

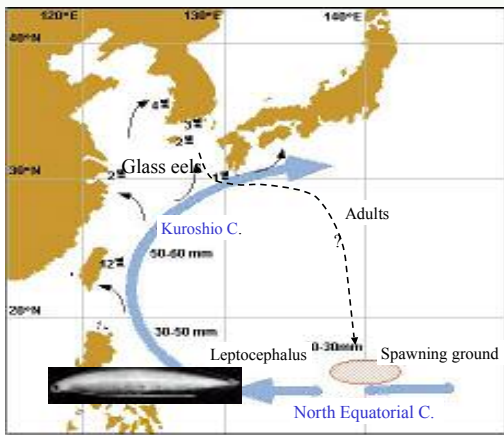
# Early growth history of *Anguilla japonica* determined from otolith microstructure in glass eels

Lee, T. W. <sup>\*1</sup>, H. T. Moon<sup>1</sup> and G.-C. Kim<sup>2</sup>

<sup>1</sup>Department of Oceanography, Chungnam National University, Taejeon 305-764, Korea [twlee@cnu.ac.kr](mailto:twlee@cnu.ac.kr),  
<sup>2</sup>Fisheries Oceanography and Zooplankton Ecology Research Lab., School of Earth and Ocean Sciences, University of Victoria, P.O. Box 3055 STN CSC, Victoria, BC, V8W 3P6

## Migration of *Anguilla japonica*

Japanese eels *Anguilla japonica* are known to spawn in the water near the Mariana Ridge in the North Equatorial Current (NEC) (Tsukamoto 1992). The newly hatched larvae, called leptocephali, migrate by drifting along the salinity front of NEC to enter the Kuroshio Current (Kimura et al 1994). The leptocephali metamorphose into glass eels around the continental slope, and continue to migrate over the continental shelf to the East Asian rivers. The glass eels appear in the Taiwan and southwestern Japanese estuaries from November to April, but mainly from December to February. The season of their upstream migration is later the farther the location is from the Kuroshio Current. In the estuaries of Jeju Island, Korea, the glass eels appear from December to April, but mainly from January to March. They appeared one month later (mainly from February to April) in the estuaries in the southern coast of Korea, and two months later (mainly from March to May) in the mid-western coast compared to the Jeju estuaries.

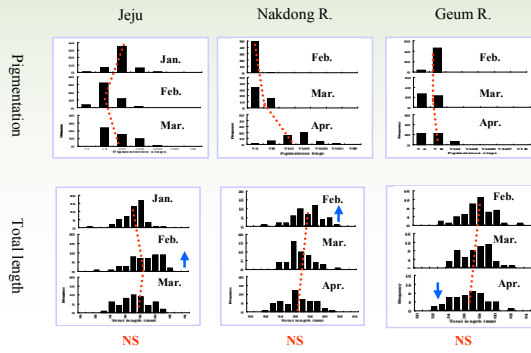
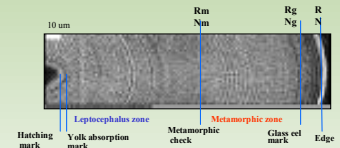


## Sampling

Glass eel samples were collected during the season of upstream migration in three estuaries in 1998: 1) Jeju from January to March, 2) Nakdong River from February to April and 3) Geum River from March to May. We measured total length (TL) and pigmentation stage. Otolith microstructure was examined under the SEM. The radii (widths) and the number of growth increments corresponding to the leptocephalus stage, metamorphic stage and glass eel stage were measured.

