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Vertical distribution and population structure of Copepoda in a water column between King George Island and Elephant Island (BIOMASS III, October—November 1986)

ABSTRACT: Planktonic material was taken in stratified hauls in the water column between King George and Elephant Islands, during the austral spring 1986. The species composition of Copepoda was diversified (abt. 50 taxa). Most frequent and abundant were *M. gerlachei*, *C. acutus*, *R. gigas*, small copepods of the family Pseudocalanidae and Cyclopoida. Interzonal Copepoda did not yet reach the euphotic zone; a comparatively low general copepod abundance and the advanced ontogenetic development in particular populations evidenced for the early spring phase of the planktonic community.

Key words: Antarctic, Copepoda, vertical distribution, BIOMASS III.

1. Introduction

In high latitudes zooplankton biomass is determined by only several mass occurring species (Vinogradov and Suskina 1987). In Antarctic waters these species belong to Copepoda; in general they are interzonal species inhabiting large depth ranges. The degree of concentration of the dominant copepod species in a water column widely fluctuates (Ottestad 1932; Hardy and Gunther 1935; Mackintosh 1937; Vervoort 1957; Andrews 1966). The range of interzonal Copepoda depends on the season of the year, on the hydrological conditions and the degree of ontogenetic development in the population (Hopkins 1971, 1985; Voronina 1972, 1975; Voronina, Vladimirskaja and Žmijevska 1978; Žmijevska 1983, 1985; Chojnacki and Węgleńska 1984).

The present paper contains the results of planktonic investigations of the Polish third phase of the international BIOMASS program. These studies were carried out in austral spring of 1986, in the area of South Shetland

Islands in a water column down to 1800 m (Rakusa-Suszczewski 1988). Early spring, stratified planktonic hauls allowed to observe the phenomenon of spring migration of the dominant copepod species.

2. Material and methods

Planktonic samples were collected from board of r/v "Profesor Siedlecki" in the region between King George Island and Elephant Island, in the period from 30 October to 3 November 1986, in 9 stations arranged along 3 transects: transect I — stations 46, 47 and 48; transect II — stations 44, 43 and 42; transect III — stations 39, 38, 37 (Fig. 1). This region was

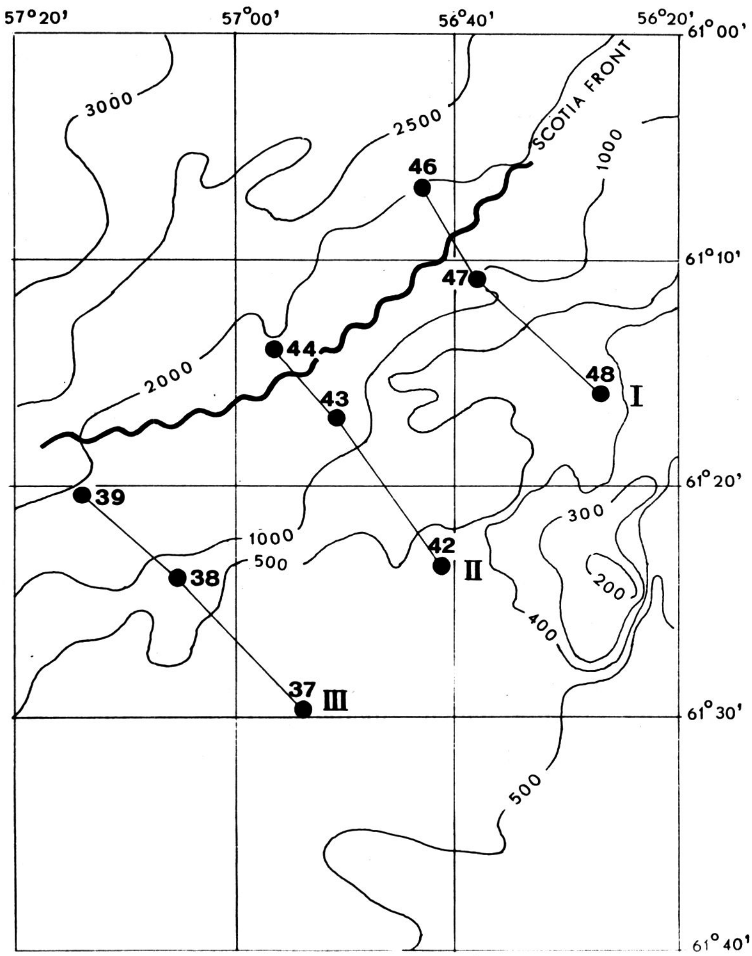

Fig. 1. Location of sampling stations at Scotia Front, 30 October — 3 November 1986
I, II, III — transects

