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Katarzyna BŁACHOWIAK-SAMOŁYK and Maria Iwona ŻMIJEWSKA

Institute of Oceanography
University of Gdańsk
Piłsudskiego 46
81-378 Gdynia, POLAND

Planktonic Ostracoda in Croker Passage (Antarctic Peninsula) during two austral seasons: summer 1985/1986 and winter 1989

ABSTRACT: The distribution of planktonic Ostracoda (Halocyprididae) was studied based on vertically-stratified zooplankton samples collected by hauling 200 μm – mesh net by day and by night during two austral seasons: summer 1985/1986 and winter 1989, from the 1200 m deep Croker Passage off the Antarctic Peninsula. Seven species of Ostracoda were recorded: *Alacia belgicae, Alacia hettacra, Metaconchoecia isocheira, Metaconchoecia skogsbergi, Boroecia antipoda, Disconchoecia* aff. *elegans* and *Proceroecia brachyaskos*. The first three species, endemic to Antarctic waters, were predominant (about 90%). Generally Ostracoda were most numerous in 600–200 m layer in summer and in 1000–400 m layer in winter. In the investigated area there was a clear contrast between the abundance of Ostracoda during austral summer and scarcity during austral winter.

Key words: Antarctic, planktonic Ostracoda, distribution.

Introduction

Pelagic Ostracoda are an important component of the mesozooplankton in Antarctic waters. Together with Copepoda and Chaetognatha, they are the dominant group as regards their abundance in waters of the Southern Ocean (Fukuchi and Tanimura 1981, Boden and Parker 1986). The ostracods' share in Antarctic zooplankton is important also in terms of biomass, because of their relatively large body size (adult animals can attain 1–3 mm length) (Hopkins 1987). However, the role and position of Ostracoda in the Antarctic ecosystem is still only vaguely known, as the research up till now focused on extremely abundant animal groups, *i.e. Euphausia superba* and copepods. The present study was devoted to pelagic Ostracoda species' composition and vertical distribution in the water of the Croker Passage in two seasons: summer 1985/1986 and winter 1989.

Material and methods

Planktonic material for this paper was collected during two austral seasons in the Antarctic Peninsula region. Between December 1985 to January 1986 (20 samples) and June to August 1989 (29 samples), zooplankton samples were taken by the r/v *Polar Duke* in Croker Passage (64°50'S, 61°50'W). A single-level openning-closing net, consisting of net mesh size of 200 µm attached side by side, with square mouth openings of 0.5 m^2, was used to collect zooplankton in oblique hauls. Two replicate day/night vertical series were taken, sampling the following discrete depth horizons: 0–50 m, 50–100 m, 100–200 m, 200–400 m, 400–600 m, 600–1000 m or 1200 m. The material was immediately preserved in sodium borate-buffered formaldehyde. 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: Sars (1928), Deevey (1978, 1982), Angel (1981) and Kock (1992). The number of specimens was calculated for 1000 m^{-3}.

Results

Seven species of Ostracoda from the family Halocyprididae were distinguished in plankton samples collected in the Croker Passage both in summer 1985/86 and winter 1989: *Alacia belgicae* Müller, 1906, *Alacia hettacra* Müller, 1906, *Metaconchoecia isocheira* Müller, 1906, *Metaconchoecia skogsbergi* Iles, 1953, *Boroecia antipoda* Müller, 1906, *Disconchoecia* aff. *elegans* Sars, 1865 and *Proceroecia brachyaskos* Müller, 1906. The three species at the beginning of the list, endemic to the Antarctic, made up over 90% of the total number of Ostracoda, both in winter (92.9%) and summer (94.4%) (Fig. 1). *A. belgicae* definitely proved to be the most dominant in this region, with up to 55.5% share on in winter and 41.6% in summer. *M. isocheira* predominated slightly in summer (42.2%), but in winter this species did not play such an important role (25.9%). The contribution of *A. hettacra*, the third endemic species, reached only slightly over 10% in both analysed seasons. Other species did not influence the abundance of Ostracoda in a significant way, except for *B. antipoda*, which attained a relatively high level 4–5% in both seasons. Such species as *M. skogsbergi*, *D. elegans* and *P. brachyaskos* appeared in negligible amounts in the studied region in summer as well as in winter (Fig. 1).

