

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

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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:

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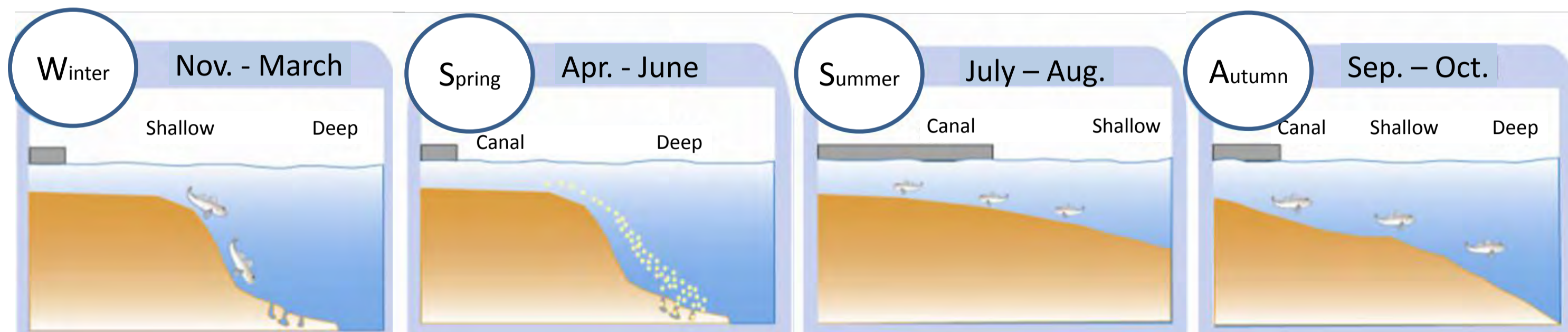
Nagase 3-1-1, Yokosuka, Kanagawa, Japan,

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# Goby: *Acanthogobius flavimanus*

Mahaze 真鯊



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# Tokyo Bay Environment Map

Environment Map of Tokyo Bay

March 2010

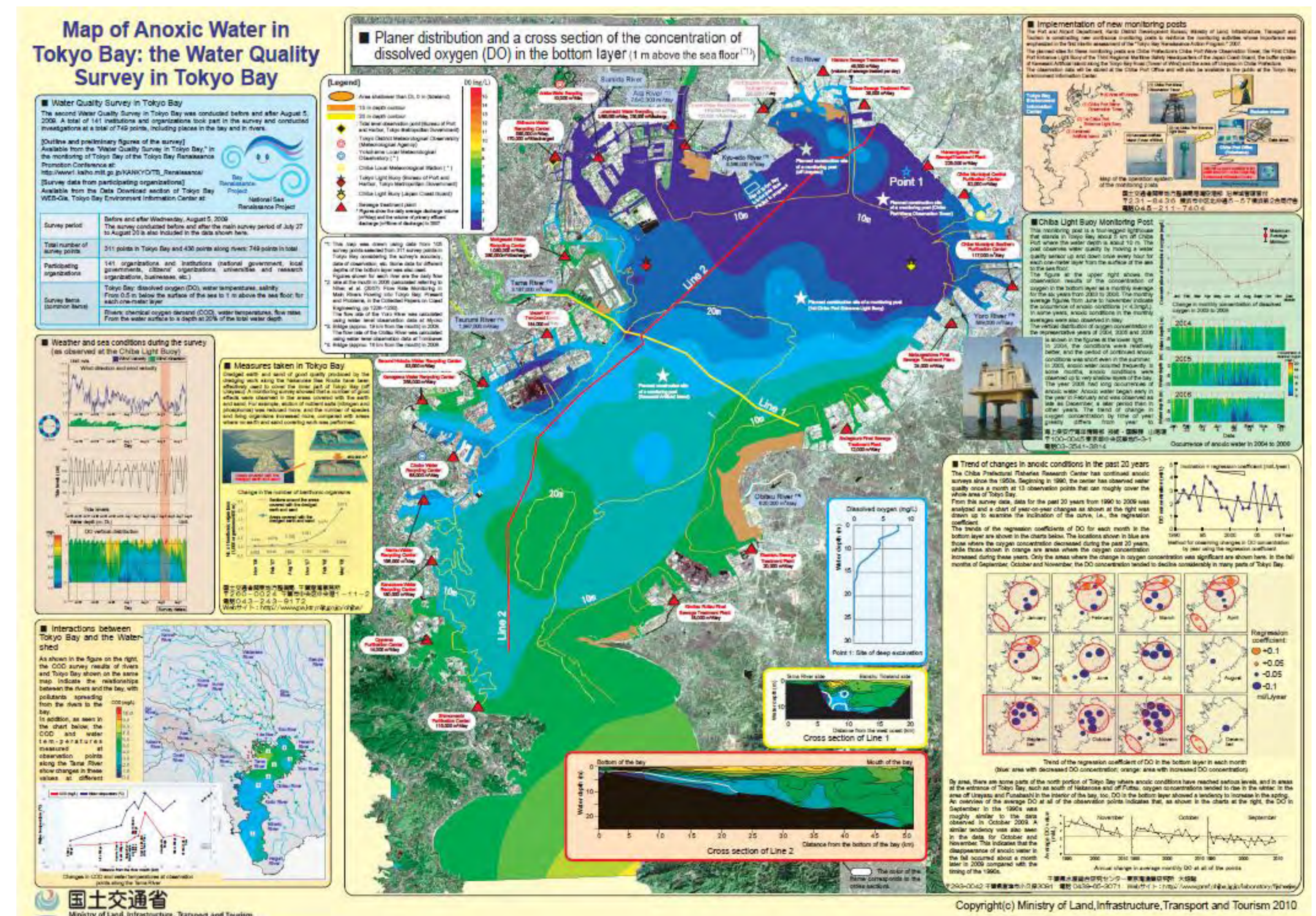
International and Environmental Division  
Ports and Harbors Bureau  
Ministry of Land, Infrastructure,  
Transport and Tourism

Marine Environment Division,  
National Institute  
for Land and Infrastructure Management

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.





# Present Situation of Tokyo Bay



Photo by Prof. Ishimaru, TUMST

Red tide (Algal broom)

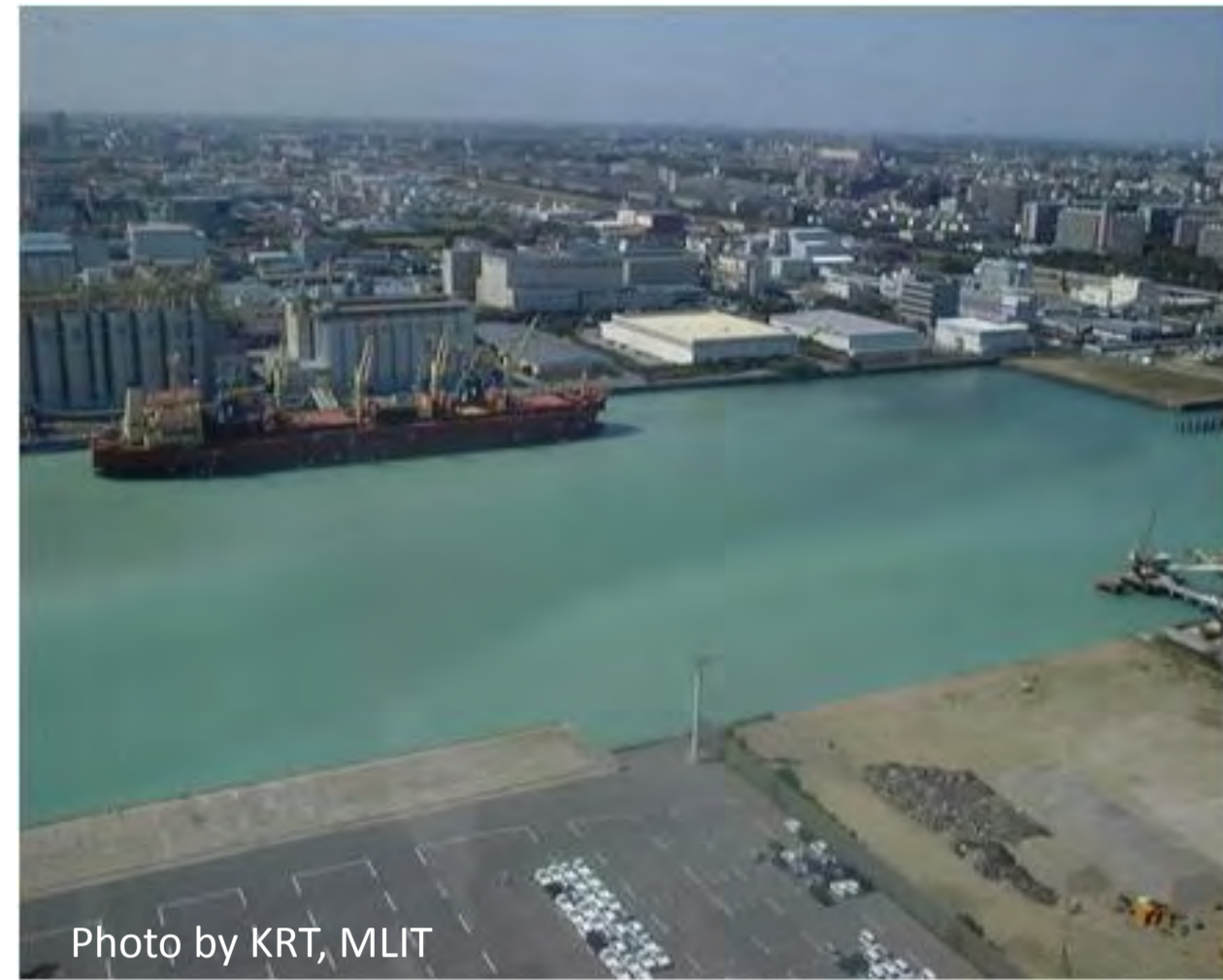
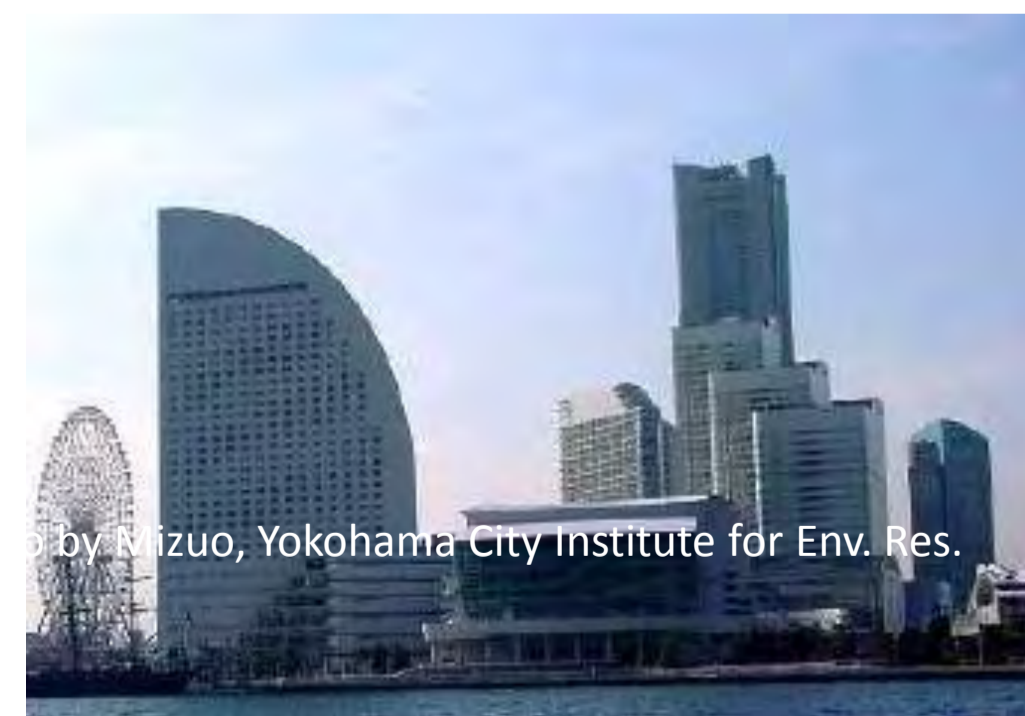


