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Evaluation of the Contribution of Anthropogenic and Natural Components in Eutrophication Problems

— For Proper Integrated Coastal Management —

Tetsuya Takahashi*

SUMMARY

The eutrophication problems represented by red tides and hypoxia are now widely spread in the world's aqua-systems. Eutrophication occurs as the result of overlap between human impacts and natural phenomena. These age-old problems are unsolved and even spreading and worsening. Today, eutrophication has become a global environmental problem comparable to global warming. The difficulties of eutrophication problems can be distilled into two aspects. First is the anthropogenic aspect, that eutrophication is closely related to food problems. Second is the unknown natural contribution to eutrophication. This study is composed of two studies on the anthropogenic and natural effects on eutrophication.

Keywords: water system, DO, eutrophication, natural environmental effect, anthropogenic environmental effect, ICM

1. Anthropogenic effects on eutrophication:

The shift from organic to inorganic fertilizer in the 19th and 20th centuries led to food production being based on mineral resources and air. Since then, large amounts of nitrogen and phosphorus have been put into the soil as fertilizer and flowed out toward the sea, causing global eutrophication in aqua-systems such as underground water, rivers, lakes, and semi-enclosed seas. Although global eutrophication bears a marked similarity to global warming, its significance has been largely overlooked in comparison.

Among the countries pressed by the eutrophication problems, Japan is anomalous because of its low food production. The USA, EU, and China account for a large percentage of world fertilizer use and excess fertilizer induces eutrophication problems. In Japan, domestic wastewater is the dominant source of eutrophication, which originates from imported food and fertilizer. Differences between producing and consuming countries lead to a gap in awareness and countermeasures against global eutrophication. Food producing countries are strengthening the integrated control of water-systems, including agriculture. In Japan, a decline in the ratio of food self-support is frequently pointed out as a

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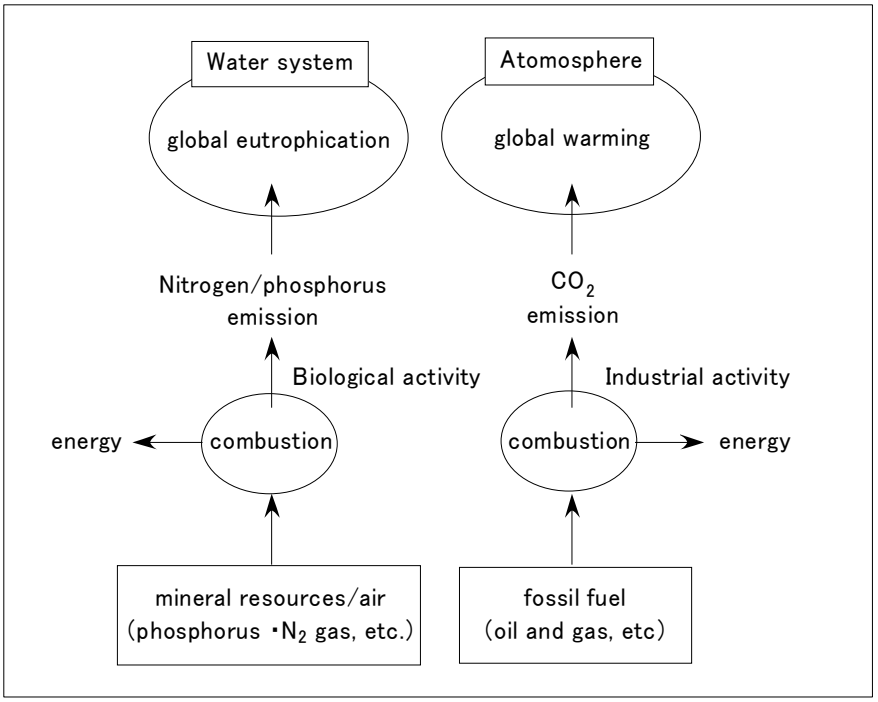

Fig. 3 Analogy between eutrophication and global warming.

problem for food security, though discussion of the global environmental aspects are lacking.

2. Effects of natural phenomena on eutrophication

Recent studies have pointed out the comparable contribution of natural phenomena to eutrophication problems. Even in semi-enclosed bays with a concentrated watershed population, the natural effect is not negligible. This fact complicates eutrophication control.

In this section, the natural component in eutrophication problems (hypoxia) in semi-enclosed bays in Japan is estimated using the box –model analysis. The study fields are Ise, Osaka, and Tokyo Bays. These are the three major bays of Japan, which are similar in size, latitudinal location, the existence of river discharge, and the frequent occurrence of water pollution such as hypoxia.

The dissolved oxygen concentration (DO) is determined by respiration and water exchange rates. The effect of water exchange is defined as the natural component and evaluated by a simple model based on the box-model analysis. The calculated DO agrees well with the observed DO. The results indicate that the oxygen decrease in Ise Bay is induced mainly by change in the water exchange rate, and that Ise Bay is highly vulnerable and the bottom sediment is suggested to be highly organic-polluted. The rapid recovery of DO by the nitrogen and phosphorus reduction policy cannot be expected, as it requires a countermeasure for reducing the concentration of organic matter in the sediment.