The vertical distribution of Ostracoda depended greatly on the time of the day and season. In general, the three dominant species *A. belgicae*, *M. isocheira* and *A. hettacra* tended to inhabit the same water layer. In summer 1985/86 they concentrated mainly between 600–200 m during the day and 400–200 m at night (Tab. 1). The maximal abundance values were observed for *A. belgicae*, *M.*

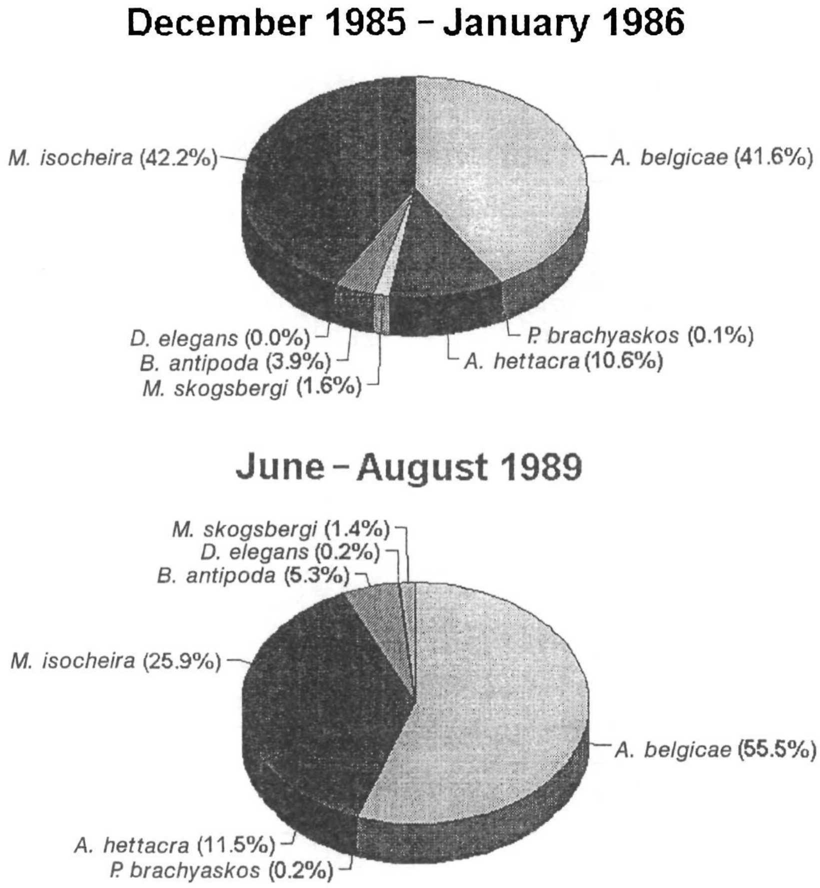

Fig. 1. Composition of Ostracoda (%) in Croker Passage during summer (December 1985 – January 1986) and winter (June – August 1989).

isocheira and *A. hettacra* at night in the water layer 400–200 m in the catch A-85-30: 6101 ind./1000 m^3, 4867 ind./1000 m^3 and 963 ind./1000 m^3, respectively. Characteristically, in summer day catches those three species showed a much wider range of maximal concentration, extending usually over two adjacent water layers (within 600–200 m) (Fig. 2), while in night catches *A. belgicae, M. isocheira* and *A. hettacra* reached the maximal concentration in single water layer (400–200 m) (Fig. 3). The inhabitant of deep water layers – *M. skogsbergi* – reached the maximum concentration (963 ind./1000 m^3) in 400–200 m water layer in the summer catch A-85-30. Relatively low abundance values were found for *B. antipoda*, only slightly exceeding 100 ind./1000 m^3 in two catches from 1190–740 m and 600–400 m. Other species, *e.g. D. elegans* and *P. brachyaskos*, appeared only in individual catches and only in trace amounts (4 and 13 ind./1000 m^3) (Tab. 1).