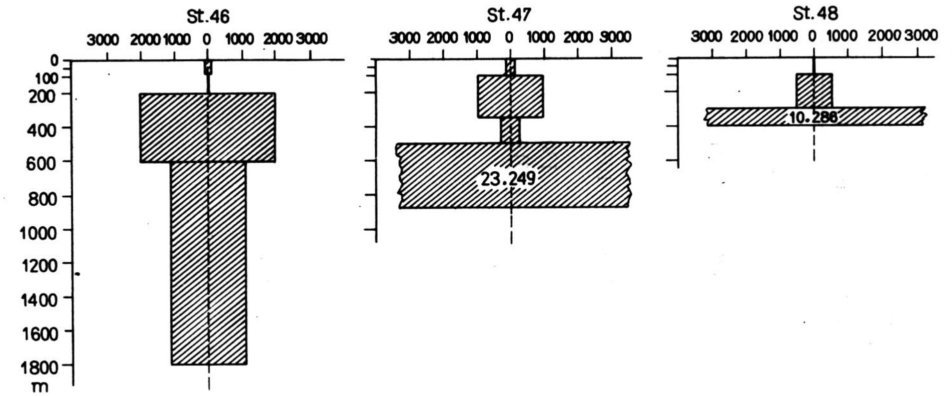

Fig. 2. Distribution of *Metridia gerlachei* in a water column in transect I (ind. per 1000 m^3)

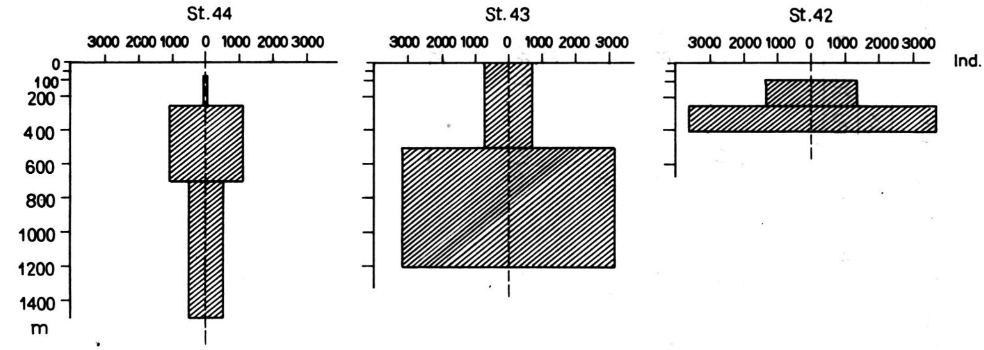

Fig. 3. Distribution of *Metridia gerlachei* in a water column in transect II (ind. per 1000 m^3)

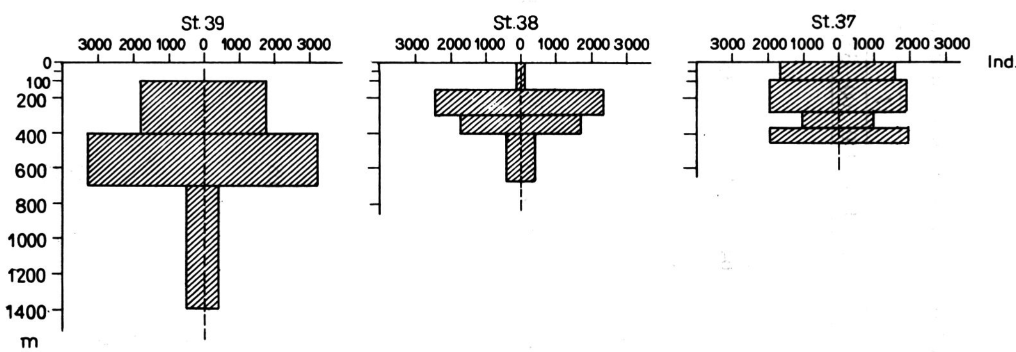

Fig. 4. Distribution of *Metridia gerlachei* in a water column in transect III (ind. per 1000 m^3)

chosen as an area of detailed oceanographic study of the present expedition because the area in question was crossed by the Scotia Front.

In the open ocean area the hauls were performed down to the depth of over 1000 m, in the neritic zone — down to the bottom (Figs. 2—4).

Table 1

Abundance of Copedoda in the water column in the BIOMASS III study area (30 October — 3 November 1986) (ind. per 1000 m³)

