HETEROTROPHIC BACTERIOPLANKTON PRODUCTION IN THE EAST CHINA SEA*

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Abstract Heterotrophic bacterial production (BP) in the East China Sea was measured using tritiated thymidine incorporation (TTI) method in winter 1997 and in summer 1998. The results showed BP in summer (1998, 3.50 - 15.70 μgC/(L·h)) was higher than that in winter (1997, 0.46 - 2.62 μgC/(L·h)). The high values of BP occurred around the Changjiang River estuary and around Station 410. The results at two anchor stations showed that vertical variation of BP was bottom > middle > surface in winter and middle > bottom > surface in summer. Compared with primary production (BP:PP), the average ratio of BP:PP was 0.17(0.04 - 0.30) in winter and 0.32(0.21 - 0.43) in summer. There were high ratios around the Changjiang River estuary in winter and around Station 111 in summer.

Key words: heterotrophic bacteria, production, East China Sea

INTRODUCTION

More than a decade has passed since bacteria was recognized as quantitatively important consumers of organic carbon in marine food webs and marine ecosystems (Fuhrman, 1992). The basic information on the significance of the microbial food web was presented by Pomeroy (1974), who pieced together data from a variety of sources that all indicated a major role of small heterotrophs consuming dissolved and particulate materials. However, his findings did not gain wide recognition until the high abundance of marine bacteria was shown visibly by epifluorescent microscopy (Ferguson and Rublee, 1976; Hobbie et al., 1977). In oligotrophic oceans, bacteria often consume up to half of the primary production via dissolved organic matter and in turn are consumed by protistan grazers (Hagstrom et al., 1988). This process is called heterotrophic bacterial production (BP) and was shown to be large (10% - 30%) comparable to primary production (Hagstrom et al., 1979; Fuhrman and Azam, 1980; 1982; Azam et al., 1983). With reasonable estimates of bacterial growth efficiency (i.e., near 50%), it became clear that heterotrophic bacteria consume an amount of carbon equivalent to approximately 20% - 60% of total primary production. Williams (1981) reached this conclusion when he synthesized the extant results on bacterial biomass and production. He also showed the "normal" well-known processes and mechanisms. As much as 60% of the primary production become dissolved organic

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carbon (DOC), and subsequently, is taken up by bacteria. Bacteria contribute significantly to microbial food webs and biogeochemical cycles in marine ecosystems (Ducklow and Carlson 1992). To our knowledge only one study has examined heterotrophic bacterial production in the East China Sea (ECS). In the work reported here, we present the results of survey on the spatial distribution of bacterial production in the East China Sea (Fig. 1).

MATERIALS AND METHODS

Water samples were collected during the cruise for Study on Key Processes of Ocean Flux in the ECS (POFLEC) from surface, 20 m and bottom at each station in the winter of 1997 and the summer of 1998 of the R/V SCIENCE 1. A rosette containing twelve 5 L Niskin bottles was mounted on the CTD to take water samples. Water at Stations 111 and 410 was sampled every four hours for one day, respectively.

Measurement of bacterial production of samples was done as follows. Replicate samples (10 ml) were incubated with 5 nmol/L of [methyl-\(^{3}\)H] thymidine (30 Ci/nmol) for one half hour to two hours. Subsamples (10 ml) were chilled in an ice water bath for one minute, and then an equal