Table 1

Distribution of Ostracoda in water column (number of individuals per 1000 m^3) in Croker Passage in summer (December 1985 / January 1986).

No. of catch	Depth (m)	Time of the day	*A. belgicae*	*M. isocheira*	*A. hettacra*	*M. skogsbergi*	*B. antipoda*	*D. elegans*	*P. brachyaskos*
A-85-3	50-25	day							
A-85-5	100-50	day							
A-85-7	200-100	day	273.4	43.2	28.8				
A-85-9	400-200	day	277.3	562.6	43.3	14.4			
A-85-11	600-400	day	25.9	13	8.6			4.3	
A-85-13	800-600	day	125.4	128.4	11.9				
A-85-22	25-0	night	65.1	65.1					
A-85-24	50-25	night							
A-85-26	100-50	night	33						
A-85-28	200-100	night	53		8.2				
A-85-30	400-200	night	6101.4	4867.1	963.4	963.4			
A-85-20	600-400	night	406.4	592.3	138.3	21.6	60.5		
A-85-17	1000-600	night	521.6	831.4	238.4		48.9		
A-85-32	25-0	day							
A-85-34	100-0	day							
A-85-36	200-100	day							
A-85-38	400-200	day	746.5	1382.1	223.6		14.1		
A-85-40	600-400	day	1645.6	1196.8	491.6		128.2		
A-85-42	866-600	day	64.9	84.3	14.9	6.4	22.4		
A-85-48	1190-740	day	289.2	252	93.7	19.4	135.7		12.9

During winter and in the daylight, *A. belgicae* was found to occupy the deepest water layers (1000–500 m) (Fig. 4). At night maximal concentrations of this species extended over three adjacent water layers (1050–200 m) (Fig. 5). The highest number of this specimens was noted between 1000–800 m in two day catches B-89-157 (469 ind./1000 m^3) and A-89-16 (325 ind./1000 m^3) (Tab. 2). *M. isocheira* was much less abundant in the winter. Similarly to *A. belgicae, M. isocheira* tended to stay at 900–500 m during the day and between 1000–200 m at night. This species concentrated maximally in the water layer between 730–600 m on two night occasions B-89-115 (194 ind./1000 m^3) and B-89-123 (165 ind./1000 m^3). *A. belgicae* showed considerably lower concentration numbers in winter. The maximal concentrations were found in two night catches in water layers 450–200 m: A-89-28 (72 ind./1000 m^3) and A-89-8 (70 ind./1000 m^3). *B. antipoda* showed similar values – max. of 51 ind./1000 m^3 in 750–500 m water layer in catch B-89-123. In winter, this species did not tend

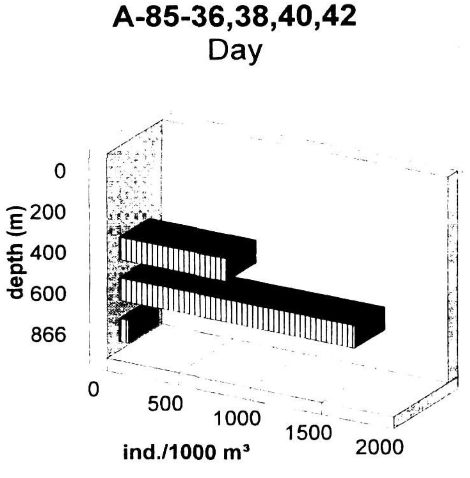

Fig. 2. Distribution of *Alacia belgicae* by water column (number of individuals per 1000 m^3) in Croker Passage during summer (December 1985 / January 1986) at day.

