SIZE COMPOSITION OF SEA SURFACE CHLOROPHYLL *a* CONCENTRATION IN KAGOSHIMA BAY

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Abstract

Size fractionated chlorophyll *a* concentrations at sea surface were investigated from May 2001 to May 2002 at the two stations in the inner and center area of Kagoshima Bay. Chlorophyll *a* concentrations in the inner area were much higher than those in the center area. Highly fluctuated chlorophyll was observed at both stations and was resulted from a rapid increase of micro-sized phytoplankton. Pico- and nano-sized phytoplankton were more predominated in the center area, although micro-sized phytoplankton was abundant in the inner area.

Keywords: Size composition, Chlorophyll *a* concentration, Kagoshima Bay

Introduction

Kagoshima Bay is a large semi-enclosed bay located at the southernmost of Kyushu, southwestern Japan. Although nutrient-poor waters, Kuroshio water, are influential in the center area, water exchange is highly limited in the inner area because of narrow and shallow channel and depth more than 100 m. Thus, size composition of phytoplankton is important. In the present study, we investigate size composition of chlorophyll *a* concentration at two different areas in Kagoshima Bay.

Materials and Methods

Oceanographic observations and water samplings were weekly to biweekly carried out from April 2001 to May 2002 during T/S *Nansei-Maru* cruises. Sampling stations were conducted around the deepest parts of the inner and center areas (Fig. 1). Depth was 225 m at Station 10 and 135 m at Station 23, respectively.

Water temperature was determined with a thermometer at sea surface and a reversing thermometer attached with Nansen bottle at other depths. Water samples for chlorophyll *a* concentrations were taken using a plastic bucket. Each water sample (200-1000 ml) was filtered through plankton net (mesh opening: 20 μm) and Whatman GF/F filter (pore-size: 0.7 μm). From mid-November, Millipore JM membrane filter (pore-size: 5 μm) was also used. Chlorophyll pigments on the filters were extracted in n, n-dimethylformamide (SUZUKI & ISHIMARU, 1990). Chlorophyll extraction was made by direct immersion of the filters into the solvent at -5.5℃ under dark condition overnight. Chlorophyll *a* concentration was measured with Turner Designs fluorometer (TD-700) by fluorometry (HOLM-HANSEN et al., 1965).

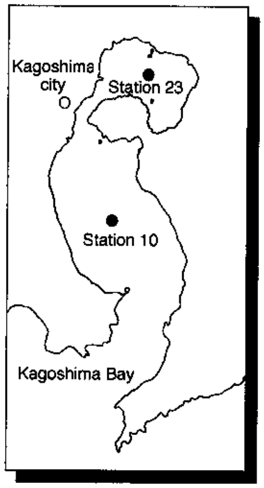

Fig.1. Sampling stations in Kagoshima Bay, southwestern Japan.

Results and Discussion

Temperature

Water temperature at both stations showed a similar pattern (Fig. 2). Surface temperature increased above 28°C from July to August and made a large difference of temperature at other depths. Sea surface temperature was reached maximum in early August, and was 30.7°C at Station 10 and 31.0°C at Station 23, respectively. Surface temperature decreased after October and no stratification occurred from January to March.

Minimum sea surface temperature was 15.2°C at Station 10 in January and 14.4°C at Station 23 in February, respectively. Bottom temperatures were near constant at 15°C at Station 10 and 17°C at Station 23 throughout the year.

