, Nepal

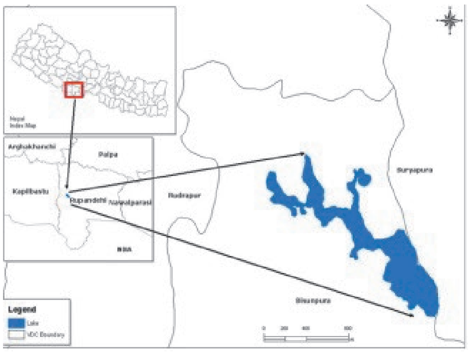
Introduction

Gaidahawa Lake (GL) is a freshwater perennial water body of 28.5 ha with greater than 34560 ha basin area in Bishnupura, Rudrapur and Suryapura VDCs of Rupandehi district, Nepal which is very close to the Lumbini World Heritage Site, the birth place of the Lord Buddha.

Fig: Gaidahawa Lake, Rupendehi

The land inhabits a human population of 20,951 populations in 3,120 households (HH). Recent research found that lake area has been subjected to the natural succession and encroachment by hill migrants of 80 households within 100 m perimeter of lake with 4.7 as an average household's size. Senior citizens claim that water body GL used to be greater than 80 ha in the past.

Fig: Location map of Gaidahawa Lake



Lake Basin represents subtropical climate with 3 distinct noticeable seasons such as hot/dry, monsoon and cool/dry. There is no major drainage in core area, but Kanchan River the largest medium size river in north east. Lake water is non-arsenic, slightly alkaline and coliform contaminated. All physical & chemical parameters are within reference of the National Drinking Water Quality Standard and comply with prevailing national guidelines for irrigation, aquaculture, livestock watering and recreation.

Gaidahawa Lake for Tourism Promotion

Gaidahawa Lake area is main attraction for domestic visitors as well as international visitors. Its closeness to the Lumbini World Heritage, the birth place of Buddha, adds value to be the high potential area for any visitors visiting to the Heritage site to spend leisure moment in lake for recreation. Blue Bull and community managed Vulture restaurant are another visiting site for bird watching especially endangered vulture, nature lovers as well as educational purposes in Gaidahawa Lake Basin Area (GLBA) which creates the visitors higher in the area. Communities' responded to interlink tourism of Lumbini Heritage Site with this area.

Current situation in Gaidahawa Lake

Tourism infrastructure for access road, visitor center, cultural museum, recreational facilities (boating, picnic points, hotels & restaurants, parking place etc.) and so on needs to establish soon followed by capacity strengthening programs to increase the visitors in the area.

However, ethnic barrier exists among upstream lake communities(mountain/hillmigrants) and downstream native dweller, the Terai communities. An unseen disharmony among them exists. VDC has leased out lake for fishery under individual contractual provision. Communities' are urging for a transparent mechanism of such individual contract. Communities are also demanding resource sharing in fishery. Government has established underground water facilities for irrigation in GLBA in 1995. By some reasons, full potential of this facility has not been utilized. Many loose groups are involved in saving & credits but their strength is not fully observed in shifting their livelihoods. Therefore to develop Gaidahawa Lake having its potential fully used for overall conservation development of GLBA, National Lake Conservation Development Committee (NLCDC) has initiated to prepare the management Plan for Sustainable Tourism in Gaidahawa Lake Basin Area.

Management Plan for Sustainable Tourism Promotion

After the national, district and communities level consultations followed by assessment study and community planning process, the management of Gaidahawa L ake have been prepared. This plan has explored activities in 4 components such as Lake Basin Governance, Lake Basin Environment, Lake Tourism & Livelihoods, and Lake Basin Management Capacity. Lake Basin Governance delivers semi-governmental institution to execute plan to restore Lake Basin Environment and Lake Tourism and Livelihoods.

For all these, Lake Basin Management Capacity builds technical, managerial and financial strength of institution and communities to integrate basin environment to tourism, biodiversity and livelihoods.

Fig: Key theme of Gaidahawa Lake Basin Area

The plan will implement 61 major activities and sub-activities mostly within 10 years, and delivers 5 outcomes and 13 outputs. 1st outcome results 2 outputs which helps to keeps lake basin governance. 2nd outcome delivers 2 outputs that appropriates basin environment for biodiversity, tourism and livelihoods. 3rd outcome delivers 4 outputs for tourism infrastructure facilities. 4th outcome provides natural resources based climate resilient income opportunities to disadvantages groups and other households, and places 4 microenterprises all following conservation codes including benefit sharing mechanism. 5th outcome from 4 outputs brings different stakeholders for lake conservation and participatory performance monitoring including 1 model school evolved in demonstrating lake awareness.

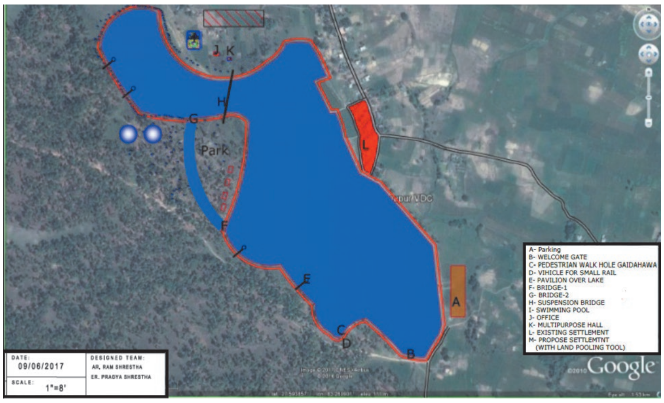
KeyActions and Outcomes in the Management Plan

1 Development of basic infrastructure for lake tourism promotion

1.1 Upgrade the condition of main access road to GL

Coordinate with DDC to improve main access road from the intersection of Bishunapura road to Pohawa and Gaidahwa up to Thakurapur-Haraiya road (about 20 km), and Thakurapur to Hariya road section (about 7 km). Both roads should be 2-laned, black-topped, and paved walkway with roadside plantation following conservation codes.

Fig: Site map plan of Gaidahawa Lake Basin Area



1.2 Establish entry fee & vehicle parking practices and guard post

Practice entry fee collection at 2 points in Pohawa and Rudrapur. A payable parking site for 150 large and small vehicles shall be arranged. Also develop 4 bed capacities of a guard house with facilities.

1.3 Construct foot-trail immediate to drain outside Zone Aquatic (ZA)

2 m wide paved trail along 7 km perimeter of lake shall be constructed following landscape gradient. A clean landscape garden (with mat, shrub and tree flowers) shall be maintained along both sides of trail having measures undertaken to minimize imposition of wildlife. Involvement of community groups such as women group of community forests in gardening may be a strategy to involve them in lake management and opportunity of reaping benefits from selling garden product.

1.4 Construct shed along foot-trail with drinking water and sanitation facilities

Fix wooden chairs & benches for resting, and build shed at different sides along foot trail to refrain visitors from heat and rain. Ensure facilities for drinking water, toilets and waste disposal are must nearby shed (10 man capacities).

2 Development of vantage sites

2.1 Construct suspension bridge (decorative)

Construction of approx 75 m long suspension bridge at bottleneck site of lake will enhance lake beauty and access visitors to cross over lake. GLBMC shall approach to DDC for survey, design and construction of such bridge.

2.2 Construct a view tower

Multistoried & multipurpose tower (view, coffee shop, rest places) at in alliance with decorative bridge is worth for air view on cost pay basis. Approach to DDC for survey, design and construction of such tower.

2.3Improve structures in existing martyrs' park

Construct suspension bridge (decorative)

Construction of approx 75 m long suspension bridge at bottleneck site of lake will enhance lake beauty and access visitors to cross over lake. Gaidahawa Lake Basin Management Committee shall approach to District Development Committee for survey, design and construction of such bridge.

3 Development of recreational facilities

3.1 Allocate picnic zone outside ZA

Allocate picnic zone with 20 spots along fringes, loops and laguna from bottleneck site of lake from south extending to west in a way encircling to lake till opposite of bottleneck in north. Each picnic spot shall have payable 25 man capacity hygienic shed for resting, cooking, drinking water, toiletry, and dish wash facilities. Such spots shall be strictly forbidden from Lake Outlet (south) up to 500 m close to vulture habitat and martyr garden to maintain unpacked outlook of entry front. Maintain notice board in each spot for 'Do & not do'.

3.2 Provide boating recreational facilities and services

Create facilities such as boat house, boat parking for 10boats, boat trails and so on. Prepare guidelines and set price for services provided that boating should not harm 'Green Band' along lakeshore.

3.3 Provide facilities and services for game fishing

Allow game fishing in selected places with guidelines and tariff.

3.4 Establish structure and facilities for a children park

Allocate playground in the northeast of swimming pool site for children with basic structural facilities like play equipment, Sea saw, swing, slipper etc..

3.5 Create facilities for swimming zone and services

Establish moderate facilities on pay basis for 20 man capacity swimming pool in a place in north of bottleneck site and south of bypass road to vulture restaurantfrom intersection of Bishnupura-Gaidahawa road.

4 Educational, cultural and conferences facilities for youth and communities mobilization

4.1 Establish Lake Habitat Center

1st floor of Lake Habitat Center shall be furnished for 30 men capacity twin bed facilities for those in study, training and workshop. Other may use facilities in unoccupied seasons.

4.2 Establish lake education center

Allocate 1.5 ha land in east of children park, and construct a 2-story Lake Habitat Center. Half of ground floor of this building shall be used for lake information center including aquarium room, gift shop and 75 man capacities fully equipped 1 auditorium. Center shall provide services to document & disseminate lake information, meeting, training etc..

4.3 Establish a cultural museum

A section of ground floor of Lake Habitat Center shall be used for a museum reflecting to local history and culture. Displays may include information on local food and cooking utensils, garments, ornaments, ritual practices and festivals.

5 Tourism promotional activities

5.1 Display tourism promotional board

Post the compelling message of lake-tourism in display boards at strategic sites in Butwal, Bhairahawa, airports in Bhairahawa and Kathmandu.

5.2 Convene media campaign and promotional materials

Prepare promotional message in nutshell on lake tourism and spread them from local & national media. Such materials may include flyer, brochure, stickers, audiovisuals etc..

5.3 Develop and practice package tour

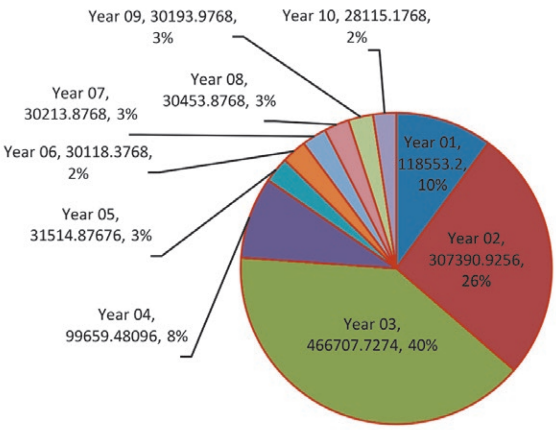
Coordinate to tour operators and institution like Nepal Tourism Board, Hotel Association of Nepal, Chamber of Commerce etc. Based on coordination, undertake appropriate steps for win-win package tour for GL with an advantage of having Lumbini Heritage at close distance.

Fig: Evaluation and monitoring program

Estimated Budget for the Management Plan

Total estimated cost for 10 years of implementation of this plan is estimated as NRs. 1,172,922thousand. Of this, 74% of fund is usable in the first 3 years especially for improving Lake Basin environment, development of tourism infrastructure and vantage sites that includes construction of multipurpose building, recreational facilities and so on. The cost after 5 years is incurred due to administrative expenses in staff salary, office operation and maintenance of structural intervention. Plan foresees indicators of financial sustainability and livelihoods enhancement only from 4th year of implementation of the plan.

Fig: Budget estimated for Management Plan



Of the total NRs. 1,172,922 about 3% is used for administrative and rest in to deliver outcomes and outputs i.e., >2% for lake basin governance, >32% for restoring basin environment and >57% for creating tourism infrastructure which together also enhances climate resilient livelihoods and contribute to employment-centric and poverty reduction strategy of Government of Nepal.

Fig: NLCDC team with local people of Gaidahawa Lake

Acknowledgements

NLCDC highly acknowledges the CODEFUND and its team for the kind support to prepare this management plan.

Registration of Ramsar Site of Higashiyoka Higata and Change in Regional Culture

Yasuhiko Takeshita
NPO Network of Regional Residents in the Ariake-Sea Coast, Saga-city, Japan

Visiting the bank at Daijugarami, Higashiyoka (Saga city, Japan) at the beginning of November, you will be surprised to look at Japn's largest colony of the autumn colored *Suaeda japonica*, a variety of halophyte called "Shichimennso" in Japanese, which spreads all over along the shore, and will breathe in its beauty. On the Higashiyoka tidal flat of the Ariake Sea spreading to the front, ducks rest feathers on the on water surface, while grey plovers, dunlins and greenshanks etc. flock in shallows. There are also black-faced spoonbills that are threatened with extinction. As far as the eye can see, there are birds at the water's edge.

This scenery is a pride and proud of the residents in Higashiyoka town, and they are striving to connect the pride to the next generation children. That strong feeling has realized the registration of Ramsar site of the Higashiyoka tidal flats. The fishermen who get foods at the Ariake Sea have known the value of the tidal flats. But for many citizens the sea was a "dirty" one, because it contains mud. What we want to convey on this poster is that it is highly appreciated as the world standard brand called Ramsar, so that the value of the tidal flats, including people who thought it was a dirty sea, has been established as a regional culture and the feeling is taken over to children. We had a lot of difficulties to reach to the goal of the registration of Ramsar site. We will explain here the process in detail.

Monitoring site 1000, Ministry of the Environment, Japan, is observing the number of sandpipers and plovers coming over that eat creatures at tidal flats, as an indicator the soundness of the tidal flats: the large flying number of the sandpipers and the plovers traveling from the Southern Hemisphere to the Siberian region of the Northern Hemisphere is regarded as an indicator that the ecosystem of the tidal flats is well maintained. As the Higashiyoka tidal flat is known as the area where the largest number of sandpipers and plovers in Japan visit, the momentum of trying to aim to register Ramsar site increased in 2004. However, while there are people who are proud of having a lot of wild birds, some people anticipated the damage of the wild birds. The administrator (Saga prefecture) of the airport adjacent to the tidal flats, worried about the measures to prevent the accidents caused by bird-collision with airplanes. Wild birds, which eat seaweed sprouts harvested carefully, and pigeons, which dig down soybean planted freshly, also annoyed fishermen and farmers.

It was the regional town-development council that demonstrated the power at that time. Taking a merge of municipalities, Higashiyoka town merged with Saga city in 2007. After the merge, the residents felt a crisis that Higashiyoka will be swallowed into the big Saga city and will not have characteristics of the area. They quickly began to respond to the proposal of Ramsar site. In addition to learning the significance of the registration, they actively contacted with the advance cities or towns in Ramsar sites, visiting there with the children.

Fortunately, the Higashioyoka tidal flat is a colonial area of "Shichimennso". Taking the advantage of the Emperor Showa's visit, the area was maintained and was carefully nurtured by the regional society for protecting "Shichimenso". The momentum to make "Shichimenso" and Ramsar site become the symbol of the regional area increased, and symposiums and learning societies were often held. In response to the regional thought that wishes the registration of Ramsar site, Mayor of Saga city announced that it aimed to register Ramsar site of the Higashiyoka tidal flats at the press conference of August 2013.

When we called the registration of Ramsar site, many of those who worry about it opposed that birds would increase if Ramsar site is registered. Certainly, the article of Ramsar contract states that countries to conclude the treaty will try to increase the number of water birds. However, in the preamble, there is a condition "by wetland management". It says to manage wetlands and tidal flats and to increase water birds.

We are human beings who have compromised the function of the tidal flats. The tidal flats were lost by large-scale reclamation. The soundness of the remaining tidal flat has been impaired by our daily activities. Ramsar convention has been concluded from that reflection. Ramsar convention says to the contracting parties that to manage properly the tidal lands that is not well managed and to keep healthy tidal flats. The rich fishing area of the Ariake Sea is being lost and people are hoping to rehabilitate it somehow. The spirit of the treaty is exactly the same as those of people who wish to rehabilitate the Ariake Sea.

Fig. 1. Primary school students near the tidal flats of Higashiyoka made a woodblock to commemorate the registration of Ramsar site in 2015. The theme is "future" where people, birds and creatures at the tidal flats coexists. Children are holding hands with mudskippers and crabs. It is a large work of 180 cm x 90 cm.

The biggest change by the registration is the feelings of the regional residents. Regional volunteers have begun new activities to make Ramsar site a symbol of the community-development. They held a learning society many times and deepened the interaction with the people at Lake Nakaumi Tottori prefecture and at Lake Shinjiko Shimane prefecture which are advanced areas in Ramsar sites.

What changed mostly by the registration of a Ramsar site? The Ariake Sea, especially the most inner part, is muddy sea involving mud rolling up from the bottom. The muddy sea is often thought as dirty one, but not, it is a soup for creators. The registration as Ramsar site made opportunity to let know the residents the wealth of the Higashiyoka higata.

The tidal flats of Higashiyoka and of Hizen Kashima were registered as Ramsar sites. Being added the previously registered Arao tidal flats three registered wetlands were born at the Ariake Sea coast.

Construction of learning facilities is planned in each area. In addition, periodical subscriptions in which the three regions collaborate have also been published. In each area efforts how to tell and how to leave to children are proceeded consciously, and the exchange of children in these areas is also active. Three regional activities and collaboration are received high praise from participants. In the Ariake Sea, attractive tidal flats spread from point to line and face. The registration of Ramsar sites throughout the all Ariake Sea coast is also not a dream. Migratory birds from the world teach us that all tidal flats of Ariake Sea are precious wetlands. Figure 1 shows a wood block made by children of Higashiyoka primary school.

Study of Evaluation of Traditional Dry-stone Revetment

Eriko Takeuchi[1, 2], Ginji Oishi[1], Hironori Hayashi[1], Yukihiro Shimatani[1]
[1]Faculty of Engineering, Kyushu University [2]CTI Engineering Co.,Ltd.

1 Introduction

This study aims to investigate the strength of the traditional stone masonry revetment without concrete in river.

The dry-stone revetment, which is a traditional works' method without using concrete, had been used for a long time as a river bank protection in Japan until the concrete river bank protection method and the mortal stone masonry revetment have been popularized. The dry-stone revetment is a combined structure of complex materials filled with small stones behind large stones on the surface. Therefore, it does not block the groundwater from the ground behind the river bank protection, so it is known that plants grow abundantly between stones and functions as a landscape or as a habitat for living things.

However, it is not used as a river bank protection in recent years, or it cannot use even if we want to use it, because skill is necessary and there is no knowledge on strength, although the dry-stone revetment has considerable strength. And furthermore, in recent years, examples of restoration of rivers consolidated by concrete and examples of river improvement considering the environment are increasing, so it is a problem to clarify the strength of the traditional dry-stone revetment.

We reviewed the design guidelines and studies of stability of revetment in road and river field. There are no detailed design standards for dry-stone revetment of rivers.

2 Methods

The hydraulic model tests are conducted to clarify dry-stone revetment strength against the flow. Variables of this experiments were flow rate, method of stacking stones and with and without of the backfill.

We made the meandering channel with a width of 8 cm and an extension of 158 cm and used it for experiments.

We adopted two methods of stacking stones: the method of stacking so that stones are engaged with each other, and the method of stacking without considering engagement. And experiments were conducted in cases with and without backfill for each stacking method.

We observed the deformation condition of dry-stone revetment while increasing the flow rate every minute from the minimum flow rate of 166 cm^3/m.

3 Results

Case1: The method of stacking without considering engagement and without backfill. The dry-stone revetment collapsed by 1 minute 30 seconds after the water starts flowing because the earth and sand behind the masonry was sucked out.

Case2: The method of stacking so that stones are engaged with each other and without backfill. The dry-stone revetment collapsed by 2 minute 30 seconds after the water starts flowing because for a similar cause of Case1, the earth and sand behind the masonry was sucked out.

Also, the bottom row of dry-stone revetment did not collapse if it was engaged with each other stacked. In the case without backfill, the earth and sand behind the masonry flowed out, the masonry collapsed because the earth and sand behind could not support it. And the collapsed stone remained in place without being flushed.

Case3: The method of stacking without considering engagement and with backfill. We confirmed that was sucked out the earth and sand behind the masonry and the stone of the convex part flowed out by 8 minute 45 seconds after the water starts flowing.

The way of collapse, unlike the case without backfill, the masonry stones flowed out downstream at once.

Case4: The method of stacking so that stones are engaged with each other and with backfill. We confirmed that was sucked out the earth and sand behind the masonry. But the dry-stone revetment did not collapse.

The flow velocity was 56 cm/s. Converting to actual size will be 5.6 m/s.

4 Conclurion

In this experiment, it was confirmed that in case of using the backfill, suction was suppressed, and the strength of the dry-stone revetment increased, and it was confirmed that it is harder to break by engaging stones. As the results of the experiment, it is thought that the way of collapse of the revetment in the case of without backfill will be maintained until the certain amount of earth and sand behind the revetment is drawn out. The way of collapse of the revetment in the case of with backfill seems to be related to the level of river water and the flow velocity, and the degree of penetration into the ground behind.

We would like to continue our research to clarify the function of the traditional dry-stone revetment and aim to disseminate the dry-stone revetment as modern technology of river revetment.

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KODOMO Ramsar in Tsurui Village

Kunihito Otonari
KODOMO Ramsar in Tsurui Village Executive Committee

Tsurui is a village with a population of approximately 2,600, located in the northwest of Kushiro Wetland in eastern Hokkaido, Japan.The name "Tsurui" means "cranes (Red-crowned Crane) are there" and as its name suggests, Red-crowned Cranes live in the village all year round. Numbers of species live in Tsurui's diverse environments including wetlands, hilly area that serves as a catchment area for the wetland, and pastures for dairy farming, the main industry of this village. 2017 is a year of milestone for this village because it is the 80th anniversary of the establishment of the village and the 30th anniversary of the designation of Kushiro Wetland as a National Park. Celebrating these anniversaries, an event named "KODOMO Ramsar in Tsurui Village" was held from 4 to 6 August 2017.

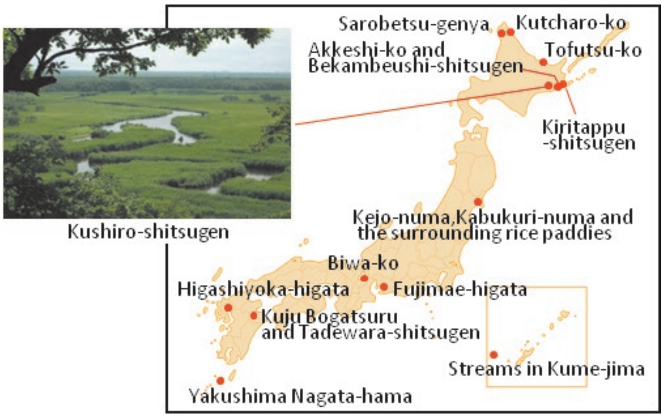
Red-crowned Crane

KODOMO Ramsar is a series of programs for environmental education and exchange between children, organized since 2006, targeting the children engaged in activities in Ramsar sites mainly in Japan. It has been organized by the Ramsar Center Japan (in Tokyo) in partnership with other bodies such as Wetlands International Japan and the municipalities and organizations at the venue.

For the KODOMO Ramsar in Tsurui Village, an executive committee was established to prepare and operate it, consisting mainly of local volunteers as well as Ramsar Center Japan, Wetlands International Japan and Mr. Daisuke Nakamura who would facilitate the children's meeting. 36 children from 13 sites in Japan, including Kume-jima, Biwa-ko and Higashiyoka-Higata, took part in this program.

The participants including adults such as organizing staff and others

The wetlands the participants are engaged in



The participants took part in some activities in the nature such as walking in Kushiro Wetland and watching Red-crowned Cranes. They also observed forestry work, dairy farming and cheese making. The young participants were encouraged to find attractive profiles of Tsurui Village through those experiences and, based on their findings, they nominate "treasures" they wish to preserve for the future.

Walking in Kushiro Wetland

Watching Red-crowned Cranes

Group shot in a pasture

Visited a dairy farm

Group discussion

After deliberate discussions, they chose 6 treasures ; "a will to live together with plants and animals" "the source of life, spring water" "Red-crowned Cranes saved by the villagers" "Kushiro wetland" "balanced relationship between people and nature" "people protecting the nature and environment". They also composed a message that points out the beauty of Tsurui village ; "Tsurui Village living with Red-crowned Cranes —the tradition of Tsurui protected by all of us, the future of Tsurui created by all of us". They integrated the message and the treasures into a poster, which was presented to the mayor of the Village.

It could be said that this program contributed to enhance the young participants' curiosity and interest in nature through various experiences as well as to promote their willingness toward their engagements in each site. On the other hand, local people were inspired by the perspectives of the children. They started to see the advantages of the village in a new light while gaining some hints for community vitalization. It is considered to be a task for local people to think about the wise use of local nature with Kushiro wetland in the center, and establish a community in harmony with local features of Tsurui village.

Presented the completed poster to the mayor of Tsurui Village

Completed poster of treasures in Tsurui

Young participants from Tsurui Village and members of the executive committee

The Progress of Environmental Education in Kashima City

Yuji Morimoto, Sayaka Nakamura
Ramsar Convention Promotion Office, Kashima City

Guide book for children

In Kashima City, we devised an environmental education program that can be implemented in elementary school classes so that children can know the importance of tideland. In order to continue this program, cooperation of elementary school teachers is essential. Having the teachers deepen understanding of Ariake Sea will lead to children learning. We thought that it would also be necessary to create a mechanism to make it easy for the teacher to teach.

So we tried to prepare a workbook to learn the environmental education program as a teaching material to help classes.

Let's having experience into the tidal flats !

Children enter the tidal flat at the beginning as they are bewildered but after a while it will be fun to be covered with mud. While playing, they find creatures and learn about biodiversity of tidal flats.

Program flow

1. Discuss what living things are in the tidal flats.
2. Go out to tidal flats and find creatures.
3. Experience the tidal flats, and observe what living things live.
4. Presentation of where living things were located.
5. Learn about creatures of the tidal flats at Kashima Mudflats Observation Center and study whether they live outside the Ariake Sea.

Let's learn the Ramsar site with hand puppet!

Based on learning of rivers and tidal flats, we will learn about the chain of life in Kashima. Water connect everything, both upstream to the mountains and downstream to the sea.

We explain this thing to children in an easy-to-understand manner with hand puppet. While children have experienced themselves, we also ask them to announce what they thought.

Program flow

1. Learn about the Ramsar Convention and study that there are global efforts to conserve wetlands.
2. Learn about "Hizen Kashima-higata" and other ramsar sites of the Ariake Sea.
3. Study endangered species inhabiting tidal flats and know that the tidal flats is a precious

Let's learn the connection between river and sea !

By examining what living things live in the river, we can know the water quality at that point.

Studying rivers near elementary school, we are familiar with water and learn the clean of rivers.

The creatures collected are classified according to appearance.

Let's observe! wild birds in the tidal flats!

While observing birds at the Ramsar site "Hizen Kashima-higata", we will learn biodiversity of tidal flats. A large number of shorebird species such as Whimbrel and Dunlin and duck species fly over to feed on the creatures in the tidal flats. Bird species of conservation concern such as the Common shelduck,Saunder's gall and Black-faced spoonbill also fly over to this tidal flats making it a major stopover and wintering habitat for migratory birds in Japan.

Flock of Whimbrels at the hizen-kashima higata

Children can notice that such migratory birds are coming to Kashima for the first time. They can also learn about the ecosystem of the tidal flats from the relationship with wild birds.

Worksheet for bird watching.Bingo game and illustration.

These are handmade by the kashima city office staff.

Children use these worksheets when birdwatching at hizen-kashima higata every time.

Towards the future...

While there are Ariake Sea familiar, environmental education to learn it has not been done so far.

By learning based on experience activities, this program makes contents that children can learn from what they felt. We would like to improve this program further and to continue learning at elementary school.

Because it is difficult to proceed like this only at school, it is necessary to create a mechanism that can support classes. We would like to continue looking at Kashima's unique environmental education and listening to opinions from various people.

Logo of Ramsar site "hizenkashima-higata"

ラムサール条約湿地
肥前鹿島干潟
Ramsar Site hizenkashima-higata

Reasonability of Cyclic Floodplain Rejuvenation for Biodiversity and Flood Management in Japanese Lowland Rivers

[1,2,3] Shigeya Nagayama, [3] Morihiro Harada, [4] Shiro Sagawa, [5] Yuichi Kayaba

[1] Aqua Restoration Research Center, Public Works Research Institute; [2] Civil Engineering and Eco-technology Consultants Co., Ltd.;
[3] River Basin Research Center, Gifu University; [4] Graduate School of Regional Resource Management, University of Hyogo;
[5] River Restoration Team, Public Works Research Institute

INTRODUCTION

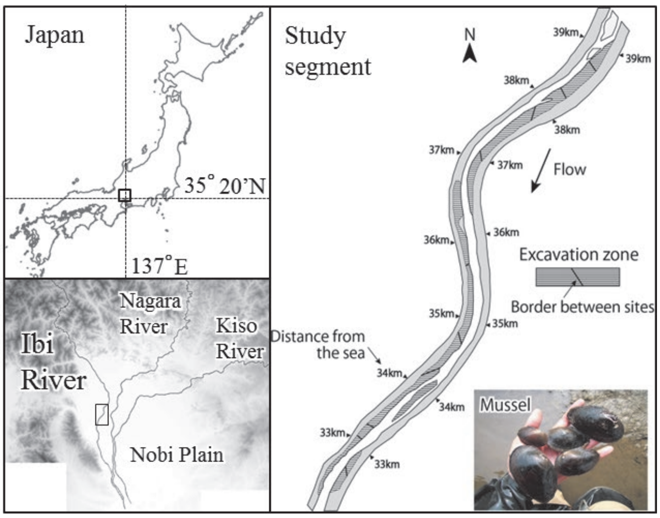
The riverscape in Japan has changed significantly since the Meiji era (1868–1912) when modern civil engineering technology was introduced from Europe (Nagayama et al. 2017a). The floodplain, which was a broad wetland on the coastal alluvial plain, has been disconnected from the main river channel due to intensive levee construction from the Meiji to the Showa (1926–1989) periods. Since the 1980s, inter-levee floodplains in many Japanese lowland rivers have been terrestrialized, with riparian forests established in the context of riverbed degradation (Nakamura et al. 2017).

The inter-levee floodplain is artificial but is now recognized as a rare habitat for a diverse range of aquatic organisms. However, terrestrialization and riparian forest establishment have led to a deterioration of inter-levee floodplain ecosystems and a decrease in flow discharge capacity. River managers have implemented tree removal and excavation of terrestrialized floodplains to increase flow discharge capacity. Excavation (flood channel excavation) is currently the primary and most practical method for flood control in Japan and it may support recovery of floodplain ecosystems due to increases in inundation area and frequency. In this study, this hypothesis was examined through the recovery of freshwater unionid mussels, which are potential indicator species of floodplain ecosystems (Negishi et al. 2013). To further the understanding of inter-levee floodplain conservation through flood channel excavation, we examined the relationships between mussel habitat (floodplain ponds naturally created post excavation) and the initial ground elevation and elapsed time (max. 12 years) after excavation. This study is based on the work of Nagayama et al. (2017b), which was published in the Japanese journal Ecology and Civil Engineering.

METHODS

This study was conducted in the lowland Ibi River (32–39 km from the river mouth) in central Japan (Fig. 1). The riverbed slope was approximately 1/3,300. The excavation work was implemented in the study area between 2000 and 2007 to increase flow discharge capacity (as well as to determine how initial excavation height affected the suppression of tree establishment, although this aspect was not examined in this study). Eleven excavation sites were selected, with different initial ground heights and different time periods elapsed since excavation. Drought, low, ordinary, and high water levels were used as a measure of the initial excavation height. The river managers did not expect the recovery of floodplain-dependent aquatic organisms. However, freshwater mussels eventually colonized ponds, which were naturally created in the excavation sites through flooding. Mussel surveys of 80 ponds were conducted in nine of the excavation sites in December 2011. In all 11 excavation sites, cumulative sediment depth and floodplain pond area were investigated based on cross-sectional profiles (2001, 2002, 2005, 2008, and 2013) and aerial photographs (2002, 2006, 2007, 2009, and 2012). Two generalized linear mixed models (GLMM) were built, in which the response variables were cumulative sediment depth (m) and pond area (m2); a generalized linear model (GLM) was also built, in which the response variable was mussel abundance (CPUE: catch per unit effort, N/hour). The explanatory variables used were initial excavation height and time elapsed (years) after excavation.

Fig. 1. Location of the Ibi River study segment in which the excavation sites were located. Modified from Nagayama et al. (2017b).



RESULTS and DISCUSSION

Both initial excavation height and elapsed time were influential factors on cumulative sediment depth (Fig. 2). Sediments continuously deposited over time after excavation and deposition rates were lower in sites with lower initial excavation height (Fig. 2). These indicate that sediment deposition rates correspond to initial excavation heights.

Pond area was influenced by elapsed time (Fig. 3). Pond area increased until year eight or nine and decreased later regardless of initial excavation heights (Fig. 3). After excavation, undulation of the ground surface formed through sediment deposition and was followed by pond formation. However, pond area decreased over time, probably due to continued sediment deposition.

Mussel abundance was influenced by both initial excavation height and elapsed time (Fig. 4). Mussel abundance was higher in sites with lower excavation heights (but higher than drought water level) (Fig. 4a), indicating that lower initial excavation height (drought-ordinary water level) was effective for mussel habitat formation. Mussel abundance increased initially and then decreased, with a peak at five years after excavation (Fig. 4b), indicating that "young" ponds can provide habitat for mussels but "old" ponds lose this function over time. Habitat deterioration was probably due to a decrease in inundation frequency (Negishi et al. 2012) and an increase in litter supply from riparian trees (Nagayama et al. 2017) with continued sediment deposition.

Fig. 2. Relationship between cumulative sediment depth and elapsed time. The models according to initial excavation heights are indicated by solid lines. Modified from Nagayama et al. (2017b).

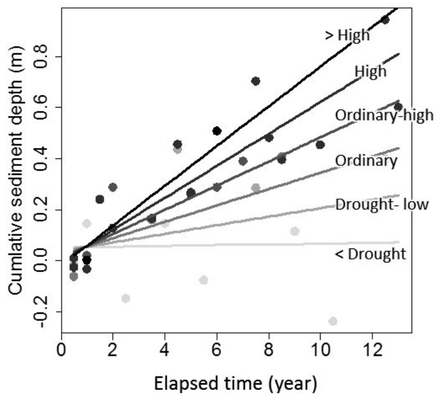


Fig. 3. Relationship between pond area and elapsed time. Modified from Nagayama et al. (2017b).

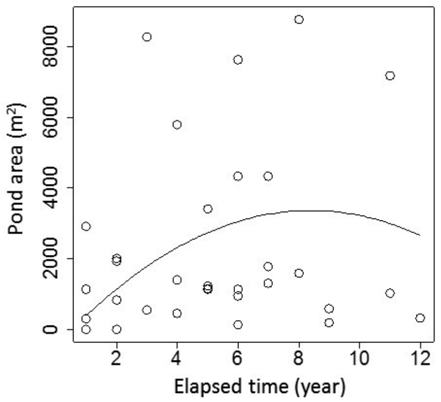
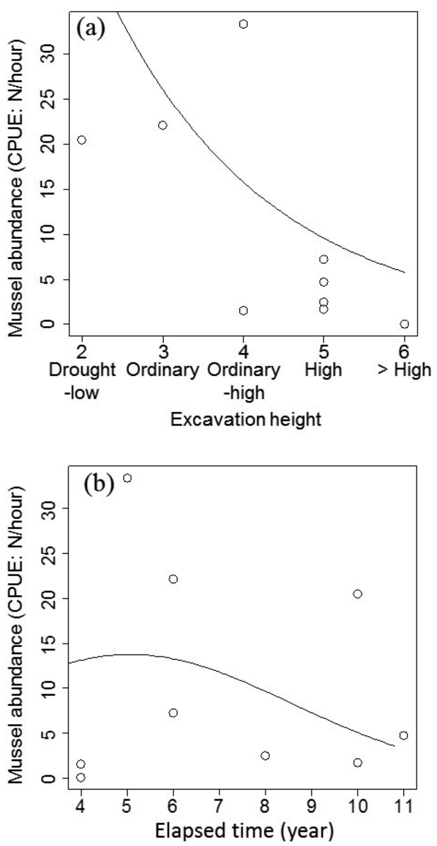


Fig. 4. Relationships between mussel abundance (CPUE) and (a) excavation height and (b) elapsed time. Modified from Nagayama et al. (2017b).



In conclusion, mussel habitat (pond) and abundance temporarily increased in the excavation sites, but decreased with continued sediment deposition. In addition, lower initial excavation height was effective for subsequent pond formation and mussel colonization. These results suggest that flood channel excavation can be used for mussel conservation and floodplain habitat creation if the excavation works are strategically planned. In the study river, we recommend that flood channel excavation should be implemented so that excavation sites with lower initial height at five to nine years after excavation always occur in a target river segment. This can be performed following the concept of cyclic floodplain rejuvenation (e.g., Baptist et al. 2004), where excavation of re-terrestrialized sites with continued sedimentation is planned (Fig. 5). Moreover, cyclic floodplain excavation can contribute to both the conservation of floodplain-dependent organisms, such as mussels, and flood management, through increasing flow discharge capacity. Therefore, this can provide a reasonable method for rejuvenation of many Japanese lowland rivers, as well as foreign rivers that possess terrestrialized inter-levee floodplains and continued sediment deposition following excavation.

Acknowledgement

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Fig. 5. Conceptual diagram of cyclic floodplain rejuvenation using flood channel excavation in a specific site in a target river segment. Time elapsed following excavation is shown in each photograph. Tree establishment and pond reduction (i.e., terrestrialization) progress over time.

Protection and Utilization of the Japanese Giant Salamander *Andrias japonicus* in Toyosaka District, Higashi-Hiroshima City

Asano Toshihisa, Shimizu Norio
Hiroshima University

1. Japanese giant salamander Andrias japonicus

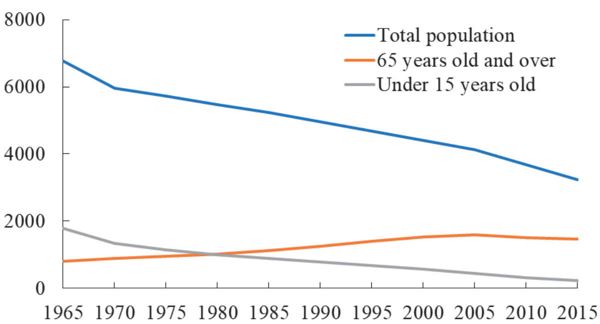
The giant salamander is the biggest amphibian in Japan as it reaches a maximum length of 150 cm. It lives in an area that spans from Gifu to Oita Prefecture; however, the largest populations inhabit the rural area of the Chugoku region (Fig. 1). It eats fish, frogs, and crabs and can live more than 50 years in captivity. The giant salamander breeds in a nest hole. Females gather in the nest and lay eggs. After spawning, one male, called a "Nushi," protects the eggs. After four or five months, the larvae leave the nest. It is protected as one of Japan's natural monuments; however, recently, this habitat has experienced serious deterioration due to artificial river and hybridization with alien Chinese giant salamander.

Fig.1 The distribution of the giant salamanders and the study area

2. Study area: Toyosaka district, Higashi-Hiroshima city

Toyosaka district is located in the basin of the Mukunashi river, which flows through the central part of the Hiroshima prefecture. Due to declining population, this district has a marked rural environment; therefore, the aging population faces serious issues (Fig.2). Toyosaka-cho merged with Higashi Hiroshima City in 2005. Higashi Hiroshima City is an academic and research center where the local universities, research institutes, and enterprises are located. In the central part of this city urbanization is advancing and depopulation is prominent in the peripheral part of this city.

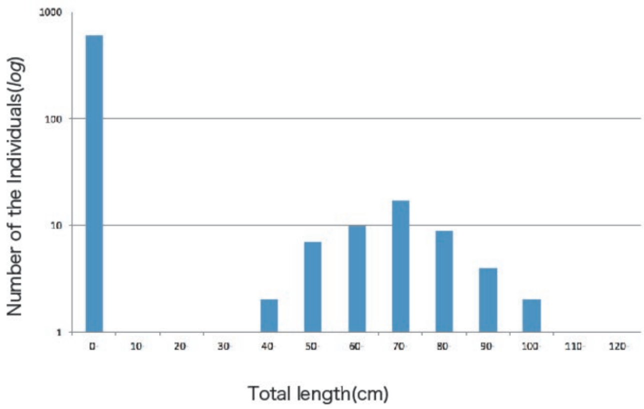
Fig.2 Transition of population in the Toyosaka district (1965–2015)



3. The giant salamander in Toyosaka district

About 60 salamanders have been found in this study site. They breed every year using natural nests. Although there are adults and larvae, the younger generation has not been found (Fig.3). The division of river channels by weirs is one of the biggest problem in this site. It is thought that the larvae are drained into paddy fields during irrigation and the downstream larvae cannot return because they are unable to climb the weirs installed in the river. Division of the habitat also leads to weight loss of adults because the feeding environment deteriorates.

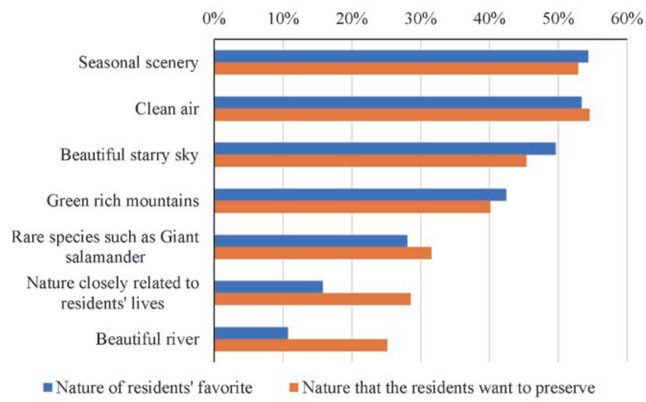
Fig.3 Number of the salamanders by total length (TL)



4. People in charge of protection activities

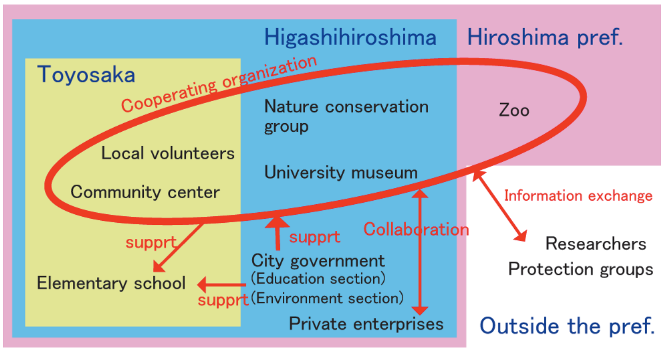
Since the 1960s, some residents in this district have been involved in salamander conservation efforts. However, as these residents have become older and some have died, it has become difficult to continue with the conservation activities. In addition, many of the younger residents are not as interested in the environment of the river or salamanders (Fig.4). These rural residents in the Toyosaka district met, by chance, the members of the nature conservation group that lives in the urban area. As a result, the conservation activities spread, adding the Asa Zoo and Hiroshima University researchers and the basic survey for the salamander conservation was restarted in 2011 (Fig.5).

Fig.4 The residents' indifference to salamander



N=2,046 Multiple answers
Sato, Nozomi (2014): A study on the coexistence of the giant salamanders and residents. Hiroshima University Master's thesis

Fig.5 The network of stakeholders



5. Main events

The main activities from 2011 are as follows.

Before 2011: Protective activities are conducted by volunteers of the Toyosaka district

2011: The involvement of the academic and research community restarts the investigation

2012: Discovery of larvae and natural nests. Active publication of survey results. Establishment of a conservation group.

2013: Increase in survey participants and awareness of the river environment problems.

2014: Holding the national convention. Environmental education at elementary school. Cooperation of local community centers.

2015: Activities to help the larvae. Expansion of educational activities. Various awards

2016: Workshop to reflect on the conservation activities (Fig.6)

Fig.6 results of the workshop (2016)

6. Further action necessary

Now, this protection group is working by setting emphasis to the following four points. They are (1) Ecological understanding and evaluation of the salamander and its habitat, (2) Recognition of the role which each stakeholder should play, (3) Promotion of the understanding of the local residents, (4) Visualization of the value of the Salamander as the regional resource.

(1) Ecological understanding and evaluation of the salamander and its habitat

The point of the current survey is to conduct an age assessment of the salamander left behind between the weirs, determine the destinations of the flushed larvae, and development of methods for protecting larvae.

(2) Recognizing issues. Who should do what?

Through the workshop, stakeholders confirmed the importance of 1) ecological understanding of the salamander and its habitat, 2) improvement in the habitat environment, and 3) promotion of the local people's understanding regarding salamander conservation. Improving the river environment is the most important priority. However, local agreement and support is indispensable for the river environment improvement. It is also desirable to develop a protective facility for thin salamanders and larvae, and an isolation facility for the hybrids.

(3) Promotion of the understanding of the local residents

Although the residents' understanding of the giant salamander and its environmental challenges has progressed through the activities and outreach in recent years, the residents' interest in protecting salamanders is low. Aggressive implementation of CEPA is desired.

(4) Visualization of the value of the Salamander as the regional resource

Educational use of the salamander is advancing. In addition, it is desirable to raise the level of the residents' interest in conservation by outlining the salamander as an opportunity to develop the tourism industry. For example, an eco-museum focusing on the salamander could be developed. As a starting point, the projects that are currently being attempted need support— nature observation tours (Fig.7), the development of products related to salamander (Fig.8), and reuse of the pools of closed elementary schools for protection and exhibition space (Fig.9).

Fig.7 Nature observation tour

Fig.8 Products related to the salamanders

Fig.9 Pools of closed elementary schools that are expected to be reused for protection / exhibition

Red-crowned Cranes in Japan: Is it Possible for Them to be Independent ?

Nobumichi Kurosawa
Kushiro Sarun Trust

Red-crowned Crane (*Grus japonensis*) is a species that represent wetlands in East Asia as an apex species in the food chain in wetland. There are two separate populations in the mainland (China and Russia) and Japan. The population in the mainland is migratory and has approximately 1,300 individuals, while the population in Japan is non-migratory and has approximately 1,750 individuals that live only in Hokkaido, especially in eastern Hokkaido including Kushiro Wetland.

Red-crowned Cranes in Japan had been regarded to be extinct in early 20th century due to hunting and habitat degradation, until a few dozen birds were found again in 1925 in Kushiro Wetland. Thanks to the effective winter feeding by local people since 1952, the population increased steadily. The conservation efforts are evaluated highly to be worthy of praise.

However, as most of the wetland, ponds and rivers in eastern Hokkaido freeze during winter, it is difficult for the cranes to find enough natural food to maintain their current population. The feeding by local people and NGO is indispensable for crane's survival. Currently the feeding is subsidized by local and national government.

As a large population of cranes, sometimes as much as 200 to 300, gathers at each of the 3 main feeding sites in winter, there is a concern over the outbreak of infectious diseases such as bird flu among them. Moreover, due to the decreasing wetland area including the Kushiro Wetland, the population density is still high in the limited habitat even in summer. It makes many of them obliged to live near people's living range. As a result, accidents to cranes, such as collision against cars, trains and power lines, and damages by cranes to agriculture are both increasing.

There are numbers of reports regarding the damages to agriculture, which include eating seeds and seedlings of maize for livestock feed during sowing season, spoiling silage (stored fodder) by pecking its plastic wrapping, and intruding into cattle shed to eat cattle feed or foul it with their feces.

Although cranes have started to disperse naturally to new habitats nearby, the number is still limited. Various efforts are needed to alleviate the concentration of crane population in Kushiro and Nemuro area.

The present period of feeding by people for cranes is from November to March. The Ministry of the Environment has started a program to encourage their autonomous disperse by reducing the period and amount of feeding. However, there is a high possibility that the cranes will depend on farm yards even more.

If they disperse into other areas, it wouldn't be a problem while the number is small, but when the number increases, new problems to agriculture, such as harming rice, vegetable and other crops, might arise before long. It will be necessary to ensure not only good wetland environments for cranes but also the consensus of local people around wetlands.

In Kushiro area, Wild Bird Society of Japan has been engaged in works to restore natural winter feeding habitats by clear cutting overgrown shrubs along riversides and ditches in pasture. The work is supported by many volunteers including local people. These new feeding habitats have been used by many cranes.

Moreover, there are several movements in central Hokkaido to promote cranes' natural dispersion by preparing good habitats and/or restoring old habitats. In Mukawa Town, a pair of crane has been breeding since 2011. The pair stay there all year round without going to eastern Hokkaido for the winter. Local people in the town organized a team for watching over cranes to prevent human disturbances of crane breeding.

Also in Nagamuma Town, local people organized a group aiming to restore a crane habitat in a new flood control basin in an area called 'Maizuru', which means dancing cranes. The name suggests that this area was a crane habitat. Because of the warmer climate of both regions compared to Kushiro area, they might become good wintering sites for cranes.

Since Red-crowned Crane is appreciated as an auspicious bird in Japan, it is highly possible that the dispersed population is welcomed in each area. In order to live along with cranes, it should be an essential step to raise awareness of local people as well as to promote wetland conservation and restoration.

Fig1: Population of Red-crowned Crane

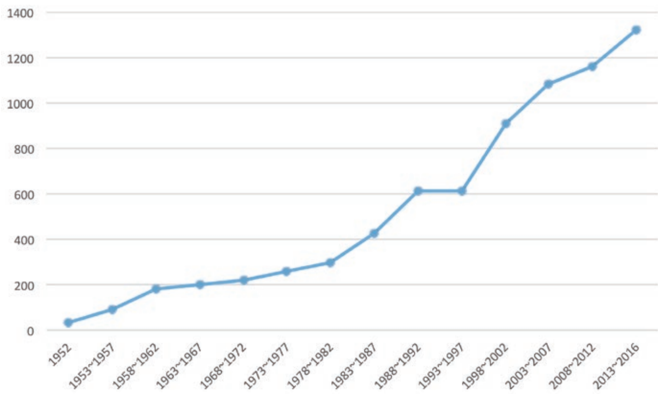
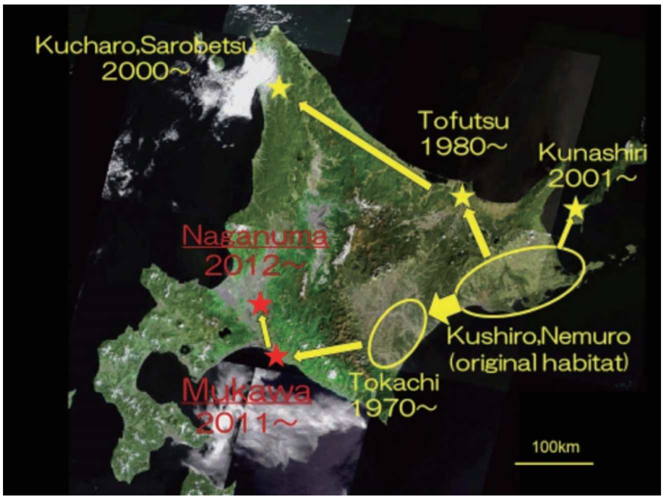


Fig2: Winter scene of feeding site near Kushiro wetland

Fig3: Invasion to a cowshed (Photo by Tancho com.)

Fig4: Dispersion of Red-crowned Crane in Japan



Integrated Evaluation of Biodiversity in Tidal Flat in Tokyo Bay

Masayuki Takada[1], Yoshio Mishima[2], Takahiro Ota[3], Hiroyuki Oguma[2]
[1] Hosei University, [2] National Institute for Environmental Studies, [3] Nagasaki University

Purpose

The purpose of this study is to create biodiversity maps, that shows integrated evaluation by combining distribution information of each taxon groups in coastal area in Tokyo Bay.

Study Site

Study site is "Sanbanze" tidal flat and shallow area, where sone features are listed as follows;

- Remain in Tokyo Bay where its 90% were lost (fig.1).
- So many migratory birds and clamming people.
- 1,800ha including 5,000m2 oyster reef.
- High productivity for fisherman.

Methods

By using the data of biological survey (2006, 2007, 2010) conducted by Chiba prefecture for Sanbanze tidal flat (1800 ha) in Tokyo Bay, we tried to create maps on biodiversity of tidal flat by combining these data. The following seven data were used.

- Bentos: "number of species" and "wet weight"
- Fishes: "number of species" and "number of individuals"
- Phytoplankton: "number of species" "total cell number"
- Algae: "number of species"

In this study, we regarded total number of recorded species as biodiversity, and average value of each survey as biomass.
The map was prepared from the point data of the survey point by the following two methods.

1) Spatial interpolation by IDW method using geographic information system
2) Estimate by multiple regression analysis from Pixel value of satellite image (Landsat)

We mapped each of the above four classification groups, seven parameters individually. Next, standardized so that the maximum value became 1, and totaled in consideration of dispersion, and created two integrated maps, which are showing the number of species and the quantity of biomass.

Results

As a result (fig.2), the spatial interpolation method has a geometric shape, and in the method using the satellite image, a noise-like pattern was appeared due to delicate reflection difference such as sea surface influence, but the following common tendency It has been clarified.

1) The number of species and biomass in Fish tended to be higher as they were closer to the land.
2) The number of species in Benthos tended to be higher in the direction closer to land, and the biomass showed an opposite tendency.
3) Plankton tended to be higher in both the number of species and biomass, closer to the offshore area.
4) The number of species of algae tended to be higher in the coast closer to the land.
5) The integrated maps roughly show the number of species and biomass tended to be higher near the land area.

It is presumed that the difference in properties of individual tidal flats (such as mud type and sand type) is difficult to find due to the location of the survey point, but the biodiversity was shown to be both rich. It is also suggested that plankton is low on the land side due to water purification effect of tidal flat.

Discussion - Is the integrated maps meaningful?

We provided these maps to conservation activity members conducting on-site surveys of tidal flat, and interviewed the following items.

1) Difference between maps and actual feeling
2) Relationship between people's use and rich areas of biodiversity
3) Effect of maps on conservation and understanding the tidal flat, and dissemination of more effective map information

As a result, the following was clarified as the effect of the map information.

1) It can lead to conviction that the area is rich in biodiversity seeing his experience of conservation activities.
2) It can be used for checking information or correcting misunderstanding by his experience.

The former is a great motivation for the continuation of conservation activities and it also works effectively for disseminating information to others. The latter is an indispensable viewpoint for adaptive conservation management.
On the other hand, the trade-off between index integration and information accuracy is a future task in terms of information disclosure and communication. Especially, according to the purpose, it may be unnecessary to provide the details of the information and uncertainty, and it is difficult for the public to understand it. It is necessary to further consider a more desirable expression method of map information through balancing these two factors.

Fig.1 Study site (Sanbanze Citizen survey group)

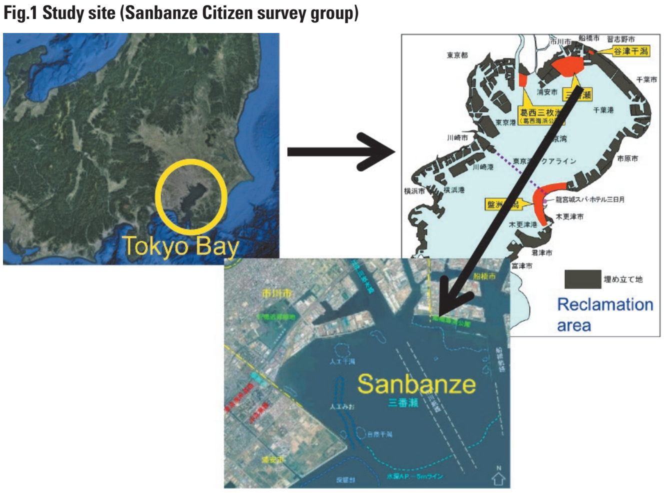


Fig.2(1) Maps using GIS

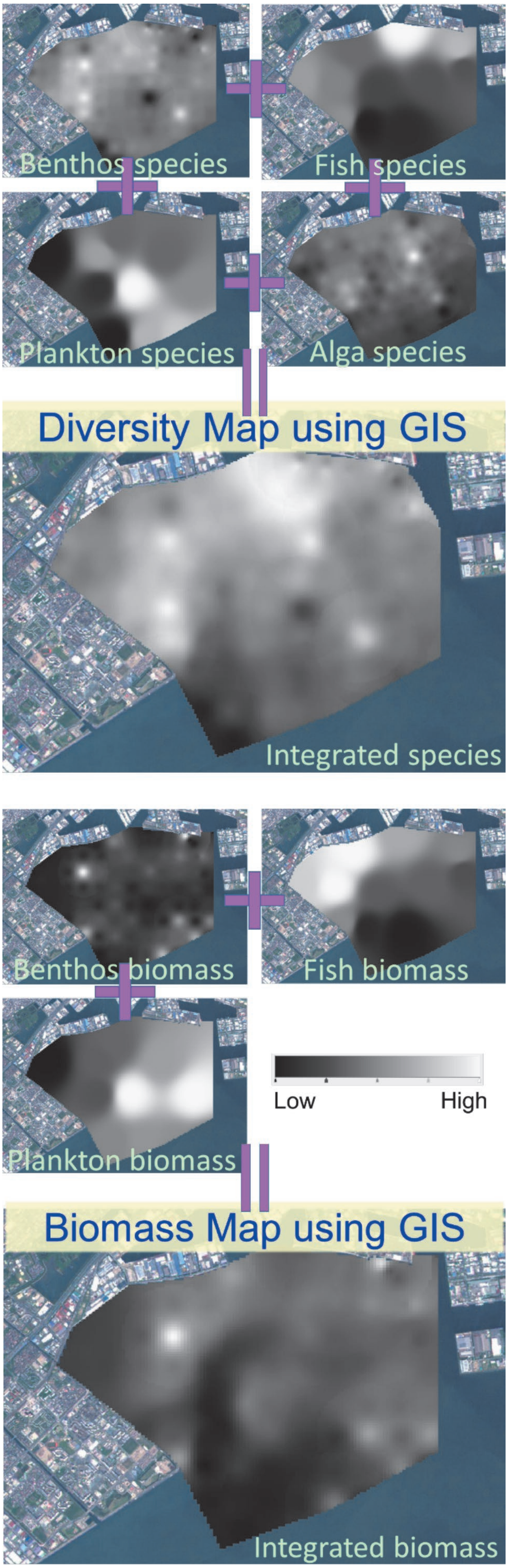
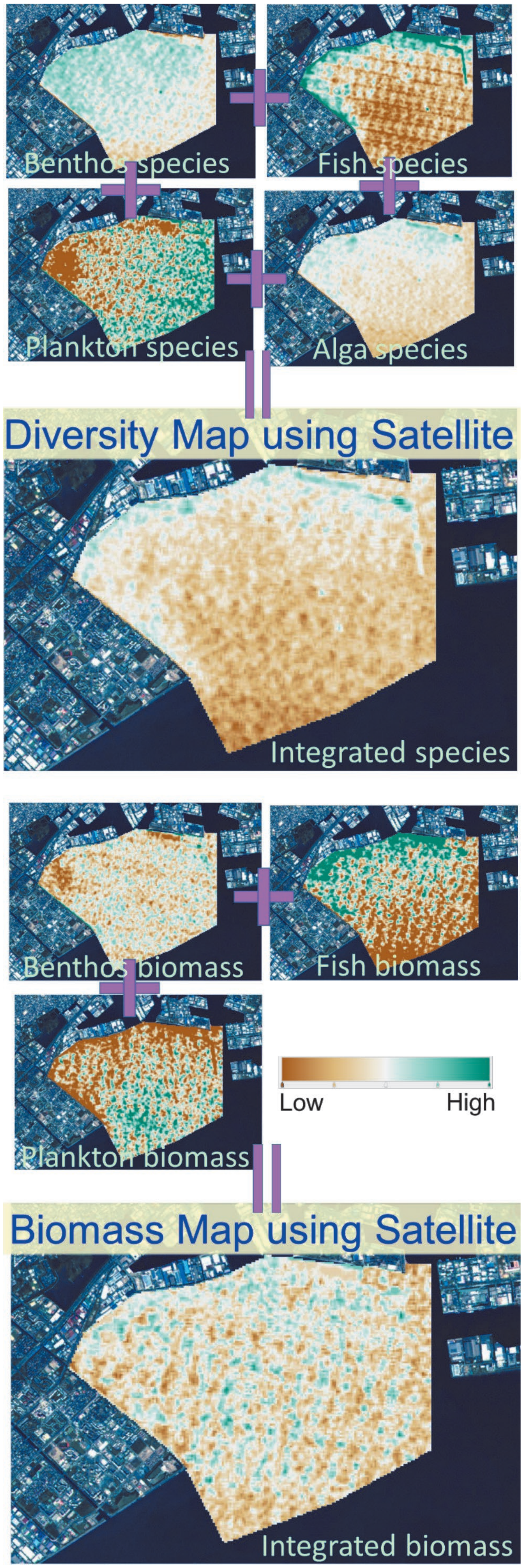


Fig.2(2) Maps using satellite



Adaptive Actions by the Community to Resolve Various Issues of Climate Change in the Wetlands Along the Coast of Bay of Bengal, Odisha, India (abstract)

Jitendriya Naik
NET-COAST

It was for the last 20 years, PALLISHREE has been performing the role of an implementing NGO in thefield ofenvironmentthrougheducation and awareness building spheres. The local problems due to Climate Change issues have been addressed by PALLISHREE. It has mobilized financial support to undertake activities fromthe Japan based support agencies such as JFGE, KNCF, NALAPO, TOYOTA, AEON and JWF in which Ramsar Center Japan has played important role in extending technical support in conceptualization as well as implementation of programmes. The programmes were implemented in more than 180 coastal villages along Bay of Bengal in Odisha. The core principle of the intervention was to build critical awareness of the community and also mobilization ofparticipation in the intervention.Thevillageswere facing Climate Change issues like Sea Erosion, increased salinity over land and water, repeated occurrenceofnaturaldisasters and erratic rainfall. As aresult, the local communities were facing sever impacts in terms of increased risk over life and livelihood. This hasbeenfurtherresultedin the migrationof poor families.

PALLISHREE has been facilitating community adaptation to the issue of climate change and its impact.

a) Land degradation: Construction of Cross and Counterbond, Gulleyplugging, check dams, grass planting and Mangrove Plantation. Plantation in School, temple and community land.
b) Indiscriminateuseofchemicalsinagriculture: Preparationofvermin-compost,useof cow dung, biological interventions, changing pattern in crop diversity and other serial cultivation to increase nitrogen in the soil.
c) Adaptation to hazard by stress tolerant seed varieties: Conservation and use of indigenousseedsand otherflood, droughtandsalinetolerantvarieties.
d) Erosion and accretion: Grass and Mangrove Plantation and palli-shed have been initiated.
e) Flash flood/water logging: Awarenessbuilding to createescapes to allow flood water into the low land. Clearing of outlets and inlets ofdrainage system.
f) Hazards like:

- Flood: Individualsurvivabilityandcommunity readiness, adaptationof flood resilient rice verity, pond renovation & rejuvenation preparation of high raised platform, tube well, toilet & house.
- Cyclone: Mangrove plantation, reopening of sea mouth blockage, adaptation of saline resilient crop, facilitating the hydrological connectivity, sand dune vegetation.
- Drought: Rain water harvesting and Adaptation of drought stress tolerant rice variety.
- As a result the organization strive to check the increasing trend of migration. For this the organizationpromotesmeasures such asalternativelivelihood like Agriculture, Fishery, Eco-Tourism, Fruit Plantation, Rice-fish culture,Silvo-culture, Poultry farming & Mushroom Cultivation, Sustainable life forest, sand dune vegetation.
- Besides the organization also work in the following spheres so as to make the adaptation process sustainable.
- Reducing the anthropogenic pressures over the wetland by demolishing all detrimental practices.
- Awareness building to create ecosystem restoration by local community.
- rohibition to use small mess size net and poaching of fish juvenile.
- Adoption of responsible fishery practices.
- Useofalternativesourceofgreen energysuch as useof solardevices and promotion.
- Training on energy saving lifestyle to the community and manage solid wastes. For this PALLISHREE used to organize awareness building activities through street play,wallpainting, poster, newsletter,booklet &leaflet.It also promotessimilar awareness generation activities in the schools targeting the students and teachers including local youth group and women.

Effect of Policy Change and Human Activity on Vegetation Pattern and Biodiversity Conservation in Coastal Wetlands: A Case Study in Yancheng, China (abstract)

[1]Zheng Zang, [1]Xinqing Zo, [2]Qiaochu Song, [2]Yulong Yao, [2]Dongju Zhang
[1]School of Geographic and Oceanographic Sciences, Nanjing University, Nanjing,
Key Laboratory of Coastal and Island Development, Ministry of Education, Nanjing
[2]School of Geographic and Oceanographic Sciences, Nanjing University, Nanjing

Using the Yancheng National Nature Reserve of China as an example, this study investigated the influence of vegetation pattern in coastal wetlands vegetation responses to land-ocean interactions. Remote sensing images were used to reproduce the changes in wetland vegetation cover over the relevant years since 1987. We explored the potential impact of policy changes and human activities on vegetation restoration and biodiversity conservation in coastal wetland.The results showed that during the study period, the vegetation displayed a zonal distribution pattern in parallel with the line of latitude, whereas the wetland type changed from sea to land as bare mud flat, hosting Spartina alterniflora, Suaeda glauca, Phragmites australis, and constructed wetlands dominated by rice. At the landscape level, the number of patches, patch density, and mean nearest-neighbor distance gradually increased during the investigation period, while the mean patch size gradually decreased in the study area. Human activity such as changes in land use patterns resulted in the progressive development of vegetation patterns toward fragmentation, and the non- zonality (intrazonality) distribution of vegetation became more obvious in coastal wetlands. To mitigate interference from human activity on coastal wetlands, an adequate buffer zone should be reserved in coastal wetlands on the basis of the zonal distribution of the vegetation. This buffer zone will guarantee the connectivity of the landscape and the sustainability of policy, further allowing coastal wetlands to play a positive role in global biodiversity conservation work.

The Seabirds of Tubbataha Amidst Change (abstract)

Maria Retchie Pagliawan*, Angelique Songco*, Arne Jensen**, Segundo Conales Jr*, Noel Bundal*, Rowell Alarcon* and Cresencio Caranay Jr.*
*Tubbataha Management Office, **Wild Bird Club of the Philippines

The Tubbataha Reefs Natural Park (TRNP), located in the middle of Sulu Sea in the Philippines, is the last intact seabird habitat in the country. Over a hundred species of birds have been recorded, of which six are regular breeders. These are the Red-footed booby Sula sula, Brown booby Sula leucogaster, Sooty tern Onychoprion fuscatus, Great crested tern Thalasseus bergii, Brown noddy Anous stolidus and the Philippine endemic subspecies of Black noddy Anous minutus worcesteri. Since 2004, the population of these species was monitored on a regular basis. This paper presents the results of the 2017 seabird census, the changes in their population in the last 13 years, and the management interventions planned in order to conserve their population.

A total of 33,650 breeding seabirds were recorded in the park during the census in May 2017. Bird Islet hosted the majority of the population (28,280 adults), while South islet had to 5,370 adults. T. bergii constituted more than half of the total count (17,126 adults), the highest record for this species in the Park. The population of A. stolidus reached 2,670 adults, the highest record for this species since the baseline counts in 1981. S. leucogaster colony continued to occupy the middle of the Bird Islet, with 2,917 adults this year. The population of O. fuscatus decreased to 5,098 adults from 8,555 last year. One interesting occurrence this year was the early onset of egg-laying for the O. fuscatus, which may have started in February, two months earlier compared to previous years. These four species are ground-breeders, constituting 82% of the population. This huge percentage of ground-breeders compared to the tree-nesters was likely influenced by the continuous decline in the vegetation in the two islets. The combined count for this year's tree-nesters (S. sula and A. minutus worcesteri) dropped to 5,797 adults compared to the 10,857 last year. This number is 50% less than the 5-year average count of 11,500 individuals of tree-nesters in the Park. This decline may be attributed mainly to the huge drop in the population of the Philippine endemic A. minutus worcesteri, which reached its lowest count (3,710 adults) since 2005 and is 54% less than its 10-year average of 8,000 adults. S. sula population is roughly 2,000 individuals, almost the same as last year's. Another highlight was the re- sighting of one Masked booby Sula dactylatra, which was first observed last year after a 21-year absence from the Park.

TRNP is being managed under a no-take policy. Despite management efforts to protect the Park and conserve its resources, the effects of both anthropogenic and natural impacts seem inevitable. Bird mortality due to entanglement in fishing lines were frequently observed. Changes in climate and local weather patterns also seem to affect the seabirds and their breeding phenology. In years when extreme El Niño occurred, T. bergii, O. fuscatus and A. stolidus did not return to Tubbataha to breed.

The loss of vegetation and the conflict in habitat use between the S. Sula and A. minutus worcesteri may have led to the decrease in the population of the latter. All these, coupled with the decrease in land area of both islets due to erosion, may have significantly influenced the seabird population in the Park. Management interventions to minimize the effects of these threats include regular clean-up and propagation of native plant species. Soft-engineering techniques are currently being explored to minimize erosion in the islets.

Recent Environmental Changes and Benthic Community Response in Lake Nakaumi and the Honjo Area, Japan (abstract)

[1]Kengo Kurata, Koji Seto, [2]Keiko Yamaguchi, [3]Ryusuke Shinohara, [4]Takeshi Sonoda
[1]Estuary Research Center, Shimane University, [2]Faculty of Life and Environmental Science, Shimane University,
[3]Graduate School of Life and Environmental Science, Shimane University, [4]Faculty of Bioindustry, Tokyo University of Agriculture

Recent environmental changes in Lake Nakaumi and the Honjo area have been studied after the cancellation of a land reclamation and freshening project. Although there is a long-term monitoring project ongoing to study the environmental changes occurring in Lake Nakaumi and the Honjo area, this paper presents its current status and summarizes the results obtained so far.

Lake Nakaumi, which flows out to the Japan Sea through the Sakai Strait, is the fifth largest coastal brackish lake in Japan, with an area of 86 km2. The halocline in the lake causes the lower layer to be hypoxic during warmer months, restricting the distribution of benthic invertebrates. The reclamation design for the Honjo area used surrounding dikes to separate the water column from Lake Nakaumi since 1981. In 2002, the local government decided that Lake Nakaumi, including the Honjo area, should remain a brackish water area; several nature restoration projects were started. In 2006, researchers started long-term monitoring projects to study the environmental changes and the benthic community response in order to examine how the nature restoration projects proceeded.

Periodic monthly samplings revealed that the biomass of several bivalve species in the Honjo area increased after the removal of the western dike, whereas those in Lake Nakaumi remained at similar levels during the same periods. Data analysis performed from May 2006 to October 2010 indicated that some of the restoration projects had indeed affected water circulation between the Honjo area and Lake Nakaumi, and that the benthic community responded to these environmental changes. The abundance of the polychaete Pectinaria okudai increased after the partial removal of the eastern dike, indicating that the other restoration measure had influenced the recruitment of benthic species at the stations near the dike opening. Monthly samples taken in the field from November 2010 to December 2011 should be included in further discussions. Another surveys conducted in the predetermined years (2006, 2010, 2014, 2016) investigated the spatial distribution of environmental parameters and benthic invertebrates. Several studies had suggested that the Honjo area with surrounding dikes showed weak or no halocline and provided suitable habitats for bivalves such as Arcuatula senhousia. However, the distribution of this species in the Honjo area was restricted to the shallower zones in the summer 2006 samples.

After the partial removal of the eastern dike, surveys conducted in 2010 and 2014 indicated either that relatively higher concentrations of dissolved oxygen could be detected in the of lower layer water samples, or that several bivalve species could be found in stations near the dike opening. Seawater flowing into the Honjo area through the opening improved the bottom sediment habitats, but the range of this effect was apparently limited to adjacent areas. The results of the 2016 survey indicated that the spatial distribution of benthic invertebrates in the summer showed restricted habitats both in Lake Nakaumi and the Honjo area. Most of the habitats in Lake Nakaumi and the Honjo area were below the halocline, resulting in severe hypoxic conditions as evidenced by the dissolved oxygen concentrations. These summer conditions had also been reported in the lower layer in Lake Nakaumi before the reclamation project, as well as in periods before the nature restoration projects.

Our Approaches on the Monitoring of Wetlands' Biodiversity for Environmental Conservation (abstract)

Misuzu Aoki, Syou Kato, Taiki Ito, Tomomi Yamashita and Ken-ich Yokoi
Wetlands International Japan

The rapid environmental deterioration of wetlands such as lakes, mires, marshes, and tidal flats is a critical threat to the plants and animals that inhabit them. This problem is also affecting our lives because the activities of plants and animals in wetlands bring us various benefits: for example ecosystem services. Therefore, it is very important to conserve the environments of wetlands and to use them in a sustainable way ("wise use"). In order to receive the wetlands' benefits continuously in the future, gathering and accumulation of data on their biodiversity is a strong pre-requisite. Understanding the current condition of the wetlands is important for us, but it is difficult to say if we have the necessary amount of relevant information.

Wetlands International Japan (WIJ) is conducting a wide range of activities and projects aimed at promoting the conservation of wetlands and wise use of them. In particular, we are working to gather and organize basic information on the biodiversity of wetlands and objectively comprehend the current state of wetlands. In this presentation, we will introduce an in-progress monitoring project that is aimed at obtaining basic information on the biodiversity of wetlands.

In 2003, The Ministry of the Environment of Japan launched a long-term ecosystem monitoring project called "Monitoring Sites 1000 Project," based on the Second National Biodiversity Strategy of Japan. This ongoing project aims to detect qualitative or quantitative changes in various ecosystems, such as alpine zones, forests, "satoyama," inland waters, and coastal regions, in the Japanese archipelago. This project is established at over 1000 investigation sites, and we will continue to conduct the survey for a period of 100 years.

As a part of this project, we are involved in ecosystem surveys that cover the coastal regions (rocky shores, tidal flats, seagrass beds, and algal beds) and the inland waters (lakes, mires, and marshes), with the objective of biodiversity monitoring in these wetlands. The surveys in coastal regions and inland waters have been conducted for about 10 years, using both qualitative and quantitative methods for assessing biodiversity. The data obtained in the project are published on the webpage of the Ministry of the Environment Japan. It is expected to be used for analyzing long-term fluctuations of biota or flora in each of the studied regions, and the elucidation of the factors behind such fluctuations, as data accumulate in the future. In addition, novel information on the invasion of alien species and on the occurrence of endangered species can be obtained. It is expected that this data will be utilized for planning the conservation measures undertaken by administrative organizations, such as preventive measures for alien species, the protection of endangered species, and assignment of red-list species. Furthermore, the part of data obtained from the surveys in the coastal regions will be shared through two global-scale database systems, the Ocean Biogeographic Information System (OBIS) and the Global Biodiversity Information Facility (GBIF), to help elucidate the long-term fluctuations of biota and flora on a global scale. On the regional scale, the data on biota and flora are also used to meet the criteria for registration with the Ramsar Convention, thus directly contributing to the conservation of wetlands.

Sungei Buloh Wetland Reserve (abstract)

Choon Beng How
National Parks Board

Sungei Buloh was first opened as a Nature Park in 1993 and by 2002, 130 hectares were officially gazetted as a Nature Reserve and renamed Sungei Buloh Wetland Reserve. In the same year, it was recognised as a site of international importance for migratory birds and awarded a certificate by Wetlands International, marking the reserve's formal entry into the East Asian Australasian Shorebird Site Network. In 2003, Sungei Buloh Wetland Reserve became Singapore's first ASEAN Heritage Park.

Singapore's National Parks Board (NParks) manages SBWR with a multi-pronged approach - conservation, education, research and nature-based recreation. While wetlands provide a plethora of ecosystem services, it is increasingly critical to focus on socio-ecological aspect, with developmental pressures and the rise of the green sustainability movement. People, remains the foci of conservation success. NParks recognises the importance of effectively engaging different stakeholders which are key to the long term conservation of the wetland reserve. It does so through a variety of programmes tailored specifically to each group, including schools, non-governmental organisations and corporate organisations.

Tucked away in the northwest corner of a highly-urbanised island, SBWR has been fitted sensitively with boardwalks, trails and bird-watching hides to bring city-dwellers closer to nature sensitively without disturbing wildlife. Information boards with species identification guides and explanatory diagrams complement trails for self-guided walks. Visitors may also choose to participate in guided walks by volunteers, prawn harvesting demonstrations, photography and birdwatching workshops and nature camps for children. The activities organised for the general public are designed to be highly interactive, and are aimed at further increasing awareness of the wetlands, the ecosystems within and how the community can do their part to conserve them. Those who prefer to have to have a first-hand encounter with the wetlands and do not mind getting their hands and feet dirty can volunteer in mangrove salvaging, habitat restoration, coastal clean-ups and biodiversity surveys. Through engaging activities like these, participants feel closer to nature and better appreciate, thus grows a need to protect it. The team at SBWR is supported strongly by a network of committed volunteers. some fo the volunteer actvities include leading guided walks, conducting workshops and contributing to wildlife surveys. The NParks website and mailing list updates act as our portal for communicating and publicizing outreach activities and events to public and volunteers.

In 2008 the draft Sungei Buloh Master Plan was unveiled, demarcating fringe areas around the Reserve that would help to reduce the pressure on it due to increased visitorship. This is in alignment with the Master Plan's three strategic thrusts of ensuring a living wetland, encouraging bio-learning and enhancing the reserve as a destination with a difference. This new Sungei Buloh extension with its nature trails and visitor centre is the result of phase 2 of the Master Plan, and will allow visitors to continue enjoying the wetlands while also allowing the existing parts of Sungei Buloh to be a more tranquil sanctuary for wildlife. The new 31-hectare extension opened in 2015, harbouring rich mangrove and coastal forests, which are home to diverse species of fauna such as crabs and mudskippers and complements the habitats in the wetland reserve. With the opening of the new visitor centre, new programmes and guided walks are offered, increasing the suite of new outdoor recreational and educational options to our visitors. It also hosts a new gallery, classrooms and laboratories, augmenting the programmes and interpretives throughout the reserve.

Wetlands in Central Asia: Raising Awareness about Their Values in Local Communities in Kazakhstan, Kyrgyzstan and Turkmenistan (abstract)

Zhanel Karina, Eldar Rustamov
Ramsar Regional Initiative for Central Asia, Regional Environmental Centre for Central Asia

Central Asia is a vast region with a diversity of wetland types such as lakes, rivers, reservoirs and marshes that are unique in their nature and provide important ecosystem services for both humans and the environment, in particular, in the arid zones. Many of these ecosystems are under increasing pressure due to the anthropogenic impacts, poor nature management and climate change. As there is no comprehensive research on the current status of the wetlands in Central Asia, application of the monitoring mechanisms is not always ensured and the countries lack effective management system for wetlands conservation and wise use, it is crucial to raise awareness about wetlands in the region.

Enhancing awareness about wetland values at all levels as well as conducting a regional inventory of wetlands and improving the management effectiveness are among priority activity areas of the Ramsar Regional Initiative for Central Asia (RRI-CA). The new Ramsar regional initiative started its activity in 2016 and currently has Kazakhstan, Kyrgyzstan and Turkmenistan as members. The Initiative aims to promote stronger cooperation and synergies within the Central Asian region to effectively implement the Ramsar Convention and its Strategic Plan at the national and regional levels.

Currently the project on the update on the status of wetlands in Kazakhstan, Kyrgyzstan, and Turkmenistan by collection and dissemination of good practices for the conservation and sustainable use of wetlands by local communities is under realization within the RRI-CA activities. The specific objectives of the project include a) raising awareness about the importance of wetlands, and vital ecosystem services and other benefits they provide; b) update of the information on the current status of the selected wetlands in Kazakhstan, Kyrgyzstan and, Turkmenistan; c) collection of the examples of good practices by local communities for the conservation and sustainable use of their wetlands; d) organization of the site based World Wetlands Day celebrations with the involvement of local communities. The main output of the project will be a manual in local languages, containing the updated information on the status of the selected wetlands in each of the three target countries and the good practices for the conservation and sustainable use of wetlands conducted by local communities. We believe that the implementation of this project will contribute to the realization of the Ramsar plan on communication, capacity building, education, participation and awareness on the regional level.

Since the representatives of the local communities play a key role in the management of local resources, they have direct impact on wetland conservation and use. The work with local communities is important in order to understand the benefits that the local communities receive from the wetlands. Using this bottom-up approach by working with local communities who utilize wetlands services, is crucial for raising awareness about the value of wetlands and for ensuring involvement of local communities into the decision-making process and dissemination of knowledge.

The Ramsar Regional Initiative for Central Asia would like to express its gratitude to the Government of Japan for their financial support of the project.

Roles of Resident Researchers to Promote Adaptive Fisheries: Lessons Learned from Lake Saroma, Japan (abstract)

[1]Kimihiko Maekawa, [2]Shimpei Iwasaki
[1]INTEM Consulting,Inc., [2]Department of Environmental Science, International College of Arts and Sciences, Fukuoka Women's University

Many scholars increasingly put high emphasis on a significance of adaptive management. Adaptive management as an approach takes uncertainty into account and assumes that management knowledge is inadequate, thus requiring experimentation and learning in an iterative process. Many traditional fishery systems faced with difficulties in adapting to changes in the environment. The emerging challenges require not only a given form of social control among resource users but also promoting adaption of scientific technology

In general, academic researchers, who usually come from universities or research institutes, mainly aim to report their findings in scholarly journals, rather to directly find workable solutions to problems of interest to fishers in a local context. On the other hands, this presentation aims to shed light on "resident researchers "as the key actor to catalyze adaptive fisheries. The term resident researchers refer to persons the trans- disciplinary solution-oriented research by committing themselves as stakeholder in the local community (ILEK 2013).

In the case of Lake Saroma, the fishers have started to employed full-time researchers since 1987. In those days, the fishers got anxious about uncertainties of changing lake ecosystem and regional variability inherent in climate change, though they made great efforts on fishing regulations such as setting allowance limit for scallops in 1970's. To promote stable fishery production, they sought to find workable solutions with active use of scientific expertise by employing resident researchers as their own staffs. Accordingly, the resident researchers living with the fishers have been committed to implement two activities.

First is research and development related to conditions of fishery resources and the lake water ecosystem. The former includes measurements of growth of scallops or such a living things. The latter includes water monitoring such as temperature, salinity, and so on. Compared to academic researchers, it is important to note that resident researchers are not only engaged in the research activities but also sharing the timely knowledge with the fishers by meetings, or face to face communication. In an urgent case that the fishers experienced difficulties in tackling with various environmental challenges, they give the reports to the researchers immediately so that the unique system makes it easier to respond to the issues by taking full advantage of scientific technology and knowledge.

Second is to create a platform for boosting collaborative partnerships among the stakeholders especially outside researchers. Scallop culture, which is one of the most important fishery production in Lake Saroma, imposes heavy burdens on the lake environment. To evaluate the conditions of environment, the resident researchers organized the Environment Monitoring Commission composed from several institutes and executed a holistic approach for the fishery management. Each researcher investigated their own fields, and sharing/discussing the results/knowledge once a year, in order to provide scientific information for decision making in the lake management. The resident researchers can lead to better collaboration between fishers and outside researchers as a catalyst by working for the interest of fishers. The information gathered by resident researchers could be used for fishers and academic researchers. The presence of resident researchers is expected to develop a win-win situation for both of them.

Long-term commitments with the fishers can lead resident researchers to choose samples, methods, questions, observations, and research designs that are required in resource management, enabling to respond to changes in the lake environment with a process of trial and error. Long-term residency can allow the resident researchers to interpret concerns of the fishers and act in a leading role in the coordination of adaptive fisheries development in strong collaboration with outside stakeholders. Their roles will be more appreciate in the resource management debate toward wise use of wetlands.

Science Communication about the Hizen-Kashima Coast (abstract)

[1]Naoki Fujii, [2]Yasuhiro Nakamura, [3]Mamoru Nagaike [4]Kenji Yoshino, [4]Yuichi Hayami
[1]Institute of Lowland and Marine Research, Saga University, [2]Hizen-Kashima Tideland Observatory,
[3]Kashima Lifelong Learning and Cultural Promoting Foundation, [4]Institute of Lowland and Marine Research, Saga University

The Ariake Sea is a typical shallow water area with the largest tidal area in Japan. In the past, it was a bountiful sea with many shellfish and creatures such as mudskippers, the Green eel goby, and the Grenadier anchovy. Recently, however, problems such as dysoxic waters and red tide have occurred, reducing the catch significantly. Therefore, other than the nori-seaweed industry, the fishing industry has been stagnating in the Ariake Sea area. According to a report from The Commission for the Assessment of Comprehensive Research on the Ariake Sea and the Yatsushiro Sea, the environmental degradation in the Ariake Sea has been caused by several complicated factors such as the Isahaya Bay reclamation project and laver acid treatment. As a result, conflicts have arisen around the coastal areas of the Ariake Sea. To overcome these conflicts, it is important to focus on ways to revitalize the Ariake Sea and its surrounding areas. Therefore, marine scientific research is needed to provide the information needed to form consensus on the Ariake Sea regeneration. However, as the scientific explanations may be too complex for the local citizens, it is necessary to develop a science based platform whereby these scientific results could be explained to the local Ariake Sea public in simple terms

In 2012, a citizen's science lecture course, held five to seven times a year, was opened to train interpreters and increase the number of people (for example, eco tour coordinators) involved in imparting scientific findings to the general public. The course content covers Ariake Sea regional culture, tideland creatures, a fishery tour, and food culture.

Originally, the course was organized by Saga University alone; however, as cooperation in the region has deepened, the course is now being held in collaboration with local organizations. Because the course was aimed at training scientific interpreters, in 2011 and 2012, the lectures were similar to university lessons, with the main content being ocean investigation methods and tideland biological collection and identification. However, as this content was academic and difficult to understand, there were few participants, with many courses having less than 10 people. Therefore, the lifelong learning concept was adopted and the content changed to focus on areas that were more familiar to local citizens, such as the fishing industry and the observation of coastal organisms. Further, rather than only having classroom based lecture, experiential learning was also included which included excursions and coastal explorations.

