NEW STRATEGIC ECOLOGICAL METHOD FOR PREVENTING THE EUTROPHICATION IN THE ENCLOSED COASTAL SEAS

Machiko Yamada, Assistant Manager, Ryota Shinohara, Director, Aqua Research Center, Kitakyushu Municipal Institute of Environmental Sciences, Shin-ike, Tobata-ku, Kitakyushu 804, Japan
Shigeru Montani, Professor, Department of Bioresource Science, Kagawa University, Miki-chou, Kagawa 761-07, Japan
Hiroaki Tsutsumi, Professor, Laboratory of Marine Biology, Prefectural University of Kumamoto, Tsukiide, Kumamoto 862, Japan
Tetsuo Yanagi, Professor, Department of Civil and Ocean Engineering, Ehime University, Bunkyo-machi 790-77, Matsuyama Japan
Shin-ichi Uye, Professor, Faculty of Applied Biological Science, Hiroshima University, Kagamiyama, Higashihiroshima 739, Japan
Hitoshi Kito, Professor, Department of Aquaculture, Shimonoseki Fishery University, Nagatahon-machi, Shimonoseki 759-65, Japan

To improve environmental conditions in an enclosed bay with extremely eutrophicated water, Dokai Bay, Kitakyushu City, Japan, we have conducted a comprehensive research project, "eco-remediation method project", since 1994. It includes 5 different collaborated studies for development of new eco-technologies to treat eutrophicated water and organically polluted bottom sediment, establishment of numerical ecological model for management of N and P levels of sea water, and development of new technologies to produce commercial products from the organisms that can be obtained from these studies. In this research project, we are aiming at promoting material circulation with activities of marine organisms in the bay system as shown in Fig.1.

Eutrophication caused by human activities has resulted in serious environmental problems in enclosed coastal ecosystem in various geographical locations throughout the world. However, no effective measures have proposed to control N and P levels of the sea water. We hope that our eco-remediation technologies could be applicable to improve environmental conditions in other various enclosed bays that have been suffered from environmental disturbance due to eutrophication.

Detail of each study in this research project is described below.

Study 1 : Development of water purification technology with fouling animals

From spring to autumn, red tide organisms bloom frequently in the eutrophicated bay, while fouling animals on the quay that include a mussel,

Mytilus galloprovincialis, often exhibit potentials to graze the phytoplankton vigorously. We are trying to apply these biological activities to decrease the density of phytoplankton in the water. We set many nets and ropes that the mussels can recruit along shore side and collect them.

Study 2 : Development of water purification technology with macro algae

In winter, macro algae that include a brown alga, tend to grow thickly in the bay, taking up nutrients from the sea water. We are also planning to set ropes along shore side to cultivate the macro algae, aiming at promotion of nutrients uptake by them.

Study 3 : Development of sediment purification technology with benthic animals

A polychaete, *Capitella* sp. I, is the most dominant benthic species at the most organically polluted areas of the bay. Recent studies on the biological impacts of this species on the chemical conditions of the sediment reveal that it can decompose the organic matter and oxidize reduced sulfides of the sediment very efficiently. We are trying to enhance these impacts on the sediment by artificially establishing a dense patches of this species and introducing its rapid population growth during winter.

Study 4 : Development of Numerical Ecological Model for Management of N and P levels of the sea water

An ecological numerical model is required not only to determine the scales of facilities for the culture of mussel (study 1) and macro algae (study 2) that can significantly promote the uptake of red tide organisms and dissolved nutrients from the water, but also to make a administrative policy to manage the water quality of the bay. We have been collecting physical, chemical and biological data to establish a highly reliable model from field monitorings and laboratory experiments.

Study 5 : Development of new technologies to produce commercial products from the organisms that can be obtained from study 1 and 2.

We are planning to produce fertilizer, medicines, feed for cultured fishes and domestic animals etc. from the mussels and macro algae that can be obtained from study 1 and 2.

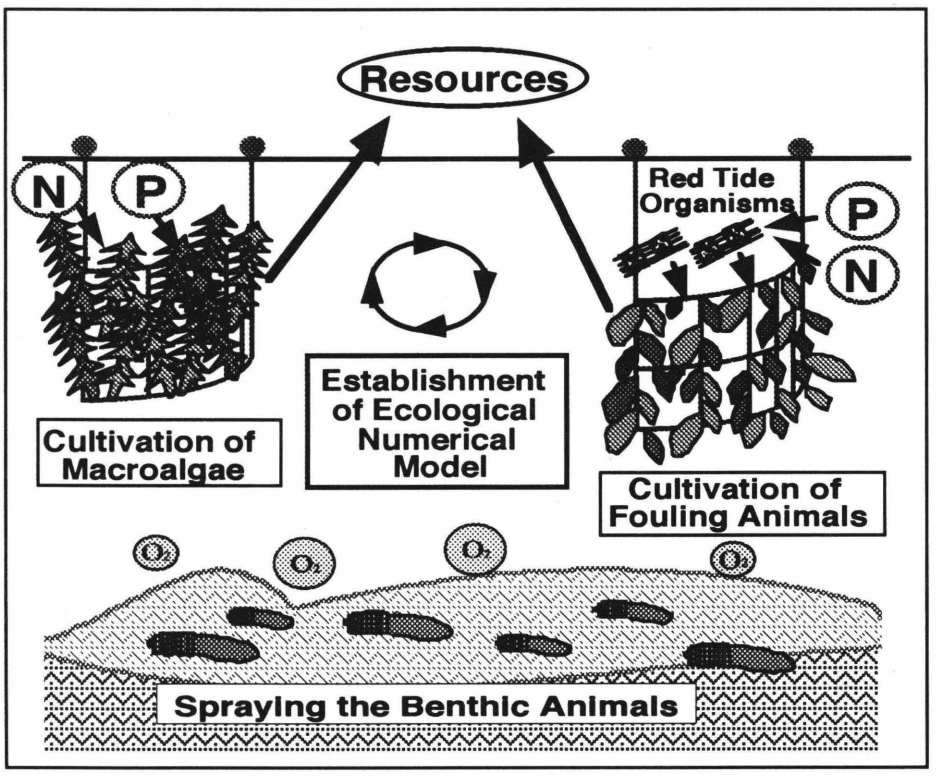

Fig. 1 A scheme of our comprehensive research project, " eco-remediation method", to improve environmental conditions in an enclosed bay with extremely eutrophicated water.