漂流観測系を用いた夏季の南極海におけるスイマー群集組成の経時変化

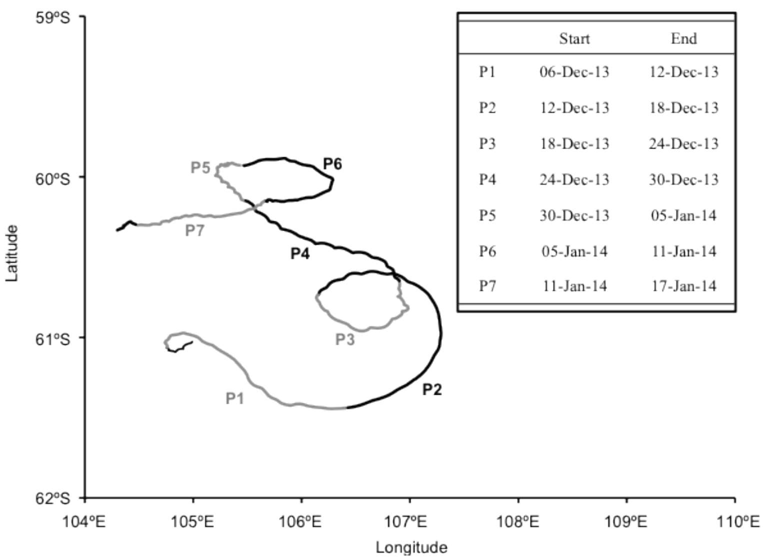
真壁竜介 [1]、成田篤史 [1]、三瓶真 [2]、飯田高大 [3]、服部寛 [4]、佐々木洋 [1]
[1] *石巻専修大学,* [2] *広島大学,* [3] *極地研,* [4] *東海大学*

Temporal change of zooplankton swimmer composition observed using a surface drifter in the Antarctic Ocean in summer

Ryosuke Makabe[1*], Atsushi Narita[1], Makoto Sampei[2], Takahiro Iida[3], Hiroshi Hattori[4], Hiroshi Sasaki[1]
[1]*Ishinomaki Senshu University,* [2]*Hiroshima University,* [3]*National Institute of Polar Research,* [4]*Tokai University*

A Lagrangian observation using a surface drifter was carried out to understand carbon cycling processes in relatively a short time scale in the eastern Antarctic Ocean in austral summer during the JARE 55 (55^{th} Japanese Antarctic Research Expedition). The drifter with multiple sensors (e.g. CTSs & photon sensors at 0 m, 25 m and 80 m) and a time-series sediment trap (80 m) was deployed on 4 December, 2013 (Shirase) and retrieved on 18 January, 2014 (RV/TV Umitaka Maru). We report here temporal changes of zooplankton swimmers collected at 80 m depth using the sediment trap. Seven sample cups of the sediment trap were filled with filtered seawater with buffered formalin (final concentration, 5%) and NaCl (adjusted to 50‰). The zooplankton swimmers were picked up and used for identification and counting under dissecting microscope.

The drifter moved in circular motions with locally distributed gyres, but was not primarily transported eastward with ACC (Antarctic Circumpolar Current) (Fig. 1). Water temperature at 25 m depth gradually increased (-1°C to 2°C) through the study period, and relatively stable at 80 m depth. Based on the data of temperature at 20 m and 80 m, frequent vertical mixing probably occurred from December 6 to 30, 2013 (P1-P4), and a thermocline developed between two depths from December 30, 2013 to January 17, 2014 (P5-P7). Chlorophyll fluorescence exited at 435 nm (indicative of chlorophyll *a* concentration) at 25 m depth in a period of P1-P5 was relatively higher than that of P6-7. The elevated



	Start	End
P1	06-Dec-13	12-Dec-13
P2	12-Dec-13	18-Dec-13
P3	18-Dec-13	24-Dec-13
P4	24-Dec-13	30-Dec-13
P5	30-Dec-13	05-Jan-14
P6	05-Jan-14	11-Jan-14
P7	11-Jan-14	17-Jan-14

Fig. 1. GPS track of a surface drifter observed during JARE55. P1 through P7 indicate successive sampling periods of the sediment trap.

fluorescence in former period was probably caused by frequent nutrient supply due to vertical mixing under less stratified upper water column.

A cluster analysis with Bray-Curtis similarity index of log transformed swimmer fluxes and the compositions revealed two community groups (G1 and G2), which markedly changed from P1-5 to P6-7. The G1 was dominated by *Rhincalanus gigas*, followed by *Calanus propinquus* and *Calanoides acutus*. In the G2, *R. gigas* was also the predominant species (67.9%), but the abundance in terms of flux was similar to that in G1 (Table 1). *Calanus propinquus* and *C. acutus* were lower than those in G1. This compositional change was primarily caused by occasional intrusions of different water masses, the occurrence of individual zooplankton group might partly be explained by the behavioral responses to environmental changes. Furthermore, *Limacina retroversa* occurred only in G1 and *L. helicina* occurred in G2. This suggested the displacement of water mass during the study period, because the former and the latter were generally found in the north and south of ACC, respectively.

The meso-scale water masses (gyres) are too complicated to understand how it forms, drifts and disappears through the conventional observations using only hydrographical water properties. The present study suggests the short-term temporal change in zooplankton swimmer composition can afford information on the dynamics of meso-scale gyres.

Table 1. The dominant taxa, total swimmer flux, diversity in swimmer community of each cluster group and average values±standard deviation of temperature (°C), salinity, fluorescence at 435 nm and light intensity (μmol m^{-2} sec^{-1}) at various depths. The number in parentheses shows contribution of the taxon to total swimmer flux.

	Group 1	Group 2	
	Rhincalanus gigas (34.1)	*Rhincalanus gigas* (67.9)	
	Calanus propinquus (31.2)	Ostracods (8.4)	
	Calanoides acutus (19.9)	*Calanus propinquus* (7.7)	
		Limacina helicina (7.6)	
Total flux (ind. m^{-2} day^{-1})	917±131	458±207	
Shannon H'	2.21±0.15	1.82±0.13	
Temperature at 25 m depth	0.075±0.402	1.443±0.339	**
Temperature at 80 m depth	-1.066±0.196	-1.184±0.064	**
Salinity at 80 m depth	33.97±0.05	33.96±0.02	n.s.
Fluorescence at 25 m depth	1.3±0.3	0.6±0.3	**
Light intensity at surface	266.9±116.0	327.2±95.7	n.s.
Light intensity at 25 m depth	52.5±20.3	72.7±21.2	**
Light intensity at 80 m depth	1.4±0.6	3.2±1.3	**

**: $p<0.01$