

# Importance of Considering Fish Behavior in Coastal Sea Ecological Modelling

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Our purpose is to construct a model that can predict the impact on fisheries by coastal development activities. To accomplish this, many species of fish must be incorporated in the model, because each type of fish has a different value as a fishery resource and reacts differently to development activity. In addition, the variable of fish movement must be considered because even when the total resource amount of fish does not change, fish may still move from the object area. These factors make the model complicated.

There are two categories of models to predict biomass change; structural models based on the food chain, and statistical models. Statistical models cannot predict the future status after a drastic change in environmental conditions such as from coastal development because they are based only on the past trends of biomass. Structural models are also not enough at present because almost all of them don't consider fish movement.

Meanwhile, a new concept called 'object oriented programming' (OOP) is attracting the attention of modellers. Fish behavior is easily be considered using the OOP concept. A paper about an ecological modelling tool, SSEM (a Shallow Sea Ecological Model), based on the OOP concept has already been published (Sekine et al., *Ecological Modelling*, 57, 221-236, 1991). It was designed to predict the change in biomass including organisms such as fish. It revealed that the predicted biomass calculated by SSEM and that by the traditional structural model varied greatly.

It was shown that SSEM can easily be applied even to a special environmental impact, such as toxic hazards. For example, we simulated a fatal accident involving fish caused by a check gate repairs and pesticide use. It revealed the cause of the accident and indicated the safety level of pesticide use. Once SSEM is applied to a specific environment, the formula and parameters can be stored like a database and re-used very easily.

A study was also done to calculate preferred environmental conditions of the fish. Two experimental watercourses connected by a junction were built. Different environmental conditions were prepared for each watercourse so that the fish could select their preferred area. The tested environmental conditions were: current velocity, food amount, water temperature, turbidity, existence of aquatic plants, existence of hiding places, and their combinations. Using the results of the experiments, a formula for preferred environmental conditions was calculated. Using the formula, a model for fish behavior in a water area was constructed which could predict behavior affected by human activity.

More research is needed to complete the study. Nevertheless, it is important to realize that fish behavior is really an essential factor for coastal sea ecological modelling.