Even though this course has been conducted for five years from 2011 (it was canceled in 2014), there has been little growth in the number of scientific interpreters. It is necessary, therefore, to organize an open science lecture to discuss the problems.

Nonetheless, the interest of citizens has expanded due to the registration of the east Yakata Flats and Hizen Kajima Tideland as a Ramsar wetland site. In addition, Kashima City Hall has started to set up a course to train tour guides for the Hizen-Kashima tidal flat. As expectations for scientific interpreters in this area are expected to increase, we would like to continue the science course.

Development of an Environmental Education Program on Tidal Flat (abstract)

Miho Hiruma, Misuzu Aoki
Wetlands International Japan

Tidal flats have many functions. These include water purification, helping the spawning and growth of fish, and supplying us with food. In addition, we use tidal flats as a place for activities such as fishing, nature observation and education. In other words, we gain various benefits from tidal flats.

However, many people cannot sufficiently recognize the benefits as being those obtained from tidal flats. One of reason that cannot recognize of the benefits from tidal flats may be that they are becoming places that are mentally remote in our daily lives. In other words, the ties between tidal flats and people are weakening in modern times. In such circumstances, in order to have people gain a greater recognition of the value of tidal flats, the most important them is for there go to the tidal flats and experiencing them using the five senses.

Wetlands International Japan works to educate the general public concerning the value of tidal flats. As a first step, we think that it is important for people living near tidal flats to learn about them by enjoying and discovering there charm and value.

Especially, In order to ensure that tidal flats are conserved for the future, we think that it is important to have the children who are responsible for the next generation recognize the benefits received from tidal flats. Thus, we started a project to create an environmental education program that utilizes tidal flats in 2016. We chose Arao-higata located in the eastern side of the central part of the Ariake Sea as the place of our activity. This project is being conducted with the cooperation of people in various positions such as staff of the local municipality (Arao City), fishermen, elementary school staff, NGOs and researchers.

In this project, we provide opportunities for children living near the Arao-higata to go to the tidal flat, and also we offer experiences of touching living things inhabiting tidal flats. Our aim is to make an education program so that children will gain an interest in tidal flats and recognize the importance of conservation of tidal flats through these experiences. In 2016, in order to accurately grasp the biota in the Arao-higata, we conducted a survey of biota in the tidal flat with researchers. We were able to record 141 species of benthic animals. Based on the result of this survey, we made the survey list named "List of Benthic Animals of Arao-higata" which selected 50 major species of benthic animals. Additionally we attempted an education program "Treasure hunt game of the benthic animals" using the survey list. This program involved three steps. At first, the children spent time learning about tidal flats and the benthic animals living there.

Second, in the field, we had the children search for the benthic animals and capture them. Finally, we instructed the children to check the names of the captured benthic animals by themselves. Specifically, to make it possible for children to search for the benthic animals by themselves, we taught the following three techniques.

1. Take a lower visual line than normal
2. Search for them under stones and seaweed
3. Dig some holes

By searching for benthic animals using these three techniques, we attempted to provide some successful experiences for children. Also, in order to maintain children's interest in searching for benthic animals, we attached scores to benthic animals and created a sense of it being a game competing for points.

In the future, in order to continue the program, we plan to develop teaching materials and to grow leaders who can explain the differences and features of benthic animals.

Where is the Future of Our Wetland? It Lies in the Hand of Our Youth (abstract)

Liangzhong Chen
Operation Earth

As the future of wetland worldwide is filled with uncertainties due to excessivewater extraction, land conversion to agriculture andurbandevelopment, shoreline and waterfront development for industrialand othereconomic activities resulted by growing pressure of human population.

One of the reasons of such situation, is our decision makers for economic development may not fully aware the critical ecological functions and roles to our future life and destiny of wildlife played by wetland. Thus to increase the awareness of wetland conservation among generalpublic, especially among our teenage, is of great importance.

The best way to publicize and educate general public and our young generation is to organize them to join the monitoring and field research activities of conservation of wetland ecosystem.

On the otherhands, to sustain currentfield research and monitoring activities for wetland conservation, need human resources and additional funding.

Operation Earth in past few years, mobilized teenage field research volunteer expedition teams, to support monitoring and conservation of wetland ecosystem program by direct participation in following research programs:

1. Amazon flooded rainforest in Peru;
2. Tonle Sap Lake of Cambodia;
3. Taihu Lake in Jiangsu Province, China,
4. Waterbirds Monitoring in the Yellow River Delta Area, Shandong, China; and
5. Ertix River Headwater area of Altay Mt., Xinjiang, China, etc.,

Thefieldresearchactivities for volunteers, must be inconjunction with local field researchers of various wetland conservation research project site, so as to really help the research program be sustained.

The methods of field research volunteers are not experts, they have to be trained before participate in monitoring activities, thus the classroom training is provided at the first day of the survey to grain knowledge of the participants on waterbird identification and counting techniques.

Survey team of field research volunteers aredivided into smallgroups to count individualwaterbird, nests and chicks at breeding colonies and feeding sites.

Our field research monitoring activities are include:

Waterbirds monitoring, to increase knowledge on waterbird identification and counting techniques, to understand population trend of the key species of large waterbirds;

Fishsurvey, to assess the conservationprojectandparticipationof the fisheries, Ecotourism and relevantauthorities. Fishery monitoring has been conducted to define fish population and density in the core area, to determine threats to fish by illegal fishing and records location of illegal fishing, number of fishers, gears and seasonal camping and boats.

Caiman Survey, to understand population, behavior and threat of caiman; Macaw survey;

Amazon Pink Dolphin Survey;Terrestrial transect survey of wildlife;

Surveyonlocalcommunityparticipatorymonitoring and conservation, to inform local community members that fishing in the core area is prohibited. Interview with localresidentsand localauthority to definepotential threats, problemsand suggestion to solve the problems.

These field research monitoring program supported by Operation Earth field research volunteers, have achieved excellent result: fieldresearch and monitoring program of wetland is sustained, awareness of wetland conservation scientifically among general public, especially among the young people, isgreatly increased and environmental stewardship is fostered among the teenage field research volunteers and their parent, which will certainly help the restoration and conserve ecological health of wetland in the future once these teenage field research volunteers grown up and become decision makers.

Community Based Management of Marine Biodiversity in Bay of Bengal (abstract)

Asaduzzaman Miah
Bangladesh POUSH

The Bay of Bengal is the largest bay in the world and a northern extension of the Indian Ocean, positioned between India and Sri Lanka in the west, Teknaf Peninsula of Bangladesh to the north, and Myanmar (Burma) and the northern part of the Malay Peninsula to the east.Numerous large rive systems including the Ganges and Irrawaddy drain into it.Teknaf Peninsula is one of the longest sandy beach ecosystems (80 km) in the world. It represents a transitional ground for the fauna of the Indo- Himalayan and Indo-Malayan ecological sub-regions. Important habitats at the site include mangrove, mudflats, beaches and sand dunes, canals and lagoons and marine habitat. Mangrove forest occurs in Teknaf peninsula both as natural forest with planted stands and mostly distributed in the inter tidal zones. The Teknaf peninsula mangroves supports the habitat of 161 different fisheries species.The beach of Shahporir Dwip in Teknaf peninsula is a suitable breeding ground for marine turtles.Globally threatened Olive ridley and green sea turtles (Cheloniamydas) are dominant in mangrove vegetated areas of Shahporir Dwip, Hawksbill and Leather back turtle nests are rarely found.

Main threats to biodiversity at the site include the degradation of sand dunes due to grazing, cutting of sand dune vegetation for fuelwood and industry; the conversion of dune, beach and mangrove habitat to agriculture, aquaculture, tourism and small scale industry; the harvesting of turtles and turtle eggs; post larvae collection of shrimp and colossal loss of biodiversity, destructive fishing methods; hunting of shorebirds; large scale shell collection; coastal erosion due to shell removal; beach compaction by vehicles; pollution and land degradation from boat discharges and ship breaking, agro-chemicals, impact of coastal aquaculture on environment, natural disasters, sea level rise, tourism and small industry etc.

Bangladesh POUSH has been implementing a project with the financial support of JFGE in association Ramsar Center Japan (RCJ) to reduce the loss of juvenile and non-commercial species from the sea to ensure the ecosystem well being for the sustainability of the Bay of Bengal resources. The project has been implementing in the shore and the sea of the Teknaf peninsula. The fishers, fishing in the sea, is the main stakeholder of the project along with the administrative authority, local community, and tourist. The participatory protection of the juvenile of the commercially important species and non-commercial by the fisher in marine fishing resulting ecological balance of the sea ecosystem and the sea resource sustainability.

The project has been conserving the biodiversity of the marine ecosystem by reducing the volume of harvesting, minimizing the accidental harvest, and releasing the juveniles back in the habitat. The local community specifically the fisher who harvest aquatic resources and the farmer along with tourist who collect terrestrial resources of marine ecosystem have been making aware about the value of the biodiversity and the practices of sustainable harvesting and conservation.The project has also been sensitizing, motivating and building up knowledge and capacity of different stakeholders and community on practicing biodiversity conservation in harvesting and diversification of the livelihood option.Along with other conservation activities marine turtle hatchery development, protection of different habitats and introduction of safe fishing nets are initiated and the activities have been creating an encouraging impact.

Community Led Biodiversity Conservation in Rushikulya Estuary, India (abstract)

Wardi Kasinath
NET-COAST

Bio-diversity conservation has got essential for maintaining a secured and safe life and livelihood of the community in a given geographical area. The Govt. agencies have clear cut mandates towards these spheres. None of the developmental measures/polices could be passed, if it has any contradiction towards the survival of the natural capital like wetlands or mangrove forests of the area. The joint initiatives taken by the NGO namely PALLISHREE and CBO namely KISSAN could able to make such mobilisation in 12 villages of Ganjam district of Odisha in conserving biodiversity.

Rushikulya River meets Bay of Bengal at Ganja in Ganjam District of Odisha. Olive Ridley Sea Turtle are arriving in millions every year. Previously, there were no conservation activities taken although this is the second largest mass nesting beach in World. The eggs were destroyed by predators. Although the Forest department has taken initiation now a days, but PALLISHREE, formed a CBO namely KISSAN "Kruma Iswaram Sangham" (Turtle-God Association) during 2006. There are mythological stories in Hindu that once God became a Turtle and saved the Earth. So in order to bring emotion among the stakeholders, the local community had kept the name of the CBO as "KISSAN". It was a part of the project supported by KNCF, Japan and technical support of RCJ, Japan. PALLISHREE enhanced the capacity of the local community in Sea Turtle conservation and build partnership with Forest Department. The local community is now taking all the responsibility till from meting of the turtle to release of hatchlings to Bay of Bengal. So they have been engaged from November to the next year June, almost 8 months in a year. Generally, they used to stop fishing in the sea from November to the next year April (6 months), to safe guard the turtles from casualty. The catch of the fisherman is very high during the rest of the 4 months.

Because the jelly fish in the coastal sea is eaten by the turtle and make the netting favourable in fishing. Jellyfish always create problem in fishing for the fishermen. Thus, the turtles are the friend of the local fishermen.

Secondly, KISSAN has taken care of the mangroves plants which have been planted by PALLISHREE. After the completion of project in the year 2008-09, the community as such KISSAN has taken all responsibility of the mangroves forest. The management has got on an average of 60,000 INR by selling the mangrove seeds annually. KISSAN is also raised mangroves nursery and provided plants to others. This mangrove forest played important role during the last cyclones "Phailin & Hud Hud" broke 2013 & 2014. The fish resources have been increased in this area. So the community has shown interest to conserve and replicate it in other places.

KISSAN has promoted women SHG in different hamlets of 12 coastal villages. The members of the SHG are organised to take lead roles in conservation of mangrove plants and turtles eggs. They could understand the importance of bio-diversity conservation in reduction of risk on their lives and livelihoods. Besides, the participation effort has resulted in the promotion of special youth Task Force in the area. KISSAN in support of PALLISHREE to build the capacity of these youth volunteers in the 'watch and monitoring' spheres. The process has attained sustainability since it is now led and managed by the community. The NGO is supporting these community groups in the spheres of coordination with other stakeholders like the Forest Department, Fishery department and other private associations.

Species and Functional Diversities of Zooplankton in Shallow Water Bodies and its Application as Ecological Indicator (abstract)

[1] Hye-Ji Oh, [2] Geung-Hwan La, [2] Eun-Jin Han [1] Kwang-Hyeon Changm, [2] Hyun-Woo Kim
[1] Kyung Hee University, [2] Sunchon National University,Korea

Bio-diversity conservation has got essential for maintaining a secured and safe life and livelihood of the community in a given geographical area. The Govt. agencies have clear cut mandates towards these spheres. None of the developmental measures/polices could be passed, if it has any contradiction towards the survival of the natural capital like wetlands or mangrove forests of the area. The joint initiatives taken by the NGO namely PALLISHREE and CBO namely KISSAN could able to make such mobilisation in 12 villages of Ganjam district of Odisha in conserving biodiversity.

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Comparison of the Photosynthetic Responses to Temperature and Irradiance of Two Edible Brown Algae, *Cladosiphon okamuranus* from Amami Islands and *Cladosiphon umezakii* from Takeno, Honshu Island, Japan (abstract)

[1]Rika Fukumoto, [2]Iris Ann G. Borlongan, [3]Gregory N. Nishihara, [1]Hikaru Endo, [4]Ryuta Terada
[1]Faculty of Fisheries, Kagoshima University, Japan, [2]United Graduate School of Agricultural Sciences, Kagoshima University, Japan,
[3]Institute for East China Sea Research, Organization for Marine Science and Technology, Nagasaki University, Japan,
[4]United Graduate School of Agricultural Sciences, Kagoshima University, Japan

Species of the brown macroalga *Cladoshiphon* (Chordariaceae; *Mozuku* in Japanese) are found along the temperate and subtropical coasts of Japan, and are regarded as important edible resources. In fact, the mariculture of *Cladosiphon okamuranus* has been widely practiced in the subtropic Ryukyu archipelago including Amami Islands, and has been one of the major industries that contribute to the islands' economy. Meanwhile, *Cladosiphon umezakii* has recently been reported as new species from the temperate region of Honshu Island, with a potential as new food resource. Although phylogenetically-related in the genus *Cladosiphon*, distribution of the two species in Japan is completely different; hence their temperature and irradiance optima or tolerances for photosynthesis may be distinct. Knowledge on this aspect still remains insufficient. In the present study, effects of temperature and irradiance on the photosynthesis of two species of *Cladosiphon, C. okamuranus* (CO) from Yoron Island in Amami Islands, Kagoshima Prefecture and *C. umezakii* (CU) from Takeno, Hyogo Prefecture, Honshu Island were determined. Measurements of photosynthesis and dark respiration rates, and photochemical efficiencies on the sporophyte stage of these two species were carried out by using optical dissolved oxygen sensors and the pulse-amplitude modulated (PAM) fluorometer. Results of the oxygenic gross photosynthesis and dark respiration experiments over a temperature range of 8–40 °C revealed the rise in gross photosynthesis rates with increasing temperature, and a sharp decline after reaching their peaks ($GPmax$ = 10.59 μg O_2 g_{fw}^{-1} min^{-1} for CO; 10.41 μg O_2 g_{fw}^{-1} min^{-1} for CU) at 29.5 and 25.7 °C, respectively. Maximum quantum yields (*Fv/Fm*) of *C. okamuranus* and *C. umezakii* after 48 h of exposure over a similar temperature range were relatively stable at low temperatures, but dropped to 0 at 36 °C and 32 °C, respectively. Although temperature optima for photosynthesis of the two species partly overlap each other; *C. okamuranus* can tolerate relatively higher temperatures than *C. umezakii*. The two species likewise showed similar responses to light at 28 °C, with comparable photosynthesis-irradiance (*P–E*) curve parameter estimates, and no reduction in photosynthetic activity and quantum yield of oxygenic evolution up to 1,000 μmol photons m–2 s–1. Photoinhibition-recovery experiments at 8, 16 and 28 °C were also carried out on both species. Their effective quantum yields (ΦPSII) after 6h of continuous PAR exposures at 1,000 μmol photons m^{-2} s^{-1} under all temperature treatments significantly decreased, and did not recover after 6h of dark acclimation. Such irradiance level was high enough for the seaweeds to suffer from photodamage, regardless of temperature.

Whereas complete recovery in post-dark acclimation *Fv/Fm* occurred for *C. okamuranus* exposed to 200 μmol photons m^{-2} s^{-1} at 28 °C, and for *C. umezakii* at 16 °C. Low temperature limitation may account for the decreased photosynthetic activity of *C. okamuranus*, while temperatures beyond the tolerable limits in *C. umezakii* may cause its greater tendency for photodomage. Overall, this study clearly showed the distinct temperature adaptations of the two species, in relation to the temperatures in their respective habitats, which further explains their distribution in coastal waters of Japan.

The Effect of Irradiance and Temperature on The Photosynthesis of a Temperate Seagrass, *Zostera Marina* (Zosteraceae) from Kagoshima, Japan, as the Southern End of its Distribution in the Western Pacific (abstract)

[1]Natsumi Shimada, [2]Gregory N. Nishihara, [1]Hikaru Endo, [3]Ryuta Terada
[1] Faculty of Fisheries, Kagoshima University, Japan
[2] Institute for East China Sea Research, Organization for Marine Science and Technology, Nagasaki University, Japan
[3] United Graduate School of Agricultural Sciences, Kagoshima University

Seagrasses (marine flowering plants / angiosperm) often form dense assemblages and provide a number of functions within the coastal ecosystem. Kagoshima Prefecture is located in the southern part of Kyushu and northern part of Ryukyu Islands, and lies at the boundary between temperate and subtropical climates. Hence, more than 10 species of temperate and subtropical seagrasses including *Zostera marina* L. (Zosteraceae) are found in the region. Although annual in habit and cosmopolitan in distribution, temperate species of *Z. marina* in Kagoshima Bay seem to have an annual habit. They disappear by the end of early summer; while newly germinated seedlings re-appear in autumn, and dominate seagrass beds in winter and early spring. Seawater temperature rise, brought about by global climate change has been a serious concern; its effect may influence the continued survival of biological organisms, particularly of such temperate species at the southern end of its distribution. In the present study, we determined the effects of irradiance and temperature on the photosynthesis of *Z. marina* from Kagoshima Bay by field and laboratory measurements. Measurements of photosynthesis and dark respiration rates, as well as maximum (*Fv/Fm*) and effective quantum yields (*ΦPSII*) were carried out using optical dissolved oxygen sensors and the pulse-amplitude modulated (PAM) fluorometer. In situ measurements of *Z. marina* population revealed a decline in *ΦPSII* with increasing incident PAR, with minimum values occurring during noon to early afternoon. *ΦPSII* recovered by evening, indicating dynamic photoinhibition. Results of in vitro photosynthesis-irradiance (*P–E*) experiments showed that *Z. marina* did not undergo photoinhibitionat 24°C, as net photosynthetic (NP) rates were saturated at *Ek* (i.e., at 154 mmol photons m^{-2} s^{-1}), and remained stable up to the highest irradiance level of 1000 μmol photons m^{-2} s^{-1}. However, an occurrence of such was observed at 8°C, given the decline in NP rates above *Ek* (134 μmol photons m^{-2} s^{-1}). The response of oxygenic gross photosynthesis (*GP*) rates over a temperature range of 8–40 °C showed a gradual increase up to 32 °C, and a decrease thereafter. *Fv/Fm* of *Z. marina* exposed to a similar temperature range for 72 hours were likewise evaluated. Values were relatively stable between 8 °C and 28 °C after 24 hours, and eventually declined to almost 0 above 32 °C after 48 and 72 hours. Results of the photoinhibition-recovery experiments (i.e., 12-hour PAR exposures at 200 and 1,000 μmol photons m^{-2} s^{-1}, and at 8 and 20 °C) revealed larger depressions in *ΦPSII* of samples exposed to 1,000 μmol photons m^{-2} s^{-1} under both temperature treatments. *Fv/Fm* of samples after 12 hours of dark acclimation were restored to initial values at 20 °C, but not at 8 °C. Indeed, low temperature, in addition to high PAR stress, has enhanced photoinhibition with greater risk of photodamage. This species is considered to be well-adapted to the current seawater temperatures in Kagoshima (15 – 28 °C); however, summertime seawater temperature at the study site is close to their tolerable limit, which could also influence its distribution at lower latitudes.

Field Observation Study on the Effect of Fe-Fulvic Acid Silica Complex Material Aiming at the NAGASU Tidal Flat Restoration (abstract)

[1]Ryoichi Watanabe, [1]Teruki Hamada, [1]Koreyoshi Yamasaki, [2]Masahiro Koga, [2]Yoshiaki Koga

[1] Fukuoka University, [2] Koyou Co.Ltd.

The NAGASU tidal flat that carried out this field experiment study is located at the middle site of Kyushu Island. The Ariake Sea is a heavily closed sea water area, therefore tidal exchange with the outside of the bay is not effective, and eutrophication progresses by pollution load from land.

For these past several years, fish catches of the Manila Clam Ruditapes hilippinarum decrease sharply in various places throughout the all over Japan. The reasons for the decrease of fish catches of the Manila Clam Ruditapes hilippinarum has not yet become clear.

It is being explained what humic substance and Fe-Fulvic acid are important for tidal flat ecosystem. Since the dam reservoir temporally stores river waters, those humic substance like Fe-Fulvic acid trap in the lake of the dam bottom. And also, after the 1960s, supply of the sand material from main rivers had decreased sharply in the Ariake Sea coastal area.

The consequent decrease in the Fe-Fulvic acid and sand supply to the sea is not advantageous to diatoms (siliceous and mostly benign) in tidal flat ecosystems. Therefore, a lot of fine organic rich suspended sediment such as silt and clay deposits on the tidal flats surface. In the Ariake bay, annual catch yields of the Manila Clam Ruditapes hilippinarum has been decreasing from the 1990s especially in Kumamoto and Fukuoka prefectures.

In this research, we observed the effect of Fe-Fulvic acid silica complex material at NAGASU tidal flat.

We installed the Fe-Fulvic acid silica complex material in the Nagasu tidal flat from July, 2014 and began observation. This observation research has carried out once a month at the NAGASU tidal flat from July, 2014. The observation contents are the observation of the tidal flat surface altitude by the RTK surveying, the collection of the bivalve in the quadrat (50cm×50cm), collection by the sampling core of the tidal flat surface layer. The area that the Fe-Fulvic acid silica complex material into the tidal flat, approximately 2,000 square meters. The Fe-Fulvic acid silica complex material is enclosed in a biodegradable bag with sand. The material is located into a a cross- woven lattice form within 2,000 square meters, and distance between the material is approximately 5m. In addition, the contrast section that did not spend the Fe-Fulvic acid silica complex material in the place approximately 100 meters away from the construction section that spent the Fe-Fulvic acid silica complex material.

Observation Results from the monitoring survey showed improvement in habitation of the Manila Clam Ruditapes hilippinarum and sediment quality, the restoration of the tidal flat was confirmed. For example, the Manila Clam Ruditapes hilippinarum have sharply increased in the NAGASU tidal flat experimental area. Also diversity of bivalves and other benthic organisms have increased in the tidal flat area, suggesting an improvement of the habitat environment. Furthermore, analysis of the Fe-Fulvic acid silica complex material in the tidal flat suggested that suspension feeders such as bivalves have an important role in the water purification process of tidal flats. Therefore increase in bivalve abundance will likely result in the improvement of water purification ability of the tidal flat area.

Poster Session II

Establishment of Monitoring Program in Iranian Wetland Ecosystems

Yosefali Ahmadi, Mehri Asna-Ashari, Abolfazl Abesht
Iran Department of Environment, United Nations Development Program (UNDP)

With the selection and application of the ecosystem approach for protection, management and wise use of Iranian wetland ecosystems, establishment of an integrated wetland management plan with the participation of all stakeholders has begun and, in cooperation with all the governmental organizations, NGOs and local communities, finalized in technical workshops and after numerous stakeholder meetings the integrated plan established.

Part of the integrated wetland management plan is dedicated to the monitoring protocol. In this section, required steps with details for monitoring of wetlands ecosystem are specified in three sections of the biodiversity, water -soil and socioeconomic. These details include monitoring parameters, suggested locations for establishment of stations, monitoring and collecting data responsible, data storage locations and reporting times. The purpose of the preparing of the monitoring protocol is to raise awareness about the biological, physical and social conditions of the wetland and its catchment area, helping the beneficiaries to better manage these resources.

Conservation of Iranian Wetlands Project with the aim of helping to implement the integrated wetland management plan and collecting important ecosystem data from wetlands facing water quality problems has begun to design and set up monitoring stations for water quality in wetlands.

The deployment of an online monitoring station in a wetland depends on the objective of monitoring in a wetland. In fact, the purpose of monitoring is to specify the type of station and its details. In addition, the costs associated with purchasing the equipment's needed and maintaining the stations, are another important factor that greatly identifies the operational framework.

After ensuring the financing of equipment and maintenance costs of the station the ecosystem condition of the wetland, according to the purpose, specifies the details and next steps of the work. In fact, the purpose of the implementation of the monitoring protocol of the wetland integrated management plan is to measure the basic parameters of the wetland ecosystem, which specifies how to work and select the parameters for subsequent studies. The next goal, which was followed, was to access instantaneous and online data from the ecosystem of wetlands, which could at any time, acquire a realistic picture of the remote conditions of the wetland. Hence, by selecting priority wetlands for monitoring the operational framework was identified for installation of the platform.

In the first phase, two Choghakhor and Kanibarazan wetlands were selected. After field surveys and review of similar experiences, the location of the stations and parameters needed to be measured at different depths was selected and finalized. The Choghakhor wetland with an area of about 2000 hectares is one of the wetland ecosystems with high habitat values, with an average depth of about two meters. The station is located on the northeast of the wetland and in depth of about 2 meters, the sensors is installed at three different depth on the floating platform. The parameters are water temperature, EC and DO in three depths (water level sensor in wetland bed) and a sensor also collect weather data such as temperature, air pressure, and relative humidity and a digital platform send data online to the server.

In the Kanibarzan wetland, with the aim of identifying of thermal stratification in the water column, installed the sensors of temperature, water level changes, EC and DO at two depths (water level sensor in wetland bed) and also air temperature, air pressure, and relative humidity parameters on a fixed platform. Also, with the purpose of collecting more data from other parts of the wetland, two satellite stations are located at two other points of the wetland, which collects temperature, water level changes and EC parameters.

In the second phase, based on the experiences of the first phase pilot, it was attempted to set up monitoring stations in Solduz and Nowroozlu wetlands, and now online monitoring station of Solduz and offline monitoring station of Nowroozlu wetland have been established. Solduz station includes temperature, water level changes, EC and DO at one depth and Nowroozlu station includes water level changes, EC and DO that all measure offline.

Location of monitoring pilot sites

Important points of the Iranian wetlands monitoring program include the participation of NGOs in data collection and the participation of universities and other research centers in analyzing data and helping to better management of these ecosystems.

In last step wetlands online monitoring databank for gathering and giving online availability to data users is under development and it provides a place for saving longtime online data.

Sustainable Use of Natural Resources for Community Livelihoods in the Setiu Wetlands, Terengganu, Malaysia

Haramaini Arifin[1], Daria Mathew[2], Muhammad Zaid Nasir[1], Nur Syahirah Wahab[1] & Dhiya Shafiqah Ridzuan[1]

[1]WWF-Malaysia (Setiu Wetlands Field Office), Lot 10575, Kg. Pagar Besi, 21020 Batu Rakit, Kuala Nerus, Terengganu, Malaysia

[2]WWF-Malaysia (Peninsular Malaysia Office), No. 1, Jln PJS 5/28 A, Pusat Dagangan Petaling Jaya Selatan, 46150 Petaling Jaya, Selangor, Malaysia

Introduction

The Setiu Wetlands or Tanah Bencah Setiu (in Malay) in Terengganu is undeniably a jewel of Malaysia's natural world. Located within the administrative district of Setiu which is inhabited by 61,700 people, represents 5.4% of Terengganu's population, the Setiu Wetlands provide numerous ecosystem services that are beneficial to the local population's livelihood and well-being. The reliance of local community has been examined via a number of studies and in a recently concluded high conservation value (HCV) assessment by WWF-Malaysia, whereby the findings confirmed the community's high dependency of natural resources from the wetlands. In this assessment, there are 6 HCV Definitions (HCV 1 to HCV 6). HCV 5 (Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for example for livelihoods, health, nutrition, water), identified through engagement with these local communities or indigenous peoples) is deemed present meaning that community reliance on the natural resources or ecosystems for meeting their basic needs.

Location of assessment

Setiu Wetlands is located in Terengganu, northern part of Peninsular Malaysia (See Figure 1). It is the largest natural wetlands in the East Coast of Peninsular Malaysia with interconnected habitats between the sea and mountains. According to Proceeding Book of Setiu Wetlands Scientific Expedition Seminar 2016 (2017), it has been found 161 species of bird, 49 species of butterflies, 36 species of reptiles, 29 species of mammals, 2 species of freshwater turtles, 9 ecosystems and 5 riverine complexes. The present of all flora and fauna mentioned above make it a key area of importance for biodiversity.

Methodology

Field data was obtained by face-to-face interviews with local communities. The questions asked were related to the usage and benefits of natural resources in Setiu Wetlands in related to their livelihood. The interviewees comprise of village heads, religious head, oil palm farmers, fishermen, rubber tappers, housewives, youths, caged farm aqua-culturists, representatives from women's groups, and operators of cottage industries. In total, 66 individuals from 14 different villages were interviewed. Additionally, the interviewees were encouraged to speak freely on relevant issues related to the area.

Findings

1) Fisheries

The mangroves ecosystem serves as fish nursery ground while the river and lagoon support freshwater and brackish water fisheries. The loss or degradation of the wetlands would cause serious implications by depriving the community of their basic necessities in terms of their main source of protein including mud crab (*Scylla olivacea*, *S. tranquebarica* and *S. paramamosain*), blue swimming crab (*Portunus pelagicus*), giant freshwater prawn (*Macrobrachium rosenbergii*) and marine shrimp (*Penaeus monodon* and *P. Merguensis*). The giant frehswater prawn was found at the riparian and upper-river ecosystems (Setiu-Chalok-Bari river basin) as an important fishing ground (WWF, 2014). The local of Setiu are involved in (i) **aquaculture farming** (cage culture and pond culture) and in their primary industry ; (ii) **fishing**. The local operate their cage culture in the Setiu lagoon on a fulltime basis. The species of garoupa and barramundi are sold via middlemen for the export market to Singapore and Taiwan. Meanwhile, fishing as an important source of income. Most of the fish harvested by the fishermen are sold to middlemen or to the Fishermen's Association who would in turn sell the catch to the markets or to middlemen. The local produced food from the fish such as budu (fermented fish sauce), fish chips, dried achovies and salted fish. It showed that it has become a culture for the local to eat fish which can be prepared in various ways. The most popular fish dishes are fish fried in batter, locally known as *ikan celup tepung* and fish sausage known as *kerepok lekor*.

2) Vegetation

The natural vegetation in the Setiu Wetlands are diverse, reflecting its range of habitats from coastal beach to mudflats, mangroves estuaries, back-mangroves, freshwater swamp and dryland, scrub, to the hill dipterocarp forests. Some examples of the natural vegetation are the morning glory (*Ipomoea pes-caprae*), the casuarina *(Casuarina equisetifolia*), nipah (*Nypa fruticans*), gelam (*Melaleuca cajuputi*), kercut (*Lepironia articulata*), nibong (*Oncosperma tigillarium*), bakau minyak (*Rhizophora apiculata*) and tumu puteh (*Bruguiera saxangula*). The assessment has proved the existence of a strong link between economic incomes of the community with cultural resources derived from the wetlands that is tied to their traditional identify ***Lepironia articulata*** **(Kercut)** leaves and ***Nypa fruticans*** **(nipah)** fronds are the raw materials used to make traditional handicraft items. **Kercut** is a type of sedge which is harvested from the wild, usually associated with the gelam (*Melalueca cajuputi)* forest. Making handicraft items from this wetlands plant is a traditional form of art and is being kept alive to preserve a traditional culture as well as to generate income to the weavers. Upon harvesting, kercut leaves are made to undergo several stages of processing before they are ready to be weaved by hand into handicraft items such as bags, floor mats, coasters and other souvenir items (See Figure 2). This initiative is headed by a group of women mostly housewives called Women Enhancement Society (KPW). The ladies involved see the kercut handicraft as an avenue in which they can preserve their tradition and culture, while at the same time earn them extra money to supplement the household income and alleviate financial hardship. But over the years, there has been a reduction of kercut plants and its habitat due to clearings for watermelon and oil palm plantations. On the other hand, **nipah** is a mangroves palm that occurs along the rivers and estuarine habitats. The young nipah fronds are used to make handicraft called *lekar*. Lekar handicraft (See Figure 2) is another traditional form of art involving weaving where the spines of the nipah frond woven together to make floor mats, kitchen accessories, baskets, Malay wedding gift trays and lamp shades which are sold and contribute supplementary income to the community.

These two traditional items are part of the culture of the local community and have existed for generations. Other than that, ***Melalueca cajuputi*** which is known in Malaysia as **Gelam** is also an important species in Setiu Wetlands. The local people have been recognized its usefulness for a long time as supply the poles, small scale charcoal industry and local honey (madu gelam) harvested by the local communities. This forest is used to be abundance but to date it reduced for wide scale aquaculture pond, silica mining and oil palm plantation.

Challenges

The Setiu district is one of the poorest districts in Terengganu thus there is great pressure and demand for economic growth to generate higher revenue. This factor also forms the catalyst for the government to implement social development and poverty alleviation programs to make available more job opportunities and income generating activities for the communities, often involving the allocation of natural and forested areas for the poor to develop into agricultural smallholdings. The prospects of faster and huge economic returns from development are often perceived to outweigh the ecological and social benefits provided by wetlands ecosystems which are usually not directly measurable. It is a challenge to convince decision makers as well as the community themselves about the need to conserve the Setiu Wetlands in order to sustain the livelihood and well-being of the communities.

WWF-Malaysia Strategy

One of WWF-Malaysia's strategies for Setiu Wetlands is to empower the local community to support and participate in conservation efforts through conservation partnership with community groups and Community Based Organizations (CBOs). Wetlands provide functions and services that positively affect the daily livelihoods of the local community. Remarkably, the CBOs act as wetlands' guardian and agent of change by promoting custodianship over wetlands and empowering the larger local communities to manage their wetlands resources in a responsible and sustainable manner. Since 2006, WWF-Malaysia has been working closely with the CBOs in Setiu in a various community participatory activities such as mangroves replanting, wetlands camp, community surveys, participation in planning processes for development and protected area planning, patrolling nesting beaches to collect the Painted terrapin eggs and transfer to the hatchery centre for incubation. Capacity building of the local community to undertake and drive conservation activities that may also contribute supplemental livelihood benefits is emphasized as an integral aspect of the community engagement. It is envisaged that through community stewardship, there is greater possibility for ensuring the Setiu Wetlands remain healthy, ecologically functioning and biologically diverse.

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Figure 1: Location of assessment in Setiu Wetlands

Figure 2: Handicraft from kercut (left) and nipah (right)

The Roles and Actions of the Wetland Centre of Yatsu-Higata Tidal Flat, a Wetland in the City that Experienced Massive Urban Development in the Inner Area of Tokyo Bay

Tatsuya Shibahara

Yatsu-higata Nature Observation Centre, Yatsu-higata Wise Use Partners/Ecological Education Centre

• What is Yatsu-higata

Yatsu-higata is located at the inner part of Tokyo Bay. It is one of the precious remaining tidal flats that survived the massive reclamation at the bay. It is an important habitat for shorebirds in the East Asian-Australasian Flyway. The area was designated as a Ramsar site, and joined the EAAF Site Network in 1996.

• About Yatsu-higata Nature Observation Center (YNOC)

It is a facility in Narashino City. The number of staff is 15 (5 members have been involved in communication and education. About 140 citizens register as volunteers. And the number of people entering the centre is about 45,000 a year.

• Current situation of Tokyo Bay

Currently, 90% of the bay's coast line is covered by artificial seawalls.

The area is highly urbanized, and represents one of the most densely populated areas in Japan with 25% of the population living there.

• Current situation of Yatsu tidal flat

1. Decreasing the number of shorebirds

Comparing the number of shorebirds today to that of 30 years ago, the number of sandpipers has decreased to a quarter, and that of plovers has decreased to a tenth.

2. Adverse effects of mass production of ULVA

Around 20 years ago, mass production of *Ulva sp.* started to stand out. Nowadays, putrid smell spreads around the residential area during summer.

3. Adverse effects of mass production of Honbinosu Clams (*Mercenaria mercenaria*)

For about 15 years, the clams have prevailed, which originated in North America. The accumulation of the clams inhibits the water flow, and narrows the tide range.

• EFFORTS OF YATSU-HIGATA NATURE OBSERVATION CENTRE

1. Deciding the anniversary day of Ramsar designation and celebrating it annually with events

The events are planned and managed by the YNOC with local citizens. Such anniversary and events provide opportunities to the citizens to participate in and reminds them of the most important conservation objectives; to promote conservation and wise use of Yatsu-higata.

2. Cooperative works for conservation and wise use of Yatsu-higata involving the wetland managers and citizens

In order to promote conservation Yatsu-higata, it is very important to cooperate with Ministry of the Environment (MOE-J), the manager of the wetlands, Narashino City and YNOC who plays a role for CEPA, and local residents, the players of the wise-use. The tasks can include discussing "how to use *Ulva sp.* and honbinosu clam as resources" to protect the tidal flat by developing the good relationship between local residents and the tidal flat, since there is no fishing or agriculture activities in Yatsu-higata.

• Networking and promoting cooperative activities among the institutions that are related to Tokyo Bay

1. Viewpoint of Tokyo Bay as an ecosystem

The other important point is "the connection with Tokyo Bay". A lot of migratory waterbirds that come to Yatsu-higata also use scattered wetlands in innermost part of the bay. The same applies to their preys like fish, benthos and plankton. Tokyo Bay is one wetland ecosystem. To protect birds in Yatsu-higata, we should monitor and protect their habitat in the scale of the entire Tokyo Bay.

2. Collaboration among Tokyo Bay related facilities

The cooperation is important for CEPA. To protect the entire Tokyo Bay, all related facilities need to cooperate to share information and connect local residents and Tokyo Bay. In the summer of 2017, six facilities located at the bay held an event together.

• Summary

- It is very hard to maintain the ecosystems in the highly-developed Tokyo Bay.
- There are a lot of people who are living without "linkages" with wetlands in urbanized areas. There is not many opportunity to feel the benefit from ecosystem services. Thus, it is difficult for them to recognize the value of wetlands.
- Remained wetlands in urban areas have a role to tackle this situation. In addition, there is a necessity to develop the conservation and management plan, and to recover wetlands.
- Although there are lots of development pressures in Asian countries, there are still lots of wetlands exist. Therefore, it has a potential to protect wetlands and conduct developments that are harmonized with nature.

The roles and actions of the wetland centre of Yatsu-higata Tidal Flat, a wetland in the city that experienced massive urban development in the inner area of Tokyo

Tatsuya Shibahara
Yatsu-higata Nature Observation Centre
Yatsu-Higata Wise Use Partners/Ecological Education Centre

What is Yatsu-Higata

The long side is 1.1 km, and the short side 400m, covering 40ha of wetland in total.

Yatsu-higata is located inner part of Tokyo Bay. It is one of the precious remaining tidal flats that survived the massive reclamation. It is an important habitat for shorebirds in the East Asian-Australasian Flyway . The area designated as a Ramsar site, and joined the EAAF Site Network in 1996.

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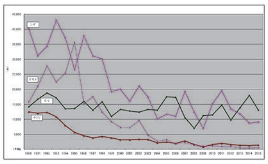
It is a facility in Narashino City.
The number of Staff is 15(5 members have been involved in Communication and Education.
About 140 people register as volunteer.
And the number of people enter the centre are about 45,000 each year.

Current situation of Tokyo Bay

Currently, 90% of the bay's coast line is covered by artificial seawalls.
It is highly urbanized, and represents one of the most densely populated areas in Japan with 25% of the population living there.

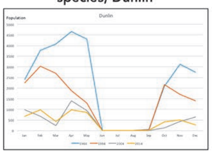
Current situation of Yatsu tidal flat



Representative species, Dunlin

Decreasing the number of shorebirds

Comparing the number of shorebirds today to that of 30 years ago, snipes has decreased to a quarter, and plover has decreased to a tenth.



The occurrence of putrid smell. Deterioration of bottom quality and water quality

Adverse effects of mass production of ULVA

Around 20 years ago, mass production of *Ulva sp.* started to stand out. Nowadays, putrid smell spreads around the residential area during summer.

Inhibition of water flow by seashell deposition

Adverse effects of mass production of honbinosu CLAMS(*Mercenaria mercenaria*)

For about 15 years, the clams have prevailed, which originated in North America. The accumulation of the clams inhibits the water flow, and narrows the hide range.

Efforts Of Yatsu-Higata Nature Observation Centre

Deciding the anniversary day of Ramsar designation and celebrating it annually with events

The events are planned and managed by the YNOC with local citizens. Such anniversary and events provide opportunities to the citizens to participate and reminds them the most important conservation objectives; to promote conservation and wise use of Yatsu-higata.

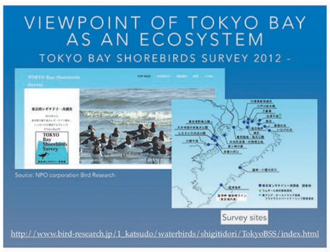
9,000 Visitors
1,100 staff members

Cooperative works for conservation and wise use of Yatsu-higata involving the MOE-J and citizens

To promote conservation Yatsu-higata, it is very important to cooperate MOEJ who manage the wetlands, Narashino-city and our centre who play a role for CEPA, and local resindents who play a role of wise-use. The task can be like "how to use *Ulva sp.* and honbinosu clam as resources" to protect the tidal flat by developing the good relationship between local residents and the tidal flat, since there were no fishing or agriculture in Yatsu-higata.

Networking And Cooperative Activities Among The Institutions That Are Related To Tokyo Bay

Viewpoint of Tokyo Bay as an ecosystem



The other important point is " the connection with Tokyo Bay". A lot of migratory waterbirds come to Yatsu-higata also use scattered wetlands in innermost part of the bay. The same for their prey like fish, benthos and plankton. Tokyo Bay is one wetland ecosystem. To protect birds in Yatsu-higata, we should monitor and protect their habitat as the entire Tokyo Bay.

Collaboration of Tokyo Bay related facilities

The cooperation is important for CEPA. To protect the entire Tokyo Bay, all related facilities need to cooperate for enforcement of information transmission, and connecting local residents and Tokyo Bay. This summer we held the events as 6 facilities work together.

Summary

- It is very hard to maintain the ecosystems in the highly-developed Tokyo Bay.
- There are lots of people who has lived with no "linkage" with wetlands in urbanized areas. There is ales opportunity to feel the benefit from ecosystem services. Thus, it is difficult to recognize the value of wetlands.
- Remained wetlands in urban areas have a role to overcome this situation. But there is a task to develop the conservation and management plan, and to recover wetlands.
- Although there are lots of development pressures in Asian countries, but there are still lots of wetlands exist. Therefore it has a potential to protect wetlands and conducting matched developments.

Evaluation of Infiltration Characteristic of Amended Soil by Long Term Observation under Natural Rainfall for Establishing Runoff Reduction Technology

Soichi Okayama [1], Rei Itsukushima [2], Yohei Ogahara [1], Yukihiro Shimatani [1]

[1] Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University, Japan

[2] Department of Decision Science for sustainable Society, Kyushu University, Japan

1. Introduction

Flood disaster has frequently occurred in urban areas. The cause is a decrease in the infiltration area due to urbanization, and an increase in localized concentrated torrential rain due to climate change. As a solution to this problem, law maintenance and introduction of rainwater storage facility have been carried out. However, existing method are not sufficiently popular due to problems such as cost. Therefore, it is indispensable to develop small, inexpensive, and easy technology for flood reduction, such as rainwater tanks, rain gardens, simple infiltration trenches, and so on.

In addition, since it is difficult to increase the infiltration area in urban areas, it is effective to improve the infiltration performance of existing infiltration areas. In this research, we focused on enhancing infiltration capacity of the compacted bare land such as ground and park. To enhance infiltration capacity of compacted soil at bare land, soil amendment materials such as humus and bamboo chips have been mixed.

On the other hand, infiltration capacity of soil at bare land decreases due to forming crusts at soil surface layer due to raindrop impact. It is reported that underground vegetation and litter in artificial forests such as cypress are weakening the impact of rain drops and inhibit the formation of crusts. However, with regard to compacted bare ground in urban areas, no technology has been established for improving infiltration capacity by suppressing crust formation on the surface layer.

Therefore, this study aims to evaluate the influence on flood reduction of soil surface layer structure and soil amendment materials for compacted soil.

Fig.1 Humus

Fig.2 Bamboo chips

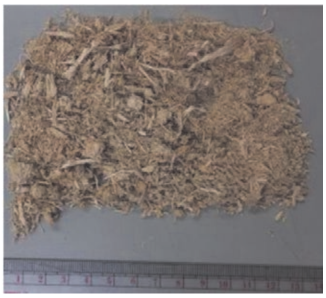
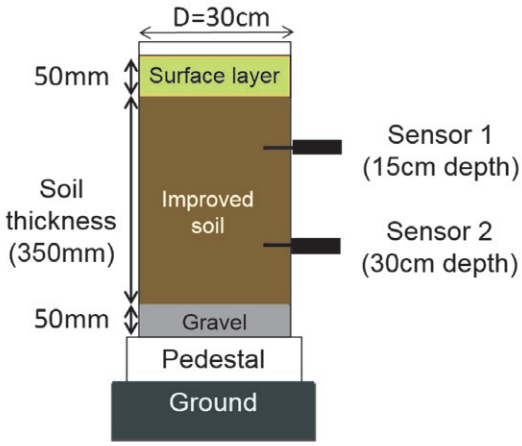


Fig.3 Gravel mulching

Fig.4 permeable soil paving material

Fig.5 experimental device



2. Research method

We conducted infiltration experiment under natural rainfall by observing surface runoff and measuring volumetric water content of soil for about four months (from September 2016 until January 2017).

We used two kinds of soil amendment materials; humus (**Fig.1**) and bamboo chips (**Fig.2**). These were mixed into decomposed granite at 30% rate. Also, three types of surface layer structure was adopted; no surface structure, gravel mulching (**Fig.3**), and permeable soil paving material (**Fig.4**). The experimental pattern was six patterns, combining two kinds of improving materials and three kinds of surface layer structures. Two samples were used for each pattern, so 12 samples were used in this experiment.

Fig.5 shows the experimental device. Improved soil is 350mm thick, and surface layer structure is 50mm thick. Sensors (CS616 manufactured by Campbell Scientific) were installed at 15cm and 30cm depth. These measured volumetric water content every one minute. At the same time, the rainfall intensity was measured every one minute by rain gauge (RG 3-M manufactured by Onset) installed near the experimental devices. Improved soil was compacted by a hammer (weight: 10.5 kg, bottom area: 64 cm^2).

3. Results

Fig.6 shows the changes of the volumetric water content (at a depth of 15 cm, the case of the bamboo tips and permeable soil paving material). The volumetric water content changes between 20% and 30%. Also, it rises immediately as rainfall occurs, and decreases promptly after rainfall. During the non-rainy period, the volume moisture content gradually decreases while repeating up and down about 1 to 2%.

Fig.7* shows the flooding level measured soon after the

54.4mm rain. Surface runoff remarkably occurred in the case of soils with no surface layer structure (**Fig.8**), and bamboo chips coated with surface layer structure hardly flooded. Also, the amount of surface runoff of humus mixing soil is larger than that of bamboo chips mixing soil.

*The actual flooding volume of gravel mulching is smaller than the numerical flooding volume.

4. Consideration

From **Fig.7***, it is considered that surface layer structure prevents surface disturbance by raindrop and avoided the decreasing of infiltration capacity. Also, infiltration capacity of humus is lower than that of bamboo chips under compaction condition. This is because depression of void structure by compaction caused the decreasing of infiltration capacity of humus mixing soil, whereas void structure of bamboo chips mixing soil was maintained after compaction.

The gradual decrease of the volumetric water content during the non-rainy period (**Fig.6**) is thought to be caused by the water being sucked up toward the soil surface by evaporation. This is because the volumetric water content turns to increase at the beginning of sunshine and turns to decrease at sunset.

5. Verification

We verified whether the influence of soil surface structure and soil amendment materials can be quantitatively evaluated from the volumetric water content. It is based on the idea that total rainfall equals the sum of water content captured by soil, flooding water, and penetrating water (**Fig.9**). Water content captured by soil is Increase width of volumetric water content (average of 2 sensors) multiplied by soil thickness (350mm).

The amount of permeated water exceeds the amount of water captured by the soil in the case of rainfall event more than 50mm. Permeation amount is more than 60% of total rainfall amount. Water content captured by soil is less than 30% (**Fig.10**). Therefore, evaluation of penetration amount is more important than that of volumetric water content.

6. Conclusion

Improvement of the surface layer structure is effective for suppressing deterioration of infiltration capacity due to crust formation.

Under compaction conditions, bamboo chips is considered to be more effective than humus for reducing floods as soil amendment material.

It is important to evaluate the infiltration performance by the penetration amount, rather than by volumetric water content.

7. Future tasks

Compaction affects the infiltration capacity, so it is necessary to evaluate the influence of compaction degree on infiltration capacity. In addition, there is a possibility that soil amendment materials such as humus and bamboo chips deteriorate over time. Therefore, we are going to continue this experiment and inspect the effect of aged deterioration on infiltration capacity.

Fig.6 changes of the volumetric water content

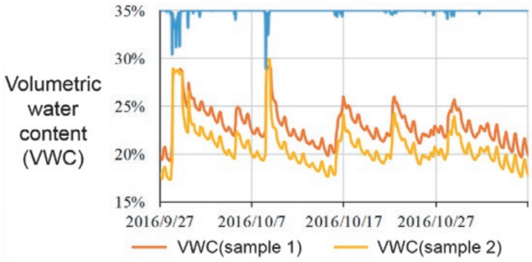


Fig.7 Flooding level (mm)

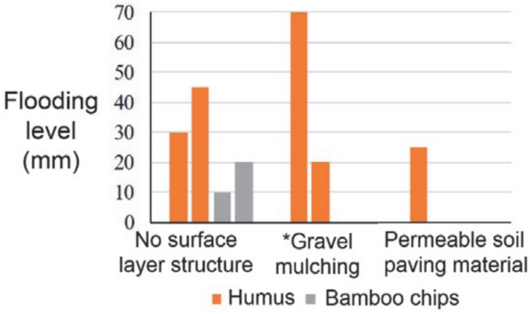


Fig.8 Flooding situation

Fig.9 Water balance of total rainfall

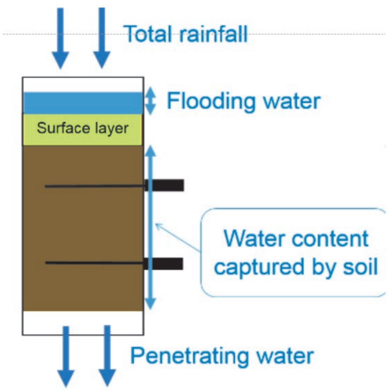
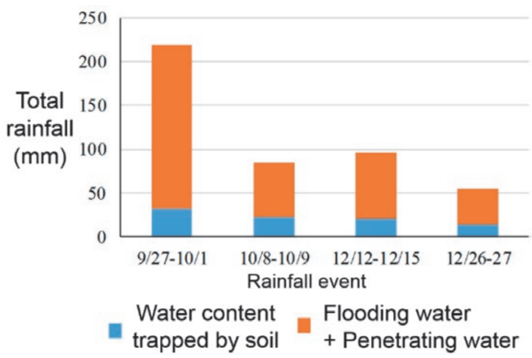


Fig.10 water content captured by soil relative to rainfall



Diversity and Distribution of Macroalgae in Chiang Mai, Thailand

Chindanai Jaitamart, Rungnapa Tagun and Tatporn Kunpradid
Department of Biology, Faculty of Science and Technology,
Chiang Mai Rajabhat University, Chiang Mai Thailand, 50300

Introduction

Chiang Mai is largest province of northern Thailand. There is located at a large plain called Chiang Mai - Lamphun basin. This area is surrounded by forest and mountain range and have the Ping River is a major river. Recently, Chiang Mai is the largest province of northern and the most popular tourist destination. Chiang Mai has changed dramatically. For example, change the land use benefit for agriculture and tourism, increasing population, expanding community and urban areas. The natural resources and environment are also impacted, such as degraded forest and water shortage due to the increase in consumption, water quality worsens by the chemical and the discharge into the water. The impact is not only presence as the physical and chemical properties but the distribution of aquatic organisms. One of the impacted organisms in the river is the algae. Algae are the most important producer in the aquatic ecosystem as a primary producer in the functional feeding pathway. More than that, algae has a great deal of usefulness to humens such as an agricultural, environmental science and local medicinal applications. *Cladophora* sp. and *Nostochopsis* sp. Have been using as food in Nan. Moreover, it can be used as medicinal application such as gastrointestinal disease, dermatitis and healthy and *Spirogyra sp.* to prevent stomach ulcers. The algae are used in other purpose such as a recipe to making a mixture of cosmetics and supplements. The macroalgae are also using in environmental aspecs such as a bio-indicator and tools for environmental education activities.

However, the applications of the algae have not been fully developed because of a lacking the knowledge, limited species level identification and the ecological data. Hence, this study aims to survey the diversity and distribution of macroalgaes and its relationships with the various habitats and environmental conditions in Chiang Mai Province, northern Thailand and processed the macroalgae hand book that could be use as a study tools for the student and local people. This book included the ecological data and development of the simple method for monitoring the environmental conditions with an easier communicated as pictures and symbols.

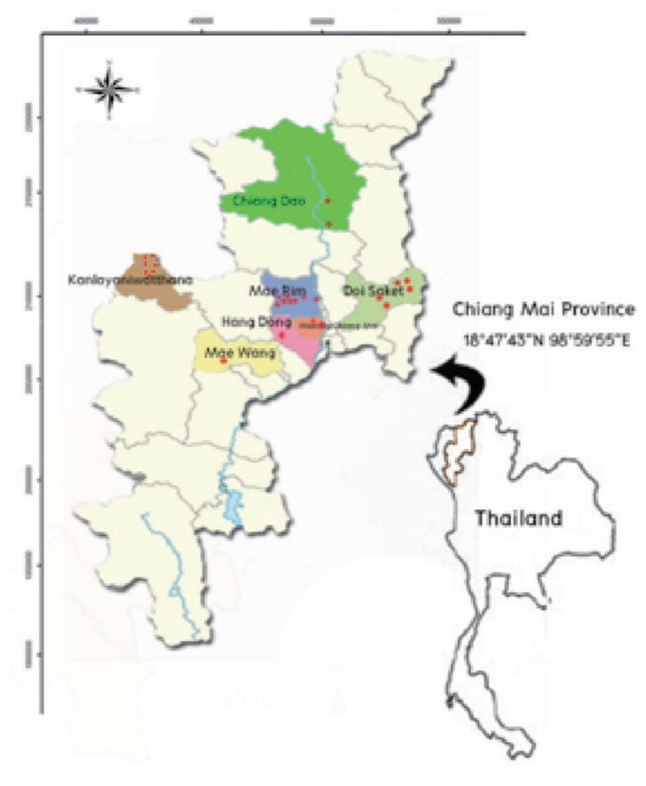
Objective

1. To survey the diversity and distribution of macroalgaes and its relationships with the various habitats and environmental conditions in Chiang Mai Province, northern Thailand.
2. To develop the macroalgae hand book that could be used as a study tools for the student and local people.

Methods

1. The samples were collected from 26 running and standing reservoir sites from seven districts throughout the Chiang Mai Province. The study was carried out from February to November 2016.
2. The attached macroalgae that can be seen with the naked eye were scraped as filaments, thalli, brown or green film from the hard substratum as rock, cobbles, gravel, sand, branches of trees. Some may be found as a free floating form on water surface.
3. Kept the samples in a 20-50 ml centrifuge tube, filled the reservoir water and preserved at 4-10 ° C to maintain conditions prior.
4. Analysis quality of water in sample sites by using Multi-Parameter analyzer for evaluate pH conductivity TDS (Total dissolved solid) and Dissolved oxygen analyzer kit (Azide Modification of Iodometric Method).
5. Other environmental variables for further study in the laboratory.
6. Identified to species level under compound microscope by using the books or relevant documents. The photo image and monograph of macroalgae samples were processed for making a macroalgae handbook.

Image 1: The 7 districts in Chiang Mai Province wer investigated in this study. Chiang dao, Doi saket, Mae Rim, Mueang Chiang Mai, Hang Dong, Mae Wang and Kanlayaniwatthana.

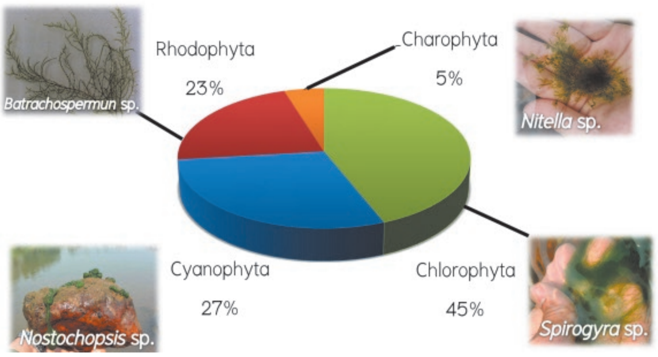


Results

Thirty-three species of ~~20~~ twenty genera in four divisions were found in this study. The Division Chlorophyta was the most dominate distribution (45%) followed by Division Cyanophyta(27%) , Division Rhodophyta (23%) and Division Charophyta (5%) respectively. The Spirogyra sp., Rhizoclonium sp., Cladophora sp., Phormidium sp., Compsopogon sp. and Audouinella sp. were a common species of the Chiang Mai area.

The highest diversity of macroalgae were found at the old traditional indigenous check dam "Fai Wang Hai". Eight species of eight genera were found in this sites including Microspora sp., Spirogyra sp., Tetraspora sp., Tetraspora cylindrical, Oscilla-

Image 2: Diversity and Distribution of Macroalgae



toria sp., Chaetophora elegans, Stigeoclonium flagelliforum and Phormidium formosum. It was concluded that the distribution of macroalgae were depended on the appropriate substrate, environmental condition as the nutrients and the physical and chemical properties, light intensity and conductivity.

Image 3: "Fai Wang Hai" the highest diversity site of macroalgae from this study

"Fai Wang Hai" the highest diversity point of macroalgae from this study

This project was including the knowledge transferred to the community such as student and local citizens. The Macroalgae handbook were issued for communities including students, teachers and the local people in the research areas along the Chiang Mai province or the related areas. The handbook could be used as a tools for environmental education activity that The local people could conducted a basic monitored and evaluated the water quality by themselves.

Image 4: "Macroalgae hand book" simple tools for monitoring the environmental conditions by youth and student and easier communicated with pictures and symbols.

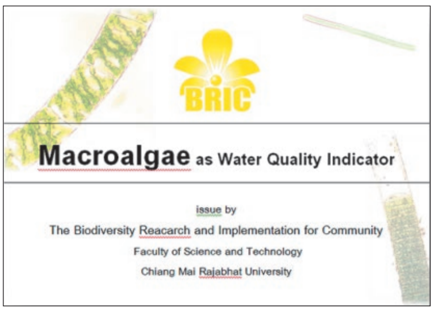


Image 5: Environmental education activity for The local people could conducted a basic monitored and evaluated the water quality by themselves.

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The Diversity of Macroalgae and Benthic Diatom in Upstream of Mae Chaem River, Kalayaniwathana District, Chiang Mai, Thailand

Thakdanai Paotajai, Rungnapa Tagun and Tatporn Kunpradid

Department of Biology, Faculty of Science and Technology,
Chiang Mai Rajabhat University, Chiang Mai Thailand, 50300

Abstract

Macroalgae and benthic diatom plays important rules in aquatic ecosystems as the producers that there are key components of food webs and related to the environmental condition in aquatic ecosystem. There are diverse, abundant and closely linked to environmental factors as well as sensitive to pollution and rapid response to external disturbance. The aim of this study is to survey the diversity and distribution of Macroalgae and benthic diatom in the upstream of Mae Chaem River Kalayaniwathana District, Chiang Mai, Thailand. The Mae Chaem River is an important tributary of The Ping River that essential to the livelihoods of the Northern Thailand community. The sampling was carried out from December 2015 to July 2016. Four sampling stations of upstream of Mae Jam River were selected and sampling once a season. Fourteen species of eight genera in three divisions of macroalgae and 62 species of eight genera of benthic diatom were found The dominant species of macroalgae were *Spirogyra* sp.,*Compsopogon* sp.,*Cladophora* sp., *Rhizocronium* sp., *Audonilla* sp., *Oscillatoria* sp., *Lyngbya* sp. and *Nostochopsis* sp. and dominant species of benthic diatom were *Cymbella tirgidula*, *Navicula radiosafallax*, *Gomphonema parrulum* var. Lagenula, *Gomphonema clevei* Fricke, *Cymbella tirgidula*, *Coconeis placentula* var. Lineata*, Navicula viridula* Ehrenberg. The diversity index ranged from 1.143 to 2.548 and the highest value recorded at MJ1 in December 2015. The evenness index ranged from 0.395 to 0.860 and the highest value recorded at MJ3 in July 2016. The highest species richness was recorded at MJ2 in December 2015 (29 species). The chemical and physical variable in each sampling sites were classified in the good to moderate and moderate according to the water quality are close to neutral as standard surface water of Thailand. Overall, the water quality of Mae Chaem River Kalayaniwathana District based on AARL-PC Score method were revealed that the water quality were oligotrophic-mesotrophic status. The data of water quality and its relationship with the organism distribution was transferred to the community via the initiation of water quality monitoring groups including the researcher, local organization, students and teacher. The group activities were develop the easy methods and planning for the local bio-monitoring. The reflection from the local citizens was satisfied the local people either appropriate simple technique for physical and chemical measurement or the organisms investigation as bio-indicator. Therefore, this method could be developed and used as the Environmental Education tool for other area especially, students and local citizen who lives nearby creek and upstream of Northern Thailand

Introduction

Mae Cham River has originate and flowed through the Kanlayaniwattana district, the latest district, No.787 of Thailand. This river is very important to the local people via direct and indirect use such as household consumption, agriculture, and fishing Currently the Kanlayanitwattna district are being impacted from the over use of chemical substance. The local people has used a numerous chemical pesticide and fertilization in the area and lead to accumulated in a land, water as well as streambed. From the phenomenon, the ecology and river health were strongly damage. The community was concerned about this issue but they need the simple methods and equipment for environmental impact monitored. The environmental impact can be studied on the various methods. Almost of the conventional methods are using physical and chemical parameters. Those are needed a complicate equipment and costly processes. However, the biological methods are the alternate with a lower budget. Microalgae and diatom, the ecological producer could be used as water quality indicators in the river. Therefore, those organism are selected to investigate about the relationship between diversity and taxonomy with the water quality (physical and chemical parameters). Moreover, the development of the guideline documents of bio-indicator (macroalgae and benthic diatom) in Mae Cheam River will be established. The guideline could be used as a tools for environment study or conserve in the Mae Cham River its self or the other river in Thailand.

Objective

To study Macroalgae and Diatoms diversity and its relationship with environment data in Mae Chaem River from different environment.

Methodology

Diatoms sampling

1. Sampling diatom samples from hard substrate (rock, stem, branch that have a brownish colors mucilage).
2. Collected the sample by toothbrush.
3. Preserved with a Lugol's Solution.
4. Separate the sediment from diatom sample (spin 2,500 rpm,15 minute)
5. The diatom samples will be boiled at 100 °C with Conc. Nitric acid. Then with 30% H_2O_2 for 15 min.
6. Prepare a permanent slide by drying on hot plate at 60 °C.
7. Use a permount mounting media to preserve samples.
8. Diatom will be identified to species level.

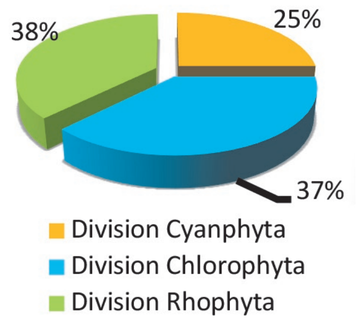
Macroalgae part

The samples (mats, bush, linear, branch or mucilage thallus) was collected randomly from specify streambed. The samples were collected by forceps and kept in cool temperature (5-10 °C). Macrolage will be identified to species level.

Result

Microalgae

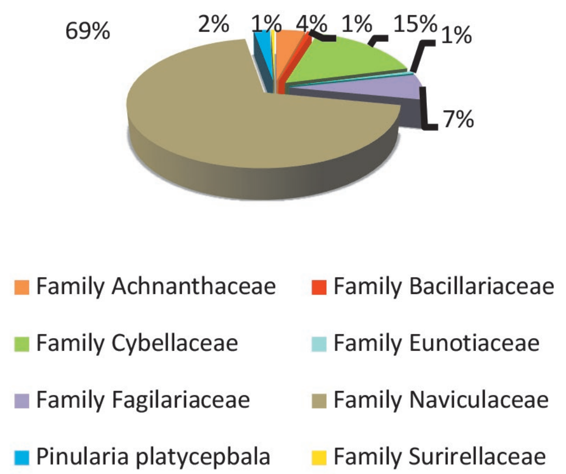
The *Spirogyra* sp., *Compsopogon* sp., *Cladophora* sp., *Rhizocronium* sp., *Audonilla* sp., *Oscillatoria* sp., *Lyngbya* sp. and *Nostochopsis* sp. were recorded as a dominant macroalgae species Divition Rhophyta 38%, Divition Chlorophyta 37%, Divition Cyanphyta 25% The dominant Divition of macroalgae were Divition Rhophyta.



Diatoms

The *Cymbella tirgidula*, *Navicula radiosafallax*, *Gomphonema parrulum* var. Lagenula, *Gomphonema clevei* Fricke, *Cymbella tirgidula*, *Coconeis placentula* var. Lineata*, Navicula viridula* Ehrenberg were recorded as a dominant benthic diatom species

Family Naviculaceae 69%, Family Platycepbala 2%, Family Surirellaceae 1%, Family Achnanthaceae 4%, Family Bacillariaceae 1%, Family Cybellaceae 15%, Family Eunotiaceae 1%, Family Fagilariaceae 7% The dominant Family of benthic diatom were Family Naviculaceae.



Conclusion

The distribution and diversity were different in each sampling site and related with their environmental condition. *Gomphonema clevei* Fricke were indicate the mesotrophic status and *Cocconeis placentula* var. *Lineata* and *Gomphonema parvulum* (Kützing) Grunow were indicate a mesotrophic-oligotrophic status. Some benthic diatom and macroalgae were selected by using a statistical package. They could be used us bio-indicator in Mae Cham River. The water quality evaluation from the biological indicator were related with the physical and chemical parameter. The overall water quality base on the AARL-PC score (physical and chemical) revealed that the water quality of Mae chaem river was good to moderate and moderate status and oligo-mesotrophic and mesotrophic status on the term of nutrients value.

Community Participation

This project was including the knowledge transferred to the local people such as student and local citizens. The data from this study were wed for workshop and start up a monitoring group. 60 student and 10 community leader were attend at a workshop on the topic of "Water Quality Monitoring by biological index".

The participants would learn about the sample collecting, monitoring and evaluating the water quality. After workshop they will be learn how to monitor a water quality at their area by themselves. By this activity, local people and students will understanding about aquatic ecosystem, the importance of water and how to monitored the water quality, the relationship between physical, chemical and biological components in streams/rivers and certainly, the monitoring group to create awareness of keeping water clean.

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Project of the Visit Center on Peatlands – Young View from Siberia

Volkova A.I.
Tomsk State University, Tomsk, Russia

The West Siberian plain is known as the most paludified area of the planet and is famous of its peatlands (peat accumulating mires). The peatlands cover more than 60% surface area in some places like Tomsk region. The largest mire system of the world – Great Vasyugan peatland system – is situated at the territories of three regions at the West Siberian plain, mainly in Tomsk region, and covers, according to recent space-image based evaluations, about 75 000 km^2.

Only very limited public in Siberia knows that mires and peatlands are important component of the landscape with special biodiversity and ecosystem services. Mires are widely known as "aggressor" occupying such plentiful areas of valuable land. Wetland centers mission is to protect mires and peatlands and to raising the awareness of wetland issues through education, research, involvement, visitor activities.

We can recognize the history of paludification and peatlands development at the territory of Siberia from the beginning of Holocene – 10-12 thousand years ago. Since those time peatlands have accumulated carbon of plant remains within peat deposits reaching now up to 11 m depth. Peatlands of the West Siberia vary on surface area, ecological types, topology, degree of the permafrost development at the peat deposits, modern vegetation, genesis and evolution as well as ecosystem services and anthropogenous impact. They are vast, huge, enormous, and endless, especially from the bird's eye view.

The goal of my work is to create a project of the peatland visit center that could visually show the diversity of peatland flora and fauna, ecosystems and communities, landscapes and functioning. The process of the development of the project of the visitor center on peatland includes the following steps: identification of target audience, conception development, creation of the design project and the working project.

Wetland centers started to appear in Russia recently. There are only few (3-4) wetland centers in Asian Russia (Siberia). One of them has been created in Tomsk region on the base of the oldest in Siberia mire science school. Since 2011, Wetland Center of Tomsk State University is a link of the global network of educational centers for wetlands – Wetland Link International, WLI. It aims the purposes of environmental education and exists mainly as Internet resource. However, virtual information is not enough. We need places where people could directly get to know the nature of the peatlands (Fig. 1).

Fig. 1 – Sketch of the main building of the wetland visit center

In addition, people can observe the diversity and behavior of birds from an enclosed space. Visitors will not only know about the biodiversity, but also about the land use on peatlands. The internal exposition represented by information stands showing the species of mammals, birds and insects that live nearby, as well as plant species, most typical for peatlands, and birds migration map (Fig. 2). The voices of birds are chosen as the soundtrack.

Fig. 2 – Sketch of the visit center interior with the installation showing the wetland birds

From the observation platform, equipped with binoculars, everyone can get acquainted with the surrounding fauna and flora, without disturbing local inhabitants (Fig. 3).

Fig. 3_– Observation platform

Visit center on peatland can be used as for scientific purposes, so for the education of ordinary citizens. It would be possible to show peatlands, which are considered a distinctive feature of our region, to foreign tourists, students and scientists. This will be a scientific enlightenment center with a training area for thematic classes, where all information relating to the peatlands of Siberia will be presented, and an open area for visitors with a viewing platform.

We need to show people that the peatland is not a gloomy and dangerous swamp, but a beautiful place and a home for many representatives of the animal and plant world.

Acknowledgement. The Program of Academic Mobility of Tomsk State University supported the participation of the author at the AWS – 2017.

TSSW

Project of the visit center on peatlands - young view from Siberia

Anastasia I. Volkova
Tomsk State University, Russia, Siberia

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Comparison of CEPA Activities and Base Facilities in Peru and Japan

Yuki Ozaki
Ramsar Center Japan

Peru is located approximately in the middle of the continent of South America, bordering Ecuador, Brazil, Chile etc. with the west side facing the Pacific Ocean. Peru is an extremely diverse country. The country has 3 main regions according to the traditional method of dividing the country by altitude: coast, mountains, and jungle. Peru joined the Ramsar convention in 1992 and has 13 registered sites. The total land area is 6,784,041ha, ranking third in Latin America. PARACAS was registered in 1992 as the first Ramsar site in Peru. The sandy beach of Paracas an important resting place for migratory birds. As part of the reserve is open as a beach, 250,000 people a year visit for swimming and sightseeing. In recent years, Tourism development and overfishing are taking place, threatening the ecosystem of the protected area. The need for CEPA activities increased, and JICA dispatched volunteers for two years in PARACAS.

This paper compares CEPA activities in Peru and Japan from the viewpoint of base facilities. Its objective is to summarize common points and differences and contribute to Asian CEPA activities.

#545 PARACAS (1992.3) / #615 YATSU-HIGATA (1993.6)

Area: 335,000ha / 40ha
Number of Staff: 25 people / 15 people
Number of Visitors per year : 250,000 people (for swimming, sightseeing, educational visit) / 40,000 people (for exercise, bird watching, volunteer activities, educational visit)
Access: 15 minutes by car from the major national highway / 15 minutes on foot from the station
Volunteer System: Summer volunteer (3 months, live-in, 20 people, students), Weekend volunteer (4 people, students) / Registration system (100 people, 13 years old ~ senior citizen)
Center Structure: (900m2) Permanent exhibition, Theater room, Bench, Walking Trail / (1750m2) Permanent exhibition, Special exhibition, Food and drinking space, Multipurpose space, Library, Bench, Walking trail
CEPA Activities: Delivery courses (irregular), Puppet theater / Nature observation tours, Center guides, Craft workshop, Picture-story show etc., Volunteer activities (27 groups: Newsletter editing, Data analysis, Carving etc.)

• Common point: There is a visitor center, and it has a permanent exhibition. There is good access to town. Both have succeeded in making use of volunteers as a solution to the shortage of staff.

• Differences: In the case of Paracas, there are few staff members in charge of CEPA activities (Only one person at the visitor center). There is no guide and no binoculars in the viewing space. Information has not been updated. The visitor's staying time is short.

Compared with Japan, the Paracas center was not well utilized as a place for CEPA. Although it is a fine building, its activities are hampered by having fewer personnel in charge of CEPA.

On the other hand, it does succeed in playing the minimum role. It accurately conveys the information of the site to many people. There is also a toilet and a promenade.

In order to solve the above problem, I carried out activities thinking about what few people with no space would be able to do.

>Guide at the boardwalk (explanatory board and binoculars that can be carried)
>School Visit to nearby elementary schools (Developed interpretation teaching materials on the theme of wildlife conservation)
>We installed an information board outside the center and renewed it every month.

CEPA activities can be raised in quality by creative ingenuity. However, to implement CEPA, both hardware and software are required. Also, it will not start unless you focus on involving people above everything else. Especially, it is important to involve the young generation as volunteers.

Comparison of CEPA activities and base facilities in Peru and Japan

This activity was carried out under the JICA volunteer system. Japan International Cooperation Agency (JICA) is a governmental agency that coordinates ODA for the Government of Japan. Japan Overseas Cooperation Volunteers(JOCV) is one of the programs of the JICA aimed at providing technical assistance in developing countries. In principle, JOCVs (aged 20 to 39) spend 2 years involved in cooperation activities, living and working with people in the community.

1- Introductioan

Peru is located approximately in the middle of the continent of South America, bordering Ecuador, Brazil, Chile etc. with the west side facing the Pacific Ocean. Peru is an extremely diverse country. The country has 3 main regions according to the traditional method of dividing the country by altitude: coast, mountains, and jungle. Peru joined the Ramsar convention in 1992 and has 13 registered sites. The total land area is 6,784,041ha, ranking third in Latin America.

PARACAS was registered in 1992 as the first Ramsar site in Peru. The sandy beach of Paracas an important resting place for migratory birds. As part of the reserve is open as a beach, 250,000 people a year visit for swimming and sightseeing. In recent years, Tourism development and overfishing are taking place, threatening the ecosystem of the protected area. The need for CEPA activities increased, and JICA dispatched volunteers for two years in PARACAS.

This paper compares CEPA activities in Peru and Japan from the viewpoint of base facilities. Its objective is to summarize common points and differences and contribute to Asian CEPA activities

2- Methods / Result

Compare Peru and Japan with the following items.

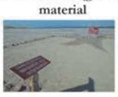
Name	PARACAS (Peru)	YATSU-HIGATA (Japan)
Site number/Designation date	#545 / 30-March-1992	#615 / 10-June-1993
Area / Number of Staff	335,000ha / 25 people	40ha / 15 people
Number of Visitors per year	250,000 people (for swimming, sightseeing, educational visit)	40,000 people (for exercise, bird watching, volunteer activities, educational visit)
Access	15 minutes by car from the major national highway	15 minutes on foot from the station
Center Structure:	(900m2) Permanent exhibition, Theater room, Bench, Walking Trail 	(1750m2) Permanent exhibition, Special exhibition, Food and drinking space, Multipurpose space, Library, Bench, Walking trail 
CEPA Activities	Delivery courses (irregular), Puppet theater	Nature observation tours, Center guides, Craft workshop, Picture-story show etc., Volunteer activities (27 groups: Newsletter editing, Data analysis, Carving etc.)
Volunteer System	Summer volunteer (3 months, live-in, 20 people, students), Weekend volunteer (4 people, students)	Registration system (100 people, 13 years old ~ senior citizen)

○Common point: There is a visitor center, and it has a permanent exhibition. ,Both have succeeded in making use of volunteers as a solution to the shortage of staff.
●Differences: In the case of Paracas, there are few staff members in charge of CEPA activities (Only one person at the visitor center). There is no guide and no binoculars in the viewing space. Information has not been updated.

3- Discussion

Compared with Japan, the Paracas center was not well utilized as a place for CEPA. There are few staff members in charge of CEPA activities such as guide and interpreter. In addition, the center is a permanent exhibit only and information is not updated. Although it is a fine building, its activities are hampered by having fewer personnel in charge of CEPA. It does succeed in playing the minimum role. It accurately conveys the information of the site to many people. There is also a toilet and a promenade. If this center follow YATSU-HIGATA example, the Paracas center will be better.

In general, each center has some restrictions. The Paracas center has the following restrictions
For example, limited funds and human resources, lack of space for special exhibition, distance from town, and the bad weather (sand storms). There were many problem in the performance of CEPA activities. In order to solve the above problem, I carried out activities thinking about what few people with no space would be able to do.

Problem	Solution	Photos
・Insufficient staff(guide) and material 	>Guide at the boardwalk (explanatory board and binoculars that can be carried) When the turistes came to boardwalk, I became a guide and explained to them the importance of protected areas with explanatory board (hand made.)	
・Lack of free space **・No updating of center information** 	>We installed an information board outside the center and renewed it every month. I updated the latest information such as the Investigation result of flora and fauna, activity of park renger, and importance of wetlands	
・Non-interactive classes **・Lack of funds** 	>Developed interpretation teaching materials on the theme of wildlife conservation (School Visit to nearby elementary schools) All the materials were original and made only with things in the office, such as backing paper and garbage bags. I emphasized hands-on learning.	

CEPA activities can be raised in quality by creative ingenuity, even if there is not enough material and people. However, to implement CEPA, both hardware and software are required.

Also, it will not start unless you focus on involving people above everything else. Especially, it is important to involve the young generation as volunteers.

4- Conclusions

The result shows that it is important that there is a visitor center on the Ramsar site. People and materials are necessary to conduct CEPA activities in the visitor center. Even if there is not enough material and people, CEPA activities can be raised in quality by creative ingenuity.

Contact : YUKI OZAKI (Ramsar Center Japan)
yukiozaki011@gmail.com

Growth and Burrows of the Japanese mud shrimp (*Upogebia major*) in the Arao Tidal Flat

Haruki Kume, Towaki Ide, Chihiro Fukushima, Syoya Oobuchi, Sinnosuke Harada, Taiyou Kiyota, Yukito Yoshimoto, Ryuki Wada, Fumiko Koyama, Hiroshi Matsuura
Kumamoto prefectural Taishi senior high school, Arao senior high school

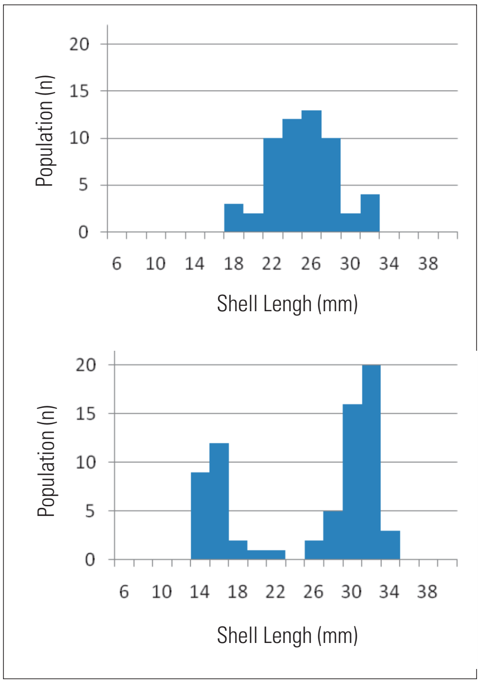
1, Growth of Japanese mud shrimp "Majak" (*Upogebia major*)

We call the Japanese mud shrimp (Upogebia major) "Majak".

We were interested in the ecology of famous Majak in the Arao area. To study their growth and development we dug up Majak over a 5month period of time and recorded their size. Within 5months, growth of about 5mm and transfer of a new generation could be clearly confirmed.

Measurement of shell length

Length of Shell

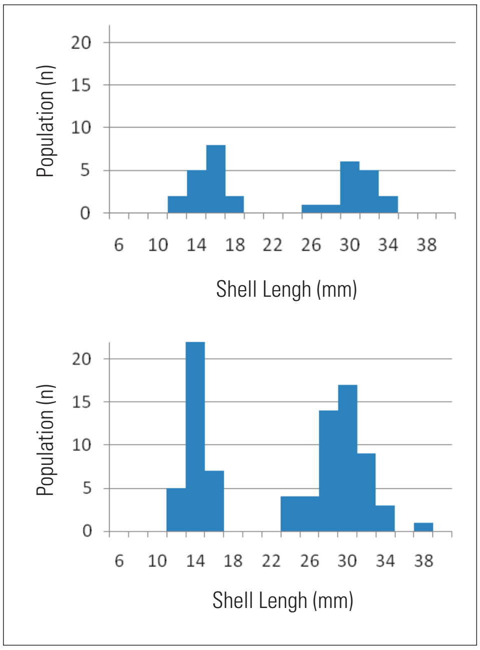


We also checked for the presence of plankton Majak affixed to the Arao tidal flat sediment.

During the September to October period, we surveyed at spring tide, which comes every two weeks, and confirmed that the Majak were growing about 5 mm on average and that a new generation of Majak was present.

In a business report by Kumamoto prefectural seaweed laboratory, reported in 1986, the size of Majak was recorded as 23.7mm for a 2year old male, 23.3mm for a 2year old female, 32.6mm for a 3year old male, 30.0mm for a 3year old female, 34.2 mm for a 4year old male, 32.1mm for a 4year old female.

Length of Shell



In Arao tidal flat, we could confirm individuals over 30 mm in the spring season. So we supposed these individuals were 3year old.

(We think that spring individuals are 2year old.)

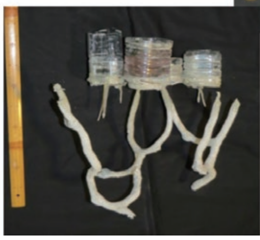
2, Burrows of Japanese mud shrimp "Majak" (*Upogebia major*)

We compared the data of the burrows which was surveyed by Imamura and Miyazaki from the Arao tidal flat that were 80 cm in depth the data of the burrows from Tokyo Bay that 207.9 cm in depth (Kinosita, k., 2002). And it was obvious that the burrows from the Arao tidal flat were shallower.

In order to confirm many burrows of the Arao tidal flat, we poured resin into a quadrat of 25 cm × 25 cm, and also poured resin into another hole which is a pair outside of the quadrat to avoid resin leaks.

A1 Burrow complete

B2 Burrow complete



F2.3.4.5.Burrows
Linking complete

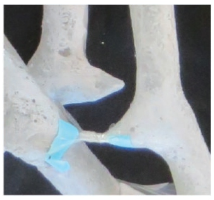
In addition, we thought that Majak seem to block the burrow even though the burrow continues. So we dug out the resin which was set in the burrow and examined it after catching the Majak. We caught Majak by the traditional method in the Arao region. We put a calligraphy brush into the burrow. Then, when the Majak came up to push out the brush, we pulled the Majak out of the burrow.

Resin running Date 樹脂を流した日	Burrows Number 巣穴の番号		Dipth 巣穴の深さ(cm)	Diameter 太さ(mm) 平均	
3月17日	A	1	85	24.1	c
		2	23	21.3	
		3	32	20.6	
		4	57	24.1	
		5	33	31.9	
		6	51	22.9	
3月17日	B	1	76	34.6	c
		2	108	33.5	c
		3	71	31.5	
		4	76	32.0	
		5	72	29.4	
		6	36	22.2	
		7	26	21.6	
		8	63	29.4	
8月31日	C	1	90	32.9	
		2	70	26.6	c
		3	90	32.3	c
		4	70	29.3	
		5	65	29.4	
9月15日	D	1	27	29.1	
		2	59	27.7	c
9月29日	E	1	110	30.5	
9月29日	F	1	74	28.1	c
		2	28	17.2	c
		3	28	13.4	c
		4	28	15.1	c
		5	28	16.0	c

With 7 each burrows and 4 tethered indicated by yellow C gotten.

Others, although incomplete, became a three-way road Resin type of nest with contact point between U-part and I-part.

On August 31st, 2015, we poured the resin into the burrows. When we dug up the resin molds, we gathered many burrows with a "Y" shape. We also found 4 small connecting tunnels between the burrows. They were too small to be made by Majak. When we connected the burrows, they made a labyrinth shape.



The 4 small connecting tunnels had a diameter of 5.6 to 12.6 mm.

3, Perspective

We will continue these investigations in the future. And, despite the fact that many Majak are gathered every year due to Majak fishing competitions and fishery.

We want to elucidate the mechanism of growth for Majak of the Arao tidal flat.

In addition, just want to think about how many Majak we should catch, to make it a steady catch every year.

And we would like to discuss the fact that the Majak burrows extend oxygen conditions to deep places in the tidal flat.