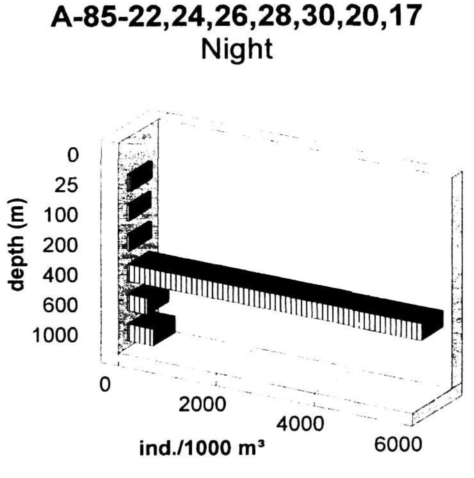

Fig. 3. Distribution of *Alacia belgicae* by water column (number of individuals per 1000 m^3) in Croker Passage during summer (December 1985 / January 1986) at night.

to concentrate in any particular water layer in relation to the time of the day. Low concentration values were also observed for *D. elegans* (present in 8 catches) and *P. brachyaskos* (presented in 7 catches). Their maximal concentrations did not exceed 4 ind./1000 m^3 (Tab. 2).

Discussion

The Ostracoda of the Croker Passage were found to occupy second place in zooplankton as regards biomass and abundance, ahead of such groups as Euphausiacea, Chaetognatha or Polychaeta (Hopkins 1985a). *A. belgicae* – the endemic species of Antarctic shelf waters – was the dominant species in this region. Hopkins (1985a) has already established the leading role of this species in the Croker Passage. In winter 1989 the representatives of *A. belgicae* appeared in the greatest numbers, while in summer 1985/86 *A. belgicae* and *M. isocheira* reached almost equivalent abundance. According to Hopkins (1985a), *M. isocheira* usually appear in the Croker Passage in great concentrations, while *A. hettacra* turned out to be the least abundant species of this basin. Its low contribution (*ca* 10%) among Ostracoda was noticed in both seasons of the study. Hopkins (1985a) also cited the *A. hettacra* abundance as third after *A. belgicae* and *M. isocheira*. *A. hettacra* preferences to open ocean waters explains the relatively low abundance of this species in the Croker Passage. Other species, like *B. antipoda, M. skogsbergi, P. brachyaskos* and *D. elegans*, formed a neg-

Table 2

Distribution of Ostracoda by water column (number of individuals per 1000 m^3) in Croker Passage in winter (June – August 1989).

No. of catch	Depth (m)	Time of the day	*A. belgicae*	*M. isocheira*	*A. hettacra*	*M. skogsbergi*	*B. antipoda*	*D. elegans*	*P. brachyaskos*
A-89-4	105-5	night							
A-89-6	220-100	night	39.6		46.2			3.3	
A-89-8	450-210	night	173	64	69.5		1.4	1.4	
A-89-10	750-350	night	128	75.3	41.9	7.5	4.7	0.9	
A-89-12	750-500	night	104.4	148.2	41.4	5.8	24.1		
A-89-18	1000-800	night	200.4	28.8	11.9		3		
A-89-24	200-100	night	24.7	0.9	17.4				
A-89-28	450-200	night	200.9	68.1	71.6				1.8
A-89-26	825-650	night	81.3	25.7	5.9	2.9	6.4		1.2
A-89-48	800-650	night	121.8	53	14.9	3.7	11.2		
A-89-38	1050-800	night	165.1	40.1	12.3	3.1	38.6		1.5
A-89-50	100-0	day	1.2						
A-89-52	210-90	day	1.8		12.8				
A-89-58	425-175	day	131	34.2	35.4		4.7		
A-89-56	650-400	day	166.3	119	35.2	9.5	4.1	1.4	
A-89-80	775-450	day	34.7	12.1	12.1		15.6		
A-89-54	850-450	day	202	135.8	14.6	2.2	10.1		
A-89-16	1000-900	day	325.4	32.9	49.3		8.2	1.6	1.6
B-89-107	190-0	day	0.62		1.2				
B-89-109	345-150	day	90.2	18.4	50.3			0.6	
B-89-113	500-300	day	42.1	4.4	18.8	6.7	10	3.3	
B-89-131	900-450	day	192	142.9	25.8	17.6	38.6		
B-89-111	800-750	day	113.6	65.5	13.3	3.1	16.4		1.1
B-89-157	1000-800	day	469.5	58.3	14.9	1.4	32.6		2.7
B-89-101	220-0	night	48.9		33.9				
B-89-121	550-0	night	169.7	30.1	52.7		1.6		
B-89-115	730-600	night	208.3	194.4	33	13.1	41.7		2.6
B-89-123	750-500	night	195.5	164.9	23.9	10.6	50.5	1.3	
B-89-139	850-800	night	177.8	98.1	5.7		36.5		

