

SUITABILITY INDEX FOR COASTAL ENVIRONMENT RESTORATION IN ENCLOSED BAY

-EFFECT OF HYPOXIC WATER AND WATER TEMPERATURE ON FISH IN TOKYO BAY, JAPAN-

Takehito HORIE¹, Tomonari OKADA² and Akira WATANUKI³

¹Team Leader of Alpha Hydraulic Engineering Consultants Co., Ltd., Email: horie@ahec.jp

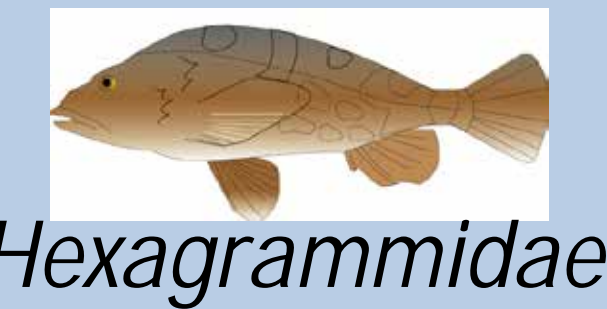
²Head of Marine Environment Div., National Institute for Land and Infrastructure Management, Email: okada-t92y2@ysk.nilim.go.jp

³Director of Alpha Hydraulic Engineering Consultants Co., Ltd., Email: watanuki@ahec.jp



Sillago japonica

We found the relationships between the total mass of fish living in Tokyo bay and environments components by the difference in time scale !



Hexagrammidae

-Painted by Y. Hirakawa-

INTRODUCTION

HSI (Habitat Suitability Index) models are a numerical index that describes the habitat quality for individual species of aquatic organism. This models are composed of SI (suitability index) models, which show the cause-and-effect relationships between biomass of target species and the variation of individual water environmental factors. Fish are often used as the environmental indicator species of HSI models, because fish are strongly related to marine algae, sea grass, water quality, and so forth, and fish are predator high in the food chain for the aquatic system.

In order to restore the marine environment of Tokyo Bay, in Japan(Fig.1), some SI models have been proposed. However, we have few precision SI models on target fish. Therefore, the objective of this study is to reveal the relationship between seasonal or daily variations of water environment components in Tokyo bay or in offshore sea area of the Pacific coast of Tokyo metro (Fig.1) and the total mass of fish living in Tokyo bay in order to create precision SI models of fish.

METHODS

There are four large-scale fishing piers, which are Ichihara, Daikoku, Honmoku and Isogo(Fig.1). Each fishing pier has been conducting fish monitoring of the TAC (total amount of catch) of individual fish species and the length of fish. Tokyo bay has some monitoring posts for water environment. In particular, Chiba Light beacon(Fig.1) has measured dissolved oxygen (DO), salinity, and water temperature, from surface to bottom with vertical spacing of 1.0m. In addition, Water temperature in offshore sea area of the Pacific coast of Tokyo is observed by Japan Meteorological Agency(Fig.1). We conducted analysis based on these monitoring data in this study.

RESULTS AND DISCUSSIONS

We show analysis results of *Sillago japonica* that live during summer in Tokyo Bay and *Hexagrammidae* that live during winter in Tokyo bay. Both of them are demersal fishes. In summer, Hypoxic water occurred not only at the bottom layer, but well up into the middle layer around Chiba light beacon (Fig.2). After a high south wind, at the same time that hypoxic water was began to attenuate, the catch of *S. japonica* per angler increased(Fig.2). In addition, other fish species also indicated a similar tendency. That is, fish living in Tokyo bay responded to the daily variation of the life cycle of hypoxic water. On the other hand, long term trends between SST (offshore sea area of the Pacific coast surface water temperature) in summer and TAC of *S. japonica* per year showed a clear correlation(Fig.3(a)). Additionally, those between SST in winter and TAC of *Hexagrammidae* showed a clear inverse correlation(Fig.3(b)). That is, it was conceivable that the seasonal variation of TAC of fish living in Tokyo bay related to seasonal variation of the Aleutian low pressure system of the north Pacific, omitting some details in our Poster.