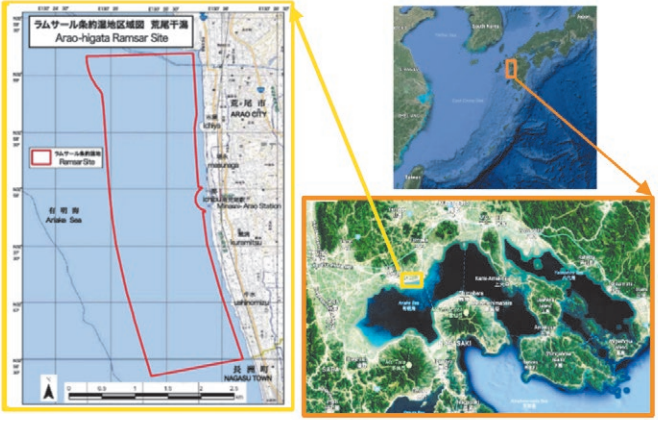
We are exhibiting the resin mold of the Majak burrows.

Benthos of the Arao Tidal Flat, Its List and Specimen

Taiyou Kiyota, Yukito Yoshimoto, Towaki Ide, Haruki Kume, Ryouki Wada,
Natsuko Kobayashi, Hiroshi Matsuura

Kumamoto prefectural Taishi senior high school

1, List of Benthos of the Arao tidal flat that we could confirm

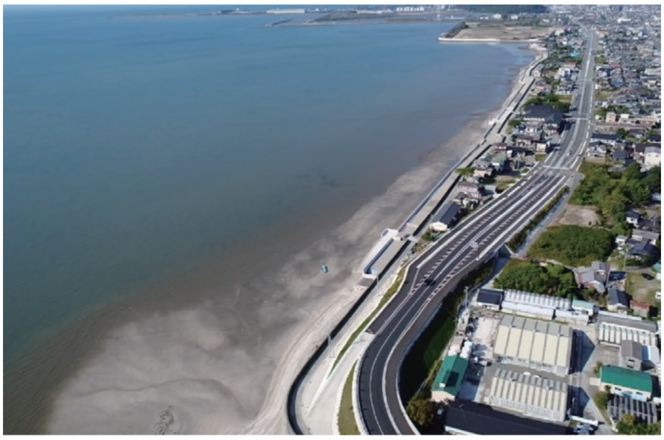


The Arao tidal flat became a Ramsar wetland site in 2012, and this year will be the fifth anniversary. In the meantime, we have continued the investigation of the Arao tidal flat.

Based on the survey method of Wetland International Japan (WIJ), we conducted 15 minute surveys of the Benthos on the surface and by digging 15 holes. Furthermore, qualitative investigations were also conducted.

We used pocket books published by WIJ, etc. to identify the organisms collected. Creatures that could be confirmed were released on the spot and several individuals that could not be confirmed outdoors were brought to school.

Also we brought typical shape samples back to school, soaked them in alcohol and made them into a preserved specimen. The results are summarized in the table.

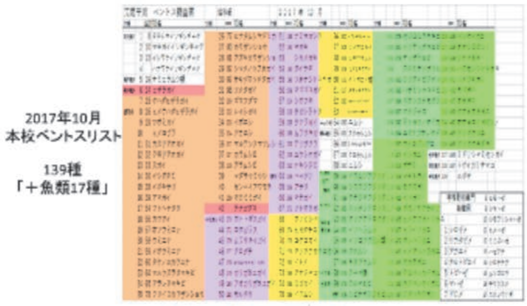


From November 2012 until October 2013, 58 species were confirmed.

By October 2014, we were able to record 78 species, including species we confirmed visually, without collecting them.

We also learned that three species were not officially listed. By October 2015, we confirmed 90 species of benthos.

We were able to confirm a total of 125 species of benthos by October 2016. By October this year, we were able to confirm 139 species and 17 species of fish, totaling 156 species.

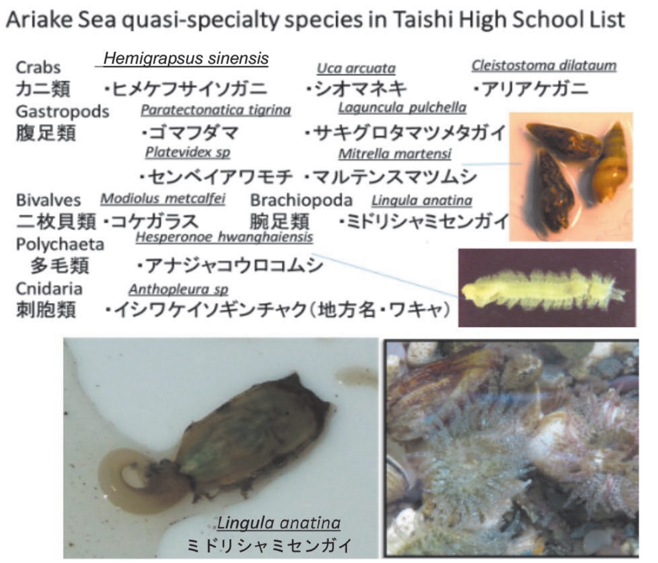


Changes in our benthos list

Taishi high school science club

"Arao City History"

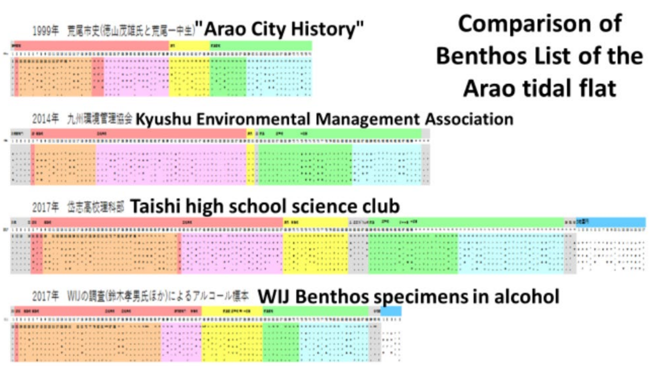
	Year 年	Species 種	Gastropod 腹足類	Bivalve 二枚貝類	Arthropod 節足動物類
"Arao City History" 荒尾市史記載	1998	80	18種 22.5%	16種 20.0%	25種 31.3%
Survey business report	2013	103	15種 14.6%	37種 35.9%	40種 38.8%
Taishi high school	2017	139	33種 23.7%	25種 18.0%	48種 34.5%
Alcohol specimens	2017	91	35種 38.5%	10種 11.0%	26種 28.6%



2, Characteristics of Benthos List of The Arao tidal flat

In addition to our list of benthos, 80 species of Benthos were confirmed in the Arao tidal flat in the "Arao City History" issued in March 2000. Shigeo Tokuyama, a member of Arao City Cultural Property Protection Committee investigated this with students in Arao Daiichi Junior High School from 1998 to 1999.

According to a survey entrusted to the Kyushu Environmental Management Association by the Arao tidal flat conservation and wisdom utilization council in 2014, they confirmed 103 types of Benthos on the Arao tideland.



There are many arthropods in every list, especially Decapoda. The next most frequent group was Gastropoda, followed by Bivalvia.

A lot of sand and muddy benthos, which is the characteristic of the Arao tidal flat, were recorded. The benthos of the Arao tidal flats are also characterized into many types. The reason is that the Arao tidal flats are a wide and ecologically diverse. For example, there are Hakusennshiomaneki (*Uca lacteal*) frequently found in the tidelands of sand near the exit of the bay, and Siomaneki (*Uca arcuata*) which are frequently found in the mud flats of the bay.

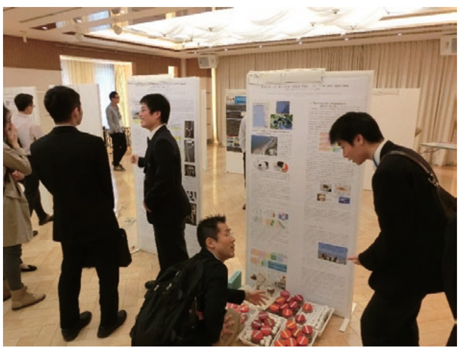
Compared with the Kyushu Environmental Management Association's list, there are creatures that are not recorded on our list. However, we found various Benthos that were not on the Kyushu Environmental Management Association's list as well.

3, Perspective

We will continue to investigate this in the future and I would like to further enrich the list. In addition, we would like to create a list of about 50 kinds of benthos for various purposes, such as an organism list that is easy to catch for each season, that is easy to catch even for elementary school students, and that is useful for observation sessions.

We exhibited alcohol specimens kept at school at the venue. Participants who observed the actual benthos specimens gave us a lot of advice and encouragement words.

We would like to continue our activities so that this "Ooshamisengai" returns to the environment of the Ariake Sea.



The Tideland which was Left in the City "HIRAKATA-BAY"

Takuma Ezoe, Noah Honda, Kokoro Nakayama
Biology Club of Kanto Gakuin Mutsuura Junior/Senior High School

We are members of Biology Club at Kantou Gakuin Mutsuura Junior/Senior High School. We have been conducting nature observations in Hirakata Bay since our inception in 1953. Like other areas in the Tokyo Bay, the Hirakata Bay has become very smallen because of the landfill but Hirakata bay is a valuable tidal flat which plays an important role as a stopping point for birds to spend the winter.

Introduction of Hirakata Bay

Hirakata Bay(35degrees 20north east longitude 139degrees 38 minutes) is an elongated bay with a length of about 0.3km and a width of 1km located in Kanazawa ward, Yokohama city, Kanagawa prefecture (partly in Yokohama city) It is a small tideland. There is a 1km square islet called Nojima and it is close to tip of the bay . It is connected with Tokyo bay by Nojima water way on the south side and Nojima canal on the north side. The narrowest part of the bay is only 6km and it can be said that sea water exchange is unlikely to occur in Hirakata bay because of the closed nature. In this bay where the sea exchange is unlikely to occur, the 4 rivers , Miyagawa, Jijyuugawa river, Takatori river, Mutuura river are flowing in regularly to prevent the increase of sediment.In the Edo era, the Hirakata bay which flourished as the port of Kamakura, which was the center of politics at that time, was many times wilder than the present. It was known as a scenic spot and it has some coves and 8 scenes therefore the spot was called "Kanazawa Hakkei". The citizens of Edo (present Tokyo) visited it for sightseeing. Many painters including Utagawa Hiroshige painted it as Ukiyo-e landscape paintings. The northern side of the Hirakata bay became cropland by the first reclamation in the 19th century and the area near the exit of the bay was landfilled in the late Meiji era. The Yokosuka Navy Air Corps was placed there. Furthermore, sediment accumulated in the Nojima waterway between Nojima in the tip of the bay and it closed up, and it was closed in 1966. Instead, the Nojima canal was dug in the north side of Nojima and it became the only passage connecting the Hirakata bay and Tokyo bay. At that time. The southern side of the bay that remained was landfilled and became a residential area, and the Hirakata bay became its current long narrow water area. Since the 1960s, the population of Kanazawe ward dramatically has then increased, and the domestic wastewater and industrial wastewater flowed into the four rivers, into the Hirakata. As a result, it became a dirty sea. Because of the strength of the closing, the situation became more severe as the year goes on. The creatures of the sea floor had almost gone extinct and the Hirakata bay became famous for the ghosts of deformities. According to the newspaper at that time, the entire bay had become a pond of domestic and industrial wastewater .

A large number of sludge was accumulated, a stench drifted, many kinds of toxic substances including cyan were detected then and in the 1980s ,Hirakata bay became the "worst marine polluted water area.The Nojima waterway opened again in 1994 and now it has been improved so much that many creatures can live. It became easier to change the sea water, sludge in the bay was removed to some extent, the sewage treatment facility was established, and inflow of the domestic wastewater ceased. Environmental conservation activities of civil organizations and fishery cooperatives have also kept it from being polluted again.

Currently state of Hirakata bay

1. Wild birds

There are a lot of ducks in winter, exceeding 20,000. There are Greater Scaup, Eurasian Wigeons, Common Pochards Tufted ducks, Northern Pintail and so on. And we can see the group of Black Coots more frequently. Little grebe, Black-necked Grebe, Great Grested Grebe have recently come to be seen frequently. Furthermore, there are Black-headed gulls, Herring Gulls, Slaty-backed gulls in winter and , also Black-tailed gulls from spring to fall. There are also traveling birds. For example, Common sandpiper, Dunlin, Ruddy Turnstone Terek Sandpiper, Grey-tailed Tattler and Lesser sand plover are seen frequently. Throughout the year, there are many Great Cormorant, Herons (Grey heron, Little Egret, Great Egret) There are also many White Wagtail. They spend the night at bowling alleys.

Field list in Hirakata Bay (1953-2017)

類/genus	学名/Scientific name	英名/English name	和名/Japanes ename	和名/Japanese name	頻度/frequence
哺乳類/Mammal	*Neophocaena phocaenodes*	F NLESS PORPO SE	Sunameri	スナメリ	C
鳥類/Birds	*Podiceps ruficollis*	L TTLE GREBE	Kaituburi	カイツブリ	B
	Podiceps nigricollis	BLACK-NECKED GREBE	Hajirokaituburi	ハジロカイツブリ	B
	Podiceps auritus	HORNED GREBE	Mimikaituburi	ミミカイツブリ	C
	Podiceps cristatus	GREAT CRESTED GREBE	Kanmurikaituburi	カンムリカイツブリ	B
	Phalacrocorax carbo	GREAT CORMORANT	Kawau	カワウ	A
	P halacrocorax filamentosus	PHALACROCORAX CAP LLATUS	Umiu	ウミウ	B
	Nycticorax nycticorax	BLACK-CROWNED N GHT HERON	Goisagi	ゴイサギ	C
	Butorides striatus	STR ATED HERON	Sasagoi	ササゴイ	C
	E gretta alba	GREAT EGRET	Daisagi	ダイサギ	A
	Egretta garzetta	L TTLE EGRET	Kosagi	コサギ	A
	E gretta sacra	PAC F C REEF HERON	Kurosagi	クロサギ	C
	Ardea cinerea	GRAY HERON	Aosagi	アオサギ	A
	Cygnus columbianus	MUTE SWAN	Kobuhakutyou	コブハクチョウ	C
	Anas platyrhynchos	MALLARD	Magamo	マガモ	B
	Anas poecilorhyncha	SPOT-B LLED DUCK	Karugamo	カルガモ	A
	Anas crecca	EURAS AN TEAL	Kogamo	コガモ	C
	Anas falcata	FALCATED DUCK	Yosigamo	ヨシガモ	C
	Anas strepera	GADWALL	Okayosigamo	オカヨシガモ	C
	Anas penerope	EURAS AN W GEON	Hidorigamo	ヒドリガモ	A
	Anas americana	AMER CAN W GEON	Amerikahidori	アメリカヒドリ	C
	Anas acuta	NORTHERN P NTAL	Onagagamo	オナガガモ	A
	Anas clypeata	NORTHERN SHOVELER	Hasibirogamo	ハシビロガモ	C
	Aythya valisineria	COMMON POCHARD	Hosihajiro	ホシハジロ	A
	Aythya fuligula	TUFTED DUCK	Kinkurohajiro	キンクロハジロ	A
	Aythya marila	GREATER SCAUP	Suzugamo	スズガモ	A
	Bucephala clangula	COMMON GOLDENEYE	Hoojirogamo	ホオジロガモ	C
	Mergus albellus	SMEW	Mikoaisa	ミコアイサ	C
	Mergus serrator	RED-BREASTED MERGANSER	Umiaisa	ウミアイサ	C
	Milvus migrans	BLACK K TE	Tobi	トビ	A
	Butastur indicus	GREY-FACED BUZZARD	Sasiba	サシバ	B
	Falco peregrinus	PEREGR NE FALCON	Hayabusa	ハヤブサ	B
	Falco tinnunculus	EURAS AN KESTREL	Tyougennbou	チョウゲンボウ	B
	Bambusicola thoracica	CH NESE BAMBOO PHEASANT	Kojukei	コジュケイ	C
	Gallinula chloropus	COMMON MOORHEN	Ban	バン	B
	Fulica atra	EURAS AN COOT	Ooban	オオバン	A
	Charadrius dubius	L TTLE R NGED PLOVER	Kotidori	コチドリ	B
	Charadrius placidus	LONG-B LLED PLOVER	Ikarutidori	イカルチドリ	C
	Charadrius alexandrius	KENT SH PLOVER	Sirotidori	シロチドリ	C
	Charadrius mongolus	LESSER SAND PLOVER	Medaitidori	メダイチドリ	B
	Pluvialis dominica	PAC F C GOLDEN PLOVER	Munaguro	ムナグロ	C
	Pluvialis squatarola	GREY PLOVER	Daizen	ダイゼン	C
	Arenaria interpres	RUDDY TURNSTONE	Kyoujyosigi	キョウジョシギ	B
	Calidris ruficollis	RED-NECKED ST NT	Tounen	トウネン	C
	Calidris alpaina	DUNL N	Hamasigi	ハマシギ	B
	Tringa brevipes	GRAY-TA LED TATTLER	Kiasisiga	キアシシギ	B
	Tringo hypolecos	COMMON SANDP PER	Isosigi	イソシギ	A
	Xenus cinereus	TEREK SANDP PER	Sorihasisigi	ソリハシシギ	B
	Limosa lapponica	BAR-TA LED GODW T	Oosorhasisigi	オオソリハシシギ	C
	Numenius phaeopus	WH MBREL	Tyuusyakusigi	チュウシャクシギ	C
	Larus saundersi	BLACK-HEADED GULL	Yurikamome	ユリカモメ	A
	Larus argentatus	HERR NG GULL	Segurokamome	セグロカモメ	A
	Larus schistisagus	SLATY-BACKED GULL	Oosegurokamome	オオセグロカモメ	A
	Larus canus	COMMON GULL	Kamome	カモメ	C
	Larus crassirostris	BLACK-TA LED GULL	Umineko	ウミネコ	A
	Sterna hirundo	COMMON TERN	Ajisasi	アジサシ	C
	Sterna albifrons	L TTLE TERN	Koajisasi	コアジサシ	B
	Streptopelia orientalis	OR ENTAL TURTLE DOVE	Kijibato	キジバト	A
	Cuculus canorus	EURAS AN CUCKOO	Kakkou	カッコウ	A

Frequency A=often B=sometimes C=rarely

類/genus	学名/Scientific name	英名/English name	和名/Japanes ename	和名/Japanese name	頻度/frequence
鳥類/Birds	*Cuculus poliocephalus*	LESSER CUCKOO	Hototogisu	ホトトギス	B
	Ninox scutulata	BROWN HAWK OWL	Aobazuku	アオバズク	B
	Apus pacificus	PAC F C SW FT	Amatubame	アマツバメ	B
	Alcedo atthis	COMMON K NGF SHER	Kawasemi	カワセミ	B
	Dendrocopos kizuki	JAPANESE PYGMY WOODPECKER	Kogera	コゲラ	B
	Alauda arvensis	EURAS AN SKYLARK	Hibari	ヒバリ	C
	Hirundo rustica	BARN SWALLOW	Tubame	ツバメ	A
	Delichon urbica	AS AN HOUSE MART N	Iwatubame	イワツバメ	A
	Motacilla cinerea	GREY WAGTA L	Sekirei	キセキレイ	B
	Motacilla alba	WH TE WAGTA L	Hakusekirei	ハクセキレイ	A
	Motacilla grandis	JAPANESE WAGTA L	Segurosekirei	セグロセキレイ	B
	Anthus hodgsoni	OL VE-BACKED P P T	Binzui	ビンズイ	C
	Anthus spinoletta	BUFF-BELL ED P P T	Tahibari	タヒバリ	C
	Hypsipetes amaurotis	BROWN-EARED BULBUL	Hiyodori	ヒヨドリ	A
	Lanius bucephalus	BULL-HEADED SHR KE	Mozu	モズ	A
	Phoenicurus auroreus	DAUR AN REDSTART	Joubitaki	ジョウビタキ	B
	Saxicola torquata	S BER AN STONECHAT	Nobitaki	ノビタキ	C
	Monticola solitaris	BLUE ROCK THRUSH	Isohiyodoro	イソヒヨドリ	A
	Turbus chrysolaus	BROWN-HEADED THRUSH	Akahara	アカハラ	B
	Turbus pallibus	PALE THRUSH	Siroharo	シロハラ	C
	Turbus naumanni	DUSKY THRUSH	Tugumi	ツグミ	A
	Cettia diphone	JAPANESE BUSH WARBLER	Uguisu	ウグイス	A
	Acrocephalus arundinaceus	GREAT REED WARBLER	Ooyoskiri	オオヨシキリ	B
	Phylloscopus occapitelis	EASTERN CROWNED WARBLER	Senndaimuskui	センダイムシクイ	C
	Cisticola juncidis	Z TT NG C ST COLA	Sekka	セッカ	C
	Cyanoptila cyanomelana	BLUE-AND-WH TE FLYCATCHER	Ooruri	オオルリ	B
	Muscicapa griseistcta	GRAY-STREAKED FLYCATCHER	Ezobitaki	エゾビタキ	C
	Aegithalos caudatus	LONG-TA LED T T	Enaga	エナガ	B
	Parus varius	VAR ED T T	Yamagara	ヤマガラ	B
	Parus major	GREAT T T	Sijuukara	シジュウカラ	A
	Zosterops japonica	JAPANESE WH TE-EYE	Mejiro	メジロ	A
	Emberiza cioides	MEADOW BUNT NG	Hoojirogamo	ホオジロ	B
	Emberiza rustica	RUST C BUNT NG	Kasiradaka	カシラダカ	C
	Emberiza spodocephala	BLACK-FACED BUNT NG	Aoji	アオジ	A
	Carduelis sinica	OR ENTAL GREENF NCH	Kawarhiwa	カワラヒワ	A
	Coccothraustes coccothraustes	HAWF NCH	Sime	シメ	B
	Passer montanus	EURAS AN TREE SPARROW	Suzume	スズメ	A
	Sturnus cineraceus	WH TE-CHEEKED STARL NG	Mukudori	ムクドリ	A
	Cyanopica cyana	AZURE-W NGED MAGP E	Onaga	オナガ	A
	Corvus corone	CARR ON CROW	Hasbosogarasu	ハシボソガラス	A
	Corvus macrorhynchos	LARGE-B LLED CROW	Hasbutogarasu	ハシブトガラス	A

Biological data of 64 years in Hirakata Bay

類/ genus	学名／Scientific name	和名/Japanes ename	和名/Japanese name	頻度/ frequence
魚類/ Fish	*Taiakidae scyllium*	Dotizame	ドチザメ	B
	Mustelus manazo	Hosizame	ホシザメ	C
	Dasyatis akajei	Akaei	アカエイ	A
	Conger myriastar	Maanago	マアナゴ	B
	Plotosus japonica	Gonnzui	ゴンズイ	B
	Mugil cephalus	Bora	ボラ	A
	Syngnathus schlgeli	Youjuuo	ヨウジウオ	B
	Sebaatea inermis	Mebaru	メバル	A
	Sebastiscus marmoratus	Kasago	カサゴ	B
	Hypodytes rubiripinnis	Haokoze	ハオコゼ	B
	Platycephalus sp.	Magoti	マゴチ	C
	Suggrundus meerdervoortii	Megoti	メゴチ	B
	Hexagrammos otakii	Ainame	アイナメ	B
	Hexagrammos agrammus	Kujime	クジメ	B
	Pseudoblennius percoides	Anahaze	アナハゼ	A
	Lateolabrax japonicus	Suzuki	スズキ	A
	Apogon semilineatus	Nennbutudai	ネンブツダイ	B
	Lobotes surinamensis	Matudai	マツダイ	C
	Sillago japonica	Sirogisu	シロギス	B
	Parapristipoma trilineatum	Isaki	イサキ	C
	Acanthopagrus schlegeli	Kurodai	クロダイ	A
	Girella leonina	Kuromejina	クロメジナ	C
	Girella puntata	Mejina	メジナ	B
	Microcanthus strigatus	Kagogakidai	カゴカキダイ	B
	Rhyncopelates oxyrhynchus	Simaisakai	シマイサキ	C
	Terapon jarbua	Kotohiki	コトヒキ	C
	Oplegnathus fasciatus	Isidai	イシダイ	B
	Ditrema temmincki	Umitanago	ウミタナゴ	A
	Ditrema viride	Aotanago	アオタナゴ	B
	Halichoeres poecilopterus	Kyuusen	キュウセン	A
	Halichoeres tenuispinnis	Honbera	ホンベラ	C
	Dictyosoma burgeri	Dainanginnpo	ダイナンギンポ	A
	Dictyosoma rubrimaculatum	Benitukeginnpo	ベニツケギンポ	B
	Plablennius yatabei	Isoginnpo	イソギンポ	A
	Scartella cristata	Nabeka	ナベカ	B
	Aspasma minimum	Ubauo	ウバウオ	B
	Repomeuenus huguenini	Yarinumeri	ヤリヌメリ	B
	Repomucenus beniteguri	Tobinumeri	トビヌメリ	B
	Tridentiger trigonocephalus	Akaobisamahaze	アカオビシマハゼ	A
	Tridentiger obscurus	Titibu	チチブ	A
	Bathygobius fucus	Kumohaze	クモハゼ	B
	Chaenogobius annularis	Agohaze	アゴハゼ	A
	Chasmichthys gulous	Dorome	ドロメ	A
	Acanthogobius fravimanus	Mahaze	マハゼ	A
	Glossogobius olivaceus	Urohaze	ウロハゼ	B
	Acentrogobius virgatulus	Sujihaze	スジハゼ	B
	Sagamia genetonema	Sabihaze	サビハゼ	B
	Platox boersii	Mikazukitubameuo	ミカヅキツバメウオ	C
	Paralichthys olivaceus	Hirame	ヒラメ	C
	Pseudopleuronectes herzensteini	Magarei	マガレイ	B
	Pseudorhombus arsius	Tennjikugarei	テンジクガレイ	B
	Pleuronectes yokohamae	Makogarei	マコガレイ	C
	Paraplagusia japanica	Kurousinosita	クロウシノシタ	C
	Stephanolepis cirrhifer	Kawahagi	カワハギ	B
	Ruadrius ercodes	Amimehagi	アミメハギ	A
	Canthigaster rivulata	Kitamakura	キタマクラ	B
	Takihugu niphobles	Kusahugu	クサフグ	A
	Takihugu poecilonotus	Komonn	コモンフグ	B
	Takihugu pardalis	Higannhugu	ヒガンフグ	A

Frequency A=often B=sometimes C=rarely

類/ genus	学名／Scientific name	和名/Japanes ename	和名/Japanese name	頻度/ frequence
甲殻類/ Crustacean	*Caprella penantis*	Maruerawarekara	マルエラワレカラ	B
	Alpheus brevicristaus	Teppouebi	テッポウエビ	A
	Heptacarpus geniculatus	Kosimagarimoebi	コシマガリモエビ	B
	Palaemon pacificus	Isosujebi	イソスジエビ	A
	Pagurus filholi	Honnyadokari	ホンヤドカリ	A
	Pagurus lanuginosus	Keashonnyadokari	ケアシホンヤドカリ	B
	Clibanarius vivescens	Isoyokobasami	イソヨコバサミ	A
	Portunus trituberculatus	Gazami	ガザミ	B
	Chavybdis japonica	Isigani	イシガニ	A
	Chavybdis feriata	Simaisigani	シマイシガニ	B
	Pachygrapsus sanguiheus	Iwagani	イワガニ	A
	Hemigrapsus sanguineus	Isogani	イソガニ	A
	Gaetice deprressus	Hiraisogani	ヒライソガニ	B
	Parasesarma pictum	Kakubennkeigani	カクベンケイガニ	B
	Eviocheir japonica	Mokuzugani	モクズガニ	C
	Ligia exotica	Funamusi	フナムシ	A
	Leusosia anatum	Tunonagakobusigani	ツノナガコブシガニ	B
	Tetraclita japonica	Kurohujitubo	クロフジツボ	A
軟体動物/ Moulluscs	*Acanthopleura japonica*	Hizaragai	ヒザラガイ	B
	Mytilus galloprovincialis	Murasakigai	ムラサキイガイ	B
	Ruditapes philippinarum	Asari	アサリ	A
	Chrolostoma lischkei	Kubogai	クボガイ	B
	Batillaria multiformis	Uminina	ウミニナ	A
	Planaxis sulcatus	Gomahunina	ゴマフニナ	B
	Littorina brevicula	Tamakibi	タマキビ	B
	Thais clavigera	Ibonisi	イボニシ	B
	Reticunassa festiva	Aramusiro	アラムシロ	A
	Anapsidea kurodai	Amehurasi	アメフラシ	B
	Sepia esculenta	Kouika	コウイカ	C
	Sepioteusthis lessoniana	Aorika	アオリイカ	B
	Octpus vulgaris	Madako	マダコ	B
	Amphioctopus fangsio	Iidako	イイダコ	A
	Perinereis nuntia var.brevicirris	Isogokai	イソゴカイ	B
	Hediste diadrama	Yamatokawagokai	ヤマトカワゴカイ	B
刺胞生物/ Cinidari	*Aurelia aurita*	Mizukurage	ミズクラゲ	A
	Chrysaora melanaster	Akakurage	アカクラゲ	B
	Porpita porpita	Ginnkakurage	ギンカクラゲ	C
	Anthopleura uchidai	Yoroiisogonntyaku	ヨロイイソギンチャク	B
	Actinia equina	Umebosiisoginntyaku	ウメボシイソギンチャク	A
棘皮動物/ Echinoderms	*Ludia avicularia*	Sunahitode	スナヒトデ	B
	Astropecten polyacanthus	Momijigai	モミジガイ	B
	Patiria pectinifera	Itomakihitode	イトマキヒトデ	B
	Asterias amurensis	Mahitode	マヒトデ	B
	Ophioplocus japonicus	Nihonnkumohitode	ニホンクモヒトデ	C
	Diadema setosum	Ganngaze	ガンガゼ	B
	Apostichopus japonicus	Manamako	マナマコ	B
	Holothuria atra	Kuronamako	クロナマコ	B
脊索動物/ Chordate	*Ciona savignyi*	Yuureboya	ユウレイボヤ	C

2. Aquatic life

Japanese sea bass are caught at sandy areas and Rockfishes are caught at the quay area in spring and in summer we can catch the Surfperch and the Marbled rockfishes. In fall we can catch the gobies ,the Ocellated octopus, Bigfin Reef Squid and so on. Autumn is the season when you

can observe the most types of creatures. Winter is the season when organisms in the bay are the fewest, but you can catch a small number of Righteye flounder and Fat greenling. In Hirakata bay, the species that we can catch change by year changes. Surfperch could be caught a lot two years ago and last year we could catch a lot of Ocellated octopus. We do not yet know the cause of such change. Benthic organisms are conspicuous such as clams, hermit crab shells, Common prawn and so on in Hirakata bay. There are also many kinds of sea hare and Starfishes, sting ray and ciona sp and so on. Therefore, we think Hirakata bay is diverse.

3. Environment

We heard heard from people related to fishery that there is still sludge in the soil of the Hirakata bay because the terrain of the Hirakata bay is easy to eutrophize. There are some years when red tide occurs. The transparency in winter is high compared to summer and we can see the bottom better. Since the incoming river was treated with sewage, it has been kept clean. That it is not so different from other waters of Tokyo bay.

What Hirakata bay is

Hirakata bay has experienced water pollution. It is a narrow and shallow watershed with a bad odor so there should be an option to make the Hirakata bay a residential area. However, Hirakata bay still remains. It is now a place for people to relax and we can fish and there are enough clams that we can go shell gathering. Hirakata bay is valuable as one of the tides left in Tokyo bay, but it may be forgotten because it is too small. Even though there is the worst environmental destruction, it can be revived, on the other hand it is difficult to restore the contaminated places. Hirakata Bay makes us realize these two aspects and for these reasons, Hirakata Bay is a valuable ocean. We think that it is important to raise our voice in order to get more attention to this area . We will continue to observe the situation of Hirakata Bay through investigation of birds and fishes, and will continue to act as a body that will care for whatever changes may happen.

Activities of the Shisei Junior High School Biology Club
—Our hometown builds on the beautiful tidal lands, levees and canals—

Takahiro Araragi, Riro Ozaki, Chika Nakao, Emi Omagari, Toru Koga, Mao Eguch
Shisei Junior High School Biology Club, Saga, Japan

Introduction

In this presentation, members of the Shisei Junior High School Biology Club will introduce our activities. The school is located in Kubota Town, Saga Prefecture, close to the Ariake Sea.

The biology club was established this year in the school. One purpose is to contribute to inshore fishery resource conservation. We have also regularly studied the culture, history and environment of our home town in a general studies class called "Shisei-gaku."*1 To study our town further and contribute to community activation, we conducted the following four activities in cooperation with the Shisei-gaku study group*2: (1) Open Seminar; (2) Field Work; (3) Development of Fish Breeding Method and Release Activity; and (4) Cultivation and Growth Experiment on Endangered Species "*Suaeda japonica* Makino."

*1 Shisei-gaku is a class at Shisei junior high school. In 2014, students developed educational materials for Shisei-gaku in cooperation with teachers and local specialists, and current students are now using the materials.

*2 Shisei-gaku study group was established as a pilot project by the parent-teacher association this year. The aim of this group is development of Shisei-gaku study program, including field work, open lectures and symposiums with local people.

Method & Result

1) Open Seminar

We held a seminar for local citizens. We invited a lecturer from a local museum and asked him to give a lecture about the original landscape of our town (Fig.1).

Fig.1 Open Seminar

2) Field Work

We visited the Saga City Sewage Treatment Center and Saga Aquaculture Promotion Center to study their operations (Fig.2, Fig.9). We also learned about an integrated water management system constructed in the 1600s (Fig.8).

Fig2. Sewage treatment

3) Development of Fish Breeding Method and Release Activity

We investigated how to raise larvae from the Ariake Sea and Genkai Nada in breeding tanks placed in our school (Fig.3, Fig.4).

We decided that if we were able to grow the larvae into adult fish, we would release them to back to the Ariake Sea and Genkai Nada.

Fig.3 Measuring total length and

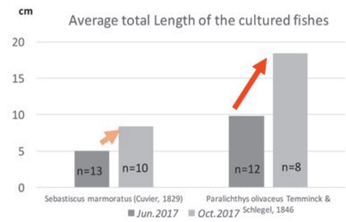
Fig.4 Indoor Breeding

4) Cultivation and Growth Experiment on Endangered Species "*Suaeda japonica* Makino"

We conducted freshwater growth experiments to preserve *Suaeda japonica* Makino (Fig.5, Fig6), which grows in communities in endangered tidelands (Fig.7).

Paralichthys olivaceu

Ruditapes philippinarum



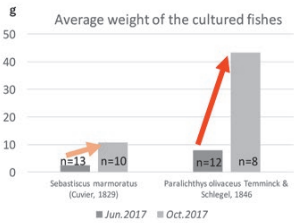


Fig.5 *Suaeda japonica* Makino during cultivation

Fig.6 Colored

Fig.7 *Suaeda japonica* Makino growing in the tidal flats of the estuary

Discussion

As above, we have learned about our town and achieved some good results with community activation. Through these activities, we understood that if we want to study our town, it is effective to receive direct guidance from local specialists. Our theme in the second half of this year is to plan and hold a "Symposium for Measures of Community Development" with some students, government officers and specialists. We will also hold the "Second Field Work and Open seminar." Subsequently, we will have an opportunity to evaluate outcomes and plan improvements of the learning program which has been conducted in cooperation with related parties this year.

On-site learning of old soil levee

Fig.8 Old Fi levees and canals

Fig.9 Fishing equipment of Ariake Sea and Ariake Tidelands

Using Art in Engaging and Enabling the Public to Act to Conserve Wetlands

Yi-Fen Jan, Chin-Ling Wu, Shih-Hung Chen
Wild Bird Society of Taipei Guandu Nature Park Office

Introduction

Guandu is situated at the confluence of flowing rivers and brackish water in Taipei, Taiwan. This estuary wetland is a great habitat for a rich variety of organisms, attracting flocks of migratory birds. An agricultural landscape with largest and the last rice paddies of Taipei City is still being kept in this region as well. In 2001, Guandu Nature Park was established to serve as a biodiversity shelter and an educational center which offers high-quality services, an ecological richness, diverse education programs, and public participation activities.

In recent years, Guandu Nature Park has devoted itself to adopting an art-based approach to engage the public in knowing the values of wetlands and biodiversity. Already a well-managed wetland reserve and a leading wetland education center in Taiwan, Guandu Nature Park is still striving to find innovative ways to expand its influence to a wider public. During the experience of organizing an environmental art event, the Park has discovered that by using art as a medium for transmitting ideas of environmental protection can have a different communicate effect to inspire people to take action.

Why This Art Project Is Started

Dating back to 2006, the Park started the *Guandu International Outdoor Sculpture Festival* as a way to finding back visitors with the circumstance of the avian flu outbreak in 2005. The pandemic disease has made the public panic about getting near to birds therefore further prevent them from visiting the Park. The art festival became an alternative solution at the moment to weaken the strong impression of the connection between Guandu Nature Park and birds. It also opened up an opportunity to re-emphasize that Guandu Nature Park is not merely a "bird park" but actually a "wetland center."

Meanwhile, new audiences such as art-lovers were attracted to visit the Park for the first time. The event was held annually by inviting international artists to create eye-catching, site-specific installations using natural or eco-friendly materials. Many art volunteers were also specially recruited to participate in the process of artwork creation. It has successfully created a buzz for the Park and gained its popularity gradually among the public.

The core concept of this art project is to creating environmentally focused art. Using natural or eco-friendly materials is a way to express the caring for the environment. It gives prominence to the concern of human impact to Nature and the possibilities of choosing a better option. The aesthetic appeal of the natural world could also play an important role to rebuild the relationship between human and Nature.

What Are the New Changes

In 2016, after celebrating its 10-year anniversary in the previous year, the event has come to a new stage by resetting its title into the *Guandu International Nature Art Festival*. Public participation, art intervention, and nature conservation are still the key elements of this event, and it is expected to serve as a catalyst to deepen the public's awareness of the environment, as well as care for the local cultures.

Besides inviting artists coming to Guandu to make work on site (the artist-in-residency program), the Festival has now transformed and expanded into a complex project combines with a variety of art, education, and public engagement programs. In order to deepen the participatory experience to acknowledge the core value of this project, both the artist-in-residence and volunteer programs are changed to involve more explorations of local stories.

A field study trip before the on-site production of artwork is implemented to the artist-in-residence program. Artist can work closely with the researchers to better know the ecological, historical and cultural situations of Guandu. The volunteer program has been changed to involve the exploration of local histories as well. They are also invited to join the field research with artists such as experiencing the habitat maintenance work.

There are also several educational programs which are co-developed with the partners: *The Sound of Wetland* (with the Soundscape Association of Taiwan), *Adventure Time in Shezi* (with the Bamboo Curtain Studio.) *The Sound of Wetland* program encourages the visitors to perceive the natural environment through listening. *Adventure Time in Shezi* is a community-based program in cooperation with the Bamboo Curtain Studio (BCS), an art studio in Taiwan dedicated to promoting cross-cultural exchanges and innovative art practices among the issues of sustainability and ecology. A series of activities related to the aesthetics of life, such as *Natural Art DIY*, *Nature Fun for Little Kids*, and *Guandu Walk*, has also been included. All aims to reflect the unique vibrancies of local history, environment, and culture Guandu area.

In 2017, "With Paths Crisscrossing" is chosen as the annual theme with the aim to explore the current status of the rice paddies in Guandu plain among the complex forces that shape the city. It focuses on the ecological value of the rice paddies as wetland systems to enhance the biodiversity. Artists have the chance to meet with a local farmer during the field trip and to explore the rice paddies from the perspective of wetland conservation. These personal experiences are further transformed into artworks to tell the local stories.

Next Steps

From 2006-2017, over 70 artists from 26 countries around the world have accomplished 82 pieces of artwork. More than 3,000 volunteers have joined this project. The whole process can be regarded to stir the public to a greater appreciation of the importance of urban wetland and nature conservation.

As the issues that Guandu Nature Park faces continue to broaden, Guandu International Nature Art Festival, therefore, plays a vital role of engaging people from a sentimental perspective to establish their personal aesthetic experiences in a natural landscape. These experiences might be a key to encouraging people to change and act. The interdisciplinary dialogues and interactions happening during this art project have also inspired each participant to reflect upon their own relationship with the land.

Photo 1. Artists are invited to create a site-specific installation using natural or recycled materials. Art volunteers are recruited to participate in the creating process as well.

Photo 2. A field study trip before the on-site production of artwork is implemented to the artist-in-residence program. In 2017, Artists have the chance to meet with a local farmer during the field trip.

Photo 3. The field trip experiences are further transformed into artworks to tell the local stories and have more connections to the place.

Using Art in Engaging and Enabling the Public to Act to Conserve Wetlands.

Yi-Fen Jan, Chin-Ling Wu, Shih-Hung Chen
Guandu Nature Park Management Office, Wild Bird Society of Taipei, Taipei, Taiwan (R.O.C.)
Email: yifen@gd-park.org.tw

Introduction

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Increasing Capacity of Local Communities to Implement Wetland Conservation and Eco-DRR and EbA Activities in the Laguna de Bay Region and Marikina-Pasig River Watershed

Amy M. Lecciones, Wilhelmina C. Ricamunda, Zenaida M. Ugat, Aaron JM Lecciones, Jose Carlo H. Quintos and Darry Shel M. Estorba
Society for the Conservation of Philippine Wetlands, Inc.

Background and Objectives

In 2014, The Society for the Conservation of Philippine Wetlands, Inc, with support from The UPS Foundation embarked on an initiative aimed to increase the capacity of local organizations to take actions for wetland conservation that will contribute to the effective reduction and management of disasters and help in implementing ecosystem-based climate change mitigation and adaptation measures. Its focus was on enhancing organizational capacity to craft strategic projects, manage them efficiently and effectively and access resources towards the desired outcome of a resilient and climate change-proof wetland community.

Objectives

The general objective of this project is to increase the capacity of local organizations to take actions in wetland conservation that will contribute to the effective management of natural and human-made disasters and help in implementing climate change mitigation and adaptation measures. Specifically, it aims to:

- Assess the readiness of local organizations to embark on wetland conservation measures.
- Improve project management skills of local organizations.
- Engage the local communities in wetland conservation activities in the Marikina – Pasig River – Laguna de Bay Region.
- Help local communities in accessing resources for wetland conservation activities.

Beneficiaries

Ten local organizations composed of fisherfolks, environmental groups, local media, and DRR-focused NGO from areas vulnerable to disasters in the Marikina-Pasig River and Laguna de Bay area were selected as participant to this project. These participant organizations were selected according to a set of criteria that ensure that they will be significant actors in the conservation of Laguna de Bay or Marikina River. Each organization had two (2) participants for a total of 20 participants.

The organizations are the following:

1. Green Movement of Angono, Inc. (GMAI)
   Angono, Rizal
2. Ugnayan ng Mga Samahan ng Mangingisda at Mamamayan ng Rizal, Inc (UGMARIZ)
   Taytay, Binangonan. Angono, Cardona in Rizal Province
3. Kapatiran ng Malalayang Maliliit na Mga Mangingisda sa Pilipinas, Inc. (KAMMMPI Rizal Chapter)
   Based in Tanay, Rizal
4. Mangingisda Alyansa ng Pila, Inc. (MAPILA)
   Pila, Laguna
5. Bulod Tao, Inc.
   San Mateo, Rizal
6. Friends of the Seven Lakes Foundation, Inc. (FSLF)
   San Pablo, Laguna
7. Environmental Broadcast Circle (EBC)
   Pasig City
8. Green Steps, Inc.
   Pasig City
9. Tanay Environment Foundation (TEF)
   Tanay, Rizal
10. Bagong Ugnayan ng Kababaihang Aalagaan ang Lawa (Bukal)
    Based in Cardona, Rizal.

Project Components

Component 1: Learning about wetlands, ecosystem services derived from them as well as the threats and ways to conserve them;

Component 2: Assessing the readiness of local organizations to embark on wetland conservation measures through a participatory capacity needs assessment

Component 3: Designing and implementation of modules to improve their project management and resource mobilization skills; and

Component 4: Implementing wetland conservation measures by proposing an activity (or a project) that will be given seed fund by the SCPW.

Approach and Methods

- Lectures, mentoring sessions, sharing of experiences, practical application of learning experiences in real situations including a field visit to an example of a best practice activity
- In-house training sessions, office practicum sessions, cross-visits, and actual project implementation.

Training Modules

Module 1: Preparation and Organizational Profiling

This module starts with an orientation meeting-workshop where the project will be introduced, the roles of the participants, and basic concepts about wetlands and wetlands conservation will be discussed to provide the context.

After an introductory session, the participants go back to their offices and work on profiling their organizations using a template. This gives the trainers the information on whether the local organization has the necessary permits, an updated vision, mission and goals and an action plan to reach their goals. This is done for 2 weeks.

Module 2: Organizational Readiness

The participants report on their organizational profiles and present actions on how to complete the items in the checklist. Learning Sessions covers lectures and practical workshops on obtaining the required permits, visioning and action planning. This is a 3-day in-house session.

This is followed by in-office follow-up work for the completion of the updated vision, mission and action plan when applicable. Permits that have to be secured will be relayed to the concerned person in the organization and commitment on when to get them will also be secured.

Module 3: Project Development and Management

The third module deals with project development and management. This is an in-house session of 3 days. Based on the organizations' VMG and the area where it operates, the participants undergo interactive project development and management sessions. It starts with sharing experiences to level off and then followed by lectures to equip them with the basic concepts, skills and tools needed for effective project development and management. The sessions includes lectures and workshops on topics such as the logical framework analysis, the project cycle, strategic planning, action planning, among others.

Module 4: Resource Mobilization and Sustainability

This module focuses on financial readiness of the organizations to embark on sustained wetland conservation activities. This is a 3-day module that tackles proposal preparation and simple business planning activity for sustainability. Lecturers from grant-giving agencies and organizations such as the United Nations Development Programme – Global Environment Facility- Small Grants Programme, Philippine Tropical Forest Conservation Foundation, Foundation for the Philippine Environment, Foundation for Sustainable Societies, among others, are invited to present their portfolios that these local organizations can access. Alternatively, the participants may visit several of these funding organizations to meet the officials of the donor agencies and observe how they work.

Each participant-organization will come up with a mini project proposal amounting to P20,000.00 for implementation within 3 months. The proposal should be responsive to the problem or issue identified in Module 3. These will be evaluated by the Resource Persons and upon approval, the P20,000.00 will be released by the project.

Module 5: Communication and Sharing of Best Practices (Actual Site Visit)

Communicating the results of the training itself and the mini-project funded by this project is essential so that learnings are documented and shared. This is another 3-day in-house session and the output is a compendium or newsletter that will contain documentation of the participant's projects and will be published online at the SCPW website. Additionally, there will be a training on simple website development so that the participating NGOs/POs can have their websites on the internet. The project will facilitate the hosting of the individual websites.

As an application of their learnings, the Project allocated P20,000.00 (USD500) to fund an activity proposed by each organization. Among the projects proposed and implemented by the beneficiary organizations are:

1. Community-Based Early Warning System (EWS)

This project aims to capacitate communities in Angono, Rizal that are most vulnerable to impacts of natural disasters. Experiences in DRRM shows that community preparedness and early warning systems enables communities for early evacuation thus minimize death tolls. Those communities remotely located from the center of the local government units relief and recovery effort in times of disasters should be able to save and help themselves before outside assistance arrives.

2. Increasing the Awareness on Wetlands Conservation and Livelihood Opportunities of Lakeshore Communities of Cardona, Rizal

This projects aims to minimize the infestation of water hyacinth in the Laguna de Bay region, specifically in the four Barangays of Cardona, Rizal, through training sessions, learning events, practical demonstrations, and actual practice of wetlands conservation activities which may result to increased livelihood opportunities for the local communities.

3. Gill Nets Production to Increase Livelihood of Fisherfolks

The money will be used to buy materials for making gill nets. Thirty members of KAMMPI will initially receive the gill nets that they can use for more or less one year. Each member-beneficiary will pay the association P10/weekday for 6 months to completely pay the cost of the gill net. The association will roll-over the funds to buy more materials and increase the number of beneficiaries. After the second cycle, KAMMPI will set aside a certain percentage of the proceeds to fund other activities of the organization.

4. Mitigating the Devastation of Knife Fish in Laguna de Bay

MAPILA will initiate a startup mitigating measure among fishermen, which hopes to address the concern of scourging knife fish in the biodiversity and local economy of the Laguna Lake. This will initially employ a pilot case of 10 fishermen in Pila, Laguna using gill nets to retrieve the knife fish in the area. The fishermen will sell the retrieved knife fish to BFAR, which would then be processed into feeds and other products.

5. Establishment of Greenhouse for Vegetables, Native and Fruit Trees Seeds Nurturing

Buklod-Tao will create a modest green house that is essential for the protection of plants being nurtured and to mitigate the bad effects of climate change. This Greenhouse is also a conventional structure in any gardening and plant nursery efforts because of its contribution on increasing the probability of successful yield of plants. Since Greenhouse ensures higher survival rate of plants, this can now complement to the target of the organization to have a higher production to meet its demand, especially for vegetables and tree seedlings.

6. Gen Y: A Youth-Oriented Cable TV Show

FSLF will produce a youth orientated TV show that will be shown via local cable network. This intends to disseminate information on the latest youth events and developments with particular focus on the environment. This will also showcase youth interests in the arts and culture, social media and promote youth activism in San Pablo City and in Laguna Province.

7. Forum on Community Wetland Conservation and Sustainable Livelihood

The Environmental Broadcast Circle (EBC) proposes to undertake a 2-component project of community scoping, stakeholders' forum to: a) Engage the Lake stakeholder groups in a discussion on wetlands conservation and sustainable livelihood; and b) Generate recommendations for holistic planning for conservation and livelihood projects (e.g., communication plans, policy recommendations).

8. Rainwater Harvesting for Alternative Domestic Water Supply and On-site Storm Water Management for Groundwater Recharge and Wetlands Ecosystems Conservation

Green STEPS will retrofit a rainwater harvesting (RWH) system from the roof catchment of a 3-storey multipurpose structure in barangay Banaba, San Mateo, Rizal. This will employ simple technologies that are doable and beneficial to the community and its environment. The project aims to help people learn to value, harvest and store rainwater, manage their rainwater and on-site storm water and enable them to practice wise use and management of water resources and wetlands ecosystems.

The other two organizations (BUKAL and TEF) did not complete their projects within the time frame of the project.

Outputs and outcomes

The trainee-organizations updated their registration documents, ie business permits;

- They enhanced their vision and mission statements and integrated wetland conservation and Eco-DRR and EbA concepts in their strategic and action plans
- They were able to access and leverage funds and other resources from various sources.
- The trainee-organizations provided counterpart funding that sometimes exceeded the seed fund provided by the SCPW.

More importantly, they were able to understand and appreciate the relationship between the integrity of wetlands and the vulnerability of local communities to disasters and other impacts of climate change. This realization urges them to do more to conserve their local wetlands.

Profiling of participating organizations

Organisational Readiness Workshop

Resource Mobilisation Module

Web development training

Project of Buklod-Tao : Green House

Project of Green Steps: Rainwater harvesting

Ramsar Biwa-Kids Ambassador Project

Shigekazu Ichiki*, Kana Hatta*, Ryo Onoue**, Daisuke Nakamura***, Yumiko Nomura****, Munetsugu Kawashima*****
*International Lake Environment Committee Foundation, **Shiga Prefectural Government, ***Shibukawa Elementary School, ****Yuta Elementary School, *****Shiga University

In Shiga Prefecture, there is Lake Biwa designated as Ramsar Site. The Shiga Prefectural Government has hosted “Biwa Kids Ambassador Project” (Biwakko Project), an environmental education program targeting children to support sustainable environmental conservation effort and to train younger generation for the future of Lake Biwa since 2008. The International Lake Environment Committee Foundation (ILEC) has been entrusted with this project since 2015. Prof. M. Kawashima, Mr. D. Nakamura, Ms. Y. Nomura and other guest lecturers have been engaged as educators of this project. Here, we make a presentation about what this program is and how it works.

The missions of the Biwa Kids Ambassador are;

1. To learn the importance of Lake Biwa and let the children in the other area know it.

2. To let the children in Shiga know what Biwa Kids learned in the national or international exchange activities.

Six to ten students(10-12 year old) selected from the elementary schools in Shiga Prefecture, participated in this program each year. For the achievement of the missions, they have learned about the living things in paddy fields and traditional fishing methods in/around Lake Biwa, and have made fish dished.

In 2015, six students (10-12 year old) selected from the elementary schools in Shiga participated in this program as the Ambassadors to learn about “lakes and their food culture”. The highlight of the program was an international exchange activities in November held in Chiang Mai, Thailand, in collaboration with the universities and elementary schools. Before visiting Thailand, the Biwa Kids learned about Lake Biwa, and its food culture and traditional fishing methods.

They experienced a traditional fishing method in Lake Biwa, and several cooking lessons using the lake’s endemic fish. But by fishing with beach seine, they knew what they caught was mostly invasive species such as large mouth bass.

One of the recipes they learned was how to prepare Funazushi, a fermented sushi made with crucian-carp , which tastes like blue cheese. They enjoyed not only interesting taste of the food but also discovered the importance of environmental conservation and the value of local food culture passed down through generations to generations in the Lake Biwa basins.

The Biwa Kids visited Chiang Mai, Thailand in November, 2015. They participated in the exchange program themed on “lakes and their food culture” jointly organized with the local elementary schools and universities. The six kids successfully made presentations on what they had learned about their home-town lake, Biwa and its food culture. Another mission they have proudly completed was to cook Japanese food using ingredients purchased from the local market. They enjoyed tasting what they prepared (such as miso-soup, fish-flavored rice, and tempura, etc.) and also discovering an exotic flavor of the Thai food prepared by Thai children.

In 2016, the study theme was “to learn about rice farming, irrigation and creatures around rice pads.” Newly selected six Biwa Kids went to local rice fields to find various creatures in the channels, and were dispatched to Bali, Indonesia, where the 16th World Lake Conference was held. The kids attended the lectures on Balinese culture and Subak at the Udayana University, and then headed north to the Subak Sembung, one of the Subak sites, where they explored various aquatic creatures. They experienced a lot of memorable moment like an enthusiastic welcome at the local elementary school and an impressive opening ceremony of WLC17.

After their return to Japan, the Biwa Kids reported their year-long activities to Vice-Governor of Shiga Prefecture, and to other students at their schools. Through the precious experiences, they have become more aware of the environmental issues.

The successful execution of the project made us convinced that these kids would play important roles in conserving the environment of Lake Biwa in their future.

This November, newly selected ten Biwa Kids will study Lake Biwa and attend the kids program which will be held in Arao-higata, Ariake Sea just before the AWS.

This summer, present Biwa Kids had meeting with ex-Biwa Kids who were high-school or university students. They studied environmental study and some of them would like to work at environmental project.

Workshop in Shiga Pictures No.1 to 4

Pic.1

Pic.2

Pic.3

Pic.4

International Exchange Activities Pictures No5 to 8

Pic.5

Pic.6

Pic.7

Pic.8

Report Meeting with Vice-Governor Picture No.9

The Effectiveness of Simple Questions during Nature Observation for Promoting Development of Self-Expression: A Suggestion for ESD through Nature Observation

Masumi Kimoto, Hideharu Masuda
Nature Saga

[1] The aim of the presentation and introduction of the subject of activity, Nature Saga

In this presentation, we aim to show the importance of encouraging children to express themselves through nature observation.

The view of this presentation is based on the nature observation activity organized by Nature Saga.

Nature Saga is a voluntary group that nurtures a love of nature through nature observation. The primary members of Nature Saga are nature observation instructors certified by the Nature Conservation Society of Japan (NACS-J).

The activities of NACS-J are science based, and Nature Saga is also trying to pursue a growth of scientific understanding of nature as NACS-J liaison to Saga prefecture.

The members of Nature Saga have expertise in various kinds of fields which cover many types of natural environment in Saga prefecture, and each member organizes nature observations focusing on what he/she loves.

[2] Why children dislike self-expression and how nature activity can tackle the problem?

According to a survey on learning methods for elementary school students, junior high school students, and high school students nationwide, it turned out that there were more children who dislike self- expression to announce their thoughts and opinions as the age got higher. The educational newspaper, which is a specialized media on education, reports on the findings on October 31.

The proportion of "dislike" is high in "To present one's own thoughts and opinions"

Elementary school (46%)
Junior high school (57%)
High school (69%)

The result of "The 63rd School Reading Survey" conducted by the National School Library Council (National SLA) etc.

The survey was conducted in June 2017, 9924 answers were obtained from 102 public schools nationwide from fourth grade elementary school to third grade elementary school.

It is said that compared to children in other countries, Japanese children tend to be poor at expressing their thought and emotion and communicating with strangers. It have been pointed out for decades.

What has been pointed out as a general tendency for many years is the result that appears as statistical figures. As the age goes up, the vocabulary should be abundant and ability to express themselves should be enriched, but the result shows that children do not like to demonstrate it.

Self- expression that children are not good in is likewise not good at adults, and is also said to be a social character and behavioral tendency of the Japanese.

This has been mainly attributed to the communication strategy of Japanese society, so-called high context society. In Japanese society, it has been deemed desirable to advance things with tacit understanding rather than spending a lot of time on discussion.

However, there are some countries and societies as well as in Japan, reticence may be regarded as virtue.

[3] Is there a correlation between children's reading comprehension and self-expression?

However, with regard to the cause, the possibility from another point of view is now emerging.

The results of the International Academic Examination (PISA) in 2015 revealed that the comprehensive reading ability of Japanese children has declined. Not a few education officials have pointed out an increase of children who cannot understand the content of textbooks.

We would like to point out the relationship with negativity to self- expression, or sense of repulsion as mentioned above, as one possibility of cause of reading comprehension decline.

Experts point out that vocabulary is becoming less likely to increase due to the fact that nuclear familization has reduced opportunities for adults to have conversation in their families. Reducing opportunities for communication with people of different age may also be considered as one of the causes.

Is it difficult to express themselves because it is poor understanding ability?

Or, does passive feelings on self-expression reduce the motivation for understanding?

It is not certain which is the cause or the result, but it is anticipated that there is some relationship.

Weakness of self-expression and comprehension is a problem in Japanese education.

[4] We believe nature experiences have a positive impact on the brain development.

So we ask children simple question they like to use their brain to answer.On the other hand, the hypothesis that outdoor activities will have a positive influence on children's brain development has been pointed out since more than 20 years ago.

For example, in 1996 a research about the outdoor activities of children reported by the ITOCHU Memorial Foundation.

In addition, brain science has been discussed significance of nature experience in outdoor activities and collective activities education.

Despite several research studies on this hypothesis, the effect of outdoor activities on the development of the brain has not been fully confirmed. Among education officials, there are those who evaluate it and others who do not.

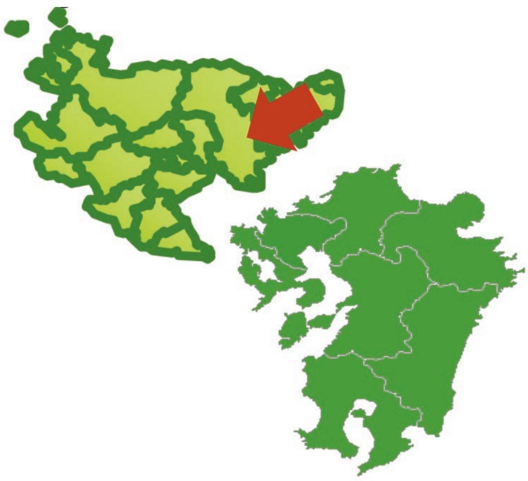
Nonetheless, even if scientific evidence is not sufficient, if people look at the children who enjoy in outdoor activities, they will be convinced that effect.

In nature observation of Nature Saga, we focus on self-expression by children that is said Japanese are not good at, and we try to set up questions to draw out the children's self-expression at observation sessions.

We think that it is desirable to make questions as simple as possible and to ask questions that can be answered even by pre-school children.

Especially at the beginning, it is important not to ask questions to answer correctly, but to set up questions to draw answers that children want to express what they like in the nature.

[5] The importance of the environment that can meet various organisms.



First, we aim to foster basis that children express what they like in front of people. Creating a program that foster scientific observation is next step. The ability to guess and get insight come later as they observe natures properly.

It is very important for children to meet their favorite creatures. Even if only limited vocabulary, children try to talk about what they like. If they are small child, the reactions are very direct, and if they get older, they may refrain from talking with embarrassed emotions that are common in adolescence, but if they only encounter a good listener they can speak eloquently.

Wetlands where various organisms such as plants, aqueous insects and fish, etc. can live are preferable environments for nature observation and it is expected that various programs will be developed in the future.

Nature Saga has been organizing nature observation in the middle area of Kasegawa (or Kase River) that runs from the north to the south of Saga city, and Tafusegawa (or Tafuse River), the tributary of Kasegawa. Those rivers and wetlands of riverbeds are two of the most important focuses of Nature Saga's observations.

One member has been holding nature observations with various citizens for about 12 years on the rice fields in the tributary around Kasegawa and Tafusegawa. And Nature Saga also has over 12 years of experience observing the Tafusegawa Riparian Park.

[6] Nature observations that parents and small children can participate together.

In recent years, Nature Saga has organized observations for families with small children, because we believe that environmental education is the key to our goal, which is nature conservation.

Nature Saga members, as nature observation instructors, provide support to parents who carry their children, or push them in strollers so that they can participate in nature observations. Reducing the parents' limitations is a very important step when starting to get into nature.

Wetland of middle area of river is a great place to conduct environmental education, because it is easy to access from residential areas of Saga city and it has a great diversity of natural creatures.

Giving parents and children the opportunity to meet something that truly inspires them during the observation is very important. The middle area of the river has various kinds of plants, aquatic insects, fish and birds. So the possibility of coming across something they find interesting is high.

[7] Anyone can talk in public if there is something to tell

To make the experience special, we often give goals to the children on the tours such as "find your favorite creature" or "let's discuss what you see at the end."

Asking simple questions at the beginning of the tour is important. Small children who have just started speaking several words sentences can answer if the goals are simple enough.

At the end of the tour we ask the group what they liked, and the small children, while nervous in front of the group, often manage to answer. Parents get to witness their child's ability to communicate grow, as the children develop their expressiveness. This makes it an important memory for everyone.

Not a few young parents who participate in our nature observation did not have experiences in the nature when they were younger. They grew up in a time of economic growth, where test scores and exams were the most important.

Japanese society has been preoccupied with those values for a while. But in recent years, people have thought more about coexisting with nature. Additionally, we are starting to realize that healthy brain development makes us smarter individuals than test scores.

[8] Self-expression is not nurtured by textbooks in the classroom.

A simple question and answer session during nature observation is valuable to the development of a children's motivation to express themselves. We believe that nature observation will increase the effectiveness of environmental education for sustainable development as a whole.

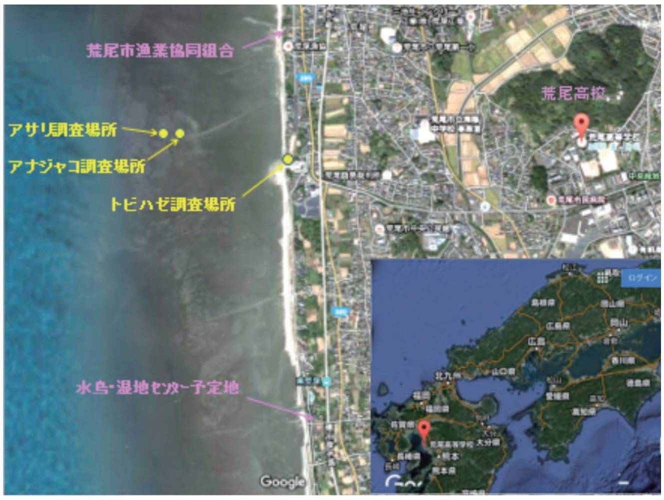
Self-expression is not nurtured by textbooks in the classroom but is nurtured in nature. Just as ancient Japanese literature like Manyoushu, Kokin-wakashu, Shinkokin-wakashu (万葉集、古今和歌集、新古今和歌集) etc. had developed in nature every season.

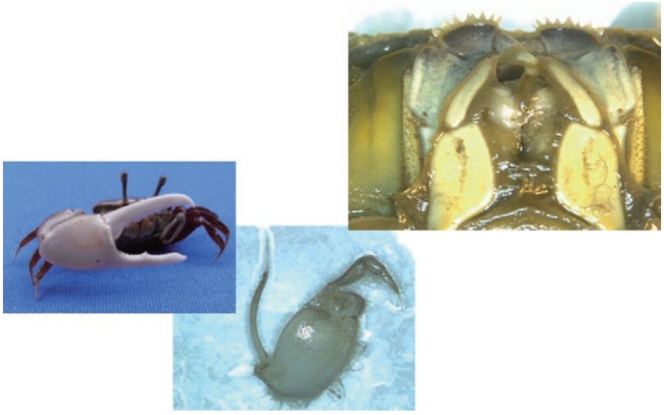
How Can a Senior High School Biology Teacher Contribute to CEPA Activities at the Arao Tideland

Hiroshi Matsuura
Kumamoto prefectural Taishi senior high school

Currently, I am a teacher of biology at Kumamoto Prefectural Senior High School. This high school is also close to the Arao tideland, which was registered a wetland of the Ramsar Convention on July 3, 2012. It is on the east side of the central part of the Ariake Sea.

What I can contribute as a CEPA activity in this Arao tideland is to let many people know about the tiny living creatures in the tidal flats and the importance of tideland ecosystem diversity.

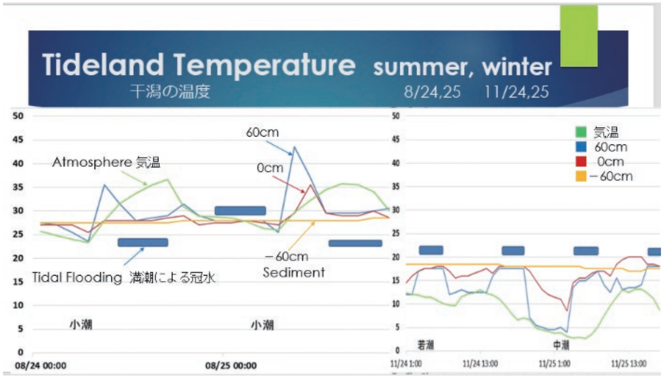




First of all, as a biology teacher at a senior high school, I suppose that the activities with our high school students themselves are CEPA activities.

The school name was Kumamoto Prefectural Arao High School in 2012. I started scientific research on Benthos of the Arao tideland as a subject of "task research" which the science and mathematics class will take for 2 years. From the beginning, I received a lot of support from the people related to WIJ and the secretariat. The theme of the research was as follows. In the classes from 2012 to 2013, "Research on the Arao tidal flat". In the class from 2013 to 2014, "Think about Arao tidal flame from the crab's mouth." Classes from 2014 to 2015 are "Benthos of Arao tidal – Livelihood separation, coexistence, symbiosis -".

This research won the best award in the west Japan, Tyuugoku, Shikoku, and Kyushu district, high school science and mathematics department, issue presentation announcement meeting. In addition, we presented a poster titled "Growth and burrows of Japanese mud shrimp (*Upogebia major*) in the Arao tidal flat" at an annual conference of the Japan Association of Benthology in 2016.



Today, the Taishi senior high school science club is studying the relationship between temperature and benthos in the Arao tideland.

In addition, we are doing activities that arouse interest and teach the importance of wetlands to those who do not know about the Arao tidal flats.

Our students joined some activities as volunteer staff so that many children could enjoy contact with the Arao tidal flats and benthos living there. I would like to support and raise this CEPA activity through Taishi senior high school science club's activities for several years until my retirement age.

Next, I'd like to contribute increasing opportunities to teach about the tideland ecosystem diversity and the importance of word-of-mouth communication.

I have been researching with senior high school students so far and I was able to meet many people who participate in tidal flats and wetland conservation activities. And I had the opportunity to work with the people of "the Arao tidal flat conservation · wisdom utilization consultation meeting". For example, I joined the activities to plan and manage the events at lecture and cultural centers, "participation in improving the Arao tidal flat as a fishing ground".

I'm engaged in activities to better understand the Arao tidal flats by connecting children with young generations and large people on many occasions. I would like to contribute to connecting the people who I got aquainted with, the stakeholders of the Ariake Sea, by making use of the Waterfowl and Wetland Center of the Arao tidal flat planned by the Ministry of the Environment and Arao City. I would like to make use of "agreement formation" I learned with Suncheon City with my students.

I believe that this can be done after retiring as a senior high school biology teacher.

Habitat Use of Some Siberian Warbler Species at a Stopover Site in Far East Russia

László Bozó[1], Wieland Heim[2], Tibor Csörgő[3]

[1]Department of Systematic Zoology and Ecology, Eötvös Loránd University, 1117 Budapest, Pázmány Péter sétány 1/c, Hungary, e-mail: bozolaszlo91@gmail.com

[2]Münster University, Institute of Landscape Ecology, Heisenbergstraße 2, 48149 Münster, Germany, e-mail: wieland.heim@uni-muenster.de

[3]Department of Anatomy, Cell- and Developmental Biology, Eötvös Loránd University, 1117 Budapest, Pázmány Péter sétány 1/c, Hungary, e-mail: csorgo@elte.hu

Introduction

In general, passerine migrants seem to use a wider range of habitats at stopovers compared to the breeding season, behaving as generalists in terms of habitat selection (Chernetsov 2006). Knowledge on the habitat use of Siberian songbird species during migration is very limited (Forstmeier et al. 2001, Egorova et al. 2009, Alström et al. 2011, Bozó 2015), **while their preferences during the breeding period** and from their wintering sites are known better (Round et al. 2014, Ayat & Tata 2015). This is also caused by lacking information regarding their migration routes, and in contrast to the situation in Europe, there are just a few ringing stations in East Asia, where it could be examined.

Materials and methods

The goal of our study was to examine the habitat use of warblers (Thick-billed Warbler *Iduna aedon*, Black-browed Reed Warbler *Acrocephalus bistrigiceps*, Pallas's Grasshopper Warbler *Locustella certhiola*, Yellow-browed Warbler *Phylloscopus inornatus*, Dusky Warbler *Ph. fuscatus*, Radde's Warbler *Ph. schwarzi*, Pallas's Leaf Warbler *Ph. proregulus*) on an autumn migratory stopover site in Far East Russia. For this we have ringed 3776 individuals of seven species between 2011 and 2014 on the fall migration periods within the Amur Bird Project at Muraviovka Park. The variety of vegetation of Park area provides an opportunity to examine habitat use of migratory species. The birds were trapped with mist-nets, which were placed in different habitat types: homogeneous reedbeds, sedges and grassy swamps interspersed with willows and raspberries, rich shrub-layered mixed forest, very dense scrub and stubble.

Results

The average vegetation height at the nets was between one and seven meters. The number of Thick-billed Warbler (R2: 0.8066), Black-browed Reed Warbler (R2: 0.5236), Pallas's Grasshopper Warbler (R2: 0.6599) and Dusky Warbler (R2: 0.489) correlated with vegetation height, while no significant correlation between the height and the number of trapped individuals was found for the other species. A strong correlation was found for 'reed warblers' (R2: 0.7444), while no significant correlation (R2: 0.1474) for 'leaf warblers'. We identified at least one habitat type for every species, which is used during migration. The most avoided habitat was the weed (6 out of 6 species). 'Leaf warblers' mostly used the woods and bushes, while the 'reed warblers' avoided those type of habitats as instead of the mentioned they preferred reeds, grass and sedges.

The Black-browed Reed Warbler used mostly the reed-beds, as well as grass and sedges, while the Thick-billed Warbler used the same habitats and the bushes. The Yellow-browed and Pallas's Leaf Warbler occurred mostly in the woods, while the Radde's Warbler preferred the bushes. The Dusky Warbler used rather the bushes, the grass and sedges. The Thick-billed Warbler preferred reed, grass and sedges habitats, but regularly occurred in the bushes as well. The Pallas's Grasshopper Warbler has no strong habitat preference, but mostly could be found in reed-bed, grass and sedges.

Discussion

Siberian warbler species are known as regular vagrants in Europe (Pfeifer et al. 2007, Bozó et al. 2016), however, only limited information is available regarding to their traditional migration and their habitat use en route. In East Asia, the number of natural habitats (particularly the wetlands and woods) has been drastically reduced and illegal trade and hunting of birds poses a serious threat even to once common species (Kamp et al 2015, Edenius et al 2016). Thus, knowledge on year-round habitat use of migratory species is crucial to their conservation in future. Our results show that all the studied species have specific patterns of habitat use, which are most likely related to food preferences and foraging methods. Usually migratory passerines seem to use wider habitat preferences during stop-overs compared to breeding period, behaving as generalists in the habitat selection (Barlein 1983, Chernetsov 2006). In contrast, our 7 species use the same habitat and it high the importance of the protection of a wide variety of habitats. Each species use a special habitat both on migration and breeding time, which most likely caused by differences in foraging methods and preferred food. Three out of the 7 species regarding to the wetlands on migration as well. Unfortunately the wetlands are one of the most endangered habitats of East Asia. If the number of these habitats will decrease in future, the population of these species might decrease as well. Similar measures would be need on the complete migration route.

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Post-Project Appraisal of Urban Wetland Restoration: A Case of Mangrove Restoration Project in Jhongdou Wetlands Park, Kaohsiung City, Southern Taiwan

Po-Hsiu Kuo[1] & Hsiao-Wen Wang[2]

[1.] Institute of Ocean Technology and Marine Affairs, National Cheng Kung University, China (Taiwan)

[2.] Department of Hydraulic and Ocean Engineering, National Cheng Kung University, China (Taiwan)

Concomitant with the proliferation of landscape projects including objectives of ecosystem restoration, there has been an increasing recognition of the need to use lessons learned from existing projects to guide the design of future projects. Numerous projects have been accomplished by trial and error practices, an extremely inefficient learning strategy. Thus, a structured and systematic evaluation method such as Post-Project Appraisal (PPA) is needed. PPA can evaluate restoration schemes in relation to their compliance with design. PPAs allow restoration success to be defined both in terms of the scheme attaining its performance objectives and in providing a significant learning experience, thereby improving future restoration designs (Downs & Kondolf, 2002).

This research aimed at applying PPA method to understand the compliance with the design of Jhongdou wetlands park and the lessons learned. Jhongdou wetlands park is located in the central area of Kaohsiung city in southern Taiwan. It occupies 12 ha and is 2.5 km from the estuary of Love River nearby Kaohsiung harbor. Through an urban renewal process this park was restored from an abandoned plywood factory capped with landfill to an eco-park in 2011. It was designed to function as one key patch of Kaohsiung Wetland Ecological Corridor. The multiple functions of this park include landscaping, recreation, environmental education, flooding detention and habitat restoration. The tidal area where Kaohsiung harbor situated was once having the most huge population and the most diverse species of mangroves in Taiwan (Hu, 1959), but all mangroves disappeared after the harbor exploitation in 1990s (Chen, 1997). This ecological background inspired the designer of Jhongdou wetlands park to define the core design strategy of the park as creating an urban habitat by restoring six native mangrove species of Taiwan in the park, including *Lumnitzera racemosa*, *Avicennia marina*, *Kandelia obovate*, *Rhizophora stylosa*, *Ceriops tagal* and *Bruguiera gymnorrhiza*. The latter two species have been extirpated from Taiwan in the past several decades due to habitat loss. After the park construction completed several monitoring of biodiversity and water quality was conducted but there was no follow-up concerning mangroves species survival, distribution, and optimal habitats.

PPA was performed to determine if the original ecotone planting design of mangroves was successful in assigning the correct species to the correct elevation and, therefore, assuring optimum survival, distribution and growth. A survey of the restored mangroves to map the distribution of those planted mangrove saplings survived was conducted. Mangrove species, growth status, and abundance were recorded. Water quality at nine selected locations in the park was measured. The data was analyzed to determine how water quality influenced each species of mangroves. An interview with the park designer was carried out to understand the design rationale. Besides, several interviews with stakeholders were conducted to understand the issues on and the factors of the environmental changing of the park. The interviewees included the park manager and a local environmental organization.

The research began with a survey of mangrove distribution at the site at low-tide to map the current distribution of those planted saplings that had survived. Mangrove species, growth status and abundance were recorded. Individuals of *L. racemosa* and *A. marina* higher than one meter were recorded and mapped. *K. obovate, R. stylosa*, and *B. gymnorrhiza* higher than 0.5 meter were recorded and mapped since the latter three species grow relatively slower than the former two species. Water quality at nine selected locations was measured in December 2013 (Fig. 2). The parameters of water quality survey included water temperature, electrical conductivity, salinity, pH, dissolved oxygen and turbidity. The data was analyzed and compared with the data from other monitoring reports to help determine how water quality influenced each species of mangroves.

The results of mangrove survey indicate that planted saplings of *L. racemosa* had the greatest range of elevation distribution and grew under the largest range of water quality parameters. *A. marina* had the second most widely distribution and tolerance to water quality variation. Both of these species grew well, but, interestingly, their dominant distribution varied from the original design plan. Specifically, the *A. marina* saplings were originally planted in a circle around the eco-island in the center of the park (Fig. 1), but after two years, it grew spread naturally to the nearby channel bank, close to the education center and the culverts. However, *L. racemosa* grew around the edges of the eco-island and replaced planted *A. marina* saplings (Fig. 2). Water quality survey data conducted monthly from March 2012 to September 2013 by Kaohsiung Wild Bird Society showed that the salinity in the park ranged from 11‰ to 31‰. As expected the salinity was relatively lower during the rainy season from June to August (11‰ to 15‰) and relatively higher during September to May (23‰ to 31‰). Water quality data during high-tide on December 2nd, 2013 showed that the salinity measured at the nine locations in the park ranged from 27‰ to 30‰. Mangroves in Taiwan are normally found in lower salinity usually only as high as 15‰ (Fan, 2006) and 22‰ (Huang & Shih, 2007), respectively.

Therefore, it appears that the high salinity of the park may have decreased the distribution and growth of some of the planted mangroves species. This research hypothesized that salinity was one key factor that influenced the distribution and growth condition of mangroves in the park. It is likely that the mangroves that have survived were merely doing so on the upper limit of their salinity range. It might be that during rainy season, lowered salinity acted as a decreased stressor for the mangroves saplings and, therefore, may allow for certain mangrove saplings to not only adapt to the changes in salinity but also allow them to get strong enough to tolerate future increased stress (i.e. high salinity).

By reviewing the design rationale, it was recognized that to achieve the objective of restoring mangroves, some ecological concepts were adopted by the designer to create different suitable habitats for diverse mangrove species by regulating salinity through introducing tidal water from love river, rainfall and drainage effluent from adjacent communities. Geomorphological and hydrological factors were less emphasized in this design. While geomorphological process is an important natural driver that can help designers to create or restore physical habitats, targeted ecosystems, or to get opportunities for improved landscape aesthetics.

The local environmental organization conducted monitoring in the park voluntarily. The volunteers found the saplings of *K. obovate*, *R. stylosa* and *B. conjugata* could not survive at the places assigned. Hence they planted new saplings of these three mangrove species at chosen locations empirically.

The park manager and the local environmental organization both stated that the condition of the drainage effluent and the water circulation was not good. In addition, water quality regulation has been the toughest task of the park management.

As the three water resources are highly dynamic, the water quantity and quality in the park are extremely unpredictable. The complexity of hydrological factors and sediment transportation process makes controlling the water circulation and geomorphic/ elevation changing more challenging. This could be the critical restrictions for the designer to assign the correct mangrove species to the correct elevation/ ecotone.

By performing PPA to review the compliance with the design, two major lessons were learned: (1) It is critical to have clearly stated project objectives with specific success criteria. The concept of adaptive management and communication with stakeholders is needed when setting these objectives. Furthermore, the project objectives should be continually re-evaluated throughout the entire restoration project. If the designer of the original project had collaborated more effectively with other key players and used applied scientific hydrology/ ecology monitoring information to create specified success criteria to reach the goal of 'optimal conditions for mangrove growth', and not just followed the original objective to 'enhance nature and build landscape', then the alternative fresh water resources to regulate the high salinity or low dissolved oxygen caused by misjudging the quality and quantity of the water resources could be secured. (2) There is a need for designers to account for wetland restoration schemes in terms of geomorphic compatibility, watershed hydrology and sediment transport processes. If a designer can incorporate with specialists that deal with restoration schemes, including across disciplines of hydrology, geomorphology, and ecology, the success of mangrove restoration may be more effective.

Finally, to ensure effective and sustainable growth of mangrove species in the future, it is important to use management techniques adapting the dynamic changes within the restoration project. To achieve the goals making mangroves not only survive but to also thrive, managers should monitor changes within a restoration ecosystem and take action to respond to the change within the watershed and between the ecosystems. By doing so, we may have been able to ensure the environmental connection of the Jhongdou wetlands park as a sustainable stepping stone of the Kaohsiung Wetlands Ecological Corridor.

Fig. 1 Original plan of mangrove planting in Jhongdou wetlands park. Arrows present the water flow directions. The lines in different colors illustrate different mangrove species. Purple line: *K. obovate*. Red lin: *R. stylosa*. Green line: *L. racemosa*. Yellow line: *A. marina*. Orange line: *C. tagal*. Pink line: *B.conjugata*.

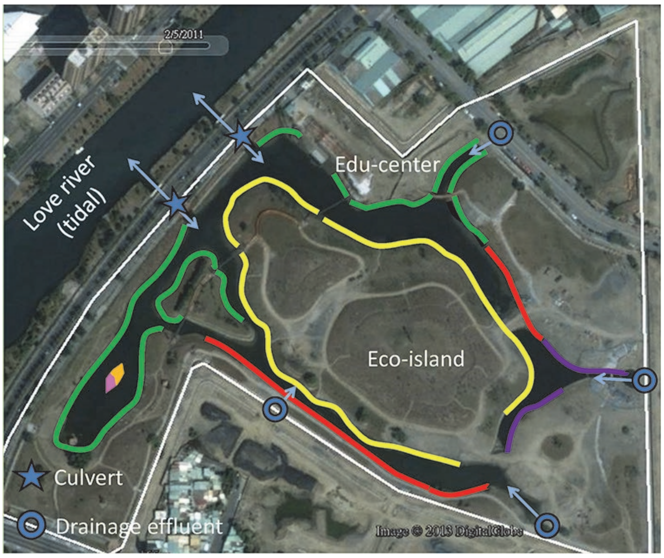
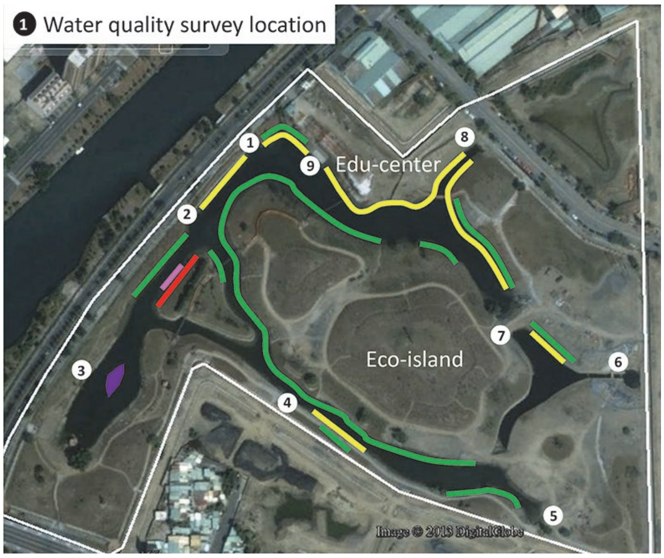


Fig. 2 The distribution of mangroves surveyed in 2013. The distribution of *L. racemosa* and *A. marina* switched banksides naturally, totally differed from the original design plan.



Landscape Design and the Evaluation of The Artificial Wetland at the Nishinotani Dry Dam Reservoir in Kagoshima, Japan

[1] Tomoko Minagawa, [2] Yukihiro Shimatani , [2] Hironori Hayashi, [1] Atsushi Tanabe
[1] Kumamoto University, [2] Kyushu University

River-floodplain ecosystems (Sparks et al. 1990) have extremely important roles in biodiversity. However, connection of ecosystems of rivers and flood plains were disturbed by the levee construction and land development, about 43% of Japanese aquatic plants are noted in the red data book of Japan (Kakuno 2012) and many floodplain-dependent species are in danger of extinction. The restorations of floodplain ecosystems have been far more important to be dealt with urgent issues in conserving biodiversity in Japan (Washitani 2007).

The Nishinotani Dam is located at 9.2 km point from the mouth of the Shinkawa River in Kagoshima city in southern part of Kyushu Island, Japan. The dam is a dry type dam which has a non-operated drain for flood control and stores water only during floods (Fig.1, Fig.2). The Shinkawa River flows through the city of Kagoshima and frequently flooded. The kagoshima prefectural government constructed the Nishinotani dam to prevent flood damage in May 2013. The embankment height of the dam is 21.5 m, the bank top length is 135.8 m, the catchment area is 6.8 km2, the flooded area of the dam reservoir is 0.13 km2 and the total water storage capacity is 793,000 m3.

The team of Kagoshima Prefecture and our researchers planned to install a biotope by using a dam reservoir that does not submerge at all times in the dry dam. We planned nine ponds, some waterways and terraced paddy-field-shaped wetlands (Fig.3). The diameters of the pond are about 30–55 m, the depth of the pond are about 0.2–0.7 m and the gland levels are set for a frequency of floods of once a year to once every five years. The ponds are designed to have different conditions such as water qualities, sauce of organisms and disturbance force by running water and sediment. These biotopes are constructed in accordance with excavation to ensure flood control capacity.

The frequency of flooding of the biotope is higher for the downstream and lower for the upstream. This difference in flooding frequency appears as a difference in intensity of disturbance.

In Australia, there is an example of installing small biotope in a reservoir dry dam, but it is the first time in the world that large-scale biotopes such as the Nishinotani Dam is installed in a reservoir of a dry dam. When we designed these biotopes, we collaborated with local residents through workshops. At the workshops, local residents, local officers, researchers of Kumamoto University and Kyushu University exchanged information on the old scenery, river shape, events, living things, natural environment, and livelihood at the Nishinotani area (Fig.4). While sharing information, we extracted basic elements of design direction and important elements. The original scenery of the residents of the Nishiniya area is a satoyama landscape with paddy fields in the valley, a lot of eels (*Anguilla* spp.), loach (*Misgurnus anguillicaudatus)*, fireflies (*Lampyridae* sp.) and shrimps (*Macrobrachium* spp.) lived and the children swam in the river. The design was carried out based on this information.

