Diel Vertical Migration of Zooplankton at a Fixed Station in the Antarctic (Bransfield Strait, Summer 1985)

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INTRODUCTION

Vertical migration is considered to be a general behavior of zooplankton communities. Since light is the main triggering factor, the study of vertical migration at high latitudes presents special interest. As a rule, publications on Antarctic copepods deal mainly with seasonal and horizontal distribution of the species. Very few papers are concerned with vertical migration. The classical articles are those by Mackintosh (1934, 1935), Hardy & Gunther (1935) and Tranmanney (1936); their results refer to large calanoids only. Andrew (1966) studied in detail the diel migration of *Calanoides acutus* and Rudyakov & Voronina (1974) recorded the diel vertical migration of *Metridia gerlachei*.

MATERIALS AND METHODS

Zooplankton samples were taken at a fixed station in the Bransfield Strait (60° 27' S; 56° 23' W), with the ship drifting (Fig. 1). The zooplankton was collected with a closing net having a 200-micra mesh aperture. The towings were performed vertically in the following layers: 50-0, 100-50, 200-100, 300-200, 450-300 m. The samples were taken every 6 hours (18:00, 24:00, 6:00 and 12:00) for one diel cycle (6-7 February 1985).

RESULTS

The copepod species represented in the samples were the following: *Calanus propinquus* Brady, *Calanoides acutus* Giesbrecht, *Rhincalanus gigas* Brady, *Microcalanus pygmaeus* G. O. Sars, *Ctenocalanus citer* Heron et Bowman, *Pereuchaeta anatarctica* (Giesbrecht), *Scolecithricella glacialis* Giesbrecht, *Metridia*

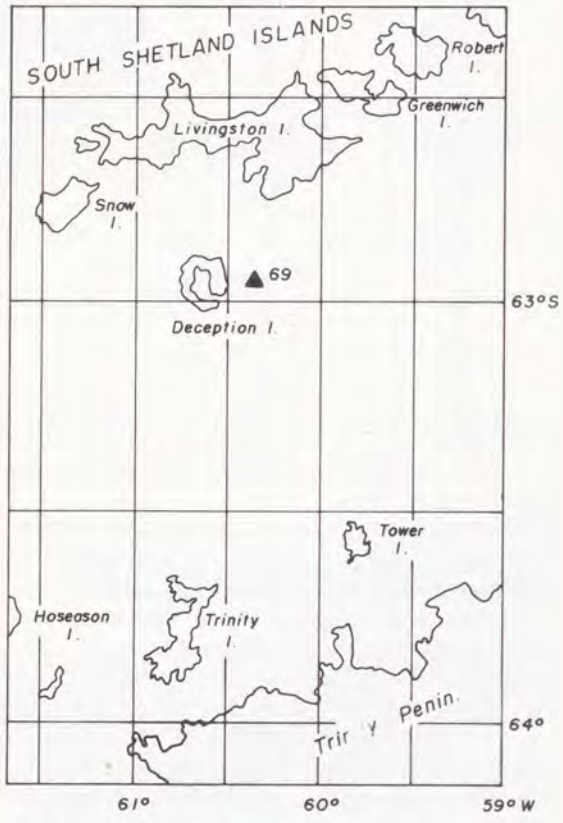

Fig. 1 – Profiles of temperature and salinity at the four sampling times (Bransfield Strait 6-7 February 1985).