## Length, pigmentation stage, radii and number of growth increments in otoliths

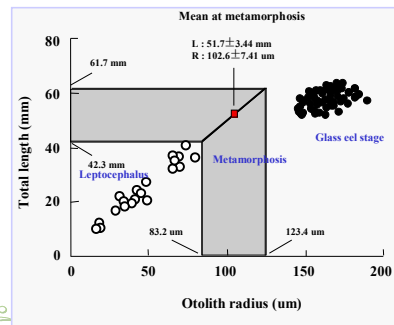
Glass eels from Jeju estuaries showed advanced pigment developmental stages. In the other estuaries, the developmental stages advanced over time. Mean total length, otolith radii and the number of growth increments in glass eels did not show any significant differences among the estuaries and sampling times. If the body and otolith sizes continued to increase after metamorphosis, the glass eels collected from the estuaries far from the Kuroshio Current should be larger and older. This result suggests that the glass eels stop growing for an unknown period of time after metamorphosis.



Site	Month	(mm)	Width (um)				No. of increments			
			Rm	Num	Rg	Ng	R	Ng	R	N
Jeju	Jan (n=16)	56.7±1.5	101.8±6	146.5±6.1	9.7	156.2±6	129.4±7.6	12±4.0	45±4.0	186±8.6
	Feb (n=15)	59.5±1.6	105±5.7	153.2±5.1	11.3	164.5±4.7	129±8.6	15±4.8	45±6.0	189±8.3
	Mar (n=15)	57.5±2.0	104.1±5.7	150.5±5.3	11.2	161.7±4.7	126.1±5.1	11±1.4	45±6.1	182±3.3
Nakdong	Feb (n=16)	58.8±2.3	103.1±6.9	152.9±8.0	11.6	164.5±7.3	129±7.1	15±4.5	44±5.7	189±9.4
	Mar (n=15)	57.4±2.2	102.4±6.4	153.1±8.8	10.5	163.6±7.8	132±7.6	15±3.7	46±5.0	193±10.5
	Apr (n=16)	56.4±2.6	101.5±8.6	152.4±11.0	13.8	166.2±10.1	128±7.9	19±4.4	45±6.6	192±11.1
Kuem R.	Feb (n=16)	57.2±1.6	103.6±7.0	149±4.0	8.7	157.7±6.0	129±5.6	13±2.9	46±2.6	188±7.0
	Mar (n=15)	56.8±1.9	102.3±5.6	149.1±9.2	8.1	157.2±6.9	128±5.6	13±3.8	45±3.9	186±7.2
	Apr (n=15)	56.6±2.4	100±8.3	152.5±9.7	10.5	163±10.7	130±7.8	19±4.1	43±5.7	192±11.1
Total (n=139)	57.4±2.2	102.6±7.1	151±8.3	10.6	161.6±8.4	129±7.1	15±5.1	45±5.0	188±9.6	

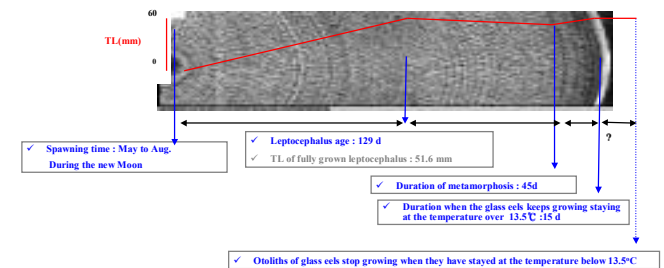
## Length and otolith growth

Using the relationship between total length and otolith radius of leptocephali, total length at the onset of metamorphosis was back-calculated using the mean radii to the metamorphic check in glass eel otolith (Rm). The estimated total lengths at the beginning of metamorphosis ranged from 42.3 to 61.7 mm (51.7±3.44 mm, mean ±SD).



## Summary of early growth history of eels

- Leptocephali began to metamorphose at the mean size of 51.6 mm at mean age of 129 d.
- During the metamorphosis, the otoliths grew fast and it took about 45 d.
- After metamorphosis, a glass eel check was formed. Glass eels that stayed at temperatures above 13.5°C continued to grow, but stopped growing at temperatures below 13.5°C.
- The number of growth increments in glass eel otoliths do not necessarily correspond to their age. The glass eel otoliths can only provide us the duration of leptocephalus stage and metamorphosis.



The material in this file is copyright © 2003 by the authors