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CHARACTERISTICS OF SEA ICE ALGAL COMMUNITY AND THE PRIMARY PRODUCTION IN SAROMA KO LAGOON AND RESOLUTE PASSAGE, 1992 (EXTENDED ABSTRACT)

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Ice algal assemblages are distributed widely and carry out primary production in sea ice covered oceans (*i.e.*, HORNER *et al.*, 1992; LEGENDRE *et al.*, 1992). In the northern hemisphere, sea ice extends from Arctic Ocean to the southern edge of the Sea of Okhotsk (44–45°N); therefore, the growth habitats of ice algae show marked differences of physical, chemical and biological environments. In this study, temporal changes of biomass (chl. *a*), species composition and photosynthetic production of ice algae were comparatively observed in two extremely different sea ice regions, Saroma Ko lagoon and Resolute Passage, in 1992.

A centric diatom, *Detonula conferevaceae*, dominated throughout the sampling

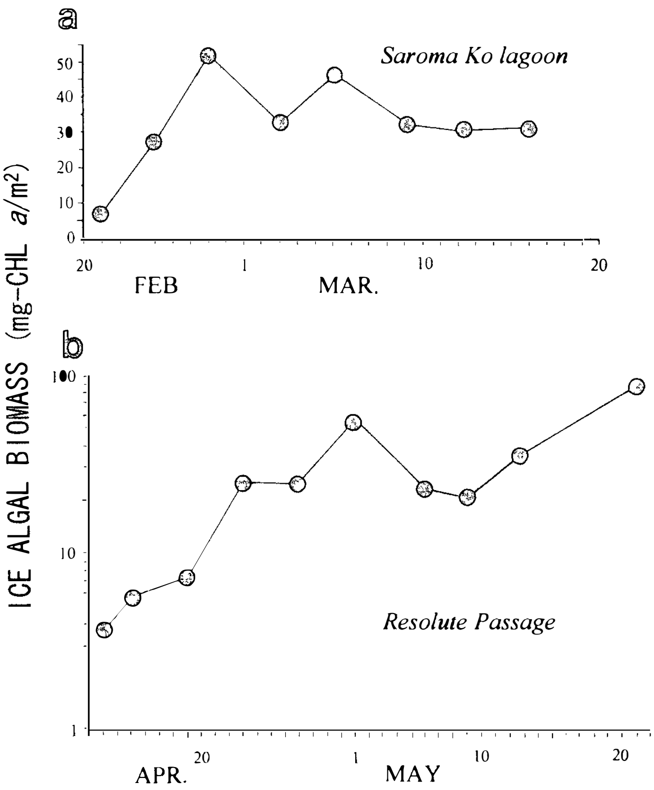

Fig. 1. Temporal changes in chlorophyll biomass in sea ice (bottom 0–5 cm) samples at Saroma Ko lagoon (a) and Resolute Passage (b) in 1992.

period in Saroma Ko. Ice algal biomass, in terms of Chlorophyll *a*, increased during February and reached a maximum (>50 mg-chl. *a*/m^2) at the end of February (Fig. 1a). The biomass remained at around 30 mg-chl. *a*/m^2 in March. On the other hand, pennate diatom species, such as colony-forming *Nitzschia* spp. and *Navicula* spp., were dominant in Resolute samples collected in May. The biomass increased exponentially in April, and then decreased during stormy weather at the beginning of May (Fig. 1b). It increased again in the middle of May and reached over 88 mg-chl. *a*/m^2 on 22 May.

In spite of the temporal changes of the biomass in both Saroma Ko and Resolute, the relationships between photosynthesis and light intensity did not show large temporal differences, respectively (Figs. 2a, b). In every Saroma Ko sample, the photosynthesis that was measured by means of simulated *in situ* incubation and the Winkler method (STRICKLAND and PARSONS, 1972) showed a positive rate over 3 $\mu E/m^2/s$, and the rate increased linearly to *ca.* 1 mg-O_2/mg chl. *a*/h with increment of light intensity of 25 $\mu E/m^2/s$. In the Resolute samples the photosynthesis measured by means of photosynthetron by the ^{14}C incubation methods (LEWIS and

