EPIPELAGIC COPEPODS OF CALANOIDA IN THE INDIAN SECTOR OF THE ANTARCTIC OCEAN (EXTENDED ABSTRACT)*

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Horizontal and vertical distributions of the epipelagic copepods of Calanoida were studied in the Indian sector of the Antarctic Ocean off Syowa Station, with special reference to the developmental stages of copepods and oceanographic conditions.

Three stations south of the Antarctic Convergence along 40°–42°E longitudes between 52° and 65°S latitudes were occupied during the period from February 24 to March 1 in 1979 (Stn. 1: 64°44′S, 40°52′E; Stn. 4: 56°08′S, 40°25′E; Stn. 6: 52°04′S, 43°17′E). Simultaneous horizontal towings with the MTD nets (MOTODA, 1971) were conducted. Ten nets were towed in the daytime for 20 min at a ship's speed of 2 knots through ten depths (0, 25, 50, 75, 100, 125, 150, 200, 250 and 300 m). The net's mouth diameter and length are 56 and 200 cm, respectively, with a mesh size of 0.35 mm. The volume of water filtered with a 20-min tow can be calculated to be 295 m^3, when the filteration efficiency of the net is 100%.

Vertical sections of temperature, salinity and sigma-*t* above 300 m along the three stations are shown in Fig. 1. During the austral summer season, the temperature minimum layer was well developed and the depth of the layer deepened from Stn. 1 (around 75–100 m) to Stn. 6 (around 150–200 m).

Nineteen species of calanoid copepods were identified from 29 samples and are listed in Table 1. General feeding habit of each species is also indicated in Table 1. The relative abundance of individual numbers (including copepodite stages) was as follows: (1) Most abundant copepods amounting to more than 10000 individuals per haul—*Calanus simillimus*, *Calanus propinquus*, *Calanoides acutus*, *Rhincalanus gigas*, *Ctenocalanus vanus*, *Scolecithricella minor* and *Metridia gerlachei*. (2) Common copepods—*Clausocalanus laticeps*, *Euchaeta exigua*, *Racovitzanus antarcticus*, *Pleuromamma robusta*, *Heterorhabdus farrani* and *Haloptilus oxycephalus*. (3) Rare

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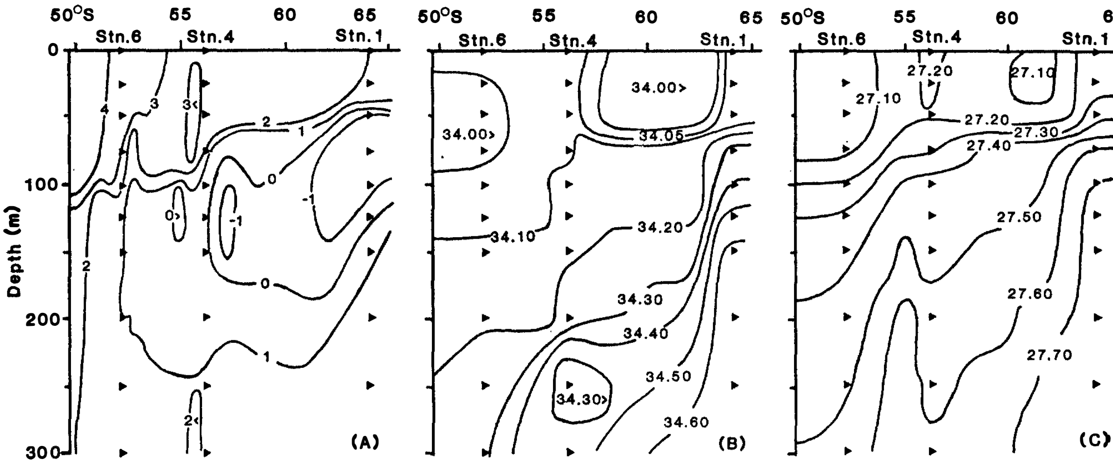

Fig. 1. *Vertical sections of temperature (A), salinity (B) and sigma-t (C) along 40°–42°E longitudes. Triangles indicate layers towed with the MTD nets (sample from 300 m depth at Stn. 1 was lost due to a cod-end trouble).*