Photo by KRT, MLIT

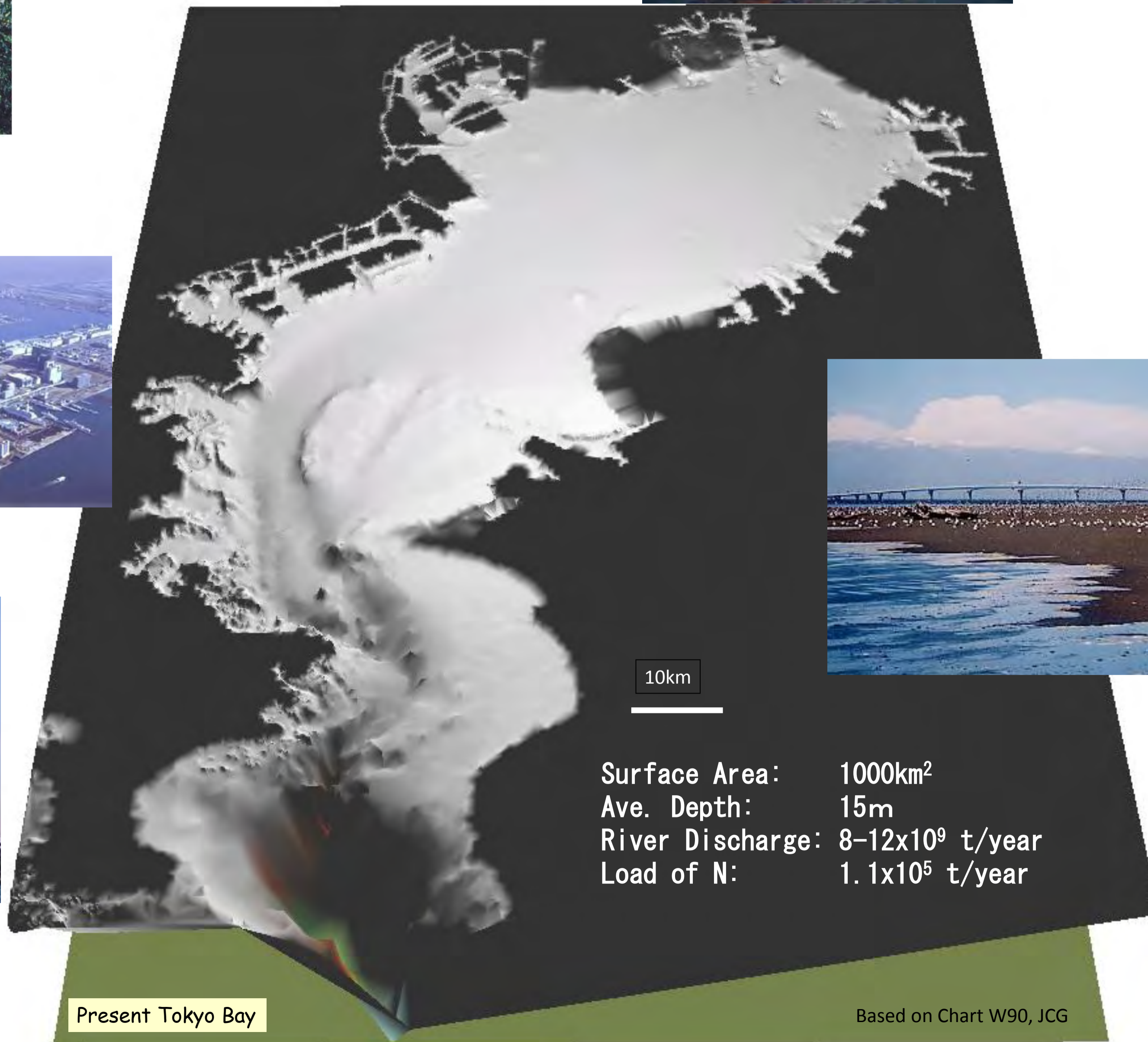
Blue tide (Anoxic Water Upwelling)



Fish Kill on 2003 (due to Anoxic Water)



by Mizuo, Yokohama City Institute for Env. Res.

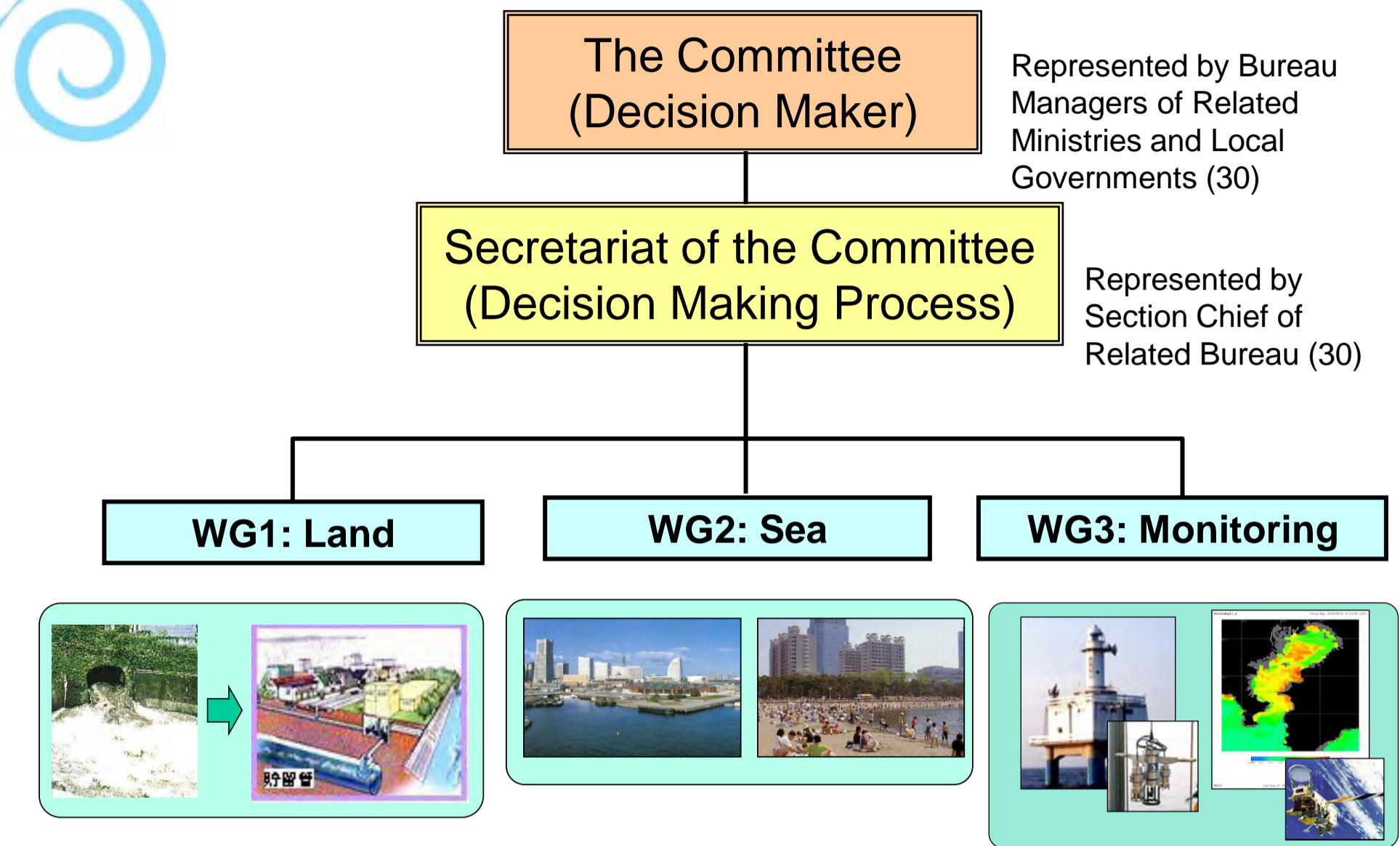


Present Tokyo Bay

Based on Chart W90, JCG



# Action Plans for Bay Renaissance



Tokyo Bay Renaissance Project, 28th March 2003 :10 years action plan

**Goal: Restore the beautiful coastal environment for enabling pleasant use and sustaining biodiversity as a wealth of capital.**

