

Pearl Culture Waste, Nutrient Load from Land or Loss of Tidal Flat, What is the Cause of the Deterioration and What Should Be Controlled for the Restoration of Ago Bay Environment?

Satoshi Chiba¹, Yasuhiro Shimizu², Hideki Kokubu² and Hiroshi Tachi²

¹Faculty of Environmental and Information Sciences, Yokkaichi University, Mie, Japan

²Mie Prefecture Fisheries Research Institute, Mie, Japan

Ago bay is a small semi-enclosed coastal sea and is known as a typical “Sato-Umi” area of Japan. The economy of the area has prospered due to rich fishery resources including its famous pearl culture industry. This water body has been extensively used for pearl culture since the 1950s and is now suffering from environmental deterioration such as the settlement of hypoxia water, the accumulation of organic matter in the sediment and the reduction of diversity in the benthos ecosystem. Pearl production has also gradually dropped and is currently only one-fifth of the production of the 1960s. Self-pollution by the pearl culture industry has been suspected as the sole cause of the deterioration, but recent studies performed by the authors have led to a new view of the cause.

As presented in the previous EMECS8 conference, we developed an integrated ecosystem model of Ago Bay by gathering a large number of observations and experimental data, and by tuning parameters of the model with that data. The model consists of a low-trophic ecosystem model in water, a one-dimensional early diagenesis model of sediment and a multi-generation pearl oyster growth model. This time, we utilized the model to measure the contribution of several environmental factors. The factors we considered are the number of the cultured oysters, the nutrient load from the watershed area as well as that from the outer sea, and the areal change of tidal flats. We performed a long-term simulation that covers 50 to 100 years to take into account the slow process in the sediment.

The results show that pearl culture does not have direct influence on the degree and extent of the hypoxia seawater, contrary to the common belief. The influential factors on the hypoxia seawater around the bay head area are the nutrient load from both the watershed area and the outer sea, and the areal change of tidal flats. The degree of influence from the outer sea was comparable with that from the watershed area. The efficacy of tidal flats very much depends on the difference between the amount of influx and efflux of nutrients. The most noticeable point is that the number of pearl oysters, which determines the amount of pearl culture waste, has little influence on the hypoxia seawater. This result comes from the fact that the total amounts of particulate organic matter (POM) settled down to the sea bed of the entire bay are not increased by the cultivation activity.

On the other hand, up to 50% increase of POM in the sediment in the vicinity of culture rafts was confirmed. The concentration of AVS was also higher there and the effusion of hydrosulfide occurred in the extreme case. These results brought us a new view of the function of pearl culture. That is, to say, a deterioration of the habitat of benthos. The destruction of the benthos ecosystem by the pearl culture could be linked to the deepening of the hypoxia seawater through a reduction of POM decomposition rate in the sediment.

Recently, the council for nature restoration of Ago Bay area which is expected to play a principal role in the planning and execution of restoration projects was organized by including administrators, fishermen and citizens of the district (Shima city) and researchers. We are going to present the current conclusion to the council.

Contact Information: Satoshi Chiba, Faculty of Environmental and Information Sciences, Yokkaichi University, Kayochou, Yokkaichi, Mie 512-8512, Japan, Phone: +81-59-340-1620, Fax: +81-59-365-6630, Email: chiba@yokkaichi-u.ac.jp