ligible supplement to the Ostracoda species composition and did not influence their abundance in this region. Hopkins (1985a) observed similar relations in the Croker Passage for the first three species.

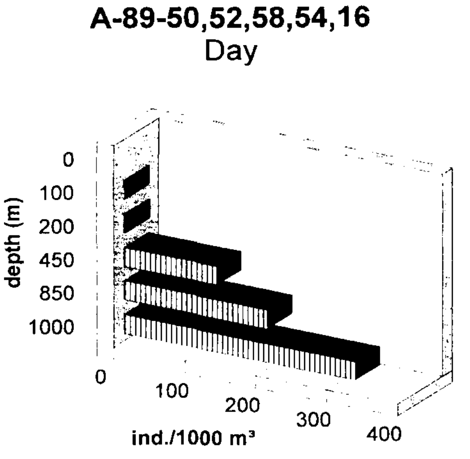

Fig. 4. Distribution of *Alacia belgicae* by water column (number of individuals per 1000 m^3) in Croker Passage during winter (June – August 1989) at day.

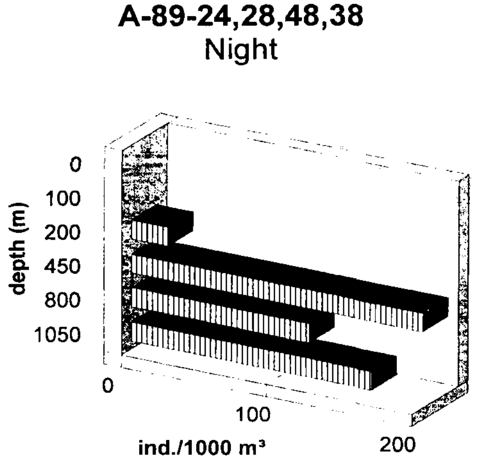

Fig. 5. Distribution of *Alacia belgicae* by water column (number of individuals per 1000 m^3) in Croker Passage during winter (June – August 1989) at night.

The vertical distribution of Ostracoda was highly differentiated depending on the season and the time of the day. In general, all ostracods avoided the uppermost water layers 100–0 m and 200–100 m. Angel and Fasham (1975) observed similar behaviour in ostracods from the northern Atlantic Ocean. This observation is also supported by the absence of ostracods in 100–0 m water layer in the Norwegian Sea (Wiborg 1954) and northern Pacific (Marlowe and Miller 1975). Foster (1987) found nearly four times greater abundance of *A. belgicae* in 300–0 m water layer than in the surface 100–0 m in the Weddel Sea. The maximal concentrations of the three endemic species of the Antarctic waters in the Croker Passage occurred within the range of lower epi- and upper mesopelagial. *A. belgicae, M. isocheira* and *A. hettacra*, the dominant species of this region in summer, concentrated at similar depths during the day (600–200 m) and at night (400–200 m). In autumn 1983, Hopkins (1985a) noted the highest concentrations of *A. belgicae* and *A. hettacra* in 400–200 m water layer, regardless the time of the day, while *M. isocheira* inhabited deeper water layers in this season during the day (down to 800 m) and ever deeper at night (1000 m). In winter, both *A. belgicae* and *M. isocheira* were found mostly at much deeper water layers (down to 1000 m). Atkinson and Peck (1990), having analysed plankton material from the shelf zone and open waters of the Southern Georgia (Atkinson and Peck 1988), classified Ostracoda as animals concentrating in upper water layers in summer, but tending to concentrate at deeper water layers in winter. This behaviour is probably a result of the varying food demands of these animals in various seasons. The extensive studies of Hopkins in Croker Passage (Hopkins

