Comparision of the Phytoplankton along the Subtropical Convergence Zone from the Southern Ocean

Lee Hak Young*, Richard M. Greene[1], In Sook Cho, Man Kyu Huh, and Jong Won Kim
Dept. of Biology, Pusan National University
[1] Dept. of Oceanography, Texas A&M University

1. INTRODUCTION

The circumpolar character of the Southern Ocean influences on the distribution, abundance, production, and behaviour of the marine organisms including planktons (Knox, 1994). Through the cruises of several Antarctic research programs, a large body of valuable data was obtained on the geographic and temporal distributions of phytopolankton and zooplankton populations (El-Sayed, 1985; 1987; Knox, 1994). However, many ecological questions remain unknown, and the data of the Pacific Sector of the Southern Ocean lags behind that of the Atlantic Sector (El-Sayed and Fryxell, 1993).

This research was performed to compare the species composition, cell number and biomass (cell carbon) of phytoplankton across the Subtropical Convergence Zone (STCZ), in the southwest Pacific Sector of the Southern Ocean.

2. METHODS

Samples for this research were collected from Nov. 16 to Dec. 8, 1995, austral early summer, on board RV *Southern Surveyer* as a part of the Australian Marine Carbon Cycles Project and IGAC ACE-1.

Water samples were collected at descrete depths within the upper 100 m of water column. Each 1 L water sample was settled for more than 2

days and 900 *ml* were carefully removed with a small tube. The remnant was settled in 50 *ml* settling chamber for 24 hr, and identified and counted the phytoplankton under an inverted microscope (Zeiss ICM 405) with phase contrast illumination. A minimum of 500 cells were counted for each sample to obtain more than 95 % of probability of encountings a taxon present at an 1 % level (Shaw, 1964). Finally, the entire bottom of settling chamber was scanned at low magnification (x100) to enumerate the larger and less frequent phytoplankton. Cell volumes were calculated by equating the shape of each taxon to a standard configuration and cell carbons were calculated using fomulae of Smayda (1978) for diatoms and Verity *et al.* (1992) for non-diatom phytoplankton.

3. RESULTS

During the early austral summer of 1995/6, the shifting of the species composition and biomass of phytoplankton did not coincide with the previously known STCZ, paralleling 45-48 °S (Nowlin and Klinck, 1986). Species composition varied along 50 °S, and biomass also decreased slightly along 50 °S. Dominant net phytoplankton species north of 50 °S were *Pseudonitzschia* spp. and *Gymnodinium* spp., whereas *Chaetoceros* spp. and *Fragillariopsis kerguelensis* codominated with *Pseudonitzschia* spp. south of 50 °S. Nanoplankton cells surpassed netplankton above 50 °S. The maximum biomass was *Protoperidinium* sp. above 50 °S and *Exuviaella* sp. below 50 °S. The biomass of *Chaetoceros* spp. and *Fragillariopsis kerguelensis* increased several-fold south of 50 °S. The maximum cell and biomass of phytoplankton were observed at 40 m depth above 50 °S, while 60 m depth below 50 °S. Chlorophyll and T-S data showed clear difference along 50 °S.

Therefore, the plankton community of the Southern Ocean of the Pacific Sector can be divided along the 50 °S zone, and the Subtropical Convergence Zone is supposed to run along this zone during this research period.

REFERENCE

El-Sayed, S.Z. 1985. Plankton of the Antarctic seas. *In* Key Environments Antarctica. Bonner, W.N. and D.W.H. Walton (eds.), Pergamon Press,

Oxford, pp. 135-153.

El-Sayed, S.Z. 1987. Biological productivity of the Antarctic waters: present paradoxes and emerging paradigms. *In* Antarctic Aquatic Biology. El-Sayed, S.Z. and A.P. Toma (eds.), BIOASS Scientific Series, 7. SCAR, Cambridge, pp. 1-22.

El-Sayed, S.Z. and G.A. Fryxell. 1993. Phytoplankton. *In* Antarctic Microbiology. Friedmann, E.I. (ed.), Wiley -Liss, Inc., New York, pp. 65-122.

Knox, G.A. 1994. The Biology of the Southern Ocean. Cambridge University Press, London, pp. 444.

Nowlin, W.D. and J.M. Klinck. 1986. The physics of the Antarctic Circumpolar Current. *Revs. Geophys.* **24**: 469-491.

Shaw, A.B. 1964. Time in Stratigraphy. McGraw-Hill, New York, pp. 109.

Smayda, T.J. 1978. From phytoplankters to biomass. *In* Phytoplankton Manual. Sournia, A. (ed.) Unesco, New York, pp. 273-279.

Verity, P.G., C.Y. Robertson, C.R. Tronzo, M.G. Andews, J.R. Nelson, and M.E. Sieracki. 1992. Relationships between cell volume and the carbon and nitrogen content of marine photosynthetic nanoplankton. *Limnol. Oceanogr.* **37**: 1434-1446.