OCCURRENCE AND AGE COMPOSITION OF *PARALABIDOCERA ANTARCTICA* (CALANOIDA, COPEPODA) UNDER THE FAST ICE NEAR SYOWA STATION, ANTARCTICA

Atsushi TANIMURA, Mitsuo FUKUCHI and Hideaki OHTSUKA

National Institute of Polar Research, 9–10, Kaga 1-chome, Itabashi-ku, Tokyo 173

Abstract: A year-round observation of *Paralabidocera antarctica*, an endemic copepod in the Antarctic, was done near Syowa Station, Antarctica, from January 1982 to January 1983.

P. antarctica occurred in the spring to the summer seasons between late September and late January and was very abundant while the phytoplankton biomass was high. The *P. antarctica* population which appeared in late September to early November was composed of copepodite stages I, II and III. Developmental stage progressed from middle November to middle December. In middle December, the *P. antarctica* population consisted mostly of adults with a few individuals of copepodite stage V. After late December it was occupied by adults only, while adult females were bearing the spermatophores commonly. *P. antarctica* seemed to have one generation in a year.

1. Introduction

Paralabidocera antarctica, a calanoida copepod, is endemic to the Antarctic (VERVOORT, 1951; WAGHORN, 1979). Occurrence of *P. antarctica* has been reported from under the sea ice near McMurdo Station (BRADFORD, 1971) and Molodezhnaya Station (ZVEREVA, 1975) in the summer season. The adult of *P. antarctica* also occurred very abundantly just beneath the under-surface of sea ice in the summer season near Syowa Station (FUKUCHI and SASAKI, 1981; TANIMURA *et al.*, 1984). However, our knowledge of *P. antarctica* is limited to the summer season. Therefore, the life cycle of this species is little known.

In this report, we discuss the seasonal change of *P. antarctica* population based on a year-round observation at a fixed station near Syowa Station (69°00′S, 39°35′E).

2. Materials and Methods

Zooplankton samples were collected by a vertical haul from near bottom (about 10 m depth from under-surface of sea ice) to the surface using a Norpac net (45 cm in mouth diameter, 0.11 mm mesh openings) fitted with a flowmeter, which was used for estimating the volume of water filtered by the net. The net haul was made through a hole bored into the fast ice at Stn. 1 in the Kita-no-seto Strait (Fig. 1). On 22 and 23 January 1982, samplings were performed at 3 hours intervals and a total of nine samples was obtained. Thereafter, each sampling was carried out at 2–3 weeks intervals

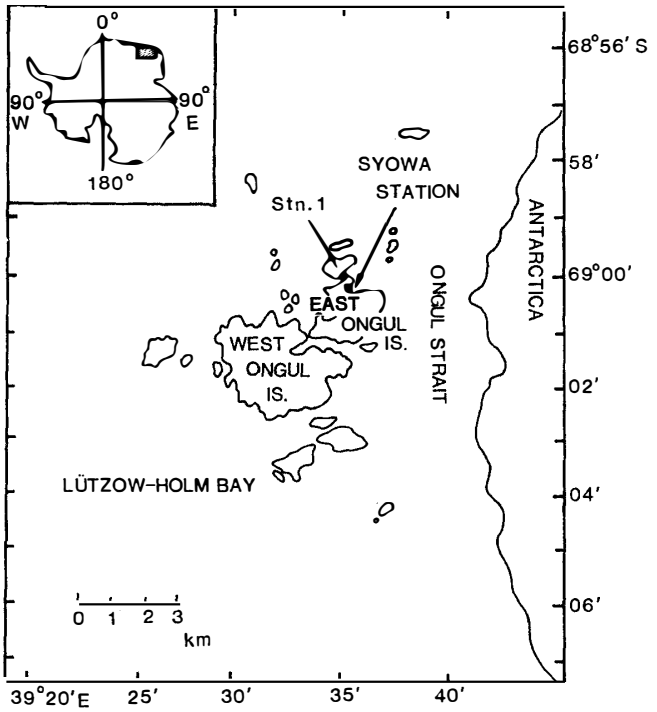

Fig. 1. Location of sampling station. Circle and square indicate Stn. 1 and Syowa Station, respectively.

during 12 months until January 1983.

Zooplankton were preserved in 5% formalin-buffered sea water. The individual numbers of copepodite stages of *P. antarctica* were counted for a whole sample. Then, abundance of *P. antarctica* per unit volume of water column (individ. no./m^2, 0–10 m) was calculated.

Water temperature, salinity (practical salinity scale) and chlorophyll *a* were measured at four layers of 0, 2, 4 and 6 m depths (see FUKUCHI *et al.*, 1984).