By six months after the completion of the Nishinagaya dam, we conducted biological surveys and confirmed important following species, *Cybister tripunctatus orientalis* (Fig.5)., *Ochthebius inermis, Chara braunii* and *Oryzias latipe*s.

We recorded 35 species of aquatic insects including 9 species of lentic aquatic coleopterans adapted to floodplain wetlands, which were once widely found in paddy fields and reservoirs, but in recent years they have drastically decreased by the field development and agricultural chemicals and many are selected as endangered species. Aquatic community structure of biotopes inflowing river water and stream water from small valley were different. The diversity of such biotopes provides habitats of animals and plants, and it will play a role in the conservation of endangered floodplain-dependent species and biodiversity.

Concrete revetment of the river in the reservoir was removed and soil bank is exposed and the nests of kingfishers (*Alcedo atthis*) were confirmed in March 2014. The biotopes in the reservoir erode and accumulate due to the influence of flow, and the topography gradually changes.

The Nishinotani Dam is located in Kagoshima city where the prefectural office is located, and it is also an environmentally important position for urban residents. Not only the neighbors, but also people who go for walks and jogging from the city area are increasing. It can be expected to be used as a place for environmental education and bird watching. The creation of floodplains wetlands utilizing dry dam reservoirs has the potential to bring environmental, social and economic value other than the intrinsic purpose of the dam.

Fig. 1 Biotope situation of the Nishinotani dam

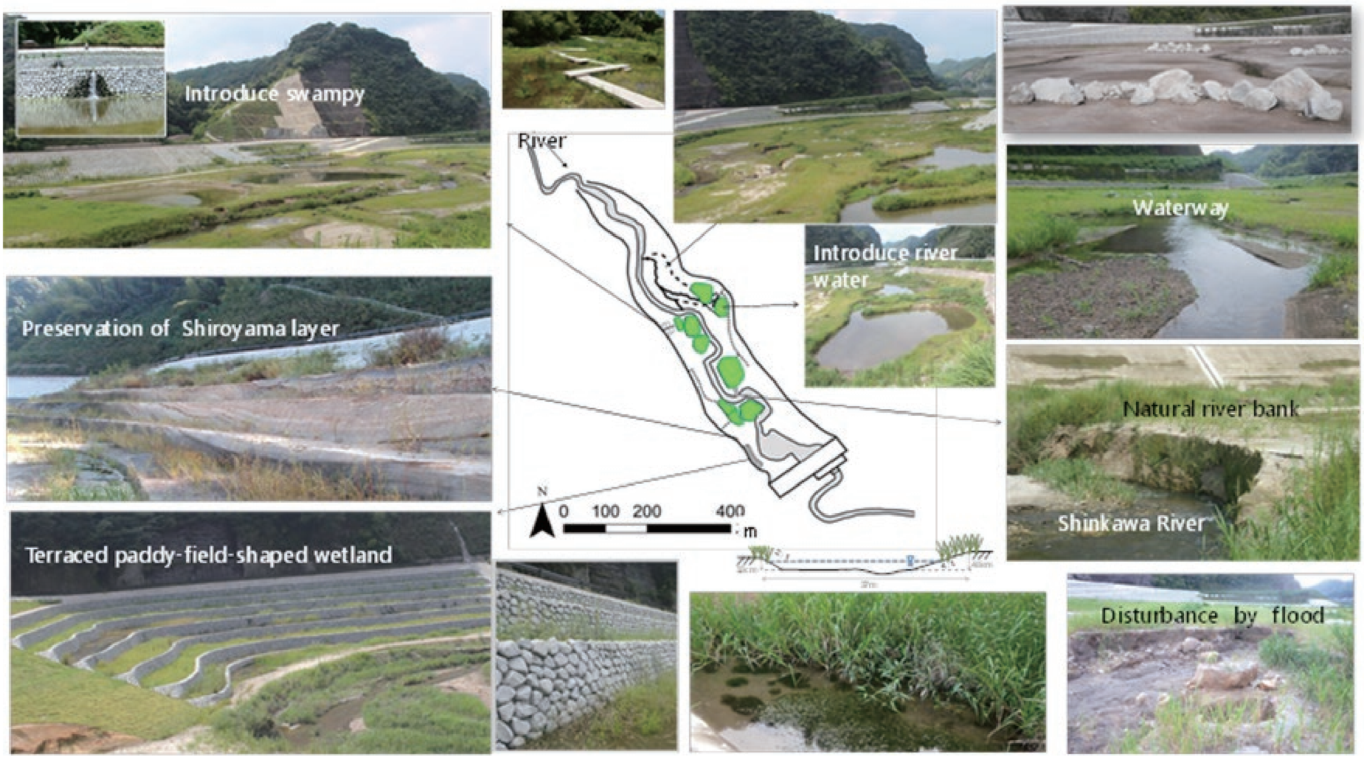
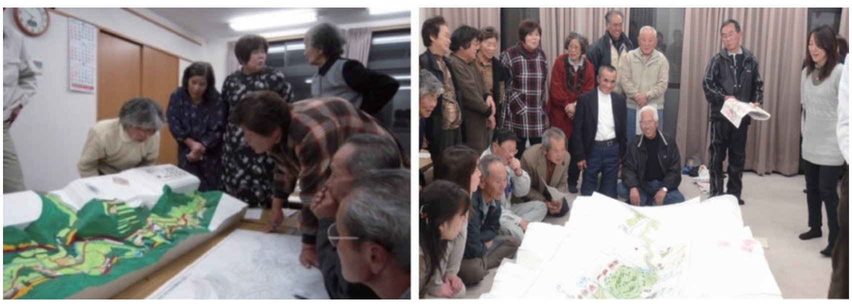


Fig. 2 Location of the Nishinotani dry dam in Kagoshima city

Fig. 5 *Cybister tripunctatus orientalis*

Fig. 3 View of the Nishinotani dry dam

Fig. 4 Workshop for design of the reservoir



Practice of Nature Restoration in Sarobetsu Mire

Takio Sano, Akitaka Iwata, Boyo Ota, Tomoya Miyahara
Asia Air Survey Co., Ltd.

Introduction

Located in the northern part of Hokkaido, the Sarobetsu Mire is one of Japan's largest high moor. It was formed in the downstream area of the Sarobetsu River over a period of 4,000 to 5,000 years. Once covering a vast area of 14,600 hectares stretching approximately 27 km north to south and 8km east to west, the wetland area decreased drastically as a result of large development projects launched in the 1960s. The remaining wetland became desiccated because of these land use changes in surrounding areas. In order to restore the original state of Sarobetsu Mire, the Sarobetsu Nature Restoration Project is being implemented by the Ministry of the Environment.

Fig.1 Changes of wetland area in Sarobetsu moor

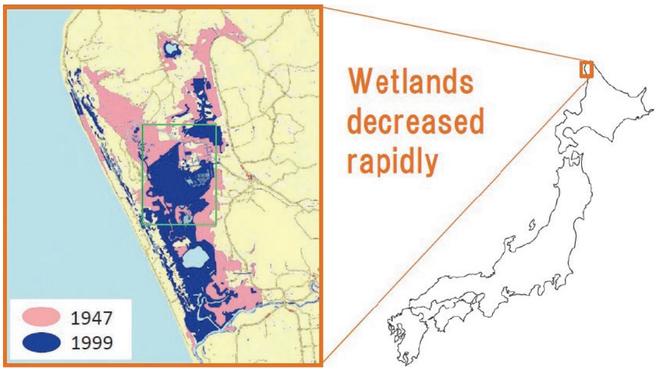
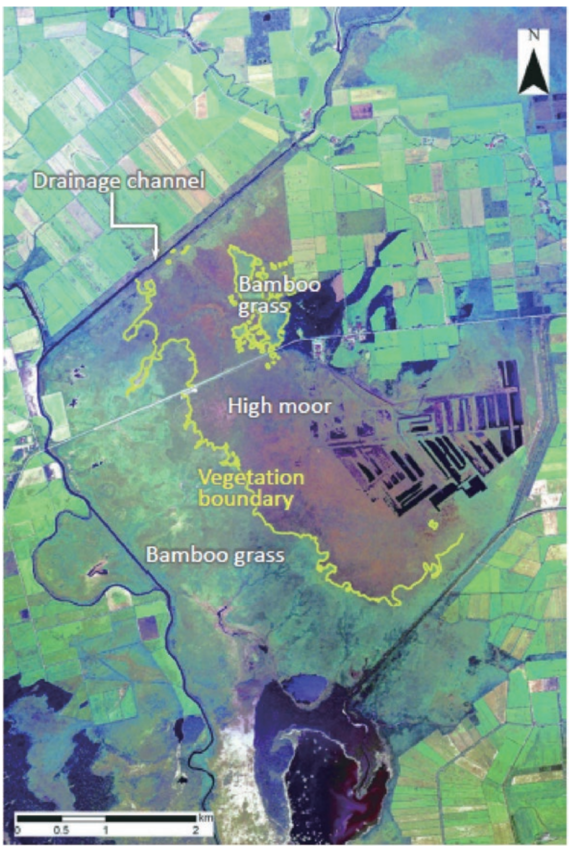


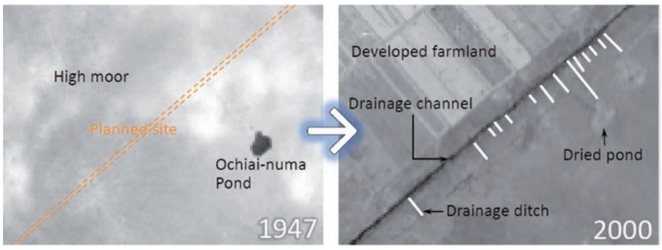
Fig.2 Location of the core of Sarobetsu Mire



Efforts against wetland drying

A distinctive approach taken in Sarobetsu Mire is the conservation of wetland along the drainage channel. At an important part of the Sarobetsu Mire, excavation of the drainage channel was begun in 1961 to prevent floods in the Sarobetsu River. The removed soil was pumped out using a dredger and then laid on the banks of the channel. Drainage ditches were also dug to remove the moisture from the excavated soil. As a result, the groundwater flowed out to the drainage channel and caused desiccation, thereby changing the vegetation along the channel from high moor vegetation dominantly covered with sphagnum and wild cranberry (*Vaccinium oxycoccus*), to *Moliniopsis japonica* communities. Ochiai-numa Pond near the channel also dried up.

Fig.3 Aerial photos before and after development



In order to prevent the degradation of the remaining high moor vegetation, efforts are being made to damming the drainage ditches to prevent the lowering of groundwater level in surrounding areas. This has been highly effective in Ochiai-numa Pond; these operations will restore the water level and thereby reduce the lowering of groundwater in a wider area. Observation after damming has confirmed the rise and stabilization of the groundwater level around the pond and continues to monitor the restore progress of high moor vegetation corresponding to this.

Fig.4 Simulation results of groundwater level before and after damming

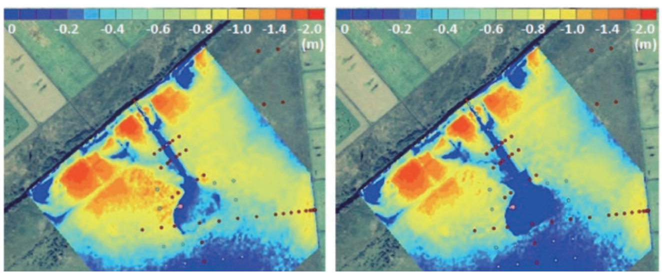


Fig.5 Damming the drainage ditch with embankment

Fig.6 Location of groundwater monitoring point

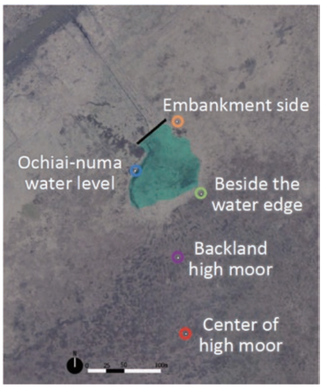
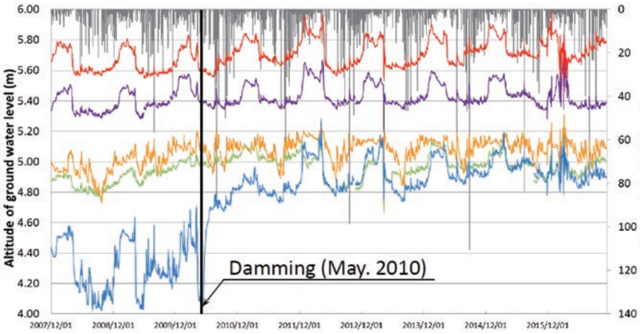


Fig.7 Current state of Ochiai-numa

Fig.8 Trend of groundwater elevation



Revegetation at the peat mining site

Another unique approach in Sarobetsu Mire is vegetation restoration at the peat mined site. Peat mining at Sarobetsu Mire started around 1970 and spread over 150 hectares mainly in the high moor area during the following 30 years. The peat sucked up by the dredger is pumped to the factory, and after the fiber for use as a soil conditioner is filtered out, the remaining muddy water is returned to the site of mining. Many fine humic substances contained in this muddy water, these became massed together in the process of being returned to the site of mining and formed a pasty floating island. This floating island that covers some mined sites has a property that the surface easily flows when rain falls and it dries extremely if the fine weather continues, because it is composed of fine humus. For this reason the plants have not rooted for many years, and they have been left as bare places.

Fig.9 Progress of peat mining

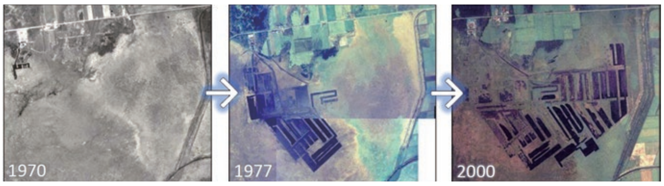


Fig.10 Mining dredger

There were several places where white beak-sedge roots from the margin area to the bare ground of floating island. From this observation, it was considered to encourage the rooting of white beak-sedge first to advance the transition of vegetation. Therefore, through the demonstration experiments that combine several types of mulching and ruffling, we have led the most effective method and expanded to the remaining peat mined site left as bare field.

Fig.11 State of peat mined site

Fig.12 Transition of vegetation recovery test site

Fig.13 Vegetation cover rate in each type from 2011 to 2015

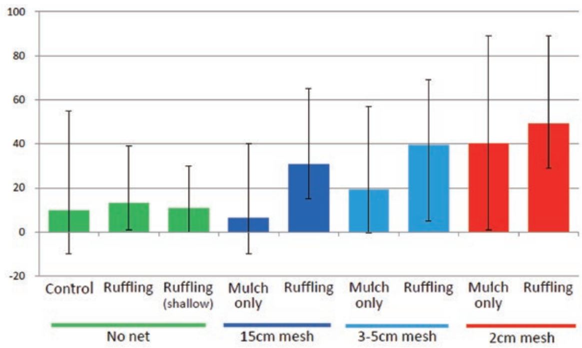
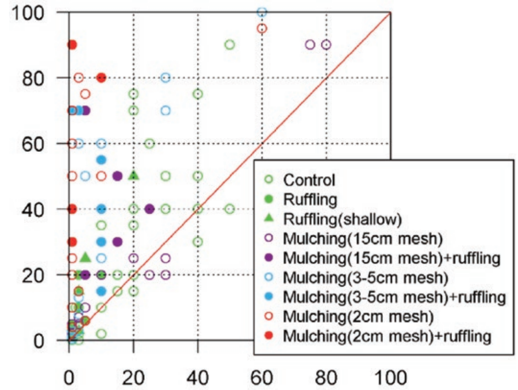


Fig.14 Changes of vegetation coverage in each test site



Conclusion

We were able to confirm the significant response of the degraded high moor in past development projects through several restoration efforts. Nature restoration in the Sarobetsu Mire is still in progress, and we are promoting the project adaptively while evaluating the response of the natural environment.

Note: The contents described in this paper were carried out in commissioned work from the Ministry of the Environment.

Temporal and Spatial Variability of Macrobenthic Fauna in the High Intertidal Mud Flat of the Ariake Bay

Sakura Maesaki [1], Masumi Koriyama [2], Atushi Nakamura [3], Takuya Ishibashi [3]
[1.] Graduate School of Agriculture, Saga University, [2.] Organization for General Education, Saga University,
[3.] Faculty of Agriculture, Saga University

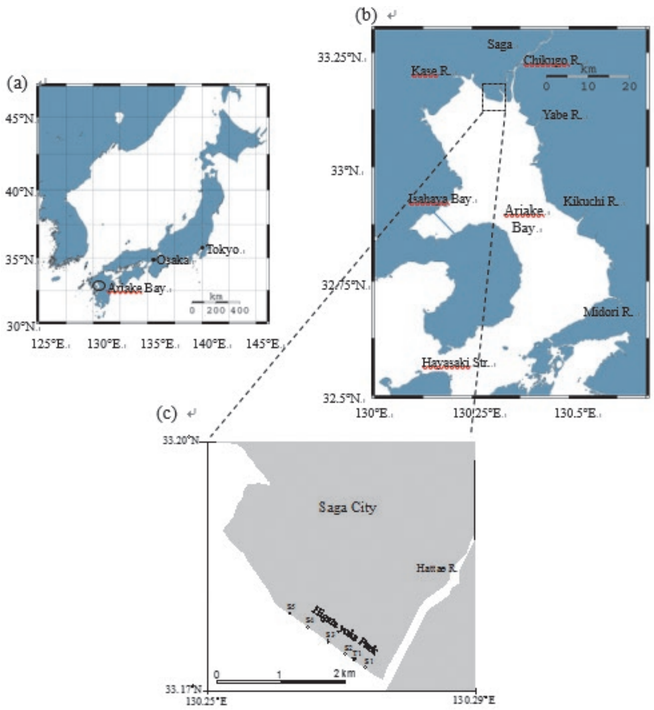
1. Introduction

In Japan, the largest area of mudflats exists in Ariake Bay (96 km in axis length, 18 km in average width, 1,700 km2 in total area, 20 m in average depth) in western Kyushu, Japan. Higashiyoka- higata is located at the northern shore of the inner part of the Ariake Bay in Saga City in the south of Saga Prefecture. Recognized for its value and significance as a habitat for migratory birds, Higashiyoka-higata was included in the List of Wetlands of International Importance (the Rmasar List) in May 2015. It is necessary to preserve the ecosystem and the environment, and to utilize as an environment resource (Wise Use). However, monitoring data for macrobenthic fauna and its habitat environments are insufficient. Therefore, in order to investigate the temporal and spatial variability of macrobenthic fauna and sediment environments in the high intertidal mud flat (Higashiyoka-higata), we conducted ecological field surveys.

2. Material and method

In order to examine the temporal and spatial variability of macrobenthic fauna and sediment environment in Higashiyoka-higata of Saga City, we conducted ecological field surveys. We collected the data on the population densities of macrobenthic fauna and the sediment environments (redox potential, Chl-a, water content, sediment temperature, organic matter content, sediment hardness, and bulk density) every month during April 2015 – June 2017. In the macrobenthic epifauna investigation, five observation sites (S1-S5) were located on the Higashiyoka-higata (Fig.1).

Figure 1 Field survey area



We counted the number of benthic organisms that live on top of the sediment at 10m, 30m, and 60m away from shore of S1-S5 using laser range finder (Bushnell, Elite 1500). On the other hand, in the macrobenthic infauna investigation, we collected the sediments (25×25×15cm^3) at 10m, 30m, and 60m from the shore of T1. Then, sediments samples were sieved with a 1mm mesh sieve and the number of individuals and the species of macrobenthic infauna were obtained.

3. Results and discussion

Figure 2 shows the spatial distribution of population densities of macrobenthic epifauna at S1 -S5 in 2015 and 2016. Throughout the survey period, the population density of macrobenthic epifauna was largest at S3, and was smallest at S1 ($P<0.01$, Tukey-Kramer test). There was a marked difference in the spatial distribution of macrobenthic epifauna at the survey sites in Higashiyoka-higata. That is, *Vertebrate Osteichthyes* such as great blue-spotted mud skipper occupied 54-78% in S1. In S2-S5, *Arthropoda Malacostrace* such as *Uca arcuata* and *macrophthalmus japonicus* occupied 64-99%. The average population densities in 2016 decreased by 10 to 67% compared to that in 2015. Especially in S3, it decreased greatly from 53 to 76%. The enormous amounts of drifting garbage with large floods accumulated on the tidal flat in June - July 2016. At the time of removing the garbage on the tidal flats, Sichimenso community that associated with high density distribution of crab was removed.

Figure 2 Distribution of population densities of macrobenthic epifauna

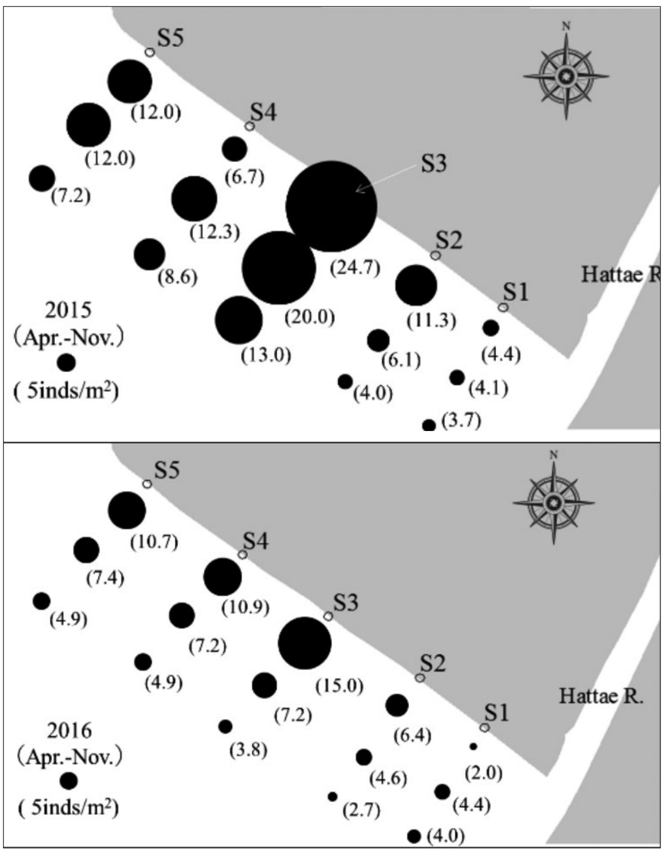


Figure 3 shows the cluster analysis for sediment environment parameters with ward method and the sediment environments in S1-S5. As a result, the sediment environment in the survey area was roughly divided into three clusters; the eastern part (cluster A: S1, S2), the central part (cluster B: S3)

and the western part (cluster C: S4, S5). The population densities of crab were low in cluster A with high organic matter content and low oxidation-reduction potential (S1-S2: Eh=-202.0- +230.6mV(-31.4 ± 14.20mV) IL_{600}=9.27-25.34% (18.07± 0.41%)). On the other hand, in cluster B and C, the sediment environments with high population density of crustaceans were lower organic matter content (IL_{600}= 10.79- 26.48 % (16.90±0.27 %)) and oxidized sediment condition (Eh= -163.8-460.0 mV (84.3±14.45 mV)) compared to that in cluster A. These results suggested that bioturbation of burrowing crabs includes the diffusion of oxygen through burrow walls into anaerobic muddy sediments and its concomitant enhancement of in situ microbial decomposition.

Figure 3 Cluster analysis (a) and sediment environments of site (April 2015 -December 2016) (b)

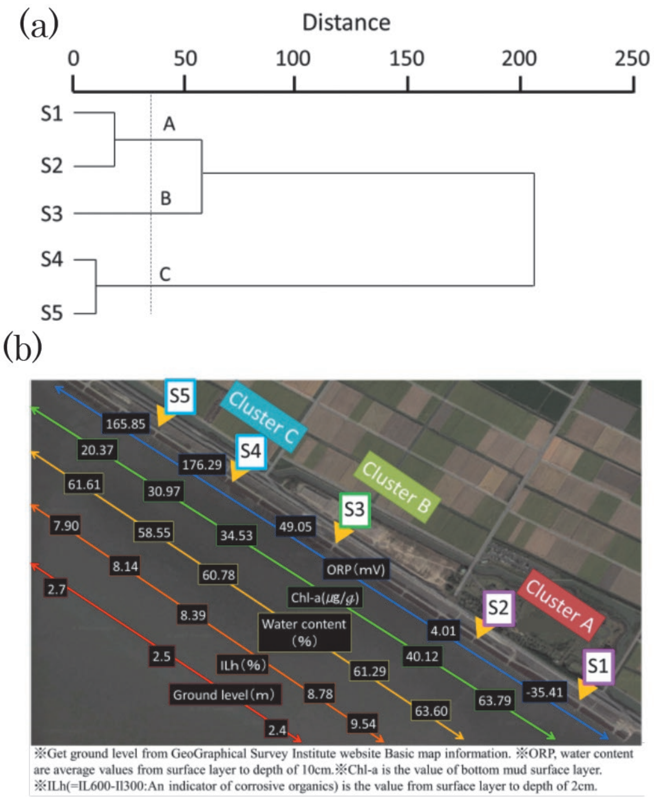


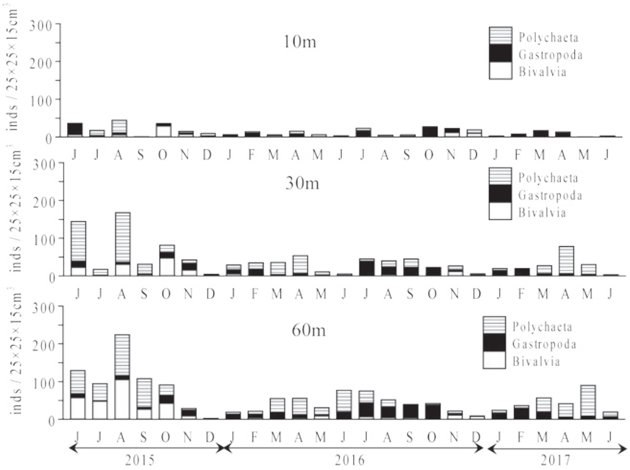
Figure 4 shows the temporal variations of macrobenthic infauna biomass at 10m, 30m, and 60m from the shore of T1. The temporal variation of macrobenthic infauna biomass showed a clear seasonal pattern. That is, macrobenthic infauna biomass tended to increase in summer and to decrease in winter. And, there were significant differences in macrobenthic infauna biomass between the sampling point of 10m and the other sampling points (ANOVA, P<0.05). The macrobenthic infauna biomass in the sampling point of 10m and other sampling points ranged from 1.67 to 44.67 inds / 252515cm^3 (16.61 ±2.92 inds / 252515 cm^3) and 5.67 to 167.33 inds /252515 cm^3 (51.15±6.29 inds /252515cm^3), respectively. The compositions of macrobenthic infauna among sampling points were different (ANOVA, P<0.05). At the sampling point of 10m from the shore, the proportions of *mollusca Bivalvia*, *mollusca Gastropoda,* and *annelida Polychaeta* were 25 %, 43 %, and 32 %, respectively. On the other hand, at the sampling points of 30m and 60 m, the proportion of *annelida Polychaeta* was 61 % and 52 %, respectively. Species diversity of macrobenthic infauna was calculated by the Shannon-Wiener index (H').

$$H' = \sum_{i=1}^{S} P_i \log_2 P_i$$

where S is the number of species and P_i is the proportion of the cover of species within the sample.

As a result, there were no significant differences in the diversity of species among sampling points (ANOVA, P>0.05; 10 m: 1.20±0.55, 30m: 1.27±0.43, 60m: 1.43±0.43). We suggested that the species diversity of macrobenthic infauna was not significantly different in Higashiyoka-higata.

Figure 4 Temporal variations of macrobenthos infauna



4. Conclusion

Spatial-temporal characteristics of macrobenthic communities in high intertidal zone of Higashiyoka -higata were clarified. In the future, we will set survey points covering the entire Higashiyoka -higata, and plan to clarify the relationship between the macrobenthic community and the habitat environment in Higashiyoka-higata.

Evaluation of Burrowing Pattern and Burrow Structures of Crabs in The Muddy Tidal Flat of the Ariake Bay

Takuya Ishibashi [1], Masumi Koriyama [2], Sakura Maesaki [3], Maho Yamaguchi [1], Atushi Nakamura [1], Haruka Ueki [1]

[1] Faculty of Agriculture, Saga University, [2] Organization for General Education, Saga University, [3] Graduate School of Agriculture, Saga University

1. Introduction

Macrobenthos are common in tidal flat and play a key role in purification functions. Organic matter decomposition in sediments may be mediated by the activity of macrobenthos. They can affect sediments chemistry by bioturbation such as burrow activity, tube-building, ingestion, defecation, respiration, and mucus secretion. The process of bioturbation, associated with the burrowing and feeding activities of infaunal macrobenthos, is one of the most important ways in which benthic macrofauna modify the physical, chemical, and biological properties of sediments. One of the small crabs such as *U.arcuata* is often the dominant macrobenthic species and one of the principal agents of bioturbation in intertidal muddy sediments. Therefore, the influence of crab bioturbation on material cycle in intertidal flat caused by their activities cannot be ignored. The objective of this study is to evaluation of burrowing pattern and burrow structures of crabs in the muddy tidal flat of the Ariake Bay.

2. Material and method

Type up of the burrow structure of crabs and observation of burrowing pattern of *U.arcuata* by fixed-point camera were conducted from August to September 2016 in the intertidal zone of Higashiyoka-higata located in Saga City, Saga prefecture, Japan(Fig.1). In order to investigate the temporal variation of burrow number of *U.arcuata*, a 50cm square quadrat was set up in the tidal flat, and a fixing time-lapse camera (Brinno, BCC100) was set up at 1.3 m above the sediment and photographed at intervals of 30 minutes.

Figure 1 Sampling point

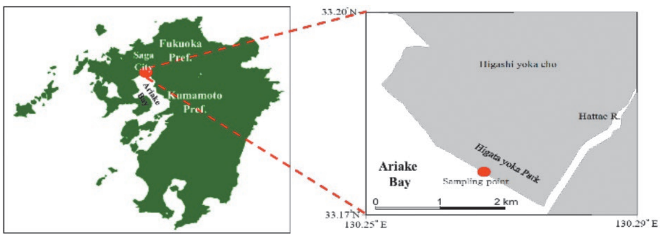


Figure 2 Burrowing pattern

*Burrows that exist on that day (Existent)
*Burrows that exists from the previous day (Survive)
*Burrows that new does not exist until the day before (Newborn)
*Burrow that collapsed had been there the day before (Broken)

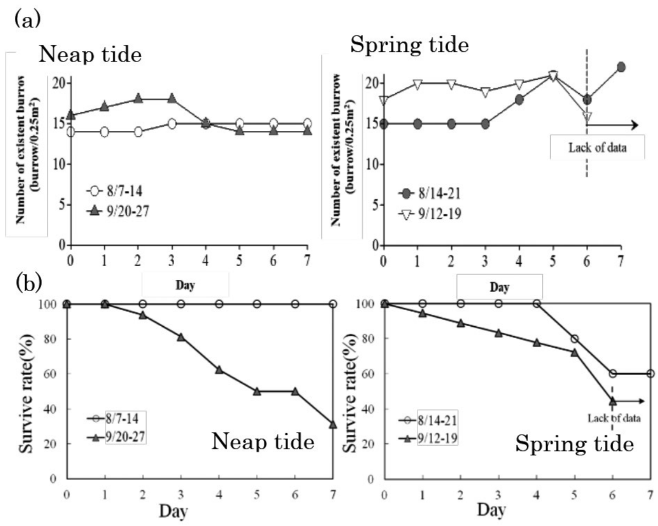
Burrowing pattern was analyzed and was classified into 4 types; existent, survive, newborn, and broken (Fig.2).

Next, we investigated the crab burrow structure. Burrow casts were obtained using polyester resin (PC-747S, Kyusyu Toryo Co.,Ltd.). Liquid resin was poured in several burrows. After several 3 hours, resin casts were pulled out and recovered. In the laboratory, burrow's depth, length, and surface area that covered aluminum foil with resin casts were calculated by image analysis using Image J. Volume was detected water volume spilled out from container into resin casts.

3. Results and discussion

Fig.3 shows the temporal variations of existent number and survive rate of *U.arcuata* burrows at neap and spring tide. The number of existent burrows during neap and spring tide ranged from 14 to 18 hole/50×50cm2 and from 15 to 22 hole/50×50 cm^2, respectively (Fig.3(a)). The existent burrows number did not change greatly for 1 week in neap and spring tide. On the other hand, except the neap tide in August, burrows survived 31-60 % after 1 week (Fig.3 (b)). These results suggest that more than half of *U.arcuata* burrows broke in 1 week and simultaneously the same number of newborn burrows as destroyed burrows were created. Because the habitat area of *U.arcuata* is the high intertidal zone, flooding time is short during neap tide. Thus, there was little turnover of the burrows during neap tide in August due to the dry sediment condition and the high sediment hardness. However, the water content of sediment became high and sediment hardness was small in neap tide of September, because a total of 190 mm of heavy rain fell on September 18th and 19th. As a result, burrows turnover might be accelerated in neap tide of September.

Figure 3 Temporal variations of existent number (a) and survive rate (b) of *U.arcuata burrows* during neap and spring tide



A total of 46 burrow casts were obtained, which *U.arcuata* and *C. dilatatum* burrow casts were 28 and 18, respectively. The carapace width and wet weight of *U.arcuata* and *C.dila-*

tatum were 9.0-23.1mm (18.17±0.76mm) and 0.54-13.3g (2.84±0.48g), and 3.6-18.7mm (12.10±1.03mm) and 0.19-3.01g (1.31±0.21g), respectively. There were significant differences in body size (carapace width and wet weight) between *U. arcuata* and *C. dilatatum* (t-test, $P<0.05$). Structurally, the burrows consisted of J-shape type and I- shape type (Fig. 4, Table 1). In the case of *C. dilatatum*, 65.4% of burrows were J-type and 26.9% of burrows were I-type. On the other hand, J-type and I-type of *U. arcuata* burrows was 50.9% and 42.4%, respectively. The burrows depth of *U. arcuata* and *C. dilatatum* ranged from 3.5 to 18.3cm (7.2±0.7cm) and from 3.3 to 14.4cm (7.9±0.9cm), respectively. The relationships between carapace width and burrow structure parameters were found (Fig.5). That is, depth, volume, and surface area of burrow tended to increase exponentially with carapace width.

Figure 4 Shape type of burrow

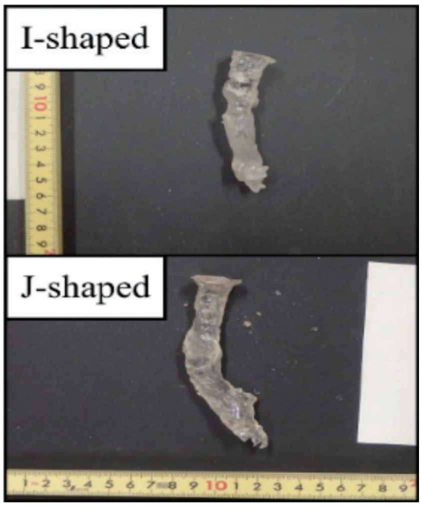


Table 1 Parameters of burrow structure

	BD (mm)	BV (cm^3)	Bd (mm)	BA (cm^2)
C. dilatatum	14.14±1.39 (4.72-26.77)	17.33±3.20 (6.0-47.0)	79.39±9.16 (32.88-144.37)	34.61±5.23 (12.81-60.46)
U. arcuata	13.42±0.77 (6.66-22.19)	15.41±2.05 (2.0-31.0)	71.87±6.96 (34.69-182.90)	42.67±3.90 (12.53-76.96)

* BD: open diameter of burrow, BV: burrow volume, Bd: burrow depth, BA: surface area of burrow

Figure 5 Relationships between crab carapace width and burrows structure parameters

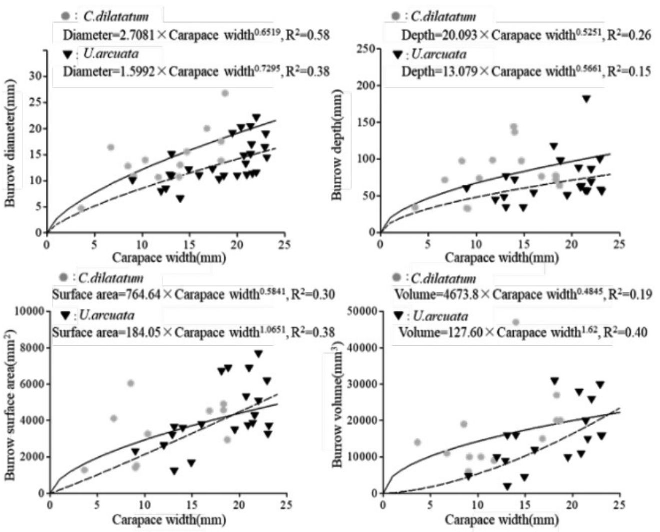


Table 2 shows the turnover rate and the open diameter of newborn burrow of *U.arcuata* and the estimation of soil-turnover amount by bioturbation of *U.arcuata* during neap and spring tide. The soil-turnover amount was calculated by turnover rate, open diameter of newborn burrow, and the regression equations among carapace width and open diameter and volume of burrow. The soil-turnover amount of spring tide period was higher than neap tide period. In August and September, soil-turnover amount of spring tide period increased to about 23 times and 1.3 times that of neap tide period in August and September, respectively. The calculated soil-turnover amount of *U.arcuata* for 1 week corresponded to 0.4-11.0% (5.5±3.8%) of muddy sediment layer ranging 0 to 10cm depth. We found that that crab bioturbation greatly influences the material cycle of mudflat sediment in Higashiyoka-higata.

Table 2 Estimation of soil-turnover amount by bioturbation of *U.arcuata*

	Turnover rate of newborn borrow ($ind/m^2/day$)	Open diameter of newborn borrow (mm)	Soil-turnover amount (cm^3/m^2)
Aug.7-14 (Neap)	0.57±0.57	14.2±0.19	485
Aug.14-21 (Spring)	10.86±5.97	15.5±0.29	11,256
Sep.12-19 (Spring)	4.57±1.84	17.1±0.36	5,908
Sep.20-27 (Neap)	5.14±1.68	14.5±0.74	4,584

4. Conclusion

In this study, we analyzed the structure and formation pattern of crab burrows during the summer. We estimated the soil-turnover rate by bioturbation of *U.arcuata*. The soil-turnover amount during the spring tide period was larger than the neap tide period, suggesting the influence of the frequency and duration of flooding due to tides and rainfall.

The Transition of River Morphology and Minor Restoration in the Kamisaigo River

Takuma Ohno [1)], Hironori Hayashi [2)], Yukihiro Shimatani [2)]
[1)] Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University, Japan
[2)] Faculty of Engineering, Kyushu University, Japan

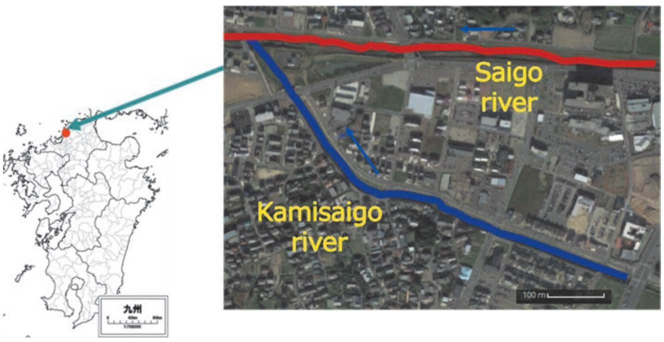
1.INTRODUCTION

In recent years, it is said that various physical environment is important for habitats of fish. Many river restoration works have been promoted in japan. In 2007, technical standards for river channel planning on small and medium rivers was notified by MLIT (Ministry of Land, Infrastructure and Transport). By this notification, it has been promoted the creating of new rivers throughout in Japan. However, there are many failed examples due to the problems caused by our misunderstanding about river flow dynamics. For example, channel narrowing changes the hydraulic environment in river and the habitat constitution living creatures. For that reason, effective river restoration method is not well established. Especially river environment in urban areas is one of the most important tasks due to loss of longitudinal connectivity and many other influences. Aims of this study are to report the results in detail recorded about minor restoration methods in river and the process of river itself.

2.TARGET RIVER

The project site is in northern part of Kyushu Island, located in the south west part of Japan (Fig.1). The Kamisaigo River runs through urbanized areas as one of the tributaries of the Saigo River. The size of a catchment area is 1.88km^2. The Kamisaigo river is a sand river derived from granite. The Kamisaigo river restoration project was started in 2011, and construction work was completed in 2013.

Fig.1 Target river



3.Research area& method

In this study, we surveyed transition process of river innovated small restoration methods in The Kamisaigo river from 2011 to 2016 in autumn. The Kamisaigo river was executed river restoration over about one kilometers, where installed various minor restoration at each section. We divided the sections where each minor restoration method is being constructed in the Kamisaigo river by about 50 m intervals, and set four points as the research section (called St. A to D from the downstream) and conducted a survey. The minor restoration method being installed in each section is as follows. (Fig.2 Research area)

St.A: Low waterway meandering and log structure
St.B: Low waterway meandering and big rock
St.C: Low waterway meandering
St.D: Low waterway meandering, big rock and solid bank

And we surveyed physical environment survey, and proportion of each habitat. Each research method is as follows.

3-1. proportion of each habitat

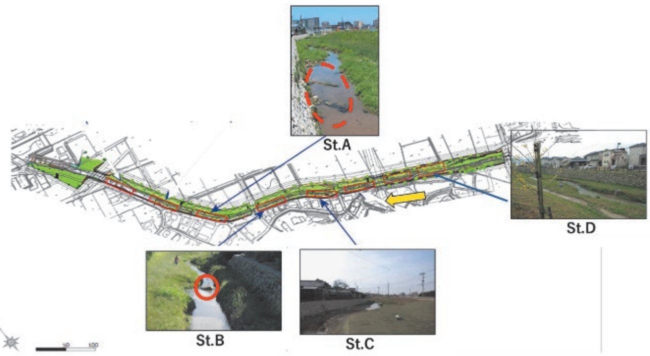
We classified the environment within each St. into 5 habitats based on the landscape feature.

5 habitats: rapids(riffle), runs(riffle), glides, pools, shallows(slacks)

3-2. physical environment

We researched flow velocity, depth of water, basin width, size of river bed material.

Fig.2 Research area



4.RESULT

The result of the proportion of each habitat became as follows.

4.1 St.A

Fig.3 and Fig.4 show the transition of the habitat map of St.A and the transition of each habitat area. In the section where the log structure was installed from May 2012, the effect of keeping the stream width was confirmed. Habitat diversity was improved around the log structure. In particular, the proportion of pool remarkably increased by having installed the log structure. Many log structure have been installed from 2012 to 2014, habitat diversity also improved. However, most of these was lost by the flood, and only three remain now. Also, between 2014 and 2016, channel narrowing was occurring greatly.

Fig.3 The transition of the habitat map of St. A

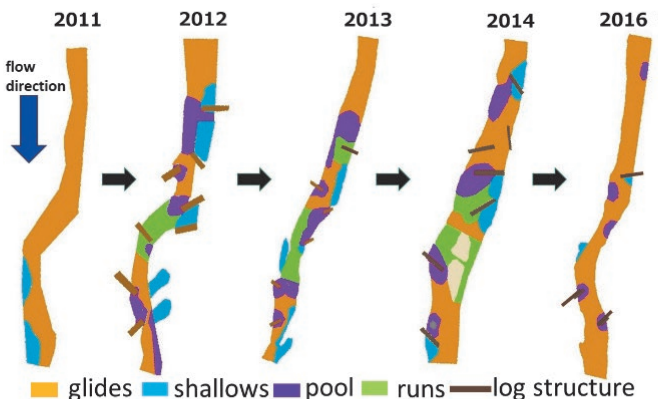
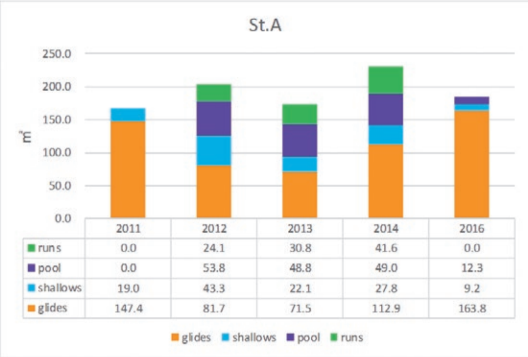


Fig.4 The transition of each habitat area of St. A



	2011	2012	2013	2014	2016
runs	0.0	24.1	30.8	41.6	0.0
pool	0.0	53.8	48.8	49.0	12.3
shallows	19.0	43.3	22.1	27.8	9.2
glides	147.4	81.7	71.5	112.9	163.8

4.2 St.B

Fig.5 and Fig.6 show the transition of the habitat map of St.B and the transition of each habitat area. In the section where the big rock was installed, the effect of keeping the stream width was confirmed. Habitat such as pool and shallow was formed only around the big rock. The upstream of the big rock was rapidly expanding, so it formed run in 2016. However, one of the two big rocks were gradually buried in the soil and the effects ceased.

Fig.5 The transition of the habitat map of St. B

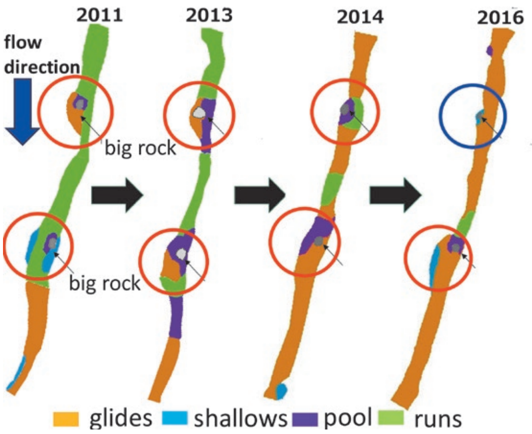
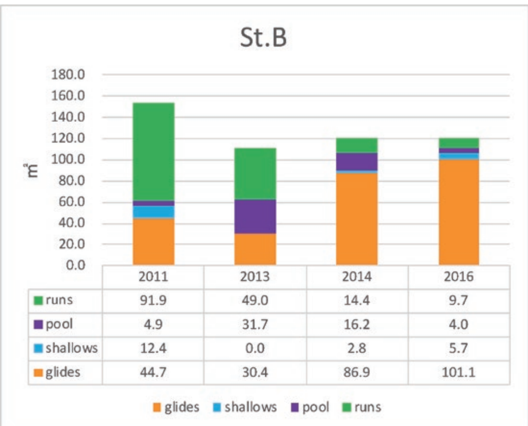


Fig.6 The transition of each habitat area of St. B



	2011	2013	2014	2016
runs	91.9	49.0	14.4	9.7
pool	4.9	31.7	16.2	4.0
shallows	12.4	0.0	2.8	5.7
glides	44.7	30.4	86.9	101.1

4.3 St.C

Fig.7 and Fig.8 show the transition of the habitat map of St.C and the transition of each habitat area. In the section where the stream flow path was artificially constructed, the flow path was not apt to fluctuate, and stabilize the shape of the stream flow path. By having decreased proportion of shallow and disappeared pool, habitat diversity became monotonous.

Fig.7 The transition of each habitat area of St.C

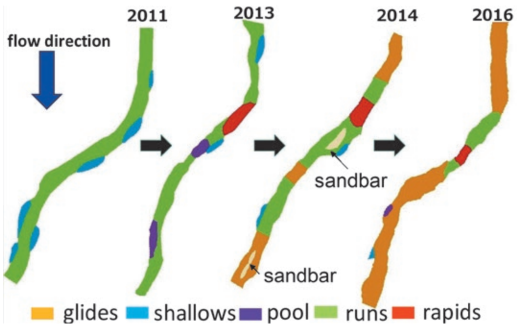
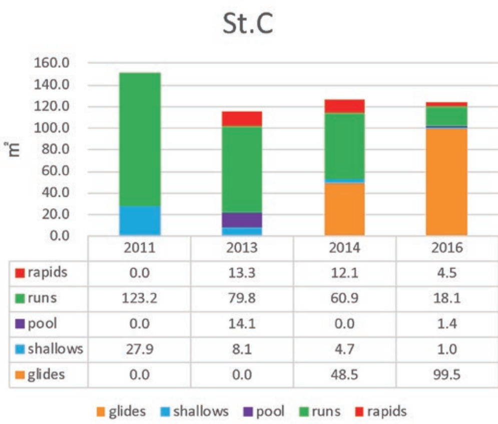


Fig.8 The transition of each habitat area of St.C



	2011	2013	2014	2016
rapids	0.0	13.3	12.1	4.5
runs	123.2	79.8	60.9	18.1
pool	0.0	14.1	0.0	1.4
shallows	27.9	8.1	4.7	1.0
glides	0.0	0.0	48.5	99.5

4.4 St.D

Fig.9 and Fig.10 show the transition of the habitat map of St.D and the transition of each habitat area. In this section, solid bank and big rock was installed in 2012. The solid bank has the effect of diversifying the flow of water at the time of the flood. Although it is only data for two years, the channel narrowing was not occurred much. The river channel meandered in two years. About Habitat, Pool was formed around the big rock. In addition, pool and riffle was formed on the downstream. In 2016, comparing with all section, habitat of St.D is the most diverse section.

Fig.9 The transition of the habitat map of St. D

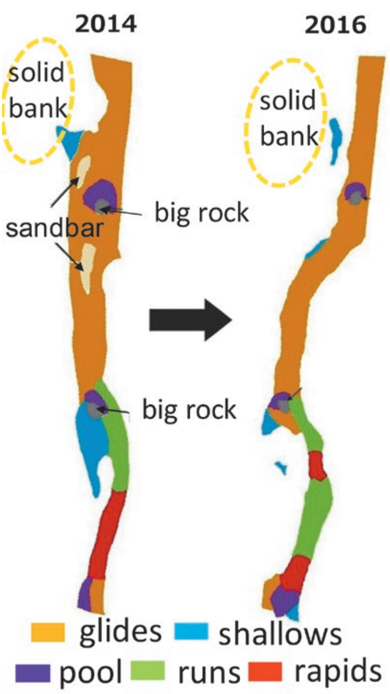
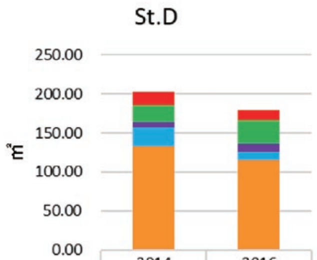


Fig.10 The transition of each habitat area of St. D



	2014	2016
rapids	17.47	13.86
runs	21.01	29.31
pool	6.90	11.16
shallows	23.92	9.76
glides	132.82	115.58

glides shallows pool runs rapids

5.DISCUSSION

5.1 the transition of every station

Fig.11, Fig.12 shows the transition of river width in every station and the transition of proportion of pools. From the Fig.11, the channel narrowing was occurred in every station with taking about three years, after that the river width was relatively stable. After three years, the river width tends to transition while repeating to occurred the river width widening after flood period. In the Kamisaigo River, the river width was seemed to stabilize at about 2.5 to 3.5 m from the graph. Also, from 2013 to 2016, proportion of pools area in every station decreased. in other words, this river after river restoration tended to have monotonous Habitat. In St.A and St.B, around the minor restoration method such as big rock and log structure habitat diversity was improved and the stream width had keeping. Also, in St. D, habitat diversity was maintained overall. It was confirmed that the minor restoration method has the effect of keeping the river width and habitat diversity was improved. And it was suggested that there effects due to the diversification of water flow by the minor restoration method. The effect of each minor restoration method is discussed in the next chapter.

Fig.11 The transition of river width in every station

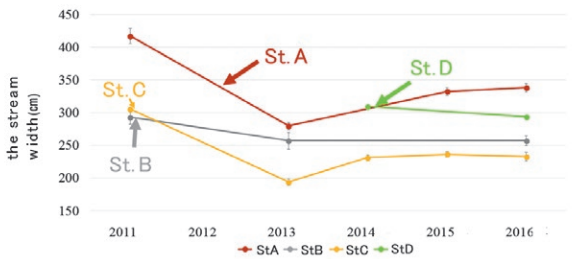


Fig.12 The transition of proportion of pools

5.2 The effect of minor restoration method

5.2.1 The effect of log structure

The log structure that had been introduced at the Kamisaigo river has been installed at various angles to the flow direction. For log structure, it was suggested that the formation of habitat and the effect of maintaining river width vary depending on the angle. According to Hayashi 's research, it is said that the direction of flow of log structure changes in the direction of installation, so that it forms pool downstream if it is installed in upstream direction and it forms shallow downstream if it is installed in downstream direction. In this study, most of the log structure installed in upstream direction was broadly formed pool from just under the log structure to the downstream. The log structure installed in downstream direction has a slow flowing place in the downstream part although it overlaps with the deep part, and it was concluded that it supported Hayashi's research. (Fig.14,15) In addition, it was confirmed that most log structure formed pool under there. It was suggested that the river bed was dug by the dragging power and pool was formed because the water flows under the log structure. Regarding the maintenance effect of river width, when installed in the upstream direction, the flow changes to a flow that scrapes the opposite bank side. Therefore, it suggested that the opposite bank side was scraped and the local widening of river width occurred at the downstream side. Also, when the log structure installed in downstream direction, the flow changes to a flow that scrapes the same bank side. Therefore, it was suggested that the downstream widens locally. Also, it was found that log structure tends to be lost when flooding.

Fig.14 Diversification of water flow by log structure (upstream direction)

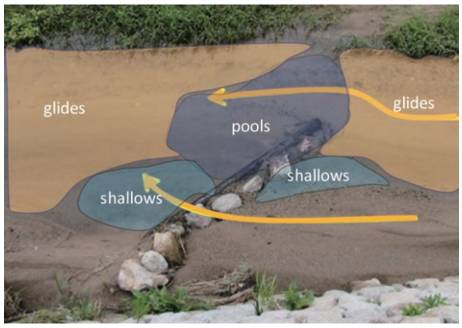
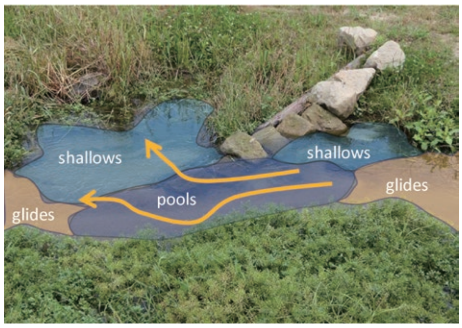


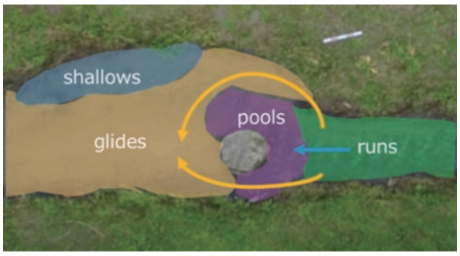
Fig.15 Diversification of water flow by log structure (downstream direction)



5.2.2 The effect of big rock

When the big rock is in the center of water route, the flow of water changes to downward flow of the big rock front and curved flow along the big rock side (Fig.13). As the descending flow collides with the river bed, the front of river bed gravel is rolled up, so that a localized pool can be formed. And the curved flow erodes the river bank by its flow and prevents channel narrowing. From the above it was suggested that the formation of habitat by the introduction of big rock forms partial scouring when it is in the center of water route. And it was suggested that regarding the river width maintenance, the closer to the center of water route, the more remarkably the effect is exerted and the range of influence is widened. When big rock is separated from the center of water route, shallow was formed partially. However, such big rock originally had on the center of water route, which has been separated from the center of water route due to transition of the river channel. Therefore, as time passed further, there was concern that it would be buried by channel narrowing. It was suggested that installed the rock needs measures such as closing the rock to center of water.

Fig.13 Diversification of water flow by big rock



5.2.3 The effect of solid bank

For solid bank, it was suggested that influencing the flow at the time of flooding led to maintenance of river width and improve habitat diversity. In St. H, placing soil discontinuously installs a section that has a smaller cross-sectional area than other sections. In St. H, sections with smaller cross section than other sections have been installed by arranging solid bank discontinuously (Fig.16, Fig.17). For the flow during floods taken at the same time, we compared the St. H with the other section downstream (Fig.18, Fig.19). During the flooding, the downstream section was monotonous along the revetment. In Compared to downstream section, the flow of water route in St.H was changed by the solid bank at the time of flooding. As can be seen from Fig.16, in the section where solid bank is installed, the right bank was shrunk when flooding, narrow sections of river width and wide sections had been made. Also compared to St.B,the flow also was affected at the time of the flood because of the installed the larger rock. Therefore, the flow at the time of flooding complicated, and it seems that the same effect as other minor restoration methods was demonstrated. However, in this study, I could only grasp that solid bank had an effect on the flood. Future task is to verify the influence of flow by solid bank in detail by hydraulic analysis or the like.

Fig.16 Position of solid bank and big rock in St.H

Fig.17 Position of solid bank and big rock in St.H

Fig.18 Photograph of downstream section during flood

Fig.19 Photograph of St.H section during flood

6.CONCLUSION

On the Kamisaigo river, after the restoration, it was revealed that the river width occurred channel narrowing and Habitat diversity became monotonous as time goes by. In the section where the stream flow path was artificially constructed, the flow path was not apt to fluctuate, and stabilize the shape of the stream flow path. In addition, in the section where the minor restoration method was installed, the effect of keeping the river width was confirmed. Also habitat diversity was improved around the minor restoration method such as big rock and log structure. However, it was suggested that the minor restoration method requires periodic maintenance. The section installed the solid bank of a minor restoration method affected keeping the stream width and habitat diversity the entire section not only around the solid bank. The solid bank has the effect of diversifying the flow of water at the time of the flood, so it was inferred having the effect of keeping the stream width and habitat diversity. However, since it is not find out in this research so far, I think that it is necessary to conduct a hydraulic analysis in the future.

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Practice of Rebirth of the Tora Area in a Special Emergency Project to Cope with Severe Disasters (abstract)

[1]Kiyofumi Kobayashi, [2]Hironori Hayashi, [2]Yukihiro Shimatani
[1]Kyushu University Graduate School of Engineering/Daishin Co.,Ltd, [2]Kyushu University Graduate School of Engineering

In the Sendai River basin which flows in Kagoshima prefecture, there was recordable heavy rain mainly in the northern part of the Satsuma region from July 19th to July 23th 2006. Total rainfall for 5 days exceeded 1000 mm at rainfall observatory. In particular, the damage of Satsuma Town was enormous. There were one person dead and three minor injuries, 214 completely destroyed buildings, 367 semi-collapsed buildings and 232 inundated buildings. This flood damage was mainly caused by unprecedented heavy rain. In the downstream part of the Satsuma Town Torai area, there was a narrowed section where the river channel was curved large. It was pointed out that rising of the water level of this greatly curved river channel part is one of the factors which caused the damage to be expanded.

On the other hand, similar floods had occurred in the area in 1972. As a result, the residents had a strong distrust against river administrators (MLIT: Ministry of Land, Infrastructure, transportation and Tourism). This project was accompanied by a remarkably large scale renovation that cuts waterways of about 250m in extension, 65m in average channel width and 700 thousand m^3 of excavated sediment. In addition, the project site is adjacent to shopping districts and residential area in the Satsuma town. For this reason, we had to fully consider the impact of river improvement project extending to an extension of 2.0km on the lives of the local residents. For that reason, it was necessary to inherit the history and culture of the area, to mitigate the impact on natural landscapes and ecosystems, and to fully consider the utilization methods after the reconstruction in advance.

In this paper, we introduce the Sendai River river refurbishment project which was carried out by participating residents in this Torai area. Specifically, the concept of planning design, the landscape hydraulic model experiment used to study the flood effect and the natural environment accompanying the division channel opening, the consensus formation process with the local residents, the maintenance management after the completion and the utilization I will introduce the situation in the local area.In the area, floods occurred two weeks after the completion, but the water level observation station supports the safety of the region, such as a water level drop of 0.8 m is confirmed. After that, six years have elapsed, flooding flows repeatedly from 3 to 5 times each year in the waterways, and now a new wetland space to be a habitat area is also created. In the 2.0 km river refurbishment section, a masonry protection stone utilizing construction-generating materials, a waterfront walking path incorporating universal design, a waterfront space that thoroughly preserves the sea, the foothills and the waterfront are also completed, and local residents and NPOs There are also many regional event by event. With this project as the opportunity, moves are also underway with the view of regional creation, such as expansion of neighboring prefectural parks, community development connecting creeks and towns, tourism projects to experience the nature of the Sendai River basin.

Study on River Improvement Technology in High Gradient River Using Masonry Groin For Environmental Conservation (abstract)

[1]Muneyuki Nakaji, [2]Rei Itsukushima, [3]Yukihiro Shimatani
[1]Department and Urban and Environmental Engineering,Kyushu University, [2]Department of Decision Science for sustainable Society, Kyushu University,
[3]Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University

Nature friendly river improvement technology of midstream is generally established. However, the technology of high gradient river or mountainous stream is not established due to large velocity and attractive force during flood. We studied to design nature friendly river channel of the Oide River (located in Nagasaki city) which is steep high gradient river.

We tried to design a river channel that can flow flood occurred once in thirty years in safety and create habitat of aquatic biota. We used masonry groin as a riverbank defense method. However, groin design technology system is not established.

Accordingly, we conducted physical, movable-bed model. The physical model was scaled 1:50 applying the Froude's law. To investigate energy dissipating effect of groin structure and fluctuation of river bed after the flood, the experiments combination is conducted 24 experiment cases. We conducted experiments changing of left bank groin size (4.0m,7.3m,not installed), groin distance (15m,20m,25m,30m) and occurrence probability of flood (1/30 and 1/10). Regarding the right bank, a groin of sufficient size was necessary to protect the right bank river bed. Accordingly, the right groin size was unified at 8.8m in all cases. Measurement items are water level which are measured at intervals of 20m at three points on the left bank, the center and the right bank, flow velocity which are measured between groins at the three points similar to the water level and photogrammetry to evaluate fluctuation of river bed.

As a result, left bank groin size of 7.3m was unsuitable because inundation occurred in the upstream part of the right bank regardless of groin distance. The phenomenon is thought to be due to the fact that the river bed rose locally and the flow cross section decreased compared to the groin size is 4.0m when left bank groin size is 7.3m. The right bank flow velocity of the case which left bank groin size are 4.0m and 7.3m were smaller than that of the case which left bank groin is not installed regardless of measurement point. This means that the flow velocity reduction effect by the left bank system also affected the flow velocity on the opposite bank. The case which left bank groin is not installed, excessive river bed scour was occurred at the left bank river bed. Therefore, we determine the left bank groin size of 4.0m as most appropriate. To decide optimal distance of groin, we evaluated the experiment in the case of left bank groin size as 4.0m.

As a result, in the case of 25m water route formed after flood was moderately meandered (sinuosity:1.06) and various habitats such as riffle-pool structure were expected to form after flood. Finally, from the viewpoint of flood control, river bed scour and environment, we decided that the left bank groin size of 4.0 m, the right bank groin size of 8.8 m and the groin distance of 25m are optimal as the structure of the groin system. As a result of this study, it is revealed that masonry groin is important element technology to design the environment consideration river channel in high gradient river.

Should We Go Alone, if We Want to Go Fast? Should We Go Together, if We Want to Go Far? A Discussion of Sustainable Cooperative Efforts among Registered and Non-Registered Wetlands (abstract)

[1]Hiroshi Tomida, [2]Eiji Sawada

[1]Manko Waterbird and Wetland Center, [2]Faculty of Economics, Kyushu Sangyo University

Old African proverb says "If you want to go fast, go alone. If you want to go far, go together." Could we apply this proverb to the wetland conservation cooperation? Ramsar sites registration increases concerns about the wetland and biodiversity conservation in the registered area, but is also expected to bring various regional financial profits ranging from increasing tourism revenue, community development to promotion of persons who have significantly contributed. In Japan, By some aspects, they might be competitors and by some aspects they might be cooperators. Then, how does each wetland develop a cooperative relationship? And in what case could they develop the sustainable cooperative relationship? We classify the stakeholder structures into four cases, and examine which case could explain the actual wetland conservation cooperation well and in which case could sustainable cooperation be developed. Classification of stakeholder structures is based on two different properties of the regional profit of Ramsar sites registration. One is the correlation between profit and order of registration. If the registration profit has the "first in time, first in right" structure, then earlier registered wetlands would earn more profit and registration would become less attractive for the non-registered wetlands. The other is the correlation between profit and the number of registered wetlands. If increasing number of the registered wetlands would make the Ramsar sites less distinctive, smaller number of the Ramsar sites would bring greater profits to the registered wetlands. From these two properties, we have four stakeholder structures; Case1: earlier registered wetlands earn greater profit and growing number of the registered wetlands increase the profit, Case2: earlier registered wetlands earn greater profit but growing number of the registered wetlands decrease the profit, Case3: earlier registered wetlands earn fewer profit and growing number of the registered wetlands increase the profit, Case4: earlier registered wetlands earn fewer profit and growing number of the registered wetlands decrease the profit. Within these four structures, both cooperation between registered wetlands and non-registered wetlands, and among non-registered wetlands are only expected in Case 3. Combining the field studies in Ariake sea and Okinawa islands, we apply every cooperation type in study area, international cooperation, national cooperation, local cooperation, to one of four stakeholder structures, respectively. As far as our studies, while many cooperation among registered wetlands and cooperation among geographically apart areas are observed, there are few regional cooperation. In geographically close areas, their profits are strongly linked and the both effect of the order of registration and the number of registered wetlands would become significant. Hence, regional cooperation has the Case1 or Case 2 stakeholder structures and that is the reason why only few cooperation are observed. Based on the above discussions, let us again consider the proverb noted in the beginning. By arranging in the context of wetland conservation cooperation, we can say "If you want to be registered earlier, then you would go alone without any cooperation among non-registered wetlands." And further can say "If you want to be registered together, then you would develop a cooperation between registered wetlands and non-registered wetlands." And finally, we have to add extra, "If you want to develop both cooperation between registered wetlands and non-registered wetlands, and cooperation among non-registered wetlands, then policy makers should redesign the stakeholder structures to make Ramsar site registration is profitable for later registered wetlands as well as the earlier registered wetlands."

Develop and Startup ESD Activities for Rehabilitation of Mangrove Forests in Malaysia (abstract)

Takuji Arai

Japan-Malaysia Association

Since year 1995, Japan-Malaysia Association (JMA) has been planting depterocarpaceae tree species for reforestation purpose in Sarawak, Malaysia. Together with the Forest Department of Sarawak and local communities, we have been conducting not only tree planting but also maintenance, raising seedlings and also environmental education activities. Based on this experience, JMA is planning to develop and startup ESD activities for sustainable rehabilitation program of mangrove forests in cooperation with local universities and communities in Malaysia.

At this moment, Kuching Wetland National Park, Sarawak and Merbok Mangrove Forest Reserve, Kedah are proposed area for our project.

Kuching Wetlands National Park, located 30 km from Kuching city, was gazette as national park in 1992 and covers an area of 6,610ha. The park is composed of coastal, marine and freshwater ecosystems.

The park is home of at least three predominantly arboreal primates, the endangered proboscis monkey, the long-tailed macaques and the silvered langurs. White-bellied sea eagles, mudskippers and horseshoe crabs are also present. Otters and the Irrawaddy dolphins can also be sighted. On nearby Mount Santubong, hornbills can be seen.

Merbok Forest Reserve is located about 1 hour drive north from Penang. Merbok F.R., which is made up of 18 compartments with a total area of 4,176 ha, is under the jurisdiction of the Kedah Forestry Department.

Merbok F. R. consists of 32 species of trees exclusive to the mangrove ecosystem, and has been considered as one of the most floristically diverse mangrove sites in the world. The FR also harbors a diverse array of fauna, most prominent are its bird communities where about 80 species have been recorded including migratory species. Other inhabitants include several species of primates, reptiles and a high number of commercially-important aquatic species occupy the estuarine river ecosystem.

In the both area, the mangrove and river ecosystems play an important role in providing livelihood for fishermen and the surrounding village communities. Some of the villagers and fishermen comprise of low income households. However some parts of mangrove forests have been degrading in effect of urbanization and development in the both area and it has been big concern on sustainability of ecosystem and biodiversity in the future.

We have had discussion with experts of Universiti Malaysia Sarawak (UNIMAS) and RCE Penang, Universiti Sains Malaysia (USM) several times for the future cooperation. At this moment, we are planning to start restoring forest in Kuching Wetland National Part with the Forestry Department, UNIMAS and local communities from next year.

Potential activities are as follows;

1. Reforestation activities at degraded sites with participation of local communities.
2. Establish mangrove seedling nursery as a stock for mangrove reforestation sites. The project's nursery can also be a supplier of mangrove seedlings for other mangrove reforestation projects in surrounding area.
3. The proposed reforestation project can be a platform to train local communities in silviculture, tree care, forest management, communication skills, and other relevant skills.
4. The proposed reforestation project can be an educational tool for local schools, visiting schools and universities to learn about mangrove ecosystem and conservation.
5. The proposed reforestation project can be used to conduct outreach and awareness programs to visitors, and the public at large.
6. The proposed reforestation project can be a platform for ecotourism and contribute to the growing ecotourism activities.
7. Establish a mangrove environmental/educational gallery and it will be the center of ESD program in the future.
8. Hold seminars at university to share experience with schools, NGOs and other related bodies and print leaflet for publication.

Continuable Hydrological Monitoring with High Data Availability (abstract)

[1]Yoshiyasu Fujimura, [2]Yoshiki Yamamoto
[1]R and D center, [2]Nippon Koei Co., Ltd.

Wetland play important rule such as supporting biodiversity, hydrological buffer, and climatic buffer. Hydrology is the driving force behind wetlands and their important functions, while it is quite variable because input/output of water can be affected by both natural and anthropogenic factors in and around wetland. Therefore, hydrological monitoring is essential for wetland management.

Most important requirement for long term monitoring is continuities in terms of cost, measurement facilities, and technical easiness. If measurement facilities are fragile, continual data collecting is difficult and frequent maintenance should also rise running cost. Technical easiness is particularly important in case of monitoring by non- professional.

After data collecting, the data should be used for evaluating wetland hydrological condition. It is preferred that evaluating whole wetland hydrology based on data from limited observation point. To make it possible, water flow in whole wetland should be considered when determining location of observation point.

In this presentation, we introduce hydrological monitoring system which is developed for a small peatland, Nishibetsu mire, as an example. Water table measurement have been carried out in cooperation with local government officer and professional engineer in this mire.

Nishibetsu mire is located in cool temperate area in northern most island Hokkaido. The mire has an area of about 7.4 ha, lies at altitude 30-35 m, and receive avg. 1135 mm/yr of precipitation. The mire is designated as natural monument as a habitat of endangered tree species Betula ovalifolia. Therefore, local town should keep mire condition which allow the tree can maintain its population. The aim of hydrological monitoring is to capture the hydrological change in the mire, and to provide suggestion about factor of hydrological change for further detailed investigation.

To consider contents of monitoring and location of observation, following investigations were carried out: ground level survey, water depth measurement in many point, measurement of ground level fluctuation, reconnaissance to seek in/outflow path, seepage/spring of water, structure which affect water flow such as drainage ditches and sheet pile. Based on these investigation, we determined contents and location of monitoring as follows: groundwater level measurement at only two observation point. One observation point is located at area where hydrological head is highest (higher observation point, HOP), while the other point at area where hydrological head is lowest (lower observation point, LOP). Hydrological component at HOP must be simple because HOP receive water from only precipitation. Therefore, monitoring data at HOP is easier to interpret than other area where hydrological component is complex. Data at LOP coupled with HOP is expected to be used when considering whole wetland hydrology such as water retention regime.

To capture the hydrological change from monitoring data, we developed a coupled tank model which simulate water level fluctuation at both HOP and LOP. This tank model is calibrated by two series of observation data, making a small improvement in the fault of traditional tank model which use many physically uncertain parameters against only one series of calibration data. Using this model, we can interpret the monitoring data regardless of amount of precipitation.

To get suggestion about factors of hydrological change, we develop a three- dimensional ground water flow model which simulate not only water level at HOP and LOP but also water flow of whole wetland. And additional simulations are carried out under the possible situation. For example, if one of the surrounding ditch will be deeper, water level at HOP will be drawdown whereas that at LOP will not change.

Such scenario analyses greatly improve monitoring data availability.

Water Quality of Malaysian Tropical Reservoir Associated with Aquaculture Activities (abstract)

Muzzalifah Abd Hamid, Harith Mokhlas, Siti Norasikin Ismail, Mashhor Mansor
School of Biological Sciences, Universiti Sains Malaysia

In October 2008, a large scale of aquaculture project was initiated at tropical Temengor Reservoir, Malaysia due to its vast area and favorable environmental conditions. The fish cage culture was operating within 100ha of the Aquaculture Industrial Zone (AIZ). The zone was identified by Perak Fisheries Department. The objective of the aquaculture industry at Temengor Reservoir is to produce a high quality of tilapia fish species that can be commercialized to local and international high- profit market. Although the positive economic impact of aquaculture is well acknowledged, however, the associated negative impacts on the environment cannot be overly emphasized. Without proper planning and management, the establishment of aquaculture could degrade the surrounding environment. Based on previous studies, aquaculture activities may contaminate the lakes and reservoirs due to the water discharge from the cage itself which contains a high concentration of nutrients and suspended solids. Therefore, the aquaculture sector must be well-managed and monitored to avoid any environmental degradation towards the Temengor Reservoir.

As there are limited documentations on the impact of aquaculture on this tropical reservoir, hence this limnological study was conducted on the water quality status and phytoplankton community at Temengor Reservoir as the elucidation of the current lake status could reflect the influence of tilapia cage cultures. A total of 15 sampling points were established and assessed along the aquaculture zone to examine the trend of water quality changes between the sites that were near to the fish cages versus those 5km away at a 1km interval. Evidently, among the physical parameters, transparency, dissolved oxygen and pH values were slightly lower in the stations with cages, while other parameters were relatively similar at all sampling points. From the water analysis, apparently, the nutrient concentrations are comparatively higher at aquaculture zone and decreased slightly at sampling points more distant from the cages. The higher concentration of nutrients was attributed to the nutrient leaching from uneaten food pellet, fish excretion and decomposition of nitrogenous and phosphate compounds.

Besides, the chemicals substances such as vitamin and antibiotics that were used to increase the aquaculture production might as well contribute to loads of nutrients.

Evidently, the higher concentrations of nutrients and chlorophyll a have contributed to the higher abundance of phytoplankton especially at the aquaculture zone. There were 21 phytoplankton species recorded in this study. The dominant phytoplanktons were Staurastrum sp., Cosmarium sp., Cyanodictyon sp., Peridinium gatunense, P. inconspicuum, Staurodesmus sp., Tabellaria sp. and Desmidiales sp. Based on the trophic state index (TSI), the aquaculture zone is eutrophic. Perhaps it is estimated that an occurrence of an algal bloom will be resulted due to the high levels of eutrophication. Algal bloom could bring many negative impacts on the lake ecosystem and surrounding such as creating unpleasant scenery, foul-smelled blooms and altering water quality by increasing acidification, turbidity and decreasing oxygen availability which will induce the suffering of aquatic life especially the native fish communities. Fortunately, the trophic state at sampling points with no cage culture is still in mesotrophic state. However, the concentrations of nutrients and chlorophyll a at Temengor Reservoir were still within the acceptable limit of water pollution as the aquaculture waste could slowly sink to deeper depths. This resulted in low concentrations of nutrients as compared to other previous studies conducted in other areas. Hence, the localized water quality observed here has not led to any detectable environmental problem so far. Nevertheless, proper control and management need to be imposed in order to avoid total destruction the lake ecosystem.

The Study of Grey Water Footprint of Organic-Rice Cultivation for the Lower Central Plain Management in Thailand: Case Study in Nakhonchaisi District, Nakhon pathom Province (abstract)

Chotika Ya-anan, Werachat Chatpanyacharoen
Faculty of Environment and Resource studies, Mahidol University

The lower central plain in Thailand has usually been used for agriculture, especially rice cultivation because of the suitability of geography and the productivity of water body. The information from Rice Department, Ministry of Agriculture and Cooperatives in Thailand has been shown that the rice cultivation area of the lower central plain in 2016-2017 is approximately 381,856.8 hectares or the third rice cultivation area of Thailand.

To have good quality and quantity of rice cultivation, it depends on many factors. One of the essential factors is the plant's nutrition from fertilizer. It has been clearly seen that most Thailand's farmers have used the chemical fertilizers that contribute to the environmental problems whereas some farmers have used organic fertilizer instead. So, this study aims to research about organic fertilizer under the study's hypothesis 'Does organic fertilizer also has an effect on the environmental problems and Thailand's lower central plain management?' by using the calculation of grey water footprint as an indicator. The grey water footprint is one of water footprint types. It is defined as the volume of water required to dilute polluted water (A.Y. Hoekstra and A.K. Chapagain, 2011), in this case, is water polluted from natural organic fertilizer. The study area is located in Nakhonchaisi district, Nakhon Pathom province which is the part of Thailand's lower central plain.

Rudimentary field research was asking the information about organic-rice cultivation procedures from the organic-rice field's farmer. The farmer informed that the area has not been used any types of natural fertilizer but growing the Sunn-Hemp plant scattering all area and ploughing it into the soil as natural fertilizer before beginning the rice cultivation. Due to its rapid growth and nitrogen-fixing capability, Sunn-Hemp is gaining popularity as the cover crop (Audrey Alwell, 2015). Grown and ploughed Sunn-Hemp 1 hectare can produce Nitrogen as much as Nitrogen from Urea (46-0-0) 93.75kg. (Land Development Department of Thailand).

Next step was collecting water samples in the organic-rice cultivation area. They were collected 3 times related to land preparation phase, the first vegetative phase (15-20 days of rice growth), and the second vegetative phase (50-60 days of rice growth), respectively. All of the water samples were analyzed the concentration of Nitrate-Nitrogen (NO_3^-) at the laboratory and its concentration was used for grey water footprint calculation. The result shows that the calculation of organic-rice's grey water footprint is 690 m^3/ton.

Even though the organic rice cultivation has no chemical fertilizer applied, ploughed up and over the Sunn-Hemp can increase Nitrogen in soil and released to water. The result of grey water footprint has been shown that organic-rice cultivation also has an effect on the volume of freshwater and widely effect on the lower central plain because almost all this area has been used for rice cultivation. It means that the volume of water used to assimilate pollutant is increasing.

In conclusion, the organic-rice cultivation can decrease the environmental problems from using the chemical fertilizers but it still has the amount of Nitrogen released to the natural water. It has been undeniable that the organic-rice cultivation also has the grey water footprint and there is much more Nitrogen drained into the natural water that may cause the problems such as, eutrophication. Therefore, grey water footprint is one of the effective indicators that can be used for managing many cases about polluted water and this research has shown that the grey water footprint will be able to use for agricultural management in the lower central plain of Thailand.

Valuation of Village Ponds as Cultural Landscape Component in India (abstract)

Gea-Jae Joo, Yuno Do, Ji Yoon Kim
Pusan National University, Korea

Village ponds are a specific type of small artificial reservoir in India. They are constructed for harvesting and preserving local rainfall and water from streams in agricultural landscapes, especially in India, which has lacked perennial rainfall for thousands of years. Village ponds primarily have been used for agricultural and drinking water but also for bathing, ritual, and aquaculture. According to the Ecosystem Services (ES) framework, classifying and evaluating the benefits for people derived from ecosystems, village ponds may have all aspects of ES including provisioning (food, fresh water), regulating (waste-water treatment), cultural (aesthetic appreciation, inspiration for culture, spiritual experience) services; but village ponds have not yet been valued regarding their ES using quantitative valuation techniques such as economic/monetary approaches. Historically, villagers retained the indigenous knowledge of usage and management practices for village ponds. Indigenous forms of knowledge regarding the sustainability of local resources are referred to as traditional ecological knowledge (TEK). Although TEK is most frequently preserved as oral traditions and as such may lack objectively confirmed documentation, TEK for village ponds has not yet been classified. In the present situation, with little concern, village ponds are at risk of disappearing and we will regret losing this critical resource. India is in rapid economic transition. Many rural villages now have dramatically modernized the drinking water supply system. Development of a water supply service for drinking water and a large reservoir for agriculture through modernization and urbanization can replace this traditional component of village ponds. The ES of TEK in village ponds should be as management practices and should be evaluated and classified for sustainable management of village ponds.

Our goal was to confirm the function and importance of village ponds in the rapidly developing areas as well as rural landscapes. We categorized village ponds based on TEK, evaluate ES of village ponds in India, and establish a framework for conserving village ponds and improving public awareness of interested parties regarding village ponds using modern approaches. Over the last two years, we assessed the benefits of village ponds located in northeast India through field surveys of the Chilika Lagoon basin (State of Odisha). The catchment area (526.3km^2) surrounding Chilika Lagoon contains a large number of villages (population; approx. 690,000). We digitized several hundred village ponds and dozens of ponds have been visited. We found that on average each village possesses 2 or 3 ponds with different usages such as irrigation, religious observance, and bathing. The questionnaire included questions on the name of the village, population, the number of the ponds, the number of alternative water sources etc. the possibility of cultural activities being practiced, management schemes, and the dependency (i.e. residential, agricultural, aquaculture, religious practices). Our project will represent the first scientific assessment of the village pond and traditional management scheme's value. The potential results will include the traditional knowledge of village ponds created by the local community to manage the pond for their cultural, economic, and domestic needs over a long time. Moreover, we are sure that the well-organized traditional management of the village pond will be applicable to increase the value of abandoned ponds in urban landscapes. The traditional knowledge based restoration will contribute in enhancing ecosystem health and the resilience of human society by strengthening ecosystem functions.

Building Capacities for Wetland Ecosystem-based Disaster Risk Reduction and Climate Change Adaptation in the Philippines (abstract)

[1]Joy M. Navarro, [2]Amy M. Lecciones, [3]Dolores Nuevas

[1]Biodiversity Management Bureau – Department of Environment and Natural Resources, [2]Society for the Conservation of Philippine Wetlands, Inc., [3]EbA Project Implementation in the Philippines, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

With the approval of the Philippine-authored Resolution on "Wetlands and Disaster Risk Reduction" at the 12th Meeting of the Ramsar Convention Conference of Parties (COP12), the Philippines has affirmed the vital role of wetland ecosystems in reducing disaster risk. Through this Resolution, the Philippines supports the need to develop and implement management plans that integrate the principles of ecosystem-based management and adaptation against water-related natural hazards. The mainstreaming of ecosystem-based disaster risk reduction (eco-DRR) and ecosystem-based adaptation (EbA) to climate change adaptation measures in spatial and management plans and into all relevant policies, action plans, programs and project designs is also affirmed by this Resolution. Furthermore, the Resolution also encourages the establishment or strengthening of CEPA programmes to "increase awareness on the role of wise use, management, conservation and restoration of wetlands in disaster risk reduction and on the role of wetlands in contributing to reducing vulnerabilities and mitigating disasters".

As part of the operationalization of the Philippine-authored Ramsar Resolution, the Biodiversity Management Bureau of the Department of Environment and Natural Resources, in cooperation with the Society for the Conservation of Philippine Wetlands, Inc. conducted a series of learning events on Main-streaming Wetland Ecosystem-based Approaches to Disaster Risk Reduction and Climate Change Adaptation (Eco-DRR and EbA) from July 2016 to June 2017. The first of the series was piloted in selected critical inland wetlands while the last was focused on capacitating wetland practitioners from the Luzon Island Group. There is plan to conduct another round for the Visayas and Mindanao clusters for next year. Integration with existing projects implementing ecosystem-based adaptation is also aimed at. Meanwhile, the SCPW had also been conducting their regular youth ecological camps which incorporate concepts on environmental protection and natural resources conservation in relation to disaster risk preparedness and climate change adaptation and mitigation in the local context of a municipality or groups of contiguous municipalities.

The learning events aimed to develop the capabilities of technical staff of DENR in operationalizing the Ramsar Resolution on Wetlands and DRR and in assisting local government units in integrating the adoption of the Resolution into local plans and programs. They also intended to strengthen and enhance the capacity of the DENR staff, particularly the wetland managers, in assessing the vulnerability of wetlands to natural hazards at the appropriate social and spatial scale to enable the designing of effective risk reduction interventions including ecosystem-based solutions and approaches to reduce the vulnerability and exposure of people and ecosystems. Moreover, wetland managers will be able to mainstream the principles of ecosystem- based approaches and adaptation against natural hazards to the management plans as part of their regular functions related to wetlands.

The paper will focus on the Philippines' efforts and challenges in building technical capacities for the operationalization of the Ramsar Resolution XII.13 entitled "Wetlands and Disaster Risk Reduction". It will highlight the challenges as well as lessons learned from conducting a series of learning events on mainstreaming ecosystem-based approaches to disaster risk reduction and climate change adaptation through wetlands conservation and management. The importance of developing partnerships for the successful conduct of such events will also be emphasized, as well as accessing national climate funds such as the People's Survival Fund. It will then discuss the various techniques which had gained positive participant feedbacks as well as some of the other key enabling and limiting factors that should be considered in developing modules for this kind of capacity-building activity.

