Proper management of fishery resources using a bivalve growth model which included fishery catch and feeding damage

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Ariake Bay, which is one of the most prominent fishing grounds, is located in southwest Japan. The area is about 1700 km^2 with a tidal flat of about 190 km^2. Since the 1980's, fishery catch has decreased year by year. Among the suspected causes of the decrease, there are outbreaks of red tide, rise of water temperature, excessive fishery pressure and feeding damage by predators. Especially, as a cause of the feeding damage, it is reported that longheaded eagle rays (*Aetobatus flagellum*) have been seen in Ariake Bay since the 1990's, and prey on large amounts of bivalves. The eagle ray is more than 1 m in body width and 10 kg in weight. In Ariake Bay, a large number of rays appear in April and disappear in December. In this study, a simple numerical simulation model based on the bivalve growth considering fishery catch and feeding by the rays is developed and applied to assist with the proper management of fishery and extermination of predators.

The growth of bivalves is simulated as a function of water temperature. The quantity of natural resources of the bivalves is calculated by multipling recent population density by habitation area. The fishery catch is estimated by summing up values of monthly catch from statistical reports. Monthly catch amount is more than 500,000 tons in the big catch years and equal to or less than 10,000 tons in the poor catch years. The biomass of the ray is estimated to be more than 3,000 tons based on the amount of capture for extermination. The daily amount of predation on bivalves by the rays is calculated to be 1% of the biomass during the appearance period.

As a result of this simulation, the bivalve resources varied according to the biomass of the rays. It was indicated that the predation pressure by the rays could be a serious factor affecting bivalve resources. With the big catch amount of the past years, the bivalve biomass of recent years was entirely consumed causing the exhaustion of the bivalve. It clearly explains that the current bivalve resources cannot support the same amount of fishing as in the past. Under the conditions of both predations of the ray and past fishery catch, bivalve resources were diminished. To maintain the resources with this predation and catch, a biomass 4 times larger than recent bivalve populations is required. Our simulation model has revealed that it is important to decrease the feeding damage and to manage the fishery catch properly to maintain the bivalve resources.

Monitoring of macrobenthos and bivalve for biologically productive artificial tidal flats, Ago Bay, Japan

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Ago Bay in Japan is a typical enclosed coastal sea, which is connected to the Pacific Ocean through a very narrow and shallow entrance. The bay has been extremely contaminated by the practice of culturing pearls, which has been ongoing for the past 110 years. Because sediment eutrophication, oxygen deficient water and harmful algal blooms have occurred in recent years, the pearl culture industries were damaged. To address this problem, many attempts are being tried in order to improve the natural self-cleaning capability in the bay region by forming artificial tidal flat, shallow water area and sea algae and/or sea-grass bed inside the bay. To clean up the dredged sediments accumulated at the bottom of the sea, where the contamination is progressive, we are exploring the technologies to decompose the organic materials. This new technology-the Hi-Biah-System (HBS)-was developed in 2005. This system could dewater muddy dredged sediments and coagulate them to the solidified sea bottom