3. Results and Discussion

The seasonal changes of water temperature and salinity are shown in the top of Fig. 2 by the means of the respective values measured at four layers mentioned above. In January 1982 and 1983, water temperature was high and salinity was low just beneath the sea ice due to melting of sea ice. Water temperature and salinity fluctuated within small ranges through the rest of the year.

Seasonal variations of chlorophyll *a* stock for 0–10 m water column are shown in the bottom of Fig. 2. Chlorophyll *a* stock was considerably high until late March. However, it became low by late April. From May to October chlorophyll *a* stock was low (less than 0.35 mg/m^2). Increase of chlorophyll *a* started at the beginning of November. But a remarkable increase occurred after the middle December. Maximum chlorophyll *a* stock of 62.2 mg/m^2 occurred in late January 1983.

Figure 3 shows the seasonal change of the *P. antarctica* population. *P. antarctica* occurred abundantly in late January 1982 (mean: 13339 individ./m^2). However,

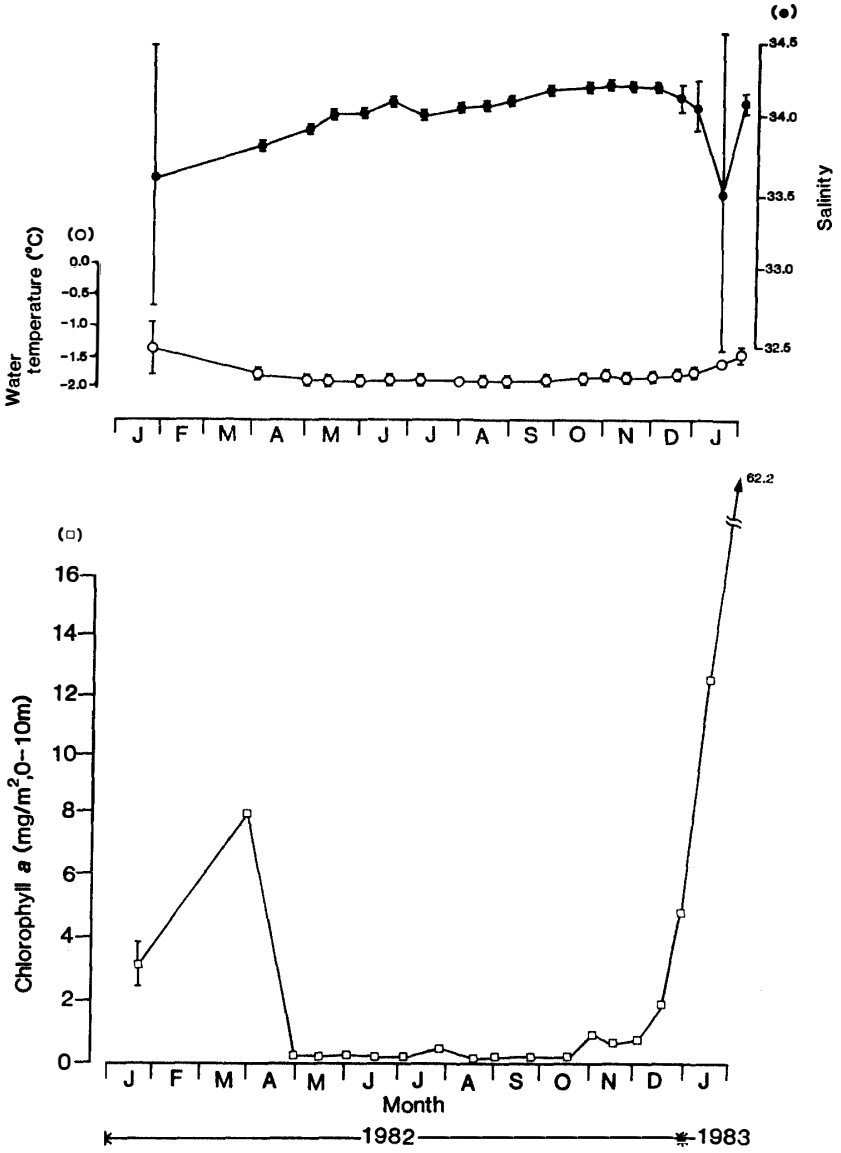

Fig. 2. Seasonal changes of water temperature (°C), salinity (practical salinity scale) and chlorophyll a stock (mg/m², 0–10 m) (cited from FUKUCHI *et al., 1984). Vertical line represents the standard deviation.*

the population disappeared in early February. No individuals were collected between March and August. In late September, a small number of *P. antarctica* appeared and the population size remained between 14 and 760 individ./m² till middle December. In late December, the *P. antarctica* population increased sharply to 12431 individ./m², which was comparable to that in January 1982. It decreased by 223 individ./m² by middle January 1983, and disappeared again at the end of January. *P. antarctica* occurred very abundantly in the summer season when phytoplankton were abundant, though there was a yearly variation in the time of appearance and disappearance. The present results agree with the reports by ZVEREVA (1975) and FUKUCHI and TANIMURA (1981), who also found that *P. antarctica* occurred in the summer season.

