

NUTRIENT CYCLING IN THE PENGHU BAY: A STUDY ON NUTRIENT REGENERATION IN SEDIMENTS IN AN OYSTER FARM¹

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ABSTRACT

Dissolved ammonia, nitrate and phosphate in the water column and in sediment pore waters from an oyster farm in the Penghu Bay were analyzed. Enrichment of nutrients in the bottom water was observed, that indicates the sediments as an important nutrient source. High concentrations of nutrients were built up in the sediment pore water. Modelling of the pore water profiles allows calculation of diffusive fluxes of nutrients out of the sediment column. Ammonia flux is the dominant one. The total nitrogen flux is estimated to be $1.8-3.0 \times 10^{-6} \mu\text{mol cm}^{-2}\text{sec}^{-1}$ under the assumption of a coefficient of bioturbation-enhanced diffusion of $10^{-4}\text{cm}^2\text{sec}^{-1}$. Such a flux could support a primary productivity of $10-17 \text{ mg-at C m}^{-2}\text{d}^{-1}$ which is significant in comparison with the measured primary productivities along the southwestern coast of Taiwan and the sea surrounding the Penghu Islands.

INTRODUCTION

Coastal and estuarine seawaters often support high primary productivity because nutrients are more available in these environments than in the open ocean. The nutrients are often provided by river runoff or coastal upwelling. Recently increasing attention was given to benthic nutrient regeneration (Rowe *et al.*, 1975; Billen, 1978; McCaffrey *et al.*, 1980; Klump and Martens, 1983; Postma *et al.*, 1984). Benthic fluxes of inorganic nutrients out of sediments provide up to 80% of the nutrient input to the Narragansett Bay at times (Nixon *et al.*, 1979).

Penghu Bay is a rather isolated neritic environment in the middle of the Penghu Islands (the Pescadores) in the Taiwan Strait. The area of the bay is about 60 km^2 (Tsai and Hu, 1986). The water temperature ranges from 16.3° to 27.4°C and the salinity ranges from 32.8 to 38.8‰. (Chen, 1986). Aquaculture is highly developed in the bay (Tsai and Hu, 1986). The area of oyster beds was estimated to be 650 hectares at one time (Fang and Hwang, 1986). Since the secondary production in the marine ecosystem is the result of organic input from lower trophic levels, the potential of aquacultural production depends on primary productivity which is in turn controlled by nutrient availability.

Fang and Hwang (1986) observed growth of benthic algae in the oyster farm at Da-Guo-Yeh in the Penghu Bay, but not in the nearby non-oyster-farming sea floor.

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