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# Horizontal and vertical distribution of Ostracoda in Drake Passage and Bransfield Strait (BIOMASS-SIBEX, December 1983–January 1984)

ABSTRACT: The material discussed in this paper was collected in the Drake Passage and Bransfield Strait (Antarctica) within the framework of the BIOMASS-SIBEX programme. Samples were collected by hauling Nansen nets verticaly through the 100–0, 300–100 and 500–300 m layers in December 1983 and January 1984. Of the six species recorded — *Metaconchoecia isocheira, Alacia hettacra, Alacia belgicae, Metaconchoecia skogsbergi, Boroecia antipoda* and *Discoconchoecia aff. elegans* — the first three, endemic to Antarctic waters — were predominant (92.9%). Ostracoda were found most abundantly in the eastern part of the study area — between Elephant Island and South Orkney Islands, and in the south-western part of Bransfield Strait. Their vertical distribution depended on the hydrological conditions. Ostracoda were most numerous in the 500–300 m and 300–100 m layers; very few were recorded in the 100–0 m surface layer.

K e y w o r d s: Antarctica, BIOMASS-SIBEX, Ostracoda.

## Introduction

Ostracoda are an important constituent of the zooplankton in the pelagial of the Southern Ocean because of their potentially large biomass in polar waters (Hopkins 1985a). In Antarctic waters the planktonic Ostracoda are represented mainly by the families Halocyprididae and Cypridinidae. They occur throughout the water column — from the lower epiplagial down to the abyssopelagial (Deevey 1978) — and comprise not only omnivores (Hopkins 1987) but also herbivores, predators and detritus feeders (Hopkins and Torres 1989). In these waters Ostracoda feed primarily on Copepoda and the remains of Euphausiacea (Hopkins 1985a). Along with other predators feeding on Copepoda, Ostracoda significantly affect the abundance of these crustaceans, the most numerous in the Southern Ocean.

Ostracoda are still a relatively poorly understood group of animals, and in most papers on the zooplankton of Antarctic waters they are hardly mentioned (Boden and Parker 1986, Boysen-Ennen and Piatkowski 1988, Freire, Coelho and Bonecker 1993, Park and Wormuth 1993 and others). The object of the present paper is to analyse the vertical and horizontal distribution of Ostracoda in the waters of Drake Passage and Bransfield Strait during the Antarctic summer in December 1983 and January 1984.

## Material and method

The material for this paper was collected during the scientific cruise of r/v "Profesor Siedlecki" from December 10, 1983 to January 8, 1984 within the framework of the BIOMASS-SIBEX research programme. The material contained 131 samples from 58 stations (Fig. 1) (Rakusa-Suszczewski and Lipski 1985). These samples were caught with a Nansen planktonic net of the diameter of 70 cm and mesh size of 260 μm from three standard layers: 0–100 m, 100–300 m, 300–500 m; in some few cases the whole 0–300 or 0–500 m water column was sampled. At neritic nearshore stations one vertical haul from the bottom to the surface was carried out. The material was immediately preserved in 4% formalin solution. In the laboratory, Ostracoda were separated from the rest of the zooplankton, and all specimens subsequently underwent bioanalysis.

Determination of Ostracoda was based on the papers by Müller (1912), Sars (1928), Deevey (1978, 1982), Angel (1981), and Kock (1992). The number of specimens was calculated for 1000 $m^3$ (Tabs. 1–3).

## Results and discussion

We recorded Ostracoda at 48 stations located in Drake Passage and Bransfield Strait. None were reported at further 7 stations, where only the 100–0 m layer was sampled, or at 3 others where samples were taken from the 300–500 m and 100–0 m layers (Tabs. 1–3). Generally speaking few, if any, Ostracoda do occur in surface waters (Angel and Fasham 1975). They occur numerously in the 100–500 m layer, but below 500 m their numbers drop quite considerably, although the species diversity is here greater (Deevey 1978). The largest numbers of Ostracoda were recorded in the eastern part of the study area, between Elephant Island and South Orkneys (Fig. 2). The occurrence of an extensive cyclonic deflection was characteristic of this region in December 1983 and January 1984 (Grelowski, Majewicz and Pastuszak 1986). In part, this is also a zone of influence of cooler and more saline waters from the Weddell Sea, which during the study period displayed very weak activity (Grelowski and

