Title: **Experimental Study on the Initial Formation of Ice Algal Community**

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## Introduction

Ice algal community is well known to develop densely under surface layer of sea ice in the high latitudes. Ice algal community is consisted of various groups of marine organisms which are incorporated into the sea ice. Ice algal community can live in brine channels as long as sea ice can grow. Ice algal community forms unique ecosystem in brine channels as isolated but relatively complete microbial loops. But those microbial loops are slightly different from so-called microbial loops in the sea. The microbial loops in ice algal community are dominated often by large cell diatoms. Based on our previous study, small cells in picoplankton size were abundant at the beginning of ice formation. This comparison strongly suggests the occurrence of species succession as sea ice grows. Our novel method to study the ice formation and incorporation of organisms into fragile ice was applied to study on the species succession of ice algal community.

## Materials and Methods

Experimental site was located near the coast of Sakaeura in Saroma-ko lagoon. Thickness of sea ice was about 45 cm with 1-2 cm overlying snow. A square pool was made and sea ice was completely removed from the surface. Surface water was collected and placed into ten light and dark incubation containers. The ice formation experiment was initiated with inoculation of $NaH^{13}CO_3$ on February 21, 2001 and lasted until March 1, 2001. Ice temperature at ice and sea water boundary

was monitored with Nchiyu Giken Kogyo underwater thermometer Model NWT-SN. Salinity was determined on ATAGO salinity reflectometer Model S/Mill-E. Subsamples were filtered onto Whatman glass fiber filters for analysis of chlorophyll pigments, and precombusted Whatman glass fiber filters for analysis of particulate organic carbon and nitrogen, and $^{13}C$. Second subsamples were filtered onto membrane filters for analysis of biogenic silica. Third subsamples were filtered through Millipore Milex HV filter for analysis of macronutrients. Chlorophyll pigments were measured on Turner Design fluorometer Model 10-AU. Nitrate, nitrite, phosphate, and silicate were analyzed on Bran and Lubbe Autoanalyzer Model AACS-II. Biogenic silica was determined spectrophotometrically. Particulate organic carbon and nitrogen were analyzed on FISON elemental analyzer Model NA1500 NCS standardized by acetanilide. $^{13}C$ was analyzed on FISON elemental analyzer Model NA1500 NCS connected to Finnigan Tracer Matt. Taxonomical identification and numeration of algal species were carried out on the light microscopy.

## Results and Discussion

Temperature at ice and water boundary was fluctuated daily according to daily solar radiation. Salinity in sea ice decreased as sea ice grew and salinity in the seawater under the sea ice increased. Macronutrient concentrations did not change in sea water during the incubation while macronutrients appeared in the newly formed sea ice on the third day of incubation. Chlorophyll *a* concentration also increased in the sea ice on the third day of incubation. A 2-0.2 μm size fraction of chlorophyll *a* concentration was dominant during the ice formation. Relative contribution of light absorption by chlorophyll *a* particles to total particles in the sea ice increased from 9.6 % on the third day to 13 % on the eighth day. $^{13}C$ uptake was not observed for the first four days and higher than 4.8 $mgCm^{-3}h^{-1}$ was observed from the sixth day. Their photosynthetic activity ranged from 0.42 to 1.7 $mgC[mgChl.a]^{-1}d^{-1}$. The present observation may suggest that phytoplankton cells incorporated into newly formed sea ice require 5-6 days to acclimate to new ice habitats to produce the organic matter.

## Publications

Taguchi, S., F. Satoh, S. Hamanaka, M. Ikeda, M. Ishikawa, and K. Shirasawa 2000. Effect of sea ice on the natural assemblages of phytoplankton in the coastal water of Okhotsk Sea. Polar Bioscience 13: 1-14.