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# Edo-Mae: Originated in Tokyo Bay



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

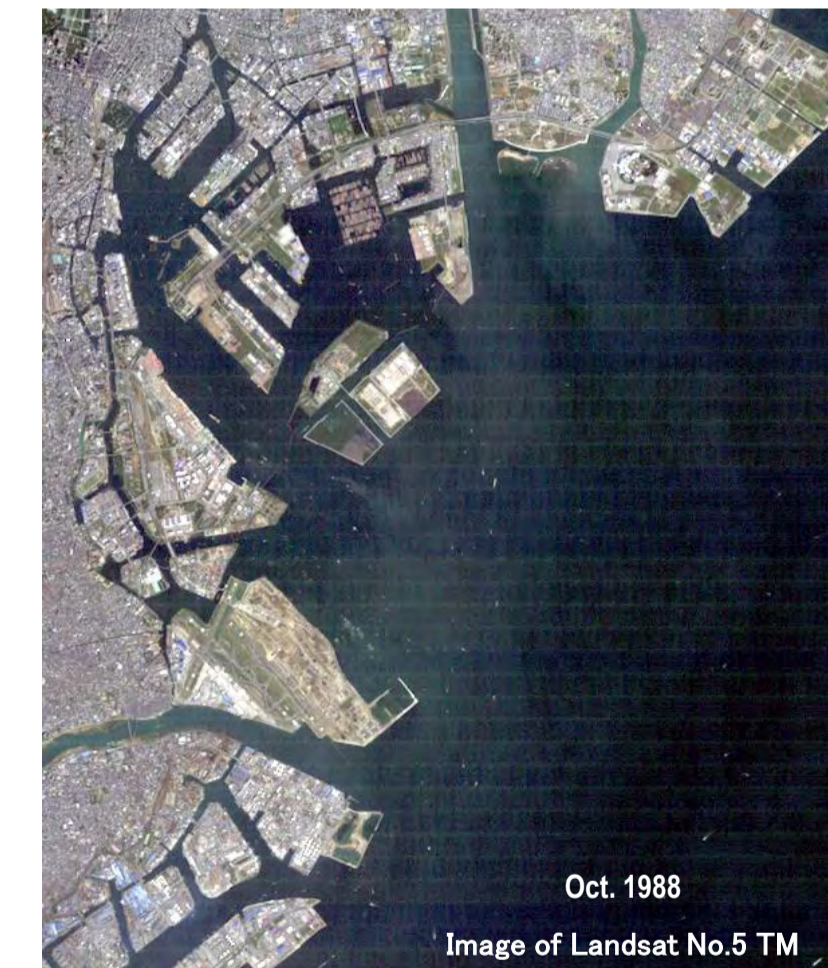
Fleet for Goby Fishing



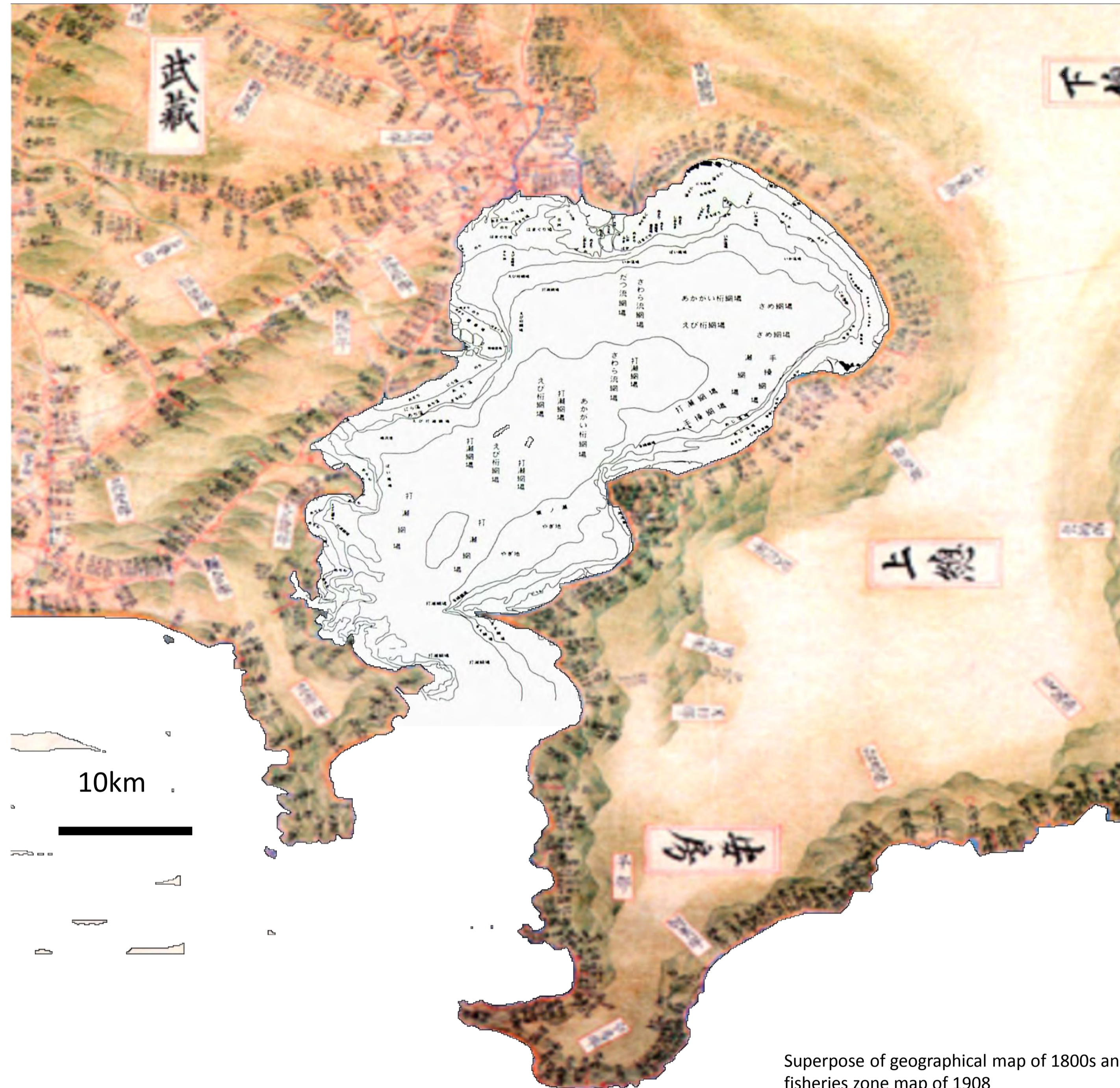
Clam shell correcting



Feb. 1960  
Tokyo Inner-bay Fisheries Records



Oct. 1988  
Image of Landsat No.5 TM

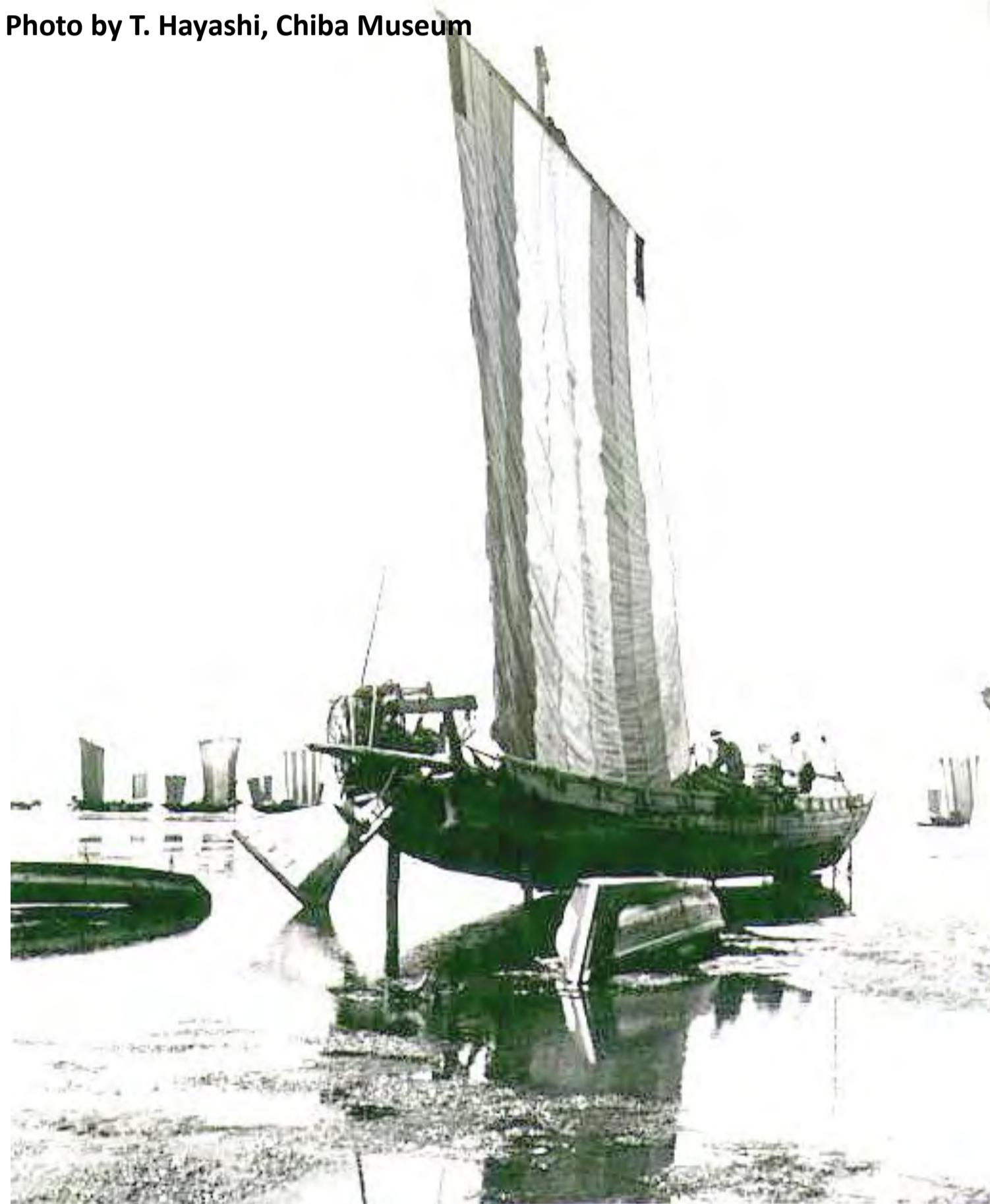


