

## Seasonal Variation of Nitrogen Cycling in Manila Bay

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### ABSTRACT

Seasonal variation in nitrogen cycling at the upper layer of the Pasig River estuary in Manila Bay was calculated during January 1996 to December 1998 by using the numerical ecosystem model. Chlorophyll a and DIN concentrations are relatively low, river discharge is small, and solar radiation is strong from March to May in dry season. The main reason of low chlorophyll a concentration is the solar radiation is too strong. On the other hand, as DIN concentration is relatively high and solar radiation is optimum, chlorophyll a concentration is relatively high from August to October in rainy season. Main source of DIN in rainy season is the vertical transport from the lower layer due to the strong estuarine circulation. The effect of loading nitrogen from the land area for the primary production in the estuary is relatively smaller than that of the vertical transport of nitrogen. It is effective to decrease the nitrogen concentration in the lower layer by sand covering of the sea bottom for prevention of red tides.

**KEY WORDS:** Nitrogen cycling; Manila Bay; numerical ecosystem model; chlorophyll a concentration.

### INTRODUCTION

Recently, water quality of Manila Bay has been deteriorated and red tides frequently occur. Velasquez *et al.* (1997) showed the average nutrient concentrations in Manila Bay, and Jacinto *et al.* (1998) calculated nitrogen and phosphorus budgets of Manila Bay using LOICZS biogeochemical budgeting procedure. Hayashi *et al.* (2006) calculated the nitrogen cycling in Manila Bay during dry and rainy seasons. Nitrogen is the limiting nutrient of primary production in Manila Bay. Nitrogen is used slowly and many times due to small nitrogen supply and weak estuarine circulation in dry season. But nitrogen is sufficiently supplied and is used quickly by primary production in rainy season. Moreover nitrogen is also quickly flushed out by strong estuarine circulation in rainy season. On the other hand, Bajarias and Relox (1996) discussed the distribution of toxic Pyrodinium, Villanoy *et al.* (1996) showed the cyst-based model for

Pyrodinium red tides. And Azanza R.V *et al.* (2004) analyzed the correlations between the cyst density of red tide organism and benthic fluxes of nitrogen and phosphorus.

Thus the red tide of Manila Bay has been researched by the international program such as UNESCO and LOICS. However, the generation mechanism of red tides in Manila Bay has not been clarified yet. We have to reveal the characteristics of the nitrogen cycling in Manila Bay, in order to clarify the generation mechanism of red tides. In this paper we described the seasonal variation of nitrogen cycling in Manila Bay by using the numerical ecosystem model, and the main factor which affects the primary production is clarified.

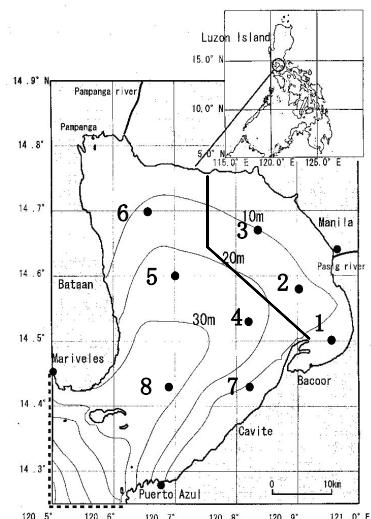


Fig.1 Study area and the observation stations in Manila Bay.  
The line shows the boundary between the box and the outer area.