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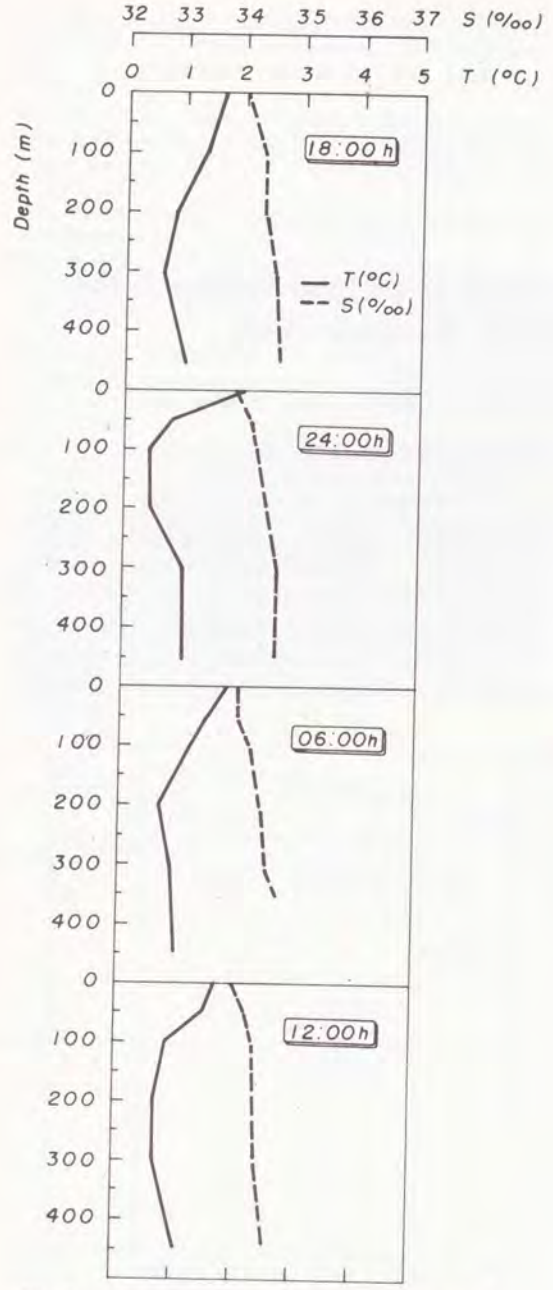

Fig. 2 – Diel vertical distribution of the total copepod population at the 24-hour collecting station.

lucens Boeck, *Metridia gerlachei* Giesbrecht, *Haloptilus oxycephalus* Giesbrecht, *Oithona atlantica* Farran, *Oithona similis* Claus and *Oncaea conifera* Giesbrecht.

The bulk of the copepod population consisted of small cyclopoids and copepodites of *Metridia gerlachei*. Only two adult females of *Metridia lucens* occurred. Larger calanoids were scarce in our samples: they are not collected by this type of net. In the Bongo net samples taken at the same time in the same area larger calanoids were abundant.

Temperature and salinity were measured at each sampling (Fig. 2).

As a whole, the copepod population sampled showed a marked vertical migration (Fig. 3). Since the hydrographic parameters of the water column were very homogeneous, neither salinity nor temperature acted as a barrier to the migration.

Different migratory patterns were found for different species (Figs. 4 e 5).

The majority of the species, namely *C. citer*, *M. pygmaeus*, *M. gerlachei*, *O. similis* and *O. conifera*, performed a marked ascent at midnight and a minor one at mid-day. The species differed as to the depth and the amplitude of their diel migration.

C. citer migrated from 300 to 0 m. *M. pygmaeus* had a greater amplitude, namely from 450 m to the surface, and only a small number of specimens reached the surface at 24:00 hr. The populations of both these species were mainly composed of adult specimens.

The vertical movement of *M. gerlachei* was very extensive, covering the entire sampled water column. The majority of the population, though, migrated between 300-200 m. Only a few adult specimens of this species occurred in the samples and these had a scattered vertical distribution.

O. similis migrated through the whole water column, but the population was mainly

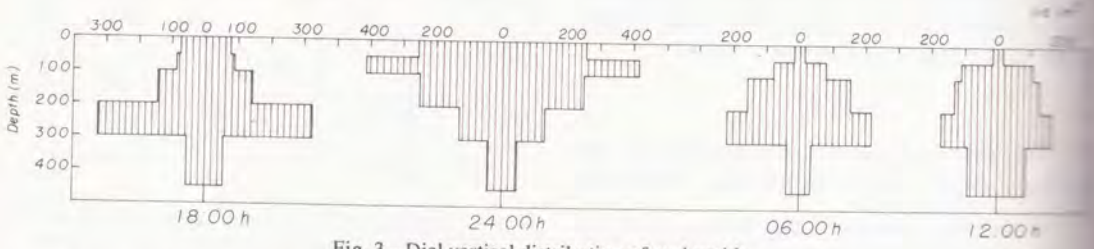

Fig. 3 – Diel vertical distribution of cyclopoids.

