

Asian Wetland Symposium 2017  
7-11 November



# Reproduction of mudskippers: Aerial embryos developing in a mudflat burrow

**Atsushi Ishimatsu**  
Institute for East China Sea Research  
Nagasaki University

Mudskippers are amphibious gobies  
specialized for life on mudflats



*Periophthalmus modestus*  
トビハゼ(東京以南)



ムツゴロウ  
(有明海・八代海)

*Boleophthalmus pectinirostris*



トカゲハゼ (沖縄)

*Scartelaos histophorus*

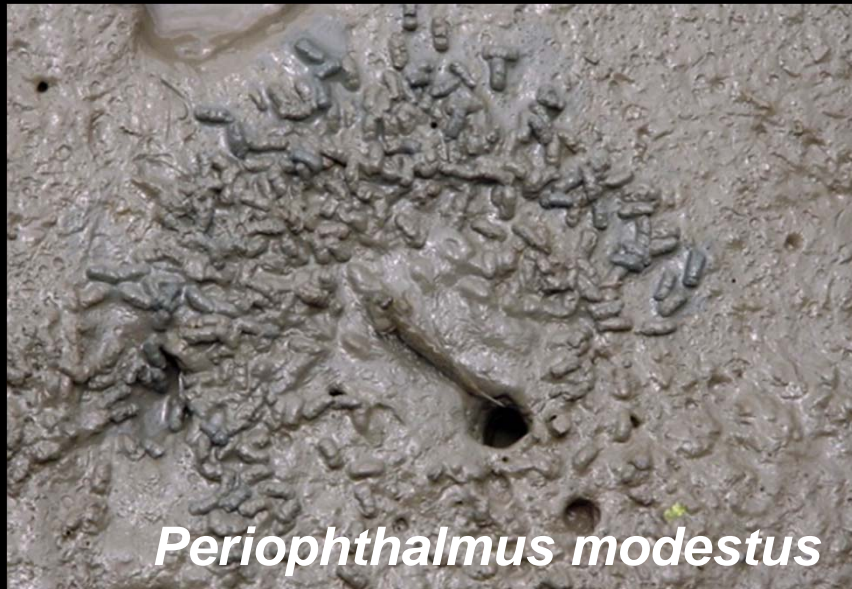


ミナミトビハゼ(沖縄)

*Periophthalmus argentilineatus*



# Basic facts about the reproduction of mudskippers



*Periophthalmus modestus*



*Boleophthalmus pectinirostris*

The reproductive season of Japanese mudskippers is from May to August in the Ariake Sea.

Mudskippers lay eggs inside their burrows.

Only a male takes care of the eggs until hatching.

The burrow are filled with water containing very low oxygen.

Mudskipper eggs will die when incubated in low oxygen burrow water

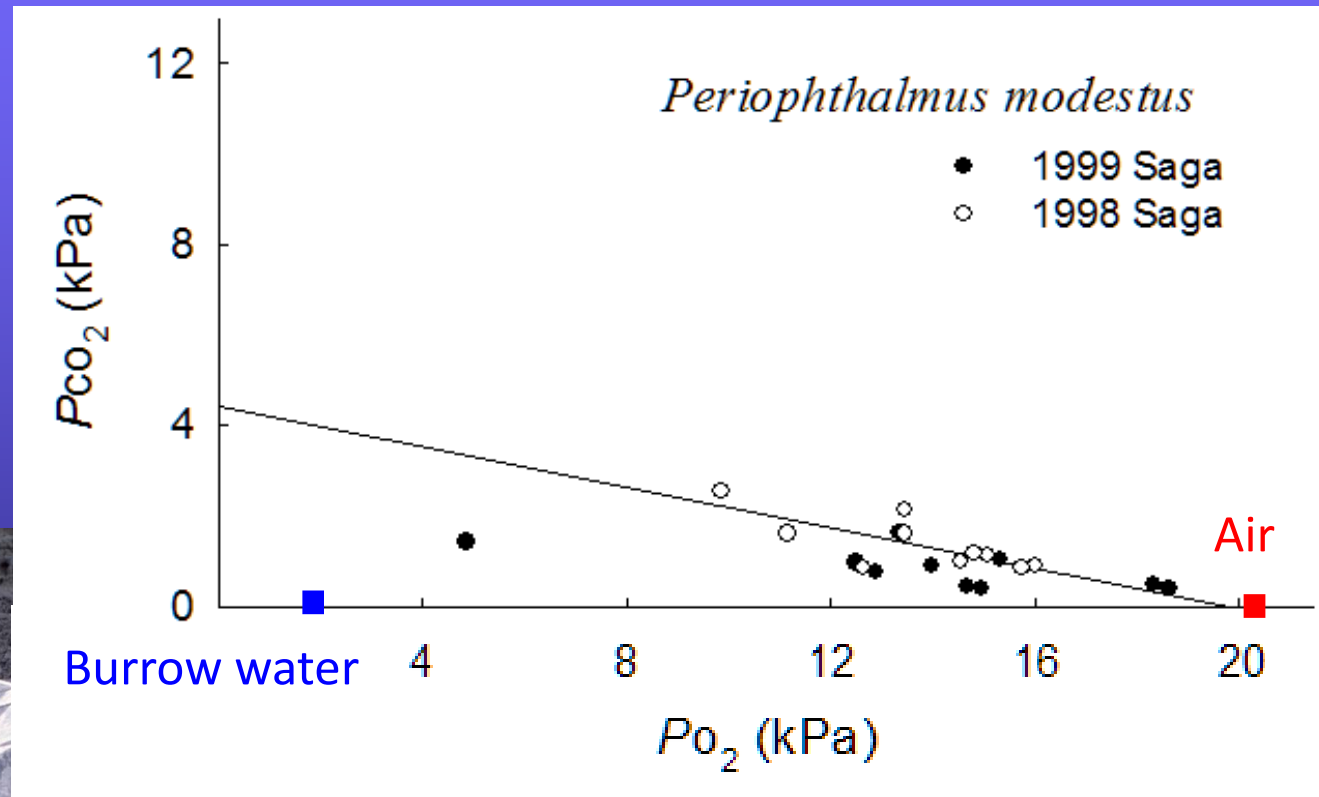
Burrow #	1	2	3	4	5
Control (Oxygen saturation 100%)					
Total Eggs	38	32	22	37	36
Hatching (%)	45	63	73	46	53
Simulated burrow water (Oxygen saturation 10%)					
Total Eggs	11	21	15	12	11
Hatching (%)	0	0	0	0	0

