Conceptual model of habitat restoration for Gobies in Tokyo Bay, Japan

Keita Furukawa¹, Tomonari Okada¹, Satomi Kamimura¹ and Jun Yoshida¹
¹National Institute for Land and Infrastructure Management, Yokosuka, Kanagawa, Japan

Tokyo Bay is an enclosed, mostly populated, and intensively used bay in Japan (Furukawa and Okada, 2006). The inner bay catchment area has a total population of some 25 million. The concentration of population and industries in the catchment area of Tokyo Bay has brought remarkable changes to its coastline. Surrounded tidal-flats have been reclaimed by land fill, and only few natural tidal flat are remaining (98% of coastal line are covered by constructed structures). Furthermore, water quality of the bay is degraded (frequent red-tides, several times anoxic water upwelling and occasional fish kill are occurred by eutrophication).

Goby (Acanthogobius flavimanus) has nest in soft saline bed in 6-8m deep water in winter, and hatched larvae swim up to upstream limit of estuarine environment and settle on sandy shallow bed in spring. It becomes 6-8cm in early summer and growing up to 15-20cm in autumn. These seasons are ideal for easy fishing for public. Most of senior residents not only Tokyo bay, but also almost all around Japan, had experience of goby fishing in childhood. So, it can be said as one of vanishing culture for coastal residents in Japan.

Preliminary census for Gobies shows possibility of limitation, degradation and discretization of coastal habitats for Gobies. Some river mouth is serving marginal habitat of Gobies. Nevertheless, bay side of the habitat is affected by hypoxic water intrusion from bottom layer. Furthermore, in the canal network that is remaining water bodies of tidal-flats that reclaimed, life cycle of Gobies seems to be adopted by discretized environment. Some of them are not having marginal habitat, but they stay in the same place for long period.

A detail examination for life-cycle of Gobies and determination for environmental status for shallow, canal, intermediate and deep area has been done, and watershed scale conceptual models were established. Since Gobies in Tokyo bay seems to have two groups which spawning in winter (conservative model) and spawning in early summer (alternative model), two different models are proposed.

For conservative model, there are three negative pressures for Gobies’ habitation i.e. 1) lack of habitat for juvenile in canal, 2) fishing pressure in canal, and 3) low DO in intermediate and deep area during summer. For alternative model, 1) lack of habitat for nesting, 2) food shortage in intermediate area, and 3) low DO are found.

Contact Information:
Keita Furukawa, Research Coordinator for Coastal and Marine Affairs,
National Institute for Land and Infrastructure Management,
Nagase 3-1-1, Yokosuka, Kanagawa, Japan,
Phone: 81-46-844-5026, Fax: 81-46-844-1145, Email: furukawa-k92y2@ysk.nilim.go.jp
Goby: *Acanthogobius flavimanus*

**Mahaze 真鯊**

Goby (*Acanthogobius flavimanus*) has nest in soft saline bed in 6-8m deep water in winter, and hatched larvae swim up to upstream limit of estuarine environment and settle on sandy shallow bed in spring. It becomes 6-8cm in early summer and growing up to 15-20cm in autumn. These seasons are ideal for easy fishing for public. Most of senior residents not only Tokyo bay, but also almost all around Japan, had experience of goby fishing in childhood. So, it can be said as one of vanishing culture for coastal residents in Japan.

The annual Water Quality Survey in Tokyo Bay have been conducted since 2008. In 2011, total of 139 institutions and organizations took part in the survey and conducted investigations at a total of 820 points, including places in the bay and in rivers.

These annual survey are aiming to promote interests of public to the bay, reporting present status of bay water quality including discharged rivers, and reveal bay water contamination mechanisms.

Hypoxic and Anoxic water in the bottom of the bay during early summer to late autumn is a one of biggest concerns for the bay environment. Especially, living resources such as fish, shellfish, and benthos are severely damaged during hypoxic and anoxic events.
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Edo-Mae: Originated in Tokyo Bay

Fishing on Tidal Flat

Fleet for Goby Fishing

Clam shell correcting

Utase Towing Sail Boat

Superpose of geographical map of 1800s and fisheries zone map of 1908

Photo by Y. Sawada: Goby fishing boats at Tokyo bay in 1960s

Sushi

Tempura

Fukagawa Bento (Lunch Box)

Nori Harvesting
Preliminary census of Gobies: Where are you?

Preliminary census for Gobies shows possibility of limitation, degradation and discretization of coastal habitats for Gobies. Some river mouth is serving marginal habitat of Gobies. Nevertheless, bay side of the habitat is affected by hypoxic water intrusion from bottom layer. Furthermore, in the canal network that is remaining water bodies of tidal-flats that reclaimed, life cycle of Gobies seems to be adopted by discretized environment. Some of them are not having marginal habitat, but they stay in the same place for long period.

Acanthogobius flavimanus as an indicator of the Bay Environment

Hiyama, 1992

Schematic image of Gobies Lifecycle

Possible change of Nesting Pattern: Do they adapt change of environment?
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