Distribution and Growth of *Pectinatella magnifica* (Leidy, 1851) in Four Large Rivers, South Korea (abstract)

[1]Eui-Jeong Ko, [1]Jeong-Soo Gim, [1]Hyo-Gyeom Kim, [1]Hyunbin Jo, [2]Hyun-Woo Kim, [1]Gea-Jae Joo

[1]Pusan National University, [2]Sunchon National University

Internationally, distribution survey of *Pectinatella magnifica* (Leidy 1851) has increased sharply in the 21th century. This species originated from North America but now is considered invasive species in Europe and Asia. *P. magnifica* is one of freshwater bryozoans that they are colonial sessile invertebrates and have asexual dormant bud (=statoblast) that it can tolerate with harsh condition. In the summer of 2014, this species had an outbreak in the four large rivers of South Korea. We have studied 1) the distribution of colonies in the nationwide four large rivers 2) attachment characteristics of colonies and 3) the growth patterns from germination to initial growth. P. magnifia prefers temperate climate region but is affected by monsoon season, distribution surveys to find a colony were conducted in June (before monsoon) and October (after monsoon). To find colonies, the littoral zone of each study site was examined up to 1 m depth, along a 100m long riverside transect. The colony attached substrates were divided into natural and artificial substrates to determine the substrate preference of the colonies found in the distribution survey. Two artificial substrata were installed within several survey points where colonies were previously reported. The number of statoblasts and colonies on the substrata was counted weekly. Also, we observed changes in the size of several of the colonies found. Our results showed the P. magnifica was distributed nationwide. In the entire survey, P. magnifica colonies were collected at total 24 sites in four large rivers. At first, P. magnifica, which was found in stagnant water, extended its distribution to the lotic water. In our survey, results of the distribution were different for each survey, but it was repeatedly disappearing and rediscovering in the mainly discovered sites. Given the tributaries that connect the large rivers and the area where they were initially discovered (i.e. dam, weir), it is possible to anticipate the prosperity of P. magnifica in the large rivers as well as in the tributaries. Freshwater bryozoans are known that they do not show species specificity for substrates. 531 colonies were used to identify substrate preferences in 4 large rivers.

Our results also showed that a large number of the colonies tend to attach to aquatic plants. However, there were no significant differences between substrates. Statoblasts have been observed continuously from our artificial substrata. Regardless of the number of statoblasts accumulated, it is considered that the point where the formation of colonies was begun is likely to continuously increase the number of colonies through growth and diffusion around habitat. The smaller size of the colony, the greater the likelihood of maintaining shape in the event of a change in rainfall or water velocity.

However, surviving colonies may continue their volumetric growth despite changes in water bodies. Because this species can form colonies longer than 1 m in length. In conclusion, our study for P. magnifica is the first distribution survey that was conducted nationwide in the South Korea. Also, it is comparable because repeated surveys were conducted using the consistent method.

The Role and Process of Wetlands Education through Environmental Education and ESD in Japan (abstract)

Kantaro Tabiraki
United Graduate School of Agricultural Science Tokyo University of Agriculture and Technology

The purpose of this presentation is to examine the educational meaning of a place of a wetland and to obtain proposals for the improvement of Wetlands Education in Japan. Although many educational programs for water sites, including rice fields, rivers, wetlands, and oceans exist individually, little study has been done to construct a systemization of education about water in a general framework. Therefore, it is important to create such educational programs to develop human resources for the effective conservation of wetlands; this viewpoint is discussed using a case study of the Reintroduction of the Oriental White Stork in Toyooka, Hyogo prefecture. Toyooka has tried to provide CEPA and an opportunity for Environmental Education and ESD. It should be effective to focus on the educational programs in the area that requires conservation of wetlands in a wide area at the beginning, so it is necessary to conduct a fundamental research on the role and process of Wetlands Education. Furthermore, by seeing these educational programs as a fundamental practical model of ESD, I would like to reevaluate cultures and skills related to a wetland and to rethink the way of intersection between School Education and Social Education as a comprehensive Citizen Education.

In this study, the kinds of CEPA required by the Ramsar convention's programme, along with the role and process of Wetlands Education, are examined through a case study of the "Lower Maruyama River and the surrounding rice paddies" Ramsar Site in Toyooka. Furthermore, the study focuses on two issues, "cooperation" and "responsiveness," from an analytical perspective concerning Environmental Education and ESD. At present, the problem is that the sport park will be moved for its development under a flood control project for the Ramsar Site in Toyooka. The land- use planning problem must be reviewed at this time and throughout development or conservation from three perspectives: 1) the process for seeking a possible site for a sport park is inappropriate, 2) the sense of "Community Development through the Reintroduction of the Oriental White Stork" is played down, and 3) the need for CEPA in consideration of the problem is emphasized repeatedly. In other words, it is necessary for possible target groups and stakeholders concerned with wetlands to adopt a way of learning through experience and sense as part of the story of the conservation of wetlands.

The second to be noticed is that a harmonious coexistence between human and nature. Unfortunately, it has become an issue that one stork released by Toyooka were accidentally shoot by a hunter. In this respect, hunters would be needed an educational program with a focus on CEPA such as a trans-disciplinary approach which is not only shooting skill but also some ESD components. It is sad thing of the shooting of the stork. But also, a hunting as a management for wildlife is even more important after people have killed the natural predators of the species hunted. This killing is often because of fear or because the predators kill farmer's animals. Considering with the restrictions on firearms and hunting in Japan and some countries which storks fly around, ESD, including a hunter education would be very beneficial to help preserve and help with the reintroduction of various animal species.

A further study of how Wetlands Education play a role of wildlife conservation should be conducted. The study also aims to develop learning material using active learning toward all people, including the hunter. Based on the above, it attempts to find educational ways as Wetlands Education to impart culture and history to future generations in a sustainable manner rather than dredging up a problem in Toyooka.

Collaborative Activities around the Hizen-Kashima Area: MAE-UMI Citizens' Association Activities (abstract)

Yasuhiro Nakamura, Sakuji Higuchi, Naoki Fujii
MAE-UMI Citizens' Association

In the past, the Ariake Sea was said to be a bountiful. However, because of recent environmental problems, the number of marine organisms, and especially shellfish, has decreased drastically. There are various reasons for the environmental problems in the Ariake Sea such as the Isahaya Bay reclamation project. The agents responsible for the decrease in the catch and other changes in the Ariake Sea are in agreement that something needs to be done, but there are conflicting opinions about the methods to be used. In particular, it has been difficult to reach a consensus on the methods to deal with the Isahaya Bay reclamation project problems. Further, people who do not depend upon the fishing industry for their livelihood have become less interested in visiting the Ariake Sea, with interest in the ocean continuing to wane. Under such circumstances, an "Ariake Sea regeneration policy" based on the understanding of the coastal region in the Ariake Sea has not yet been developed.

To deal with these issues, for six months from November 2013, preparations were made for a meeting to seek the cooperation of local citizens, with a citizens' association named the MAE-UMI Citizens Association finally being established in April 2014. MAE-UMI members are made up of groups engaged in regional promotion, fishery companies, faculty members, lawmakers, and other citizens. The main activities of this group are to hold monthly meetings and hold events related to the Ariake Sea in cooperation with other groups in the area. At the monthly meetings, information such as activity reports, forecasts for various organizations, and Ariake Sea status reports are presented and discussed. In addition, members of the Association introduce relevant topics on the Ariake Sea; for example, in 2015, the reasons for the high nori cultivation in the Kashima waters were discussed. Since 2015, biological observation meetings have been conducted through walking tours of the Ariake Sea coastline.

Externally, in 2015 and 2016, an event titled "Enjoy! Ariake Sea" was also held, in which science corners were set up for adults and children, and exhibitions related to the Ariake Sea were held such as the promotion of Kabayaki; a dish made by broiling mudskippers in a thick sweet sauce; and a bus excursion titled "Let's go around the Ariake Sea!." The event was held at Michi-no-eki "Kashima" (roadside Station) and attracted many people. In 2015, farmers in Saga Prefecture told stories of nori- seaweed and in Yanagawa City, participants were invited to an event called "ARIAKE- MON" where they could try dishes made from Ariake Sea products. In 2016, a tour around the Ariake Sea coastal area by bus was arranged, on which lectures were given that included: a tour of the Arao tideland, one of the Ramsar registered wetlands; a tour of the Ariake Sea on the Ariake Ferry; a lecture on Unzen mountain; and a lecture by the temple priesthood in Ooura. It was hoped that these activities would increase the public interest in the Ariake Sea; however, as there are few members, we would like to broaden the scope of the activities.

The Massive Noxious Golden Apple Snail *Pomacea canaliculata* Populations Were Wiped During Rainy Season: A Case Study on Chenderoh Reservoir, Perak, Malaysia (abstract)

Siti Norasikin Ismail, Nurul Izzati Abdul Wahab, Muzzalifah Abd Hamid, Mashhor Mansor
School of Biological Sciences, Universiti Sains Malaysia

Approximately twelve years ago, massive noxious golden apple snail *Pomacea canaliculata* populations invaded 2500ha of Chenderoh Reservoir. Chenderoh Reservoir is the oldest man-made lake in Peninsular Malaysia. Chenderoh Reservoir was built for the purpose of hydro-electric power generation. The dam was commissioned in 1930 across the Perak River. The noxious populations of *P. canaliculata* were originally recorded from the adjoining rice field areas. Consequently, the rice fields were abandoned due to the low production and non-profitable harvest after three to five years of establishment. Eventually, the population of *P. canaliculata* were spread into the Chenderoh Reservoir. The dispersal of these populations had brought concerns towards the lake environment. Based on previous study, a high distribution of golden apple snail population in freshwater ecosystem may cause a serious loss of the aquatic plants. The infestation also has reduced the number of native Asian freshwater snails species especially Pila due to the interspecific competition to get the available food resources. Evidently, each female individual was observed to lay approximately 500 eggs in one egg mass. Although the eggs were immersed in the water, however the percentages of the eggs to hatch are about 60%. In addition, the egg masses were recorded to attach on floating weeds such as *Eichhornia crassipes*, particularly on the stems and leaves of aquatic plants with 43% occurrence. Besides, *P. canaliculata* was found to lay eggs on other hard medium such as boats, rocks, fish cages and emerged bamboo pile with 14% occurrence.

Apparently, *Phragmites australis* or common reed from Poaceae family was the most preferred plant (41%) for egg depositions whereas the least preferred plant for egg depositions was *Neptunia oleracea* (3%) from Fabaceae family. Moreover, the snail populations were also attached to *Pandanus helicopus* populations which could be found along the lake's shore. Nevertheless, the recent big flood during the rainy season from February to April 2017 had wiped out the whole populations of golden apple snail in the lake ecosystem. There was no egg depositions observed at 15 points of sampling sites throughout the lake area and subsequently the adult individuals were also absent. During the rainy season, the flow of water is faster compared to dry season. Therefore, it wiped out the eggs and individuals of golden apple snails. The attached plants were also damaged by the hard water current and thus the chance for the snail populations to survive is low. In addition to high water levels, the slosh of surface water against the emergent vegetation has resulted in the massive destruction of golden apple snail populations in Chenderoh Reservoir. Apparently, the findings from this study showed that those three environmental variables are responsible in controlling the golden apple snail populations. Thus, the management of lake water level by Tenaga Nasional Berhad (TNB) is crucial to eradicate the resurgence of this noxious population. As the invasive *P. canaliculata* is considered to be in the top 100 of the "World Most Invasive Alien Species", therefore, the behavioural studies and ecological assessment are needed in order to control and reduce the economic loss especially in the agriculture sector and subsequently for a healthier lake environment.

Aster tripolium (sea aster) and Greening of the Sea Wall in Tokyo Bay (abstract)

[1]Noboru Kuramoto, [1]Rasuna Mishima, [1]Hisako Okada, [2]Tim Gardiner
[1]Meiji University, [2]Essex Nature Club

Aster tripolium L. is an endangered plant in Tokyo, whereas in England it is a keystone species of salt marshes. We have studied *A. tripolium* in Tokyo Bay, Japan, since 2000, and in the River Thames and Thames Estuary, England, since 2015. In contrast to Tokyo Bay, which supports only several small populations of this plant, there are many large populations in the Thames Estuary.

We initially studied the *A. tripolium* population in the mouth of the Tama River, south west of Tokyo Bay. All population in the Tama River was extinct by vegetation succession until 2013. Mr. Takashi Ueno wanted to conserve the population and requested that the Tokyo Metropolitan Government managed the vegetation for *A. tripolium*. However, the population was not deemed worthy of conservation as there was another population in in the Tokyo Metropolis at Kasai Rinkai Park.

We therefore subsequently studied the Kasai Rinkai Park population. There are two small local populations in Kasai Rinkai Park and Kasai Kaihin Park. Kasai Rinkai Park is located along the Kasai waterfront area of Tokyo Bay. This park, which opened to the public in 1989, is relatively new, and is the largest park within Tokyo's 23 wards. Kasai Marine Park is located in front of Kasai Rinkai Park and consist of two beaches and sea.

Tokyo birders (members of the Tokyo branch of the Wild Bird Society of Japan) and citizens of Tokyo have been working to convert Kasai Sanmai-Zu into a Ramsar convention wetland. In 2017, Ms. Yuriko Koike, the governor of the Tokyo Metropolitan area announced that Kasai Kaihin Park will be made into a Ramsar convention wetland.

The East Beach of Kasai Kaihin Park has been designated an environmental conservation zone. The *A. tripolium* population here is growing on mud in the intertidal zone of the East Beach.

We have also been studying the micro-distribution of *A. tripolium* on the seashore of Kasai Rinkai Park. *A. tripolium* was found growing in the mud on concrete blocks of the lowest floor of the sea wall flood defenses in Kasai Rinkai Park, which is located in the intertidal zone. The width of the lowest floor is 980 cm and *A. tripolium* grows over ca. 750 cm from the sea edge. We found that the distribution of *A. tripolium* is correlated with the thickness of the mud on the concreate blocks.

A. tripolium grows only in mud that is over 3mm thick, and does not grow in freshly deposited mud. If there is mud on the sea wall in Kasai Rinkai Park, a larger population of *A. tripolium* might grow there.

In 2015, we displayed a poster presentation on the notice board of Kasai Rinkai Park, and in 2016 arranged three activities related to seashore vegetation observation.

Furthermore, in 2016, we made a proposal to the Tokyo Metropolitan Government that small projections should be installed in Kasai Rinkai Park to trap mud.

In contrast to the sea wall in Tokyo Bay, which is a hard wall constructed entirely of concrete, the sea wall of the Thames Estuary is a soft wall, the middle part of which is constructed of mud. The port engineers state that the sea wall in Tokyo Bay must be harder than that in the Thames Estuary as the wave power in Tokyo Bay is greater than that in the Thames Estuary. We intend to study the wave power Tokyo Bay and make the sea wall green by facilitating the colonization of salt marsh plants. We hope that the sea wall will be green from Kasai along the entirety of Tokyo Bay.

An Assessment of Species Diversity and Abundance of Waterbirds in Gulf of Mottama Wetland, Myanmar (abstract)

Min Thiha Zaw
Biodiversity and Nature Conservation Association (BANCA)

Water birds serve a very important role in ecological systems and are often used as indicator species of ecosystem vigor. Water birds often quickly respond to changes in their habitat and can provide valuable insights into habitat health and stability. Wetlands play a crucial role as bird habitats and birds use them for nesting, breeding, roosting, and rearing young ones and for feeding, resting, shelter, social interaction and wintering grounds for both locally and millions of migratory water birds. Monitoring water bird species density, richness, and associations with habitat and environmental variables can help inform management and restoration decisions. Thus, water birds are often used as a metric for assessing habitat health and restoration success. The Gulf of Mottama or Martaban is one of the coastal zone and as the newly designated Ramsar Site, the most extensive intertidal mudflats and is one of the largest of its type in south-east Asia. The objective of this paper is to assessment of the species diversity of water birds and their number and distribution. The investigation of water birds at six sites and mid-winter in January and February flyway coordinate count along the route of Gulf of Mottama estuary wetland from 2015-2016. Survey was conducted in an effort of observing the overall landscape to stratify the habitat for line transects segments and setting point count stations. Direct counting was adopted for areas for large assemblage of water birds and group number counting a suitable vantage point was selected and all visible birds were counted. Total bird counts were conducted for water birds and species richness, evenness and Shannon-Weaver species diversity indices were calculated. Overall, a total of 66 individual species of water birds belonging to twelve families and an estimate population 100,000 water birds were recorded during the study. The waders were most prominent with 31 species being recorded. Scolopacidae was the richest family by 24 species (46%) followed by Charadriidae family 4 species (8%), Pluvialidae family 2 species (4%), Laridae family 3 species (6%), Sternidae 5 species (10%), Ardeidae family 6 species (12%), Threskiornithidae family 1species (2%) and Falconidae family 4 species (8%) recorded to the sum of Glareolidae 1 species(2%)and Podicipedidae 1species (2%) . This site has been found to be the key wintering area for the Critically Endangered Spoon- billed Sandpiper (*Calidris pygmeus*), hosting an estimated 180-220 , more than 50% of the world population. Also, the six other globally threatened species Painted Stork, Black-headed Ibis, Black-tailed Godwit, Eurasian Curlew, Nordmann's Greenshank and Great Knot. Thus, a strong conservation action with harmonized and alterative promising sites should be needed to increase bird diversity in such kind of Gulf of Mottama estuary wetlands areas. Also need continues intentional improvement and awareness creation to the local community regarding of intertidal mudflat or adjacent mangroves conservation has any formal protection.

Poster Session III

Possibility as Eco-DRR of The Japanese Traditional Water Management System

Jun Teramura, Yukihiro Shimatani
Faculty of Engineering, Kyushu University

Japanese Traditional Water Management System

In Japan, Ingenuity of flood control and water utilization has long been taken. There are 60% of mountainous land in Japan, plains tend to be less. Therefore, various measures had been taken to increase the agricultural productivity in the plain section. Various flood technologies had been developed against the flooding of rivers caused by floods. In addition, efforts had been made to efficiently secure fresh water, maintenance of irrigation canals for water use for rice cultivation and other purposes. In addition, efforts had been made to efficiently secure fresh water and maintenance of irrigation canals and reservoirs for use of water for rice cultivation and the like. Many such Japanese old water management systems had been lost, however some still exist as traditional techniques.

Means techniques for achieving the purpose such as concrete, heavy machinery and dams are becoming highly advanced in the present age. However the old days there was no such means techniques. Therefore, it has been devised by limited materials such as wood, stone and human power, experience value and view of nature. In other words, ideological technology had developed. The Japanese traditional water management system is a collection of advanced ideological technology.

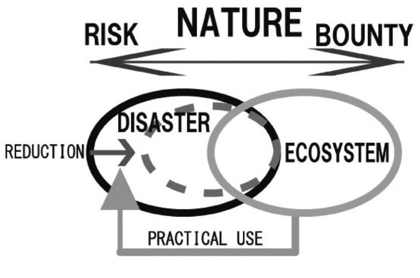
Eco-DRR

In recent years, Green Infrastructure and Eco-DRR(Ecosystem-based Disaster Risk Reduction) have attracted worldwide attention. The Japanese traditional water management system is technology based on the idea to understand and utilize nature. It contains a lot of ingenuity to alleviate disasters and enjoy the full benefits of nature's blessings. This idea seems to be highly compatible with the technical thought of the Green Infrastructure and Eco-DRR.

Eco-DRR is a technical thought of reducing disaster risk by natural ecosystem. A typical example is a mangrove forest distributed in the estuarine region of Southeast Asia. With this mangrove forest, there is a proven track record that a tsunami energy dissipation effect was obtained.

The Japanese traditional water management system is made for the purposes such as flood control and water use. This system utilizes the natural materials, there is a device that does not destroy a large natural environment. Therefore, many of these cases function as part of the ecosystem. In addition, by maintaining the system, we are constantly providing a place where humans are involved with nature. For this reason, Eco-DRR and Japanese traditional water management system are common at ideological stage.

Fig.1 Eco-DRR concept



Examples of Japanese traditional water management systems with potential as Eco-DRR are as follows.

Cases

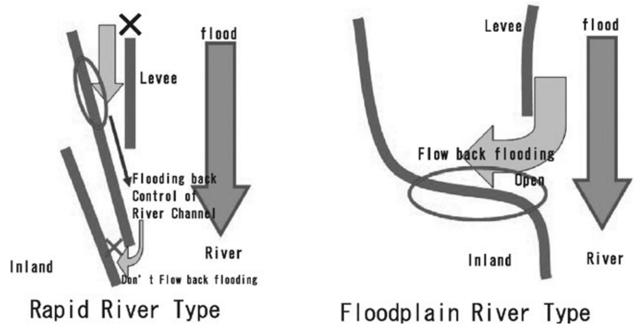
· Open Levee In The Rapid River · Floodplain River

Open Levee is in the form of a levee made in the traditional method of Japan. Among them, there are still existing ones made by famous warlords of the Warring States Period. For example, the Shingen Levee of Kamanashigawa River in Yamanashi is Open Levee. In addition, Open Levee, which was built in the 1600s and 1800s, still remains all over the country.

Regular levees are continuous from upstream to downstream so as not to overflow the flood. However, Open Levee is not continuous. It is important that the Open levee is not continuous. Open Levee play various roles by not being continuous. The function of Open Levee depend on the river bed slope of the river.

Open Levee has a function to flow back flooding from the opening of the Levee. This is the function of the open levee in the floodplain river type. This is called a retarding function. This feature is by flooding the flood in a specific location, to reduce the flood risk in the downstream. In addition, since the flood flows backward to overflow to the upstream side, the momentum of flooding can be alleviated and the damage of the field can be reduced.

Fig.2 Open Levee type



Open Levee of the rapid river has little retarding function. Even if you build a high levees, you can not accumulate many floods. This is because the bed slope is steep. In addition, the flood of the rapid river is included in a lot of sediment. A large amount of sediment deposits when these flow into the retarding basins. As a result, it can not be used as a farmland.

The function of the Open levee on the rapid river is control of the river channel and flooding back. When the rapid river is not treated for flood control, the location of the river channel is not stable. Every time the floods flow, the river channel moves and diversion. Therefore, Japanese traditional flood control method has a technique to fix the river channel with a structure called "SUISEI (Groin)". This has evolved and the enormous one is the open levee of the rapid river. Flood of the rapid river contains a lot of sediment. The levee is fragile. The levee of open levee folds double and triple. Even if one levee breaks, the next levee stops the flood. This allows you to return the flood to the river channel.

In this way, the functions of open levee are different in floodplain river and rapid river. In addition, this function can be classified with riverbed gradient as 1/450 boundary. There are various shapes and functions in open levee due to regional characteristics and different installers. In this way, Open Levee is a traditional flood control structures of Japan, which has been devised from the old era1).

This Open Levee has been maintained as 300 years river structures. As a result, it forms a habitat of the living things. Habitat of open levee is responsible for part of the creatures of the life history.

The role of open levee as a habitat greatly differs between the rapid river and floodplain river. This is the same as the flood control function.

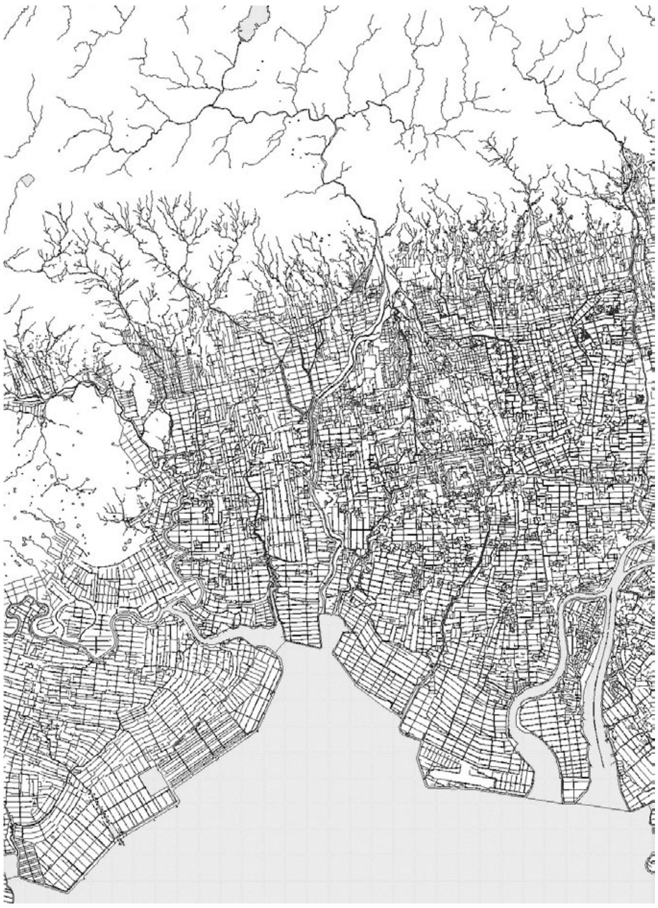
Open levee of floodplain river is temporarily made wetland environment at the time of flood. This temporary wetland environment becomes evacuation place for floods of fish and insects. It also becomes a growth environment for fish egg laying and fish. Besides this, the flooded area is supplemented with nutrients and earth and sand which are carried from the mountains.

Open Levee of rapid river is a particularly important environment as a haven, such as fish. Open Levee of rapid river water stagnation at the time of the flood. In the flood of the rapid river where the flow velocity is fast and the sediment content is high, the Water stagnation becomes a very important fish evacuation place.There were customs for residents of the flood area to do fishing and driftwood hunting.

Main Function: Retarding (When flooding in the river, accumulate flood upstream to reduce the flow of the downstream flood.)

Ecosystem: Spawning · Emergency Evacuation (A wetland environment suitable for spawning fish can be temporarily made. At the time of the flood, it becomes a refuge place of fish and insects.)

Fig3. Creeks and Rivers of the Saga Plain[3)]



Secondary: Nutrition Provision(In the flooded place, nutrients and earth and sand which are carried from the mountain enter.)

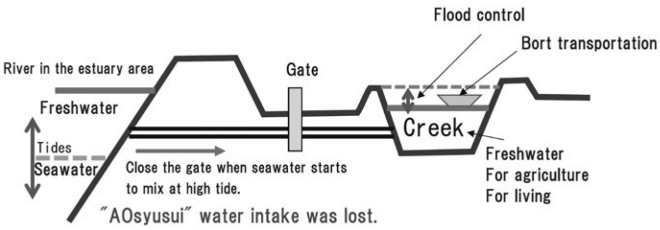
· Creeks Of Saga Plain

Creeks in Saga plain is the most famous in Japan. Saga plains there is little elevation. Wide range is 0 meters above sea level. It is difficult to secure fresh water in such areas. For this reason, the creek has been developed to details of the plains. Creek of Saga plain total length reaches about 1600km. (Fig3: Displaying only the creeks and rivers of the Saga Plain)

The Creek is not only carry water from the river, to store the fresh water. Pooled fresh water is used in agriculture and life. It is also possible to temporarily store the flood to the creek. Once upon a time was necessary to devise secure further fresh water in the area close to the sea. Therefore, in the location close to the sea it was water intake of the fresh water in the brackish water. This is called “AO syusui”. “AO” means freshwater. “syusui” means the water intake for irrigation. “AO Irrigation” used the tide level.

In the brackish water area there is a place where sea water and freshwater are separated. Freshwater has a lower specific gravity than seawater. Therefore, seawater flows through the bottom of the water, and fresh water flows through the surface layer. “AO Irrigation” intakes only this fresh water part. “AO Irrigation” is very difficult to manage. If the tide level rises too much, sea water mixes, therefore, the salt concentration becomes dense. It is necessary to close the gate just before that. The manager of the gate looked at the seawater with taste. AO intake water is not currently implemented. It is a lost technique.

Fig4.Creeks and “AO syusui” system



Creek in Saga Plain is a habitat of one of the largest freshwater fish in Japan. Very many freshwater fish inhabit. Further, among them includes a plurality of rare freshwater fish. Creek is a habitat suitable for fish. A certain degree of depth is always maintained. The wooden pile of the slope protection and the reed of the shallow become an evacuation place of the fish. There are many agricultural lands and the supply of organic matter is large, so food is abundant. However, water quality may deteriorate in some cases. There is almost no flow rate. The riverbed has many mud or fine sand. These environments are habitats that are easy to live for freshwater fish.

Main Function: Agricultural Water · Domestic Water (Creek stores freshwater at sea level 0 meter.)

Ecosystem: Natural Fish Pond (One of the leading freshwater fish habitats in Japan. Many kinds of freshwater fish live.)

Secondary: Flood Control · Inland Navigation

· Others

Besides this, various cases such as Flood Restraining Forest Belts, Irrigation Ponds, Fascine Weir, Trees Planted to Arrest Shifting Of Sand and the like have the possibility to function as Eco-DRR besides the original function as well as the bank.

The Japanese traditional water management system is still being used in various places. However, many of them are affected by the modernization of society. Almost the old technical thought has been lost.

The Japanese traditional water management system have good effects not only on human society but also on the natural environment. New values, such as the recent Eco-DRR and green infrastructure, there is a possibility to find a new value to the Japanese traditional water management system that is being lost. To that end, we need to verify the value of these Eco-DRRs in detail in the future.

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Response of Biotic Components after Hydrological Intervention in the Tropical Lagoon: Chilika Lake

Ji Yoon Kim[1], Yuno Do[2], Gu-Yeon Kim[3], Gea-Jae Joo[1], Ajit K. Pattnaik[4], Krupasindhu Bhatta[4], Gurdeep Rastogi[4]
[1]Pusan National University, [2]Kongju National University, [3]Kyungnam University, [4]Chilika Development Authority

Background

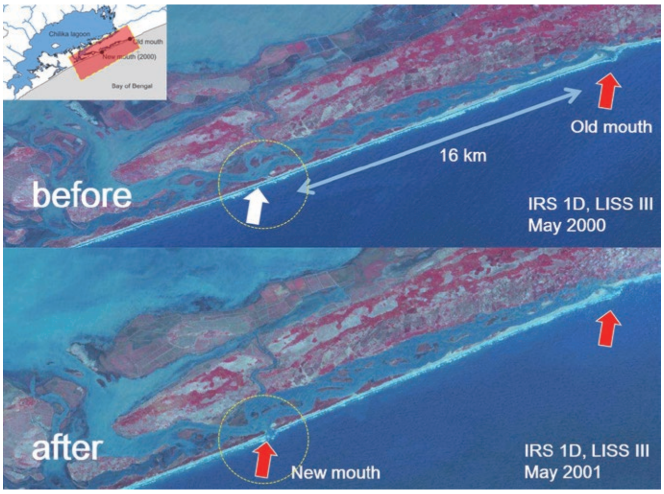
Lagoon ecosystems have been severely degraded by anthropogenic activities, which result in ecological and hydrological changes in the system. Detailed understanding of the recovery processes of restored lagoon systems has been impeded by the underlying complexity of integral environmental components.

Chilika Lagoon, the largest brackish lake ecosystem in East Asia, experienced severe problems such as excessive dominance of freshwater exotic plants and rapid debasement of biodiversity associated with decreased hydrologic connectivity between the lagoon and the ocean.

To halt the degradation of the lagoon ecosystem, the Chilika Development Authority implemented a restoration project, creating a new channel to penetrate the barrier beach of the lagoon. The opening of the new mouth provided a favorable increased salinity regime throughout the lake, with higher fluctuations and improved water clarity due to sediment flushing through the new mouth.

The aim of this study was to understand different recovery responses of lagoon biota in a restored lagoon, and temporal and spatial changes at each recovery stage after lagoon restoration.

Fig. 1. Aerial image of lagoon channel before and after restoration.



Methods

Using a satellite-derived normalized difference vegetation index (NDVI) dataset, we compared the trend of vegetation changes after the lagoon restoration, from April 1998 to May 2014. We also compared temporal response of lagoon animals based on the local monitoring literatures.

Response of lagoon animals during restoration periods was estimated from the annual production records or population survey results of local monitoring reports. We established temporal data of planktons, fish, birds, and mammals from 2000 to 2014.

Results

Compared with other biological studies, long-term analysis of NDVI in the restored lagoon revealed that diverse biological taxa responded differently, and had a different range of recovery rates after the restoration event. In this study, plant productivity was decreased for half a year after the restoration, and took about twelve years to return to previous productivity levels.

Fig. 2. Spatial pattern of physico-chemical parameters

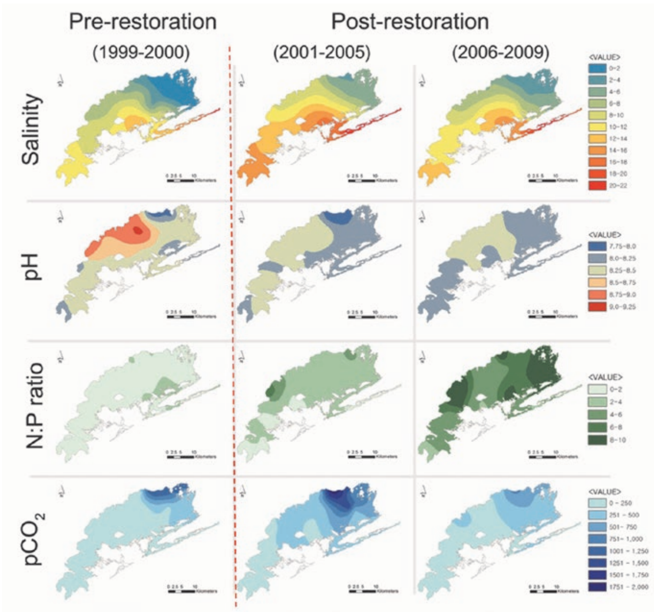
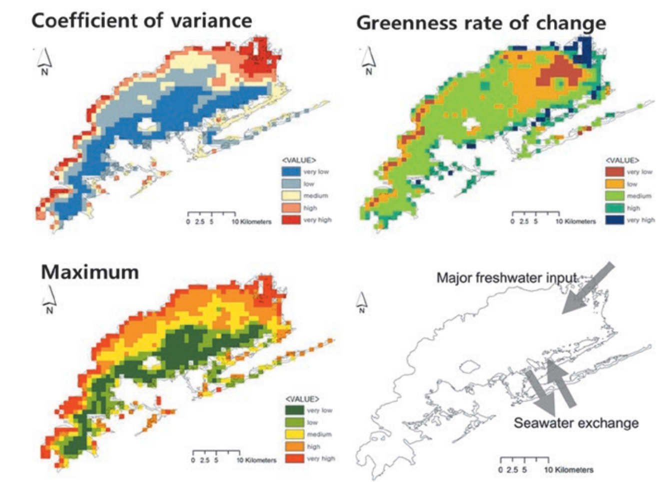


Fig. 3. Spatial pattern of NDVI after restoration event

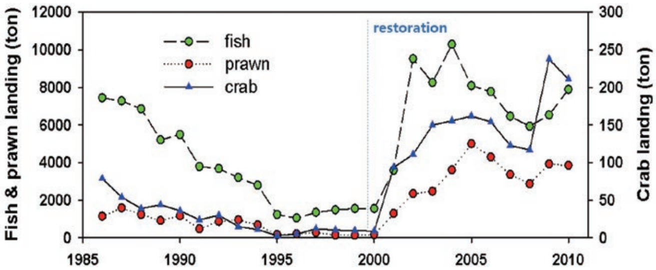


It seems that a rapid decrease of NDVI was caused by the sudden dieback of proliferated freshwater species. The large decrease of NDVI in the freshwater region was caused by dieback of freshwater species in response to the salinity change at the very early stage of restoration. After restoration, gradual increases of brackish lagoon vegetation, including *Potamogeton* sp. and sea grasses, were identified in the field.

Other lagoon biological taxa, including phytoplankton, also showed a rapid recovery response to the levels of the 1980s after the mouth restoration. The biomass of fish and prawns in

Chilika Lagoon showed a seven-fold increase (i.e., 8500 tons in 1986, 1600 tons in 1998, and 11,878 tons in 2002) during the two years after the opening of the new mouth. Increased fishery production was maintained and stabilized for several years.

Fig. 4. Trend of fish, prawn, and crab landings in the Chilika Lagoon



Number of Irrawaddy dolphins showed gradual increase in the population number (98 in 2006, 138 in 2008, 153 in 2013). It was notable that diverse biological taxa showed different recovery responses after lagoon restoration event. Generally, plankton, and fish had rapid increase (2-3 years) after recovering connectivity between lagoon and ocean, while aquatic vegetation and large mammals had gradual increase (4-12 years) to reach previous natural condition.

*part of the results were published in the following papers.

Ji Yoon Kim, Gurdeep Rastogi, Yuno Do, Dong-Kyun Kim, Pradipta R. Muduli, Rabindra N. Samal, Ajit K. Pattnaik, Gea-Jae Joo (2015) Trends in a satellite-derived vegetation index and environmental variables in a restored brackish lagoon, Global Ecology and Conservation 4:614-624.

Ji Yoon Kim, Krupasindhu Bhatta, Gurdeep Rastogi, Pradipta R. Muduli, Yuno Do, Dong-Kyun Kim, Ajit K. Pattnaik, Gea-Jae Joo* (2016) Application of multivariate analysis to determine spatial and temporal changes in water quality after new channel construction in the Chilika Lagoon, Ecological Engineering, 90:314-319.

Setiu Wetlands, Malaysia: Assessing Changes in Landscape Condition and Building, A Case for Improved Management

[1] Daria Mathew Abdullah, [2] Haramaini Arifin, [3] Muhammad Zaid Nasir, [4] Nur Syahirah Wahab

[1] WWF-Malaysia (Peninsular Malaysia Office-HQ), [2] WWF-Malaysia (Setiu Wetlands Field Office)

This paper highlights about the Setiu Wetlands in the state ofTerengganu, Malaysia pertaining to its unique features, conservation and socio-economic significance, as well as the challenges and their impact on the wetlands. Also discussed are the approach used for evaluating the wetlands' condition and efforts by WWF (World Wide Fund for Nature)-Malaysia, a nature and scientific based non-governmental organization (NGO) to achieve the conservation and sustainable management of Setiu Wetlands.

Introduction

Drained by the Setiu-Chalok-Merang-Bari riverine complex, the Setiu Wetlands consists of a diverse array of inter-connected freshwater, brackish and coastal ecosystem types. The key ecosystems include rivers, Melaleuca or *gelam* forest, riparian forest, peat swamp forest, mangrove forest, lagoon, seagrass beds, mudflats, beach, coastal forest and sand islands.

The Setiu Wetlands provides a great range of ecosystem services such as flood control, erosion mitigation, nursery ground for juvenile marine fishes and supply of natural resources for the local population's traditional livelihood. The wetlands also have great potential as an ecotourism destination that can generate economic returns to the local communities and to the State. Administratively, the Setiu Wetlands falls within the district of Setiu with a population of 63,500 people (UPEN Terengganu, 2015) who depend on or derive benefit from the wetlands directly and indirectly.

Biodiversity records indicate that the Setiu Wetlands harbours 29 species of mammals, 176 species of birds, 36 species of reptiles and amphibians, 56 species of butterflies and 217 species of plants. The Painted and River terrapins, both critically endangered freshwater turtle species occurs in the Setiu Wetlands. Remarkably, the Setiu Wetlands is among the very few places in Malaysia with presence of viable populations of Painted terrapin. Another interesting fact is that in Setiu Wetlands, the Painted terrapin shares the same nesting beach with the Green sea turtle.

Challenges and Changes in Wetlands Condition

Setiu Wetlands is undeniably one of Malaysia's most spectacular natural treasures and in fact, it has been classified as nationally important for its ecological and conservation values, and is listed in the Malaysian Wetland Directory (1987). However, it is also fragile, thus efforts to prevent it from degradation would be critical. The collapse of the wetland's ecosystem could mean the end of its many ecosystem services and its biodiversity. Sadly, over the years, the wetlands have experienced progressive conversion. The lagoon and its fringing mangroves have been subjected to tremendous aquaculture development. The Melaleuca forest has and continues to be targeted for conversion to agricultural activity especially involving oil palm by companies and smallholders. Additionally, there has been conversion of large areas of Melaleuca forest to aquaculture farm and for silica mining. Construction of an artificial river mouth to facilitate navigation of fishing vessels, development of jetties and installation of bunds for coastal protection caused the alteration of river channels and coastal morphology as well as changes in the wetlands hydrological regime. The widespread conversion and changes in land use are sending warning signals due to the resulting degradation and loss of substantial areas of wetlands besides other negative impacts including on the wetlands ecological functions and services.

WWF-Malaysia's Strategy and Efforts

It is the contention of WWF-Malaysia that the Setiu Wetlands, particularly the areas of high conservation value is afforded with improved protection and holistic management effected within the landscape. This could, hopefully provide a fighting chance for the ecosystems and biodiversity of the Setiu Wetlands to continue being part of our environment, in order to build a future in which humans live in harmony with nature.

Following years of active and persistent advocacy for the protection of Setiu Wetlands by WWF-Malaysia and other like-minded partners, eventually a major conservation milestone was achieved in 2013 when the Terengganu government announced its commitment for a Setiu State Park. Several processes have been mobilized towards realizing this plan, however to date Setiu Wetlands has yet to be formally gazetted as a protected area.

In pursuing conservation efforts in Setiu Wetlands, one of WWF-Malaysia's key approaches is to conduct ecosystem assessments and monitoring to establish baselines and to understand the changes and impacts, through collaboration with research bodies and experts. Support and involvement from local communities and corporate sector are often equally valuable. WWF-Malaysia is keen on working together as there are many benefits of working in partnership. The most common benefits from forming partnerships is the combining of complementary skills, which enable more to be achieved jointly than working alone.

Using information and recommendations derived from the studies, WWF-Malaysia advocates for threat minimization aimed at safeguarding the wetlands' ecological integrity. The findings of these studies are also vital in helping to provide key inputs for informed decision to realize the sustainable management and protection of Setiu Wetlands for the benefit of all in the long term.

The main studies undertaken in Setiu Wetlands by WWF-Malaysia include:

- *Land cover and land use change analysis in oil palm development (on-going);*
- *High Conservation Value (HCV) assessment (2016-2017);*
- *Setiu Wetlands scientific expedition (2016);*
- *Population study of Painted terrapin (2015-2016);*
- *Water quality monitoring (2015);*
- *Mapping of riparian vegetation using satellite imagery (2014).*

The respective studies employ specific methods ranging from field sampling and data collection, on-site observation and verification, laboratory analysis, satellite image interpretation and GIS analysis.

Among the notable findings from these studies are:

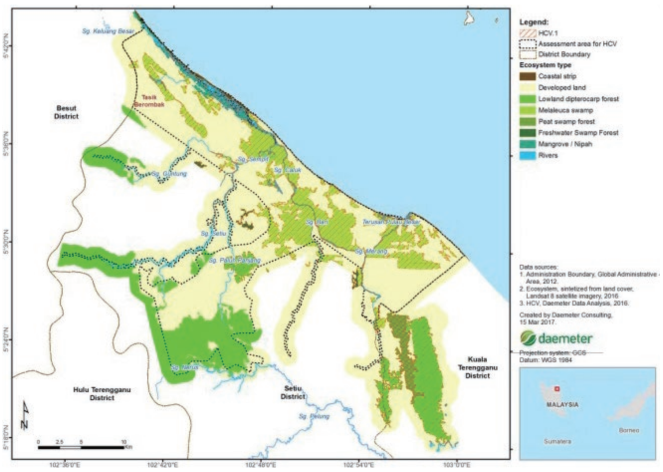
- There are many areas of HCV within the wetlands but unfortunately, mostly are severely threatened or already in poor condition from anthropogenic activities such as burning, clearing, draining, fragmentation and pollution.

- Of the total 47,244ha of Setiu Wetlands included in the HCV assessment area, 15,082ha were identified as HCV areas. The HCVs are essentially areas that possess exceptionally high social, cultural or biological value. Five of the six classes of HCVs are present in Setiu Wetlands (see Table 1). The identified HCVs also included the potential areas for inclusion into the Setiu state park (see Figure 1). In addition, stakeholders' supported management and monitoring plan to ensure maintenance of these values were formulated as part of the study.

Table 1: HCV areas in Setiu Wetlands

HCV Class	Area (ha) within the assessment area
1 – Species diversity	11,505
2 – Landscape level ecosystems	0
3 – Ecosystems and habitats	9927
4 – Ecosystem services	15070
5 – Community needs	13,055
6 – Cultural value	1
Total	15,082

Figure 1: HCV Core Area recommended to be included in the Setiu State Park (shown in light green)



- 12,248ha (26%) of the HCV assessment area comprise of oil palm plantations which represent the most dominant land cover type.
- Based on common observation of the condition of oil palm that grows on BRIS (Beach Ridges Interspersed with Swales) soil in both corporate and smallholders block within the HCV assessment area of Setiu Wetlands, it appears that the oil palm yields are poor and uneconomical. BRIS soils are abundant in the Setiu Wetlands area. These soils are problematic for agricultural use primarily because they are poorly structured and have low water retention and limited ability to support crop growth.
- Nevertheless, there has been a rapid change in land cover involving oil palm plantations within the Setiu catchment area over the 10-year period from 2006 to 2015. The extent of oil palm planted area in the Setiu area as of 2015 was around 40,000ha, indicating that it is the main land cover class.
- Species inventories conducted covering 16 research topics during the Setiu Wetlands scientific expedition in 2016 provided an updated record with the discovery of 33 species of exclusive mangrove plants that include five new records and three hybrids, 17 species of mangrove snails and 30 species of plants in the Melalueca forest.
- Besides enabling the biodiversity status and condition of key habitats to be evaluated, the expedition provided the avenue for collaboration involving 49 researchers from seven organisations comprising local universities and research institutions, NGOs and media.
- Based on the preliminary survey of Painted terrapin population in 2016 to obtain an updated status (since the existing data was recorded a few decades ago and are presumably no longer relevant), a total of 22 individuals of Painted terrapin comprising four males and 18 females were recorded foraging along Setiu River. Comparatively, in 1994 the Setiu River recorded an annual nesting population of around 180 females (Sharma, 1994).
- The updated database and knowledge on the status and distribution of Painted terrapin is vital in determining the appropriate management measures that will complement conservation of the species and its habitats.
- Findings of the quarterly sampling and monitoring of water quality at 20 stations of the Setiu-Chalok-Bari-Merang river basin involving 12 different types of parameters conducted from January to December 2015 showed three parameters (namely oil and grease, nitrate, faecal coliform) exceeded the Malaysian Marine Water Quality Criteria and Standard (MWQCS) Class E recommended value. There was also increase in salinity of water in the Setiu lagoon within the vicinity of the constructed artificial river mouth, which could have resulted from the heightened seawater intrusion.
- Mapping using satellite imagery for riparian vegetation has covered 89 sampling points within Setiu Wetlands and indicated the riparian areas along the rivers comprise broad categories of mangroves; exclusive, non-exclusive and associate mangroves, which function as conducive habitat for fauna and flora. It was suggested that improved management of the river reserves should be given more attention.

Way Forward

The ecosystem assessments and monitoring undertaken has enabled us to understand the state of the wetlands in terms of its ecological health and resources so that the appropriate management including remediation measures can be implemented accordingly. We socialize the findings and recommendations from the studies to the relevant stakeholders via a number of platforms. This included the Setiu Wetlands Scientific Expedition Seminar held in October 2016, which served as an avenue to disseminate the important study outputs that are vital to the ecological and conservation values of the Setiu Wetlands. Other strategic platforms were the consultation of the Peninsular Malaysia's East Coast Rail Link (ECRL) alignment that traverses Setiu Wetlands, advocacy for inclusion of Setiu Wetlands as an ecological linkage under the Terengganu component of the Malaysia Central Forest Spine Master Plan and discussion on baseline information and reference for the preparation of the Setiu Special Area Plan. These studies, in particular the HCV assessment and Scientific Expedition are timely in strengthening the justification for protection of Setiu Wetlands thus complementing the Terengganu state government's efforts to realize its plan for a state park in Setiu Wetlands.

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Shorebirds and Spoon-billed Sandpiper in Kyushu and Ariake Tidal Flats: Trends and Importance of Conservation

Minoru Kashiwagi[1], Takurou Hattori[1,2], Shigeki Takano[1,3], Kimiko Kouno[1,2], Sayaka Nakamura[1,4], Nobuhiro Hashimoto[5]

[1] Ramsar Network Japan, [2] Fukuoka Wetland Conservation Study Group, [3] Yatsushiro Bird Society, [4] Wild Bird Society of Japan, Saga Chapter, [5] Nanko Wetland Group

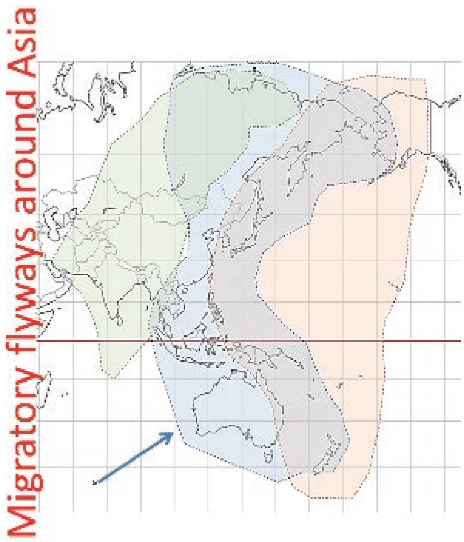
Population Decline of Shorebirds in Asia

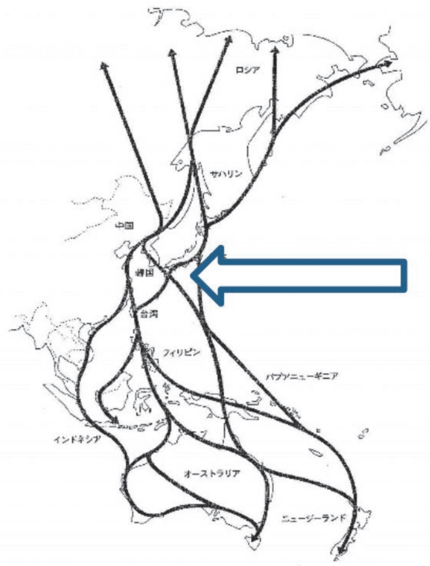
Ariake Sea in Kyushu Island, Japan, has three tidal flat Ramsar Sites, Arao-higata, Kashima-shingomori-higata and Higashiyoka-higata designated at the last two Ramsar COPs in 2012 and 2015

Tidal flats on the coasts of Ariake Sea and neighbouring Yatsushiro Sea support significant number of shorebirds as their staging sites. They are survey sites of National Monitoring Sites 1000.

These areas are **at crossroads** in the East-Asian/Australasian Flyway: for both shorebirds populations

- those using Eurasian continent via Korean Peninsula
- and those using Japan Archipelago.





東アジア・オーストラレシアにおけるシギ・チドリの渡りルート

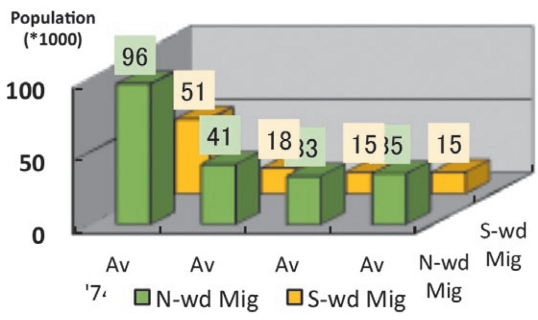
Threatened Species

Tidal flats in Ariake Sea and Yatsushiro Sea are also important in s**upporting threatened species** including Spoon-billed Sandpiper and Nordmann's Greenshank.

This sea area has characteristics similar to Yellow Sea, connected hundred thousands of years ago as shown by the existence of common endemic benthic species.

However, this area are experiencing decline of population as is the sites in othe sites of the East Asian-Australasian Flayway, EAAF.

Decline in Shirebird Population



Decline of shorebirds in Japan

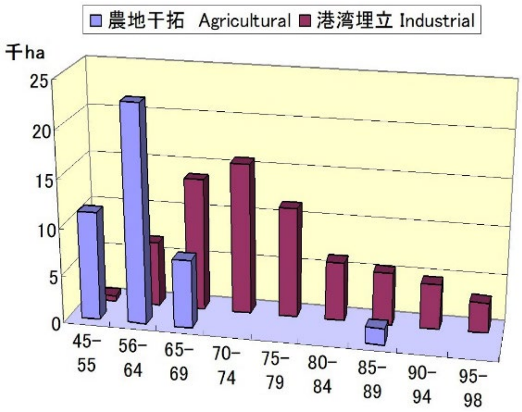
Fig. above show the trend of ten-year averages of shorebird population monitoring since 1970s till 2010s. And the one below shows the progress of development of coastal and inland i.e. agricultural development in the latter 1900s. A clear correlation can be seen. These development means the loss of wetlands, which are habitats of birds

National Isahaya Bay Reclamation Project

Isahaya Bay supported around **10 000 individuals of shorebirds** on their spring migration. At the first half of 1990s, this meant the largest in Japan together with Fujimae Tidal Flats at Nagoya City.

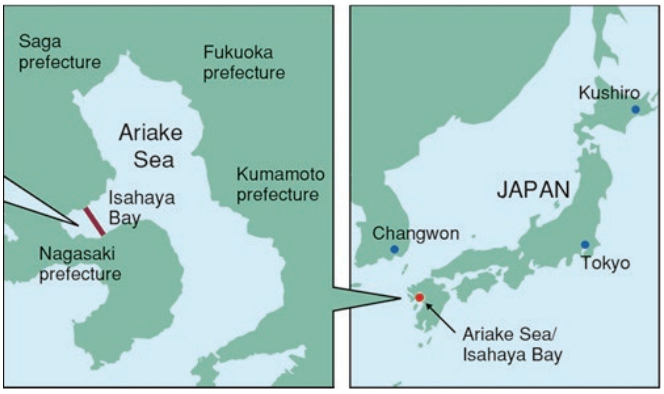
The tidal flats habitat was critically damaged in April 1997.

Agricultural Industrial Landfill of public water surface in Japan



Tidal Flats was closed from the sea due to a reclamation project. Inflow of salt water to the tidal flat was blocked. Immense bentic animal died.

Some part of the bird population could change their stopover site to nearby Higashi-yoka and other tidal flats, but for others nobody knows. The population of shorebirds depending on the tidal flats must have become smaller as seen in the heap of dead benthic animals in the tidal flats.

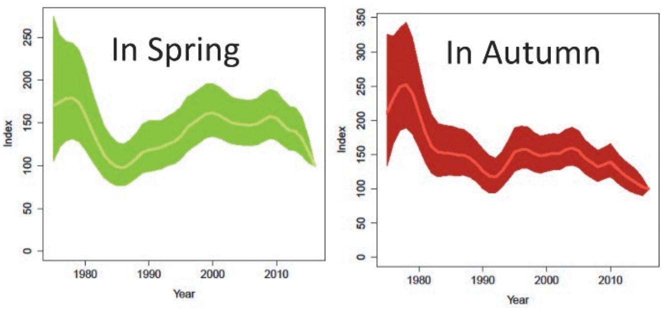


However, we could **not** find a proof of the change **with the existing shorebird monitoring data**.

Three years later in 2000 there occurred serious fishery depression called **Ariake Tumult**.

The tidal flats once uncountably rich never recovered and poor fishery in the Ariake Sea still continues.

Change in Shorebird Population (Bayesian Model 1971-2016)



Repeat the Same Tragedy

Figures shown above shows the trends of count for total population of shorebirds according to the data obtained by NGOs and the government for the period of 1971 to 2016 according to shorebird monitoring scheme, Monitoring Sites 1000. The graphs show two periods of decline, namely:

1. 1970s – 1980s: Tidal Flats Loss in Japan - Development of High Economic Growth Era
2. 2010 – present: No further decrease of habita - Impact from elsewhere suspected

The authors would like to emphasise the importance of conservation and restoration efforts not only in Japan but also in the whole flyway. Developments are going on in habitats that are still supporting a considerable size of population. We expect that the presentation gives an idea on the serious impact of development project going on especially in Yellow Sea.

Social Innovation for Biodiversity Preservation in a Marsh Around Kahokugata-Lagoon:

Vegetable Cultivation for Establishing a Sound Material-Cycle Society "Suzume-Yasai", and Rice Cultivation by Cooperation in a Farmers and NPO "Ikimono-Genki-Mai"

Hisashi Takahashi
Kahokugata Lake Institute

Background

Kahokugata lagoon in Ishikawa Prefecture is the shallow lake in the location near the sea (Fig.1). Origin was the inland sea-lake which was the brackish water which connected with a sea until about 50 years before. 2/3 of a lake was losted by the state-operated reclamation project which has started in 1963 (Fig.2). At the same time, the surrounding wetland was altered. Degradation of biodiversity in Kahokugata and a circumference area has formed by the recent years' environment alteration which starts from this project. Kahokugata Red Data Book that we edited in 2013, 39 species of plants, two kinds of vegetation, and 71 species of animals were picked up as endangered species (Fig.3). Most of species to inhabit the rice field are exposed to crises for extinction. It is thought that the use of agricultural chemicals in the rice field is related to the extinction of the wildlife (Fig.4). Preservation of biodiversity in this area is a pressing problem.

Aggravation of the quality of the water was caused as another serious problem. It led to a water quality degradation that Kahokugata lagoon was changed fresh-water lake in reclamation project. The quality of the water of the current Kahokugata lagoon cannot satisfy an agriculture water standard.

Two business is performed by Kahokugata Lake Institute aiming at a solution of a problem of biodiversity and environmental preservation in a marsh around Kahokugata at present.

Fig.1 Kahokugata Lagoon

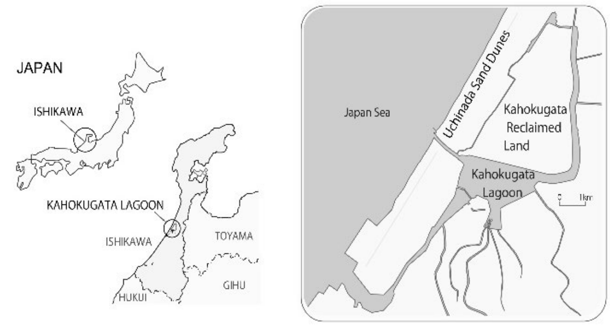


Fig.2 Process of the reclamation

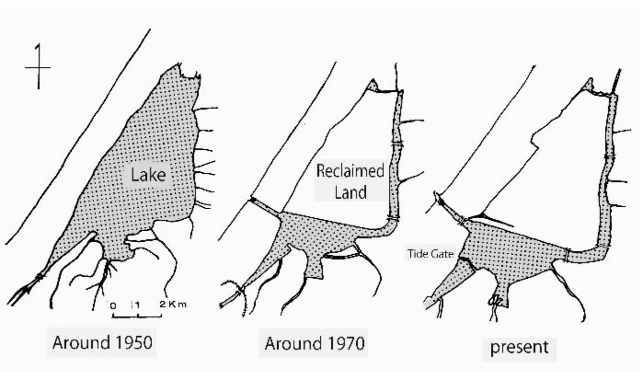
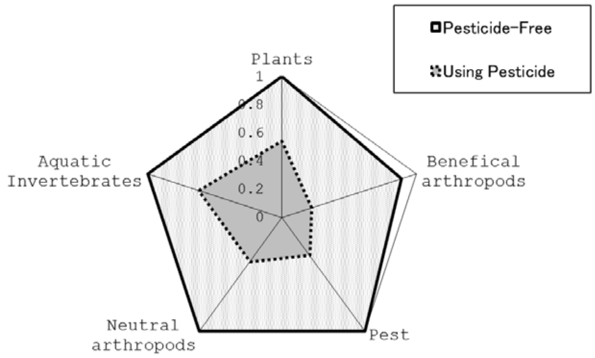


Fig.3 Kahokugata Red Data Book

Fig.4 Comparison between the rice field which does not use a pesticide and the rice field using (Create based on Takahashi and Kawahara 2014



Suzume-Yasai

"Suzume-Yasai" which means "Sparrow vegetables", is a business of the vegetable cropping (Fig.5). *Paspalum distichum* L.var. *indutum* which is an alien plant which flourishes excessively at Kahokugata and a marsh around it is used as a compost on this business (Fig.6).

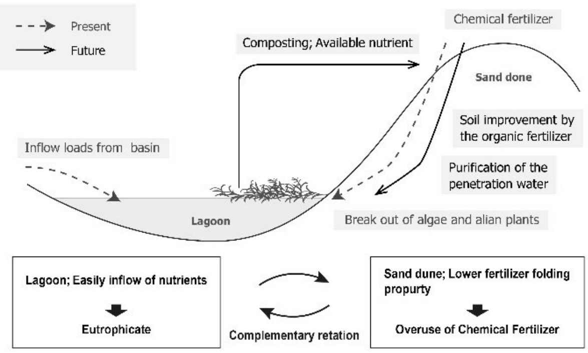
Kahokugata is the lake where eutrophication was done, but the Uchinada sand dune which is immediately aside of Kahokugata is the oligotrophy environment. Sound material recycling is promoted by taking the plant lush in Kahokugata which is an eutrophic lake and using it by the Uchinada sand dune which is the oligotrophy environment. A cost of the waterside management are served by selling vegetables on this business at the same time. When business of "Suzume-Yasai" spreads, and use of a compost is developed in the field in Uchinada sand dune, and use of chemical fertilizer becomes little, nitrogen concentration of the groundwater which flows into Kahokugata from Uchinada sand dune will be low, and improvement of the water quality of Kahokugata can be expected (Fig.7).

The present problem is that plant construction of compost-ization isn't developed. Therefore it's still small-scale business.

Fig.5 Suzume-Yasai

Fig.6 *Paspalum distichum* L.var. *indutum*

Fig.7 Solution to problems by the local circulation



Ikimono-Genki-Mai

"Ikimono-Genki-Mai" which means preserving all wildlife is a business of the rice cropping. NPO cooperates with a farmer, and this business is put into effect to make the farmland a habitat of wildlife.

Helicopter spraying of Insecticide isn't performed at the rice paddy where "Ikimono-Genki-Mai" is grown. A herbicide isn't used for a ridge. A contract farmer requests a creature investigation from NPO and receives authentication of the reliability (Fig.8). The rice certified adds extra value as "Ikimono-Genki-Mai", and is sold.

"Ikimono-Genki-Mai" is certified in each 1 rice paddy, and is bagged. The location of the field, cultivation method and the confirmed information on wildlife are recorded on a wrapping bag. This is mechanism of the best traceability (Fig.9, Fig.10).

Seven farmers participate at present, and "Ikimono-Genki-Mai" is grown at 10 rice paddies. Additionally there is 1 field of lotus root. A problem by restricting use of agricultural chemicals has not formed up to now. The change in the inhabit situation of the large-sized organisms isn't confirmed, but it's confirmed that small-sized organisms is increased. The farmer who hopes for participation in this business is the possibility which will increase from now on.

The present problem is securement in a market. Securement in an original market in the respective farmhouses is behind schedule. Each farmer depends on the market NPO has reserved.

Fig.8 Mark of the authentication of the Ikimono-Genki-Mai

Fig.9 First characteristic of Ikimono-Genki-Mai, traceability

Fig.10 Second characteristic of Ikimono-Genki-Mai, searchable the result of survey on organisms

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RiceBED Project, for Mainstreaming Biodiversity in Rice Paddies by Networking People of Various Sectors in Japan and Overseas

Masayuki Kurechi, Minoru Kashiwagi
Ramsar Network Japan

RiceBED Project – it is an acronym for Rice Paddy Biodiversity Enhancement Decade Project. It was in 2013 that Ramsar Network Japan (RNJ) kicked the project off. It is an action project focussing on a capacity of rice paddies to hold biological diversity. Making best use of the capacity of rice paddies, it aims to mainstream enhancement of biodiversity in rice paddies. The project calls for those people, in various area geographically and socially, interested in maintaining and enhancing biodiversity in rice paddies. It invites their participation by declaring implementation of at least one action they can practice to enhance biodiversity in rice paddies. RNJ plays a role to provide a platform for participants to exchange information on related activities. In this way, the project aims to create a new trend for enhancing biodiversity in rice paddies by bundling power of participants while expanding the basis of people concerned about conservation of biodiversity in rice paddies.

In 2010, at CBD/COP10 in Nagoya, the Government of Japan was instrumental in suggesting the twenty 10-year targets aiming to restore lost biological diversity that were adopted as the "Aichi Biodiversity Targets."

Ramsar Network Japan (RNJ) suggested a framework to widen the field for their implementation beyond the scope of CBD, which was realized as "United Nations Decade on Biodiversity" (UNDB) through the discussions of the CBD/COP10.

RNJ has launched the "Rice-paddy Biodiversity Enhancement Decade" (RiceBED) to provide a platform for a wide variety of activities that put into practice the contents of the resolution (X.31 in Ramsar) and decision (X/34 in CBD) on enhancing rice paddy biodiversity adopted by the Ramsar and CBD, respectively.

Ramsar Network Japan drew up an action plan in 2012, with participants from local governments and organizations, as well as individuals who have already been engaged in this field, and the "RiceBED Action Plan" was put together.

This Action Plan gives concrete shape to the action necessary to achieve the Aichi Biodiversity Targets and international rice paddy resolutions. Activities aiming for completion in 2020 are now being initiated and carried out all over Japan.

We call on all agriculturalists, citizens, corporations and government authorities with an interest in rice paddy biodiversity to join hands with us to carry out this plan to pursue and achieve the goals of the Aichi Biodiversity Targets and rice paddy resolution. Number of participants in the project counts over 200 individuals and organisations until now.

RiceBED has been also developing a global platform involving Asia, Africa and Neotropics.

Activities thus far:

- Seven local meetings and three meetings at national level/ joined partners meetings of Double 20 Project.
- Engaged in establishing Local Biodiversity Strategy of local governments.
- Informal Civil-Government Meetings for the Implementation of the Rice Paddy Resolution; a framework to discuss and exchange information on enhancing biodiversity in rice paddies; 57 times since 2009.
- International action: released Rice BED Action Plan in English at the CBD/COP12 (Korea in 2014); organised a side event with Japanese Government on rice paddies inviting speakers from Asia, Africa and Neotropics at the Ramsar COP12 (Uruguay, 2015); and joined in JICA projects in Uganda and Costa Rica.
- Awareness-raising activities; Web-page, e-mailing list, newsletters, some documents both in Japanese and English.

Toward 2020:

- The goal of RiceBED Project is 2020:
  *Target for 500 registrations of action in the year.
  *RiceBED becomes a leading project, mainstreaming biodiversity in rice paddies.
- Further information and registration form to the project, see the following:
  *RiceBED Project Access Guide
  http://www.ramnet-j.org/doc/ricebedproject-e2.pdf
  *RiceBED Project HP (English)
  http://www.ramnet-j.org/tambo10/tambo/en/

The “Wise Use” of Green Infrastructure: Community-Based Revitalization of Urban Wetland in Gowanus Canal, New York City

Kyohei Takizawa, Yukihiro Shimatani, Satoquo Seino, Taku Watanabe

Kyushu University

1.introduction

The purpose of this study is to examine the activity and planning process of a conservancy program that aims to revitalize an urban wetland by a community-based, green infrastructure program. Cities worldwide have a common problem with combined sewer overflow (CSO), which has a negative influence on water quality in urban waterways and wetlands. We conducted interviews and surveyed documents of environmental groups, citizens, and city officials that manage the Gowanus Canal in Brooklyn New York City (NYC), where Green Infrastructure have been implemented by the city administration, with the cooperation of Gowanus Canal Conservancy (GCC). GCC is a nonprofit conservancy founded in 2006 that serves as a community-based environmental steward of the Gowanus Canal. GCC envisions “the evolution of an Open, Clean and Alive Gowanus Canal and Watershed with accessible, connective open space”. New York City’s Green Infrastructure Program intend to prevents stormwater runoff from entering the City’ s sewer systems, and to reduce CSO discharges into NYC’s waterbodies. As a result, the water quality in NYC’s rivers and the urban amenity is expected to improve.

2.results

The Gowanus Canal was constructed in 18th Century on the site of a former saltmarsh and creek. The Canal is one of America’s most polluted waterways, due to historic industrial contamination and 377 miilion gallons of CSO into the canal every year.

Fig1:Gowanus canal today

Declared a Superfund site in 2010 by the US Environmental Protection Agency (EPA), the Canal has plans to dredge heavily contaminated sediment. The NYC Department of Environmental Protection (DEP) have planned and constructed grey and green infrastructure (Long Term Control Plan) across the watershed to reduce CSO from 2012(Fig2).

Some rain gardens and bioswales in the watershed are managed by citizens and GCC(Fig3). For that reason, GCC has their own nursery and composts station. GCC operate the volunteer programs and the education programs including planting and taking care of plants in bioswales.

Fig2:The time line of restoration Gowanus canal watershed and GCC activities

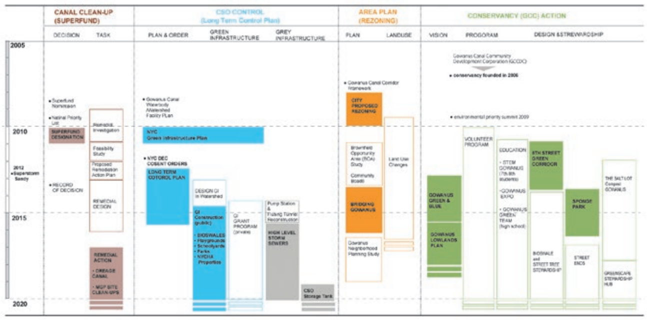
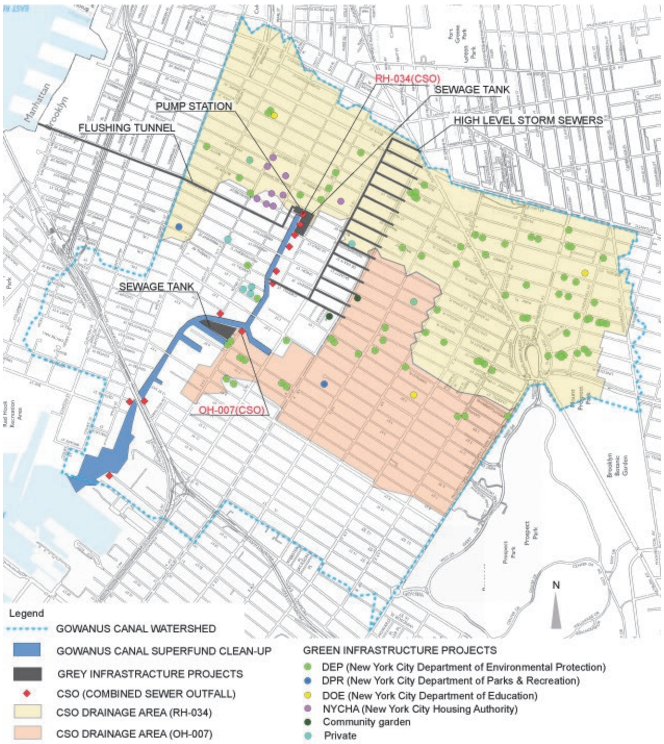


Fig3: Locations of Grey and Green infrastructure of Gowanus canal watershed



Since 2015, GCC has led a planning process with community members, elected officials, and agency representatives to identify open space priorities from a diverse range of neighborhood stakeholders. In 2017 GCC summarized the vision of area called “GOWANUS LOWLANDS”.

GCC plays the four roles in the community: volunteer engagement; education; greenscape management; and design adovocacy(Fig4).

3.discussion

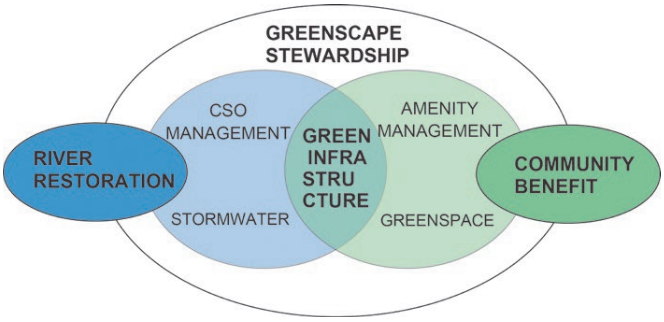
Through the analysis of the research, the most important keyword is abstracted : a stewardship. GCC recognize a stewardship as making a connection citizen’s activities in the area to CSO problem.

Activities that help reduce CSO, such as planting trees in rain gardens and bioswales, foster a public awareness of the participants’ connection to the entire watershed and strengthen their sense of public commitment. The GCC fosters watershed stewardship among their members by linking the restoration of wetland with community improvement and beautification.

Fig4: The roles of GCC in the community

Volunteer Engagement		Education		Greenscape Management		Design Adovocacy	
Empowering their Clean & Green program volunteers to implement positive change through hands-on projects, many driven by their dedicated team of volunteer coordinators.		Teaching community members of all ages about the complex environmental, social and political issues of the Gowanus so that they can become better advocates for change.		Building community capacity to install and manage gardens, bioswales, street trees, parks, and other public spaces that support a healthy Gowanus ecosystem.		Facilitating community visioning and design for the future of open space around the Gowanus Canal.	
Projects	Partner	Projects	Target	Projects	Green Type	Projects	Adovocater
·CLEAN & GREEN PROGRAM	CIVIC	·STEM GOWANUS	Elementary School	·6TH STREET GREEN CORRIDOR	BIOSWALE	·Bridging Gowanus	Community
·COMPOSTING GOWANUS	CIVIC/GOVERNMENT	·GOWANUS GREEN TEAM	High School	·SPONGE PARK	RAIN GAREDN	·GOWANUS GREEN+ GOWANUS BLUE	GCC
·2000 GALLON PROJEC	BUSINESS/ GOVERNMENT	·EXPO GOWANUS	CIVIC	·SALT LOT	COMPOSTING/NURESERY/BIOSWALE	·GOWANUS LOWLANDS	GCC
·POP-UP NURSERY	CIVIC			·3RG&3RG GARDEN	GARDEN		
·ART LABO	CIVIC/BUSINESS			·BIOSWALES	BIOSWALE		
·RIVER SWEEP	CIVIC			·PLANTING STREETS	STREET TREES		
·CANOE FLOTILLA	CIVIC			·NURSERY	NURSERY		
				·PARKS	GARDEN		

Fig5: Greenscape stewardship and Green infrastructure



Onga River Reconstruction Project: East Side High-Water Channel Design to Balance the Flood Control and People-Friendly Open Space

Tomoki Takebayashi, Akihiko Higuchi, Fumiko Taura
Urban and Environmental System, Faculty of Engineering, Kyushu University, Fukuoka, Japan
Email: contact@tomokitakebayashi.com

Introduction:

Nogata Riverside Park of Onga River is one of a few contemporary examples in Japan that has successfully improved the riverfront from a drainage channel to a people-friendly public open space. In 2004, Kyushu University Landscape Lab. Including authors was asked by Ministory of Land, Infrastructure and Transport Kyushu Regional Development Bureau Onga River Office (MLIT) to prepare an alternative plan for Onga River's riverfront in the central area of Nogata. In this region, citizen-involved river reconstruction works have been conducted and more than 60-times citizen meetings were held since 1996. Major attendee is Nogata Kawazukuri Koryukai, a not-for-profit group aiming to revitalize Onga river. After a series of intensive discussion with a concerned local citizen group, the design team prepared a design plan to balance the flood control and the creation of organic open space.

Photo 1. Discussion with local citizen

East Side High-water Channel Design:

The east side high-water channel was designed to be lowered with newly built stonewalled terraces. While, the west side shoulder of the flat high-water channel was shaped as a gentle slope connecting the downtown Nogata and the water surface both physically and psychologically. The east side high-water channel is likely to be eroded due to the west-curved waterway. Existed concrete embankment walls along the water's edge of the channel protect the eastern high-water channel from the erosion. However, there are alternative solutions to design the walls. It became clear that a series of terrace stonewalls and grass fields in between are strong enough to protect the flat high-water channel from the erosion. This terrace structure should provides easy access to the water and also help to provied attractive public space on the east side riverfront.

Outcomes:

Undulating topography of the east side high-water channel and stonewalled terraces realized over the entire east side. Though the stonewalls are reinforced solidly by concrete, the gaps between stones on the wall are open so that wild grasses could grow and cover the wall in a few years. A wooden boat slip is inserted in front of Mizubekan, riverfront activity center/flood shelter. A stone-paved plaza space is connected spatially with the slip. The slip and stonewalled terraces on the east side connected by gentle slopes and stone steps make accessible space. After the completion of the project, the number of daily visitors has increased by 50% both in weekdays and weekends in one year. Also, the increase of the cross-sectional area of the waterway has improved the river's security of flood control.

Photo 2. Overall view after the Project.

Photo 3. Existed concrete embankment walls before the Project

Photo 4. Newly built stonewalled terraces.

Conclusions:

This project achieves a solution to secure flood control while to create a people-friendly public open space on an urban riverfront simultaneously. The critical factors to realize the design include followings: 1) The design team tried to involve citizens in design processes and to know citizen's needs to use river open space as well as the past landscape of the riverfront. Here contribution of Nogata Kawadukuri Koryukai was indispensable and their stories were helpful for

Photo 5. Boat slip in use for canoeing.

designing the desirable landscape of Onga river. 2) The design tried not to use many materials; there are only grasses, stones that are the same stones used in previous constructions, and woods. This design strategy contributed to strengthen the space integrity of the entire landscape of Onga river. 3) The design ensures the wheelchair-friendly access slopes and paths. Not only people in wheelchairs but family with baby strollers and seniors become possible to access to the water's edge easily. This water accessibility enhances the space attractiveness.

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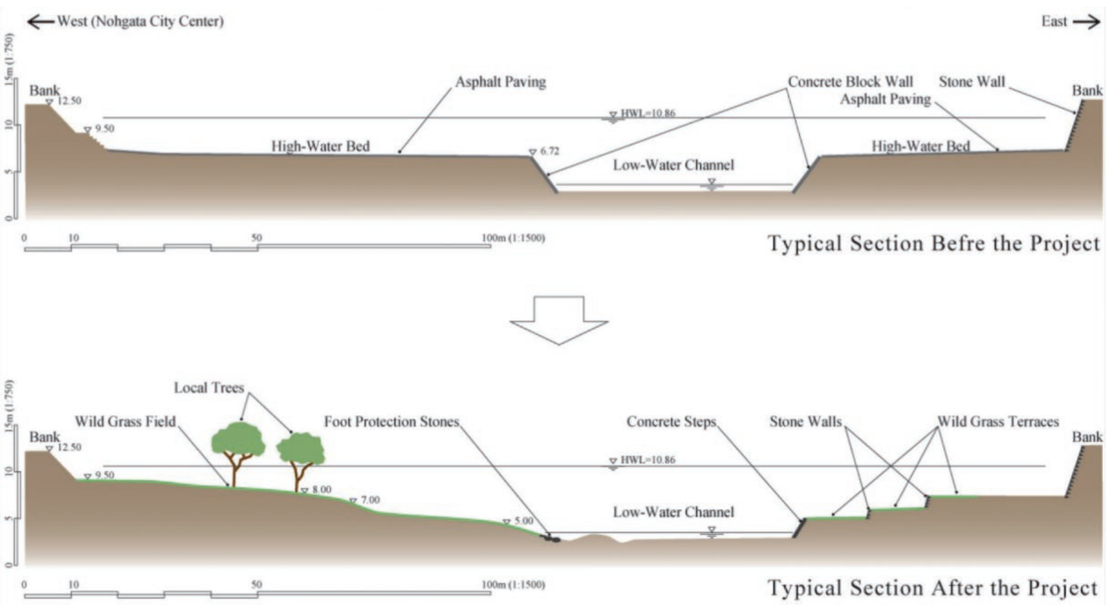
Figure 1. Final plan prepared by design team.

Figure 2. Sectional diagram of proposed design in comparison with the previous condition.



Cultural Ecosystem Services of Temperate Coastal Areas of Japan: Uses of Tidal Flats, Sandy Beaches, and Rocky/Coral Areas

Takehisa Yamakita

Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Ecosystem services are an important concept that connects biodiversity and human well-being. However, evaluations of coastal ecosystem services are very limited, and few such studies have directly connected biodiversity and human well-being. Even monetary-based evaluations, a standard technique in this area of study, are still in the early stages. For example, Costanza et al. (2014) modified the monetary-based evaluation of coral reefs reported in Costanza et al. (1997) from USD8000 to USD350,000 per ha. Of the estimated increase, USD104000 was from the addition of cultural ecosystem services. Martin et al. (2016) did a systematic survey of studies of coastal and marine ecosystems from 2004 to 2014 and found only 24 papers that evaluated cultural ecosystem services. Moreover, half of these papers were published in 2014. Although it may be difficult to evaluate cultural ecosystem services, the number of studies is beginning to increase (Yamakita 2017).

In the case of Japan, coral reefs and tidal flats were evaluated by a committee established by the Ministry of the Environment (Fig. 1). The committee found high monetary values for coral reef services (JPY234.4 billion) but not for the cultural services provided by tidal flats based on a travel cost method for shellfish gathering (JPY45 billion; Ministry of the Environment Japan).

In 2016 we started a research program named "Predicting and Assessing Natural Capital and Ecosystem Services" under the Environment Research and Technology Development Fund (ERTDF), Ministry of the Environment, Japan. Through our project, we are assessing and predicting the social and economic value of natural capital and ecosystem services, and assessing the potential of the ecosystem functions of related services through various means, including a survey of biodiversity and the status of various ecosystems.

In particular, we expect to produce outputs related to the latter items during this five-year program. We plan to share our result with the Convention of Biological Diversity (CBD), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) regional and global assessments, Ecologically or Biologically Significant Marine Areas (EBSAs), and ecosystem-based climate change adaptation programs of the IPCC. We also expect to make contributions to national and local biodiversity strategic action plans in Japan. With the program outputs, we expect to promote the implementation of Sustainable Development Goals (SDGs), localization of the Inclusive Wealth Index, establishment of a Green Economy in the Asian region through the efforts of the International SATOYAMA Initiative, participation in ecosystem-based disaster risk reduction (Eco-DRR), and development of new multilevel governance of natural capital. We also hope to collaborate with international and national global environment research initiatives such as Future Earth and other ERTDF projects.

Fig. 1. Summary of a monetary-based evaluation (modified from a report of the Ministry of the Environment).

Coral reef value assets in Japan

– Tourism and recreation
  240 billion yen/year
– Commercial Fishing
  (seafood) 11 billion yen/year
– Coastal protection function
  7.5-84 billion yen/year

→ Limited to tropical region

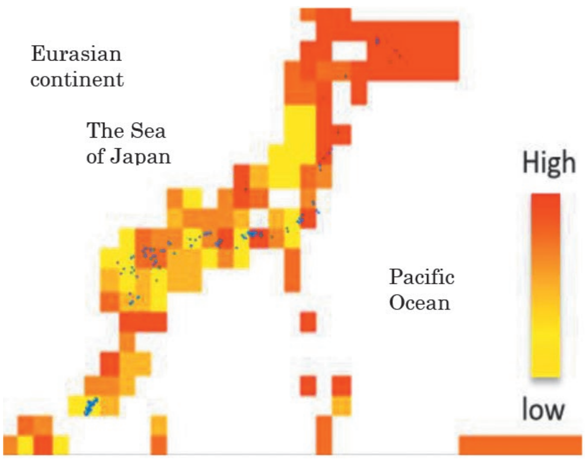
Economic valuation of tidal flats /wetlands

Ecosystem Services		Price / yr (billion ¥)	Unit Price /ha/yr (million ¥)
Provisioning	Food	90.7	1.85
Regulating	Water qualification	296.3	6.03
Habitat (Supporting)	Habitat offering	218.8	4.45
Cultural	Recreation, Environment education	4.5	0.091

→ Limited category of services
(clamming was the only one for cultural)

Fig. 2. Illustration of people clamming near Tokyo tower (Shinagawa) in 1861.

Fig. 3. Distribution of clamming grounds in Japan (dots) overlaid on important marine areas (rectangles) using criteria from Ecologically or Biologically Significant Marine Areas (EBSAs) integrated with a Marxan complementarity analysis (based on the methodology explained in Yamakita et al. 2015; 2017a). Colors of the rectangles means the importance considering EBSA criteria based on the number of selection using Marxan.



As a first step, our group focused on the spatial and temporal distribution of several cultural ecosystem services in temperate coastal areas of Japan. We evaluated indicators such as the number of visitors and the distribution of these services. As examples of coastal area services, we considered sea bathing, shellfish gathering, and coral reef diving.

A case study of a clamming ground

Clamming (shellfish gathering; *shio-hi-gari*) is one of the most popular coastal leisure activities in Japan. Historically, it has been a leisure activity since at least the 9th century and became popular in the 17th century (a picture in 19thC in Fig. 2). In 2003, 2,240,000 people throughout Japan enjoyed clamming (Fig. 3).

To investigate the dynamics of clamming activities, we evaluated people's use of a tidal flat area based on field observations (Fig. 4) and questionnaires administered before and after the 2011 Tohoku earthquake and tsunami (Yamakita et al. 2017b). The study was conducted at the Urayasu city side of the Sanbanze wetland in Tokyo Bay. We chose this study site because of its proximity to residential areas, its local history (which includes cessation of a land reclamation plan in 2011), and the involvement of local citizens in the participatory process that includes multiple stakeholders in the consensus-building and planning processes (Kawabe 2004; Sanbanze Restoration Planning Committee 2004).

Clamming and walking/jogging were the most common activities in the area before the earthquake (Over 50% people did. See Blue shaded bars in Fig. 5). Although walking/jogging decreased only slightly after the earthquake, clamming activity decreased by 64% based on the questionnaire data and by 73% based on field observations in 2013 compared with 2010 (one year before the earthquake). Interestingly, other minor uses did not show clear trends, possibly because of the small sample sizes.

Another clamming ground in Tokyo Bay showed a 62% decrease on average after the earthquake compared with the mean from 2008 to 2010 (Fig. 6). The percentage of visitors entering the clamming area was 48% of the previous average (2008 to 2010) in 2012 and 63% in 2013.

In contrast to similar trends observed for sea bathing following the earthquake in 2011, both the number of visitors to swimming pools and the total number of visitors for all sightseeing in Chiba prefecture in 2011 were at least 80% of the mean from 2008 to 2010 (Fig. 6). The number of visitors fully recovered to 2010 levels by 2012. Differences in the recovery rates between marine leisure use and other leisure uses therefore were evident. The earthquake decreased clamming, the most important cultural ecosystem service of the tidal flat, even in the Tokyo Bay area, which is located far from the earthquake's epicenter.

Fig. 4. Images taken by an automated camera system used to count the number of people at high tide (top), low tide (middle), and when the tide was coming in (bottom). We used this system to count the maximum number of people because the number depends on the tide (modified from Urayasu Whole Nature Explorers 2014).

Predictions of future coral diving locations

To evaluate the potential future demand and supply for coral diving spots, we conducted an investigation of current and future potential diving locations considering the distribution of coral reefs.