1985b) showed that ostracods are mostly omnivorous and detritus feeding animals. A parallel study by the same author in the Ross Sea (McMurdo Sound) proved that the following components are essential to the diet of ostracods: phytoplankton (*Nitzschia* sp., Coscinodiscineae, *Chaetoceros* spp., peridinians etc.), copepods (*Oncaea* spp., *Oithona* spp., *Metridia gerlachei, Calanoides acutus* etc.) and fragments of Coelenterata, *Limacina helicina* and Euphausiaceae (Hopkins 1987). Such a wide food spectrum explains the considerable independence of Ostracoda of any single food source, thus the animals tend to inhabit deeper, more stable water layers in winter when phytoplankton is eliminated from their diet by natural causes.

According to Roe (1974) diurnal migrations are observed mainly for Ostracoda living in surface water layers. Among the species found in the Croker Passage, only *D. elegans*, appearing in trace numbers, occupied the surface water layer. Angel (1977) suggested that this species might migrate in the northern Atlantic according to season. However, due to its trace abundance in the analysed plankton samples this finding could not be confirmed for Antarctic waters. Moguilevsky and Angel (1975) noticed that the migrations are characteristic of ostracods from tropical and subtropical areas, excluding basins with well developed thermal stratification. The meso- and bathypelagic species – *B. antipoda* – definitely preferred the deepest water layer. In the northern Atlantic, Ellis (1985) noticed the maximal concentrations of this species at 1100–1300 m. Angel (1977) suggested the high probablity that *B. antipoda* migrate to deeper water layers, however, this could not be proved due to its scarcity in the analysed materials. In the Croker Passage, the species concentrated generally below 600 m, equally in summer and in winter. Similar behaviour was characteristic of other deep water species: *M. skogsbergi* and *P. brachyaskos*.

References

ANGEL M.V. 1977. Studies on Atlantic Halocyprid Ostracods: vertical distribution of the species in the top 1000 m in the vicinity of 44°N, 13°W. — J. mar. biol. Ass. U.K., 57: 239–252.

ANGEL M.V. 1981. Ostracoda. — *In*: D. Boltovskoy (ed.), *Atlas del zooplankton del Atlantico sudoccidental y metodes de trabajo con el zooplankton marino.* INIPED, Mar del Plata: 543–585.

ANGEL M.V. and FASHAM M.J.R. 1975. Analysis of the vertical and geographic distribution of the abundant species of planktonic Ostracods in the North-East Atlantic. — J. mar. biol. Ass. U.K., 55: 709–737.

ATKINSON A. and PECK J.M. 1988. A summer-winter comparison zooplankton in the oceanic area around South Georgia. — Polar Biol., 8: 463–473.

ATKINSON A. and PECK J.M. 1990. The distribution of zooplankton in relation to the South Georgia Shelf in summer and winter. — *In*: K.R. Kerry and G. Hempel (eds.), *Antarctic Ecosystems*: 159–165.

BODEN B.P. and PARKER L.D. 1986. The plankton of the Prince Edward Islands. — Polar Biol., 6: 81–93.

DEEVEY G.B. 1978. A taxonomic and distributional study of the planktonic Ostracods collected on three cruises of the Eltanin in the South Pacific and the Antarctic region of the South Pacific. — *In*: L.S. Kronicker (ed.), *Biology of the Antarctic Seas VIII*. Antarct. Res. Ser., 28: 43–70.

DEEVEY G.B. 1982. A faunistic study of the planktonic Ostracoda (Myodocopa, Halocyprididae) collected on eleven cruises of the Eltanin between New Zealand, Australia, The Ross Sea and the South Indian Ocean. — *In*: L.S. Kronicker (ed.), *Biology of the Antarctic Seas X*. Antarct. Res. Ser., 32: 131–167.