CONCLUSION

The SI models for fish living in Tokyo bay are different by time scale. In particular, global water temperature change of open sea is the most important environmental factor considering the long time scale. Additionally, it is difficult to evaluate the original and the best suitable habitat of individual fish species in the bay where hypoxic water occurs in a wide range of aquatic systems by using HSI models, because of strong effect of hypoxic water on fishes.

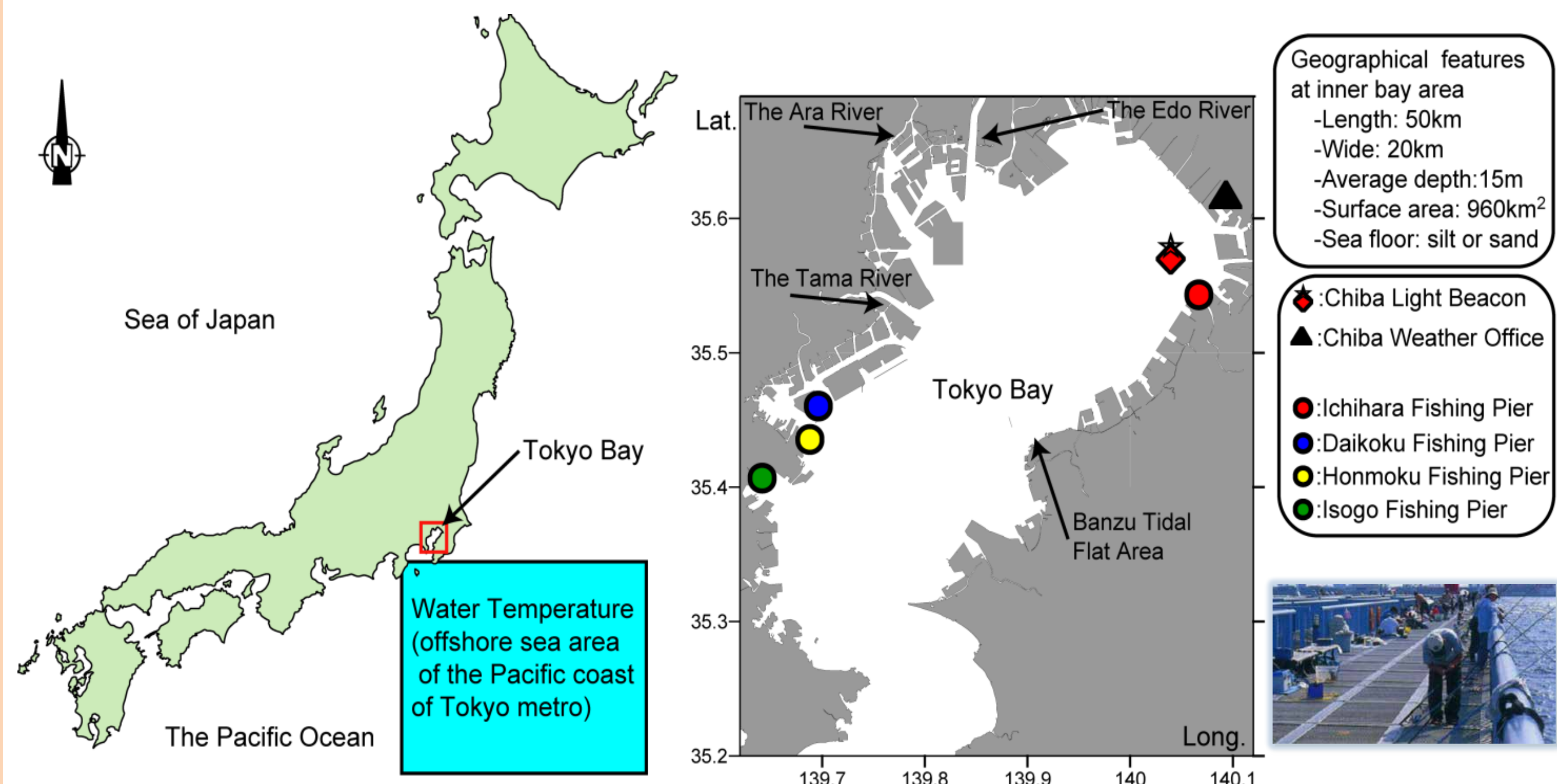


Figure 1 - Location of Tokyo bay, Japan, observation points for water environment and 4 fishing piers.