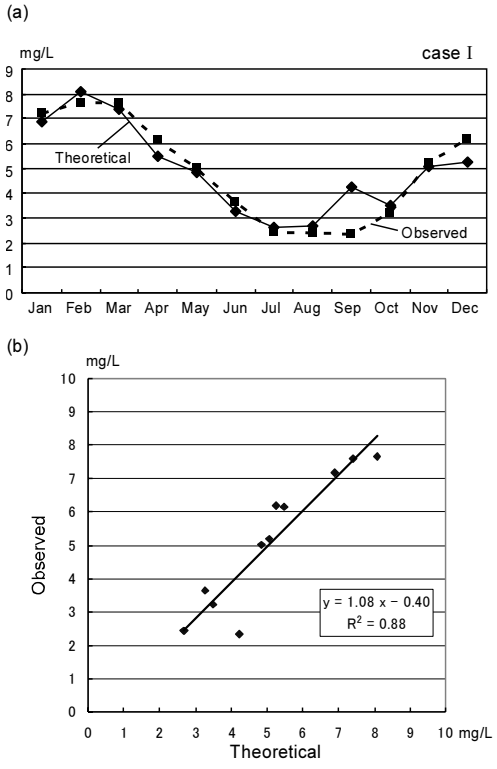

Fig. 5 (a)Seasonal variation in observed and calculated DO with constant respiration rate.
(b) Map of observed and calculated DO.
(Repiration rate:constant, residence time:variate)

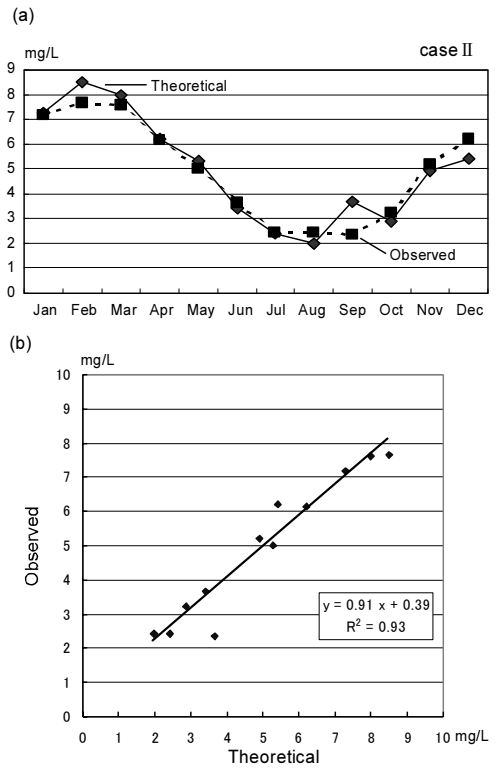

Fig. 6 (a)Seasonal variation in observed and calculated DO with constant respiration rate.
(b) Map of observed and calculated DO.
(Repiration rate:variate, residence time:variate)

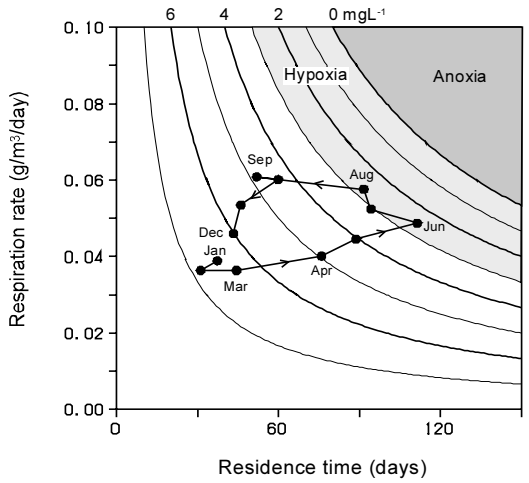

Fig. 7 The variation in respiration and residence time in Ise Bay.

An Analysis of the Impact of Land-based Water Pollutant Flowing into the Sea of Japan and Optimal Allocation of Environmental Investment among the Countries in the Sea of Japan Area

Katsuhiro SAKURAI*

SUMMARY

This study focuses on the Sea of Japan, a sea area located along the northeastern part of the Asian continent. It is separated from the North Pacific Ocean by the Japanese Archipelago and Sakhalin. The Sea of Japan area consists of Japan, DPR Korea, South Korea, China, and Far East Russia in Northeast Asia. Cooperation among these countries is necessary to manage the ocean environment and attain sustainable development in the region.

The purpose of this study is to present an optimal international investment model for the water environment that takes into account, through dynamic simulation, the economic situations and environmental influences of this area over a certain period of time. The system simulation model is formulated by an objective function, which is defined as the maximizing of total GDP, the structure of the environmental system, and the socio-economic system of target countries and regions in the coastal areas of the Sea of Japan.