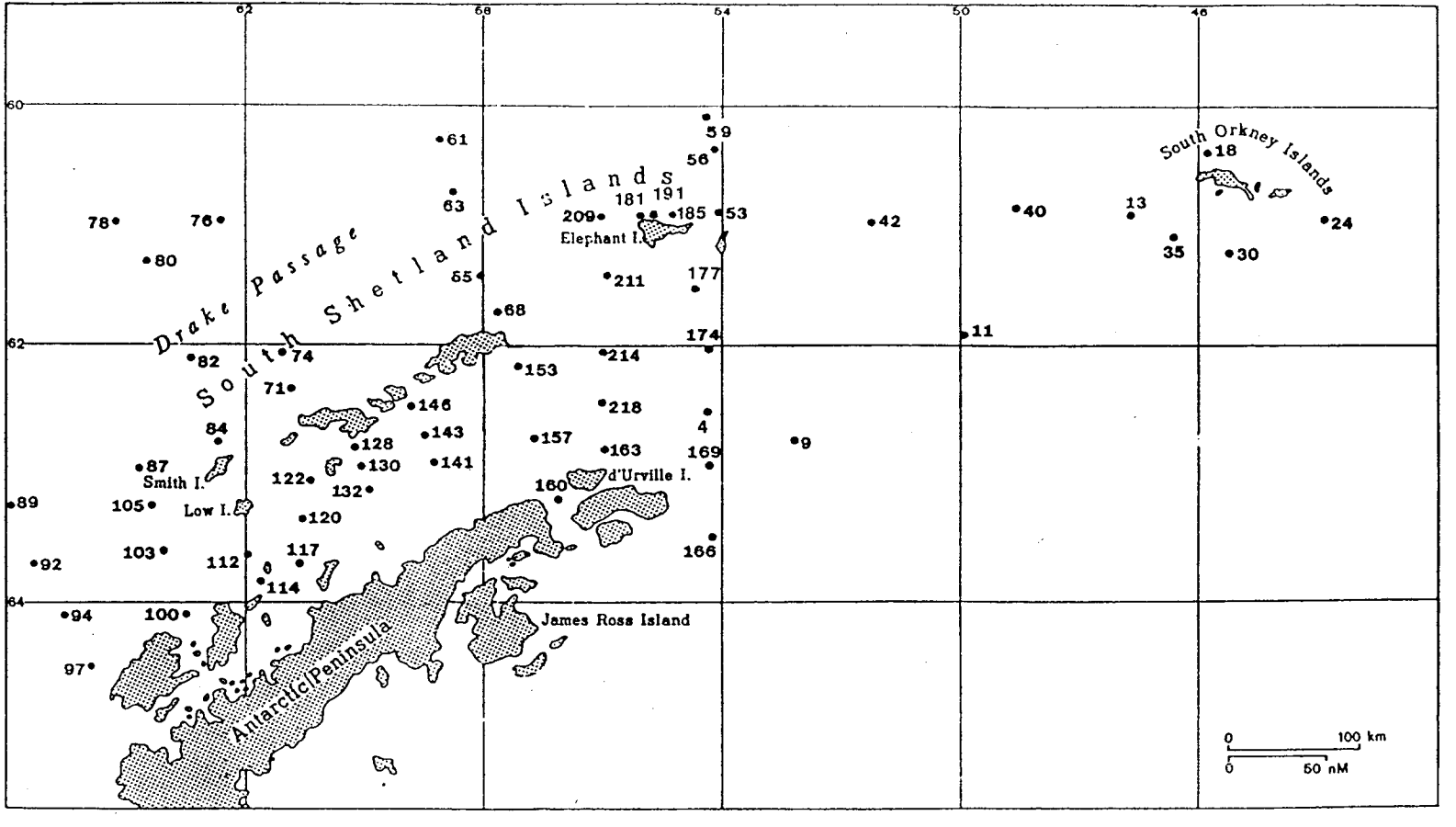



Fig. 1. Map of sampling stations in Drake Passage and Bransfield Strait (December 1983–January 1984; BIOMASS-SIBEX) (Grelowski and Tokarczyk 1985).

Table 1.