As a first step, we analyzed a scatter plot of the area of coral reefs and the present number of diving spots in 10km grids. We did not use a simple correlation, but rather the observed maximum value of diving locations. Therefore, we used a 95% quantile regression analysis on the scatter plot to estimate the potential number of diving spots depending on the area of the coral reef. The current distribution of potential diving spots was then mapped on the basis of these results. By doing so, we were able to show the gaps between the actual use (demand) and amount of potential service (supply) based on natural capital.

There was a notable gap near Okinawa's southern island in 2000 (Fig. 7). Okinawa is in a subtropical region and a large area of coral reefs was recorded in the area, but the area was not suitable for comparison with the studied temperate areas where we expending northward up of the distribution of coral reefs. Thus, we did not focus on the area around Okinawa in this study. Relatively large gaps were present at the tip of the

Fig. 5. Comparison of ratios of various uses of a wetland area (%) in 2010 (Blue shaded line bars; Q1) and 2013 (Green filles bars; Q1-Q5). A large decrease was observed in clamming use after the 2011 earthquake (modified from Yamakita et al. 2017b)

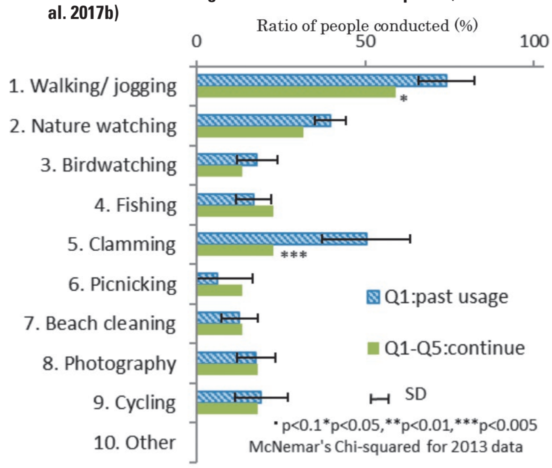
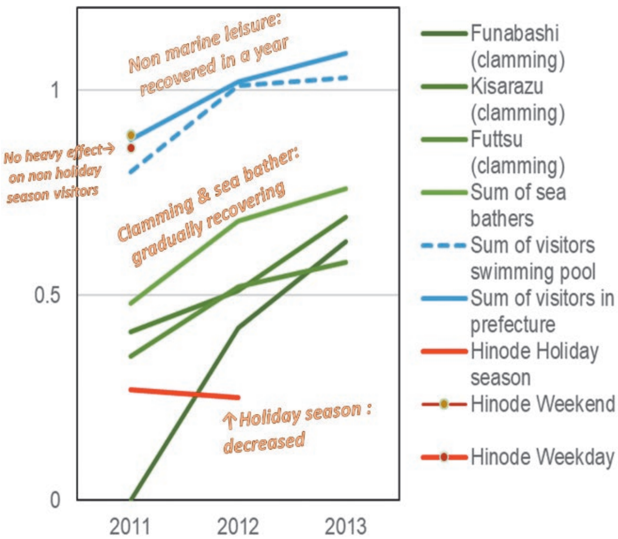


Fig. 6. The ratio of annual visitors participating in various activities after the earthquake relative to the mean for 2008–2010 (data extracted from Yamakita et al. 2017b).



peninsulas in Kyushu and Shikoku, all of which are affected by the Kuroshio Warm Current that meanders off the Pacific side of the Japanese coast.

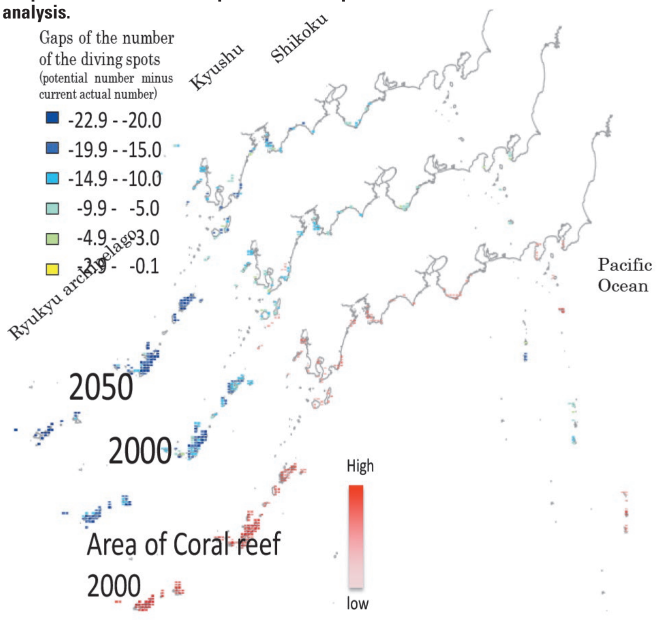
As a second step, future changes in the area of coral reefs and gaps in the number of diving spots were evaluated. We applied the future sea temperatures presented in MIROC model RCP8.5 of IPCC AR5 as the scenario. The area of coral reefs was estimated from the relationship between the area and seawater temperature in the current reefs and the possibility of the establishment of the reef are limited using several environmental factors such as coastline length and complexity and water depth. Most of increase of the reefs are conversion from rockey interidal in the complex coast line facing warm currents.

Given the projected area of coral reefs in the future, we estimated the gap between the potential number of diving spots in the future estimate and the current actual number of diving spots. In Figure 7, the larger area of darker colors in 2050 show the gap increased as compared to the year 2000.

In particular, the gaps increased west of Kyushu. Although the Ryukyu archipelago located south of Kyusyu also showed increases, the gaps may have been overestimated because we neglected the negative impact of high temperatures in tropical areas, such as coral bleaching.

These results reveal a high potential, on the supply side, to use the coral resource to increase tourism. To further consider the potential use of such areas, we need to better understand demand-side aspects, such as population, infrastructure, transportation, and existing local industry (e.g., fisheries).

Fig. 7. The area of coral reef in 2000 (lower), and gaps between of the potential number of diving spots and area of coral reef in 2000 (middle) and 2050 (upper). Increases in the gaps between demand (actual use) and supply (potential use) were observed in temperate areas in 2050. Tropical and subtropical areas were not considered in this analysis.



Past expansion of sea-bathing locations

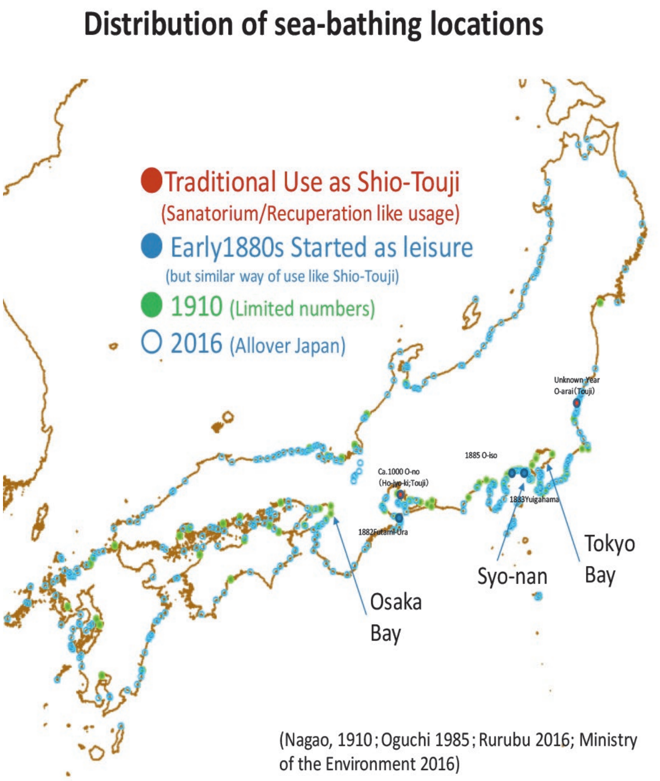
We also evaluated temporal changes in the distribution of sea-bathing locations (Fig. 8).

In Japan, travel to soak in sea water (*yu-ami*) has been known since at least the 10th century, and it became more popular in the 17th century as *shio-touji* (sanatorium/recuperative use) in some places. However, modern sea bathing for the general public is considered to have started in the 1870s. The practice was influenced by foreign visitors and returnees from the Iwakura Mission following the opening of the country. At that time, sanatoriums and associated travel became popular in the United Kingdom, such as in the Scarborough and Brighton areas. The first modern sea-bathing spots in Japan were Kanazawa-ku in Yokohama, Yuigahama in Kamakura, Oiso beach in Oiso, and Futami-Ura in Ise.

As shown by the green dots in Figure 8, by 1910 sea bathing had spread to several prefectures on the Pacific side of Honshu (the main island of Japan) and the west side of Kyushu. In terms of the number of tourists, the Shonan area attracted 10 million people as did the beaches at Kyoto in that period.

By 2016 the number of sun-bathing beaches had increased, not only on the Pacific coast but also on the Sea of Japan, northeastern Honshu, and even on the northern island of Hokkaido (not shown in Fig. 8). Interesting patterns of development can also be observed in enclosed bays. Compared to the increase in the numbers of sun-bathing locations in the countryside, Tokyo Bay and Osaka Bay showed a decreasing trend after the 1970s. Before then, there were several sea-bathing beaches, even on the inner part of the bay. In the 1970s in Tokyo Bay, almost all sea bathing stopped as areas closed because of landfilling and a decrease in water quality. In 1989, artificial beaches were created in some locations. Even with the creation of new areas (i.e., the alteration of natural capital into artificial capital), the water quality was not yet good enough for sea bathing in the innermost part of the bay. The consideration of both artificial and natural capital will be a challenging issue for in future evaluation of these types of conditions.

Fig. 8. Distribution of areas for the traditional use of beaches, and the rapid expansion of sea-bathing locations from the early 1880s to the present.



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The Seletar Kids Art Education Project – A Project to Document the Wetland Jewels of Malaysia

Wong Yun Yun, Ng Hong Jing
Nature Classroom, Malaysia

'Seletar', the 'Orang Laut", sea people in Malay language, is one of the 18 indigenous ethnic groups in Malaysia. They are Austronesian and were once part of the sea nomads that lived in boats at coastal areas and estuaries along Straits of Johor (between Malaysia and Singapore). After the independence of Singapore in 1965, most of the Seletar tribes were relocated to Johor, the southern state of peninsular Malaysia.

Today, the Seletar people lives across 9 villages in southern Johor. Even though they have settled on land and stop living freely on the sea like their ancestors, they are still depending heavily on sea for livelihood and resources. They still practice traditions and culture that closely related to sea and the mangrove forest. Many of them are animist but some converted to Christian or Muslim.

Due to rapid development such as the large scale reclamation project along Johor Straits, the Seletar people are facing drastic changes in their homeland and lifestyle. Quality of life is dropping as the sea getting more and more polluted and exploited for urbanisation. The Seletar children are found very difficult to adapt the mainstream education system. They are sometimes marginalised due to their weaknesses in academic achievements.

As sea nomads that used to live in boats and now living at settlement surrounding mangrove forests, the Seletar are highly intertwined with natural environments through years of interactions. We understand that Seletar people inherited some fascinating culture and old stories which ae still remain unknown to the world. These beautiful cultural heritage are worth to be learned and conserve. However, Seletar language do not have any proper writing system. Besides, many younger people prefer to speak Malay language and those old Seletar customs could be fast disappearing.

The 'Seletar Kids Art Project' were initiated to help the younger generation of Seletar to rethink and to document their history, culture, homeland and lifestyle through art education. We are currently conducting a monthly art class for the Seletar kids between the age of five to fifteen. We guided them in an interesting way, such as storytelling, drawing, colouring and making handcraft and art pieces related to their family, their village, their myths & folklores as well as their daily life.

By implementing the project, we hope this could encourage Seletar kids to learn better in schools. After several monthly session, we discover that many of them are highly interested in learning and very talented in art. Our next target is to collect the children artwork as well as the Seletar's folklores and historical tales for subsequent documentation and publication of their beautiful untold stories at Johor Straits.

In the following poster (figure 1), the author portrait the identity, history, culture, living environment, as well as the Seletar kids art education project from the eye of Lawra, a 7-year-old Seletar kid. We hope our work will be able to help to preserve the wetland together with the intangible culture that inherited by the indigenous tribe of Seletar.

Figure 1

Seletar Kids Art Education Project
A Project to Document the Wetland Jewels of Malaysia
Wong Yun Yun, Malaysia
Nature Classroom
Video
Scan the QR code to watch our project's video.
Project Location
Contact
natureclassroom.nhj@gmail.com or scan the FB profile code for instant messaging.
1. Identity & History
Hello, my name is Lawra. I'm 7 years old. I was born and raised in a small village in Johor Bahru, Malaysia.
My parents told me that our family and other villagers are "Seletar" or "Orang Laut". (Orang laut - sea people in Malay language).
I slowly understand that "Seletar" is one of the 18 indigenous ethnic groups in Malaysia.
Our ancestors were Sea Nomads that roamed the coastal areas and estuaries along the Straits of Johor (between Peninsular Malaysia and Singapore). We speak our own Seletar language, but we do not have any proper writing system.
2. Culture & Tradition
My grandma loves to tell stories of the old times. According to her, before our tribe settled on land, our people lived freely on the sea by using house boat.
I wonder how our ancestors got their daily necessities, such as clothing and medicine. Grandma smiled and said, we can get everything from the mangroves!
That is right, I remember when I practise traditional dance, the teacher let us wear head bands and skirts made of "mengkuang (Pandanus odoratissimus)" and "nipah (Nypa fruticans)".
Both can be harvested from nearby mangrove forests.
3. Home & Family
I live with my family at one of the nine Seletar villages in the Johor state of Malaysia which is also the nearest to the big city of Johor Bahru.
However, most of us are still staying in wooden stilt houses along the coast.
According to our village head, there are about 80 families or 400 people in this village. Though our ancestors are animistic, many have now converted to Christians or Muslims.
Today, we are very diverse in religion. Regardless, we love to be Seletar!
4. Childhood & Livelihood
I go to school everyday. I know I am lucky because my parents and grandparents never went school. I love to go to school and learn new things.
But sadly, I have a very hard time following lessons, finishing homework and facing exams. It is too difficult for my friends and I.
After school, we play almost every corner in the village. If the tides get higher, we will just jump into the sea water and have fun. We were born to be good swimmers!
5. Nature & Environment
My father is a fisherman, like most of the Seletar adults. As he always says, we earn a living from surrounding mangroves. He wants us to be grateful towards mother nature.
Following my father to the mangroves is like an adventure because I can climb trees, play with mud, catch crabs and fishes. My father will teach me the different usage of mangrove plants.
Unfortunately, there is a coastal development project nearby our beautiful mangroves and had caused pollution and a massive drop in our catch. I feel sad for that but what can I do?
6. Art & Education
Few months ago, I started joining monthly art class by Nature Classroom. It is free of charge as it is a volunteer project. The teacher gathered seletar kids together and did activities like story-telling, painting and making handcrafts.
The teacher and volunteers encouraged us to draw more about our lifestyles, our families, our village, our myths and folklores. They said, Seletar inherit fascinating culture and history which are fast disappearing. As the younger generation, we should treasure our own cultural heritages.
They want to help us document our stories through art education. I do not really understand, but I found the classes very interesting.
Lawra, 7-year-old
Johor, Malaysia
Oct 2017
Acknowledgement
We are grateful to be able to conduct the "Seletar Kids Art Education Project". We would like to express sincere gratitude to all volunteers, supporters, family & friends, and everyone who helped succeed this project. Without your kindness and contributions, it is impossible for us to keep on working for community education and nature conservation.
A special thanks to our late mentor, Mr. Choo Chee Kuang where his early work in Seletar village had inspired us to establish current project.
Supporting Organizations
SELETAR CULTURAL & ARTS SOCIETY
Diamond Heart
Photo credit
Chai Kah Keong Yong Shi Wen Ng Hong Jing
Sponsors
Friends of Pbadss (Choo Jen Ling)
Arty-Party (Wong Fen Fen)
Wave Rest House & Cafe
Wong Tein Tein & family
亲子玩乐学习坊 (Ching Pik Ngoi)
Anna Tang Hoi Ching
Janice Lim Khai Sean
Chai Soo Kian & Pang Yin Hui
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Langur Project Penang
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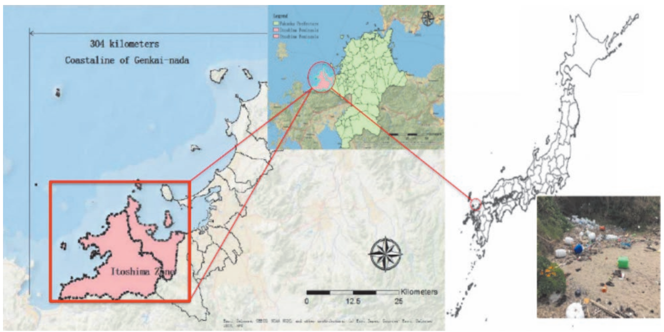
Community Based Management of Beach Litter in Itoshima Peninsula, Fukuoka, Japan

[1] Shuyuan Geng, [2] Satoquo Seino, [3] Mitsuhiro Aizu

[1] Graduate School of Engineering, Kyushu University, [2] Graduate School of Engineering, Kyushu University,
[3] Faculty of Engineering, Kyushu University

Sand beaches were defined as the wetland area of global importance by the Convention on Wetlands. On the other hand, the amount of rubbish found dumped on beaches has rapidly increased in recent years. Marine litter have a bad influence not only on decreasing the aesthetic and recreational values of beaches but also the wildlife. Itoshima Peninsula (or Itoshima zone) is one of the most important marine regions along Genkai-nada coastal area (Sea of Japan). One of the most significant trends affecting its future shoreline management is marine litter. However, due to the imperfect data collection, in Itoshima zone a litter is known about the litter composition on beaches. Therefore, we conducted a questionnaire survey and a field survey over a period of one year from 2017 and analyzed the presence of litter on the beaches.

Fig.1 Map of the study area and field photo of marine litter along the beach in Itoshima zone



A structured questionnaire was used as the way to inform people the marine litter issues. It was conducted during the autumn of 2016, to explore in more detail the marine litter issues by region. The questionnaire started with a number of questions about the presence of litter on the beaches. We had received 86 responses, with the response rate of 90.5%. 32 replied as high school students, 27 replied as fishermen, eight replied as salarymen. Nineteen respondents replied as an "other". There was no significant difference between the number of males and females who took part in this survey. The majority of participants were in the 14-25 years and 36-55 years old category.

Ages structure of the responses as shown in below:

- 25 years old and below: 37.21% (male 17/female 15)
- 26-35: 9.30% (male 4/ female 4)
- 36-45: 16.28% (male 11/ female 3)
- 46-55: 15.12% (male 5/ female 8)
- 56-65: 8.14% (male 4/ female 3)
- 65 years old and above: 13.95% (male 8/ female 4)

Six questions were designed for this questionnaire to evaluate public attitudes to marine litter in Itoshima zone. (1) How many times have you participated in cleanup activity? (2) How do you know if a cleanup activity happens? (3) What is the major source of marine litter in Itoshima Peninsula? (4) Have you ever heard of International Coastal Cleanup Data Card (ICC Data Card)? (5) How many percentages of marine litter do you think it originates from your country? (6) Which one do you think the local government should do to improve the promotion of beach cleanup project? (Multiple-choice). The analysis for each question was shown by the following chart.

Fig.2 Analysis of the question 1

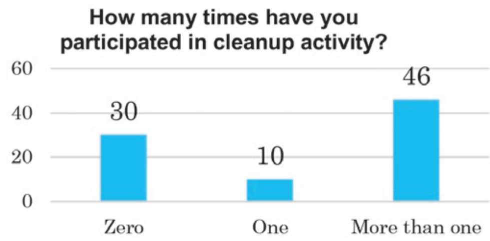


Fig.3 Analysis of the question 2

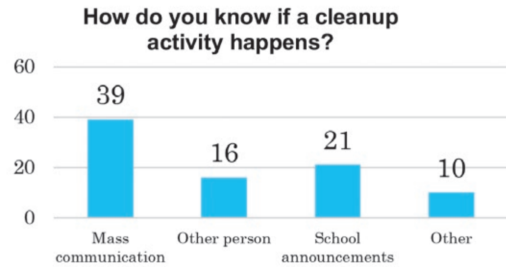


Fig.4 Analysis of the question 3

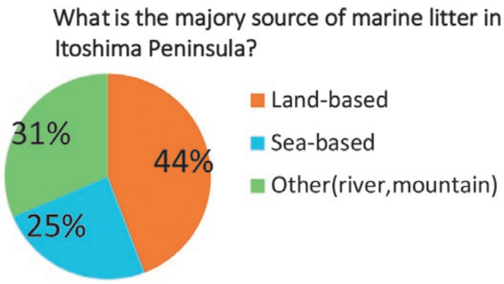


Fig.5 Analysis of the question 4

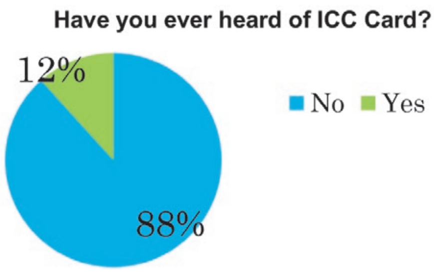


Fig.6 Analysis of question 5

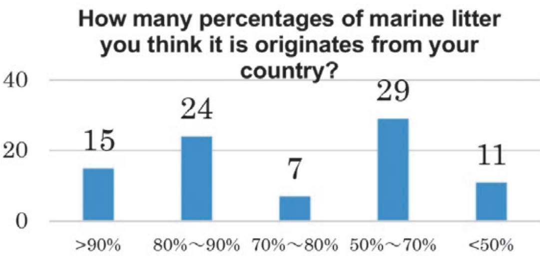


Fig.7 Analysis of the questions 6

Top3. The local residents think the local government should do to improve the promotion of beach cleanup project			
	Item Content	TP	%
1	Strengthening cooperation with local residents.	36	41.9%
2	Speeding up waste collecting, transporting and disposal.	35	40.7%
3	Improve the release of information regarding cleanup initiative.	27	31.4%

TP: number of responsdents

In spite of over half of respondent (53%) answer that it is not the first time, they join the cleanup initiative. About one-third of them (35%) still have never joined any cleanup initiative yet. Most of the participants know a cleanup activate by mass communication while teenagers are through school announcement. Land-based sources are responsible for marine litter and the remainder was due to sea-based activities. However, only 44% of respondents attributed the main source of litter on the beaches to land-based sources, the rest of them (54%) insist that major sources of marine litter can be the others (river, mountain, and sea). Before the questionnaire is conducted few people answered that they had already heard of ICC Data Card. From The Association of North East Asia Regional Governments over 90% of the litter in the beach of Itoshima zone comes from their own country [1]. However, only a few know the truth, many of the respondents believe that litter originates from distant countries dominates on beaches. As for management options by respondents to reduce beach litter, such as affording free trash bags for NPOs and volunteer organizations, and making a waste management policy to disaster litter also required by many respondents. As four aspects of marine litter (i.e., the scope of removal efforts, scope of strengthening the partnership, the scope of support system, and the scope of public awareness and education campaign), the scope of removal efforts they care about the most. While only near 10% of them agree that it is essential to develop the public awareness and education campaign. Marine litter problem involves various complicated issues if only rely on the cleanup campaign, not scientific data. This problem will never be solved. Unfortunately, this fact seldom realized by people.

Actually, the promotion of public awareness and education project in Itoshima zone is more advanced than other zones in Fukuoka prefecture [1]. However, the results of this questionnaire survey confirm that local residents did not understand the presence of marine litter very well. It is speculated that this result is primarily caused by incomplete data collection.

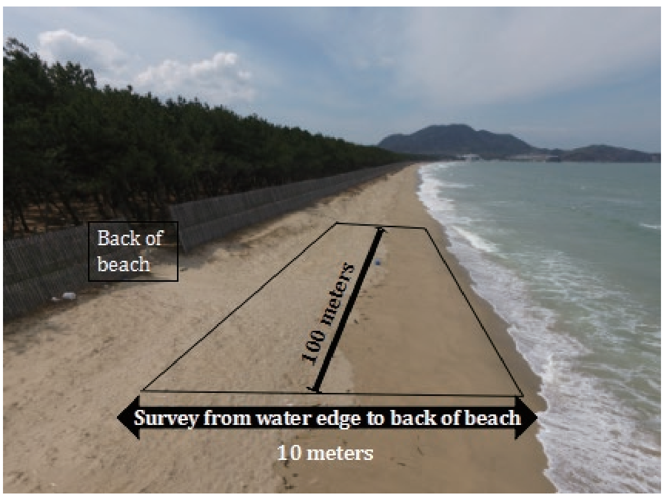
Recent studies have suggested the importance of monitoring as part of integrated environmental research programs that help policymakers evaluate their policies and inform the public. In Japan, ICC data collected by volunteers over the last two decades play a critical role when Basic Policy on Fukuoka RAP was published in 2009 [2]. Numerous scientific and community-based approaches to surveying and beach cleanups including outreach programs targeting the involvement of volunteers and coastal residents have been deployed, though. In Itoshima zone a little is known about the litter composition on beaches from Fukuoka RAP. Furthermore, it is largely unknown what the contribution of Itoshima's recreation and non-recreation to beach litter found on the beaches of Itoshima zone is. There was a strong need to perform a quantitative evaluation litter on the beaches of Itoshima zone. Thus, we also conducted a survey regarding monitoring the beach litter in the study area. The whole year of 2017's data was used in this study. (i.e., 100m standing stock survey, which is a shoreline method designed by NOAA will be used for monitoring debris in the beaches of Itoshima zone). This shoreline survey technique is designed as a rapid, quantitative beach assessment for the collection of standardized and consistent data that can be applied to address policy and management needs at various spatial scales. In addition, this shoreline technique is designed to be usable by trained community volunteer organizations while simultaneously providing data that can be used to address key management questions [3].

The beach of Nagahama and Keya are selected as the survey station (Fig.8). Both are located in Itoshima zone, but Nagahama is a non-recreation beach, which is placed in the Nishiku of Fukuoka-shi, while Keya is a recreation beach, which is placed in the southwest region of Itoshima-shi. Fig.8 shows the location of study sites, Nagahama (site1, E 130°15′09.67″N 33°36′9.05″) is a sandy beach facing to Hakata Bay, the stretch of beach is three kilometers. Keya (site2, E 130°06′31.60″N 33°35′10.13″) also a sand beach but facing to Genkai-nada and the Sea of Japan, the stretch of beach is 500 meters. Keya Beach has been selected among Japan's 100 Best White Sand and Green Pine Beach, because of the beautiful scenery of beaches with its white sand and green pine trees beach.

In order to analyze the maximum width of the shoreline section during a relatively rapid beach assessment, sampling should be conducted within three hours of low tide (Fig.9).

Fig.8 The locations of standing stock survey

Fig.9 Schematic representation of belt transect, drawing of a beach, indicating low tide line and transects setting.



The debris item concentration (number of debris items/m2) per transect is calculated as follow: (1a)

$$C = n/(l * w) \quad (1a)$$

C = concentration of debris items (# of debris items/m2)
n = # of macro-debris items observed
w = width (m) of shoreline section recorded during sampling (i.e., transect width, 10-m in this work)
l = length (m) of shoreline sampled = 5-m

For the results of the standing stock survey, a total of 2948 items of different kinds of litter were recorded along the shoreline under study. A higher number of items was observed in autumn. While a lower number of items was founded in spring. The higher amount was found on Nagahama Beach and the lower amount was found on Keya Beach. Litter densities varied significantly different between seasons. Mean litter densities (± SD – standard deviation) at Keya Beach is 1.17b±0.42, Nagahama Beach is 1.78b±0.69 (Fig.10). Plastic was illustrated the predominant type of material found on both shorelines (Fig.11, and Fig.12). At Nagahama Beach, plastic and Styrofoam vary from season to season. The number of plastic items after the tourist season increased, reaching a total of 569. The number of litter items at Keya Beach was similar, except the "Fishing" category

Fig.10 Mean litter densities (± SD) in five transects at Keya and Nagahama during four seasons

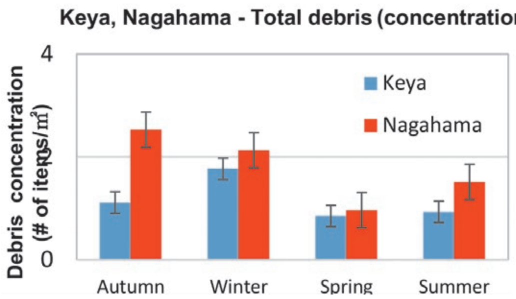


Fig.11 Summed debris counts across the five transects by material type on Nagahama Beach

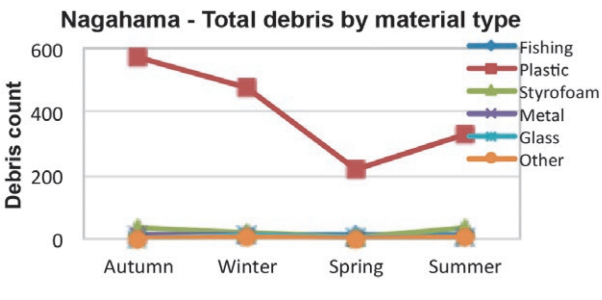
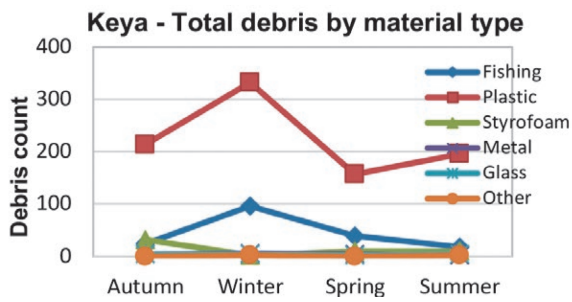


Fig.12 Summed debris counts across the five transects by material type on Keya



Plastic Consumer Products include Food Wrappers, Plastic Beverage Bottles, Other Jugs/Containers, Bottle/Container Caps, 6-Pack Rings, Bags, Cups, Plastic Utensils, Straws, Balloons, and Personal Care Products. Plastic Smoking Products >2.5 cm include Cigarette Tips, Cigarettes, and Disposable Cigarette Lighters. Plastic Fishing Related Products include Plastic Rope/Net, Buoys & Floats, and Fishing Lures and Line.

At Keya Beach, plastic debris is mainly comprised of consumer related products and fishing related products (Fig.13). Meanwhile, at Naghahama Beach, plastic debris is mainly comprised of consumer related products and smoking-related products (Fig.14). Including smoking related products, the number of plastic products after the tourist season increased. Also, Detailed maps were created to compare a 100-m transect from both Nagahama Beach and Keya Beach to explore how items vary in their distribution along beaches. It is apparent from an examination of transects at Nagahama Beach (site 1) and Keya Beach (site 2) that other and bottles are the most common items observed (Fig.15). The category other varied for two locations and included numerously broken or weathered plastic debris (>2.5 cm) which could not be identified during fieldwork.

The sources of litter found during the period 2017 (forty 25m-surveys; total number of debris items counted 2948) give results as in Tab.1. According to the analysis of data collected, 36% of marine litter on the beach of Itoshima zone from the shoreline and recreational activities. Another observation when looking at Tab.1 is that 46.13% marine litter from unidentified sources (the classification system used is that applied by the Ocean Conservancy). This is due to a larger number of

Fig.13 Summed plastic debris counts across the five transects by user category on Keya Beach

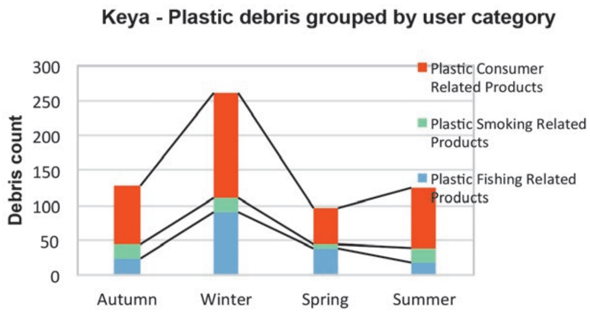


Fig.14 Summed plastic debris counts across the five transects by user category on Nagahama Beach

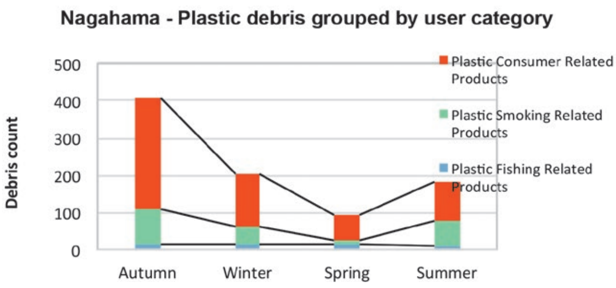
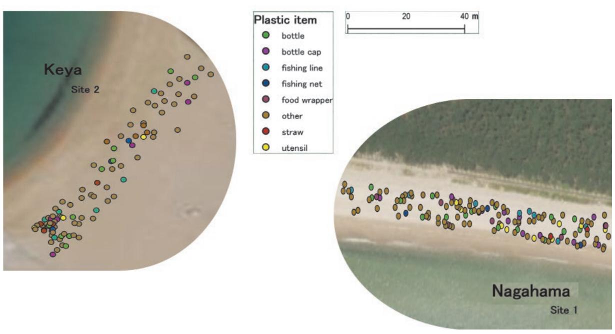


Fig.15 Comparison of type of item found in two 100-m transects of different study areas



Tab.1 The classification of sources of marine litter in Itoshima zone

Sector/Item type	Total NO.	% NO.	Total% NO.
Shoreline&Recreational Activities			
Bags(Paper)	61	0.02	36.91%
Bags(Plastic)	76	0.03	
Balloons	28	0.01	
Firework	46	0.02	
Beverage Bottles (plastic) 2 liters or less	72	0.02	
Glass Beverage Bottles	31	0.01	
Beverage Cans	44	0.01	
Caps,Lids	198	0.07	
Clothing, Shoes	21	0.01	
Cups, Plates, Forks, Knives, Spoons	168	0.06	
Food Wrappers/Containers	232	0.08	
Pull Tabs	16	0.01	
6-pack Holders	3	0.00	
Straws, Stirrers	92	0.03	
Ocean/Waterway Activities			
Bait Containers/Packaging	16	0.01	8.68%
Bleach/Cleaner Bottles	6	0.00	
Buoys/Floats	13	0.00	
Plastic pipes (used in oyster farming)	38	0.01	
Crates	2	0.00	
Fishing Line	78	0.03	
Fishing Lures/Light Sticks	7	0.00	
Fishing Nets	43	0.01	
Light Bulbs/Tubes	2	0.00	
Oil/Lube Bottles	3	0.00	
Pallets	17	0.01	
Strapping Bands	31	0.01	
Smoking-Related Activities			
Cigarettes/Cigarette Filters	62	0.02	7.06%
Cigarette Lighters	18	0.01	
Cigar Tips	3	0.00	
Tobacco Packaging/Wrappers	125	0.04	
Dumping Activities			
Appliances (refrigerators, washers, etc.)	0	0.00	1.02%
Batteries	0	0.00	
Building Materials	21	0.01	
Cars/Car Parts	8	0.00	
55-Gallon Drums	0	0.00	
Tires	1	0.00	
Medical/Personal Hygiene			
Condoms	3	0.00	0.20%
Diapers	1	0.00	
Syringes	0	0.00	
Tampons/Tampon Applicators	2	0.00	
Unidentified			
Plastic pieces (uncertain materials, foam, etc.)	1360	0.46	46.13%
Total	2948		100.00%

plastic pieces were found on beaches under study.

The density of litter found along the shorelines of transects under study was found to be season-dependent. The higher number of items was observed in autumn. Plastic was illustrated the predominant type of material found on both shorelines. The number of three types of plastic related products (plastic consumer products, plastic smoking products, and plastic fishing related products) after the tourist season increased. It can thus infer that this increase is mainly caused by the gradual increase of beachgoers in the past year.

Moreover, a large number of plastic pieces were found on beaches under study. Plastic comprised 83.35% of all debris items observed (Fig.11, Fig.12). 46.13% marine litter from unidentified sources caused by the breakdown small plastic pieces can found anywhere on beaches, and a major source of beach litter at Itoshima zone was found from the shoreline and recreational activities.

Results show that such as using standing stock survey is valid for more data collection. Issues exist in the process of data collection seems that related to various groups according to the local residents (Fig.16). For the status of local residents understand the presence of marine litter, a negative feedback was given by the analysis of questionnaire survey, though. Since the fact that the promotion of public awareness and education project in Itoshima zone is more advanced than other zones in Fukuoka prefecture is acknowledged [1]. So, on the next step of managing beach litter in that area, how the local residents engaging in data collecting process is become important. For these reasons, we would like to give a proposal which is building a frame to manage scientific data in order to improve this problem (Fig.17). We are hopeful that this proposal could be one of the marine litter issue solutions in the future.

Fig.16 Issues exist in the process of data collection

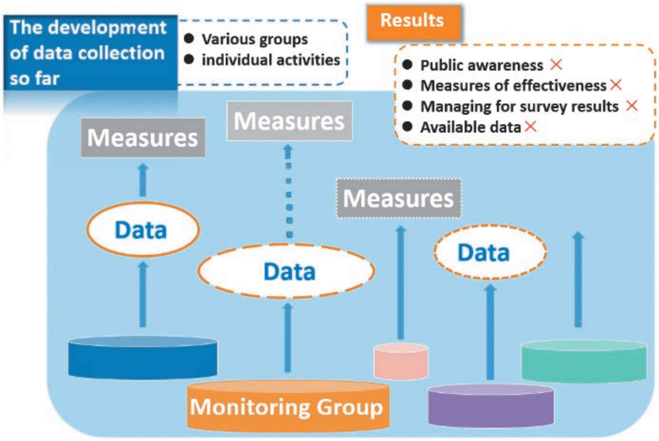
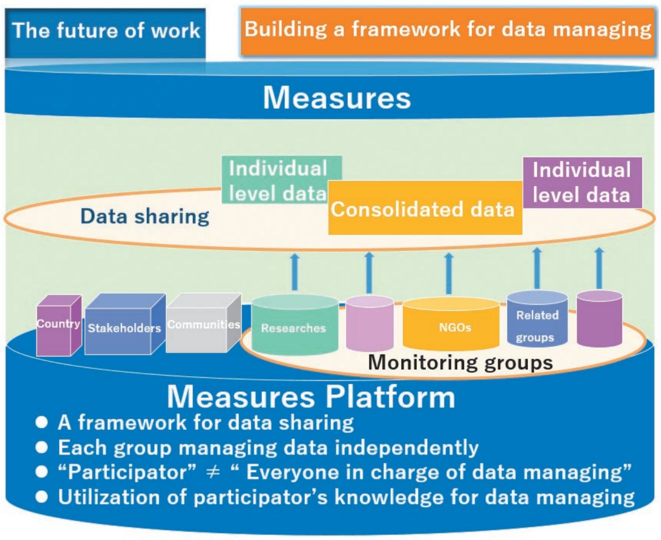


Fig.17 Measures for solving the issues exist in the process of data collection



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Development of ESD Program Focusing on Conservation Ecology of *Suaeda japonica* Makino (Chenopodiacea), a Threatened Wetland Halophyte

Takashi Shimoyamada[1] and Satoquo Seino[2]

[1] Shisei Junior High School, Japan

[2] Ecological Engineering Laboratory, Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University, Japan

Introduction

Conservation ecology is concerned with the origins and preservation of biological diversity. It seeks to understand how the rich variety of plants, animals and other creatures exists in the ecosystems around us, and how diversity has been maintained by natural processes.

The ecosystem concept is central to this conservation ecology, which aims to protect biological diversity and sustainably manage the biosphere. It is important to be aware of how extinction can accelerate as a result of the disruption of basic ecosystem processes (Cox 1993).

In this report, we develop an Education for Sustainable Development (ESD) program based on conservation ecology, biology and related knowledge, making use of the *Suaeda japonica* Makino (Chenopodiacea) plant as the teaching material.

This report clarifies the characteristics of tidal flats (referred to below as "wetland") environment around Suaeda japonica and studies the characteristics of this species naturally suitable for wetlands. Based on the results, we would like to further consider the seawall construction methods along the Higashiyoka coast (as a wetland under the Ramsar Convention) from the viewpoint of conservation of this species and wetlands.

Materials

Suaeda japonica Makino (referred to below as "the species") is native to wetlands around estuaries and seashores in northern Kyushu in Japan, including an area around our town. Due to the loss of wetlands and changing ecosystem processes in recent years, this species is on the decline nationwide and facing extinction regionally.

The first documentation of this species was by Makino (1909). Its Japanese name "shichimen-sou" means turkey herb and is derived from the changing colors of its leaves, invoking images of the face of a turkey. Its tinted autumnal leaves are a defining feature and tidelands are beautifully colored by them. The autumn foliage is popular for tourists.

Methodology

This ESD program is concerned with *Suaeda japonica* on this wetland and is developed based on the following four perspectives, with the aim of clarifying the characteristics of the wetland environment around this species.

1 ***Learn the flooding frequency of tidelands***

Conduct a comparative observation of the tide table near this tideland and the tide level where this species is flooded to obtain an understanding of the frequency of flooding of this kind of community throughout the year (Fig. 1).

2 ***Learn the characteristics of the tideland environ-ment where this species grows naturally***

Study the soil of the tideland (mainly muddy soil), to learn that this species and other halophytes (*Suaeda malacosperma, Aster tripolium* L.) in the same area of the tidelands are separated by slight height differences from sea level (Fig. 1). Furthermore, we compare the biodiversity of the tidelands with biodiversity around the school and learn the role of basic ecosystem processes on tidelands.

3 ***Consider the breeding strategy of this species on tidelands from the relationship between temperature variations (associated with hours of sunshine and impacts on plant growth, Fig. 3) estimated flooding frequency (Fig. 1), and the number of remaining individuals in this plant community (Fig. 3)***

In addition to the past annual temperature record (Fig. 3) announced by the Meteorological Observatory and Fig. 1, the change in the number of remaining individuals based on quadrat surveys carried out also in the past (Shimoyamada *et al.*,1995) about this species (annual grass), learn the characteristics of the environment where germinated individuals are washed away by waves. Furthermore, considering these features, we consider the adaptation strategy of germination that may have evolved over time, as this species continued to propagate on tidelands.

4 ***Investigate diurnal changes in germination rates of halophytes and growing plants at risk of extinction***

For each plant, 50 seeds are seeded in a petri dish and the germination rate is examined at 25°C. under natural light.

Results

The results (Fig.1, Shimoyamada *et al.*(1995), Fig.3, Fig.5: Shimoyamada(1999)) from Method 1 to Method 4 were as follows:

Fig. 1 Estimated number of floods per month at the Fukudomi Beach at about 5 m tide level where *Suaeda japonica* Makino community grows naturally.

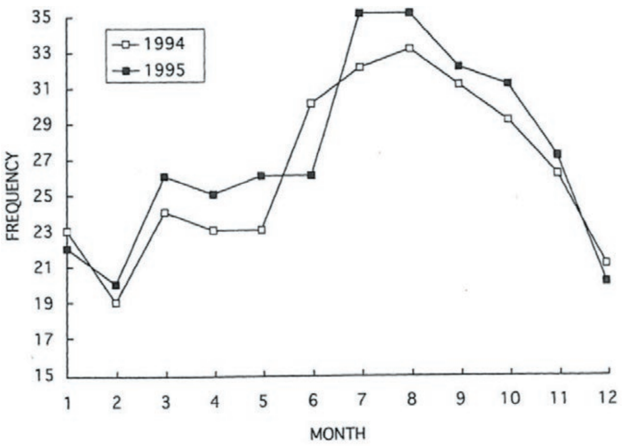
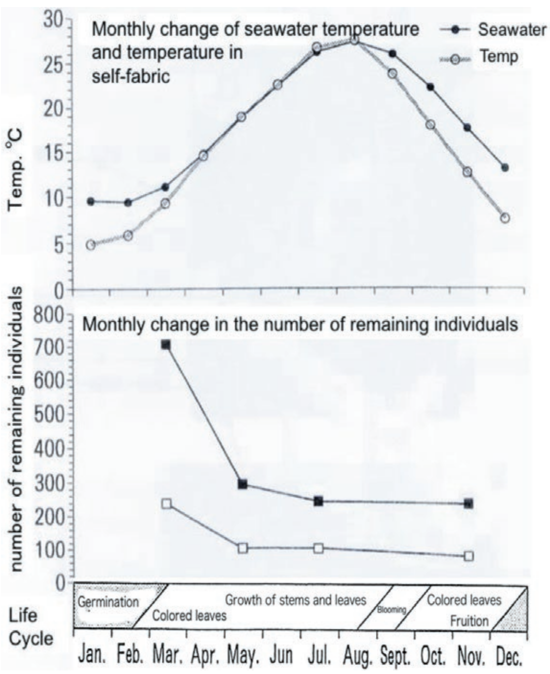


Fig. 2 In the tidal flats, different communities will form based on elevation differences.

Fig. 3 Top: Average monthly water and air temperature in Ariake Sea (Tidal chart 1994 by Saga Pref. Ariake Fisheries Promotion Center). Bottom: Quadrat survey for this species (Shimoyamada *et al.*,1995).



Discussion

(1) These wetlands (tidal flats) are located in the intertidal zone and affected daily throughout the year by flooding and waves containing salt.

(2) Salt water in the tidal flats is thought to prevent intrusion of other species. Also, from observation, the effects of flooding and waves differ with slight differences of the tidal flats from the sea level, and as if to adapt each species seems to select a niche. The existence of tidal flats with slight differences in elevation maintains the diversity of halophytes. *Suaeda japonica* was forming communities at the lowest elevation, closest to sea level, compared with other halophytes.

(3) In this species and other halophytes, germinated seeds settled on tidal flats and many individuals had been lost during flooding around spring time when their growth was prosperous. It seems to be important for the establishment of seeds of this species on tidal flat which is disturbed by flooding and waves as a strategy for "rapid rooting" to survive. Furthermore, it is considered that irregularities on the tidal flats are working advantageously for fixing in order to establish rooted state individuals flushed by flooding in the tidal flats.

Fig.4 Daily change of germination rate of halophytes
a: Halophytes (25°C)
▽ *Suaeda japonica* ● *Suaeda malacosperma*
■ *Aster tripolium* ▲ *Suaeda maritima*
b: Cultivated plants (25°C)
■ *Raphanus sativus* L. ● *Phaseolus vulgaris*

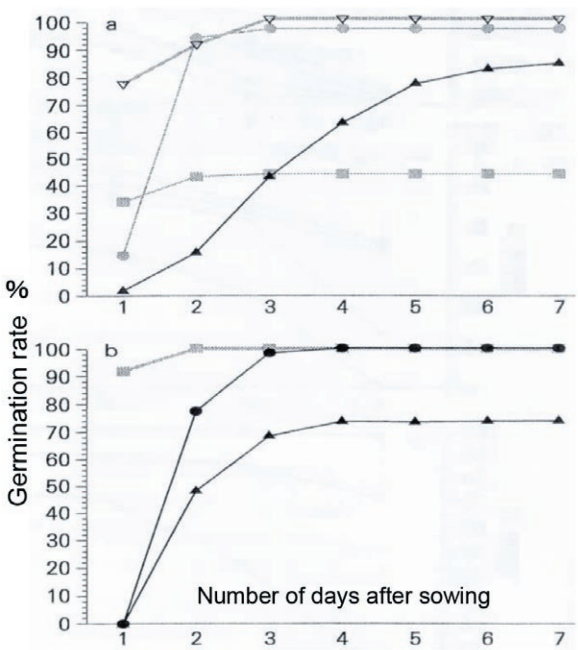


Fig.5 Tideland and halophyte communities are affected by environmental disturbances. These drift materials will continue to move between the wetlands and offshore with the tides unless they are removed.

Peat Accumulating Mountain Wetlands of South Siberia: Biodiversity and Ecosystem Services

Volkova I.I.
Tomsk State University, Tomsk, Russia

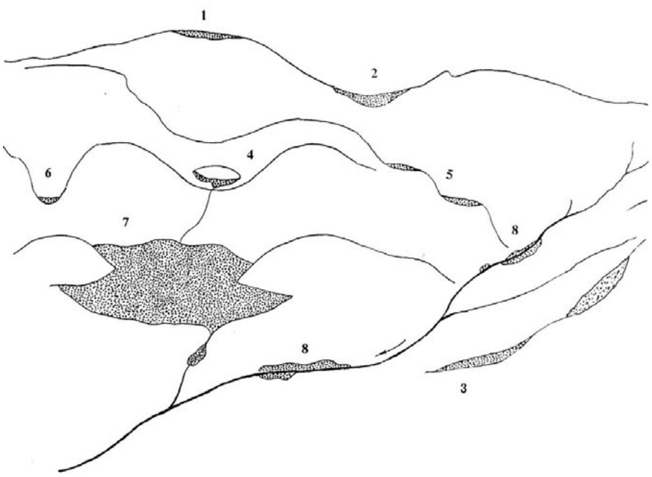
West Siberian plain is well known by the largest peatlands of the world situated here. However, mires and peatlands can be found not only at the vast plains of Siberia but in the mountains too. Siberian mountain mires are unique type of wetlands that can be found at the large mountain land at the south of West Siberian plain, in Altai Mountains (Fig. 1).

Figure 1. The largest mire of Altai – Tugurukskoje mire

Altai is a large mountain country (about 150 thousand km2) with a range of various climate, relief, hydrology and vegetation conditions in different parts. Thus, the climate varies from hyper-humid on the western macro-slope of Kuznetsky Alatau ridge in the north of the Altai region where precipitation reaches 3000 mm per year to arid with only 120 mm per year in the South-Eastern Altai.

Mires occupy concave and flat areas such as large depressions, high-mountain circuses, river valleys, saddles, flat tops, the slopes foots and even gentle slopes of the mountains (Fig. 2) (Volkova, 2014, Volkova et al., 2015).

Figure 2. Mire massifs situation in the mountains of Altai



Our research started in 1996 and covered more than 100 mire massifs where about 800 geobotanical releves were conducted. The research objective was to establish a scientific basis for the protection of mountain mires – rare natural wetland type in continental Asia – in Altai mountains (about N 49°04'–55°38' and E 83°57'–89°52').

The most of mires in Siberia are peat-accumulating ecosystems – peatlands. We carried out more then 50 peatlands coring; peat samples for botanical composition, degree of decomposition and mineralization were analyzed, several cores from Altai and Kuznetsky Alatau mountains were also selected and analyzed for heavy metals in the upper layers of the deposits.

Siberian mountain mires are sources of water supply to many river basin heads, including the upper Ob' – the largest Siberian river. One model (typical) mire system – Krestovskye mires, consisting of 5 massifs at area of 1000 hectares at altitudes above 850-900 m a.s.l. – was chosen, and black box model was used as a base for the study planning and the data processing and analysis. Water samples from inflowing and outflowing streams as well as from different mire complex elements such as likes and hollows were taken. Control samples from the streams with peat-free catchment were picked out. Also, precipitation was collected on Krestovskye mires in the mountain forest belt and at neighboring mountain peak at 1200 m a.s.l. At the same time in the field conditions water samples were tested for temperature, pH, electrical conductivity and alkalinity. Water samples were analysed for NH4+, NO3-, Cl-, PO43-, Al, Ca, Cd, Cu, Fe, Mg, K, Mn, Na, Pb, Si, S and Zn.

60 peat samples from 9 cores were obtained at all depths of the peat deposits, representing entire Holocene peat sequence and varying from 30 to 150 m, with more often selection of less thick samples in the upper modern layers of deposits (depth till 20-30 cm) for identification of a layer, that appropriates to the beginning of hard industrial pollution. Undisturbed peat samples at intervals of 3-5 cm were taken. Taking into account specialization of the largest regional air polluting enterprises, the peat samples were investigated on fraction structure of the undissolved particles and on the content of heavy metals Cd, Zn, Pb, Cu, As, Hg.

The most of heavy metals studied, in particular lead, showed the increased concentrations in the top layers of the peat deposits of mountain mires as well as in upper on the slopes mire parts, that is probably connected to industrial human activity. But, their concentrations are minimal, and the mountain mires of Kuznetsky Alatau are still in pristine condition in spite of the nearby-situated large coal-mining industrial centre "Kuzbass". The content of the investigated chemical elements in the waters of Kuznetsky Alatau also does not exceed the background values given in works of other researchers. The content of many elements in the water of the studied mire system inlets is appreciably higher (1,5-10 times) than in outlets. The filtering and water-purifying capacity of the mountain peatlands proved to be rather significant.

The filtering and water-purifying capacity of the mountain peatlands are evaluated also and proved to be rather significant (the content of many elements in the water of the studied mire system inlets is appreciably higher (1,5-10 times) than in outlets) (Volkova et al., 2009).

Peat mires started to develop in Altai Mountains in the middle of Holocene, at the end of time period called the Holocene thermal optimum, about 4.5-5 thousand years ago, having accumulated up to now maximally 3.9 m peat deposit depth. Plant remains of sedges (mainly the remains of *Carex altaica*), brown mosses and sphagnums are found most frequently at mountain mires peat deposits. Today, mountain mires are covered by sedge, sedge-brown moss, dwarf shrub-sedge brown moss and sedge-sphagnum plant communities.

Mires as vital landscape features are critical for conserving and promoting biodiversity and are apparent especially in arid regions of Altai, where they are natural refuges for hygrophilous plants, animals and their communities. They differ from other ecosystems by the large variety of habitats they include. This habitat diversity increases with the altitude and allows the existence of not only characteristic mire plants (sphagnum mosses, cranberry, marsh cinquefoil *Comarum palustre*, buckbean *Menyanthes trifoliata*, etc.) and animals, but also a significant amount of alpine and plain species (originating in steppe, tundra, forest). Some plant communities are rare in Siberia (such as crooked birch *Betula alba* ssp. *tortuosa* community of the wettest and snowiest region of Altai – Kuznetsky Alatau ridge) and some species are rare, endangered, or vulnerable (such as mire orchid *Liparis loeselii* (Fig. 3), black stork *Ciconia nigra*, gray crain *Grus grus*, demoiselle *Anthropoides virgo* and many others) because of habitats lost, overgrazing, low productivity and disturbance factor.

Figure 3. Mire orchid *Liparis loeselii*

There is no doubt that mires have a critical role in the carbon cycle, and hence, in the maintenance of biosphere stability under conditions of increasing human impact. Mountain mires act as natural filters, reservoirs, and sources of clean water as well as providing a significant contribution to biodiversity.

Mountain mires in continental Asia represent a rare natural wetland type. Central Asian mountain peatlands usually are sedge-dominated fens (like in Kyrgistan mountains, Mongolian and south-east part of Russian Altai). Lavrenko (2000) described these mires as a "special type of central-asian mountain sedge mires". East Siberian mountains as far as northern Mongolia also occupied by "polygon mires" that usually are formed in areas with continuous permafrost, especially in the Arctic (Joosten, 2002).

Our research at the large mountain system in the central part of Eurasian continent, in the south of West Siberia, in Altai-Sajan mountains, showed, that significant mires with thick peat deposits occur even in the most arid regions of the Altai.

While a strategy of natural resource management and wise use is developed for the Altai region, there should be special attention given to mires and other wetlands. We hope that our research of mires will help solve a number of problems of science and nature protection and will promote the performance by the Russian Federation of its international obligations, accepted in frameworks of the Ramsar Convention on Wetlands and the Convention on Biodiversity. Undoubtedly, some of the Altai mountain mires deserve the status of wetlands of international importance as unique mires (peatlands, wetlands) of intra-continental mountain systems of Asia.

The results were obtained while fulfilling the government order from the Ministry of Education and Science of the Russian Federation (Project No 5.4004.2017/P).

Habitat Restoration: Bringing Back the Brackish Water in Guandu Nature Park

Pin-Hsiu Chou[1], Tsai Fu Yeh[1], Lan-Feng Fan[2] and Hwey-Lian Hsieh[3]

[1]. Guandu Nature Park Management Office, Wild Bird Society of Taipei, [2]. National Taiwan University, [3]. Academic Sinica

Introduction:

Guandu Nature Park is located in northern Taiwan roughly 10 km from the mouth of the Tamsui River and still within the tidal range, thus the wetland within the Park is a mosaic of brackish and freshwater. The Park serves as a major stopover for migrating birds along the East Asian Australian Flyway, and has been considered as an Important Bird Area (IBA) by Birdlife International. In the past, large stretches of agricultural fields dotted the landscape, but dramatic changes in the soil and water chemistry - an influx of salinity in the water and overdraft of groundwater - rendering farming difficult in the area. Since then, agricultural fields have largely been abandoned and some were replaced by freshwater ponds, grasslands and rice paddy fields. This mosaic of habitats makes Guandu unique and a home to a variety of organisms.

Over time, this once vibrant marsh has slowly turned towards more of a grassland environment and the decline of birds (waterfowl and shorebirds) became noticeable. As a part of management, the Park schedules annual habitat restoration projects to remove sedimentation buildup and vegetation. These projects aim to prevent succession from further progressing, to restore and maintain the wetland as a marsh. Yet, despite these efforts, bird numbers have continued to decline and Park management explores tidal flushing as a method to restore the wetland.

Tidal flushing refers to the systematic replacement of water in a bay or estuary as a result of tidal flow (Cook 1982). Lin *et al.* (2003) suggested that the maintenance of tidal flux would be beneficial to enhance the biodiversity of the Guandu wetlands. It is believed that one of the causes for the decline is due to the levee located south of the Park, as it blocks water flow and prevents biotic exchange between the wetland within the Park and the Tamsui River. Park management began to consider the possibility of reopening the sluice gates on the levee to allow for brackish water to reenter. This would facilitate exchange between environments (outside and inside of the Park), which would increase salinity and nutrients. Furthermore, it would allow a temporary biological corridor to form. The Park worked together with Taipei City to establish a new set of valve system for the sluice gate, this would allow for brackish water to enter the Park during high tide periods.

The opening of the sluice gate would cause a temporary increase in salinity levels, where the tidal flushing leads increases in salinity and has been documented to suppress emergent macrophytes such as Common Reed (*Phragmites australis*) and Narrow-leaved cattail (*Typha angustifolia*, Swamy *et. al* 2002). Reduction of emergent macrophytes in the mudflat area creates more suitable environment for feeding and resting waterfowl and shorebirds.

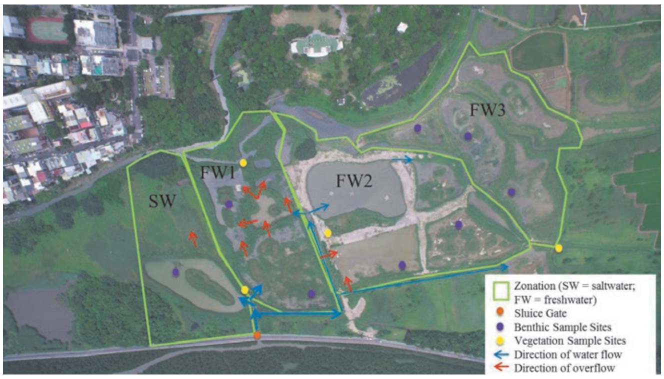
Tidal flushing from the opening of the sluice gate would lead to a formation of a temporary biological corridor which would allow bethnic macroinvertebrates and other organisms to enter. Benthic macroinvertebrates are crucial food sources of waterfowl and shorebirds (Chen and Chen 1994, Tsai and Chen1994), especially at stopover or wintering sites where birds need to quickly refuel after a long flight (Alerstam *et al.* 1992). In particular, the absence of certain macroinvertebrates (particularly members of the Polychaeta family) may explain the decline of waterfowl and shorebirds within the Park.

This study examines the impact of opening the sluice gate on salinity, habitat and food availability favoured by waterfowl and shorebirds, and its management implications. The Park expects that the opening of the sluice gate will bring about changes in salinity levels which will result in changes (suppression) in the vegetation cover. Then the creation of a temporary biological corridor to allow macroinvertebrates such as Polychaeta to enter, in turn increasing the availability of food for birds.

Materials and Method:

Starting from 2016, the sluice gate is opened twice a month for a period of four hours. The opening of the sluice gate is timed so that the third hour is at high tide, to increase the amount of brackish water to enter the wetland from the outside (Figure 1). Salinity is measured prior to the opening, during high tide and before closing the sluice gate.

Figure 1: Sample sites, zone designation and areas affected by opening of the sluice gate.



Benthic sampling occurs every July across the nine sites with three samples at each site. A PVC pipe with a diameter of 10cm is used, and samples are sieved using a 0.5mm sieve. Samples are preserved in 99% ethanol before sorting and counting. Abundances are then calculated based on those numbers. Historical data which were collected using the same methods are used in the analysis for comparison.

Comparison of the effects of salinity on vegetation cover uses data collected from 5 m x 5 m quadrants from five sites from the mudflats.

Results and Discussions:

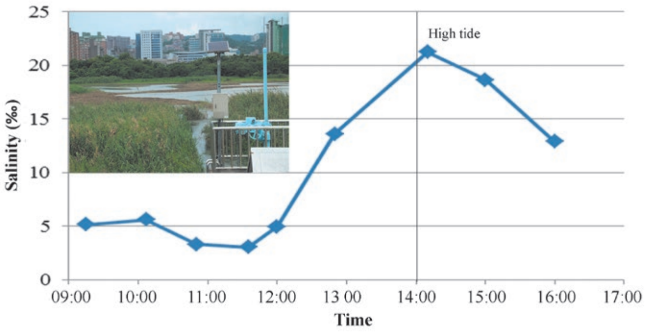
Salinity

During experimental opening of the sluice gate, it was recorded that salinity would peak around high tide and drops off shortly afterwards (Figure 2). Thus to maximize the amount of salinity entering, the opening the sluice gate is timed to include the high tide so that the intake of salinity is the highest.

Vegetation

Vegetation cover was documented to examine whether or not there would be changes in the cover as a result of increased salinity levels. Reduction of the cover of Para Grass (*Brachiaria mutica*) is more prominent than Common Reed *(Phrag-*

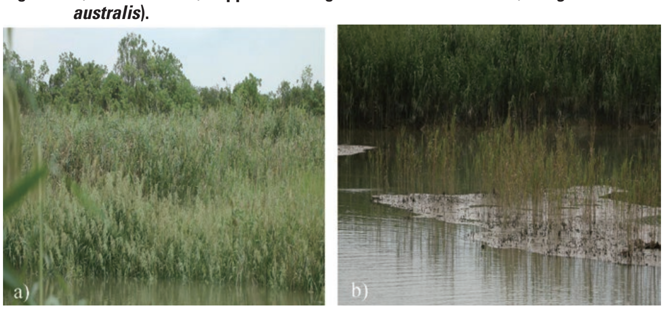
Figure 2: Changes in salinity (‰) during an experimental opening of the sluice gate.



mites australis) based on the vegetation sampling. However, visually there it was possible to see that the increase in salinity has resulted in the stunted growth and suppression of Common Reed (Figure 3a and b). It is possible that Para Grass is more affected by the increase of salinity, thus the suppression is more evident. On the other hand, Common Reed is able to accommodate for the increased salinity, with only stunted growth and suppression in only some areas. Another possibility is that the sites for sampling are widely distributed across the Park and not just in the SW or FW1 area where the impact of the sluice gate is more direct.

Over all, there is a reduction of vegetation cover in the wetland, in particularly around the islands, these open areas and mudflats are more favourable habitat for both waterfowl and shorebirds. Thus, the opening of the sluice gate is beneficial for waterfowl because more favourable environment is created, this will draw birds into the Park.

Figure 3: a) Stunted and b) Suppression of growth of Common Reed (*Phragmites australis*).



Macroinvertebrates

The total abundance of benthic organisms (Figure 4a) within the Park is subjected to various factors, the main contributing factor is the result of habitat restoration projects, where there is largescale removal of vegetation and sedimentation. These yearly projects are crucial to maintaining open mudflats favoured by waterfowl and shorebirds. However, these projects disrupt the lifecycles of macroinervebrates and sudden changes to the environment results in unfavourable conditions for their survival. The opening of the sluice gate allows for the formation of a temporary biological corridor, in which will allow macroinveretbrates to enter. After the opening of the sluice gate there was an increase in the abundance of Polychaeta, such as *Laonome albicingillum*, *Neanthes glandicincta*, and *Capitella* species, in the SW area (Figure 4c). An increase in Polychaeta and the total abundance of benthic organisms provides an increase in food availability for waterfowl and shorebirds.

Conclusion and Management Implications:

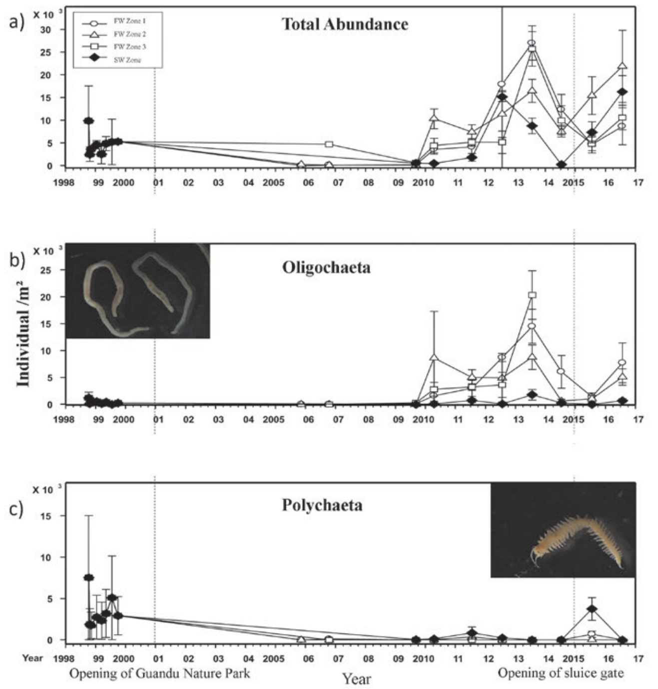
Guandu Nature Park as an important stopover and wintering site for migratory birds, and thus the wetland needs to provide suitable habitat and maintain adequate food availability for birds when they arrive. The opening of the sluice gate located in the southwestern part of the Park has resulted in some positive changes, which in the long term hopes to revitalize the Park.

The temporary flux of increased salinity within the wetland has resulted in visible changes in the vegetation cover. The suppression of both Para Grass and Common Reed create open areas for birds to use. In terms of management implications, the reduction of vegetation cover reduces the need for largescale intensive removal of vegetation in the form of restoration projects. This in the long-term may be beneficial to the maintenance of benthic population within the Park. The Park will also then be able to reallocate some of the funding usually reserved for habitat restoration projects to other areas.

This tidal flushing has also formed a temporary biological corridor allowing macroinvertebrates to enter— increasing biodiversity and food availability for birds. These findings are consistent with other studies done on tidal flushing (Lui *et al.* 2001, Peck *et al.* 1994, Swamy *et al.* 2002), where there is an increase in benthic organism once the tidal flux is restored.

The opening of the sluice gate has only been in effect since 2016, and opened only twice a month for four hours, thus it will likely take longer for more significant changes to be evident. But based on current results, there appears to be positive change within the wetland and that the overall habitat may be returning to a more suitable state for birds and other wildlife. The Park will continue to monitor changes and adjust management practices according to the changes observed.

Figure 4: Changes in a) Total Abundance b) Oligochaeta c) Polychaeta from 1998 to 2016.



Acknowledgements

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Biodiversity of the Kampar Peninsula

Prayitno Goenarto[1], Donny Gunaryadi[2]

[1]Riau Ecosystem Restoration, [2]Fauna & Flora International, Indonesia

INTRODUCTION

The Kampar Peninsula is a 673,000 ha landscape that includes 344,000 ha of peatswamp forest, approximately 181,000 ha of fibre plantations, and a mixture of other multiple land use areas. This kaleidoscope of multiple land use areas comprises of industrial-sized oil palm, rubber plantations as well as small-holder plantations, farmlands and human settlements. The Kampar Peninsula is possibly the largest contiguous area of peatswamp forest remaining on Sumatra. Distributed across much of South East Asia, tropical peatland forests possess a characteristic assemblage of flora and fauna borne out of humid and acidic waterlogged conditions. The Kampar Peninsula is also of global significance being designated as a Class II Tiger Conservation Landscape, Important Bird Area (IBA) as well as a Key Biodiversity Area (KBA) as the site contains significant number of globally threatened species as well as biome-restricted species.

Furthermore a total of around 130,000 ha of this are licensed under four concessions and managed under the Riau Ecosystem Restoration (RER) Programme (Fig. 1). The RER Programme brings together private and civil society groups, as well as government regulatory agencies, in a landscape level approach to protect, assess, restore and manage previously degraded peatland. Detailed inventories have been conducted since 2010 of these wetlands, recording a total of 299 bird, 152 plant, 74 mammal, 107 amphibian and reptile and 89 fish species. Around 49 species are listed in the IUCN Redlist as threatened (Critically Endangered [CR], Endangered [EN], Vulnerable [VU]). These inventories represent the first documentation of the biodiversity of the Kampar Peninsula, and are especially important in light of the current conservation status of peatlands on Sumatra.

Figure 1. Map of the Kampar Peninsula

METHODS

The biodiversity baseline results are largely a collation of two major biodiversity surveys completed by Tropenbos in 2010 and Fauna Flora International (FFI) in 2015. However the result also takes into account anecdotal and personal observation from 2004, 2007, up to June 2017 collected while out in the field.

The 2010 Tropenbos survey consisted of 29 biodiversity survey sites distributed mostly across the periphery of the Kampar Peninsula but also on the peat dome core areas. The surveys lasted for a few months and were carried out in the morning and afternoon by teams depending on the targeted taxa. The survey focused on collecting information on mammals, birds, plants, reptiles and amphibians. The survey also incorporated local knowledge and information on species sightings through interviews with locals.

The 2015 FFI survey was conducted primarily on RER concessions, dividing three concessions (PT. GCN, PT SMN, PT. TBOT) into grids and sampling along defined transects. Survey times were also divided into daytime and nighttime surveys with the addition of single and paired camera trap stations set up to be active for 24h. Additionally fish diversity of the Kampar Peninsula was sampled along the Serkap, Sanggar and Turip rivers. The entire list of survey methods employed for each taxon summarized in a table (Fig. 2)

Figure 2. Table of survey methods used for each Taxon

Activities	Bird	Mammal	Amphibian / Reptile	Plant	Fish
Interview	✓	✓	✓		✓
Camera Trap	✓	✓	✓		
Point Count	✓				
Visual Encounter Survey (VES)	✓	✓	✓		
Sound Call Back	✓				
Trapping		✓			
Sample Collection			✓	✓	✓
Plots				✓	
Point Sample					✓

RESULTS

Records indicate high avian diversity in the Kampar Peninsula, with 299 species from 66 families, 241 are resident, 49 migratory and 9 have both migratory and resident populations. Fourteen bird species are considered globally threatened as classified by the IUCN Redlist with 1 CR, 3 EN and 10 VU species. The Kampar Peninsula hosted 8 out of the 9 possible hornbills found in Sumatra including the Helmeted Hornbill (*Rhinoplax vigil*) which was the only critically endangered species. The survey also revealed new distributional records for the Black Partridge (*Melanoperdix niger*) and Bonaparte's Nightjar (*Caprimulgus concretus*). Peatland associated species found include the Hook-billed Bulbul (*Setornis criniger*), Storm's Stork (*Ciconia stormi*) and White-winged Duck (*Asarcornis scutulata*) which has an estimated population of less than 150 individuals in Sumatra.

Eight of the 152 vascular plant species recorded are globally threatened, with the critically endangered peatswamp endemics *Shorea platycarpa* and *Vatica teysmanniana* recorded. The dominant plant families were Myrtaceae and Dipterocarpaceae, with the high abundance of *Shorea teysmanniana* and *Shorea uliginosa*. Dipterocarpaceae are the most abundant tree family with six species that are all listed as threatened. Of the 152 species recorded, 112 were woody plants (trees) that possessed widespread buttressed roots which were well adapted to areas with high water fluctuation and waterlogged conditions. The remaining 40 plant species were comprised of various orchid species as well as two species of pitcher plants; *Nepenthes ampullaria* and *Nepenthes rafflesiana*.

Seventeen of the 74 mammal species recorded are globally threatened, with 2 CR, 3 EN and 12 VU. Six primate species were recorded including the Agile Gibbon (*Hylobates agilis*) and the nocturnal Sunda Slow Loris (*Nycticebus coucang*). The critically endangered species include the heavily threatened Sunda Pangolin (*Manis javanica*) and the Sumatran Tiger (*Panthera tigris sumatrae*). Six cat species are found through out the entire island of Sumatra, five of them can be found in the Kampar Peninsula, only the Asiatic Golden Cat (*Catopuma temminckii*) is absent. Camera trap photos from five separate camera traps during the FFI survey revealed the presence of the elusive Flat-headed Cat (*Prionailurus planiceps*), a species strongly associated with wetland habitat.

From the 22 amphibian and 85 reptile species, 10 are globally threatened, with 1 CR, 4EN and 5 VU. The numbers of amphibians are low due to the acidic conditions however survey revealed new distributional records for the recently described cryptic frog species *Hylana rawa* and *Hylarana parvacola*, both of which are endemic to Sumatra. Two crocodile species the Estuarine Crocodile (*Crocodylus porosus*) and the vulnerable False Gharial (*Tomistoma schlegelii*) was confirmed present. Ten species of turtles were documented, this includes the critically endangered Painted Terrapin (*Batagur borneoensis*).

Preliminary fish surveys documented 89 species that are dependent upon narrow and extreme abiotic conditions. Low pH, low dissolved oxygen levels, as well as high tannin levels are conditions that require specific adaptations from the fish species. Cyprinids are the most represented family with 35 species (39%) out of the 89 total. Fish species are important for the community as around 39 species are found in the aquarium trade as well as 15 species sold for food. A new species *Pectenocypris nigra* and the world's smallest fish *Paedocypris progenetica* were notable discoveries from the survey.

DISCUSSION

With the wide ranging variety of species found in the Kampar Peninsula come inevitable conservation issues when dealing with threats to their populations. Birds are a popular commodity, as keeping them as pets or for songbird competitions connected to Javanese culture and is considered common practice. Blue-crowned Hanging Parrot (*Loriculus galgalus*), shama, sunbirds and leafbirds represent popularly traded species. Plants and trees face direct threats from illegal logging and fires that are used for clearing land. Mammals face a wide variety of threats, with macaques often captures and sold as pets, chevrotain and deer hunted for food and the Sumatran Tiger and Sunda Pangolin targeted for the illegal wildlife trade. Reptiles face hunting threats with Reticulated Pythons (*Malayopython reticulatus*) and Estuarine Crocodile (*C. porosus*) being hunted for their skin. Turtles represent the most endangered reptile group as they are often caught as bycatch and sold for meat. Seven out of ten turtle species found are considered globally threatened.

RER's management of 19% of the Kampar Peninsula serves an important role in protecting globally threatened species and in supporting Indonesia's commitment to climate change mitigation. In order to more comprehensive understanding of the biodiversity within the Kampar Peninsula more research and collaboration should take place. Furthermore a survey of RER"s fourth and last concession on the Kampar Peninsula; PT. GAN is scheduled for the near future.

Status of White Winged Duck in Kampar Peninsula

Muhammad Iqbal
Riau Ecosystem restoration, Indonesia

Introduction

The White-winged Duck (Asarcornis scutulata) is a tree-nesting duck. Historically the species was distributed from the Northeastern India states bordering Brahmaputra river and its major tributaries to Greater Sunda Islands of Sumatra and Java in Indonesia. Now the birds survive in scattered area of its former range. It is locally extinct in Java and no recent confirmed records in Malay Peninsula.

The Sumatran population is distinctive in appearance from the Northern mainland population with more white coloration on the head and wings. Some authors suggest the Sumatran population should become a separate subspecies. Its range on Sumatra has been drastically reduced over the last 30 years. Based on 2016 assessment, IUCN classifies White-winged Duck (WWD) as Endangered. It is a protected species in Indonesia.

Prefers low laying water body adjacent to natural forest and have been recorded visiting rice fields. Unlike other duck species which form flock, white-winged ducks are commonly observed in pairs.

White-winged duck in Kampar Peninsula

The Kampar Peninsula is one of the most important areas of peatland on Sumatra, covering some 673,000 ha of peat swamp forest, fiber plantations, oil palm, rubber and sago farms. It is possibly the largest contiguous area of peat swamp forest remaining on Sumatra. 311,000 ha area of these wetlands is managed by the APRIL Group, where 181.000 is fiber plantation and 130,000 ha of natural forest is managed under the Riau Ecosystem Restoration (RER) Program.

Initiated by APRIL in 2013, the RER Program brings together private and civil society groups, as well as government regulatory agencies, in a landscape level approach to protect, assess, restore and manage previously degraded peatland. This ecosystem restoration license is granted for 60 years. The forest is home to critically endangered sumatran tiger, sunda pangolin and some other unique wetland species such as flat headed cat, storm stork, white winged duck and false gharial. The presence of suitable habitat in Kampar Peninsula with better management and protection would contribute to secure future survival those taxa.

In 1990, Asia Wetland Bureau (AWB) organized island-wide surveys in all suitable habitats and visited historical sites of White-winged Duck sightings. Two years later, BirdLife conducted an assessment of Important Bird Area (IBA) on Siak-Kampar peat swamp forest in Sumatra including the Kampar Peninsula.

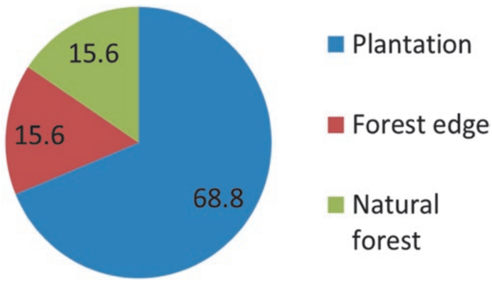
The survey focused on the northern part of the Kampar Landscape. Both surveys failed to find WWD in Kampar peatland. These findings raised questions about the presence of WWD in this landscape since they were recorded on Giam-Siak kecil Landscape on the north and Kerumutan Game Reserve on the south.

WWD was first sighted in Kampar Peninsula peatland landscape on April 2007. Since then duck sightings have been reported every year. In 2013 WWD recorded for the first time inside Riau Ecosystem Restoration. In total there are 30 confirmed sightings in last ten years.

Habitat preference

Encounters occurred mainly on artificial canals, either in plantation or forested areas (e.g. canals constructed for illegal logging prior to ER concession). The rest of sightings were birds flying over plantation, or over natural water ways. Aged canals in the plantation seems to match WWD required habitat, this ducks are more likely to be found on 4 years or older stands where tree canopy creates shade over the canal. Long straight canal gives the duck space needs for take off. They are quite frequently observed on perimeter canals bordering plantation and natural forest. When feel threatened the ducks left the water and fly, quite frequently perch on main branch of large native trees (please refer to fig. 1).

Figure 1. Percentage of sighting location/habitat usage



Before 2013 there was limited time spent traveling on the natural forest and riverine area which meant there was a bias towards finding birds in the plantation canals. When ER stated to operate within the landscape, travel on the rivers increases, as they are the main access routes to reach the ecosystem restoration area. However, this did not increase the number of duck observation on the river and natural forest away from plantation. There is a single observation or 3.3 % from total of bird sighted flew over one of the river.

In natural forest, they may avoid open rivers and prefer small lakes that are scattered on the flood plain (interview with local fishermen). These lakes only connected to the main river during rainy seasons floods. WWD was observed to visit water holes created during the construction of access path through peat swamp forest about a year after the establishment of the access.

Breeding record

Ducklings were observed in April. An adult duck along with five ducklings was photographed on plantation canal in 2015. Other records were from ducklings collected by fishermen in April 2016, presumably after killing and consuming the mother. The first report of breeding in Acacia plantation was from August 2014. The clutch size observed were five ducklings in 2015 and 2016 observations. Number of clutch of 2014 observations cannot be confirmed. These records raise the possibility that white-winged ducks nest in plantation.

Threat

Thread occurs in the form of opportunistic hunting and has been recorded. One of the incident involve molting birds and the other on breeding female (see above). Molting birds shed part of their feathers and lose their ability to fly, temporarily making them vulnerable. Apart from hunting the adults, collecting ducklings was also documented. Fishermen and workers are educated and requested not to take the birds. A Standard Operation Procedure was created to provide guidance on how to handle birds that are temporarily unable to fly. Other threats include natural predators such as water monitor lizards prey on duckling and birds of prey kill adult birds.

Activity Pattern

The majority of observations occur before 10 o'clock. It is suggested that peak activity of WWD in Kampar is around that time. Since most observation occurred on plantation the activities within plantation may have some impact on WWD activity pattern. Long term observation in Way Kambas in Southern Sumatra suggests double peak on WWD daily activity. Its highest activity is between 7 to 8 o'clock in the morning and 4 to 5 before sunset (Figure 2).

Population Estimation

In the past population estimation of WWD was conducted by direct count of animals sighted during the survey. There is no standardized method applied on this subject. Hence no estimation number of WWDs available for the Kampar Peninsula. However given the current observation records, breeding records, the extend of the landscape, better controlled access, it might assume that the population could be small but stable.

Activity in the future:

Conduct intensive search during suspected breeding period (March to April) to document breeding in the plantation.

Increase awareness to fishermen and workers about status of the bird, especially during breeding season. No hunting sign for white-winged duck and other protected animal will be put on places easy to look at by passer byes.

Trial of better methods to estimate population will be conducted.

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Figure 2. Cumulative sightings of white-winged duck during day light.

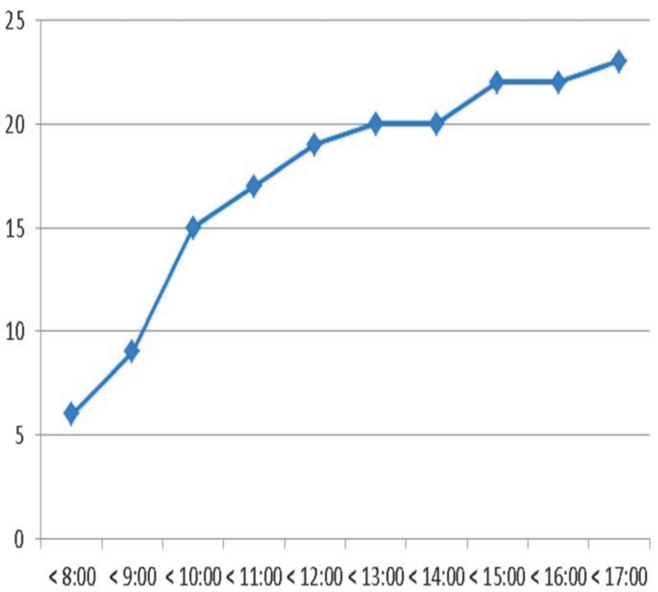


Figure 3. Pair of white-winged ducks on man made canal

Wetland Conservation in the Mai Po Inner Deep Bay Ramsar Site

Wing-Sun Chow
Agriculture, Fisheries and Conservation Department, Hong Kong Special Administrative Region Government

Background

The Mai Po and Inner Deep Bay area of the Hong Kong Special Administrative Region (HKSAR), the People's Republic of China, was listed as a Wetland of International Importance (i.e. Ramsar Site) under the Ramsar Convention on 4.9.1995. The Ramsar Site covers an area of approximately 1,500 ha of wetland habitats, including 300 ha of inter-tidal mudflat, 350 ha of inter-tidal mangals, 230 ha of gei wai (traditional shrimp ponds), 400 ha of fishponds and about 260 ha of marshes, rivers and channels. The listing is a formal recognition of the international importance of the area and helps promote public awareness of the site.

Ecological Importance

The Inner Deep Bay area regularly supports 50,000 – 80,000 wintering migratory birds, including ducks, gulls and terns, ardeids and spoonbills, shorebirds, cormorant, rails and coots. Over 400 species, including 50 species of globally threatened and near-threatened species according to the IUCN Red List have been recorded, e.g. the Spoon-billed Sandpiper, Black-faced Spoonbill, Nordmann's Greenshank, and Saunders' Gull. The site is also among the network of sites along the East Asian - Australasian Flyway for migratory waterbirds, which helps to promote public awareness, training and information exchange on migratory shorebirds and thus contribute to the long-term conservation of the birds and their habitats along the Flyway.

Conservation Management

The Agriculture, Fisheries and Conservation Department (AFCD) of the HKSAR Government is the administrative authority of the Mai Po Inner Deep Bay Ramsar Site. It formulates and implements the Ramsar Site Management Plan (RSMP) which provides a framework for the conservation management of the Ramsar Site. The work includes law enforcement, ecological monitoring, advising on the wise use of wetland for development proposals, as well as partnership with non-governmental organisations (NGO) to carry out habitat management, public education and bird monitoring programme.

According to the RSMP, the Ramsar Site is divided into four Management Zones with different management objectives based on habitat type, ecological value and land use. The Core Zone (consisting of the inter-tidal mudflat and mangals) and the Biodiversity Management Zone (consisting of gei wai), are primarily designated as a Restricted Area under the Wild Animals Protection Ordinance (Cap. 170), where access is restricted to permit holders only. The Biodiversity Management Zone covers the Mai Po Nature Reserve (MPNR) which is managed by WWF-Hong Kong with advice and financial support from AFCD. The Wise Use Zone and Private Land Zone mainly consist of commercial fishponds.

The traditional practice of pond drain-down in commercial fishponds during harvest provides additional feeding opportunities to waterbirds in the Deep Bay area. Since 2012, the Government's Environment and Conservation Fund has provided funding to the Hong Kong Bird Watching Society to collaborate with the fishpond operators through Management Agreement projects to encourage the operation of the fishponds in an ecologically sustainable manner by continuing the traditional drain-down practice, while conducting a wide range of public education activities to promote local aquaculture and biodiversity conservation in the Deep Bay area. The project has achieved win-win between fisheries and bird conservation and set an example of wise use of wetlands.

In 2016, the Government promulgated the first city-level Biodiversity Strategy and Action Plan (BSAP) for Hong Kong, to step up biodiversity conservation and support sustainable development in the next five years (2016-2021). One of the key actions is to maintain and enhance the management of the Ramsar Site for biodiversity conservation. Continuous effort will also be put in scientific research, promotion of sustainable fisheries and Management Agreement projects.