To determine environmental impact, the total amount of land-based water pollutant from human activities in coastal areas of the Sea of Japan is estimated by the unit value method. The pollutant index measure in this study is COD (Chemical Oxygen Demand). The total amount of COD inflow is derived by multiplying the total amount of COD emission of socio-economic activity by the environmental purification ratio.

Next, socio-economic activity is analyzed in the model from a regional economic perspective. Human activities in the land area are divided into industrial and household activities, and it is assumed that water pollutant is originated by two sectors of wastewater.

Industrial activity is classified into the 6 categories of agriculture, manufacturing industry, construction industry, communication and transportation industry, commerce and service industry, and others. It is assumed in this model that “others” emit no water pollutants. Household wastewater disposal system is also classified into the following 6 types of treatment facilities: sewage system, rural community sewage system, combined treatment septic tank, treatment septic tank, night soil septic tank, and untreated domestic wastewater.

Next, an investment policy to reduce the land-based water pollutant from coastal areas into the Sea of Japan is evaluated by a system simulation approach. It establishes several simulation cases, and the running period is set from 1995 to 2007 in the calculation. For example, Case00 is assumed as the basic

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case maximizing GDP of the target area in the last term with restriction of 0% reduction rate of COD inflow based on 1995 data.

As a result of the simulation, a feasible solution is obtained, in which 6% maximum reduction rate of COD inflow of the first period (1995 level) is achieved through the simulation term. It is concluded that Case06 is the feasible and preferable solution from environmental and economic viewpoints in the target area, which means the average amount of COD emission and economic development in the coastal area of the Sea of Japan. It is also important for abatement of water pollutant to invest in environmental policy and to promote technologies through industrial and economic development. Furthermore, countries and regions around the Sea of Japan area have to cooperate for integrated ocean management in various activities, such as the efficient investment for industrial abatement of water pollutant and for the regional economy. This study shows that quantitative analysis is important and gives useful information for future perspectives and policy evaluation.

Key words: the sea of Japan, impact of land-based water pollutant, optimal allocation of environmental investment, COD dynamic simulation

Science and Politics in the International Whaling Regulation:

Toward a Revision of Japanese Whaling Diplomacy

Ayako Okubo*

SUMMARY

In the mid-1990's, IWC formally adopted an outcome of scientific assessment, the revised management procedure (RMP), which had been recommended by a consensus of scientists of the Scientific Committee of IWC, for situations where scientific uncertainty and value-conflict are unavoidable. Nevertheless, disputes over resumption of commercial whaling continued during the negotiations at the most recent meeting of the International Whaling Commission (IWC). RMP is a calculation procedure of catch limits for commercial whaling that can avoid serious increases in the extinction risk of whale stocks. This article analyses the development process of RMP and identifies characteristics of the scientific assessment that provides a useful basis for international consensus building. It then considers what implications are derived from those characteristics for current utilization of science in IWC. Furthermore, with the aim of testing widespread discourses and assumptions related to whaling issues and establishing a ground for elaborating pragmatic policy options, the appropriateness of Japanese whaling diplomacy is examined in light of the long-cherished target of the Japanese government, i.e., the resumption of commercial whaling. Lastly, this article suggests possible options for Japanese whaling diplomacy in the near future. Policy agendas for each option are also discussed.

Key words: science and politics, whaling, Japanese diplomacy, resource management, IWC

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Building an Integrated Container Network and Policy in Northeast Asia

－An Anlysis of Current East Asian Reginal Ferry Network－

Han, Jong-Khil*

SUMMARY

This paper focuses on development and integration of the East Asian regional ferry network. Presently, the East Asian economies are moving to integration. An integrated transportation network is the base of economic integration. A ferry system currently connects the three East Asian countries with transportation for passenger and cargo. Thus, in this paper, we analyze 1) the present condition of the ferry network, 2) how to identify problems and priorities for the opening of new ferry routes by shipping companies, 3) how to react to the current development of the regional ferry network for Osaka Port.

Major findings of this research are as follows. Firstly, the barriers to opening anew China-Korea ferry route are, 1) procurement of a suitable vessel, 2) flexibility in the Chinese CIQ service, 3) speedy work on the ferry terminal, 4) development of a transportation network between the terminal and hinterland. Secondly, barriers to opening a new Japan-Korea ferry route are, 1) volume movement of cargo and passengers, 2) convenience of multimodal transportation, 3) flexibility in the CIQ service, 4) a connecting transportation network to the hinterland.

Thus, we propose the following policy measures for Osaka Port, 1) add more flexibility in the CIQ service, 2) develop and redesign the transportation network that connects to the hinterland, 3) enrich the multimodal transportation system, 4) up-grade space and facilities for passengers.

Key words: East Asia, ferry,integration, opening of new ferry routes, barriers.

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