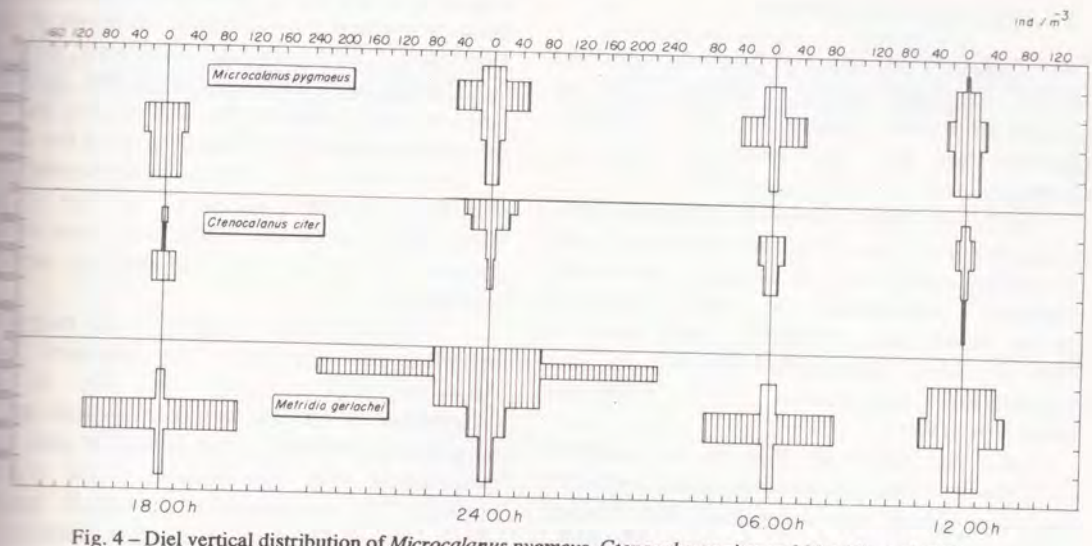

Fig. 4 – Diel vertical distribution of *Microcalanus pygmeus*, *Ctenocalanus citer* and *Metridia gerlachei*.

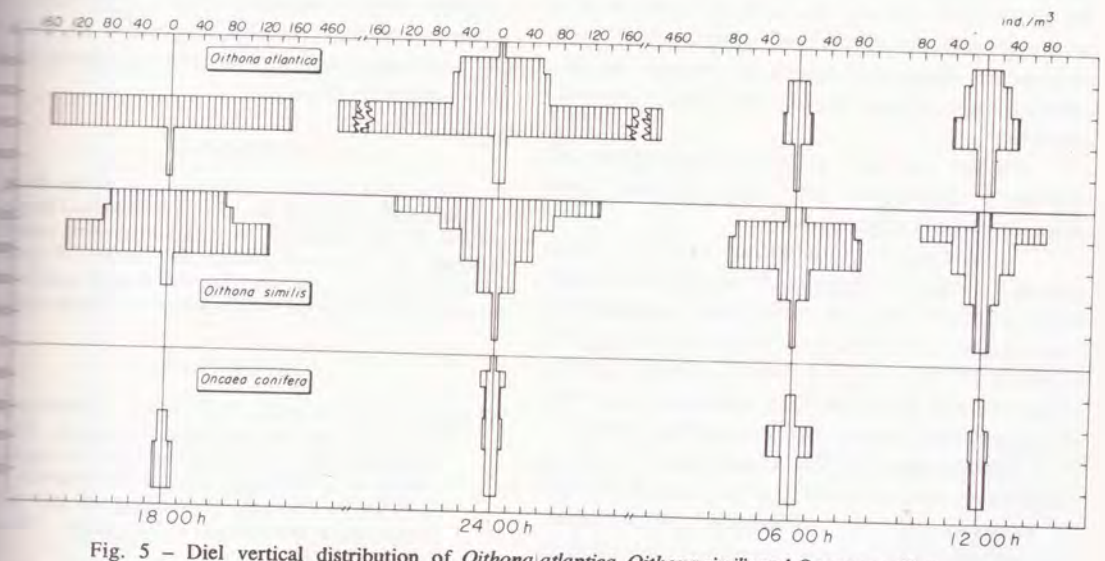

Fig. 5 – Diel vertical distribution of *Oithona atlantica*, *Oithona similis* and *Oncaea conifera*.

ncentrated in the upper 200 m. *O. atlantica* migrated through the whole column but more numerous within the 300-200 m layer. Although the two species coexist in the same layers, *O. similis* prefers shallower waters than *O. atlantica*.