The distribution of Ostracoda in the 100–0 m layer (number of individuals per 1000 $m^3$) at the stations situated in Drake Passage and Bransfield Strait (December 1983–January 1984, BIOMASS-SIBEX)

| Station | Species | | | | | |
|---|---|---|---|---|---|---|
| | *A. belgicae* | *M. isocheira* | *A. hettacra* | *M. skogsbergi* | *B. antipoda* | *D. aff. elegans* |
| 9 | | | | | | |
| 11 | | | 26 | | | |
| 13 | | | | | | |
| 18 | | | | | | |
| 24 | | | | | | |
| 30 | | | | | | |
| 35 | | | | | | |
| 40 | | | | | | |
| 42 | | | | | | |
| 53 | | | 26 | | | |
| 56 | | | | | | |
| 59 | | | | | | |
| 61 | 52 | 26 | 26 | | | |
| 63 | | | | | | |
| 65 | | | | | | |
| 68 | 26 | | | | | |
| 71 | | | | | | |
| 74 | | | | | | |
| 76 | | | | | | |
| 78 | | 26 | | | | |
| 80 | | | | | | |
| 82 | | | | | | |
| 84 | 52 | | | | | |
| 87 | | | 52 | | | |
| 89 | 26 | | | | | |
| 92 | | | | | | |
| 94 | | | | | | |
| 97 | | | | | | |
| 100 | | | | | | |
| 103 | | | | | | |
| 105 | | | | | | |
| 112 | | | | | | |
| 114* | 15.3 | | | | | |
| 117 | | | | | | |
| 120 | | | | | | 13 |
| 128 | | | | | | |
| 130 | 52 | | | | | |
| 132 | | | | | | |
| 141 | | | | | | |
| 143 | | 26 | | | | |
| 146 | | | | | | |
| 153 | 156 | 26 | | | | |
| 157 | | | | | | |

Table 1 cont.

| Station | Species | | | | | |
|---|---|---|---|---|---|---|
| | *A. belgicae* | *M. isocheira* | *A. hettacra* | *M. skogsbergi* | *B. antipoda* | *D. aff. elegans* |
| 160 | | | | | | |
| 163 | | | | | | |
| 166 | 130 | 78 | | | | |
| 169 | | | | | | |
| 174 | | | | | | |
| 177 | | | | | | |
| 181 | | | | | | |
| 185 | | | | | | |
| 191** | | | | | | |
| 209 | | | | | | |
| 211 | 26 | | | | | |
| 214 | | | | | | |
| 128 | | | | | | |

* — 0–170 m layer
** — 0–190 m layer

Table 2.

The distribution of Ostracoda in the 300–100 m layer (number of individuals per 1000 m$^3$) at the stations situated in Drake Passage and Bransfield Strait (December 1983–January 1984, BIOMASS-SIBEX)

| Station | Species | | | | | |
|---|---|---|---|---|---|---|
| | *A. belgicae* | *M. isocheira* | *A. hettacra* | *M. skogsbergi* | *B. antipoda* | *D. aff. elegans* |
| 4* | 14.4 | 108.3 | 57.8 | 7.2 | 14.4 | |
| 9 | 39 | 65 | 65 | | | |
| 11 | 13 | 104 | 325 | | | |
| 13 | 13 | 65 | 130 | | | |
| 18* | | 34.7 | 17.3 | | | |
| 24 | 17.3 | 86.7 | 34.7 | | | |
| 30 | 34.7 | 34.7 | 34.7 | | | |
| 40 | 26 | 182 | 390 | 13 | | |
| 42 | 39 | 52 | 52 | | | |
| 53 | 52 | 52 | 39 | | | |
| 56 | 104 | | 13 | | | |
| 59 | 13 | | | | | |
| 61 | 13 | | 494 | | | |
| 63 | 52 | 194 | 484 | | | 156 |
| 68 | 123.2 | 136.8 | 82.1 | | | |
| 71 | 26 | | | | | |
| 74 | 52 | 52 | 52 | | | |
| 76 | 13 | 13 | 91 | | | |
| 78 | | | 377 | | | |
| 80 | | | 78 | | 26 | |
| 82 | 78 | 26 | 299 | | | |
| 84 | 39 | 117 | 39 | | | |
| 87 | | 13 | 52 | | | |

Table 2 cont.