ELLIS C.J. 1985. The effect of proximity to the continental slope sea-bed on pelagic Halocyprid Ostracods at 49°N, 13°W. — J. mar. biol. Ass. U.K., 65: 923–949.

FOSTER B.A. 1987. Composition and abundance of zooplankton under the spring sea ice of McMurdo Sound, Antarctic. — Polar Biol., 8: 17–35.

FUKUCHI M. and TANIMURA A. 1981. A preliminary note on the occurrence of copepods under sea-ice near Syowa Station, Antarctica. — Memories of National Institute of Polar Research. Series E, Biology and Medicinal Science, 34: 37–43.

HOPKINS T.L. 1985a. The zooplankton community of Croker Passage, Antarctic Peninsula. — Polar Biol., 4: 161–170.

HOPKINS T.L. 1985b. Food web of an Antarctic midwater ecosystem. — Mar. Biol., 89: 197–212.

HOPKINS T.L. 1987. Midwater food web in McMurdo Sound, Ross Sea, Antarctica. — Mar. Biol., 96: 93–106.

KOCK R. 1992. Ostracoden im Epipelagial vor der Antarktischen Halbinsel — ein Beitrag zur Systematik sowie zur Verbreitung und Populationsstruktur under Berücksichtigung der Saisonalität. — Ber. Polarforsch., 106: 1–209.

MARLOWE C.J. and MILLER C.B. 1975. Patterns of vertical distribution and migration of zooplankton at Ocean Station "P". — Limnol. Oceanogr., 20: 824–844.

MOGUILEVSKY A. and ANGEL M.V. 1975. Halocyprid Ostracods in Atlantic neuston. — Mar. Biol., 32: 295–302.

ROE H.S.J. 1974. Observations on the diurnal vertical migrations of an oceanic animal community. — Mar. Biol., 28: 99–113.

SARS G.O. 1928. An account of the Crustacea of Norway, 9, parts 1–277; Bergen.

WIBORG K.F. 1954. Investigations in zooplankton in coastal and offshore waters of western and northwestern Norway. — Fisk Dir. Skr. Ser. Havunders, 11: 1–246.

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Streszczenie

W Cieśninie Crokera zanotowano obecność 7 gatunków małżoraczków należących do jednej rodziny Halocyprididae: *Alacia belgicae, Alacia hettacra, Metaconchoecia isocheira, Boroecia antipoda, Metaconchoecia skogsbergi, Disconchoecia* aff. *elegans* oraz *Proceroecia brachyaskos*. Dominujące okazały się trzy endemiczne gatunki wód antarktycznych: *A. belgicae, A. hettacra* oraz *M. isocheira*, stanowiące łącznie ponad 90% wszystkich małżoraczków. Analiza rozmieszczenia pionowego Ostracoda wód Cieśniny Crokera potwierdziła tendencje tych zwierząt do unikania powierzchniowej warstwy wody i koncentrowania się w dolnym epipelagialu oraz górnym mezopelagialu. W warstwach głębszych (poniżej 600 m) małżoraczki osiągały zazwyczaj niższe liczebności, natomiast wraz z głębokością wzrastała bioróżnorodność, ściśle związana z pojawieniem się licznych form batypelagicznych Ostracoda. Dwa zdecydowanie dominujące w cieśninie gatunki: *A. belgicae* oraz *M. isocheira* skupiały się generalnie w górnych partiach wód w lecie (do ok. 600 m), podczas gdy w okresie zimowym wykazywały tendencje do zajmowania głębszych warstw w kolumnie wody (do 1000 m). Sezonowa zmienność małżoraczków w badanym akwenie Oceanu Południowego przejawiała się zróżnicowaną liczebnością tych zwierząt w czasie antarktycznego lata (rzędu kilku tysięcy osob./1000 m^3) i zimy (kilkuset osob./1000 m^3 wody).