Wetland Conservation in the Mai Po Inner Deep Bay Ramsar Site Hong Kong Special Administrative Region

Agriculture, Fisheries and Conservation Department (AFCD)
Hong Kong Special Administrative Region Government

漁農自然護理署
Agriculture, Fisheries and Conservation Department

Background information

- Over 1,500 ha of wetland habitats including intertidal mudflat, mangals, *gei wai* (traditional tidal shrimp ponds), fishponds, marshes, rivers and channels
- Listed as a Wetland of International Importance under the Ramsar Convention in 1995
- Regularly supporting 50,000 – 80,000 wintering migratory birds
- Over 400 bird species, including 50 globally threatened species recorded
- Overall conservation management overseen by AFCD



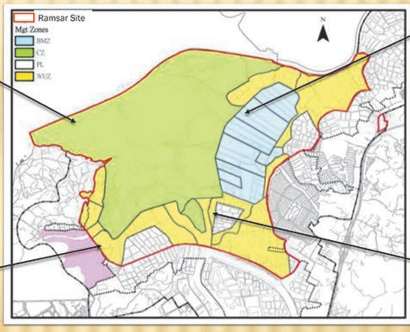



Ramsar Site Management Plan

- Maintaining and enhancing the conservation values of the Ramsar Site
- Delineating 4 management zones with different management objectives

Core Zone
- Covering the intertidal mudflat and mangal
- Important foraging site for a high diversity of migratory waterbirds
- Mostly designated as a Restricted Area under Wild Animals Protection Ordinance (Cap. 170) where access is controlled

Biodiversity Management Zone
- Covering the gei wais in Mai Po Nature Reserve
- Within Mai Po Marshes Restricted Area
- Managed by WWFHK with financial support by the Government
- Guided by the Mai Po Management Plan



Wise Use Zone
- Mainly consisting of commercial fishponds
- Encouraging the operation of fishponds in a sustainable manner e.g. through Management Agreement projects

Private Land Zone
- Consisting of commercial fishponds on private land
- Emphasizing cooperation with land owners / fishpond operators on the sustainable management of the fishponds e.g. Management Agreement projects

Effect of the Artificial Tidal Flat Restoration on Benthos and Fish Habitat in Urban Canal Area

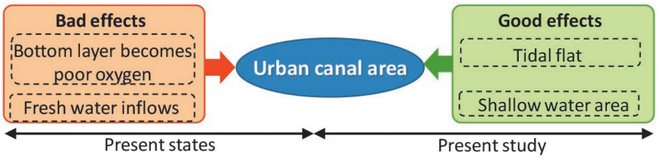
Kana Takeyama[1)], Katsuhiko Tanaka[2)], Hiroshi Kohno[3)], Kota Nakase[1)], Katsumi Ishibashi[4)]

[1)] Penta-Ocean Construction Co., Ltd., [2)]Tokai University, [3)]Tokyo University of Marine Science and Technology, [4)]Ota City

1. Introduction and purpose

In the canal located in urban area, the bottom layer becomes poor oxygen due to the influence of the saline wedge and thermocline. The purpose of this study was to evaluate the function of the tidal flat and shallow water area created in the urban canal area by the monitoring survey.

Fig.1 Environmental issues in urban canal area and background of this study



2. Survey area outline

- The Furusato-no-Hamabe Park (Furuhama) in the Keihin canal, which was constructed in 2000-2004, is located at the innermost of Tokyo Bay(Fig.1).
- Furuhama is a park aims to (1) secure park green space, (2) secure urban disaster prevention function, (3) be a water park, and (4) improve water quality.
- Furuhama is composed of tidal flat (about 1.0 ha), sandy beach (1.2 ha) and shallow water area (4.6 ha) , and various kinds of habitat are created.
- Because of the closed watershed, the bottom of the canal (depth A.P*.-5 m) is poor oxygen in the summer, while the tidal flat and shallow water area (A.P. +1.5m) are rich of DO(Fig.2).

*A.P. : Arakawa Peil,A.P.0.0m is nearly extreme low water spring tide

Fig.2 Survey area

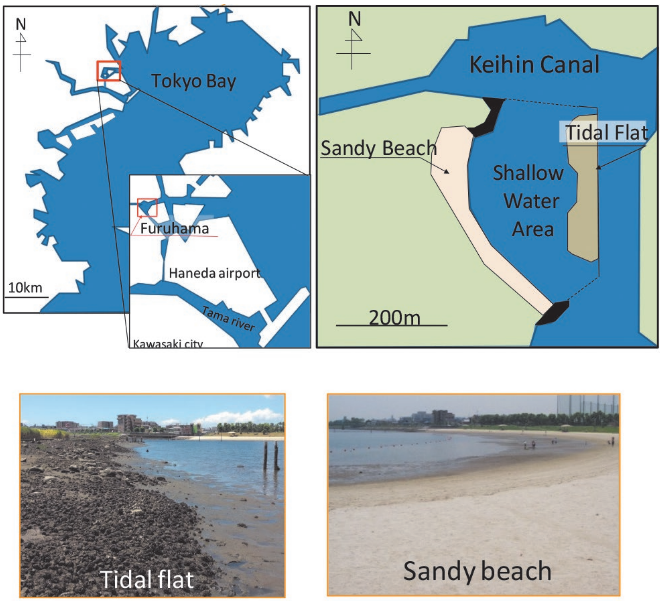
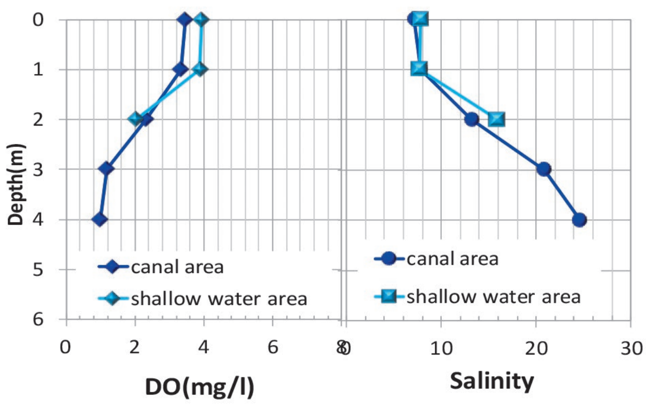


Fig.3 Water quality in summer (2016.9)



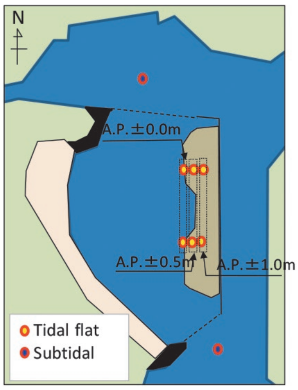
3. Field survey

(1) Benthos

1) Materials and methods (Fig.4)

- Survey period:
  April 2002 (before construction) to the present (3 -4 times a year)
- Survey point:
  Tidal (A.P. + 0.0m, 0.5 m, 1.0m)
  Subtidal (bottom of canal)
- Methods:
  Using the 20 cm × 20 cm quadrat and Eckman - Berge mud sampler and analyzed for benthos sorted out with 1 mm mesh sieve

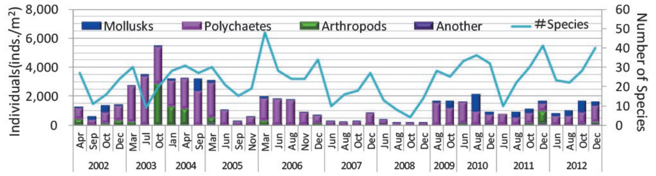
Fig.4 Survey points



2) Results (Fig.5, Fig.6)

- Benthos appeared just after the construction in the tidal flat.
- The canal area was unsuitable for benthos in summer. In the tidal flat, benthos appeared throughout the year.
- In the early stage of the improvement, many small benthos such as Corophiidae and Polychaetes appeared; however large benthos such as bivalves appeared in the late stage.
- In the canal area, benthos was quite scarce. Only in winter, small polychaetes such as Spionidae tolerant to pollution appeared.

Fig.5 Change of the individuals of the benthos in tidal flat



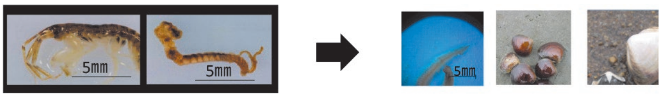
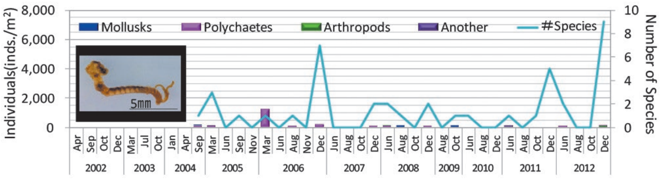


Fig.6 Change of the individuals of the benthos in bottom of canal



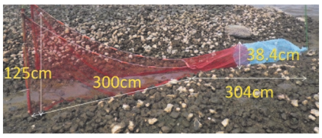
(2) Fish

1) Materials and methods (Fig.7, Fig. 8)

- Survey period:
  April - December 2012 (once a month)
- Survey area:
  Tide pools, shallow water area and small channel (Mio)
- Method:
  Hand net (tide pools), small set nets (shallow water area and Mio)

Fig.7 Survey area

Fig.8 Small set nets



2) Results (Fig. 9, Table 1)

- As the result of comparing the proportion of species appearing in survey areas, the species that appearing only in the tide pool accounted for about 36%.
- In Furuhama, *Acanthogobius flavimanus* was the most abundant at all areas, followed by *Gymnogobius breuginii* in the tide pool and small channel, and *Lateolabrax japonicus* in the shallow water area.

5. Conclusion

- Even in the summer when the bottom layer of canal area is poor oxygen, many fishes appeared throughout the year in the tidal flat and shallow water areas, And thus these areas are considered to be evacuation places for the fish and benthos in the canal area.
- This study indicates that the improved micro topography such as the tide pool in Furuhama is highly possibly to provide the micro habitats for benthos and fishes and to promote their diversification.

Fig.9 Composition of species by habitat

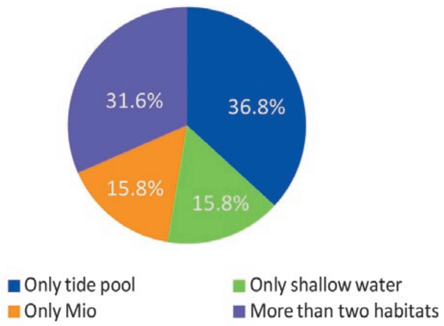


Table 1 Number of fish individuals by habitat

Family and Species	Indivisual (No.)			Total	Occurrence	Indivisual (%)			Size range (TL mm)		
	Tide Pool	Shallow Water	Mio	Individual No.	Month	Tide Pool	Shallow Water	Mio	Tide Pool	Shallow Water	Mio
Dasyatidae											
Dasyatis akajei	0	1	0	1	6	0	100	0	–	no data	–
Anguillidae											
Anguilla japonica	0	1	0	1	8	0	100	0	–	no data	–
Mugilidae											
Mugil cephalus cephalus	35	12	5	52	4–7	67	23	10	29–62	32–64	30–38
Atherinidae											
Hypoatherina valenciennei	0	0	6	6	9	0	0	100	–	–	33–59
Moronidae											
Lateolabrax japonicus	0	280	63	343	4,6,8,9	0	82	18	–	26–208	53–167
Leiognathidae											
Nuchequula nuchalis	0	118	0	118	6,9	0	100	0	–	31–49	–
Teraponidae											
Rhyncopelates oxyrhynchus	0	0	1	1	12	0	0	100	–	–	28
Gobiidae											
Chaenogobius gulosus	1	0	0	1	5	100	0	0	13–68	–	–
Gymnogobius sp.	2	0	0	2	5	100	0	0	25–74	–	–
Gymnogobius heptacanthus	43	0	0	43	6	100	0	0	29–45	–	–
Gymnogobius breuginii	162	34	903	1099	4–9	15	3	82	20–79	30–66	9–129
Gymnogobius macrognathos	1	0	0	1	9	100	0	0	47	–	–
Glossogobius olivaceus	0	0	9	9	8–9	0	0	100	–	–	80–143
Acanthogobius flavimanus	533	1504	2132	4169	4–12	13	36	51	16–119	17.5–175	30–173
Pseudogobius masago	65	0	0	65	4–12	100	0	0	13–40	–	–
Redigobius bikolanus	21	0	0	21	6,7,10	100	0	0	25–43	–	–
Mugilogobius abei	145	0	1	146	5–12	99	0	1	11–59	–	18–26
Acentrogobius sp.A	3	0	0	3	7	100	0	0	52–61	–	–
Tridentiger obscurus	43	1	4	48	4–12	90	2	8	21–92	22–69	27.2–80

A Study on the Present Condition and Transition of Habitats of Freshwater Mussels in the Kikuchi River

Kengo Saito [(1)], Hironori Hayashi [(1)], Hiroyuki Otubo [(2)], Yukihiro Shimatani [(1)]

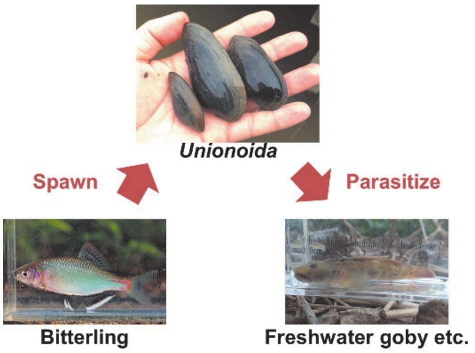
[(1)] Kyushu University faculty of Engineering, [(2)] NIPPON KOEI

Objective

Freshwater mussels (order Unionoida), one of the species which live in floodplain, have important roles for river ecosystems. **Figure.1** shows the Ecological system of *Unionoida*. Bitterling spawn eggs in a gill of *Unionoida*. On the other hand, glochidium adhere to the fins and scales of fish after exiting into the water and they expand their habits. So they are regarded as the good indicator species of floodplain. There are 18 kinds of *Unionoida* in Japan, of which 13 are endangered species.

In recent years, the environment of floodplains is deteriorating due to river refurbishment and urbanization of basin. As a result, many species now reduce their population and habitats In Japan, while knowledge on fundamental ecology is steadily accumulated, studies from application aspects related to habitat environment etc. are absolutely lacking. In the Kikuchi river (Kumamoto Prefecture), it was proved that *Unionoida* are decreasing rapidly. Rapid conservation and regeneration of habitat are required. The purposes of this study are 1. Determine detailed distribution of *Unionoida*, 2. Clarify the habit limiting factor of *Unionoida* from the relationship with the physical environment, 3. Propose suggestions for conservation and regeneration.

Figure.1 Ecological system of *Unionoida*

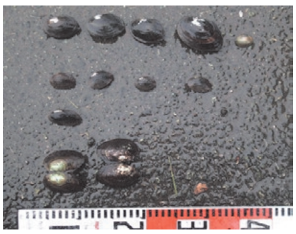


Research

In this study, we conducted distribution survey at 370 sites (wide area: 107 sites, detailed area: 263 sites) in the floodplain of the Kikuchi river. First, we surveyed at wide area, and then surveyed at detailed area receiving the result of wide area research. We capture the *Unionoida* in 3 people 10 minutes (**Figure.2**) and measure its size (**Figure.3**). After the research, *Unionoida* were returned to its original sites. Simultaneously, we measured the physical environment such as flow velocity, water depth, water width, water temperature, pH, chlorophyll, etc.

Figure.2 Survey scene

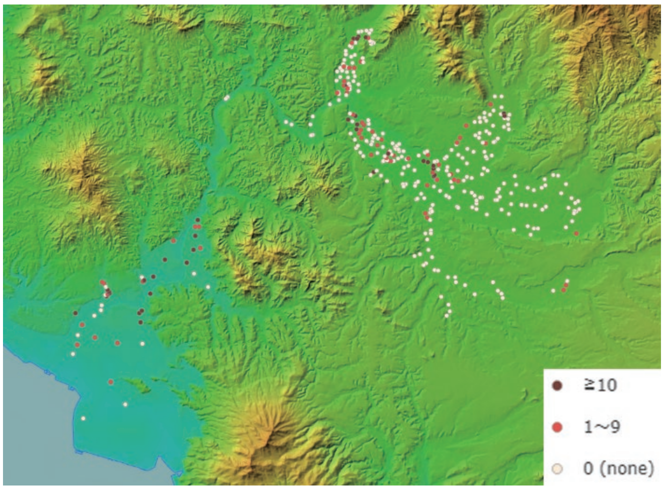
Figure.3 Captured *Unionoida*



Result and Discussion

Figure.4 shows the distribution of *Unionoida* in the Kikuchi River. In the 370 research sites, 7 species of 2426 *Unionoida* were confirmed at 96 sites (1132 *Unio douglasiae nipponensis* (in Japanese, Ishigai), 702 *Pronodularia japanensis* (Matsukasagai), 464 *Inversiunio yanagawensis* (Nisematsukasagai), 90 *Anodonta lauta* (Numagai), 30 *Lanceolaria grayana* (Tongarisasanohagai), 7 *Anodonta japonica* (Tagai), 1 *Obovalis omiensis* (Katahagai)).

Figure.4 Distribution of *Unionoida*



The distribution was limited, but there are some points that enable to capture a lot of *Unionoida*. There are some features at these points.

Table.1 Comparison of *Unionoida* habitat

	Percentage of habitat(%)			
	Status of waterway		Watershed area	
	River	Irrigation cannel	Mid stream	Down stream
Ishigai	20.9	28.1	12.3	45.2
Numagai	2.3	18.8	4.6	23.8
Matsukasagai	0.0	23.4	6.2	26.2
Nisematsukasagai	0.0	15.6	0.0	23.8
Katahagai	0.0	1.6	0.0	2.4
Tongarisasanohagai	0.0	4.7	0.0	7.1

Table.1 shows the comparison of Unionoida habitat at wide area. In the Kikuchi river, it proved that *Unionoida* inhabits mainly in irrigation channel, but it is crisis situation especially in the middle watershed. So we conducted distribution survey of detailed area and target to irrigation cannel of middle basin.

There are hotspots that we captured a lot of Unionoida. In the other channels, it was almost impossible to confirm the species. But *Unionoida* is concentrated to hotspots. It is considered that the ecological system of the old channels has been continued up to the present time at this place. Indeed, we confirmed many fish (Bittering, Freshwater goby etc.). Compare it with the aerial photograph of 1948, it confirmed that there is almost no change in the waterway and no refurbishment likely to destroy the ecosystem. About the reason of no change in that channel' shape, it is thought that there is existed along the residential area. Also, even in the same waterway channel as the hot spot, we could not confirm the *Unionoida* if the channel is made by only concrete and no deposition of gravel. It was suggested that deposition of gravel is necessary in the habitats of *Unionoida*.

On the other hand, we conducted statistical analysis by GLM (generalized liner model). In choosing the model, AIC (Akaike Information Criterion) was used, and the one with the smallest AIC was taken as the best model. Also, not only the best model but also the top 10 models with small AIC are examined. We considered the degree of influence on the distribution of the *Unionoida* was compared by the number of selected times in the top 10 model. In this GLM, we chose the explanatory variable as flow velocity, water width, water depth, deposition, water width change, CPOM, submerged plant, revetment, flow velocity (agricultural season), shear velocity (agricultural season). And we chose the purpose variable as *Unio douglasiae nipponensis*' existence (0, 1 data).

Table.2 shows the result of GLM. "+", "–" means the positive or negative of the coefficient when incorporated in the model. It revealed that there are some important factors.

<u>Flow velocity</u>

The flow velocity showed a negative correlation with the square. It means that flow velocity has an appropriate value. Because it is thought that Unionoida will be drained if the flow velocity is too fast and oxygen in water will be lost if the flow velocity is too late.

<u>Water width</u>

The water width showed a negative correlation with the square. It means that water width has an appropriate value. Although it is also reflected in the actual survey results that *Unionoida* is not confirmed if the water wide is too narrow or too wide, the reason is unknown.

<u>Deposition</u>

The deposition showed the positive correlation. It means that deposition is necessary for Unionoida habitats. This is because *Unionoida* usually lives in the deposition.

<u>Submerged plant</u>

The submerged plant showed a negative correlation with the square. It means that moderate submerged plant is necessary for *Unionoida* habitats. Why "moderate" is unknown, but submerged plant has a function to stop *Unionoida* from flowing.

<u>Share velocity (agricultural season)</u>

The share velocity showed the positive correlation. It means that smaller share velocity is good.

Conclusion

In the Kikuchi River, most agricultural channels are made of concrete, and many parts are found to be linear. And as roughness of the riverbed decreases, deposition will not accumulate in the channel. The habitats of *Unionoida* are rapidly decreasing because the sediment becomes difficult to deposit and the flow velocity becoming faster due to linearization of channel. Hotspots of *Unionoida* were also discovered, but the location is very limited. And there are some points in the hotspots that their habitats will easily disappear if something actions occurred. Therefore, conservation and regeneration of habitats of *Unionoida* is urgent matter. First we chose the point of conservation and regeneration.

<u>Conservation</u>

We chose conservation points from hotspots or around hotspots. Regarding the method of conservation, there are methods such as maintenance to prevent the habitat of the

Table.2 Analysis by GLM for *Unio douglasiae nipponensis*

Explanatory variable		Best Model	How many times selected in top 10 model	
			+	-
Flow velocity	Squared	-0.003	0	10
	First	0.139	10	0
Water width	Squared	-0.000	0	10
	First	0.019	10	0
Water depth	Squared		0	1
	First		0	1
Deposition		17.44	10	0
Water width change			2	0
CPOM			0	4
Submerged plant	Squared	-0.001	0	10
	First	0.085	10	0
Revetment			0	4
Flow velocity (agricultural season)			0	2
Share velocity (agricultural season)		-2.495	0	10

Unionoida from destroying any more, and to stop if the local residents have done activities (destruction of deposition) that destroy the habitat is there. In any case, it is necessary to obtain consensus from residents who use the channel.

<u>Regeneration</u>

We selected from non-sedimentary channel downstream of the hotspot. Regarding the method of regeneration, it is conceivable to install a structure in a section without deposits and make it easier to deposit. Regarding regeneration as well as conservation, it is necessary to obtain consensus from residents who use the channel too.

Regardless of whether conservation and regeneration is carried out, it is necessary for the residents to agree. For that purpose, it is necessary to engage with the residents by conducting workshops on conservation of *Unionoida*. In October 2017, we organized an environmental classroom on *Unionoida* in the Kikuchi river and interacted with residents (**Figure.4**). In order to propose a plan for reclamation of channels, at present it is planning to conduct hydraulic model experiments in situations when constructing structures were settled under site conditions.

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Figure.4 Environment class of *Unionoida*

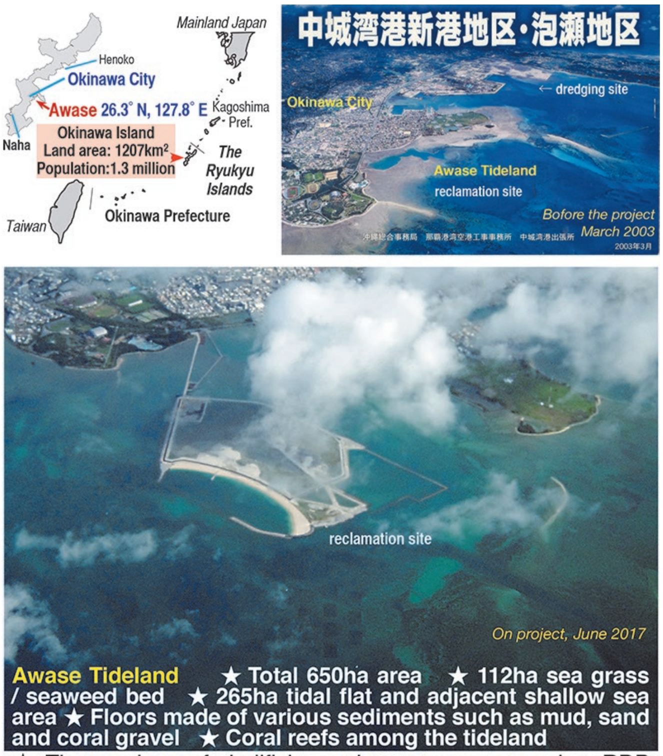
Analyses and Counter Measures on the Severe Damages to the Ecosystem of the Awase Tideland Area on Okinawa Island, Southwest Japan by a Dredging and Reclamation Project

Kita, Jinen [1], Maekawa, Seiji [2], Kameyama, Norikazu [3]

[1] Okinawa Godo Law Office, [2] Save-Awase-Tideland Network, [3] University of the Ryukyus

Awase Tideland is located in the east coast of Okinawa City, Okinawa Island, south west Japan. Awase Tideland area has 112 ha sea grass / seaweed bed and 265 ha tidal flat and adjacent shallow sea area, floors of which are made of various sediments such as mud, sand and coral gravel. (Fig.1) There are also coral reefs among the tideland. The numbers of shellfish species, sea grass species, RDB species, new species and the population of a migratory bird *Pluvialis fulva* in winter are the highest among the tidelands in Japan.

Fig.1 The location of Awase Tideland area and the reclamation site



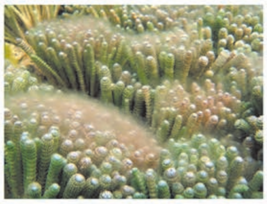
★ The numbers of shellfish species, sea grass species, RDB species, new species and the population of a migratory bird *Pluvialis fulva* in winter are the highest among the tidelands in Japan.

Awase Tideland area is, no doubt, one of the hotspots of biodiversity in Japan. (Fig.2) Government of Japan also has recognized the importance of Awase Tideland area. : Awase Tideland is a Potential Ramsar Site, and one of 500 Important Wetlands in Japan respectively designated by Ministry of the Environment. Nevertheless, the government of Japan and local governments of Okinawa Prefecture and Okinawa City began island reclamation and harbor dredging works in 2002. (Fig.3)

We local residents, NGO activists and scientists organized Save-Awase-Tideland Network in 2001. Then, we made original researches on the impacts against the wetland ecosystem, local economy and public finance by the project, and on the estimated natural disasters on the reclaimed island. Results of our researches showed the dredging and reclamation project would have negative effects on both human society and natural ecosystem. Eleven new species of sea animals and

Fig.2 Animals and plants featuring Awase area

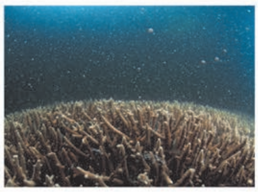
KUBIOREMIDORO, *Vaucheria constricta* (CR+EN), is an endemic seaweed species, only found at 3 area in Okinawa Island among the world.



ISOSUGINA, *Halycoryne wrightii*, is the dominant seaweed species in Awase Tideland.

Population of a bird MUNAGURO, *Pluvialis fulva*, in Awase reaches max. 53 % of that of Japan.

TOKAGEHAZE, *Scartelaos histophorus* RDB IA (CR), is an endemic fish species, only found in Okinawa Island among Japan.



Coral colonies are found within sea-grass / seaweed area. Oviposition of *Acropora aspera* has been observed.

A small population of KUROTSURA-HERASAGI, *Platalea minor* RDB IB (EN), is observed every year.

plants have been also discovered and described since the reclamation began.

They made a lawsuit claiming claiming local governments not to use tax money to the project and the court affirmed injunction of budgeting in 2009. We believed that the protection of Awase Tideland area was realized. However, the state and prefectural governments made a minor change in the reclamation plan in Oct. 2010 and restarted the project. Then, we made the 2nd lawsuit on trial.

In Japan, there is no legislation to make local residents or scientists directly check public enterprises. People cannot make a lawsuit to stop the budgeting of the state government. The court only judges whether budgeting of the local governments was decided under regal process. Japanese legislation

Fig.3 The first and the modified plan of the reclamation project.

The first plan of Awase reclamation project by the governments

★ 187 ha reclamation for harber dredging and construction of a resort city

AREA 1 (YELLOW): on project
AREA 2 (ORANGE): work not yet started

事業者(国)の目的：新港地区東埠頭の泊地・航路の浚渫土砂処分場
事業者（県)、利用者(沖縄市)の目的：埋立地をリゾート地として活用
宿泊施設、多目的広場等を造成する
多目的広場は、米軍泡瀬通信施設の専用海域に位置しているため、専用海域を一旦解除し、完成後米軍用地になり、沖縄市が共同使用するというもの。新たな米軍基地の造成、使用の制限という問題があり、またその区域はクビレミドロの生育地でもあった。
その他の施設も設置主体がいない、過大な需要予測などの問題があった。

泡瀬干潟を守る連絡会が 2001 年に結成され、埋め立て反対、住民民投票条例などの運動を展開し、2005 年第一次泡瀬干潟公金支出差止め訴訟（一次訴訟）を提訴した。

私たちの運動の結果、2006 年沖縄市長は埋立計画の 2 工区のうち「1 区推進、2 区困難」と判断した。

We made a lawsuit claiming local governments not to use tax money to the project in 2005.
Mayor of Okinawa City decided to decrease reclamation area in 2006.

The court affirmed injunction of budgeting

The district court affirmed injunction of budgeting in Nov. 2008. We won again at the upper court in Oct. 2009; it was the final judgment.

Local newspaper Okinawa Times selected the Awase case as one of 10 news of the year, since **it was the first dudgement to stop budgeting for ongoing public enterprise by the government in Japan.**

Mr. Maehara, Minister of State, stated to abandon the project of landside half of project area, and to stop the ongoing work of oceanside half.

09年10月5日　琉球新報
前原大臣と東門市長の対談
○巨額の投資忍してペイ出来なければ住民負担としてにしかかる。計画が達成できるか市長にはトータルで判断してほしい。
○仮にペイ出来しないとの判断でも、市民が税金で負担してもいいという意見が出てくれば、考え方が変わるのではないか。市の主体的な見解を示すためにも1度立ち止まって考えて欲しい。
○控訴審判決を踏まえた上で事業を再検証するよう求めた。

前原大臣の発言は、これまでの私たちの主張を代弁するものであった。

The new government by Democratic Party of Japan was negative to the whole Awase reclamation project at first.

泡瀬裁判で敗訴した沖縄市が、新たな「土地利用計画」(沖縄市案)を策定し、国に提出、国は即日了承(2010年8月3日)

- 控訴審(2009年11月19日)
- 沖縄市・市民部会、見直し案(2009年12月)
- 沖縄市・専門部会、見直し案(2010年3月)
- 沖縄市案策定、2010年4月？
- 沖縄市案、議会・政党へ説明、7月30日
- 前原大臣(当時)へ提出・了承・埋立再開表明

But the reclamation project didn't stop.
This is 'the mystery' of Japanese administration we often confront.

The second (present) plan of Awase reclamation project

★ 187 → 95 ha reclamation for dredging and a resort city

埋立進行により失われたもの

- 海草藻場(特に大型海草)が極端に減少した
  1区約56haの海草藻場が埋められた。海草に限れば約46ha。
  大型海草被度50%以上の面積が大きく減少した
  平成13年56.8ha→平成28年1.4ha
- サンゴ類が失われた
  ヒメマツミドリイシが絶滅危機(平成17年被度60%→平成27年度5%)
  他のサンゴ類 ショウガサンゴ(50→+)、ハマサンゴ(5→5)、ヤッコアミメサンゴ(5→5) も被度減少か生息僅か
- 渡り鳥(特に、ムナグロ)の飛来数が少なくなった
  2001年1554羽 → 2015年224羽
- 砂州が衰退(東側砂州)、消滅(泡瀬運動公園側)
  東側砂州→コアジサシの産卵場所、育雛場所消失、ウミガメ産卵場消失
  運動公園側砂州消滅、土砂が近くの海草藻場を覆い藻場消滅
- トカゲハゼ(絶滅危惧ⅠA類)の個体数、生息面積が減少した。

Reduced Reclamation area, but the conclusion of our research is:
NOT reduced impact to the wetland ecosystem and the estimated natural disasters.
WORSENED effects to the local economy and public finance.

Many people understood our opinions through our activity such as lawsuits, field works and town meetings.

説明責任をはたしていない

- ●計画の根拠
- ●事業費の明細、根拠
- ●工事を急ぐ理由
- ●自然環境保全
- ●防災対策(地震・津波・液状化)
- ●追加費用はどうなるのか 何処が負担するのか
- ●総事業費は1,000億円？
- ●生産誘発効果1,600億？

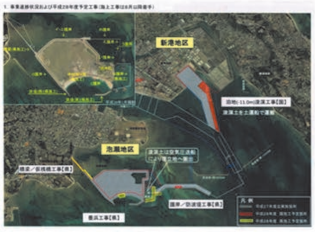
Local newspapers also critisized the policy of the governments.

裁判の経過

- 2000年12月、埋立承認・許可(187ha)
- 2001年1月、泡瀬干潟を守る連絡会結成
- 2005年5月、第一次泡瀬訴訟提訴(自然の権利訴訟)
- 2006年12月、沖縄市東門市長、1区推進・2区困難表明
- 2008年11月、那覇地裁、住民側勝訴、公金支出差し止め
- 2009年10月15日、福岡高裁那覇支部、住民側勝訴
- 2011年7月、埋立変更を承認・許可(1区のみ、95ha)
- 2011年7月、第二次泡瀬訴訟提訴
- 2015年3月、那覇地裁、住民側敗訴(不当判決)
- 2016年11月8日、福岡高裁那覇支部、住民側敗訴
- 2016年11月18日、最高裁へ上告
- 2017年2月7日、最高裁第二小法廷から「記録到着通知書」
- 2017年10月18日、最高裁第二小法廷から「上告棄却」の通知

The court this time supported the modified project by the governments.

Fig.4 Impacts by the projects and Activities by Save-Awase-Tideland Network



Reclamation is ongoing, which gave visible effects to the local ecosystem. But Awase area is still one of the most impartant tideland in Okinawa.

UMIERA, Sea pen or a species of Pennatulacea, is found on the floor of very shallow sea in Awase. A large population has been buried by the reclamation.

A crab-parasiting shellfish MENAGAOSAGANI-HASAMI-EBOSHI, *Octolasmis unguisiformis* RDB IA (CR) was newly recorded in April 2017.

Large groups of MINAMI-KOMETSUKI-GANI, *Mictyris brevidactylus*, can be seen just off the resident area.

Fieldwork with a specialist of sea-habiting spiders

Eleven new species of sea animals and plants have been also discovered and described since the reclamation began.

Our activities for scientific study and social education

A leaflet published in 2009

Fig.5 Accelerating degradation of environmental conditions around Awase Tideland area

The conservation of the ecosystem of Awase Tideland area :
We need immediate action to prevent or restore from accelerating degradation of environmental conditions, suggested by unexpected phenomena.

Seawater repeatedly becomes muddy.

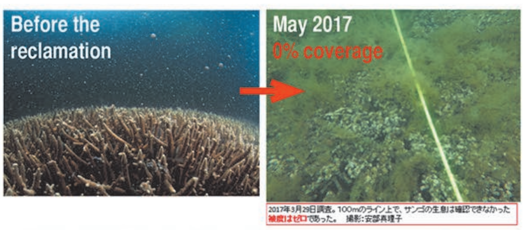
Shallow sea floor became greenish in spring : Algae increase explosively,

Ulva clathrata and another green alga species in 2017 and a brown alga *Hydroclathrus clathratus* in 2016,

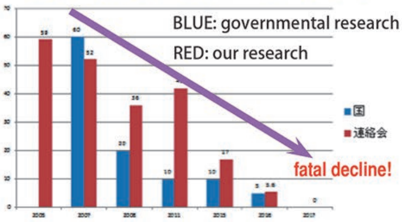
which respectively resulted in **the huge death of shellfish including RDB species.**

Collected shells of NIKKOGAI *Tellina virgata*, KAWARAGAI *Tapes literatus*, RYUKYU-ASARI *Fragum unedo*, DAIMYOGAI *Pharaonella perna* after mass mortality.

Explosive increase in algae and subsequent shellfish death has also occurred in the Wajiro Tideland, Fukuoka, which also has a reclaimed island.



Changes in the seafloor coverage by colonies of a branch coral species *Acropora aspera* between 2005 and 2017 →

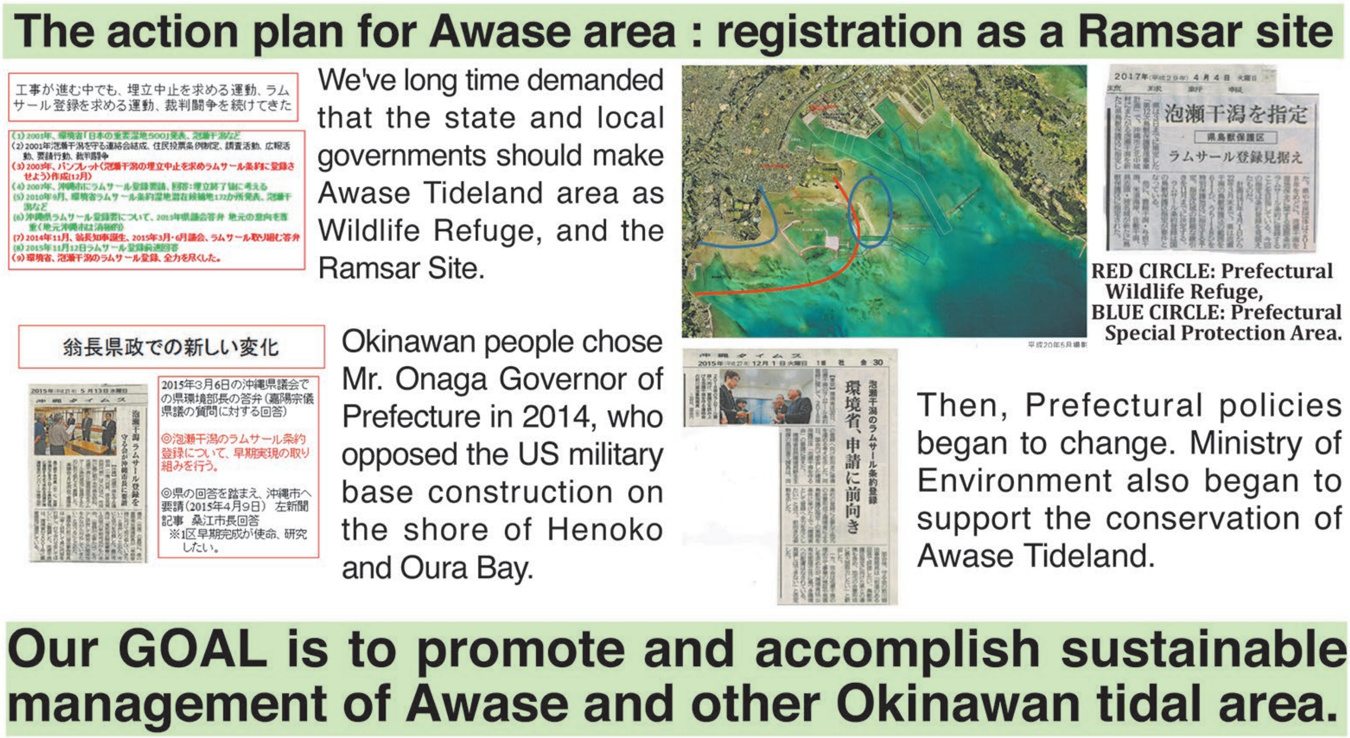


ヒメマツミドリイシ群落被度変化のグラフ 赤:連絡会 青:国
国は2007年から調査。2017年は国の報告は現時点でなし。連絡会調査2017年3月29日ではゼロであった。

Coral species *Acropora aspera* in the tideland area are in the crisis of distinction.

Undoubtedly, plant and animal population in Awase Tideland Area is now becoming in UNSUSTAINABLE or even FATAL conditions

Fig.6 Awase Tideland which should be resistered as a Ramsar site



for the local authority is inadequate from residents' and scientists' point of view. As a result, the court did not stop the project.

We also made various activities for scientific study and social education on the ecosystem of Awase area. (Fig. 4)

The reclaimed island with 95 ha area is now appearing at the center of Awase Tideland and the surrounding shallow sea area. Changes as follows are observed in Awase Tideland area after the appearance of the island, none of which are expected in the environmental impact assessment report made by the government:

[1] The coral colonies of a branch coral species Acropora aspera in the tideland area are in the crisis of distinction.
[2] Seawater repeatedly becomes muddy.
[3] A sandbank, which has long been a breeding site for a tern *Sterna albifrons*, became completely inundated during high tide, and then it's ground level fluctuates.
[4] Algae increase explosively, *Ulva clathrata* and another green alga species in 2017 and a brown alga *Hydroclathrus clathratus* in 2016, which respectively resulted in the huge death of shellfish including RDB species. Explosive increase in algae and subsequent shellfish death has also occurred in the Wajiro Tideland, Fukuoka, which also has a reclaimed island.

Such phenomena suggest the accelerating degradation of environmental conditions in Awase Tideland. (Fig.5)

The dredging and reclamation project in Awase Tideland area may be a severely damaging factor to the protection of the wetland ecosystem there as well as the sustainability of the local economy and public finance, as mentioned above. Therefore, the national and prefectural governments are required to alter the dredging and reclamation project policy and to realize the conservation and wise use of wetland environment in Awase Tideland area, which meets Ramsar Convention.

The activities for the protection of Awase Tideland, including two lawsuits, also revealed that the enough involvement of local residents, NGO specialists and scientists to the policy making and administration process by the local/national governments would be the better solution for the protection, restoration and wise use of local natural resources including tideland ecosystem. Japanese legislation is inadequate from this point of view.

Okinawa prefectural government has stated Save-Awasetideland Network that Awase Tideland would be designated as prefectural wildlife refuge by the autumn 2017, and then as national wildlife refuge. Okinawa prefectural government clearly has the policy to make Awase Tideland registered to Ramsar List of Wetlands of International Importance.

Okinawa Prefecutural Government makes new Wildlife Protection Plan and prepares to make 650 ha of Awase Tideland area Prefectural Wildlife Refuge, including 280 ha of Prefectural Special Protection Area.

Okinawa City Government still doesn't agree with Prefectural Wildlife Refuge plan. Therefore, promotion activity is very important to realize the policy for the conservation of Awase Tideland.

Following the prefectural decision, Ministry of the Environment will designate there as National Wildlife Refuge and Special Protection Area.

Our goal is to promote and accomplish sustainable management of Awase and other Okinawan tidal area. (Fig.6)

The Effects of River Modification to the Spawning Habitat of Ice Goby (*Leucopsarion petersii*)

Hiroki Iyooka
Fukuoka University

1. Introduction

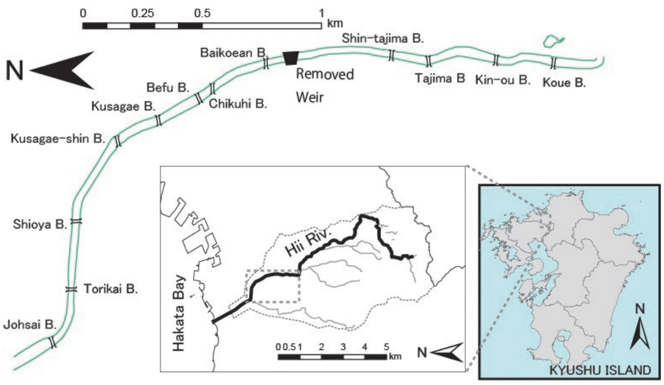
River modifications control river flow and enhance safety of our lives from the flood. On the hand, it could also modify the river ecosystem. River ecosystem and its biodiversity provide a broad variety of valuable goods and services for human societies and some of which are irreplaceable (Covich et al., 2004). Declines in biodiversity are far greater in fresh waters than in the most affected terrestrial ecosystems (Sala et al., 2000). So as there is a growing concern about the losing these services following declines in species diversity, the cases of river restoration and river modification using nature oriented methods are increasing (Hayashi et al., 2016, Minagawa et al., 2013.) .

In the case of Hii River, as the result of a huge flood on July 2009, river modification began in 2010 and completed in 2015. In this modification, the nature oriented methods such as the slide down dredging which does not change the cross profile and gradient of the river, removal and decentralization of the weirs and returning coarse sediment components to the riverbed after the dredging were adapted (NAGAI et al., 2014). Though some reports showed the positive effects to fish habitats such as more fishes migrated to the upstream of the modified area(Shimatani, 2016), the effects of this modification was not assessed enough especially in the downstream and estuarine area. In this study, we focused on the Ice Goby (*Leucopsarion petersii*) which specifically uses the cobble environment of the upper brackish area as its spawning habitat. The effects of the river modification to the spawning habitat were investigated.

2. Methods

Field works were carried out on middle to end of April from 2011 to 2016 at the Hii river estuary (1.8km to 4.6km from the river mouth). Sampling station was set to the every 50 meters along the river. (Fig.1) 0.25m2 quadrat was set to the submerged riverbed. Picking up the cobbles which are approximately over 30mm diameter and capable of working as the spawning redd, numbers of the batches of the eggs were recorded in the quadrate. In case of no batches in the quadrate, cobbles within a radius of 8 meters from the quadrate was checked to verify the existence of the eggbatch at the stations. At the same time sediment sample were collected to analyze sediment components. Water temperature and salinity and velocity were recorded at each station using multiple

Fig.1 Research area



water quality meter (DS5X, Hydorolab) and water velocity meter (Alec AEM1-D, Alec Electronics).

Field monitoring of the tidal effect was carried out on October 4th, 2013. River modifications in the estuarine area were almost finished and modifications of the upstream area were a standstill period due to the rainy season. Vertical salinity distribution was recorded in 4 tidal conditions (high tide, ebb tide, low tide and flood tide) using the multiple water quality meter (DS5X and MS5, Hydorolab) at the deepest point of the 14 bridges which located in 0.0 to 4.15km from the river mouth.

3. Results and Discussion

According to the result of the field works on 2011, a lot of eggbatches were found in the range of 2.2km to 3.0km from the river mouth (Fig.3). It indicated that that spawning habitat had not been affected at this point. Early stage of the river modification was mainly river bed dredging in river mouth area: downstream of the research area. Original spawning habitats remained because they had not been disturbed and dredging ship was surrounded with the turbidity barriers and water quality through the spawning area to the river mouth was less affected. During 2012 to 2015; the central stage of the river modification, almost no eggs were found at the research area. In this period, original spawning habitat was directly disturbed. And due to the dredging ship could not go up the tidal area and turbidity barrier did not work effectively, highly turbid water flew out the river. High saline water over 30 PSU reached 2.0km at low tide and 2.7km at high tide. Due to the slide down dredging and weir removal of 3.3km, where used to be the upstream end of the brackish area, the tidal effect reached to the 3.6km at high tide (Fig.4, Fig.5). On the other hand, the upstream end of the spawning area reached to 4.2km: flesh water area. The most remarkable spawning area moved from 2.2km in 2011 to 2.9km in 2015 after the river modification. And the spawning area became smaller and localized. Sediment components

These results might be related to the change of the sediment components and riverbed salinity. Because of the turbid water formed turbidity maximum around the upstream of the brackish area, accumulation of the finer sediment caused negative impact directly to the spawning habitat. Returned coarse gravels worked as a spawning substrate on the upstream side of the brackish area. However the returned coarse gravels of the middle brackish area had been buried by the sand after several small floods and they did not worked as the spawning substrate. In the upstream area, the slide down dredging would not change tractive force due to the cross-sectional area and river gradient would not change. In the estuarine area, so as the cross-sectional area would increase due to tidal conditions even though the slide down dredging were adapted, tractive force would be reduced and sediment components tend to become finer.

4. Conclusion

At the mention of river modification in the upstream of the tidal limit, the slide down dredging would not change tractive force due to the discharge area and river gradient would not change. On the estuarine area, so as the discharge area would increase due to tidal conditions even though the slide down dredging were adapted, tractive force would be reduced and sediment components tend to become finer. Though the tidal effects make the physical environment more complex, we have to examine how the salinity and tractive force change in the river estuary and decide where to restore fish habitats.

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Fig.2 Components of bed material

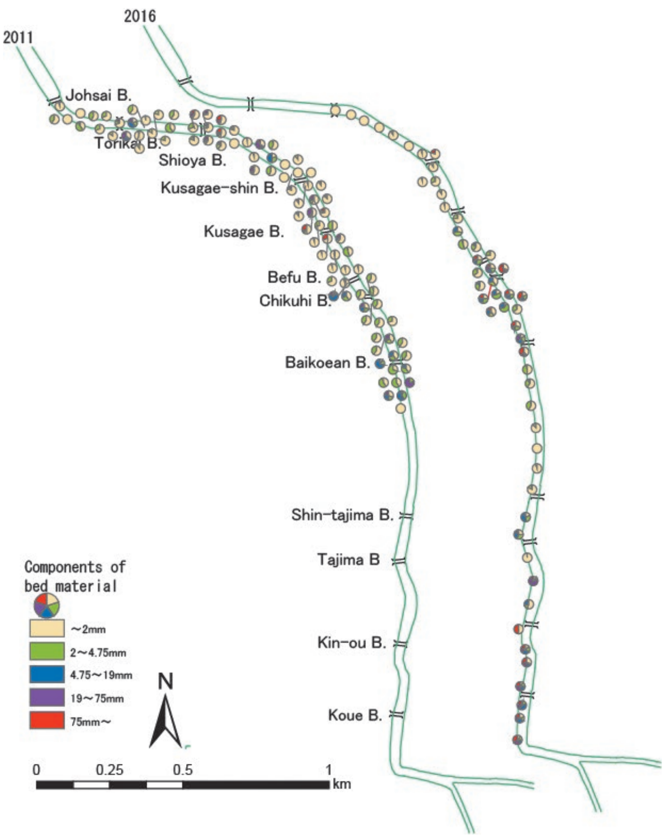


Fig.3 Distributions of Egg batches

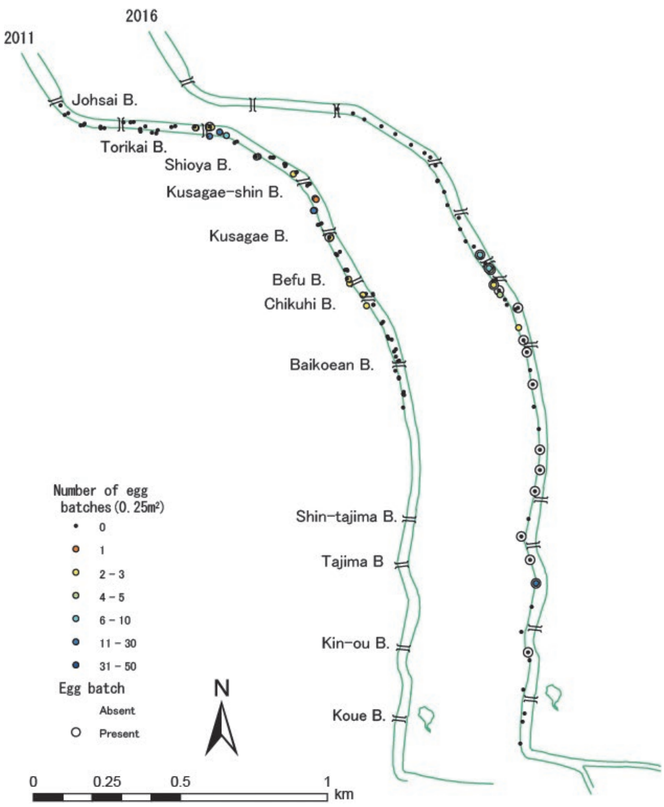


Fig.4 Salinity Distribution (high tide)

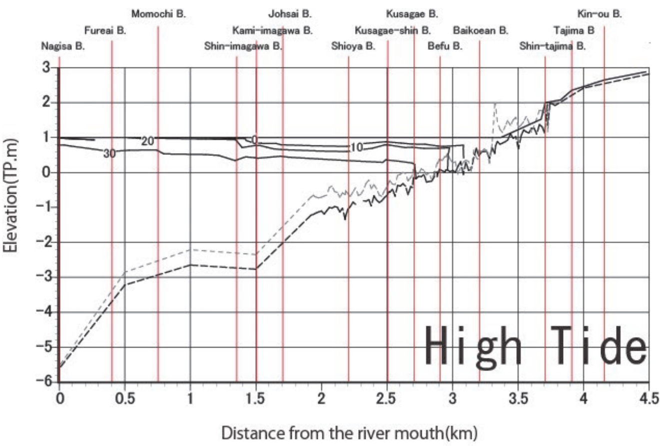
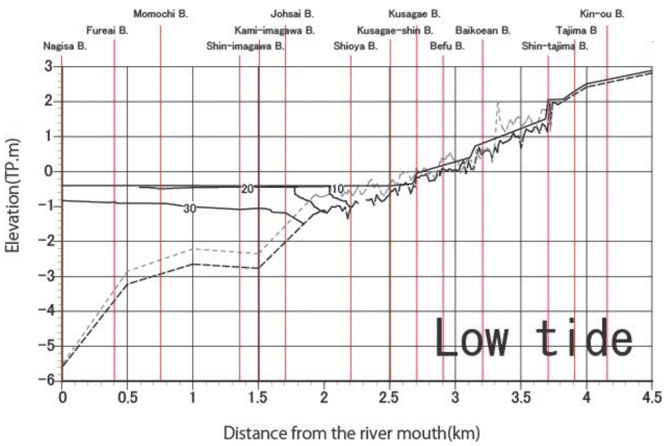


Fig.5 Salinity distribution (low tide)



The Influence of Agricultural Activities on Water Chemistry and Aquatic Biota in the Freshwater Springs of Uchinada Dune, Japan

[1] Masao Nagasaka, [2] Morihiro Takano, [3] Haruo Fukuhara, [3] Hisashi Takahashi

[1] Kanazawa Seiryo University, [2] National Institute of Technology, Ishikawa College, [3] Kahokugata Lake Institute

Introduction

Uchinada Dune is one of the largest coastal dunes in Japan. It is located in the central island of Japan. It has a length of 20 km, a width of 1.5 - 2.0 km and a maximum height of 61.3 m. Some freshwater springs are naturally occurring at the foot of the dune (Fig. 1).

Although the local inhabitants used to use both the spring water and the shallow groundwater for their daily life, they stopped using the spring water recently. On the other hand, the farmland and residential land have been constructed on the dune since 1950's. Pump facilities were also built at the coast of Lake Kahokugata to irrigate the farmland on the dune. For these reasons, it is supposed that the water quality of the springs get worse.

The purpose of this study is to document the present state of the springs and to find out the way to conserve the spring environment.

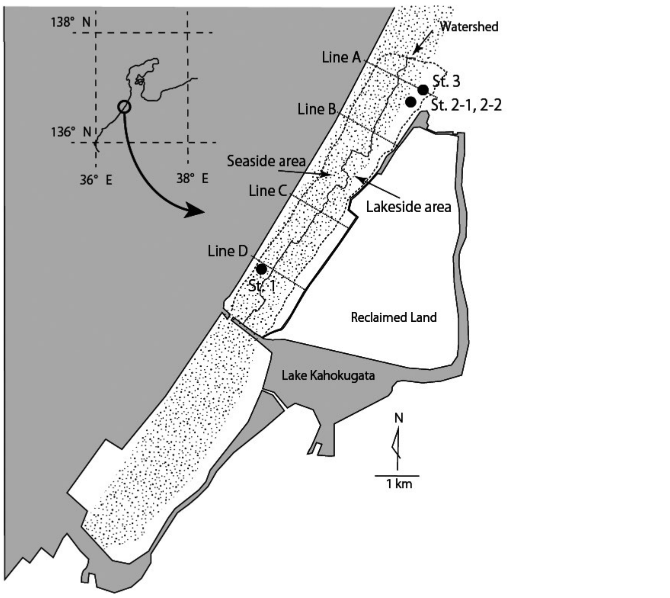
Study site and methods

Water quality survey was carried out at four springs (St. 1, St. 2-1, 2-2, and St. 3) from January 2016 to January 2017. Water temperature, pH and electronic conductivity (WM-22EP, TOADKK), dissolved oxygen (Pro-ODO, YSI) were measured on the sites. Concentration of total nitrogen (TN M-1, Shimadzu) and major dissolved ions (PIA 1000, Shimadzu) were analyzed.

Flora and aquatic fauna in the springs were surveyed in 2015 to protect endangered species. Aquatic animals were collected by using a D-frame net.

The distribution of the farmland on the dune and the variety of crops at the farmland were surveyed in summer (July to August) and autumn (October to November) 2016. Annual amount of fertilizer application for each crop on the dune was estimated using a cultivation techniques manual for farmers (Ishikawa prefecture 2012).

Fig. 1 Location of Uchinada Dune and the study sites. It is located in a catchment area of Lake Kahokugata.



Results

Water quality

High concentration of total nitrogen ranging from 2.7-7.2 mg l^{-1} was observed at St.3 which is located in the northeast foot of the dune (Fig. 2). On the contrary, low concentration of total nitrogen ranging from 0.4-4.9 mg l^{-1} was observed at St.1 which is located in the southwest foot of the dune. High concentration of manganese ion was also observed St.3 and St.2 and low concentration of manganese ion was observed at St.1 (Fig. 3). A linear relationship was observed between concentration of total nitrogen and manganese ion in the spring water (Fig. 4). Nitrogen and manganese in the springs should come from fertilizers applied on the farmlands.

Fig. 2 Changes in total nitrogen concentration in the springs.

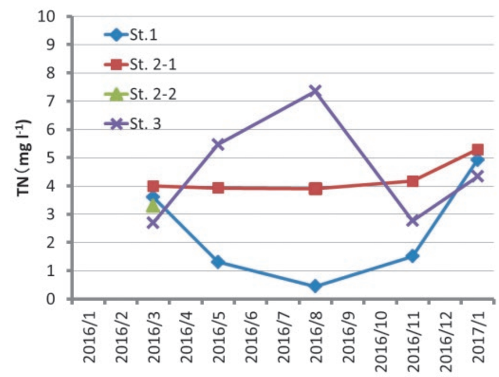


Fig. 3 Changes in manganese ion concentration in the springs.

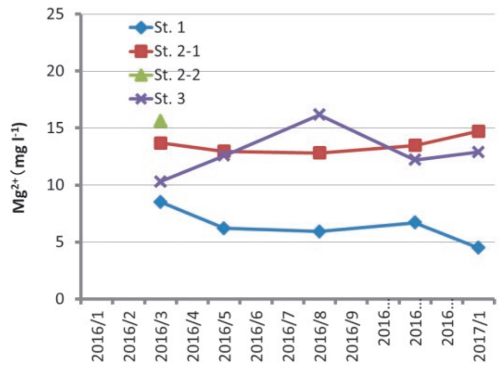
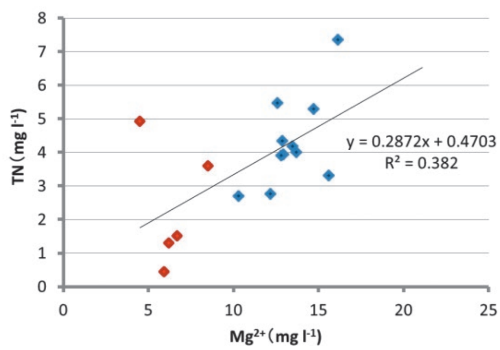


Fig. 4 Relationship between total nitrogen and manganese ion in the springs.



Aquatic biota

A total of 55 species of plant was found in the springs. All of them are common hygrophyte. The dominant plants were *Carex dispalata*, *Calamagrostis epigeios*, *Persicaria thunbergii*, *Oenanthe javanica* and *Iris pseudacorus*. The aquatic fauna of the springs was composed of 22 species (Fukuhara *et al.* 2016). It was dominated by crustaceans, insects and molluscans. As for crustaceans, *Gnorimosphaeroma naktongense* and *Jesogammarus hokurikuensis* were found. These are the species typically seen in the spring around the coastal area.

Distribution of farmland and Calculation of fertilizer application

The main crops of the farmland on the dune were sweet potato, watermelon, vegetables and Chinese white radish (Table 1). Chinese white radish was planted in the autumn season, following the harvest of watermelon.

The average of nitrogen application to the farmland was calculated as 166.8 kg N ha^{-1} year^{-1}. It was reported that over 300 kg N ha^{-1} year^{-1} of nitrogen was applied in other costal dune farmlands in Japan (National Institute of Agricultural Sciences 2006). The amount of nitrogen application to the farmland in Uchinada Dune is smaller than the other dunes in Japan.

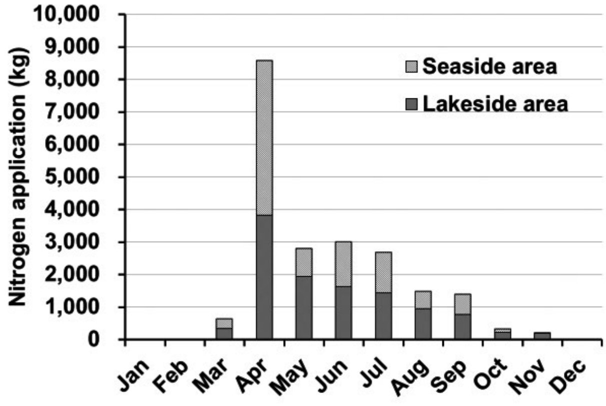
A total of 21.1 ton of nitrogen was applied on the survey area of the dune in 2016. Forty percent of nitrogen was applied on April (Fig. 5), and high concentration of total nitrogen was observed at St.3 in May and in August (Fig. 2). The catchment area of the spring located at the northeast foot of the dune is mainly occupied by the farmland (Line A, Fig. 6).

On the other hand, there is few farmland in the catchment area of the spring (St. 1) at the southwest foot of the dune (Line D, Fig. 6). The water quality of the springs would be affected negatively by the application of fertilizers.

Table 1 Area of crops on the dune (Nagasaka *et al.* 2017).

Summer crops	Area (ha)	Autumn crops	Area (ha)
Sweet potato	49.0	Chinese radish	11.7
Watermelon	32.3	Sorghum	2.0
Vegetables	27.3	Crotalaria	1.2
Paddy field	9.3		
Grape	2.8		
Japanese leek	2.0		
Chinese yam	1.9		
Burdock	1.5		
Welsh onion	0.3		
Total	126.4		14.9

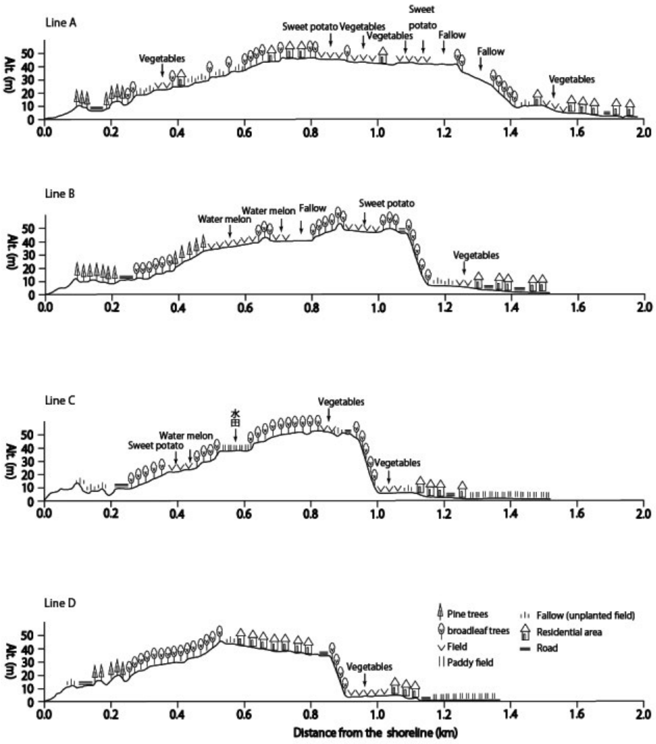
Fig. 5 A monthly application of nitrogen on the dune (Nagasaka *et al.* 2017).



Conclusion

The average of nitrogen fertilizer applied to the farmland was calculated as 166.8 kg N ha^{-1} year^{-1}. Although the amount of nitrogen application to the farmland in Uchinada Dune is smaller than the other dunes in Japan, the water quality of the springs would be affected by the application of fertilizers. Appropriate fertilizer management is required to reduce nitrogen leaching from the farmland.

Fig. 6 Distribution of the farmland on the line A –D. (Nagasaka *et al.* 2017).



Acknowledgments

We appreciate Oosaki district resident's communities for their kind cooperation. This study was partly funded by a grant from Kanazawa Seiryo University.

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New Fish Fauna Inventory and Survey Techniques for Marine Protected Area Planning: Environmental DNA Metabarcoding

[1] Mitsuhiro Aizu, [2] Satoquo Seino, [3] Tetsuya Sado, [3] Masaki Miya
[1] Research Institute of Environment for Sustainability, Faculty of Engineering, Kyushu University
[2] Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyushu University
[3] Natural History Museum and Institute, Chiba

Introduction

A Marine Protected Area (MPA) can be an effective tool for the conservation and sustainable use of marine and estuary biodiversity. In the Japanese legal system, coastal Ramsar sites are regarded as MPAs. A local government has promoted the establishment of MPAs along the coast of Tsushima Island in Nagasaki Prefecture, in response to declining fish catches and the loss of seaweed forests. These areas once had several fine fishing grounds and seaweed forests. The disappearance of seaweed advanced gradually from the south, but reached Waniura Bay in the northern part of the island in 2016. Data on fauna such as fish and zooplankton are necessary to establish and promote MPA designation. Inventory surveys have been implemented at several sites.

Previous surveys were conducted not only for scientific purposes but also for environmental assessments. In the case of some environmental assessments, essential data on ecosystems was not collected because the main purpose was for development approvals. The lack of adequate data could result in ecosystem damage by enabling destructive developments. Conventional methods of inventory surveys also involve long time periods, incur significant costs, and require taxonomic expertise. They are based mainly on literature searches and external morphology, the latter requiring a high degree of specialization. Samples for morphological analysis are typically collected from field surveys by cast nets, scoop nets, and other tools. Fish catches are also used to reveal information on coastal and offshore fish fauna. However, with these sampling methods it is difficult to collect small fishes, so the results may not accurately reflect ecosystem conditions. New inventory methods are needed to accurately describe the ecosystems and limit the loss of important environments.

Environmental DNA (eDNA) metabarcoding can be useful here. The technique can reveal whole communities from DNA in water samples, can conduct analyses quickly, and require no taxonomic knowledge. Expertise is only required for DNA extraction in the laboratory; almost anyone can collect the eDNA samples from water after receiving basic training. In this study, we applied this technique to an inventory survey to assess the fish fauna along the coast of Waniura Bay.

Materials and Methods

Water samples were collected in August 2016 from five points and the samples were mixed in one bottle (fig.1,2). Collected sample was filtered using Sterivex™-HV Sterile Vented Filter Unit, 0.45μm (MERCK MILLIPORE) (fig.3). After filtering, RNA later® Stabilization solution (Thermo Fisher Scientific) was immediately inserted into the Sterivex filter to preserve eDNA. Total DNA was extracted using a DNeasy Blood and Tissue Kit (Qiagen) following manufacture's manuals. 12S rRNA gene was amplified with MiFish primer, and adaptor sequence and index sequences were add to the amplicon. Metabarcoding was conducted in MiSeq sequencing, and taxonomic assignment was performed following previous studies [1,2].

fig.1 Map of whole Tsushima Island and enlarged view of sampling sites. Sampling sites were located in Waniura Bay.

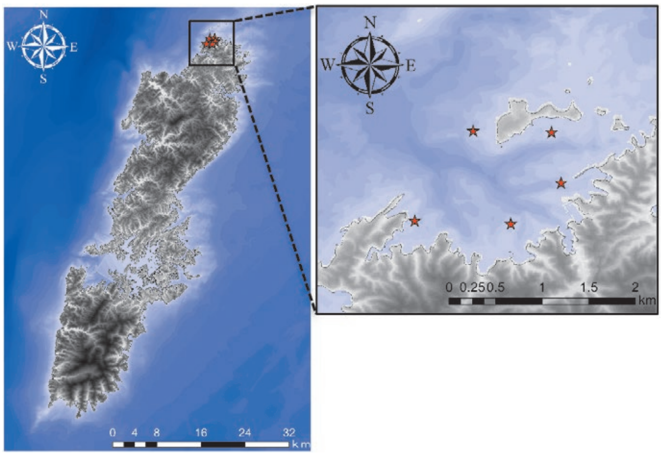


fig.2 Location of sampling site. Water sampling was conducted using the small boat.

fig.3 SterivexTM-HV Sterile Vented Filter Unit with 0.45μm.

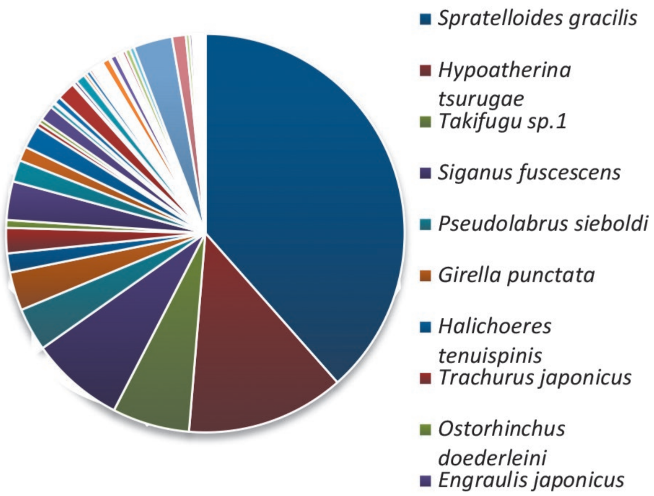
Results and Discussion

Compared with the 379 species identified in previous studies based on conventional methods in a larger area [3], this study identified over 70 OTUs from the water sample taken from a small area (fig.4). Most of OTUs were considered as fish that inhibits in coastal waters.

Some sequences could not identify as a species because several species had same sequence among species. Especially genus *Takifugu* shared common sequences due to the evolutionary process. They experienced explosive speciation [4], therefore, target regions of MiFish primer could not identify the species. It is recommended to use other primer to distinguish these species.

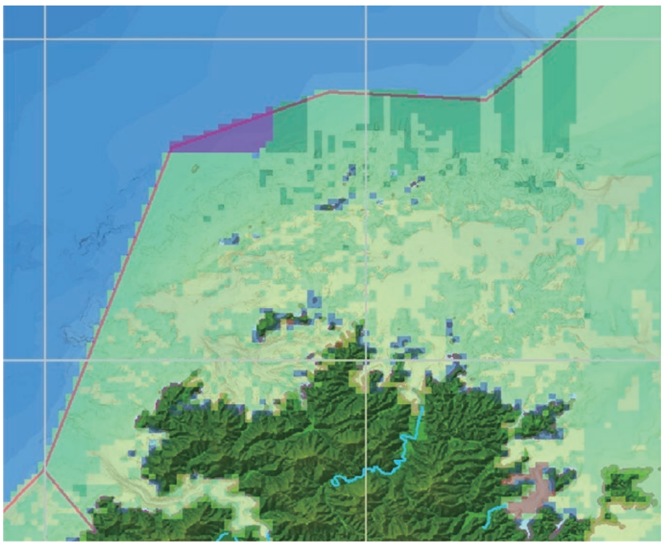
In addition, some OTUs were suggested as contaminant during laboratory work considering their habitats. It is recommended to avoid the cross-contamination to obtain the accurate marine ecosystem.

fig.4 Pie chart of obtained OTUs. Top 10 OTUs of obtained reads were represented in the legend of right side.



The banded blue sprat (*Spratelloides gracilis*) was the most counted species, and this could be explained by a shoal of these fish staying around the sampling area, and also by the area having a sandy bottom (the species favors that environment) (fig.5).

fig.5 Marine geography around Northern part of Northern Tsushima Island [5]. Sandy bottom was colored in yellow.



This study showed the utility of eDNA metabarcoding for inventory surveys, and the environmental conditions could also be postulated based on fish fauna data. This technique could complement conventional methods and be applied for inventory surveys in other areas to reveal detailed information about marine and estuary ecosystems. Monitoring based on eDNA metabarcoding can be used to quickly reveal changes in ecosystems. Our study demonstrated the potential benefits of these new techniques, including contributions to establish and effectively manage MPAs.

Acknowledgement

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The Environmental Conservation in Yatsu Wildlife Protection Area

[1] Kiwamu Kawaguchi, [1] Sohei Ikeda, Shuji Kanda, [2] Aya Genseki, [3] Yoshihiro Natori

[1] IDEA consultants, Inc., [2] Ministry of Environment, [3] Wetlands International Japan

Yatsu Higata (Yatsu Tidal Flat) is a muddy/sandy tidal flat with the area of 40 hectares located at 2 kilometers inland of Tokyo Bay.

Because of the various and large number of migratory shorebirds and waterfowls hosted by Yatsu Higata, it was designated as an official site of Ramsar Convention in 1993.

More than 110 species of birds are able to be observed in a year including about 70 shorebird and waterfowl species. Since Yatsu Higata is a major stopover for migratory birds, we can observe large number of shorebird corresponding to 10% of entire shorebirds coming to Japan.

In addition to the bird species, Yatsu Higata hosts many kinds of aquatic creatures such as fishes, worms, crabs, bivalves and so on. Abundance of the benthic species makes Yatsu Higata to good place for feeding and resting for migratory birds.

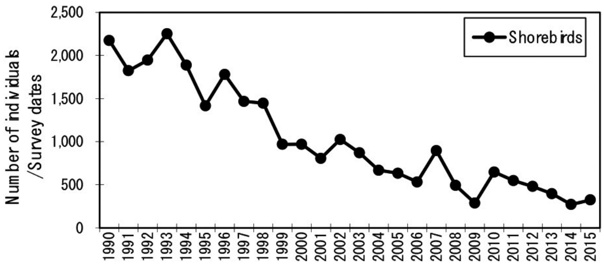
Yatsu Higata is familiar to many citizens because it is located close to Tokyo.

The Ministry of Environment designated Yatsu Higata as a wildlife protection area aiming to protect the environment for birds.

Number of shorebirds migrating to Japan is decreasing recently. Comparing to 1993 when Yatsu Higata was designated as an official site of Ramsar Site Convention, the numbers of shorebirds decreased to be 1/4(Fig.1).

The Ministry of Environment started conservation project in 2010 to improve habitat condition of Yatsu Higata to restore the number of the migrate birds.

Fig.1 Changing the number of observed shorebirds in Yatsu



Because it is a valuable tidal flat left in the urban area, we aim to be a tidal flat where nature's activities and people's living can be coexisted, nature can coexist with people, and tidal environment and the living environment of the surrounding residents.

The feature of this conservation project's approach is that based on scientific data, the project was carried out with emphasis on the current status grasping -> factor analysis -> countermeasure examination -> effectiveness verification flow. Also, in order to deal with the uncertainty of countermeasures, we carefully examined the adequacy of countermeasures based on small-scale demonstration tests.

We examined indicators to evaluate the tidal flat change and the effect of countermeasures and set quantitative conservation targets.

In the short term, we are maintaining the current situation.

In the long term, we are targeting the condition around the time of registering the Ramsar site (1993).

Table1 Features of the Environmental Conservation

1	Understanding the Phenomena: Investigation of countermeasures to reduce impact
2	Adaptive Management: Small Scale Testing・Monitoring・Continuous Improvement
3	Regional Cooperation: Information Sharing・Cooperation of government and region

Table2 Conservation Targets

[Reduction of Feed Place]

Index	Current Situation	Conservation Targets
Drying Area・Drying Time of Tidal Flat	2012 【0.55】 (After the Great East Japan Earthquake) *Drying Area*：22.2ha 【0.93】 *Drying Time*：2.3hours 【0.59】	**[Short Term]** 2010【1】(Before the Great East Japan Earthquake) *Drying Area*：24.0ha【1】 *Drying Time*：3.9hours【1】 **[Long Term]** 1993【1.60】 *Drying Area*：28.2ha【1.18】 *Drying Time*：5.3hours【1.36】

[Changes in Quantity and Quality of Bait]

Index	Current Situation	Conservation Targets
Wet Weight of Polychaetes	Average Value of 2011 to 2014 : 12.1g/m² 【1】	**[Short Term]** Maintaining the Current Situation：12.1g/m²【1】 **[Long Term]** 1995：22.7g/m²【1.63】

IDEA Consultants is conducting scientific researches to support the conservation project of Yatsu Higata which is led by the Ministry of Environment.

Environmental conservation and management methodology based on the monitoring results have been proposed by IDEA Consultants.

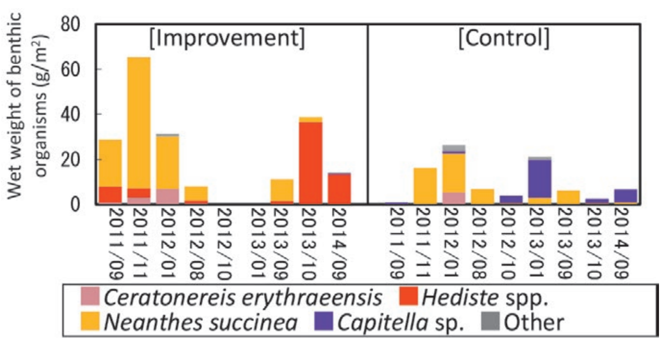
(1) Improvement of sediment condition for creatures fed by shorebirds

The sediment condition of Yatsu Higata has been changing from mud to sand due to gradual discharge of mud.

Along with the sediment change, worms and crabs that live in mud have been replaced with snails and bivalves that live in sand(Fig.2). Changing biota seem to be causing deterioration of feeding condition for shorebirds.

We are trying to place back the original biota to improve the condition for shorebirds by replacing sediment; we replaced sandy sediment with muddy sediment in some areas.

Fig.2 Changes in benthic organisms after sediment improvement



(2) Dredging in the canal and the flow path

The elevation of the tidal-flat is becoming lower gradually because of the mud discharge through canals.

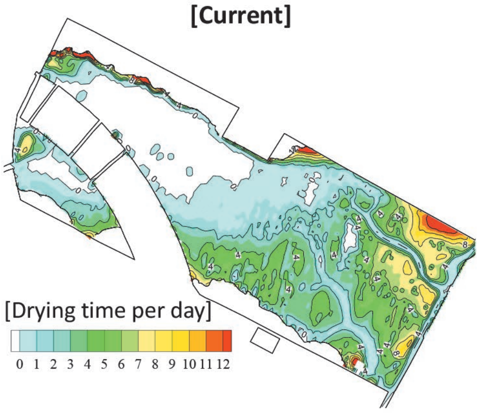
Seashells accumulated in the canal and the flow path connecting to Tokyo Bay hinder the outgoing tidal flow from the tidal-flat. It causes reduction of exposed areas of the flat and the time duration to feed shorebirds.

To regain the exposure time and the area, we are going to dredge in the canal and the flow path to improve water flow.

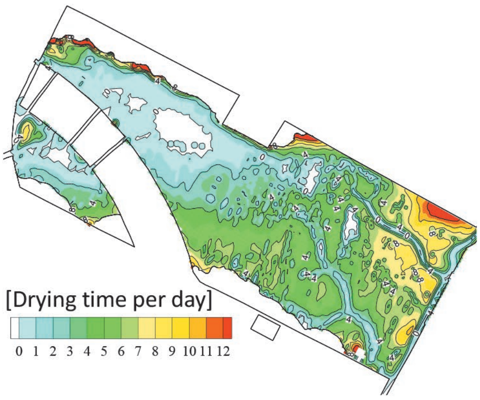
We are investigating the ways of dredging not to effuse mud from tidal-flat based on the simulation results of sea water flow and topographic change(Fig.3).

Fig.3 Calculated pattern of area and duration of exposure by numerical simulation

[Current]



[Simulation in dredging in the canal and the flow path]



(3) Regional Cooperation

Cooperation with local residents and related organizations, with the proper role sharing, we aim to consolidate with the region.

• Exchange of Opinions

We hold a briefing session and reflect local needs in business. About 11 times the local briefing session and about 270 people participated.

• Spread Awareness

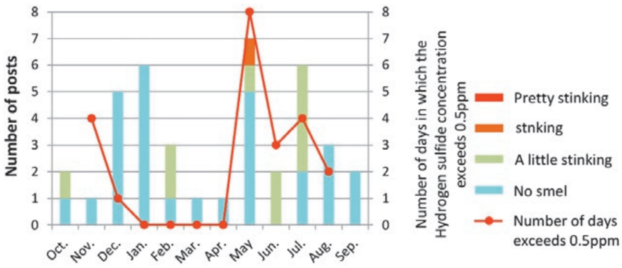
About 600 people took part with the event held six times.

• Web Monitoring

Approximately 9,000 people visited the website, about 50 participants to participate in the citizen participation monitoring

There are 400 postings since then, many local residents are interested in Yatsu Higata, and participation and cooperation in conservation project efforts are obtained(Fig.4).

Fig.4 Seasonal change in the number of smell posts



• Collaboration

Government and the community are working together on conservation together. We carried out the removal of shells and bamboosa.

What is the Rainwater Underground Harvesting Tank "Tametotto"? (abstract)

Shinji Kawano
Daiken Co., Ltd.

The rainwater underground harvesting tank (nickname) "Tametotto" is a mechanism that can store and use a large amount of rainwater with just maintenance, with water quality comparable to that of drinking water, with easy construction in a short period of time. We got inspiration from the wetland's water holding capacity and water purification ability and got guidance from Kyushu University and developed it.

Moreover, the upper portion of the installation can be used for "Tametotto", and it can be installed in the garden, the parking lot, the evacuation center of the area, the park etc. Usually it is used as water for garden tree sprinkling, washing water in toilet and washing water for washing. When "torrential downpour" or "local heavy rain", etc., it can be used as living water even in the event of a disaster because it will be operated by hand pump as a countermeasure against flood damage by storing it.

As a result, we have set up "Tametotto" in each of the two elementary schools in Atapu Province of Laos, People's Democratic Republic of Laos at the request of the United Nations Habitat in 2014. Both of them have a capacity of 100 tons, "drinking water" for residents is the purpose.With the establishment of "Tametotto", 400 people in Taoum village, 400 people in Pusai village, 220 people in 35th house of Pusai village, 220 teachers and staff of two schools totaled about 650 people, for a minimum of 2 months in the dry season, 1 It will be possible to secure 2-3 liters of drinking water a day.

From the United Nations Habitat, we taught five reasons about "reason for adopting" reason.

1. Low installation cost. (In Laos it was possible to make it about 15,000 yen per ton of water storage.)
2. Short construction time. (We were able to create 100 ton class water storage in Laos in one week.)
3. Installable by local people as no specialized skills are required.
4. Local materials can be used.
5. Post-installation maintenance is easy.

We received a letter from Laos 1 year after installation, reported that I was able to use water for 4 months during the semi-annual dry season where it did not rain, and I was able to make vegetables using saved rainwater It was a good evaluation. So in May of this year, I received my second request from the United Nations Habitat and built the third "Tametotto" for Laos.

For the future "Tametotto", we are planning to develop as a mini dam near the residence, not aiming for a huge cost like Japan and a huge amount of time, a large dam near the mountain. "Tametotto" is to exist in the vicinity of the living environment, to secure stable water for daily life and to "life-saving facilities" to protect human life from torrential rainstorms, want to develop to countries such as Laos, Vietnam, Indonesia etc. thinking about. And I would like to contribute to local consumption of water resources in Southeast Asian countries even a little.

Wetland and Sustainable Tourism Higashimatsushima Version (abstract)

Hiroki Mori
Higashimatsushima city municipal office, City planning section Group

The coastal area of Higashimatsuhima City, Miyagi Prefecture in northeast of Japan, was severely damaged by the tsunami caused after the Great East Japan Earthquake in March 2011. The City immediately began the process of land restoration for disaster prevention collective relocation with 1,288 lots (of which 571 lots are public housing). Building lot delivery were started from June 2014 and completed in November 2016. Ever since, home building in the newly restored area has been very active and 80% of the lots are already finished.

One of the remaining issues is how to utilize the devastated lands that the City purchased from citizens after the tsunami. The area was originally a combination of residential neighborhood, rice paddy and wetland but cannot be used for residents as the above sea level is too low. Of those 174 hector, 99 hectors are already allocated to be used for agriculture and industry-related-purposes, however, 75 hector still remains undecided.

The City wishes to regenerate the wetland and the surrounding area as a strategic site to reconstruct tourism and promote mental well-being of citizens and tourists who visit the area. Furthermore, the area with the surrounding forest is part of a schooling project, the Mori-no-Gakko (school in the forest) Project, and classes of Miyanomori Elementary School are part of the official curriculum. Classes includes biological observation of plants and insects, and woodworking using timber from forest thinning in the area and such. When taking the class to the forest during the nurturing season of accipiter gentilis (northern goshorks), a native birds of prey in Japan, the route is changed so that the class does not bother the nurturing bird. The area was rich with flora and fauna and the City believes it to be promising to regenerate the wetland.

With the regeneration of the wetland and the bird sanctuary as the precious natural value, the coastal area will be the center of touristic content and also part of the environmental education program for human resource development.

Valuation of Village Ponds as Cultural Landscape Component in India: Preliminary Study (abstract)

Injun Son[1], Hogyeum Joo[2], Gu-Yeon Kim[3], Ji Yoon Kim[1], Yuno Do[4]

[1]Pusan National University, [2]State University of New York at Stony Brook, [3]Kyungnam University, [4]Kongju National University

Village ponds are a specific type of small artificial reservoir in India. They are constructed for harvesting and preserving local rainfall and water from streams in agricultural landscapes, especially in India, which has lacked perennial rainfall for thousands of years. Village ponds primarily have been used for agricultural and drinking water but also for bathing, ritual, and aquaculture. According to the Ecosystem Services (ES) framework, classifying and evaluating the benefits for people derived from ecosystems, village ponds may have all aspects of ES including provisioning (food, fresh water), regulating (waste-water treatment), cultural (aesthetic appreciation, inspiration for culture, spiritual experience) services; but village ponds have not yet been valued regarding their ES using quantitative valuation techniques such as economic/monetary approaches. Historically, villagers retained the indigenous knowledge of usage and management practices for village ponds. Indigenous forms of knowledge regarding the sustainability of local resources are referred to as traditional ecological knowledge (TEK). Although TEK is most frequently preserved as oral traditions and as such may lack objectively confirmed documentation, TEK for village ponds has not yet been classified. In the present situation, with little concern, village ponds are at risk of disappearing and we will regret losing this critical resource. India is in rapid economic transition. Many rural villages now have dramatically modernized the drinking water supply system. Development of a water supply service for drinking water and a large reservoir for agriculture through modernization and urbanization can replace this traditional component of village ponds. The ES of TEK in village ponds should be as management practices and should be evaluated and classified for sustainable management of village ponds.