| Station | Species | | | | | |
|---|---|---|---|---|---|---|
| | *A. belgicae* | *M. isocheira* | *A. hettacra* | *M. skogsbergi* | *B. antipoda* | *D. aff. elegans* |
| 89 | | 13 | 78 | | | |
| 92* | 17.3 | | 26 | | | |
| 94 | 520 | 533 | 468 | | | |
| 97 | 741.5 | 327.4 | 67.4 | | 9.6 | 9.6 |
| 100 | 1222 | 91 | 13 | | | |
| 103 | 35.9 | 80.7 | 71.7 | | | |
| 105 | 54.7 | 314.7 | 82.1 | | | |
| 112 | 74.3 | 118.9 | 175 | | | |
| 120 | 52 | 26 | 39 | | | |
| 122 | 117 | 78 | 130 | | | |
| 130 | 13 | 13 | 13 | | | |
| 132 | 13 | 26 | 65 | | | |
| 141 | | | | | | |
| 143 | 26 | 91 | 65 | | | |
| 146 | 338 | 260 | 13 | 13 | | |
| 163 | 12.4 | 12.4 | 24.8 | | | |
| 166 | 34.7 | 190.7 | 17.3 | | | |
| 169 | | | | | | |
| 174 | 39 | 78 | 26 | | | |
| 177 | | | | | | |
| 181 | 11.8 | 21.7 | | 11.8 | | |
| 209 | | 13 | 26 | | | |
| 211 | 67.4 | 48.1 | 38.5 | | | |
| 214 | 104 | 52 | 52 | | | |
| 218 | | | 13 | | | |

* — 0 – 300 m layer

Table 3.

The distribution of Ostracoda in the 500 – 300 m layer (number of individuals per 1000 m³) at the stations situated in Drake Passage and Bransfield Strait (December 1983 – January 1984, BIOMASS-SIBEX)

| Station | Species | | | | | |
|---|---|---|---|---|---|---|
| | *A. belgicae* | *M. isocheira* | *A. hettacra* | *M. skogsbergi* | *B. antipoda* | *D. aff. elegans* |
| 9 | 65 | 533 | 429 | 234 | 26 | |
| 11 | | 1183 | 468 | 143 | 39 | |
| 13 | 39 | 377 | 208 | 13 | | |
| 40 | 91 | 1443 | 637 | 351 | | |
| 42 | | 1443 | 1456 | 234 | 91 | |
| 53* | 67.6 | 182 | 130 | 15.6 | 31.2 | 5.2 |
| 56* | 52 | 46.8 | 72.8 | | | |
| 59 | 91 | 234 | 117 | | | |
| 61 | 65 | 156 | 182 | | | 312 |
| 63* | 10.4 | 41.6 | 228.8 | 5.2 | 5.2 | 88.4 |

Table 3 cont.

| Station | Species | | | | | |
|---|---|---|---|---|---|---|
| | *A. belgicae* | *M. isocheira* | *A. hettacra* | *M. skogsbergi* | *B. antipoda* | *D. aff. elegans* |
| 74* | 109.2 | 161.2 | 130 | | | |
| 76 | 13 | 156 | 143 | | | |
| 78 | | 91 | 104 | | | |
| 80 | | 39 | 221 | 13 | 39 | 65 |
| 82 | 130 | 351 | 533 | | 13 | |
| 84 | 118.2 | 212.7 | 47.3 | | | |
| 87 | 39 | 117 | 117 | 13 | | |
| 89 | | 325 | 117 | 26 | 104 | |
| 94 | 169 | 494 | 104 | | | |
| 100 | 650 | 325 | 299 | | | |
| 120 | 67.6 | 343.2 | 150.8 | 83.2 | | 5.2 |
| 132 | 26 | 52 | 26 | | | |
| 141 | 169 | 377 | | | | |
| 143 | 39 | 286 | 260 | 39 | | |
| 209 | 78 | 104 | 39 | | | |
| 214 | 741 | 689 | 143 | 13 | | |

* — 0–500 m

Tokarczyk 1985). This unique hydrological conditions were undoubtedly responsible for the high concentrations of Ostracoda in the region.

The north-western part of Bransfield Strait is the other region with a high concentration of Ostracoda (Fig. 2). This is due to the inflow from the west of somewhat warmer and less saline waters from the Bellingshausen Sea (Grelowski, Majewicz and Pastuszak 1986). The structure of the water masses in Bransfield Strait is rather complex owing to their various provenance and the circulation of the currents there (Grelowski and Tokarczyk 1985), and their considerable dynamics probably contribute to their high fertility.