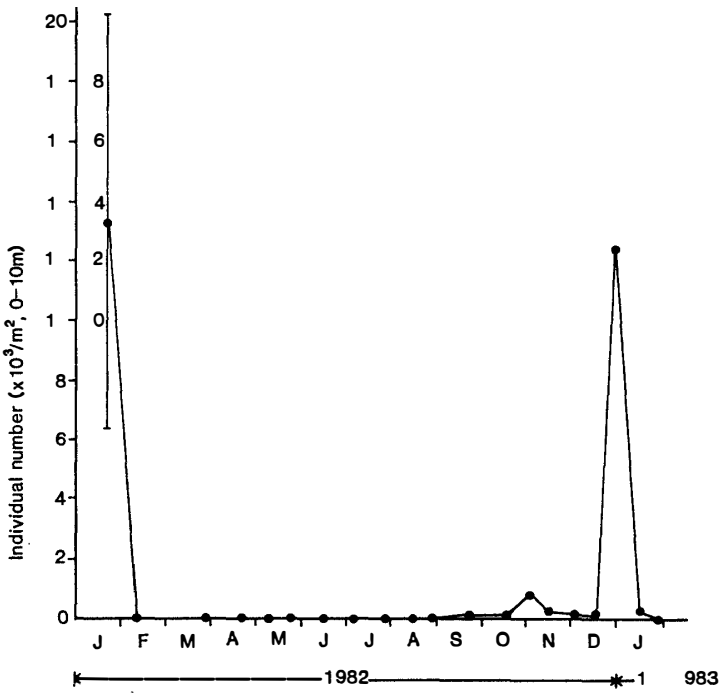

Fig. 3. Seasonal change of abundance of Paralabidocera antarctica *(individ. number/m², 0–10 m). Vertical line represents the standard deviation of nine data obtained in January 1982.*

Seasonal changes in age composition of *P. antarctica* are shown in Fig. 4. In late January 1982, the population was composed almost of adults (99.8%) and a few individuals in copepodite stage V (0.2%). The majority of adult females carried spermatophores on their genital segments. Based on this fact, TANIMURA *et al.* (1984) assumed that copulation was done in this period.

In late September and middle October, only one specimen of copepodite stage I was collected. In early November, the population was composed of copepodite stages I, II, III and IV and the percentage of copepodite stage I was 70%. In middle November, the percentage of copepodite stage I decreased and conversely those of copepodite stages II, III and IV increased. Copepodite stage V also appeared. The age composition of *P. antarctica* in early December did not differ from that of middle November. A remarkable change in the age structure of the *P. antarctica* population was observed in middle December. The population consisted of adults (80%) and copepodite stage V (20%). This age structure was similar to that in late January 1982 but the size of this population was extremely small compared with that in January 1982 (see Fig. 3). After the end of December, the *P. antarctica* population was composed of adults only. Adult females bearing spermatophores were commonly observed in the 1982–1983 summer season as was seen in January 1982. The assumption made by TANIMURA *et al.* (1984) was assured.

In the present study, it is considered that *P. antarctica* completes one generation in a year. Disappearance of *P. antarctica* between February and August could be explained by the following two reasons: One is that adults survived by staying close to the bottom sediment throughout the winter, so that the vertical haul could not catch