O. conifera showed a very marked vertical migration with a wider amplitude than that of other cyclopoid species. There are indications that *O. conifera* migrates from waters deeper than those sampled by our net.

P. antarctica and *H. oxycephalus* are deep-water species, therefore they occurred in low densities. *P. antarctica* rose to the 100-50 m layer at midnight, and *H. oxycephalus* occurred only in layers deeper than 200 m.

A reverse migration was observed only in *S. glacialis*. This species was found during the day at all depths, while at midnight it appeared oly in the deepest layer.

C. propinquus, *C. acutus* and *R. gigas* occurred frequently in our samples but in low numbers. They showed no clear patterns of vertical migration.

DISCUSSION

Although this study is based on only one 24 hr sampling period, previous data on vertical copepod migration at high Antarctic latitudes, are few and scattered, referring, moreover, only to larger copepods.

In recent years, sampling of zooplankton in the Antarctic has also been done with nets of smaller mesh size. As a result, previously neglected populations of small copepod species hawe been sampled. These seem to form a very important fraction of the zooplankton (Kaczmaruk 1983; Almeida Prado-Por, 1984).

We can conclude that in our samples most copepod species showed pronounced diel migration. There was a peculiar, less evident second upward migration at noon. To date, this peculiar behavior has been mentioned only for *M. gerlachei* (Rudyakow & Voronina, 1974). Such a second rise seems to be performed mainly by species that have a wider amplitude of vertical distribution. This pattern of migration might be related ot the special light regime during the late Antarctic summer.

Earlier records on vertical migration of Antarctic copepods are very limited and sometimes fairly inconclusive.

According to Raymont (1983), there appear to exist all grades of migration at very high latitudes and the behavioral patterns of the species are seasonally modified. Hardy & Gunther (1935) suggest that *C. acutus* and *R. gigas* do not perform diel migration and that they have only a seasonal vertical migration.

Ommanney (1936) states that *R. gigas* undertakes seasonal vertical migration similar to species of the Northern Hemisphere. Mackintosh (1937) does not report any evident vertical migration in *R. gigas*, but a marked descent from surface layers in the summer to deep and warm waters in the winter. He further states that adults of *C. propinquus* normally inhabiting the surface layer do not perform effective daily migrations, nor apparent annual migration.

Bogorov (1954) compares the migratory behavior of zooplankton species under Arctic polar conditions in the Barents Sea (i.e. around 70°N) and the subpolar conditions of the White Sea (i.e. about 65°N). Under polar conditions, the zooplankton shows diel migration only during the short autumn, when there is a clear change in the duration of day and night. Under subpolar conditions, some of the species also migrate during the summer since at such latitudes the sun is very low on the horizon during the second half of the day.

Our study was carried out in summer at a southern latitude comparable to that of the White Sea. As in the White Sea, most of the species (ten of thirteen) did perform vertical migration.

The conflicting results on the migratory behavior of copepods, as reported from Antarctic waters, may be due to the differences in latitude between stations and to seasonal differences. The subpolar zone is a transitional area with respect to the vertical behavior of zooplankton. A single species might have different migration patterns at different latidudes and in different seasons.

As a rule it seems that large calanoids show a more irregular diel pattern than smaller species: their seasonal depth distribution is more constant. The small species, as well as *M. gerlachei*, are regular diel migrators in the sub-Antarctic summer.

SUMMARY

The diel vertical migration of copepods during a 24-hour period at a fixed station in the Bransfield Strait was studied in the Antarctic summer. Different migratory behavior was observed among the species. A peculiar secondary rise at noon was observed in most species. The data found are compared with those from both polar regions.

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