Biological analysis of the plankton caught in Drake Passage and Bransfield Strait in the 1983/84 summer season revealed low specific diversity among the Ostracoda, only 6 species being present, all from the same family: Halocyprididae, sub-family Conchoeciinae:

*Alacia belgicae* Müller, 1906
*Alacia hettacra* Müller, 1906
*Metaconchoecia isocheira* Müller, 1906
*Metaconchoecia skogsbergi* Iles, 1953
*Boroecia antipoda* Müller, 1906
*Discoconchoecia aff. elegans* Sars, 1865

This monotony of species is due to the fact that only depths down to 500 m were sampled, and on the other hand to the relatively small geographical area studied (59°59″8′S – 64°30″2′S; 66°00″6′W – 43°58″3′W).

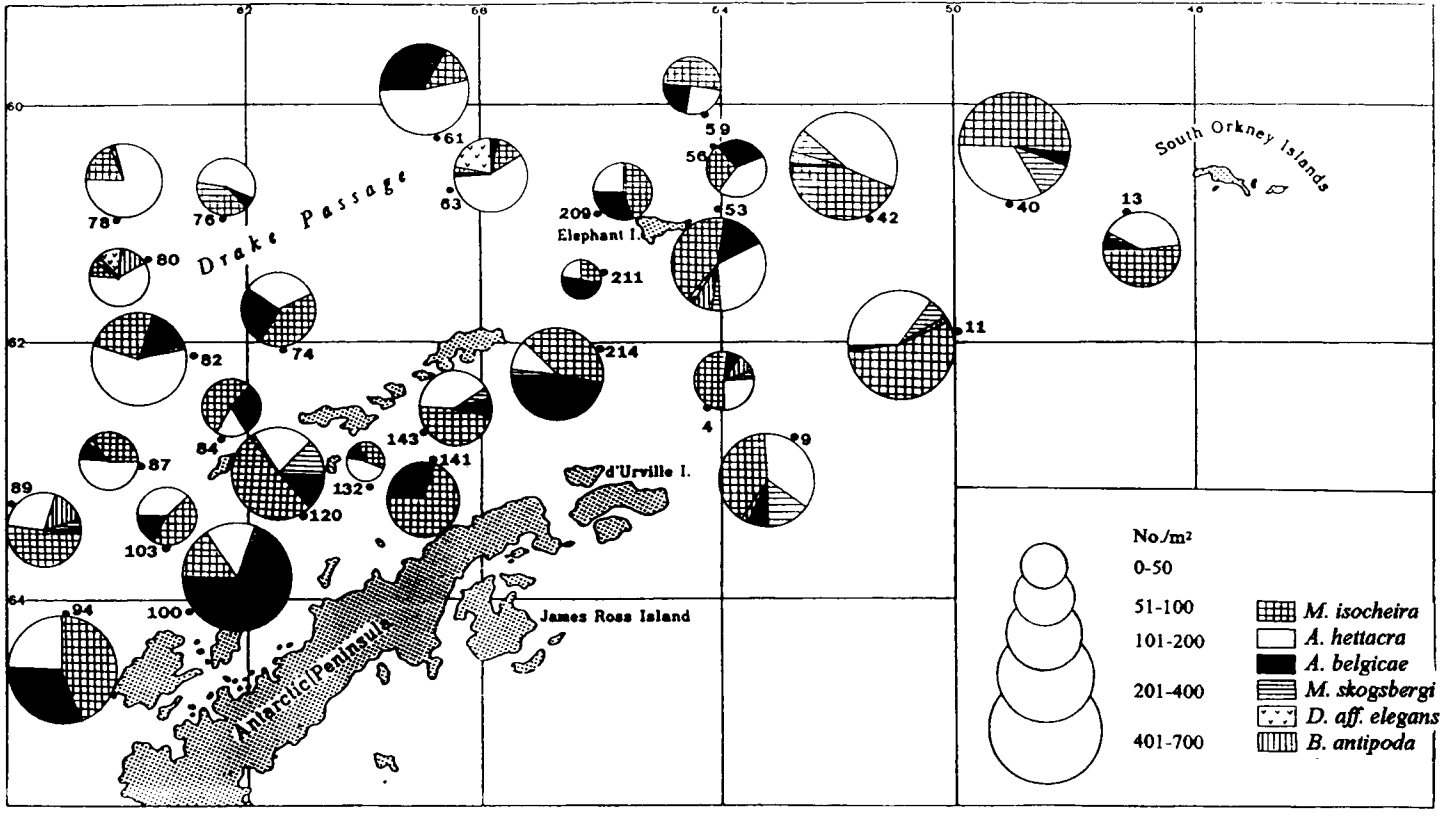



Fig. 2. The quantitative distribution of Ostracoda (ind./m²) in Drake Passage and Bransfield Strait (December 1983 – January 1984; BIOMASS-SIBEX). (Water layers summarized)

According to Deevey (1982) 17 species of Ostracoda occur south of 60°S, and only 9 south of 70°S. Barely 6 typically Antarctic species are capable of survival at latitude 77–78°S.