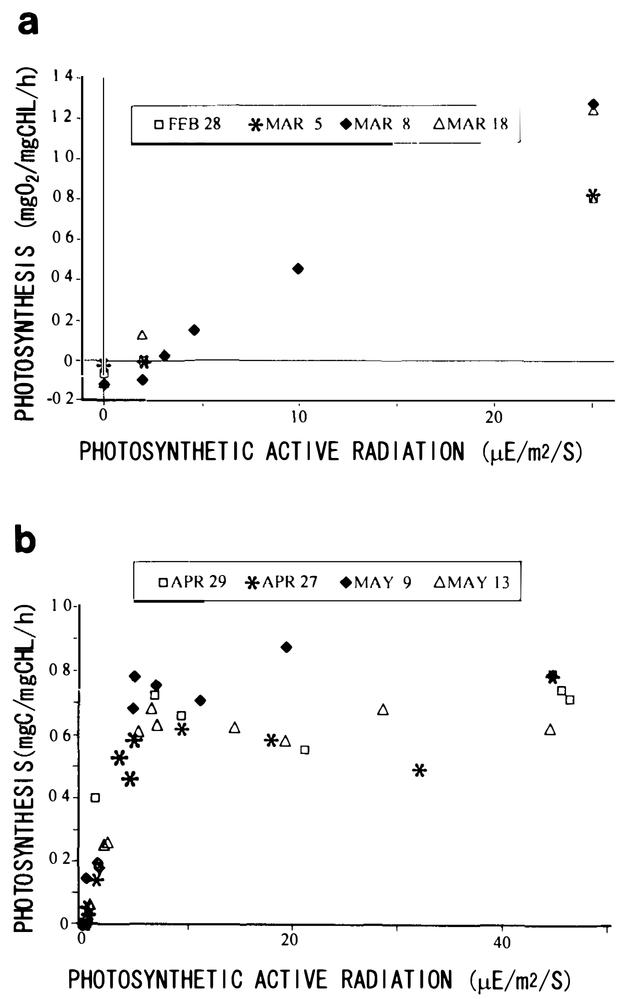

Fig. 2. Photosynthesis-irradiance relations obtained from ice algal samples from Saroma Ko (a) and Resolute (b).

Table 1. Summary of biomass (chl. a*), daily primary production, carbon/Chlorophyll* a *ratio and Biomass (mg-C/m²)/Production (mg-C/m²/d) ratio of ice algal samples in Saroma Ko lagoon and Resolute Passage, 1992.*

Saroma Ko	24 Feb.	27 Feb.	2 Mar.	9 Mar.	12 Mar.
Biomass (mg-chl. a/m^2)	27.3	52.6	32.8	32.5	30.7
Production (mg-C/m^2/d)	44.9	101.4	35.4	74.0	59.3
Carbon/Chlorophyll a (w/w)	n.d.*	n.d.	n.d.	7.2	11.3
Production/Biomass (d^{-1})	n.d.	n.d.	n.d.	0.3	0.2
Resolute Passage	23 Apr.	27 Apr.	9 May	13 May	
Biomass (mg-chl. a/m^2)	7.3	25.5	21.5	35.4	
Production (mg-C/m^2/d)	57.7	171.6	122.6	206.7	
Carbon/Chlorophyll a (w/w)	24.0	n.d.	17.0	13.0	
Production/Biomass (d^{-1})	0.3	n.d.	0.3	0.4	

* n.d.: not determined.

SMITH, 1983) became saturated around 5 μE/m^2/s and the rate was *ca.* 0.7 mg-C/mg-chl. a/h. The photosynthesis slightly decreased under higher intensity of 10 μE/m^2/s. The difference of photosynthesis–irradiance curves (P–I curves) between the Saroma Ko and Resolute samples may be due to different light-shade adaptation states of ice algae, *i.e.*, better shade-adapted in the Resolute samples. The maximum light intensity reaching under sea ice bottom was 28 μE/m^2/s in Saroma Ko but only several μE/m^2/s in Resolute during this study. It seems that the ice algae might adjust their optimum photosynthesis to their available maximum light environment.

Using the biomass, P–I curves and available light intensity data for the ice algal habitat at both sites, ice algal photosynthetic daily production was estimated (Table 1). The production was in the ranges of 35–102 mg-C/m^2/d in Saroma Ko, nearly twice that 57–207 mg-C/m^2/d, in Resolute. Production/Biomass ratio, however, was not greatly different between the Saroma Ko and Resolute samples. This might suggests that *in situ* production performance (growth rate) for ice algae among the two extreme regions was almost the same, in spite of many environmental differences such as ice thickness, day length, light intensity and so on.

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