Superpose of geographical map of 1800s and fisheries zone map of 1908



Fishing on Tidal Flat

Photo by T. Hayashi, Chiba Museum



Utase Towing Sail Boat



Sushi



Tempura



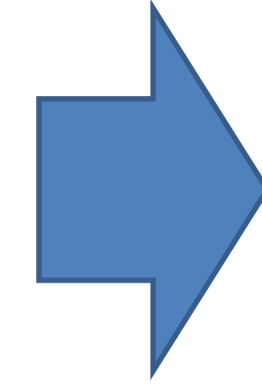
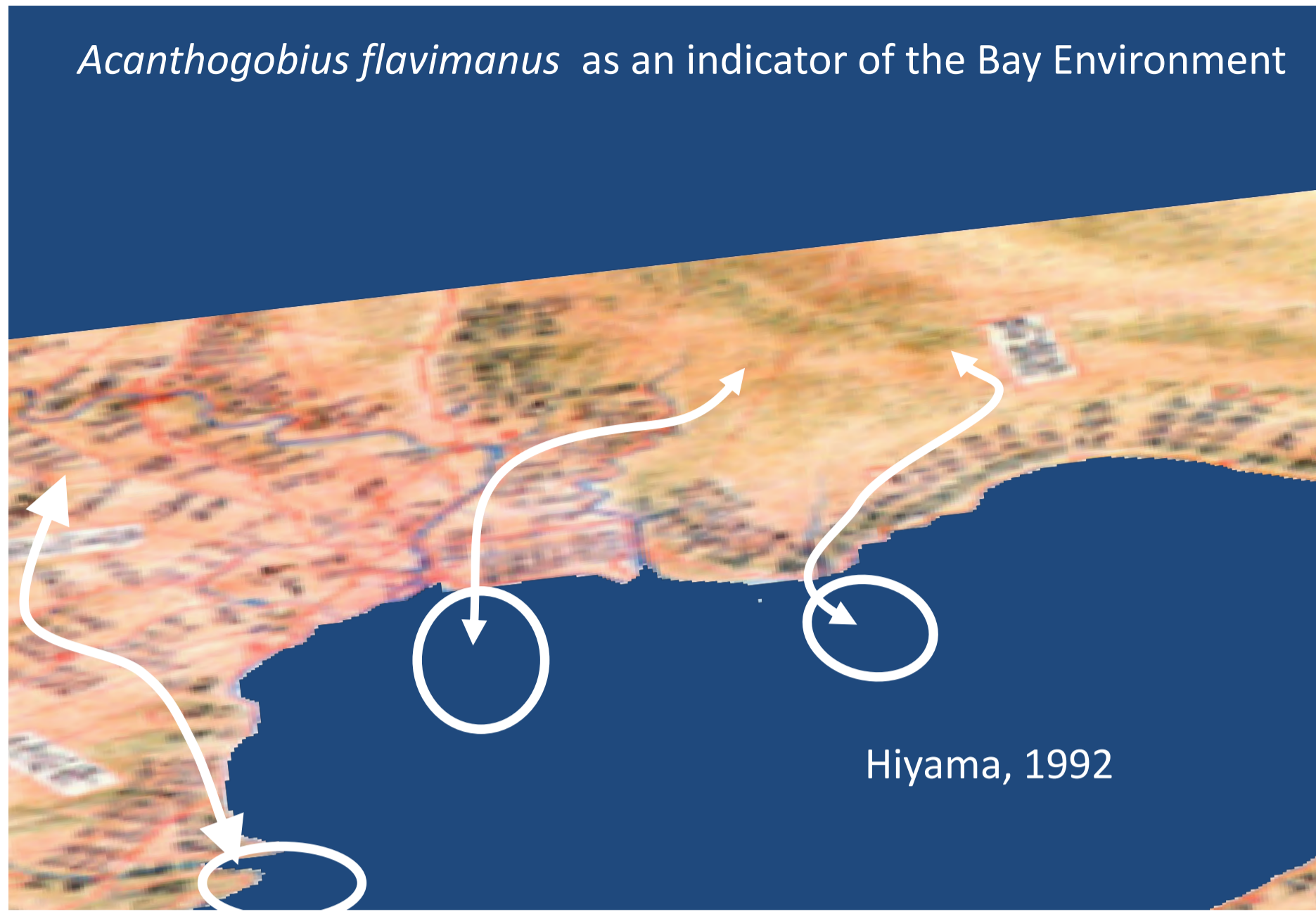
Fukagawa Bento (Lunch Box)



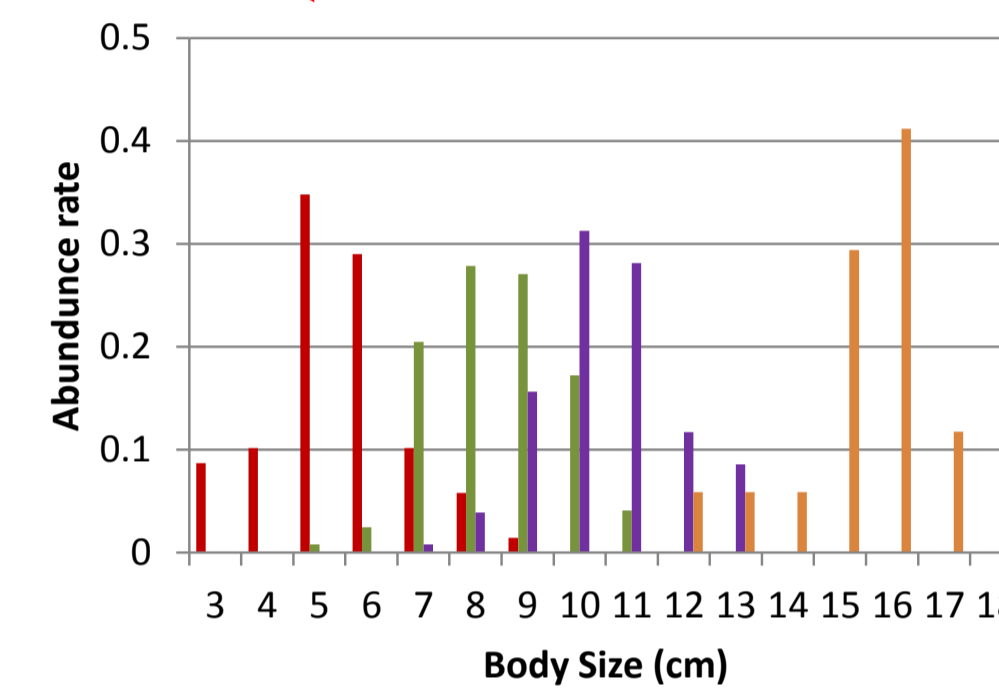
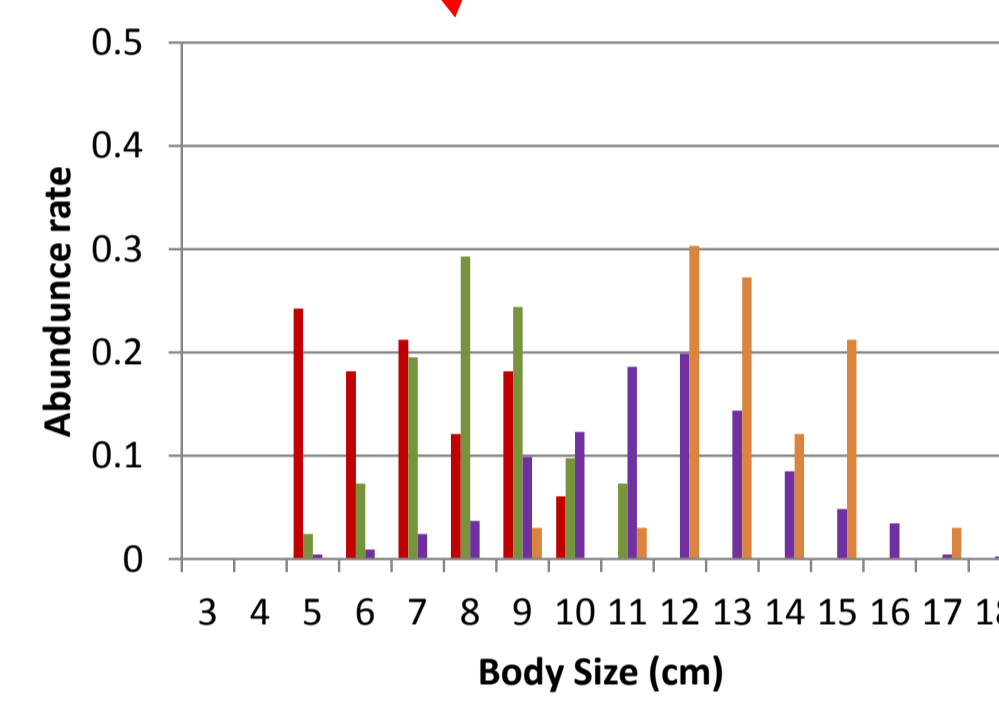
Nori Harvesting