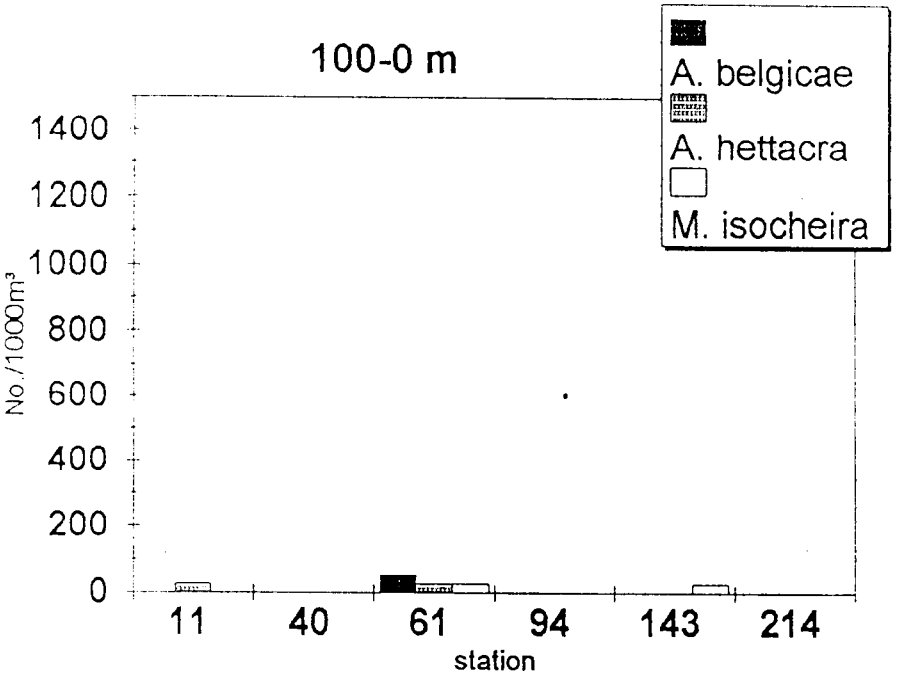
There is also an evident asymmetry in the species diversity among the pelagic Ostracoda in Antarctic waters: 23 are of Pacific origin, whereas only 7 from the Atlantic (Kock 1992).

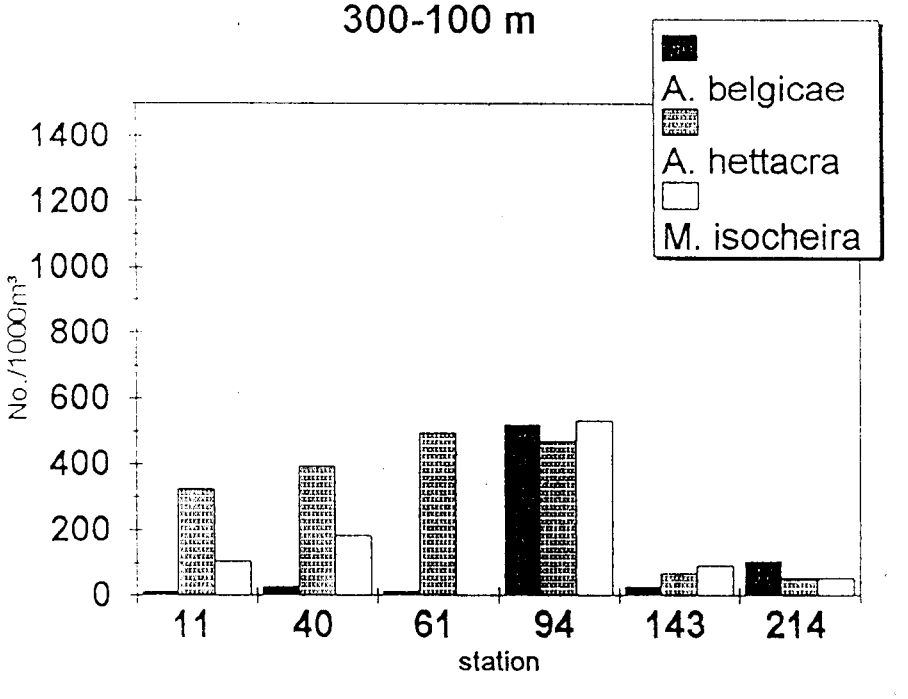
The principal features determining the distribution of Ostracoda in Antarctic waters are the preferences of species for certain depths and hydrological conditions (Deevey 1978, 1982, 1983).