How can mudskipper eggs develop in burrows?

Then we found that air is stored in mudskipper burrows!

*Periophthalmus modestus*

$47 \pm 17$  mL ( $N = 17$ )

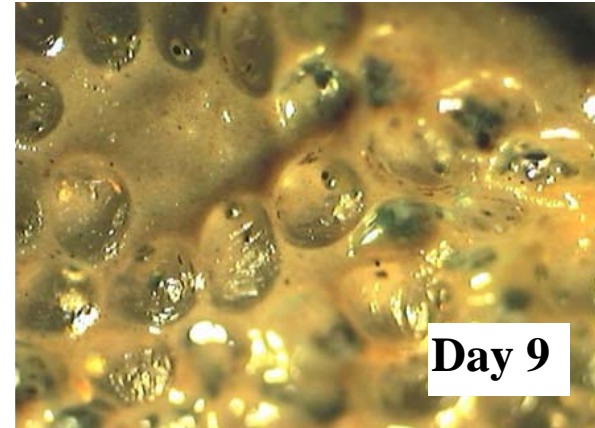
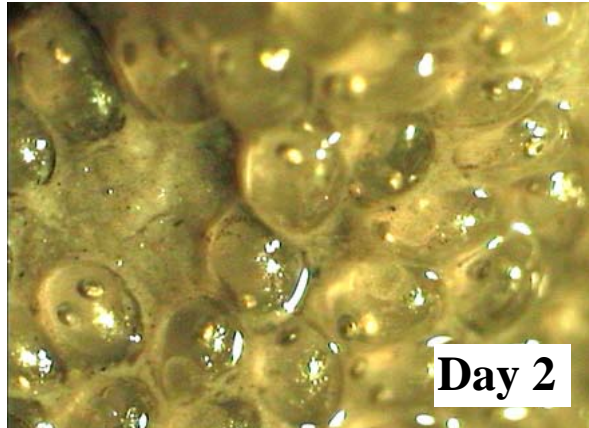


Collection of burrow gas from  
a *P. schlosseri* burrow

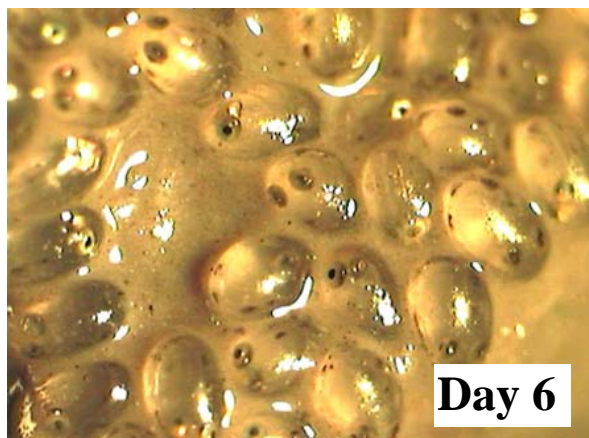
Ishimatsu et al. 1998 Nature 391, 237  
Ishimatsu et al. 2007 J Exp Biol 210, 3946



*Mudskipper* eggs develop normally in air but eventually die without hatching.



Submersion in water is necessary  
for *P. modestus* eggs to hatch.



# Research questions

1. How does the oxygen level of the burrow gas maintained during one-week egg incubation period?

(There are 5000 eggs consuming oxygen in a 47 mL egg chamber.)

2. How and when do the eggs are submerged in water in natural burrows?

# 「NHK ダーウィンが来た！」より



(broadcast on June 4, 2017)



A photograph of a man lying on his side on a muddy beach. He is wearing a white head covering and a dark t-shirt, and his clothing is covered in mud. He is smiling at the camera. Next to him are two blue plastic crates and two white buckets. In the background, there is a concrete pier structure extending into the water, and a long concrete wall or dam in the distance under a clear sky.

Thank you for your attention

Thanks are due to the late Prof. Jeff Graham of Scripps Inst., UCSD, Dr. Tatsusuka Takeda (Kyushu Univ), and students (Yu Yoshida, Naoko Itoki, Shohei Noma and many others)