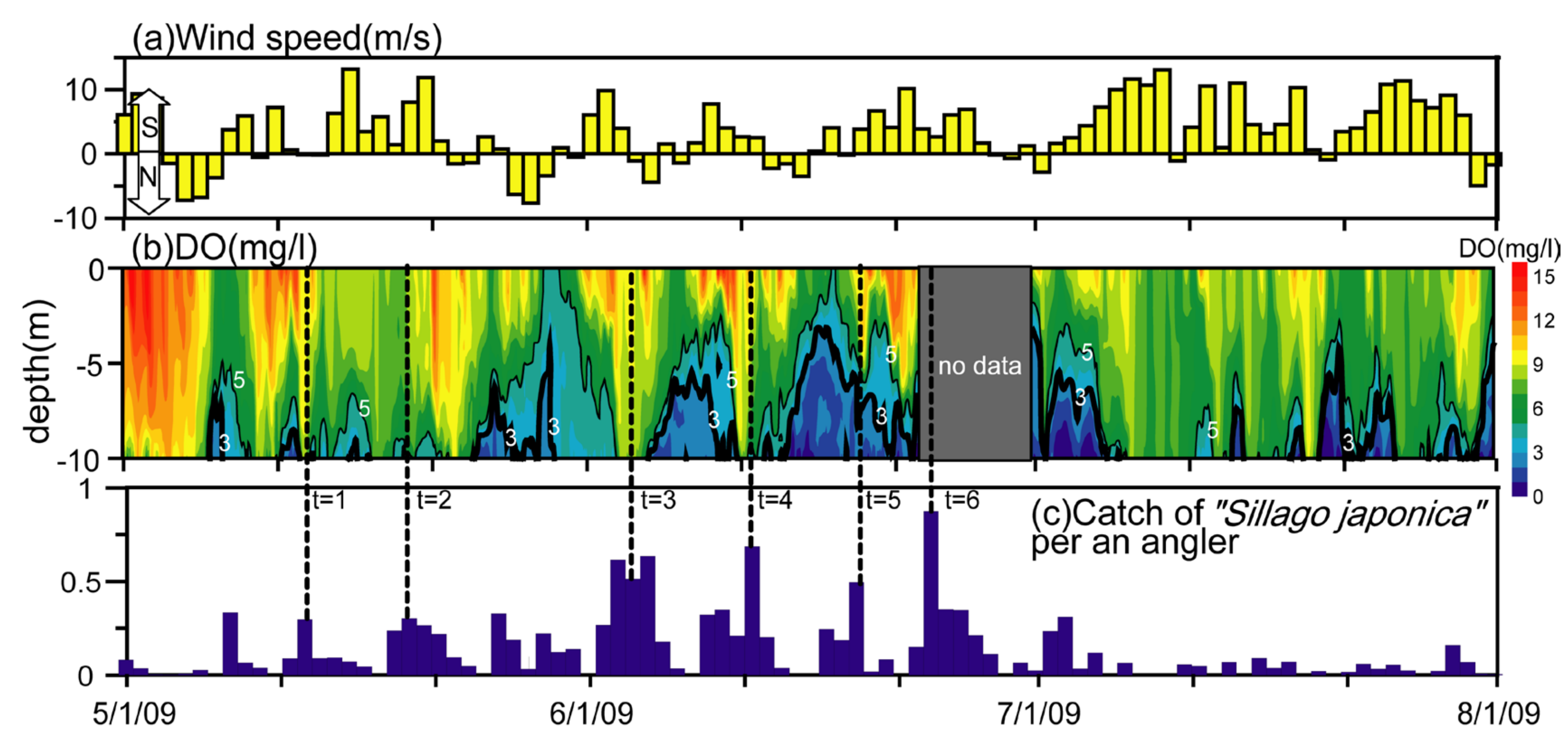


Figure 2 - Variations of (a) wind speed (North and South) at Chiba weather office, (b) DO concentration profile at Chiba Light Beacon, (c) catch of *S. japonica* per an angler at Ichihara fishing pier.