Of the Ostracoda species recorded in our materials three species endemic to Antarctica were predominant — *A. hettacra, A. belgicae* and *M. isocheira* — together making up 92.9%. This is in agreement with the observations of Kock (1992, 1993), who reports that three last-mentioned species comprised about 90% in of ostracods in Antarctic waters. 38.8% of our Ostracoda — the highest proportion in the study area — were *M. isocheira,* a typical Antarctic species, the largest numbers of which are recorded south of the Antarctic Convergence (Deevey 1982). The highest density — 1443 specimens/1000 m$^3$ — was recorded at stations 40 and 42 in the 500–300 m layer. In general, the largest numbers of *M. isocheira* were reported from the 500–300 m layer at stations 11, 94 and 214, and from the 300–100 m layer at station 94 (Fig. 3). Although *M. isocheira* is an epipelagic form concentrating mainly in the 50–400 m zone (Hopkins and Torres 1988), its range of occurrence is in fact wider and it can be found down to 2000 m (Deevey 1978). The hydrological instability (Grelowski and Tokarczyk 1985) in the study area was probably the cause of the very low numbers (or lack) of this species in the 100–0 m layer (Tabs. 1–3).

*A. hettacra* takes second place with 32.8%. The highest numbers of this species were recorded at station 42 between Elephant I. and South Orkneys in the 500–300 m layer (maximum concentration of 1456 specimens/1000 m$^3$) and at stations 61 and 63 in Drake Passage at depths of 300–100 m. The vertical distribution of this species in the study area tallies with Hopkins' observations (1985b): he states that in Antarctic waters *A. hettacra* tends to concentrate in the 200–500 m depth range. *A. hettacra* is widespread in the Southern Ocean and shows a distinct preference for open waters (Hillman 1969). This is confirmed by the fact that it made up over 50% of all the Ostracoda caught in stations in Drake Passage (Fig. 2).

The third species endemic to Antarctica, *A. belgicae,* comprised 21.3% of the Ostracoda recorded in Drake Passage and Bransfield Strait. The maximum density was 1222 specimens/1000 m$^3$ at station 100 in the 300–100 m layer. Somewhat smaller numbers were reported from stations 94 (300–100 m) and 214 (500–300 m) (Fig. 3). This also corresponds with Hopkins' data (1985b) on the vertical distribution of *A. belgicae* — there is an evident maximum in the 200–400 m layer. *A. belgicae* shows a mainly continental distribution (Kock


100-0 m
A. belgicae
A. hettacra
M. isocheira
No./1000m³
1400
1200
1000
800
600
400
200
0
11
40
61
94
143
214
station


300-100 m
A. belgicae
A. hettacra
M. isocheira
No./1000m³
1400
1200
1000
800
600
400
200
0
11
40
61
94
143
214
station

