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Factors Affecting Nutrient Cycling in Intertidal Sandflats

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Synopsis

The present study aimed to improve our understanding of nutrient cycling in intertidal sandflats. Special emphasis was placed on the biogeochemical role of benthic microorganisms, including bacteria and microalgae, in nutrient removal from coastal areas. This paper consisted of three main parts: (1) the method used for the counting and sizing of benthic bacteria, as required for the quantification of various bacterial roles in sediments (Chapter 2), (2) the biogeochemical role of intertidal sandflats during immersion (Chapter 3), and (3) the biogeochemical role of intertidal sandflats during emersion and inundation (Chapter 4). In Chapter 2, the author reported a new dual-staining technique using both 4′,6-diamidino-2-phenylindole (DAPI) and acridine orange (AO) for estimating the abundance and biovolume of benthic bacteria. The effect of dispersion procedures and sediment characteristics on bacterial enumeration and sizing was also investigated. In Chapter 3, the author reported the simultaneously measured rates of nitrification, denitrification, sediment-water nutrient exchange, and sedimentary oxygen production in the Banzu intertidal sandflat located in Tokyo Bay. These data were then used to assess the relative importance of different processes on spatial and temporal variation in sediment-water nutrient exchange fluxes and denitrification in the intertidal sandflat. In Chapter 4, tide-induced temporal changes in the concentrations of three porewater nutrient species (nitrate, ammonium, and phosphate) during different seasons were investigated to elucidate the effect of tidal cycles on porewater nutrient dynamics in the Banzu intertidal sandflat. The author focused on (1) the influence of diffusive fluxes and advective transport on nutrient pool sizes during emersion and inundation; and (2) the role of emersion in microbial processes, including nitrification and nitrate reduction.

Key Words: eutrophication, microbial processes, nitrogen and phosphorus cycles, Banzu tidal flat, Tokyo Bay

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