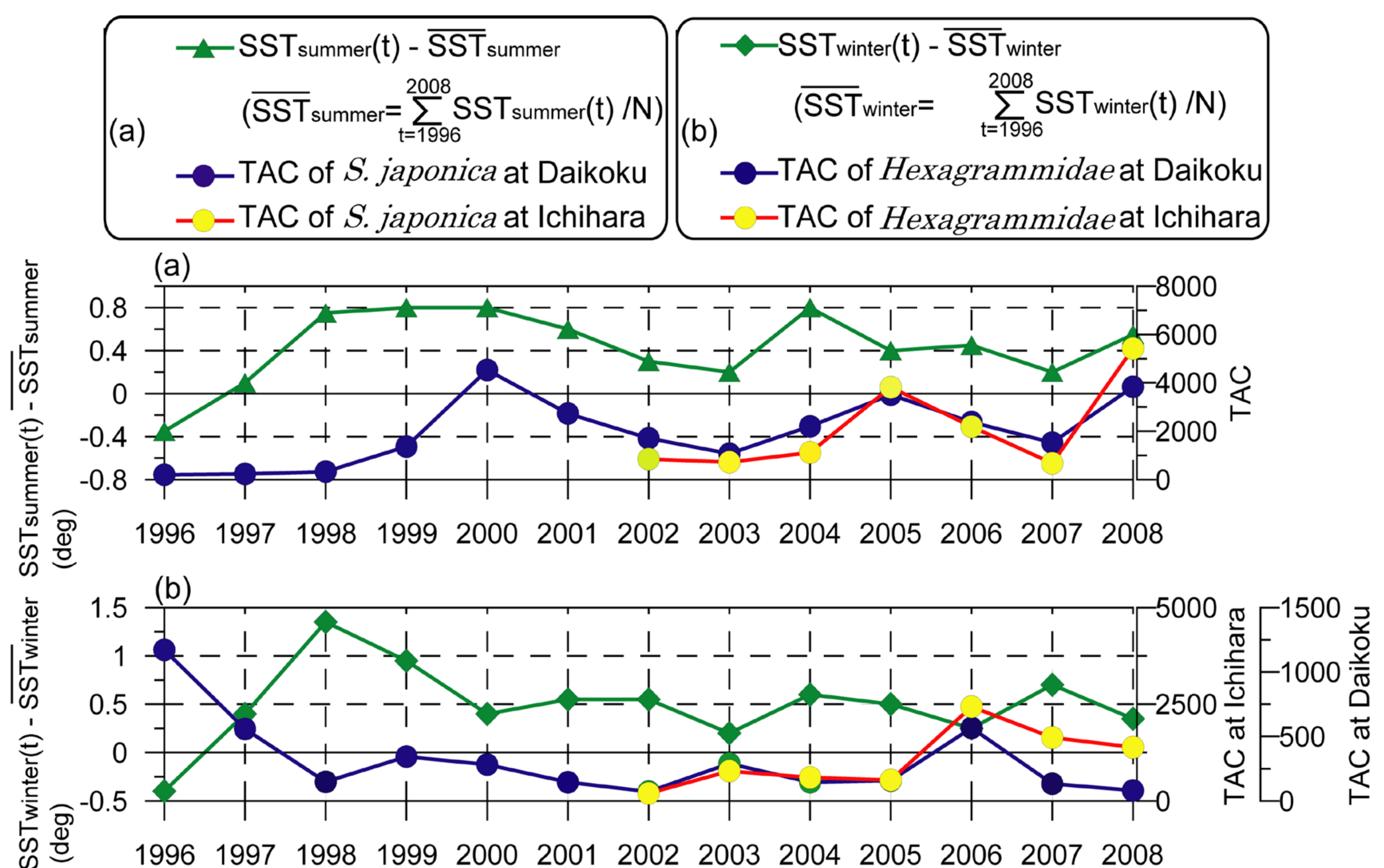


Figure 3 - Seasonal variations of (a) deviation of SST in summer and TAC of *S. japonica* per year, and (b) deviation of SST in winter and TAC of *Hexagrammidae*.