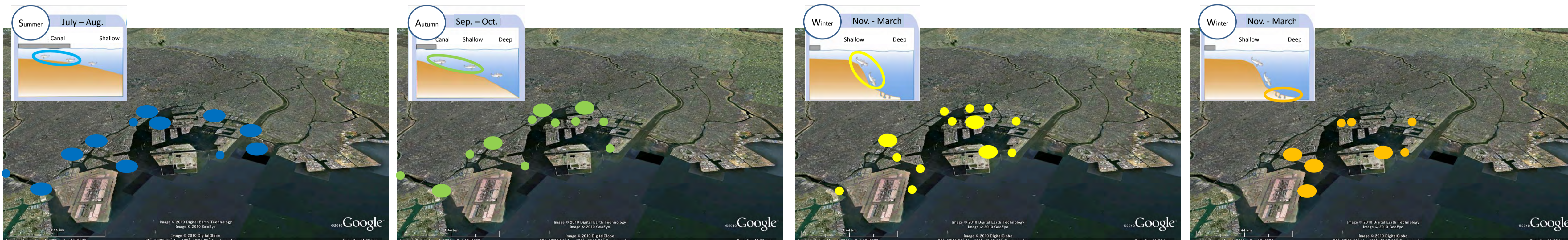
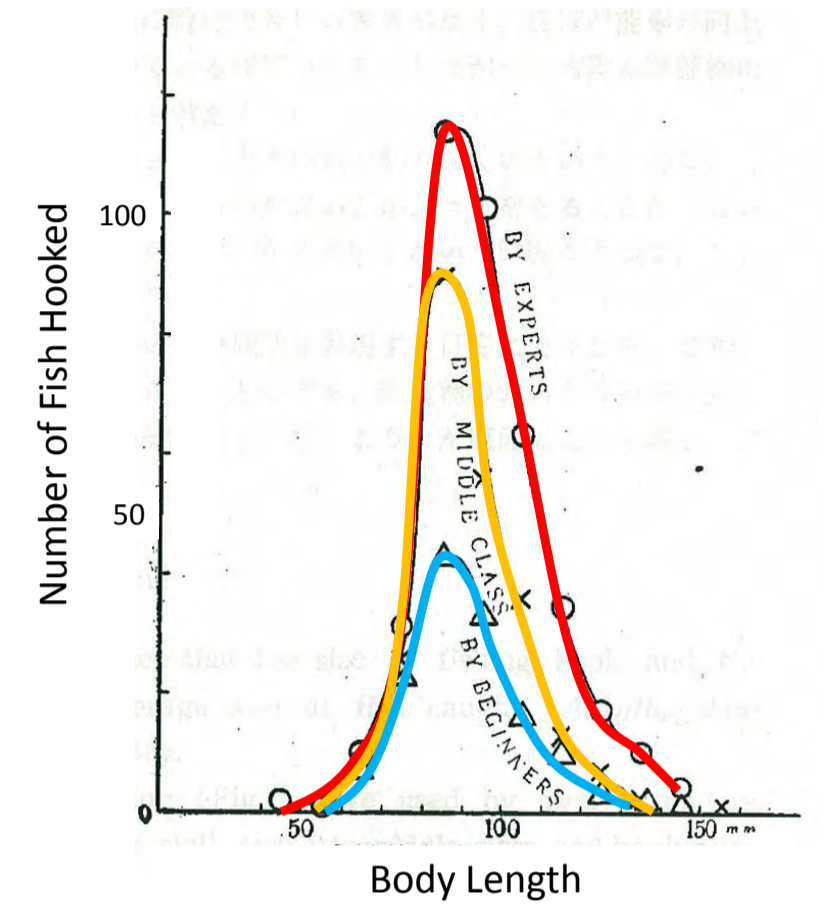
# Preliminary census of Gobies: Where are you?



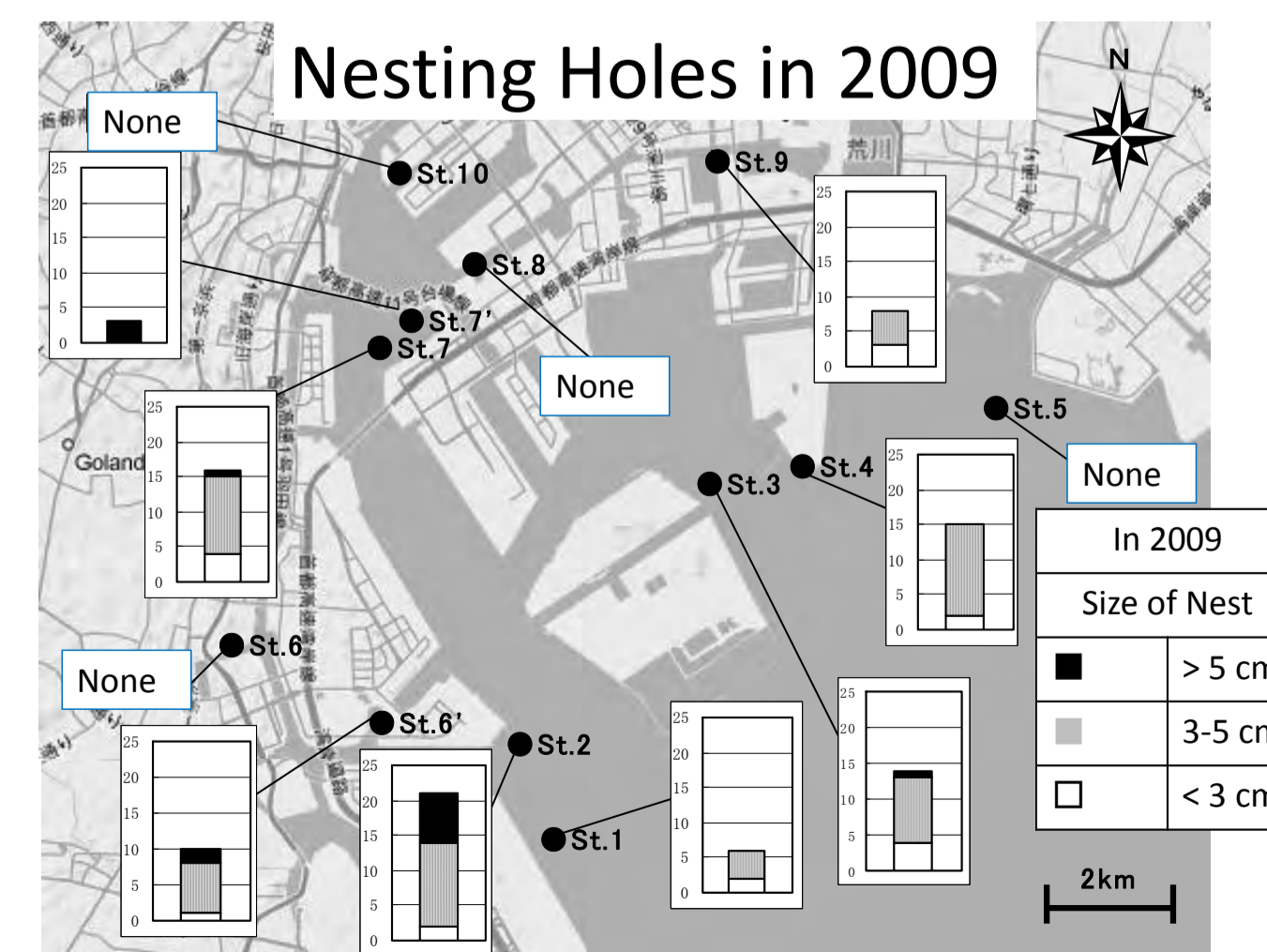
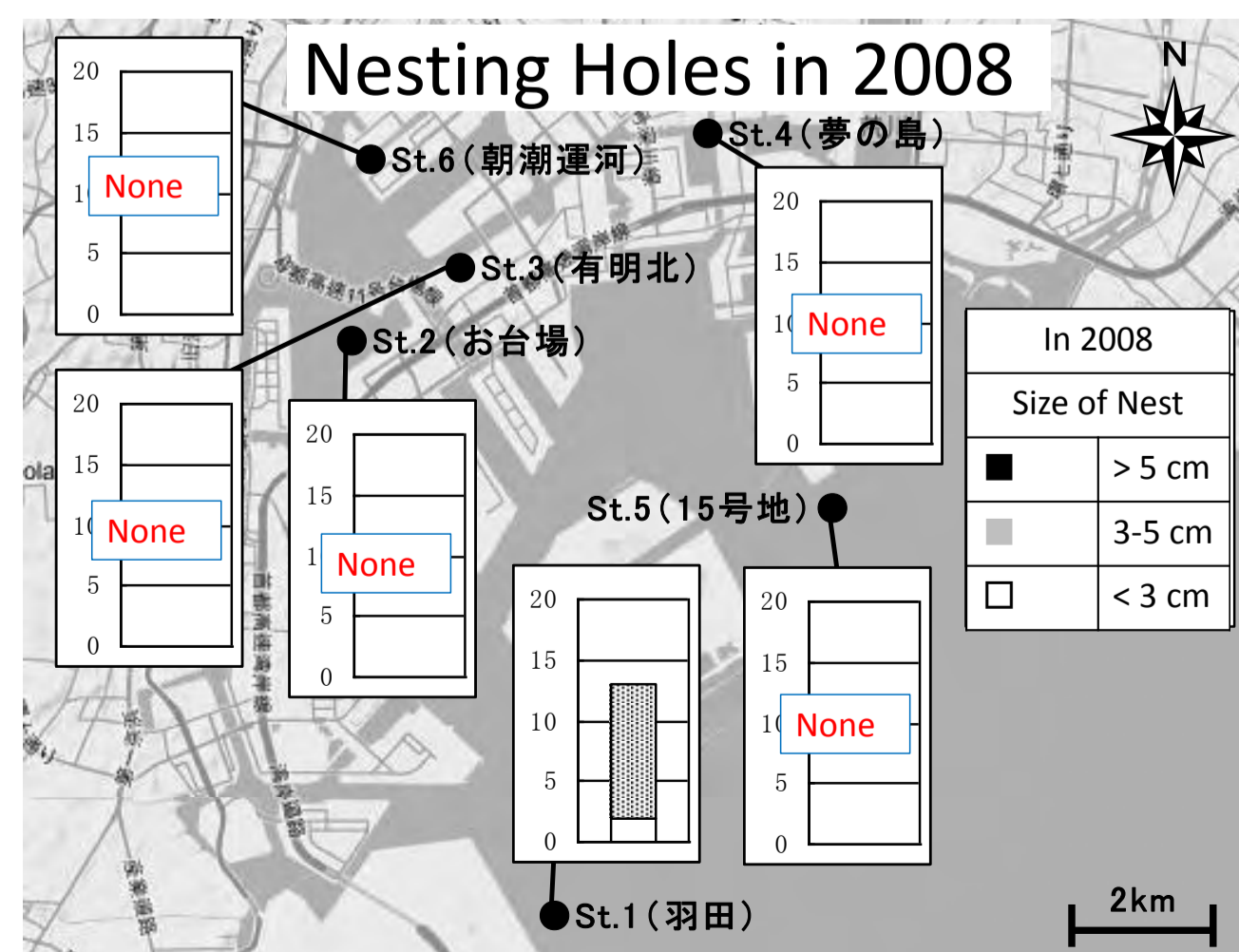
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釣鉤の大小、及び技術の差によるマハゼの魚体長の選別について  
 岸山 義夫・草下 孝也・船勢 幸雄  
 (東京大学農学部水産学教室)  
 Site selection in fishing caused by size of hook and skill of Angler.  
 Yoshio Hirayama, Takuya Kusaka and Yukihiro Nono  
 (Fisheries Institute, Faculty of Agriculture, Tokyo University)