Our goal was to confirm the function and importance of village ponds in the rapidly developing areas as well as rural landscapes. We categorized village ponds based on TEK, evaluate ES of village ponds in India, and establish a framework for conserving village ponds and improving public awareness of interested parties regarding village ponds using modern approaches. In order to understand the morphological characteristics of the Indian village pond, a 30-km^2 geographical quadrat was established and the ponds inside of the quadrat were digitized using the GIS program. The density of village pond was 14.6 ponds / 10km^2 and the median of pond size was 341.1 m^2. Over the last two years, we also assessed the benefits of village ponds located in northeast India through field surveys of the Chilika Lagoon basin (State of Odisha). The catchment area (526.3km^2) surrounding Chilika Lagoon contains a large number of villages (population; approx. 690,000). We found that on average each village possesses 2 or 3 ponds with different usages such as irrigation, religious observance, and bathing. The questionnaire included questions on the name of the village, population, the number of the ponds, the number of alternative water sources etc. the possibility of cultural activities being practiced, management schemes, and the dependency (i.e. residential, agricultural, aquaculture, religious practices). Our project will represent the first scientific assessment of the village pond and traditional management scheme's value. The potential results will include the traditional knowledge of village ponds created by the local community to manage the pond for their cultural, economic, and domestic needs over a long time. Moreover, we are sure that the well-organized traditional management of the village pond will be applicable to increase the value of abandoned ponds in urban landscapes. The traditional knowledge based restoration will contribute in enhancing ecosystem health and the resilience of human society by strengthening ecosystem functions.

Fundamental Research on Residents' Water Use and Consciousness Related to River Environment (abstract)

Hironori Hayashi[1], Masahiro Fujioka[2], Yukihiro Shimatani[1]

[1]Kyushu University, [2]Fukuoka City Government

Since around 1990, the concept of green infrastructure, mainly in the Europe Union and the United States, has developed. On the other hand, in Japan, the river law was revised in 1997, and the environment was legally positioned for the functions required for rivers. Therefore, It is recognized that to give due consideration to the environment in river improvement is one of the most important matters in river management.

Knowledge and evaluation on the impact of rivers with different environmental levels on human use and consciousness are not sufficient. From the viewpoint of developing measures related to green infrastructure, accumulation of scientific knowledge on human use and consciousness on different river environment levels is urgent as well

In this research, we conducted surveys on people's actual situation and consciousness survey for two rivers with different environmental levels (whether or not river refurbishment considering the environment was done). One river is named Kamisaigo river which was maintained by the renovation method considering natural environment and human use. And the other one is named Tokunaga river which was maintained by a renovation method with conventional concrete We tried to clarify the influence of differences in river environmental level on river use / consciousness of people in both area. The catchment population of both rivers and the surrounding development situation are almost the same. The survey method was in accordance with the river space utilization actual situation survey "river waterside census manual (Ministry of Land, Infrastructure and Transport)". For the questionnaire survey, we targeted elementary school children (fourth to sixth graders) located near each river and their parents. The questionnaire was done in a way to collect after distribution. Main questions included concerning age, sex, frequency of use of river and its contents, environmental consciousness, attachment to the area, concerning the sense of justice and morality, about the intention to pay based on the virtual market evaluation method (CVM) .

From the results of the actual situation survey, the following was clarified. (1) The variety of activities are higher for rivers with higher environmental levels. (2) The number of river users on the waterfront increases by about 8000, (3) there is no big difference in the number of river users per population. From the results of the questionnaire survey, the following results were clarified. (1)Environmental awareness of people's rivers is higher for rivers with higher environmental level. (2) As rivers with high environmental level have more river usage frequency, usage becomes diversified. (3) As river with higher the environmental level have the higher attachment to the area of elementary school students and parents (4) The people who lives along the river with higher environmental level has higher willingness to pay in CVM. There were no differences between rivers in communication skills, justice and morality of children. This research revealed that when the river environment level is high, people's waterfront use becomes diverse. It became clear that the environmental consciousness to rivers increases as the river environment level is high. These results indicate that river improvement considering the natural environment has a good effect on people's use.

Community Based Migratory Bird Conservation at Mangalazodi in Chilika Lagoon Ramsar Site, India (abstract)

Acharya Chinmaya Mishra
PALLISHREE

Chilika is the second largest brackish water with shallow coastal wetland in Asia designated as Ramsar site in 1981 which assemblage of marine, brackish and freshwater ecosystems. This is also the largest wintering ground of migratory water fowl of Asiatic sub-component and the habitat of many vulnerable and endangered species listed in IUCN Red List. It supports the largest waterbird population among the wetlands in India with 8,00,000 to 10,00,000 numbers includes 250 species annually. This unique natural resourceful lagoon provides an ideal nesting, feeding and roosting place for thousands of aquatic birds both migratory and residential. This highly productive eco-system provides livelihood to 0.1 million fishers from 132 fishermen villages in and around the lagoon.

Mangalazodi is freshwater zone coming under northern sector of Chilika with marshes, emergent vegetations and reed beds. It has a variety of micro habitats zone with wet meadow, very swallow water open patches, with nyphae and water hyacinth with phragmites. The approximate area of 58.59 sq.km. is consisted of emergent vegetation zone dominated by reeds & phragmites and 11.79 sq.km. of marshland with wet meadow. Exclusive phragmites and reeds provides shelter for fresh water birds such as Common Coot, moorhens, rails, crakes, migratory warblers and bitterns.

Rampant poaching of aquatic birds both was a regular practice of the local people previously. The Forest Department of State Government arrested the poachers and put into jail in the year 1997 & 1998. A local social worker, Mr. Nanda Kisore Bhujabala organised meetings under the leadership of Dr. Ajit Kumar Pattnaik, IFS, the then Chief executive of Chilika Development Authority (CDA) to sensitise the poachers on conservation of birds. As a result, the leader of the poacher, Mr. Kisore Behera and his group took oath to leave poaching in 1999. They started a Community Based Organisation namely Mahabir Pakhi Surakshya Samittee and started conservation of birds. They got training of eco-guide with the Support of CDA. The local stakeholders were also started supporting them in their conservation activities. Accordingly the poachers became conservationists and started eco-guide for tourists. It came to the notice of Government and awarded with the prestigious State level environment award namely "Bju Pattnaik Award for Wildlife Conservation" with a certificate including 1,00,000 INR. In due course another 2 CBOs have been formed and engaged in bird conservation activity, namely Mangalazodi Eco-tourism and Mangalazodi Conservation Tourism Trust. Annually on an average of 5000 tourists are visiting this zone. In 2016 winter, 147 species of migrating bird of 3,50,000 in number have arrived in this zone.

Now the migratory bird such as clossy idis and duck species of spot-villed, lesser whistling & grater whistling have started nesting here.

In this zone, the birds are tertiary consumers that help recycle nutrients back into the eco-system through guano. The major factor for the high biomass production of macrophytes and the lucrative fisheries in Chilika is the amount of guano deposited into the Chilika eco-system by the waterfowl estimated to be around 33.8 tonns of nitrogen and 10.5 tonns of phosphorous. Waterbirds prune the vegetation while they eat and this does not only maintain the fresh sprouting of tender shoots and leaves with rich proteins, but also controls its excessive growth. This fresh growth will benefit the fish and invertebrates. The foraging actions by the waterbirds leads to the thinning of vegetation in the lake, this enables the free movement of fish in the areas with dense vegetation as well.

Big Business & Big Wetlands, Can They Thrive Together? (abstract)

Lucita Jasmin
Asia Pacific Resources International Ltd (APRIL) - Riau Ecosystem Restoration

The island of Sumatra has one of the largest areas of peatlands in Asia. Over the past 30 years, almost 80 per cent of this area has been deforested or degraded due to forest conversion, illegal logging, and land-clearing fires, drastically reducing the main ecological feature of these peatlands: peat swamp forests. Oil palm estates, fibre plantations, and rubber plantations dominate the landscape today, the remaining forests are fragmented, and the original abundance of wildlife has been dramatically reduced, threatening biodiversity conservation.

The 673,000 ha Kampar peninsula on the east coast of central Sumatra has probably the largest area of contiguous peatswamp forest remaining on Sumatra, approximately 344,000 ha. The most prominent pulp and paper company on the Kampar peninsula is the APRIL Group, managing some 60% of the peninsula as Acacia plantations (150,000 ha), High Conservation Value Forest (96,000 ha), and Ecosystem Restoration concessions (130,000 ha) in Riau province, Indonesia.

Restorasi Ekosistem Riau (RER) was established by Asia Pacific Resources International Limited (APRIL) in 2013 and is supported by APRIL's US$ 100 million initial commitment to conservation and restoration. As a not-for-profit partnership between business and civil society organizations s, RER's ambitious goal is to protect and restore a very large tropical wetland within a production forest landscape. It aims to manage the peatswamp forest with diverse partners, secure sustainable livelihoods for nearby communities, work closely with government regulators, and demonstrate an integrated landscape model where deforestation is halted, all land is allocated to a responsible management authority, and secure financing is available from responsibly managed production areas to enhance biodiversity and protect natural capital.

The RER project forms part of a response to a 2004 programme launched by Indonesia's Ministry of Environment and Forestry to restore 1.7 million hectares of Indonesia's degraded production forest through awarding ecosystem restoration licenses. RER now has the responsibility for managing four ecosystem restoration licenses on the Kampar peninsula for a 60-year period.

The RER project is implemented in collaboration with Fauna & Flora International, The Nature Conservancy, and the local social NGO Bidara. Following what is called the production-protection model; APRIL's fibre plantations form a buffering ring around a large peat dome in the centre of the peninsula. APRIL Group has a unique 1-for-1 commitment of conserving a hectare of natural forest for every hectare of plantation developed. With 400,000 hectares under its protection, including the restoration forests on Kampar Peninsula, APRIL is at 83 per cent of this goal.

The challenges for a large pulp & paper company to achieve such a goal are discussed with respect to governance, community perceptions, land tenure issues in Indonesia, existing protected areas on the Kampar peninsula, and sustainable financing of restoration initiatives in Asia.

Some insights are presented around the opportunities for big business to make significant and long-lasting impacts on large areas of important wetlands. The story of the Kampar peninsula would not be worth telling if it did not involve, and depend upon, big business commitments, building wide-ranging partnerships and ultimately, protecting landscape level wetlands.

The Return of The Smooth-Coated Otter to Singapore: Distribution, Growth, Public Perception and Conservation Management (abstract)

Sivasothi N., Meryl Theng, Max Khoo
Department of Biological Sciences, National University of Singapore

Smooth-coated otters (*Lutrogale perspicilata*) are a native species of Singapore but with the rapid development of the modern city state, otters were absent from teh mainland in 1970's and 1980's. There have also been heightened efforts to clean waterways, establish protected areas and increase the green cover of the country (including urban greenery such as streetscapes) from 35.7% to 46.5%.

In the late 1990's, smooth-coated otters returned from southern Malaysia to establish residence in the protected north-western mangroves of Sungei Buloh Wetland Reserve. Highly adaptable they spread along natural coastal habitats and also occupied modified inland waterways and reservoirs. They now number some 70 individuals in about 10 families. Primarily fish eaters, they are feeding on a less diverse but abundant diet of mostly exotic cichlids which dominate urban waterways. In mangroves, prawns are part of this piscivores' diet.

Rivers in Singapore are mostly canalised outside of their headwaters in nature reserves. Designed primarily for dispersal of rainwater, there are few sloping banks or riparian vegetation needed by otters. Despite this, smooth-coated otters have adapted to semi-natural and artificial structures along waterways for resting and sprainting sites, and holts for overnight rest and natal dens. Several territorial family groups of 10-13 individuals live in such spaces and consists of parents with up to three litters of cubs.

When individuals or groups of otters seek out new territories, they must survive urban barriers such as highways, roads and construction sites. Their movements are monitored by researchers, park managers, naturalists, nature photographers and members of the public who contribute records to the national repository "Mammal Records," and OtterWatch, a dedicated Facebook page enabling photo submissions and information sharing. Private What's App chat groups of dedicated otter followers also provide good spatial information information to researchers and managers.

Although urban otters live in proximity with people in the narrow viable spaces adjacent to waterways, they have been reasonably indifferent to or tolerant of people. The public are appreciative although there is some concern about their population number. To address various concerns and promote good observer behaviours, an Otter Working Group comprised of various government and non- government entities and individuals collaborate to produce advisories through physical signs, engage with private property owners, conduct public outreach at otter sites and festivals, and provide support for news and social media sites, as well as documentary makers. This group has also facilitated rescue of individuals, recovered dead otters, and address concerns of the public and policy makers alike.

The smooth-coated otters' close presence has resulted in studies of their diet, home range, activity pattern, reproduction, aspects of behaviour, vocalisation and human-wildlife interaction. It is hoped that both the research and lessons from management since their return to Singapore will contribute to conservation efforts of otters in Asia.

High Genetic Diversity of *Cottus pollux* Middle-Egg Type in Kyushu Island and Related River Topography (abstract)

Kazuki Kanno, Norio Onikura
Fishery Research Laboratory, Kyushu University

Cottus pollux (Japanese freshwater sculpin) is a unique freshwater sculpin endemic to Japan. It is widely distributed across the Japanese archipelago where it preferentially inhabits cool, well-oxygenated and clear waters, such as gravel riffles in mountain streams (Ramsar wetland type classification M: permanent rivers/streams/creeks). *Cottus pollux* is considered polytypic and includes three biological species, conveniently named *C. pollux* large-egg (LE) type, *C. pollux* middle- egg (ME) type, and *C. pollux* small-egg (SE) type. These species are collectively called *Cottus pollux* complex. The three types of the *C. pollux* are morphologically similar, but they can be distinguished based on the number of pectoral fin rays with LE individuals having 12–14 (mode 13), ME 13–16 (mode 15), and SE 15–17 (mode 16). In addition, studies have shown that the three *C. pollux* types are genetically divergent, and that *Cottus reinii* from Lake Biwa actually belongs to the SE group.

The population of *C. pollux* complex in Japan is thought to be declining due to the presence of river barriers, such as dams and weirs. In fact, both the SE and ME types have been designated as endangered (EN), and the LE types has been designated as near threatened (NT) according to the Red List published by Japan's Ministry of the Environment in 2015. However, data on the distribution and genetic diversity of this fish in Kyushu Island are sparse. *Cottus pollux* complex species in Kyushu have sometimes been described as *C. pollux* ME and LE (Fukuoka Prefecture, 2014), simply *C. pollux* ME (Nagasaki Prefecture, 2011), amphidromous and fluvial *C. pollux* (Saga Prefecture, 2003), or *C. pollux* and C. reinii (Kumamoto Prefecture, 2014; Oita Prefecture, 2011). Therefore, the purpose of the present study was to better characterize the habitat, genetic, and morphological diversity of *C. pollux* complex in Kyushu Island.

Specimens were collected from 30 rivers in 20 river systems in Kyushu. Based on the number of pectoral fin rays, sculpins were divided into two types: modes 13 (M13) and mode 15 (M15). M13 sculpins were distributed in upstream areas of large river systems, while M15 individuals were distributed in downstream areas of small systems. Mitochondrial DNA analysis showed that both types were in fact *C. pollux* ME. These findings indicated that *C. pollux* inhabiting Kyushu Island belongs to one single genetic group (ME) which can be divided in two groups according to morphological and distributional traits (fluvial M13, amphidromous M15). A more detailed genetic analysis showed that the fluvial M13 group was in fact heterogeneous, with genetic differences detected in specimens from different rivers, whereas the amphidromous M15 group was genetically homogenous. In addition, large differs were observed in terms of genetic diversity within the M13 group between rivers. Next, we used two generalized linear models (GLM) to examine the relationship between river topography and (1) M13 distribution, or (2) population genetic diversity. The dependent variables were presence/absence and number of haplotypes, respectively; while predictor variables included topographical data collected by GIS, such as a mean gradient, percentage of metamorphic rocks, upper stream catchment scales, and area of river systems. The distribution model selected variables on habitat quality in a present condition, while the genetic model selected variables on habitat quality in a long-term perspective.

Corn and Cameras: Wildlife Management Issues in Restoring the Migration of Red-Crowned Cranes in Hokkaido, Japan

Takehiro Watanabe, Takeshi Ito
Sophia University

The conservation history of Kushiro Wetland, in Eastern Hokkaido, Japan's northernmost island, is entwined with the history of protecting the red-crowned cranes (*Grus japonensis*). Once thought to be domestically extinct, this charismatic bird has experienced a healthy increase in numbers due to early national-level protection of this species and its habitat, support from local communities, and the prohibitive cost of wetland drainage. The conservation program of this species is regarded as a successful case of community-based initiative and had contributed to the protection of Kushiro Wetland, Japan's first Ramsar site.

The cranes, however, face challenges brought on by this success. The winter feed program has caused a dependency on and familiarity with humans, resulting in traffic accidents and damage to farms. In particular, the crane damage to dairy cows is substantial and has been a major regional issue. Also fueling the farmers' frustration is the increase in the number of tourists and birdwatching enthusiasts, sparked by the crane's iconic status and investment in transportation infrastructure that has made traveling easier. Moreover, the overcrowding at feeding stations has led to international concerns about bird influenza and other diseases.

One goal in Japan's red-crowned crane conservation is the restoration of its original migratory behavior. For conservationists, the ultimate goal would be to restore the migratory patterns so that they visit wetlands in the central and southern portions the Japanese archipelago. But what happens when this bird species, begins to winter in other communities that may be less forgiving to the damage they cause? Would the birds be able to survive wetlands with less protection and feed?

This paper identifies the social obstacles facing efforts to restore the migratory pattern of this crane species, by examining the relationship with stakeholders in on-going conservation efforts in Hokkaido. Local farmers and fish hatcheries are dealing with damage to their livestocks and salmon fries, respectively. Especially problematic is the cranes' wintertime dependency on dent corn, which is also used as feed for dairy cows. The tourism industry is also encouraged to limit human contact with the cranes by educating photographers who disturb crane habitat and propagation. Moreover, the cranes themselves must be re-trained in human-based environments.

Currently, Japan's Ministry of the Environment, with the support of scientists and civic groups, is implementing a feed reduction program, in order to encourage the dispersion of the bird population. Some cities are currently receiving cranes (Mukawa City) or planning to reconstruct wetlands as crane habitat (Naganuma City). Yet it is becoming evident that providing wetland habitat will be insufficient, as wildlife-human conflicts are predicted. This effort must also grapple with how to manage the ecological and social links between wetlands of different levels and styles of wildlife management. This linking of wetlands via birds, a key guiding principle of the Ramsar Convention, may also require distant human communities to share information and coordinate programs with local managers who are at the frontline of the conservation efforts.

The conservation efforts for the red-crowned cranes in Eastern Hokkaido exhibits a wider problem for wetland restoration as it highlights the continuing problem with Japan's land-use policy. Problems of human-animal conflict, a major issue in wildlife management programs worldwide, will be addressed. The presentation will explore the question of whether the concept of "wise use" can be expanded to wildlife as a beneficiary of wetlands.

Sustainable Forest Management for Soil and Water Resourse under SGEC Certification (abstract)

Yuuko Iizuka
Sumitomo Forestry Co. Ltd.

Sumitomo Forestry can trace its beginnings to the use of wood harvesting operations in neighboring forests to fortify the Besshi Copper Mine opened in Ehime Prefecture in 1691. Timber was crucial for the mining operation, as it was needed in construction, for the mine posts, and for the fuelwood to refine copper. However, by the end of the 19th century, the forests around the Besshi Copper Mine were facing severe degradation due to long periods of excessive harvesting and smoke pollution. The then principal of the mine, Teigo Iba, believed that "allowing this land to be degraded while moving forward with business made possible by its fruits runs counter to the proper course of our relationship with nature. We must return all the mountains of Besshi to their verdant state." With this belief, he launched the Great Reforestation Plan in 1894 to restore the forests that had been lost. Through a process of trial and error, and by implementing large-scale planting efforts of up to more than one million trees per year, the mountains were eventually returned to a state of rich greenery. It is the sustainable forest management based on this spirit of repaying what has been reaped from the land that serves as the starting point for Sumitomo Forestry's business activities and for its corporate social responsibility (CSR) efforts.

Currently, Sumitomo Forestry owns forests in Hokkaido, Shikoku, Wakayama and Kyushu, corresponding to a total area of over 46,000 hectares, or about 1/900 of the land area of Japan. These company-owned forest is managed based on this principle of sustainable forest with the cycle of planting and carefully cultivating trees before harvesting them, according to the forest management plan established by the Company every five years. They are also 100% certified under SGEC (Sustainable Green Ecosystem Council).

The SGEC certification requires forest management with seven criteria that include preservation of biodiversity and the conservation and maintenance of soil and water resources. While Sumitomo Forestry has gobs of expertise in forest management with its long history of experience, acquiring the third party certification is a way to show its commitment to sustainability and high quality of operation to the interested stakeholders. Prior to acquiring the SGEC certification in 2006, the Company created an operation manual for the riparian forest and set the policy to conserve 15m wide area alongside rivers. By adding this riparian information to our proprietary Forestry Management Data Mapping System, which amalgamates tree species, ages and other information with map data, it can secure forestry operation in a sustainable manner.

Production of timber has been the major focus of the forest management. However, Sumitomo Forestry strives to expand the functions and roles of forest, such as water resource cultivation and landslide prevention, through its sustainable forest management. We also wish to provide opportunities for stakeholders to understand the close link with forests and wetland as one of water resources.

Side Event

Commemorating the 25th Anniversary of Asian Wetland Symposium

[1.]Bishnu B. Bhandari, [2.]Hiroji Isozaki, [3.]Motokazu Ando, [4.]Reiko Nakamura

[1.] President. Nepal Wetland Society and International member, Ramsar Center Japan

[2.]Professor, Sophia University, Japan; Vice President, Ramsar Center Japan

[3.]Professor, Yamazaki University of Animal Nursing, Japan; President, Ramsar Center Japan

[4.]Secretary-General, Ramsar Center Japan

Abstract: Asian wetland symposium is a "regional forum and provides" opportunities to diverse target groups to share, promote and learn their knowledge, wisdom and practical experiences , raise profile of the conservation and wise use of wetlands and translate findings into application. During the past 25 years, 169 contracting parties have joined the Ramsar Convention with the designation of some 2282 sites covering 218 million ha. During this period, some 7 AWS 's were organized in different countries, the 8th being held in Japan. The Symposium is being overseen by a professional international team. It also has been investing in children, called KODOMO Ramsar for the future. Major problems include (1) heavy use of resources, (2) conversion, (3) pollution, (4) change in land use and land cover, (5) habitat destruction, and (6) poor governance & knowledge gap. The paper also contains self-assessment of the activities related to conservation and wise use works from 11 countries. The paper concludes with some practical suggestions to raise the profile of the Asian Wetland Symposium for the conservation, sustainable development and wise use of wetlands around the world.

Part One: Asian Wetland Symposium

1. Historical Journey of AWS

1. Asian wetland symposium is a "regional forum for all that provides" opportunities to diverse target groups (Such as policymakers, managers, NGO representatives, donors, promoters, and students) to share and learn their knowledge, wisdom and practical experiences on the management and conservation of wetlands in Asia.

2. According to the report of the first symposium', the evolution of the idea of Asian wetland symposium goes back to 1987, when the first international conference on the legal assessment of wetland protection was held in Lyon, France. It was then felt that the Conference did not fully cover the issues of the Asian region. Therefore, it was suggested that a similar conference be held in the Asian region.

3. The 4th Ramsar Conference of the Contracting Parties (COP4) was held in Montreux, Switzerland in 19990 and decided Kushiro, Hokkaido, Japan as the venue of the 5th Conference of the Contracting Parties in Kushiro. The then newly established Ramsar Center Japan in partnership with Ramsar Convention Bureau, International Union for the Conservation of Nature (IUCN) and International Waterfowl and Wetlands Research Bureau (IWRB) proposed a symposium on wetland for the Asia region on the shore of Lake Biwa in Otsu, Shiga Prefecture, Japan. The International Lake Environment Committee (ILEC) was the first organization to endorse the idea and co-organize the symposium.

4. In the mean time, in 1992 the Environment Agency of Japan had already initiated a plan to hold a pre-Ramsar Asian Seminar in Kushiro, Hokkaido, Japan.

5. In the middle of 1991, the Environment Agency of Japan and the Ramsar Center Japan (RCJ) arrived at a consensus to hold the seminar jointly. Then they chose to name it as Asian Wetland Symposium (AWS). Thus the first AWS was held in two places: the first part in Otsu and the second part in Kushiro, Japan, from 15 to 20 October, 1992.

6. AWS is a valuable complementary forum for the discussion of scientific and technical issues and priorities for the conservation and wise use of wetlands. Its ultimate purpose is to enhance effective regional cooperation and networking on wetlands. The following have been its major objectives.

1. Provide technical inputs to the Convention on Wetlands, particularly through its STRP (Scientific & Technical Review Panel), contracting parties and international partner organizations
2. Develop a common view on issues, trends and priorities on matters related to wetland management and conservation in the Asian region
3. Facilitate discussion, advocacy and debate in the contemporary issues on sustainable uses and integrated management
4. Identify practical strategies and mechanism for enabling integrated wetland management, conservation, restoration and sustainable development.

7. During the past 25 years from 1992, seven symposia have been held in a number of countries and sub-regions. The time difference between the 1st and 2nd was nine years, the first one was held in 1992 in Otsu/Kushiro, Japan and the second one in Penang, Malaysia in 2001. However, during those nine years, series of thematic local wetland workshops were held in the region as mentioned in the Ramsar Resolution IX.I9.

8. The first local workshop organized by Ramsar Center Japan with the cooperation of Asian Wetlands Bureau-Indonesia was the "Editorial Meeting of Asian Biodiversity and Wetland", Serpong Tangerang, Indonesia, in 1994. The second meeting, "Asian Regional Workshop on Public Awareness of Biodiversity in Wetland: Ensuring Local People and Community Participation "was held in Nakhon Pathom, Thailand, in 1994 with cooperation of the Mahidol University, Thailand.

9. The International Wetland Symposium at the Yatsu- Higata Ramsar site in Narashino, Japan was held in 1995 and produced the Narashino Statement for active and informed participation by local people and communities in wetland management that contributed to the Ramsar Resolution VII.8. The workshops such as "Wetland Conservation and Management: The Role of Research and Education in Enhancing Public Awareness" (Penang, Malaysia, 1998). "Wetland, Awareness, Local People and the Ramsar Convention in the Mekong River Basin" (Phnom Penh, Cambodia, 1999) and the "Ecosystem of Rice Paddy and Conservation of Biodiversity" (Quebec, Canada, 2000) played an important role to maintain and prepare bases and a network for developing the third meeting of Asian Wetland Symposium in Penang in 2001.

10. The 3rd Symposium was held in Bhubanewar, India on 2995, and then the 4th, 5th, and 6th symposia were held at the

interval of three years after the adoption of Ramsar Resolution IX. I9. There was only one symposium in between the two COPs but in 2011 two symposia were held within a period of 4 months as this was demanded by two national partners, one by Malaysia and the other by China. Still another symposium was held in Siem Reap, Cambodia in 2014. Until now, AWS's have been held in seven countries covering south Asia, Southeast Asia and East Asia. Malaysia had the privilege of holding symposium two times within a period of ten years. Each time the theme was different and pertaining to the real life situation of wetlands. The first three symposia produced proceedings as well as declarations, whereas the second three produced only summaries along with declarations. The last one in Siem Reap produced only the meeting report.

11. The title of declaration was different in each symposium. For example, the first symposium gave the title of its resolution as recommendations, whereas the second and third ones used as statements. In Chilika, a special session on Tsunami was held to discuss the then burning issues related to the Tsunami and coastal wetlands. Over 15 papers were presented along with the adoption of recommendation for actions on Tsunami and coastal wetlands. Likewise, the fourth and fifth ones gave the title of call for action and the sixth one as a declaration. The seventh symposium produced no statement or declaration. The summaries of these declarations are given in Box A below.

Box A: Characterization of AWS Declarations

1. Otsu/Kushiro Recommendations (1992) 1. Public awareness 2. Capacity building 3. Monitoring 4. Consensus building 5. Policy and legislation 6. International cooperation 7. Development assistance 8. Ecotourism	**2. Penang Statement (2001)** 1. Strategic partnership & cooperation 2. National wetland inventory 3. Cultural heritage 4. Education & awareness 5. Increase Ramsar sites & CPs 6. Legislation & guidelines 7. Role of women 8. River basin management 9. Environmental impact assessment 10. Wetland loss & its mitigation 11. Climate change & wetlands
3. AWS Chilika Statement (2005) 1. Environmental flow 2. Biodiversity conservation 3. Cultural heritage 4. Promoting livelihood 5. Strengthening community participation 6. Mainstreaming wetlands into national process 7. Development of wetland plan, policies & strategies 8. Promotion of successful practices 9. Education and awareness 10. Capacity building 11. Restoration & rehabilitation	**4. Hanoi Call to Action (2008)** 1. Restoration of degraded wetlands 2. Develop best practice approach to agriculture 3. Assessment, monitoring & evaluation 4. Promote cultural practices & indigenous knowledge in wetlands 5. Biodiversity conservation 6. Climate change 7. Wetland-friendly structure, mechanism, 8. policy & legal framework 9. Transboundary wetlands 10. Transfer of knowledge
5. Sabah Call for Action (2011) 1. Integrated management system 2. Updating national inventory 3. Interlinkage between wetlands & forests 4. Mainstreaming forests & wetlands 5. Investment in forests & wetlands 6. Involvement of the private sector 7. Use of economic & financial tools (like PES) 8. Natural & wetland capital for livelihood 9. Strengthening of CEPA 10. Traditional & cultural values	**6. Wuxi Declaration (2011)** 1. Incorporate wetland priority into legislation, policy and plan 2. Holistic management of wetlands 3. Building capacity of the country through high-level dialogue 4. Disaster-centered rehabilitation 5. Control of invasive species 6. Maintaining the ecology of rice paddy ecosystems 7. Restoration of urban & peri-urban wetlands 8. Incorporation of cultural values in wetland management 9. Invest more on communication, education & training 10. Develop the network of habitats for migratory birds
7. Siem Reap Declaration (2014)	

Source: Bhandari & Nakamura (2012: 31-52)

12. The number of countries participating in symposium was high in the first three symposia but has remained around 20 in the 4th, 5th and 6th ones. Concerning the number of participants, the first symposium was successful to draw 1000 participants. In the 6th symposium, there were about 720 participants from 20 countries. And it was held in China from 11 to 13 October 2011. The chronology and basic characteristics of the AWS's are given Table I.

Table 1: Chronology of AWS Events

AWS	Year	Place & Country	Theme	Outputs	No. of countries	No of participants
1st AWS	1992	Otsu/Kushiro, Japan	Towards wise use of the most productive place, wetlands	Proceedings & Recommendations	26	1000
2nd AWS	2001	Penang Malaysia	Bringing partnership into good wetland practices	Proceedings, Penang Statement	37 countries	350
3rd AWS	2005	Bhubanewor, India	Innovative approaches to sustainable development	Proceedings, Chilika Statement	32	400
4th AWS	2008	Hanoi, Vietnam	Wetlands, heart of Asia	Call to Honoi Action	20	187
5th AWS	2011	Sabah, Malayasia	Integrated biodiversity conservation: Linking forests & wetlands	Call to Sabah Action	19 (circa)	322
6th 7th AWS	2011	Wuxi, China	Wetlands & Human Well-being	Summary Report Wuxi Declaration	20	720
7th AWS	2014	Siem Reap	----	Meeting Report	21	162

Source: Nakamura (2007), Hanoi Call for Action, Sabah

13. An international team is responsible for steering the process, direction and governance of AWS. The team is called International Steering Committee (ISC). Its overall objective is to provide guidance, advice, technical support and inputs to the national organizing the symposium. The Committee also serves as a focal point to disseminate information and outputs in the region including identification of appropriate experts for the symposium as well as analysis of issues and problem for drafting the resolutions. The number of members serving in the committee differs from time to time. For example, the number of members was 18 in India and 25 in Vietnam. The sixth Steering Committee for AWS in China consisted of 22 members from 12 countries representing various disciplines, organization and areas of expertise.

14. The conservation of wetlands requires active, well-informed and responsible participation of the relevant stakeholders. Their continuous engagement is the key to the success of wetland implementation on the ground. One of th vibrant and dynamic program is KODOMO, which means children in Japanese. Working with children is, in fact, a long-term investment for the future. The tradition of engaging our future generation began since the 3rd AWS in 2005, when children from the three lagoon lakes: Chilika (India), Saroma lake (Japan) and Thale Noi (Thailand) gathered in India to plead for whole-hearted support for the wise use of wetlands from the region. The active engagement of KODOMO centred in three countries: China, Japan and Korea, as an exchange program, which led to their active participation along with children from Uganda in the Ramsar COP9 to make a collective plea to the delegates and observers for a concrete program on the management and conservation of wetland ecosystem. Since then it has been a regular feature for AWS. The ultimate goal of this program is investing for the future.

Part Two: Global Status of Wetland Conservation

1. Conservation indicators

Wetland conservation has made a quantum jump from 1992 to 2017 both globally and regionally. For example, the total number of contracting parties were only 74 in 1992 but has increased to 169 in 2017. Similarly the number of Ramsar sites were only 575 in 1992 but it increased to 2266 in 2017. The area under Ramsar site grew almost 60 times in was only 3.6 million ha in 1993 but that has grown 218.1 million ha which is almost 60 times higher in 2017 (See Table 2). In a single year of 2004, 146 Ramsar sites were globally designated. This is the highest record in the history of the Ramsar Convention.

In Asia, all the three indicators show that the status of conservation in wetland has grown way up. During the past 25years, the number of contracting parties has grown up by 3 times, the number of Ramsar sites by 6.4 times and the total area by 7.2 ties (See Table 2). At present, the total number of contracting parties is 33 with the designation of 318 sites covering 18.1 million of area. About 10 more countries are yet to join the Convention.

Table 2: Change in Conservation Status of Wetlands in the World and Asia (1992-2017)

Indicators	1992[1]	2017[2]	Change
World			
1. Number of Contracting Parties	74	169	2.3 times
2. Number of Ramsar Sites	575	2282	3.9 times
3. Total Area of Ramsar sites (ha)	3.6 mil	218.1 mil	60 times
Asia			
1. Number of Contracting Parties	11	34	3 times
2. Number of Ramsar Sites	49	318	6.4 times
3. Total Area of Ramsar sites (ha)	2.5 mil	18.1 mil	7.2 times

Note:
1. Navid (1992: 26)
2. Ramsar Sites Information Services, Ramsar Convention: http://www.ramsar.org/ Retrieved on May 20, 2017.
3. This is just for information that the largest site is Ili River Delta & South Lake Balkhash (area = 976,630 ha; Kazakhstan) and the smallest site is Ganghwa Maehwamareum Habitat (Area = 1 ha; South Korea)

2. Global Distribution of Ramsar Sites

The Ramsar Convention has taken regional approach for assisting the Contracting Parties in the implementation of the Ramsar Convention globally. The area has been divided into six regions, which are called Ramsar region. They are (1) Africa, (2) Asia, (3) Europe, (4) Latin America & the Caribbean, (5) North America and (6) Ocean. These regions house 2282 internationally important wetland sites, which are called the Ramsar sites. Their distribution according to the region is presented in Table 3. The Table shows that the Europe Ramsar Region houses 48% of Ramsar sites, which is the highest of all regions. The Asia region houses only 14%, which is third after the African region.

Table 3: Regionwise Distribution of Ramsar Sites

Ramsar Region	Number	%
1. Africa	386	17
2. Asia	**319**	**14**
3. Europe	1089	48
4. Latin America & the Caribbean	192	8
5. North America	217	10
6. Ocean	79	3
Total	**2282**	**100**

3. Management Plan

According to the Ramsar Sites Information Services, the total number of Ramsar sites is 319. It can be said that still a large percentage of Ramsar sites are not operated under the concept of the management plan. Only 115 (36%) sites have prepared their own management plans while 62 (20%) sites are reported to be preparing them. The remaining 142 (44%) sites do not have management plans at all.

4. Montreux Record

The Montreux Record is the register of wetland sites on the Ramsar list where changes in ecological characters have occurred, are occurring, or are likely to occur as a result of external condition like pollution, technical development, or human interference. The Record is determined by the Contracting Parties. The Record should be employed to identify the priority sites for positive, natural and international attention. The inclusion of a particular site on a Montreux Record is a useful tool available to the Contracting Parties in circumstance where,

1. Demonstrating national commitment to resolve the adverse changes would assist in their resolution
2. Highlighting particularly serious cases would be beneficial at the national and /or international level
3. Positive natural and international conservation attention would benefit the site, and
4. Inclusion on the Record would provide guidance in the allocation of resources available under a financial mechanism.

The Ramsar Technical Mission is a technical assistance mechanism to assist the Contracting Parties in the management and conservation of listed sites where ecological characteristics are threatened. The objective is to provide assistance to the developed and developing countries alike in solving problems or threats that make inclusion in the Montreaux Record necessary.

A total of 47 sites are included in the Montreaux Record globally (See Table 4). According to the Table, 23 Ramsar sites belong to the Europe Ramsar Region. It should be noted that Europe houses the highest number of Ramsar sites, i.e. 1067. In the Asia Ramsar region, there are only 10 sites under the Montreaux Record. These sites belong to four countries; (1) Jordan, (2) Iraq, (3) India and (4) Iran. According to the Ramsar Sites Information Services these sites occupy 760,045 ha surface area. Out of these sites only the four have management plans. The 2 sites will have their plans soon. The rest 4 sites do not have any plan. The surface area of the sites that are included in the Montreaux Record ranges from 2,500 ha (Shurgol, Yadegarlu & Sangi Lakes, Iran) to 400,000 ha (Shadegan Marshes & Mudflat of Khor-E-Al Maya & Khol Musa, Iran). It should be remembered that the inclusion of the sites under the Montreaux Record is not delisting of the sites. It is rather to help the Contracting Parties maintain the ecological characteristic of the site.

Table 4: Sites on Montreaux Records Worldwide

Ramsar Regions	No
1. Africa	8
2. Asia	**10**
3. Europe	23
4. LA & the Caribbean	5
5. North America	1
Total	**47**

1 The sites are Azraq Oasis (Jordan), Hawizen Marsh (Iraq), Keoladeo NP and Loktak Lake (India). Other six sites are from Iran, which include (1) Shadegan Marshes and Mudflats of Khor-Al Amaya & Khor Musa, (2) Hamun-E-Saberi & Hamun-E- Helmand, (3) Shurgol, Yadegarlu & Dorgesh Sangi Lakes, (4) Hamun-E-Puzak, South End, (5) Neiriz Lakes and Khamjan Marshes, (6) Anzali Wetland Complex.

Part Three. Status of Ramsar Sites in Asia

1. Status of Ramsar Sites in Asia

Basic information about the general status of Ramsar Convention in the Asia Ramssar Region is presented in Box B. In Asia, there are 33 contracting parties and have designated some 308 Ramsar sites. Only 140 sites have management plans whereas 109 do not have any. For the remaining 58 sites, plans are under preparation. More information is presented in Box B.

Box B: The Status of The Convention in Asia

Contracting Parties = 34
Ramsar sites = 319
Surface area = 18,063,760 ha.
Management plans = (Yes = 115, No = 142, Under Preparation = 62)

Source: Ramsar Sites Information Services, Dec 26, 2015

2. Ramsar Regional Initiatives

Under the Ramsar Convention, there are two types of regional initiatives. The first category consists of training, capacity building and network for regional cooperation, whereas the other is networks that provide platform for collaboration between government, technical experts, international NGOs, local communities and private companies.

The training center are (1) Ramsar Regional Center – East Asia, (2) Ramsar Regional Center – Central & West Asia, and (3) Ramsar Regional Center – Central Asia. The network initiative includes (1) East Asian-Australasian Flyway Partnership and (2) Indo-Burman Regional Initiative.

3. Ramsar Conservation Award

The following institution and individuals were awarded Ramsar Wetland Conservation Awards from Asia.

2002 - Chilika Development Authority (India)
2005 - Ms. Reiko Nakamura, Japan (Award for Education)
2008 - Dr. Sansanee Shoowaew, Thailand (Award for Education)
2012 - Prof. Tatsuichi Tsujii, Japan (Award for Science)
2015 - Prof. Gea Jae Joo, South Korea (Award for Merit)

4. Various Frameworks at Work

Table 5 shows that 105 Ramsar sites in Asia Ramsar Region are being protected by more than one framework. Some 34 sites are protected by global international legal and other frameworks and Ramsar Convention. Another 34 sites are being overlapped by different categories. About 22 sites are protected by Ramsar Convention and UNESCO framework of biosphere reserve both the frameworks. It means to say that in addition to the Ramsar Convention, other legal as well international frameworks protect the Ramsar sites (Table 5).

Table 5: More than One Framework Protecting the Ramsar Sites in Asia

Statutory Designations	No. of Sites
International legal frameworks	34
Overlapping site categories	34
UNESCO Biosphere Reserve	22
World Heritage Site	12
Other Global Designation	3
Total	105

5. Major Threats to the Asian Rasar Sites

Major threats to the Ramsar site in Asia are presented in Table 6. The information was taken from the Ramsar Sites Information Service. About the three-fifths of the Ramsar sites face the problem of natural system modifications. Biological resource use is also equally common in 56 sites. Pollution is the number three threats to the Ramsar site in Asia whereas agriculture and aquaculture are the number four threats. More threats are presented in Table 6.

Table 6: Major Threats to the Asian Ramsar Sites (N = 318)

S.N.	Threats	Frequency	% age
1	Natural system modifications	186	58
2	Biological resource use	173	54
3	Pollution	156	49
4	Agriculture & aquaculture	145	46
5	Human settlement (Non-agriculture)	134	42
6	Water regulation	96	29
	Human intrusion & disturbance	83	26
7	Invasive & other problematic species	79	25
8	Transportation & service corridor	65	20
9	Climate change & severe weather	62	19
10	Others (energy production, mining, geological events)	8	3

Source: Ramsar Sites Information Services. (http://www.ramsar.org/)

6. Factors responsible for wetland loss & degradation in Asia

The specific problems prevalent in wetland conservation and management are summarized in this section. In the presentations, words like threats, obstacles, concerns, issues and challenges have been used interchangeably. Whatever the nomenclature, the bottom-line is that there have been barriers to the smooth implementation of conservation, management and sustainable utilization of wetlands on the ground. All the problems included in the presentation are enumerated and collated into six clusters. These clusters, individually or collectively, directly or indirectly have remained responsible for the loss and degradation of wetlands and are causing failures in the successful implementation of the concept "wise use of resources" in Southeast and East Asia. The specific problems under these clusters of issues are briefly elaborated below.

1. **Heavy exploitation of resources**: Wetlands are the means of livelihoods in rural areas. Resources are used to meet the basic, secondary as well as tertiary needs of the people. These resources are vitally important for the sustenance of local people. The decreasing availability of fish species, low volume of fish harvest as compared to the past, shrinking area under water bodies are the indicator of what we call overfishing. Likewise, other wetland resources are also being exploited intensively. The common activities that are responsible for the heavy exploitation of wetland resources are fishing (legal as well as illegal, appropriate as well as inappropriate use of fishing gears like electric fishing gear, gun powder), use of water for agriculture, intensive grazing of domestic animals, use of aquatic resources, firewood collection, forest fire etc.
2. **Conversion of wetlands:** Farming is the main occupation of the people in Southeast Asia. The small land holdings preponderate in the region. Also, the boundaries of the wetlands are not well-marked and illegal activities are common inside the area. Therefore, people around and about wetlands tend to encroach the wetlands for cultivation and building shelters. Some activities related to conversion are reclamation for aquaculture, rice farming, shrimp culture, gardening and cultivation of other aquatic resources, deforestation, clearing of low land forest, rubber and oil palm plantation, swamp forest, mining and extraction (uranium, gold, sand and gravels) and low level of freshwater.

3. **High level of pollution:** Since wetlands are in the depressed areas, all the runoffs from the surrounding areas go to wetlands. Because of this they are highly vulnerable to threats such as the discharge from agricultural fields (pesticides and chemicals, algae, plankton, micro-organisms), cities (waste water, rubbish, litter, sewage, sludge), pastures and grazing lands, sludge from the factory or mines, use of chemicals and pesticides, oil spills, marine debris (in case of marine wetlands).
4. **Change in land use and land cover:** Change in land use and land cover in the catchment or basin area is another serious threat to wetlands in the region. For example, mining (gold in Myanmar, uranium in Mongolia, sand and gravel mining in Nepal), flooding, siltation, sedimentation, drought, forest fire, disturbances in hydrological system, shifting of river course, hydro-power development, water inundation upstream and downstream, impact of development, shifting cultivation, clearing of land, deforestation, burning and cutting of trees and even illegal farming have singly or collectively changed the land use and land cover in the catchment area and thereby deforming the natural integrity of wetlands.
5. **Habitat destruction/degradation:** The destruction of wetlands has caused the loss of food, space and water for the water-dependant flora and fauna. Some of the species are on the verge of extinction. The habitat destruction has affected the long-distance migrant birds like Demoiselle Crane, *Grus virgo,* Spoon-billed Sandpiper and many others. This situation has arisen basically due to sand-mining, human encroachment, land conversion, illegal logging, illicit timber trade, intensive fishing, use of inappropriate fishing gears, growing human population, impact of plantation, shipping industry, drying of freshwater sources, land clearance, prolific growth of alien invasive species such as water hyacinth, Golden Apple snail and so on.
6. **Poor governance & knowledge gap**: Wetland resources are directly related to daily livelihoods of the people. On the one hand, lack of community friendly legislation, low level of enforcement, poor management, weak institution, unmotivated staff and governance encourages illegal activities, hunting and poaching around and about wetlands. On the other hands, still a lack of baseline data and information, local capacity & education and limited technical knowledge are the hurdles in the conservation and management of wetlands and their resources.

Part Four: Self-Assessment in Wetland Conservation

A mini-study was conducted to assess the progress made in some selected countries in Asia. The study has two pronged-objectives. One was to review the issues mentioned in the AWS declarations. Six topics were repeatedly included in the declarations. They are (1) governance (6 times), (2) wetland education (6 times), (3) partnership & networking (6 times), (4) cultural values (6 times), (5) conservation of biodiversity (6 times), and (6) international cooperation (4 times) in the AWS declarations. A brief overview of issues mentioned in the AWS declarations over 25 years are summarized in Annex I. Other issues are also presented in the Annex.

Then, the other issue, the implementation status of these 6 topics was the main concern of the study. So a set of questions was sent to 11 countries for their rapid assessment. The voluntary participation from these countries - (1) Bangladesh, (2) Cambodia, (3) China, (4) India, (5) Japan (6) Malaysia, (7) Myanmar, (8) Nepal, (9) Philippines, (10) Thailand, and (11) Vietnam – made possible for their rapid overall assessment. The summaries of their assessment, which was done in the form of questions, are briefly mentioned below.

1. Governance (6)
What measures your country has taken to improve the governance of wetland conservation?

Bangladesh
- Intervention in the form of many Acts, Rules, Ordinance, Strategy & Action Plan
- Adopted international agreements both by central as well as local government.

Cambodia
- Allocation of budgets to the departments
- Expansion of protected areas

China
- Drafted the National Regulation on Wetland Conservation
- Set up a Special fund at the central treasury
- Incorporation of wetlands in many industrial plans
- Invested 3.1 billion RMB Yuan in the past 5 years
- Set up 600 Wetland Nature Reserves, over 1000 wetland parks and 49 Ramsar sites
- Set up the National Wetland Science & Technology Expert Committee

India
- Wetland Rules 2010 enacted
- Set up State Wetland Development Authority
- 20 additional Ramsar Sited Designated.

Japan
- Regional Environment Office established
- 3 Nature Conservation Officers assigned
- Wildlife Division made responsible for conservation of 50 Ramsar sites

Malaysia
- Two committees formed; High-level National Wetland Committee and Technical Wetland Committee.

Myanmar
- National Wetland Committee established in 2016.
- Indigenous Community Conservation Area (ICCA) acknowledged.
- National Wetlands Policy drafted.

Nepal
- Adopted National Wetland Policy 2013
- National Wetland Committee Formed.

Philippines
- National Wetland Action Plan 2011-16 prepared
- Inland Wetland Conservation Program (2017-2021) under preparation

Thailand
- National Wetland Management Committee & Technical Working Group on Wetland Management on the ground.

Vietnam
- Action Plan on National Environmental Protection Strategy to 2020 and Vision to 2030 adopted.
- Master Plan on Biodiversity Conservation in 2014
- Regulation for Marine Protected Areas of national and international importance.

2. Wetland Education (6)
Mention some of the innovative methods adopted in wetland education or in CEPA.

Bangladesh
- Round-the –year program on environmental awareness
- Universities offer graduate degrees on environmental science, limnology and ecology

- Green clubs established in schools
- Has set up National Environmental Awards

Cambodia
- Observing days (fish, wetlands, planting, environment, biodiversity, etc).

China
- WWD, Chinese Wetlands Cultural Festivals
- 10-thousand Mile Journey Along the Coastal Wetlands
- Wetland Messenger Actions

India
- Center for Environmental Awareness & Education (CEAE) established (a library, specimen, exhibits, hands-on experience)
- Guided tours to lake and visitor centers
- Designation of the science teacher as the resource persons

Japan
- Has been running KODOMO Ramsar for the past 10 years.
- Each Ramsar Site has Maga-Ranger & Gata-Ranger
- Malaysia
- Organized AWS 5 in 2012 in Sabah

Myanmar
- Environmental Education Center (EEC) established in Moeyungyi Wetland Wildlife Sanctuary

Nepal
- Community-based education on theme-based, target oriented and season-centered.

Philippines
- Organizes Youth Ecological Camps
- Competition on design for the wetland center
- Bangklase (education tour on the boat) in Lake Naujan

Thailand
- Courses on Wetland Ecology & Management offered at the University
- Wetlands used as Natural Classroom and laboratories
- Set up of Conservation Group in the school.

Vietnam
- Celebrating WWD with different programs
- Organizes training, workshop and dialogue
- Networks of wetland experts established

3. Partnership & Networking (6)
Describe efforts taken to promote partnership & networking in wetland conservation?

Bangladesh
- Network for birdwatcher, disaster management, advocacy & haor basin

China
- Yangtze River Wetland Conservation Network established
- Yellow River Wetland Conservation Network established
- Yellow Sea –Bohai Region Wetland Conservation Network established

India
- Inter-Ministerial Coordination Unit set up

Japan
- Meeting of Japanese Municipalities Involved with Wetlands Designated under the Ramsar Convention
- National Ramsar Committee established
- Hokkaido Ramsar Network established
- Japan Wetland Society launched

Malaysia
- Malaysian Environmental NGOs (MENGOs)
- Malaysian Water Partnership (MyWP)

Myanmar
- IBRI (Indo-Burma Regional Ramsar Initiative set up

No specific activities from other five countries (Cambodia, Nepal, Philippines, Thailand & Vietnam)

4. Cultural Values (6)
How have cultural values been taken to improve wetland conservation and prevention of loss of wetlands and associated resources?

China
- Wetland Cultural Festivals organized in various parts

India
- Village ponds conserved with religious sentiments

Japan
- Monumental works "33 Examples for the Cultures & Technologies of Wetlands in Japan in 2012" and Wetland Culture in East Asia in 2015".

Vietnam
- Integration of some spiritual values in wetlands

No specific activities from other eight countries (Bangladesh, Cambodia, Malaysia, Myanmar, Nepal, Philippines & Thailand)

5. Conservation of Wetland Biodiversity (6)
Summarize the major achievements in the conservation of wetland biodiversity – in particular wetland ecology, species and conservation?

Bangladesh
- 34 Protected Area & 12 Ecologically Critical Areas Set up
- Coastal Zone Management Plan developed.

Cambodia
- Zoning of Protected Areas

China
- Biodiversity Conservation Plan implemented
- Monitoring regularly conducted

India
- Develop an exhaustive guideline on the management of wetlands
- Inventorying of wetland flora and fauna
- Monitoring of lake water
- Use of Ecosystem Health Report Card

Japan
- 500 potential Ramsar Sites listed in 2001 & the review of the same in 2016

Malaysia
- Published a National Ramsar Information Toolkit
- Developed Coral Reef Bleaching Response Plan (early warning system, response trigger, management actions, communication)
- Planted 6.2 million seedlings in the past 10 years.

Myanmar

Nepal
- Wetlands included in the National Biodiversity Strategy & Action Plan
- Cleaning of the lakes regularly after festival.

Philippines
- Developed National Wetland Action Plan
- Additional listing of Ramsar sites
- Developed Policy on Integrated Coastal Resource Management.

Thailand
- Eradication of water Hyacinth as the National Agenda

Vietnam
- Declaration of more Ramsar sites, now 8 in Vietnam

6. International Cooperation (4)

What strategy your country has adopted to secure international cooperation in wetland conservation?

Japan

- The Ministry of Environment of Japan conducted Cooperation Projects in 1989 in Southeast Asia
- International cooperation projects carried out in Malaysia, Thailand, Cambodia and Myanamar
- International cooperation project on ecosystem services in Myanmar in 2014 Bangladesh

No specific activities in other countries (Cambodia, China, India, Malaysia, Myanmar, Nepal, Philippines, Thailand & Vietnam)

Part Five: Existing Tool, Opportunity & Challenges

i. World Wetlands Day (WWD) as an existing Tool

World Wetlands Day (WWD) is celebrated every year on 2 February. This day marks the date of the adoption of the Convention on Wetlands in 1971 in the Iranian city of Ramsar on the shore of the Caspian Sea (See http://www.ramsar.org/). This day is the red-letter day in the history of the Convention on Wetlands, popularly known as the Ramsar Convention. The annual commemoration is the commitment of the international community to raise the profile of wetlands in all directions, at all level, by all the concerned and all time as well as by the members who are outside the wetland community.

It should be remembered that the notion of WWD originated at the International Conference on Wetlands and Development held in Selangor, Malaysia from 9-13 October 1995 hosted by the Ministry of Science, Technology and the Environment of Malaysia. The Conference adopted a 9-point statement called **Kuala Lumpur Statement on Wetlands and Development** (1995). The paragraph related to WWD in the statement reads as follows;

> *That improved programs should be developed providing education, training, information materials and mechanism to improve the level of awareness and capacity to implement wetland conservation and sustainable use, for example, the establishment of an annual World Wetlands Day to effect popular mobilization. Particular attentions should be given to those people living in and around wetlands, to other user for those wetlands, to decision makers and to wetland managers.*

The above statement was discussed in the 19th meeting of the Standing Committee held in late October 1996. The meeting officially designated 2 February of every year as World Wetlands Day. As mentioned above, this day is the anniversary of the signing of the Ramsar Convention on Wetlands in 1971, as an opportunity for governments, organizations, and citizens to undertake big and small actions intended to raise public awareness of wetland values and benefits in general and the Ramsar Convention in particular and translate their commitment into actions. Since then it has been one of the tools to campaign, communicate and capacitate around the world.

ii. Opportunity

According to the Ramsar Site Information Services of the Ramsar Convention, there are 34 contracting parties in Asia and these parties have already listed 319 Ramsar sites, which is 14% of the total Ramsar sites worldwide. They occupy about 18 million ha of surface area. About 10 sites are included in the Montreaux Record and only 140 sites have their own management plans. In order to upgrade the level of conservation of Ramsar sites in the region, the following suggestions are put forward.

1. The establishment of an informal network of Ramsar sites would be beneficial to share each other's experiences, knowledge and perspective including the exchange of visits from one site to another.
2. Wetland conservation is a multidisciplinary concept and its conservation would not be complete until the engagement of all the stakeholders, both inside and out of the Ramsar family members. So, it is better to involve as many stakeholders as possible in this regard.
3. The community that are wetland-dependant and that live around and about the site should be involved in all respects of conservation works that takes place. Every attempt should be taken to integrate their concerns, experiences and knowledge in any activity that takes into consideration the wise use philosophy.
4. Inter-stakeholder dialogue should be a regular feature of wetland conservation. It would enhance the understanding as well as their intention in the conservation of wetland resources.

iii. Challenges

Major challenges include the discrepancy between concepts and actions. For example, it gets the topmost priority in planning but low in implementation. Many a times, it stands alone although it is tagged as an interdisciplinary subject. As such wetland conservation embodies a broad scope but lacks particular focus in implementation. Secondly, wetland conservation always lacks the balance between quantity and quality of conservation work. Most of the time, it is skewed towards quantity. Thirdly community participation remains still a myth. It is far from reality. The genuine involvement and participation of local community is the key to rally the forces of conservation in wetlands. In many countries, jurisdiction is a problem. Still, there is no clear-cut provision on the jurisdiction as there are boundary problem in many wetland sites

vi. Way forward to promote AWS

The idea of AWS has not moved well in the region excepting in Asia. It is because of the lack of an organization that is responsible for its overall management. At the moment, it is going well due to voluntary support from a few groups. No organization is responsible for its implementation, neither the Ramsar Convention Secretariat, nor the International Partner Organizations. Secondly, there is no consistency in the selection of the concepts or words. For example, the AWS has been using the words like statement/declaration, call for action, call to action and recommendations. The use of different words for the same is rather confusing the readers and practitioners. Its target is diverse. In the beginning the declarations used to be translated into different languages disseminated into different languages but this tradition has not been continued any more. Proceedings used to be published but not anymore. Therefore, the imperative need that is in the offing, is the dissemination, raising the profile, and implementation of the concept of AWS on the ground.

In order to promote the concept of AWS in the region as well as in other areas, the following suggestions were received from the study and area put forward for the readers' information.

- Continue the tradition of organizing AWS every three years
- Set up small grants for action research or study
- Provide incentives to young scholar and graduate students

- Focus studies on wetland-dependent communities
- Set up young researcher award
- Publish journal regularly
- Establish academic institutions for higher study
- Organize issue-based, area-based mini-symposia
- Refocus the target group (not academicians, scientist but practitioner, civil society, volunteers and others
- Involve the media
- Share only the best practices

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Annex I : Inclusion of the Topics in the AWS Declaration over 25 Years

Categories	Identified topics	AWS 1 Otsu (1992)	AWS 2 Penang (2001)	AWS 3 BBSR 2004)	AWS 4 Hanoi (2008)	AWS 5 Sabah (2011)	AWS 6 Wuxi (2011)	AWS 7 Siem Reap (2014)
Repeatedly-raised over two decades but not solved topics								
Governance	Policy, legislation & legal framework	Yes	Yes	Yes	Yes		Yes	
	Community Based Organizations	Yes	Yes	Yes	Yes			
	Integrated &/ or Multi-disciplinary approach		Yes		Yes	Yes	Yes	
Monitoring	Wetland inventories & monitoring	Yes	Yes			Yes		
Biodiversity	Wetland resources, ecology, species			Yes	Yes	Yes	Yes	
Partnership & Networking	Private sector, Stakeholders' participation Consensus building (partnership)	Yes	Yes		Yes	Yes	Yes	Yes
Communication	Sharing information, Awareness, Education, Dialogue, Training, Capacity development	Yes	Yes	Yes		Yes	Yes	Yes
International cooperation	Investment/funding mechanism Development Assistance	Yes	Yes			Yes		Yes
Cultural values	Traditional knowledge, practices & custom	Yes	Yes	Yes		Yes	Yes	Yes
Topics taken up 2-3 times								
	Climate change		Yes		Yes			
	Restoration (disaster-centered)			Yes	Yes	Yes		
	Best practice approach			Yes	Yes			
	Mainstreaming wetlands			Yes		Yes		
	Wetland value recognition					Yes		
	Ramsar site designation		Yes					Yes
	Transboundary wetlands				Yes			Yes
Topics taken up only one-time								
	Eco-tourism	Yes						
	Increase Ramsar site		Yes					
	Protected area establishment		Yes					
	Woman		Yes					
	Convening of AWS		Yes					
	Tsunami			Yes				
	Agriculture & forests				Yes			
	Invasive species					Yes		
	Environmental Impact Assessment		Yes					
	Payment for ecosystem services					Yes		
	River basin management		Yes					
	Environmental flow			Yes				
	Livelihood			Yes		Yes		

Source: Bhandari & Nakamura, 2012 & Meeting Report of AWS 7, Siem Reap (2014)

Population Decline of Migratory Waterbirds and Habitat Changes – Shorebirds as Indicators

[1] Tomoko Ichikawa, [2] Mika Yasuda, [3] Toshimitsu Nuka, [4] Toshifumi Moriya, [5] Minoru Kashiwagi, [6] Chen Kelin, [7] Tatsuya Shibahara

[1] East Asian-Australasian Flyway Partnership, [2] BirdLife International-Tokyo, [3] Wild Bird Society of Japan, [4] Japan Bird Research Association, [5] Ramsar Network Japan, [6] Wetlands International-China, [7] Yatsu-higata Nature Observation Centre

1. Introduction:

Japanese wetlands, especially tidal flats, act as significant stop-over habitats for migratory waterbirds of the East Asian-Australasian Flyway (EAAF) that stretches from Alaska and Russian Far East, southwards through East Asia and Southeast Asia, to Australasia including Australia and New Zealand (fig.1). However, these Japanese wetlands have been disappearing due to coastal developments associated with economic growth, and subsequently, shorebird populations have declined by 50-60% over the last 40 years. Similar developments have been occurring in other Asian countries, and it brings about the sharp decline in the population of the long-distance migratory waterbirds, especially shorebirds, in the EAAF (fig.2).

The Japanese case can serve as a cautionary to other nations seeking to protect both their tidal flats and migratory waterbird populations in the EAAF and other Asian regions where rapid economic developments are affecting the coastal habitats. A side event for sharing information about Japan's case study was held in the Asian Wetland Symposium 2017 in Saga, where the situation of the Yellow Sea was also reported, and the difficulty of managing highly disturbed wetland ecosystem in Tokyo Bay was shared.

2. Wetlands support human and migratory waterbirds

Migratory waterbirds have fascinated people with their beauty and unique features of migration. They come to the tidal flats in Japan for refueling for their long journey. The tidal flat ecosystems have been supporting not only living creatures but also local fishermen with fish, shrimp, and other fishery products.

It has been changed due to the disturbance such as reclamation of the tidal flats and construction of huge facilities that affect ecosystem of the tidal flats. Fishermen have noticed the change in ecosystem and been experiencing sharp decline in fishery catch. In Oura, Saga, Japan, the fishermen used to have a good domestic production values (fig.3). However, they have not been able to do the Short-necked Clam fishing for around 11 years and Pen Shell fishing for 6 years due to the change in the ecosystem. The fishermen have tried to improve their fishing ground, but once it has gone it is almost impossible for human to repair the ecosystem. In addition, waterbirds, especially shorebirds that forage on benthos in shallow tidal flats are disappearing from the coastal areas. This part was presented as a shape of a message video. See for the script at the end of this summary report.

3. Decline of Shorebirds: 40-Year-Nationwide-Data in Japan

Tidal flats in Japan are important stop-over sites in the East Asian-Australasian Flyway for the conservation of migratory waterbirds. However, in the past 40 years, the area of tidal flats in Japan has been decreased by development projects, and the population of shorebirds using tidal flats has decreased drastically.

The population trends of migratory shorebird species were assessed by Bayesian models to understand the causes of trends. It is based on data of nation-wide shorebird population surveys between 1975 and 2016 conducted by MOE-J and national NGOs. The results show that the number of dominant species have decreased both in spring and autumn in the 1980s and after 2010 (fig.4). The decline in the 1980s could be caused by loss and degradation of tidal flat habitats of shorebirds by reclamation related to development projects during the high economic growth period in Japan (fig.5, 6).

On the other hand, the decline from 2010 can be caused by the loss of habitats along the EAAF outside of Japan, since most of the reclamation activities in Japan ceased in 2000. Thus, it is hard to deny the impact of development projects on tidal flats in the Yellow Sea, which is one of the most important stop-over sites in the Flyway (fig.7).

4. Status on waterbird populations in Yellow Sea

Waterbirds are globally recognized as long distance migrants. Millions of waterbirds migrate from as far as North-East Asia to Australasia and return annually to meet their needs for survival and breeding. The Yellow Sea is one of the most important areas for waterbirds to stopover during the migration period in the East Asian-Australasian Flyway, by providing rich food sources. It is estimated that over 80% of the total migratory shorebird populations in the EAAF migrate through this region.

However, this vital link of the Flyway is now becoming a very fragile one. Large and intensive reclamation projects along China's coastline for ports, industries, power generation and aquaculture etc. pressures the habitats for migratory waterbirds. In 1990 to 2008, the average area of reclamation was estimated as 285 square kilometers per year, but for the term of 2009-2020, it is prospected to be more than 500 square kilometers per year. Area of the tidal flats in Yellow Sea is less than half compared to that in 1950s (fig.8). Very important tidal flat habitats including North Bo Hai and Yalujiang in China are also affected by such development. The reclamation of the Bohai Bay affects more than 60% of the EAAF population of Red Knots.

In addition to the reclamation activities, there are other factors that can lead to further habitat loss. An invasive species *Spartina* is spreading in the tidal flat and causing loss of roosting habitats. Sea level rise and land subsidence also leads to tidal flat loss. The more a bird depends on the Yellow Sea, the faster the rate of population decline they experience (fig.9).

The key to change this tendency is a sound policy and effective management that depend upon robust scientific knowledge. It needs to be discovered where the birds are using and how they respond to the changing conditions. Many actions including satellite tracking, surveys on benthic prey stocks, and monitoring responses to management interventions, are now being conducted.

Satellite tracking opens new horizons to learn how birds respond to changes and see if there is flexibility in migration systems. It is found out that there are changes in benthic prey stocks (fig.10). There is an increasing competition among birds and between birds and people. It is important to involve marine factories including shellfish farming by promoting opportunities for eco-farming such as Marine Stewardship and Aquaculture Stewardship, and actively implementing China's organic food regulations. Also, it is important to support to control and eradicate *Spartina*. There is an increasing need to build new partnerships for sustainable use of coastal wetlands.

In China, a lot of activities concerning waterbird counts have been conducted by Wetlands International-China and many local agencies, universities and nature reserves. These have resulted in the identification of the most important waterbirds sites around the Yellow Sea-Bohai coast of China. The survey recorded a total of 806,679 waterbirds of 119 species at 18 sites along the Yellow Sea-Bohai Coast. Among them, total of 49,459 waterbirds were not identified, accounting for 6.13% of the total. 656,830 shorebirds, accounting for 81.42%; 54,727 gulls and terns, accounting for 6.78%; 21,999 swans, geese and ducks, accounting for 2.73%; 17,114 herons (*Ardeidae*), accounting for 2.12%; 3,560 Crakes and Rails, accounting for 0.44%; 2,990 other species, such as cormorants, grebes, ibises and spoonbills, storks, cranes and pelicans, accounted for 0.37% of the total recorded.

The results of the China Yellow Sea-Bohai Coast Coordinated Waterbird Survey highlight that these wetlands are very important for northward migratory waterbirds. However, the region is facing some problems such as severe degradation and loss of wetlands and migratory waterbird habitats, waterbird food supply shortages as a result of rapid economic development in the region. In the new Chinese national strategy for strengthening the construction of ecological civilization, it is particularly urgent and extremely important to protect wetlands and their biodiversity in the Yellow Sea-Bohai Region. It is also a major challenge we are currently facing. This is the significant reason why Wetlands International has organized a Yellow Sea-Bohai Coast Waterbird Survey again after a lapse of 10 years.

5. Wetland Management in the Highly-Developed Tokyo Bay

The reclamation of tidal flats in the Tokyo Bay has progressed rapidly and on a large scale since the 1960s. Currently, 90% of the bay's coast line is covered by artificial seawalls, is highly urbanized, and represents one of the most densely populated areas in Japan with 25% of the population living there (fig. 11). In spite of this, Yatsu-higata still exists as one of the few valuable tidal flats remaining in the Tokyo Bay. Due to local citizen's efforts beginning in the 1970s, the site was designated as a National Wildlife Protection Area by the then Environment Agency Japan and Narashino City in 1988. Then, the site was registered in the List of Internationally Important Wetlands of the Ramsar Convention in 1993.

However, in recent years, an edible green algae, Aosa (Sea Lettuce), has grown at high levels resulting in the production of putrefactive smells in the summer. Also, the number of shorebirds that migrate to Japan has declined to just a quarter of the peak level recorded in the 1990s (fig.12). In addition, exotic bivalves have settled, and it has been a concern that sedimentation of dead seashells will inhibit the tide. This correlates to the decline of wetlands around Yatsu-higata, meaning most of the coast of Tokyo Bay, and the loss of the connections between wetlands and human beings through fishing, agriculture, or recreation activities such as shell gathering.

Promoting Wise Use of tidal flats is the key for tidal flat conservation. Yatsu-higata Nature Observation Centre puts great efforts to conduct capacity building by taking advantage of the strengths of being in urbanized area. The centre provided various events and programs for different groups of 14,000 people in 2016. However, to protect Yatsu-higata, the cooperation among the government, city and the Centre as well as local residents who engage in activities of Wise Use is essential. Also, to protect the entire Tokyo Bay for migratory waterbirds, all related facilities need to work together for enforcement of information transmission, and connecting local residents and Tokyo Bay.

6. Discussion

In the side event, there were voices raised from the floor.

Mr Pyae Phyo Aung from Myanmar emphasized the importance to encourage local community for conservation and support their sustainable livelihoods. He also pointe out the need to collaborate with governments authorities and decision makers. Mr. Zau Lunn, also from Myanmar, mentioning the importance of working closely with local communities, emphasized that they are the important stakeholders that depend nearby habitats for their livelihood. He also pointed the need to obtain the support of concerned government department to obtain their support to the conservation/restoration projects. Dr. Lew Young of Ramsar Secretariat highlighted the importance of engaging all the important stakeholders, for example, North Korea for Yellow Sea conservation. It is important to support the country by expertise for conservation and also for livelihood. We have to change our mind to make conservation as part of livelihood programme. Mr. Golam Rabbi of Bangladesh government mentioned the importance of conducting supplementary income generation program, integrated management plan including zoning for sustainable fisheries, measures for invasive species management, effectiveness assessment, and mass awareness raising for coastal habitat conservation. He also noted that action plans and education programmes involving local community is effective for migratory waterbirds conservation, and the necessity for the collaborative platform for primary and secondary stakeholders, information sharing, and collaboration at regional and international levels.

7. Conclusion

The conservation of the remaining coastal habitats is an urgent issue. In order to conserve migratory waterbirds and their habitat, the remaining coastal wetlands need to be protected with high priority, and a holistic conservation approach is necessary by seeing the ecosystem in larger scales such as a bay, a sea and a region.

The critical need of the coastal habitat conservation was also raised in the Twelfth Session of the Conference of the Parties to the Convention on the Conservation of Migratory Species of Wild Animals (CMS), held in October 2017 in the Philippines. A resolution on Promoting Conservation of Critical Intertidal and Other Coastal Habitats for Migratory Species was endorsed. It urges parties to give urgent protection to remaining intertidal wetlands, especially in coastal regions that are suffering high rates of wetland loss, notably in Asia, paying particular attention to sites that form part of the networks of migratory species; urges parties to withdraw or modify any perverse incentives to convert intertidal or other coastal wetland habitats, and implement sustainable coastal engineering measures for climate change adaptation; and requests the Secretariat to work with other relevant MEAs to initiate a global Coastal Wetland Forum. See CMS website for more information at: http://www.cms.int/en/document/promoting-conservation-critical-intertidal-and-other-coastal-habitats-migratory-species-0

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Murray, N., et al., 2014, Tracking the rapid loss of tidal wetlands in the Yellow Sea, Frontiers in Ecology and Environment 12: 267-272
Studds, C.E., et al., 2017, Rapid population decline in migratory shorebirds relying on Yellow Sea tidal mudflats as stopover sites, Nature Communications
Wilson et al. 2011. Analyzing Variability and the Rate of Decline of Migratory Shorebirds in Moreton Bay, Australia

Figures and tables

Fig.1 East Asian-Australasian Flyway (red line)

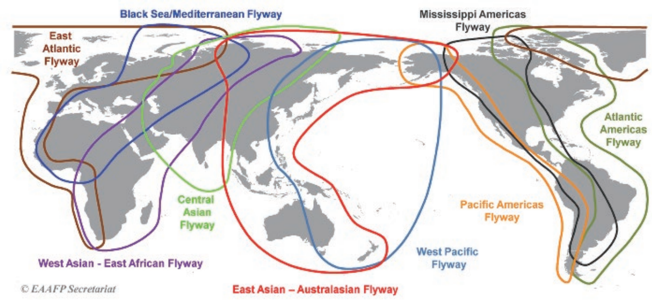
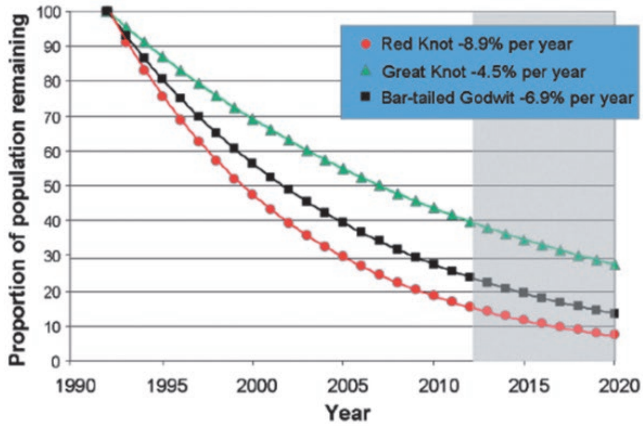


Fig.2 Projected population losses of three shorebird species given current rates of decline of 5-9% per year



after Amano *et al*. 2010 and Wilson *et al*. 2011

Fig.3 Domestic production values in 1998. Fishermen have not shipped pen shell, prawn and short-necked clam since 2007. (Source: Nobukiyo Hirakata, Graph: BirdLife International-Tokyo)

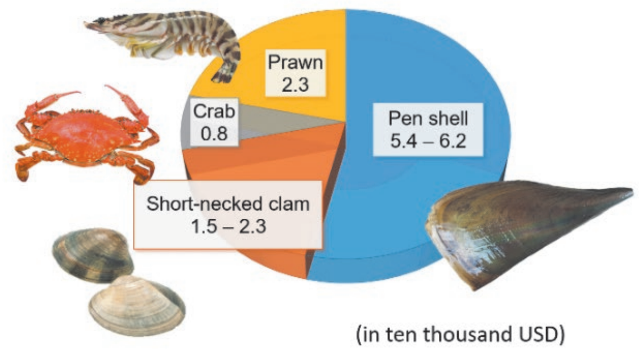
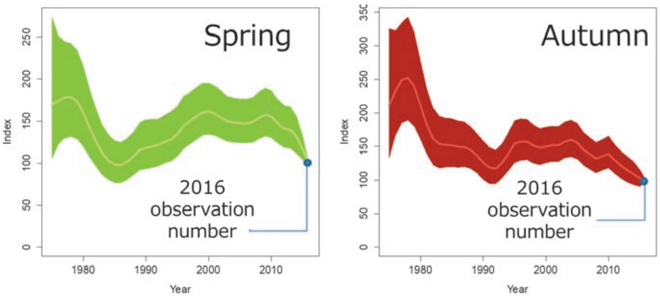
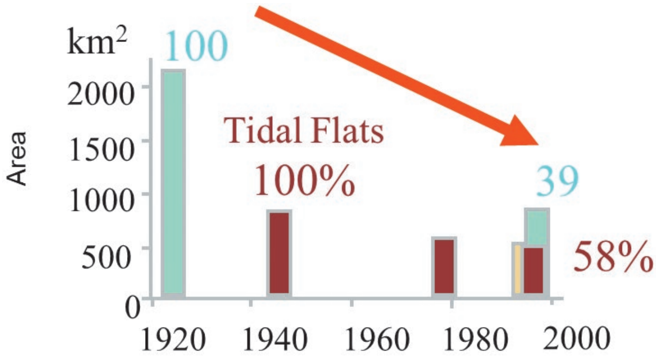


Fig.4 Trends of dominant shorebird species in Japana



Population in 2015 is set as 100

Fig.5 Loss of Tidal Flats in Japan (Hanawa, 2006)



Area of tidal flats (brown) and swamps (blue)

Fig.6 Proportion of Lost and Remaining Tidal Flats in Japan in 1945 – 2000

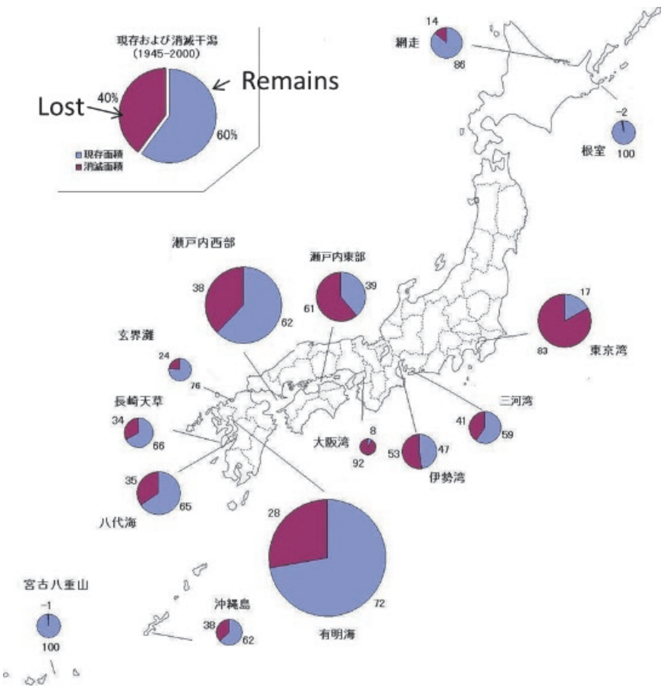


Fig.7 Important stop-over site in EAAF (Conklin, J.R. et al., 2014)

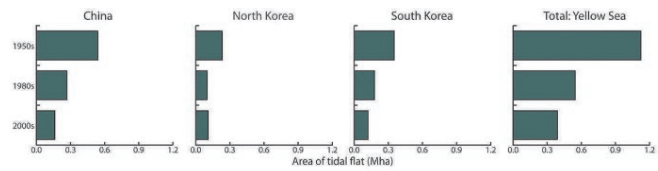
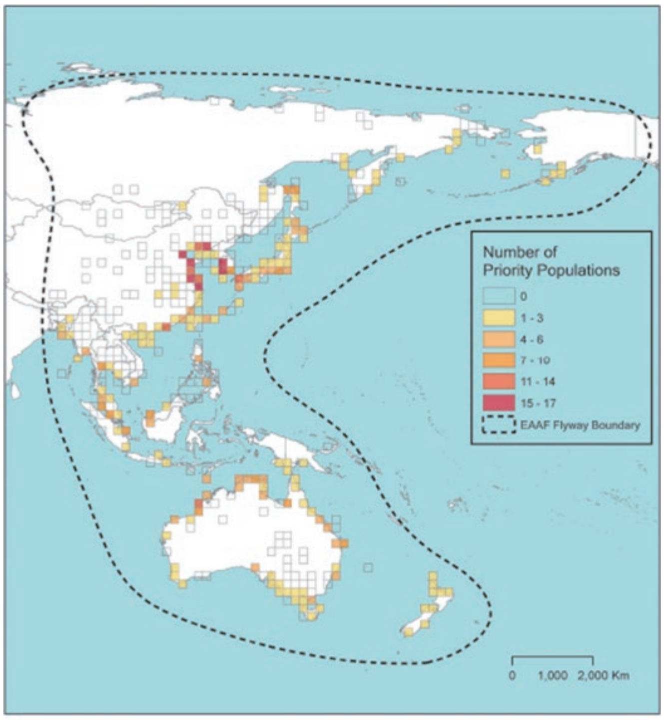


Fig.8 Area of tidal flat (Mha) (Murray et al. 2014)



Critical areas of the EAAF, based on the number of priority shorebird populations supported in internationally important numbers.

ent 12: 267-272

Fig.9 Flyway-level population trend and Yellow Sea reliance (Studds et al., 2017)

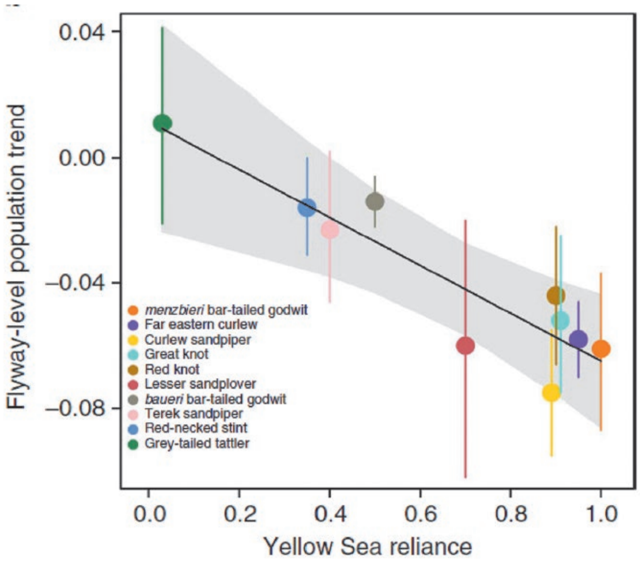


Fig.10 Major changes in benthic prey stocks in Yellow Sea (Zhang et al. in prep)

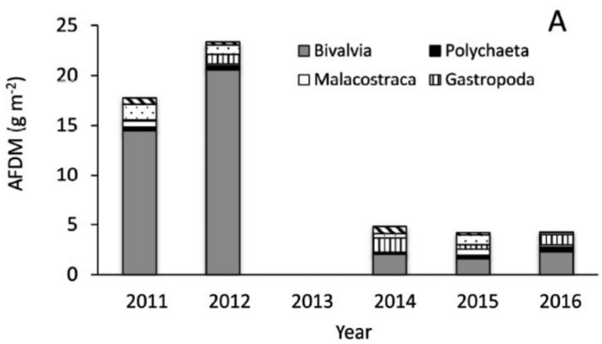
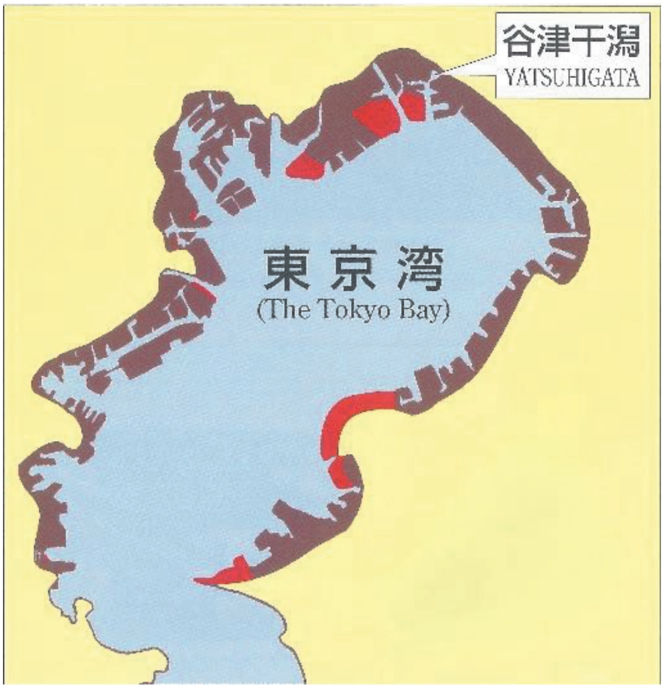
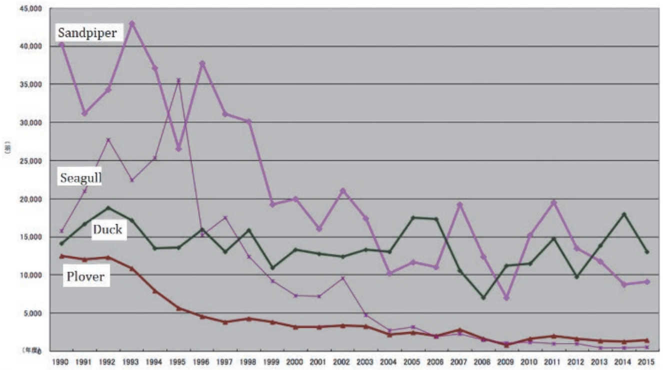


Fig.11 Reclamation of Tokyo Bay (designed by YNOC)



Grey: Reclaimed area, Red: Tidal flat and shallow sea

Fig.12 The trends of the waterbird population during the past 30 years in Yatsu-higata (Data source: Ministry of the Environment, Japan, Graph: YNOC)



Script for the message video

Mr. Ryoji Tokitsu: I have been visiting Isahaya Bay for 30 years. I have been fascinated by birds for years, as I cannot forget those good old days. The most impressive view was thousands of Dunlins flying around in a flock, changing directions and thus the colour of their wings as they turned away. I often visited here to see these sights that I used to love so much. The environment has changed dramatically after a seawall was built. Bird species that used to forage for worms in the mudflat have disappeared. I am very sad to see this. Some people say, “the birds will go to the other remaining tidal flats' or 'there are many other tidal flats elsewhere,' but I cannot agree with it. They come here because this is the best tidal flat for them. It is a very sad situation.

Mr. Nobukiyo Hirakata: When the sea was much healthier, the tidal flat surface was fully covered with small crabs. There were lots of migratory waterbirds on the tidal flat to forage for these crabs, competing with us human beings. Healthy circular tidal flat was spread throughout the coastlines of the entire Ariake Sea. 60-70% of our total annual domestic production was from Pen Shell fishing. We used to earn USD 54-64 thousand on average through Pen Shell fishing, followed by USD

23 thousand from prawns, USD 15-23 thousand by Manila Clams. We also had USD 8 thousand from crabs. Currently, I strongly feel that our tidal flats have been polluted more and more by various factors, including public constructions. We have not been able to do Pen Shell fishing for six years, and no Manila Clam fishing for around eleven years. There is nothing for us to catch anymore, so the fishermen here have been having a very difficult time. If human beings only pursue better convenience by changing the environment, like covering all of the coastlines, the number of living creatures like fish definitely decline. Once this happens, there is no better method of recovery than letting nature take over the healing process before it is too late. Human beings cannot do any better than nature. I have a small dream. I would like to take back the ocean where I can carry out fishing together with my son.

End

Thank you