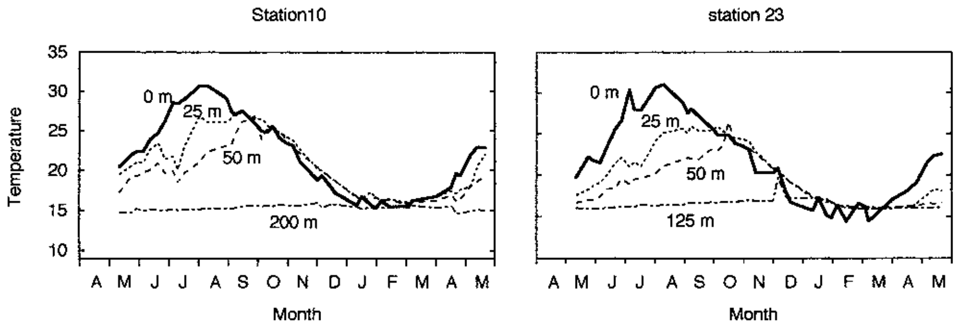

Fig.2. Seasonal changes in temperature (°C) at sea surface, subsurface (25 and 50 m) and near-bottom from 2001 to May 2002 in the center area (Station 10: left) and in the inner area (Station 23: right).

Size composition of chlorophyll a

Sea surface chlorophyll *a* concentrations at Station 23 were much higher than those at Station 10 (Fig. 3). Highly fluctuated chlorophyll was observed at both stations and was associated with a rapid increase of micro-sized phytoplankton. Because actively growth of large phytoplankton have been well known in the nutrient-rich waters (PARSONS et al., 1984), there might be spontaneous nutrients input from the rivers caused by rainfall throughout the year. However, seasonal variation patterns were pronounced for micro-sized phytoplankton and they were predominated in May to June, October to December, and February to March. On the other hand, pico- and nano-sized phytoplankton were abundant in July to September, January to February, and April to May. In general, small phytoplankton was more predominated in the center area, although large phytoplankton was abundant in the inner area. According to the results of ICHIKAWA et al. (1999), the volcanic ashes from Mt. Sakurajima accelerated the formation and downward export of large particles in Kagoshima Bay. These results suggest that large amounts of phytoplankton are exported downward as a carbon source without grazing and decomposing by zooplankton. Considering the limited water exchange and the predominant of large phytoplankton in the inner area, excess nutrients input might rapid accelerate not only harmful algae bloom in the surface but also depletion of oxygen at the near-bottom.

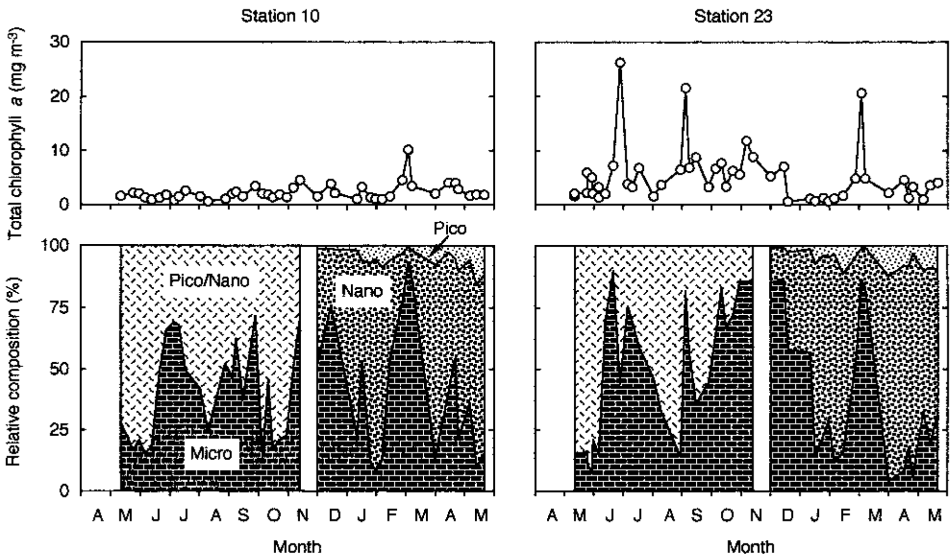

Fig.3. Seasonal changes in sea surface chlorophyll *a* concentrations (mg m^{-3}) and relative composition of pico-, nano- and micro-sized phytoplankton from May 2001 to May 2002 in the center area (Station 10: left) and in the inner area (Station 23: right).

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