Schematic image of Gobies Lifecycle



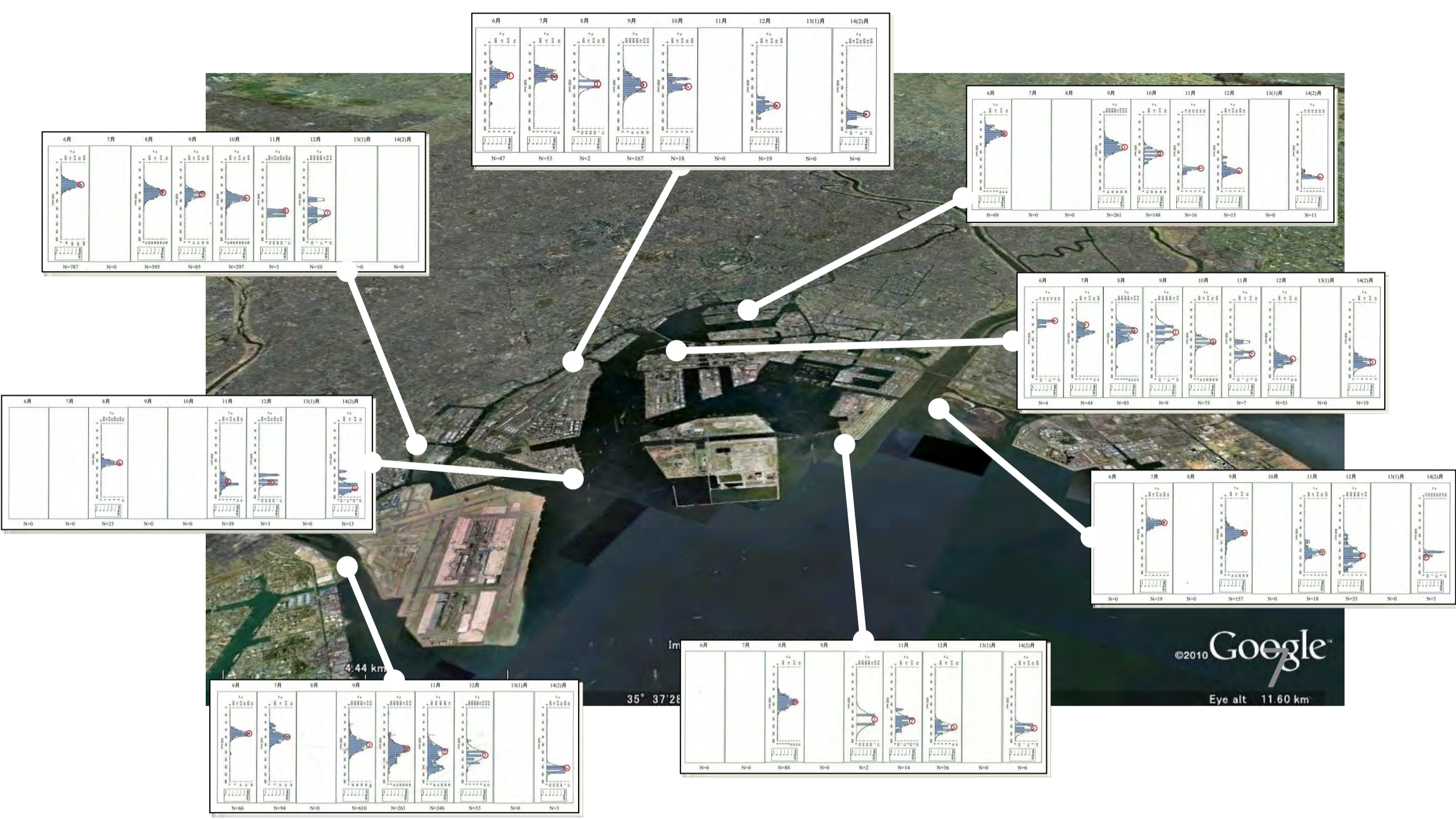
Possible change of Nesting Pattern: Do they adapt change of environment?



