New technology for developing biologically productive tidal flat with use of muddy dredged sediment in Ago Bay, Mie prefecture, Japan

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Ago Bay is located in Ise-Shima National Park, Mie prefecture, Central Japan. This bay is famous for the pearl oyster culture because this is the first place where the artificial culture of pearls was succeeded and the pearl oyster culture has been continued for more than 100 years. However, harmful algal blooms and infectious diseases make the pearl oyster culture for whole year difficult. Furthermore, sediment eutrophication and frequent occurrence of oxygen-deficient water has caused the deterioration of benthic ecosystem and decrease of biological productivity in recent years. It is considered that one of the major causes of these phenomena is stagnation of the material circulation by reduction of shallow coastal area including a tidal flat, sea glass and sea weed beds. We made clear by the multi-spectrum aerial picture analysis that approximately 70% of tidal flat and shallow area decreased by land reclamation and other artificial environmental transformation in Ago Bay. Therefore, for environmental restoration of Ago Bay, it is necessary to enhance the natural purification capacity which tidal flat, sea glass and sea weed beds provide, and to recover a smooth material circulation around the shallow area. We developed new artificial tidal flat using muddy dredged sediment which contains rich-organic matters and is usually treated as a useless material in Ago Bay. The present study is a part of the Ago Bay Environmental Restoration Project under the program of Japan Science and Technology Agency.

We set up the six experimental tidal flats in which the mixing ratio of dredged sediment with sand (original sandy sediment of the area) is changed. Sediment quality and benthic species of experimental tidal flat study areas have been monitored for three years. The field study shows the following results: 1) The number of the benthic species in the experimental tidal flat constructed muddy dredged sediment was increased after six months, and stayed the steady state which was the same level before the tidal flat construction after 12 months. 2) The suitable range of sediment quality condition of tidal flats for benthic species was found to be 3-10mg/gDW for COD and 15-35% for mud content ratio (silt and clay content ratio). These results mean that benthic species is decreased not only when organic matter and mud content is too much in a tidal flat sediment, but also when organic matter and mud content is too less in the sediment. Accordingly, artificial tidal flat mixed with muddy dredged sediment rich in organic matters and natural tidal flat sediment provide better condition for the habitat of the benthic species than a conventional construction method of a tidal flat which uses clean sand.

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