Coastal and marine ecosystems, biology and ecology

Nitrogen Dynamics In The Yodo River Estuary, Japan

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The increase in human population in coastal watersheds has increased the delivery of nitrogen from the land to coastal environments. Accelerated nitrogen cycles in coastal environments have led to an increase in hypoxic waters and instances of harmful algal blooms. Physical and biogeochemical processes within estuaries generally regulate nitrogen fluxes from land to sea. The estuaries of major rivers on the continents are thought to be sites of massive nitrate losses. However, function of estuaries to nitrogen transfer must vary according to each estuarine hydrology and biogeochemistry. Osaka Bay is one of the most eutrophic embayments in Japan. A large amount of terrestrial nitrogen empties into the bay head from the Yodo River. Although the estuary would have a crucial role in modifying nitrogen fluxes, its function to nitrogen transfer is still unclear. In this study, we examined concentrations and stable isotope ratios (d15N) of dissolved inorganic nitrogen (DIN) in the Yodo River Estuary to clarify the dominant biogeochemical processes on DIN dynamics within the estuary and to assess the effect of function of the estuary on eutrophication in Osaka Bay. Contrastive results were obtained from the observations during spring tides in May 2010 and 2011. Nitrate concentrations were high and d15N-NO3 was low when high salinity water (>30) intruded into the estuary. Most of the d15N-NO3 variations within the estuary were expressed by the Rayleigh accumulation model with isotope discrimination of nitrification, suggesting the importance of remineralization for determinant of DIN concentration within the estuary. However, nitrate concentrations were low and d15N-NO3 was high when the high salinity water was excluded from the estuary. d15N-NO3 variations essentially depend on the isotopic effect through the algal assimilation process. These results implied that DIN remineralization and subsequent nitrification within the Yodo River Estuary would promote the eutrophication in Osaka Bay.