Fishing events for Goby Census



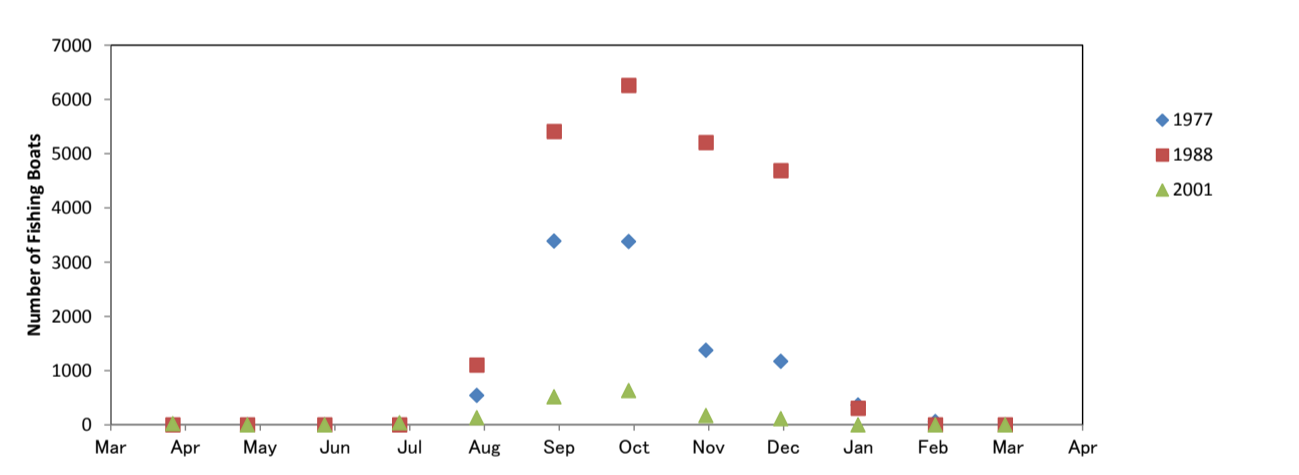
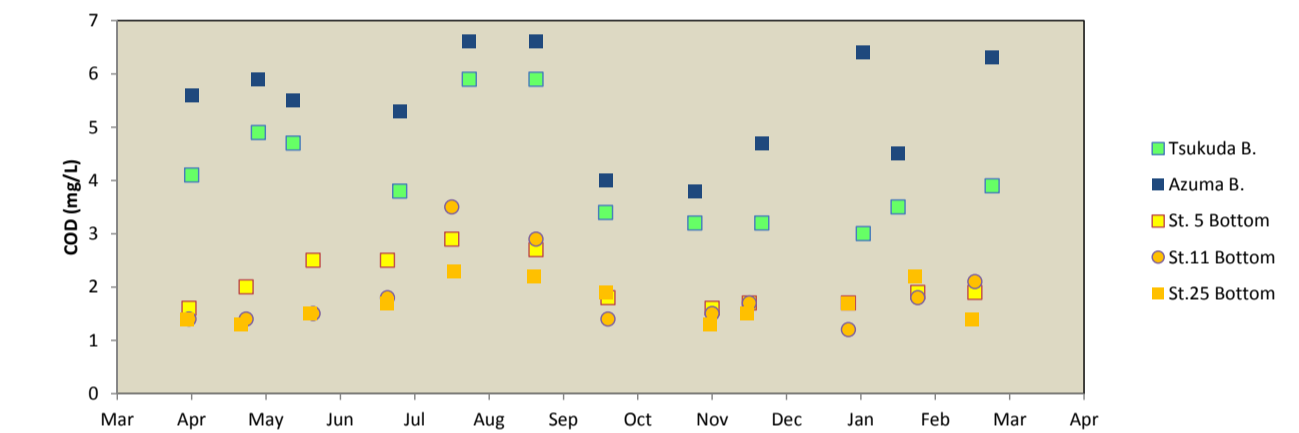
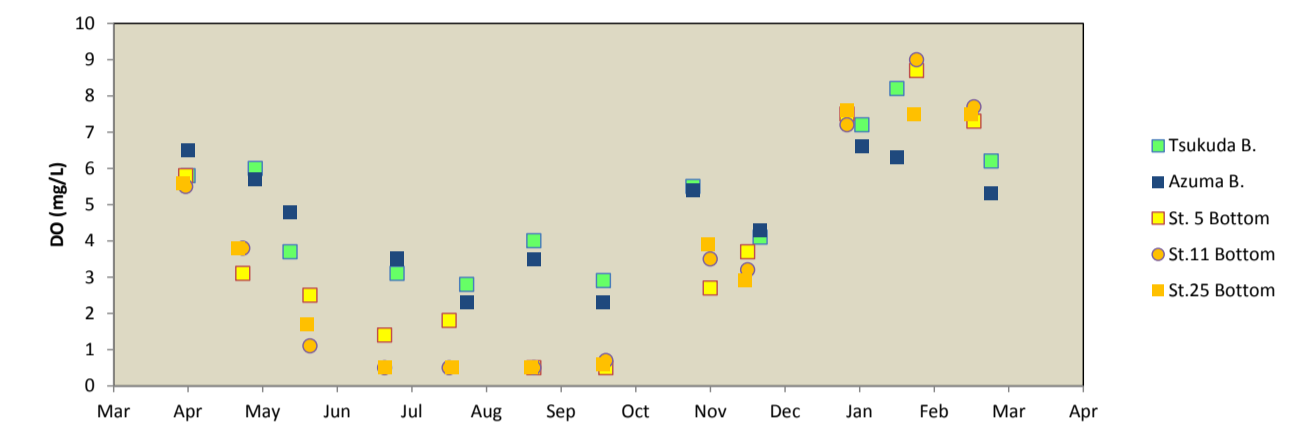
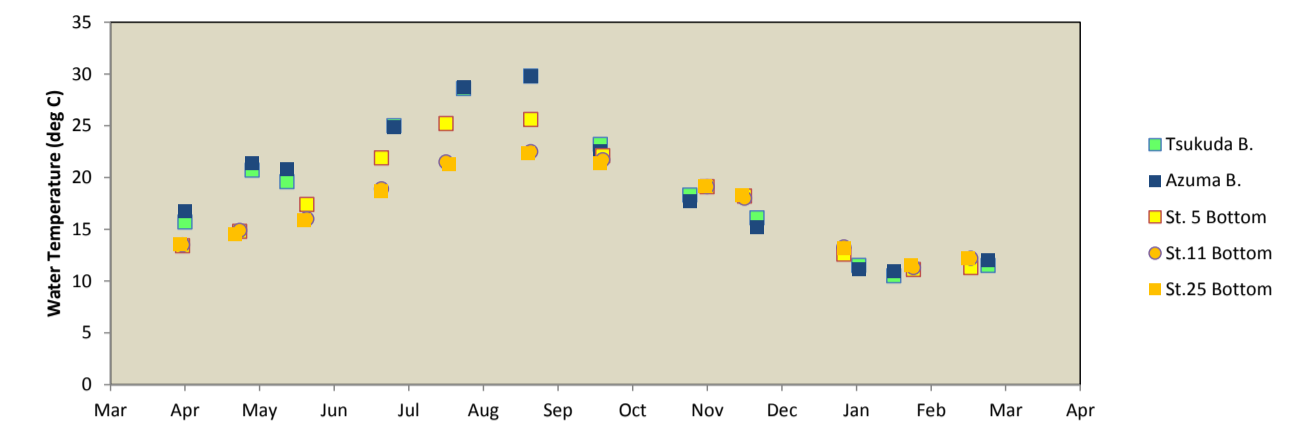
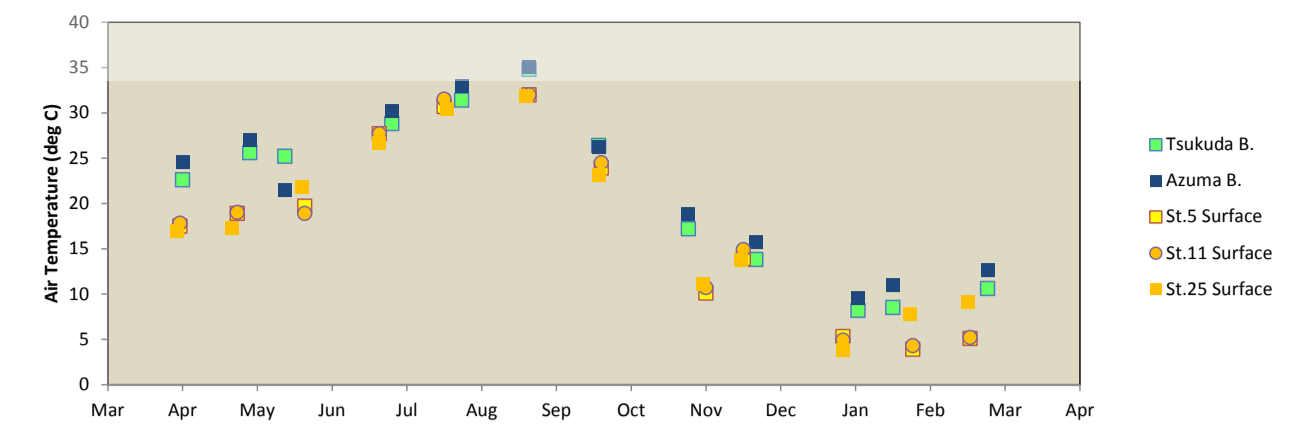
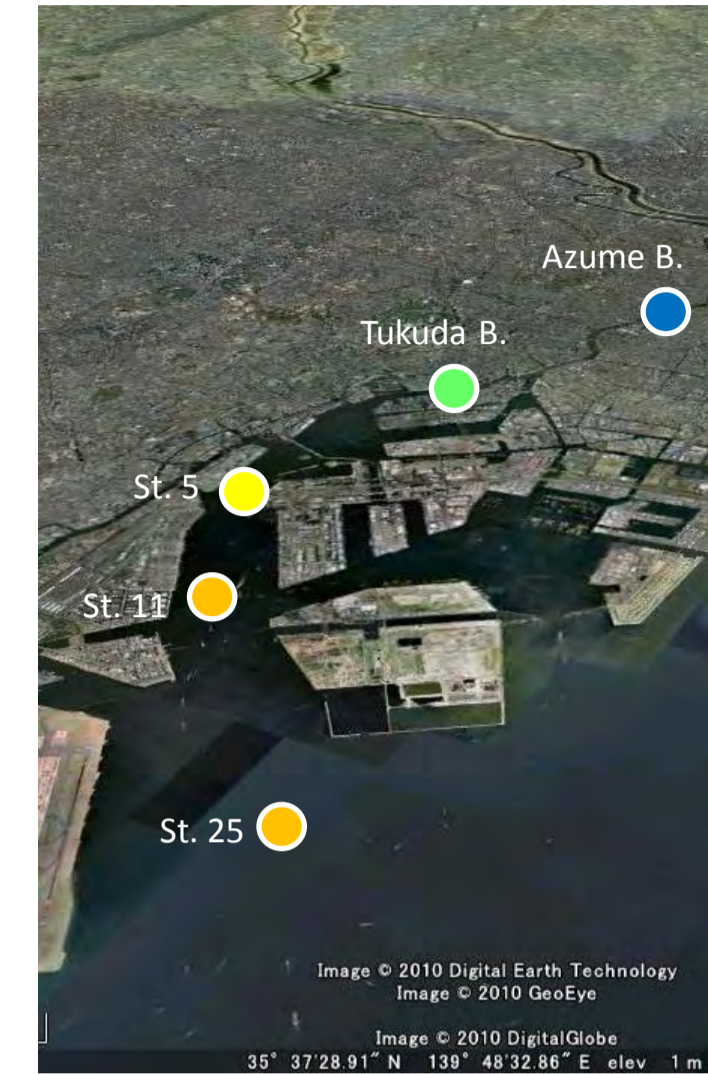
# Conceptual Model for Gobies: What should we do?