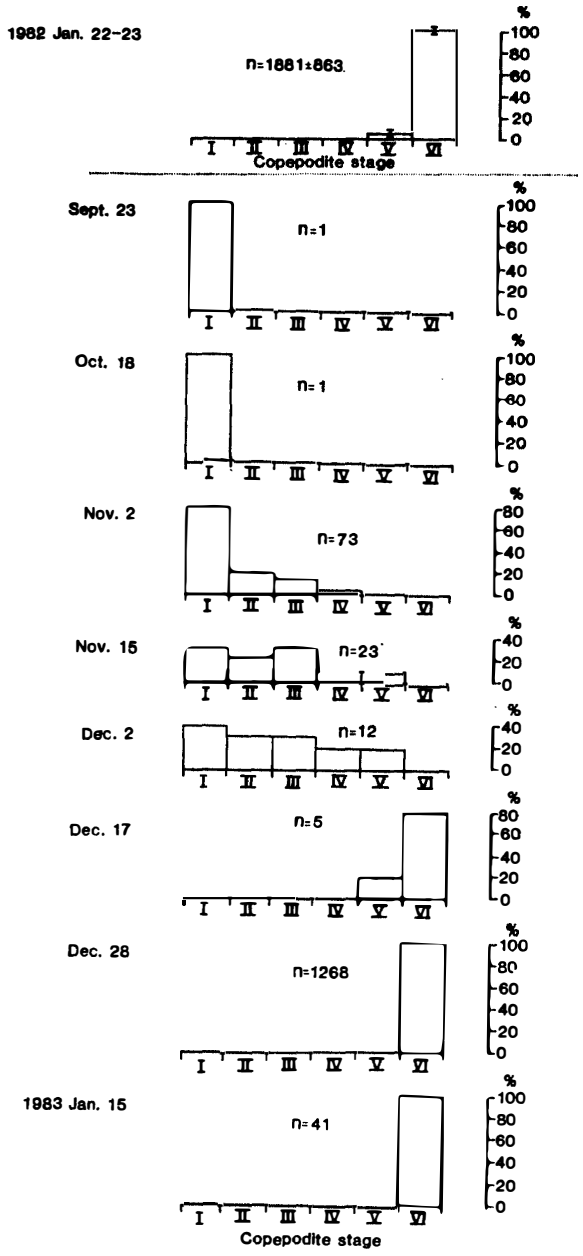

Fig. 4. Age composition of the Paralabidocera antarctica *populations. n: counted number of copepods. In January 1982, mean and standard deviation of counted number for nine samplings are listed and vertical lines indicate the standard deviation of age composition.*

them. The other is that *P. antarctica* overwinters as the egg or in the nauplius stage. More extensive data on the developmental process from egg to nauplii are needed to confirm the life history of *P. antarctica*. Vertical investigations under the sea ice including the lower part of the sea ice, water column and bottom sediment must be done to elucidate the mechanism of maintaining population for next generation.

Acknowledgments

The present authors are grateful to Prof. T. HOSHIAI, the leader of the 23rd Japanese Antarctic Research Expedition (JARE-23), National Institute of Polar Research and to Prof. T. MINODA of Hokkaido University, for their valuable suggestions. Thanks are also due to JARE-23 members for their support in the field work.

References

BRADFORD, J. M. (1971): The fauna of the Ross Sea. Part 8. Pelagic Copepoda. N. Z. Oceanographic Institute Memoir, **59**, 9–32.

FUKUCHI, M. and SASAKI, H. (1981): Phytoplankton and zooplankton standing stocks and downward flux of particulate material around fast ice edge of Lützow-Holm Bay, Antarctica. Mem. Natl Inst. Polar Res., Ser. E (Biol. Med. Sci.), **34**, 13–36.

FUKUCHI, M. and TANIMURA, A. (1981): A preliminary note on the occurrence of copepods under sea ice near Syowa Station, Antarctica. Mem. Natl Inst. Polar Res., Ser. E (Biol. Med. Sci.), **34**, 37–43.

FUKUCHI, M., TANIMURA, A. and OHTSUKA, H. (1984): Seasonal change of chlorophyll *a* under fast ice in Lützow-Holm Bay, Antarctica. Mem. Natl Inst. Polar Res., Spec. Issue, **32**, 51–59.

TANIMURA, A., MINODA, T., FUKUCHI, M., HOSHIAI, T. and OHTSUKA, H. (1984): Swarm of *Paralabidocera antarctica* (Calanoida, Copepoda) under sea ice near Syowa Station, Antarctica. Nankyoku Shiryô (Antarct. Rec.), **82**, 12–19.

VERVOORT, W. (1951): Plankton copepods from the Atlantic sector of the Antarctic. Verh. K. Ned. Akad. Wet., Afd. Nat., Sect. 2, **47**(4), 1–156.

WAGHORN, E. L. (1979): Two new species of Copepoda from White Island, Antarctica. N. Z. J. Mar. Freshwater Res., **13**(3), 459–470.

ZVEREVA, Zh. A., ed. (1975): Seasonal changes of Antarctic plankton in the Molodezhnaya and Mirny region. Geographical and Seasonal Variation of Marine Plankton. Jerusalem, IPST, 248–262 (Exploration of Marine Fauna, **12** (20)).

(*Received April 17, 1984; Revised manuscript received May 14, 1984*)