

総説

「きれいな海」から「豊かな海」へ

－ “干潟・浅海域と湾央域” 及び “底生系と浮遊系” の
カップリング (内湾複合生態系モデル) から見えてきたもの－

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Abstract

A new ecosystem model - the first model describing the ecological connectivity consisting of both benthic-pelagic and central bay-tidal flat ecosystem coupling while describing the vertical micro-scale in the benthic ecosystem, simultaneously - was developed and applied to Tokyo Bay (Sohma *et al.* 2005a). The model permits the prediction/evaluation of the effects of environmental measures, such as tidal flat restoration, sand capping, dredging, and nutrients load reduction from rivers, on the hypoxic estuary from the perspectives of (1) the whole estuary composed of temporal-spatial mutual linkage of benthic-pelagic or central bay-tidal flat ecosystems (holistic approach), and (2) each biochemical and physical process contributing to oxygen production/consumption (elemental approach). The model outputs demonstrated the significant ecosystem responses as follows. First, the oxygen consumption in the benthic system during summer was quite low due to low level of dissolved oxygen (hypoxia), although reduced substances, Mn^{2+} , Fe^{2+} , and S^{2-} , were highly produced and accumulated in the pore water. This result denotes importance to use the oxygen consumption rate under the high level of dissolved oxygen as the index of hypoxia potential. Second, both the tidal flat creation and nutrients load reduction decreased the anoxic water volume and mass of detritus in Tokyo Bay. However, the tidal flats creation led to the higher biomass of benthic fauna, while the nutrients load reduction led to the lower biomass of them compared to the existing situation. This result clarifies the differences from the measure aimed at a “bountiful ocean; a non-hypoxic and rich production of higher level trophic biology” to the measure just aimed at a “clear ocean; a non-hypoxic and low level of particulate organic matter” and also the differences from a bountiful ecosystem to a higher water quality. Lastly, in the simulation, Tokyo Bay reproducing reclaimed tidal flats (earlier Tokyo Bay system) prevented the increase of oxygen consumption potential (hypoxia potential) and the decrease of the higher trophic production to red tide compared to the existing Tokyo Bay system with reclamation of tidal flats. This result demonstrates the higher ecosystem tolerance of the earlier Tokyo Bay to red tide, and tidal flats function of keeping an optimized ecological balance to the environmental perturbation.

Keywords : coastal ecosystem, environmental restoration, hypoxia, tidal flat creation, nutrients load reduction