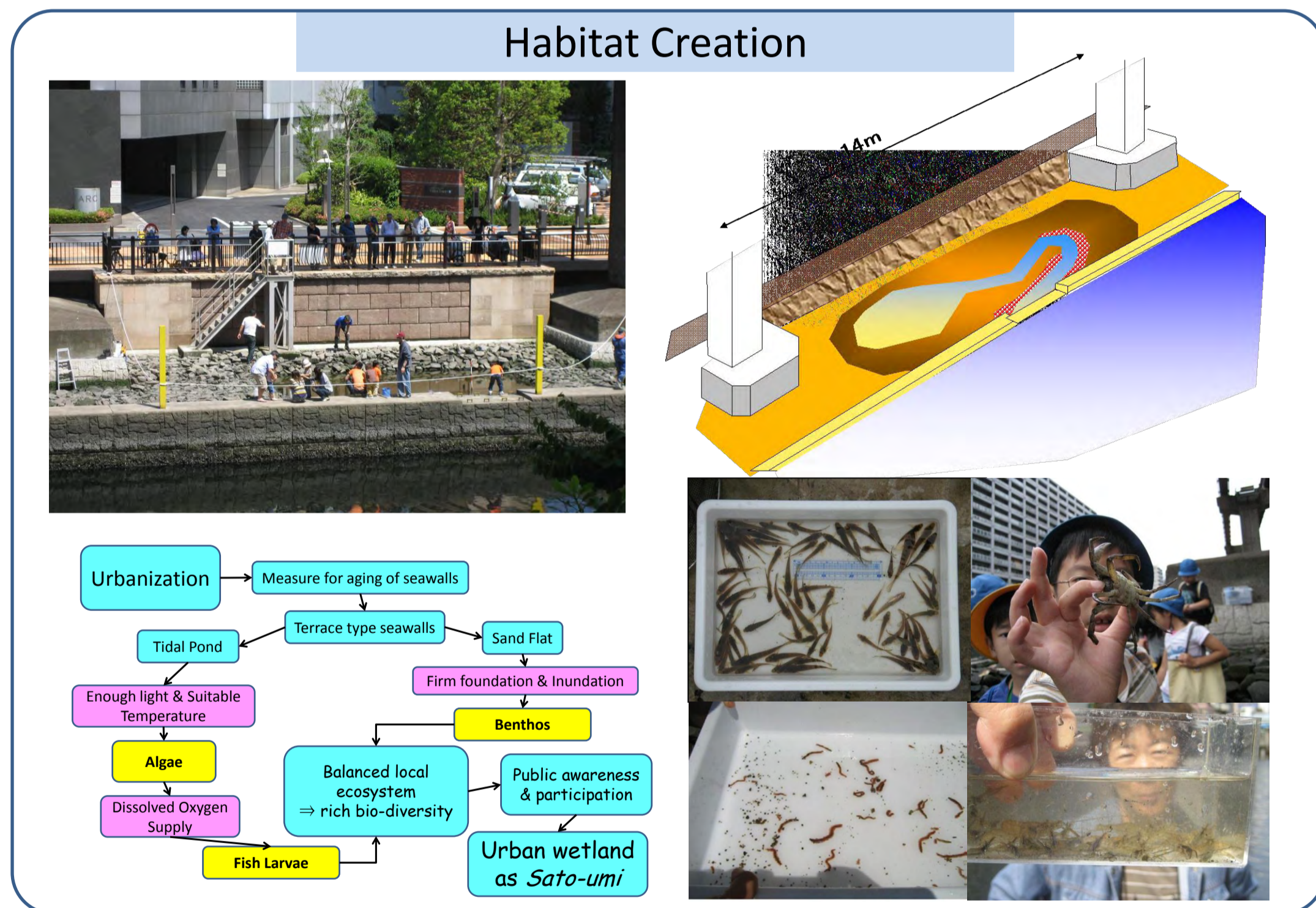
Classification of Life Stage

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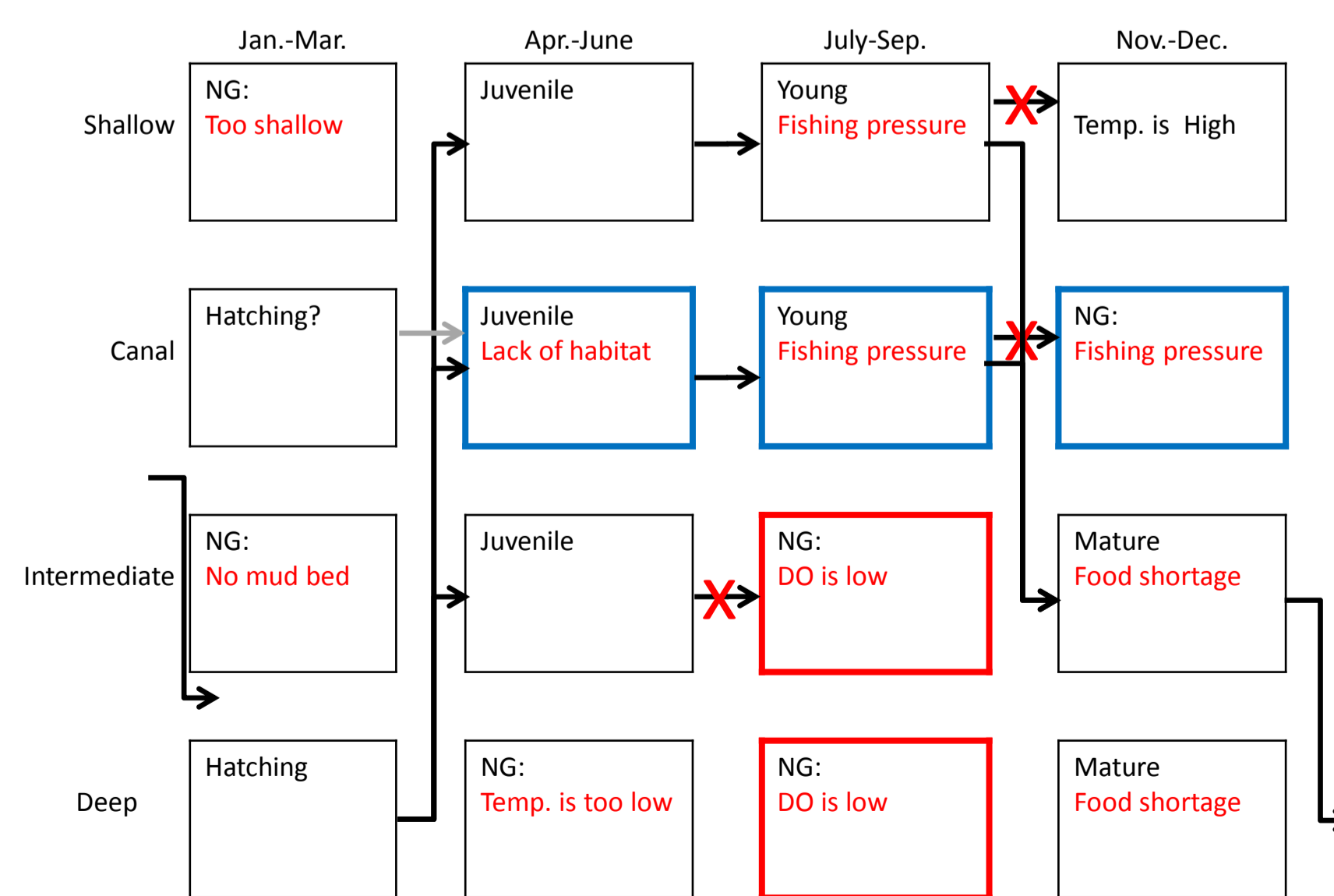
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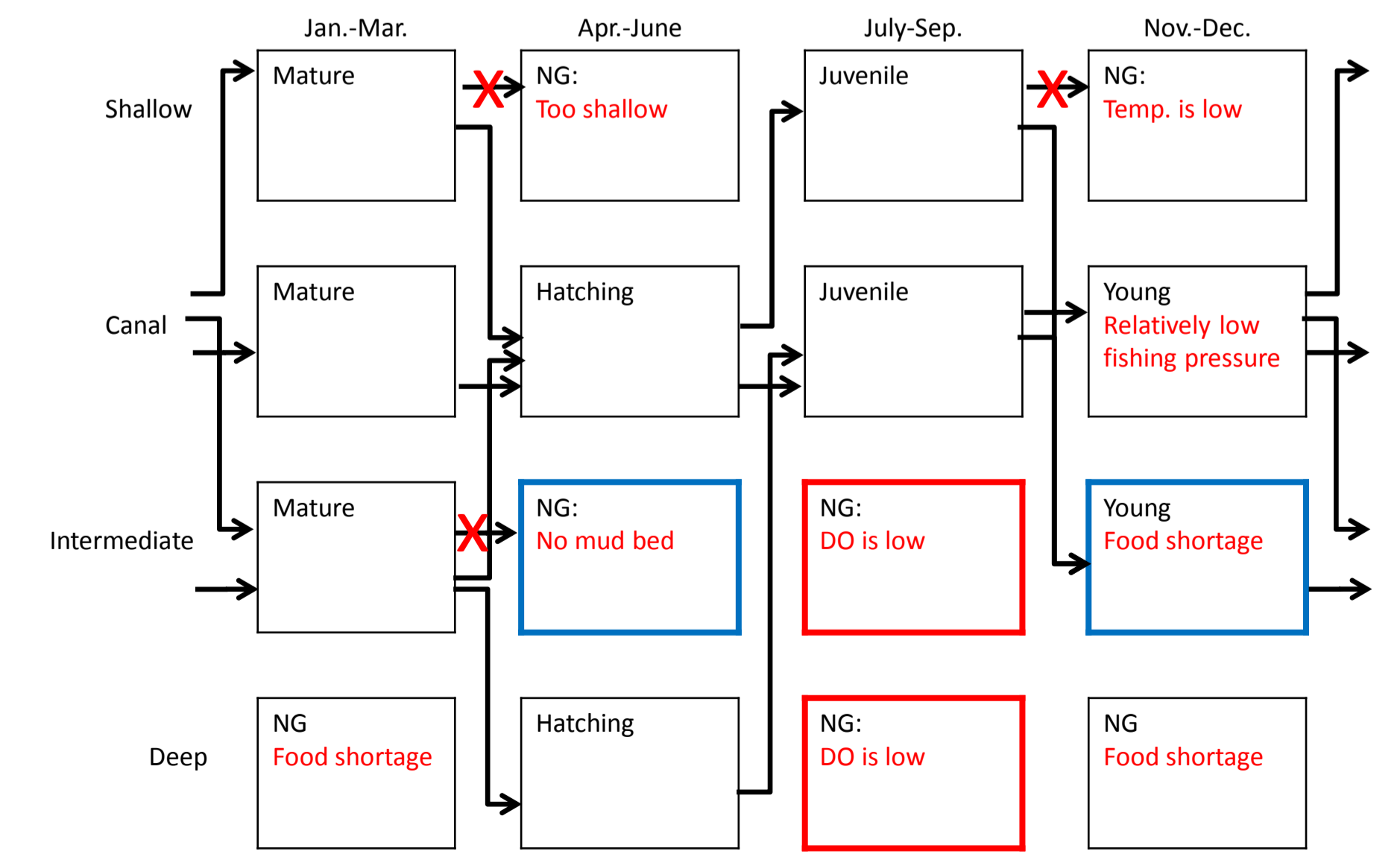
Environmental Status



Classification of Area



Conservative Model (Hatching at Winter)  
Needs control of fishing pressure



Alternative Model (Hatching at Early Summer)  
Needs hatching area restoration

## Integrated Model: Watershed size