Table 1. *Nineteen species of calanoid copepods.*

Order Calanoida
- Family Calanidae
  - Genus *Calanus* Leach, 1816.
    - □*Calanus simillimus* Giesbrecht, 1902.
    - □*C. propinquus* Brady, 1883.
  - Genus *Calanoides* Brady, 1883.
    - □*Calanoides acutus* Giesbrecht, 1902.
- Family Eucalanidae
  - Genus *Rhincalanus* Dana, 1852.
    - □*Rhincalanus gigas* Brady, 1883.
- Family Pseudocalanidae
  - Genus *Clausocalanus* Giesbrecht, 1888.
    - □*Clausocalanus laticeps* Farran, 1929.
    - □*Ctenocalanus vanus* Giesbrecht, 1888.
- Family Aetideidae
  - Genus *Euaetideus* Sars, 1925.
    - ▲*Euaetideus australis* Vervoort, 1957.
  - Genus *Gaidius* Giesbrecht, 1895.
    - ▲*Gaidius tenuispinus* Sars, 1900.
  - Genus *Euchirella* Giesbrecht, 1888.
    - ▲*Euchirella rostrata* Claus, 1866.
  - Genus *Valdiviella* Steuer, 1904.
    - ▲*Valdiviella insignis* Farran, 1908.
- Family Euchaetidae
  - Genus *Euchaeta* Phillipi, 1843.
    - ▲*Euchaeta exigua* Wolfenden, 1911.
- Family Scolecithricidae
  - Genus *Racovitzanus* Giesbrecht, 1902.
    - ▲*Racovitzanus antarcticus* Giesbrecht, 1902.
  - Genus *Scolecithricella* Sars, 1903.
    - ▲*Scolecithricella minor* Brady, 1883.
- Family Metridiidae
  - Genus *Metridia* Boech, 1864.
    - ▲*Metridia gerlachei* Giesbrecht, 1902.
  - Genus *Pleuromamma* Giesbrecht, 1898.
    - ▲*Pleuromamma robusta* Steuer, 1931.
- Family Heterorhabdidae
  - Genus *Heterorhabdus* Giesbrecht, 1898.
    - △*Heterorhabdus farrani* Brady, 1918.
- Family Augaptilidae
  - Genus *Haloptilus* Giesbrecht, 1898.
    - △*Haloptilus ocellatus* Wolfenden, 1908.
    - △*H. oxycephalus* Giesbrecht, 1902.
- Family Candaciidae
  - Genus *Candacea* Dana, 1846.
    - △*Candacea maxima* Vervoort, 1957.

□ Herbivorous species ▲ Omnivorous species △ Carnivorous species

copepods, being less than 200 individuals per haul—*Euaetideus australis*, *Gaidius tenuispinus*, *Euchirella rostrata*, *Valdiviella insignis*, *Haloptilus ocellatus* and *Candacea maxima*.

The relative abundance of each species was compared among the three stations and the following four groups were distinguished in the horizontal extent from south

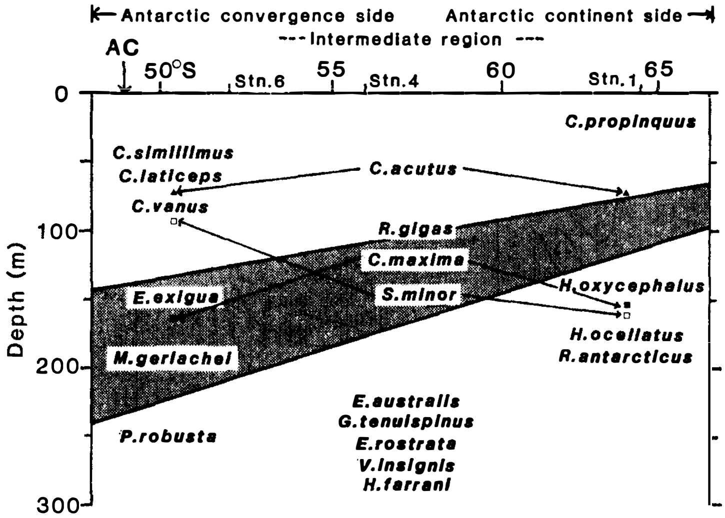

Fig. 2. Schematic representation of distribution of calanoid copepods in the Antarctic Surface Water.

to north: (1) Distributed mainly in the southernmost region toward the Antarctic Continent—*C. propinquus*, *R. antarcticus*, *H. ocellatus* and *H. oxycephalus*. (2) Distributed mainly in the northernmost region toward the Antarctic Convergence—*C. simillimus*, *C. laticeps*, *C. vanus*, *E. exigua*, *M. gerlachei* and *P. robusta*. (3) Distributed mainly in the intermediate region around Stn. 4—*R. gigas*, *E. australis*, *G. tenuispinus*, *E. rostrata*, *V. insignis* and *H. farrani*. (4) Distributed widely from south to north—*C. acutus*, *S. minor* and *C. maxima*.