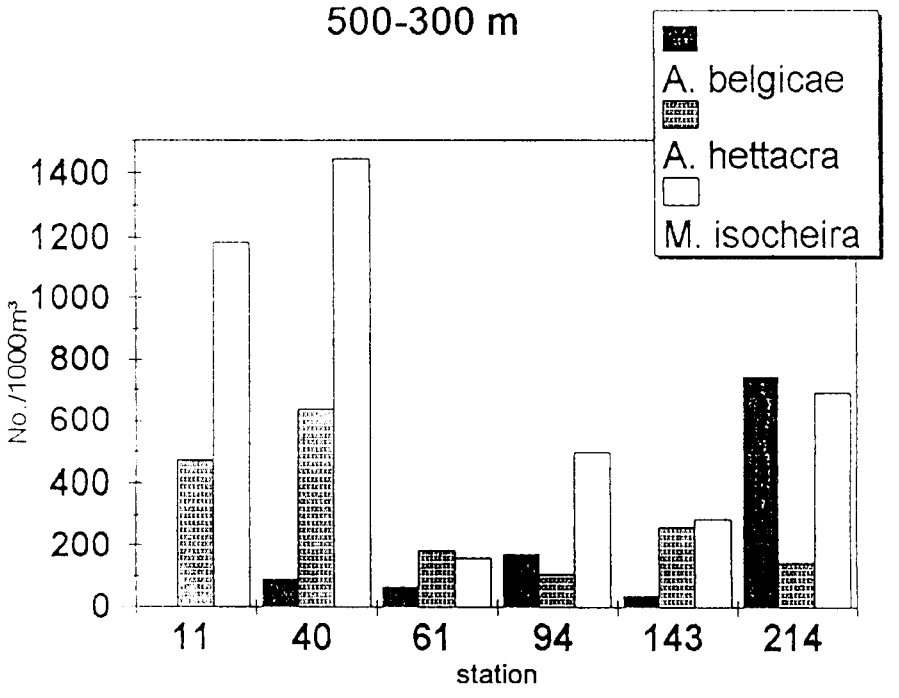



Fig. 3. Distribution of predominant species of Ostracoda in a water column at six selected stations in Drake Passage and Bransfield Strait (December 1983–January 1984; BIOMASS-SIBEX)

1993). The large concentrations of this species at stations in Bransfield Strait testify for its ecological preferences for the neritic zone (Fig. 2).

*M. skogsbergi* is the fourth most numerous Ostracoda in the region (3.7%). Specimens of this deep-water species have been recorded below 500 m from latitude 34°S to 78°S (Deevey 1982). This explains its total absence from samples taken in the 100–0 m layer, and its presence in only 4 of 49 samples from the 300–100 m layer but in quite a number of samples from 500–300 m (Tabs. 1-3). The largest numbers of *M. skogsbergi* were recorded in the 500–300 m layer in the area between Elephant I. and South Orkneys; the maximum number was 357 specimens/1000 $m^3$ (station 40).

Another species occuring in small numbers was *D. aff. elegans* (2.2%). This is a widespread species, occurring in the Atlantic between 80°N and 56°S (Deevey 1978). In our material *D. aff. elegans* was recorded almost exclusively in Drake Passage at depths of 500–300 m. This concurs with Deevey's observations (1982), who states that this species tends to concentrate in the upper water layers (above 500 m), though avoiding the surface (100–0 m).

*B. antipoda* was the least numerous species in the study area (1.2%). Like *M. skogsbergi* it is a deep-water species recorded south of the Antarctic Convergen-

ce as far as 68°S (Deevey 1978). The highest numbers of *B. antipoda* — 104 specimens/1000 $m^3$ were recorded at station 89 in the 500–300 m layer.

To summarize, the highest concentrations of Ostracoda were recorded in the eastern part of our study area, between Elephant I. and South Orkneys, and the south-western part of Bransfield Strait. In the vertical, Ostracoda were most abundant in the 300–500 m depth range, and somewhat less so between 100 and 300 m. Very small numbers were recorded in the surface 0–100 m layer.

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## Streszczenie

Próby planktonowe zebrane przez polską wyprawę w ramach programu BIOMASS-SIBEX obejmowały 131 prób z 58 stacji rozmieszczonych głównie w Cieśninie Drake'a i Cieśninie Bransfielda (Rys. 1). Próby pobierane były pionowymi zaciągami siatki Nansena w warstwach: 100–0 m, 300–100 m i 500–300 m na przełomie grudnia 1983 i stycznia 1984 roku. Stwierdzono obecność sześciu gatunków Ostracoda: *Alacia hettacra, A. belgicae, Metaconochoecia isocheira, M. skogsbergi, Boroecia antipoda* oraz *Discoconchoecia aff. elegans*. Wśród zanotowanych gatunków Ostracoda dominowały zdecydowanie endemiczne gatunki wód antarktycznych: *M. isocheira, A. hettacra* i *A. belgicae*, które łącznie stanowiły 92.9%. Przedstawiciele Ostracoda najliczniej reprezentowani byli we wschodniej części badanego rejonu, pomiędzy Wyspą Elephant a Orkadami Południowymi oraz w południowo-zachodniej części Cieśniny Bransfielda (Rys. 2). Rozprzestrzenienie horyzontalne małżoraczków modyfikowane było zmiennością warunków hydrologicznych. Generalnie Ostracoda skupiały się w zakresie głębokości 100–500 m (Rys. 3) unikając powierzchniowej warstwy wody 0–100 m (Tab. 1–3).