The relative abundance was compared also among ten depths, and three groups were distinguished in relation to the oceanographic conditions as follows: (A) Occurring mainly in the surface layers above the temperature minimum layer—*C. simillimus*, *C. propinquus*, *C. acutus*, *R. gigas*, *C. laticeps* and *C. vanus*. (B) Occurring mainly in the temperature minimum layer—*E. exigua*, *S. minor*, *M. gerlachei* and *C. maxima*. (C) Occurring mainly below the temperature minimum layer—*E. australis*, *G. tenuispinus*, *E. rostrata*, *V. insignis*, *R. antarcticus*, *P. robusta*, *H. farrani*, *H. ocellatus* and *H. oxycephalus*.

Schematic representation of horizontal and vertical distributions of nineteen copepods is shown in Fig. 2. From the viewpoint of feeding habit, group (A) is composed of herbivorous copepods, group (B) is composed mainly of omnivorous copepods, and group (C) is composed of omnivorous and carnivorous copepods.

Life history of some species was already reported by ANDREWS (1966; on *C. acutus*), OTTESTAD (1932; on *C. acutus*, *C. propinquus*, *R. gigas* and *M. gerlachei*) and VORONINA (1970; on *R. gigas*). They stated that there was a time lag of spawning period among these copepods. Frequency distribution of developmental stages (copepodite I, II, III, IV, V, female and male) is shown in Fig. 3 for eight species of copepods which are found relatively abundant. *C. propinquus*, *C. acutus* and *R. gigas* are dominant copepodite II and III. *C. simillimus* and *M. gerlachei* are further growing and *C. vanus*, *R. antarcticus* and *S. minor* are maturing. Dominant stage was different from species to species, and it changes from young to adult stages in the fol-

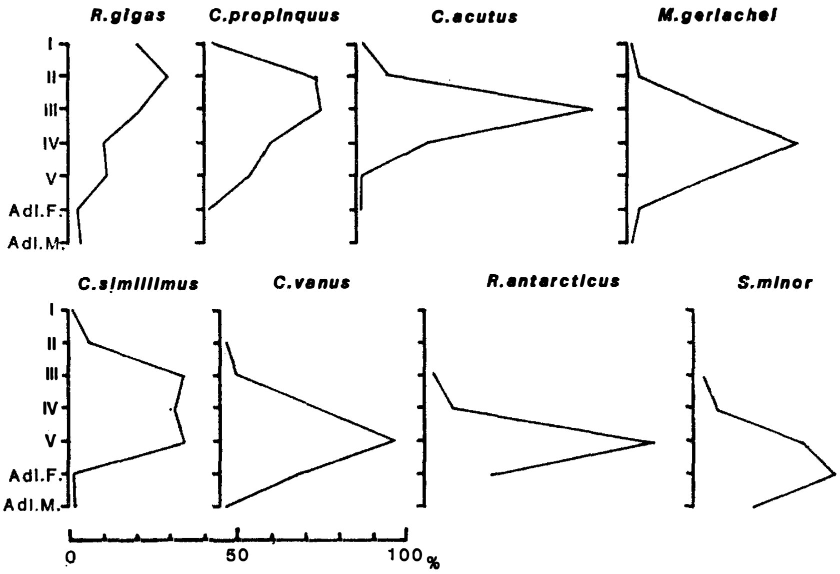

Fig. 3. Frequency distribution of developmental stages (copepodite I—V, adult female and male) for eight dominant copepods.

lowing order; *R. gigas*→*C. propinquus*→*C. acutus*→*M. gerlachei*→*C. simillimus*→*C. vanus*→*R. antarcticus*→*S. minor*. In the present study it was especially noticed that dominant stages of *C. vanus*, *R. antarcticus* and *S. minor* were different by species. This may be closely related with the reproduction cycle of each species and suggests that the spawning period of copepods progresses according to the above-mentioned order.

Within the Antarctic Surface Water, the epipelagic copepods showed specific distribution in horizontal and vertical extents as shown in Fig. 2. The specific distribution seems to be closely related with the oceanographic conditions and the feeding habit of copepods. Among the hervivorous copepods, in particular, the specific distribution and the different spawning period might lessen the competition.

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