(a) Station	37				38				39			
(b) Water layer (m)	0—100	100—300	300—375	375—450	0—150	150—300	300—400	400—680	0—100	100—400	400—700	700—1400
Taxon												
1. *Calanus simillimus*												
2. *Calanus propinquus*	26				17	17				7		
3. *Calanoides acutus*	104	13	35		69	242	76	121		130	121	8
4. *Eucalanus longipes*												
5. *Rhincalanus gigas*	52	13		35	121	17	76	9		52	35	4
6. *Clausocalanus* spp.												
7. *Ctenocalanus vanus*		4576		1039	2397	3636		186		260	1039	
8. *Drepanopsis frigidus*												
9. *Stephus longipes*		13		35			26	121			130	4
10. *Microcalanus pygmaeus*	77	4156		1039	1558	519	1039	742		5195	519	
11. *Spinocalanus* spp.												
13. *Snellioctideus arcuatus*												
14. *Chiridius* sp.							26	27				4
15. *Gaidius ternuispinus*												
16. *Gaidius intermedius*												
17. *Pseudochirella* sp.												
18. *Pseudochaeta* sp.												
19. *Valdiviella* sp.												
20. *Euchaeta antarctica*		208				121	52			121	130	8
21. *Phaenna* sp.												
22. *Cornucalanus* sp.												4
23. *Racovitzanus antarcticus*										7		
24. *Scolecithricella dentipes*											7	
25. *Scolecithricella auropecten*												4
26. *Scolecithricella glacialis*												
27. *Scolecithricella* spp.		13		35				9	26		15	41
28. *Scaphocalanus brevicornis*		13		35				27			35	8

29. *Scaphocalanus* sp.		13		35				9			15	
30. *Metridia gerlachei*	3272	3818	1904	3947	104	4710	3377	761		3498	6485	926
31. *Metridia curcicauda*								37			165	169
32. *Metridia lucens*												
33. *Pleuromamma robusta* f.*antarctica*												
34. *Lucicutia frigida*								18				63
35. *Lucicutia curta*								9				
36. *Lucicutia ovata*												
37. *Heterorhabdus austrinus*								18				
38. *Heterorhabdus farrani*												30
39. *Heterorhabdus pustulifer*				104				37				4
40. *Heterorhabdus* spp.							26				17	8
41. *Haloptilus ocellatus*												
42. *Haloptilus oxycephalus*		26				17						4
43. *Heterostylis major*												
44. *Candacia maxima*											7	
45. Calanoida (copepodites I—V)												
46. Calanoida (nauplii)												
47. *Oithona similis*	779	22338		2078	124675	2597	1039			5195	2597	
48. *Oithona frigida*		1039							26			
49. *Oncaea conifera*		519				519		186		260	519	222
50. *Oncaea curvata*		2597	2078	1039		2597		1113		260	4156	
51. *Oncaea notopus*												222
52. Cyclopoida (nauplii)												
53. *Tisbe rakovitzai*												
54. Harpacticoida (copepodites IV—V)												
(c) Calanoida — total	3388	12961	1939	6304	4266	9279	4698	2121	26	9270	8720	1316
(d) Cyclopoida — total	779	26493	2078	3117	124675	5713	1039	1299	26	5715	7242	444

Table 1 — continued

(a)	42			43				44			
(b)	0—100	100—250	250—400	0—100	100—300	300—500	500—1200	0—75	75—250	250—700	700—1500
1.											
2.		17		26	52	36	7		59	6	
3.		173	450	77	130	140	126		89	352	98
4.											
5.		52	69		52	10	22		15	58	53
6.							22				
7.		2597	2597	26	390	831	333		440	104	
8.		17					7				
9.			35			10	22			312	104
10.		519	519		390	1622			104	104	104
11.				413							
12.							7				2
13.											
14.											
15.			35			5	15			23	
16.							7				20
17.											
18.											
19.											2
20.		52	121		26	42	22		15	29	15
21.											
22.											
23.					52	10	7		74		
24.											
25.											2
26.											
27.		52			208	163					10
28.			17			10	7			6	7
29.		519	17			10	7			17	
30.		2701	8935	77	208	1371	6286		148	2165	1064

31.			104				111			130	50
32.										6	
33.											
34.			17				15			75	33
35.											
36.											
37.							74				
38.			87								
39.											
40.										29	28
41.											5
42.		17									
43.							15				
44.											
45.											
46.											
47.		4156	519	103	12077	6243	333	2078	33840	415	
48.		519			2727	208	167				
49.						416				104	
50.			4675			1039	1033			1040	104
51.			519								
52.											
53.											
54.											
(c)		6716	13003	619	1300	4345		7275	959	3439	1397
(d)	4675	5713	103	14804	7897		1593	2078	34799	1559	104

Table 1 — continued

(a)	46				47				48		
(b)	0—75	75—200	200—600	600—1800	0—100	100—350	350—500	500—880	0—100	100—300	300—400
1.			19								
2.			32	2		52		102	26	26	26
3.		21	117	41	181	125	35	575		52	86
4.				2							
5.			154		156	21		150	26	299	208
6.				2							
7.		21	325		78	1039	519	547	342	65	260
9.			39	104		21	516	547		52	208
10.	34	42	649	433	156	519	1018	2734		104	233
11.		63						27			
13.				24							
14.								7			
15.			117	24		10		102			26
16.			52	11				7			
17.			19					7			
19.											
20.			52	13		83	17	191		13	104
21.				2							
22.			65			10					
23.			15	7		21		7		13	26
24.			7	2							
25.			39	18	78	21		7			
26.		21	84	69	156	83	17	150		65	130
27.			54	7			35	75	26		
28.											130
29.		21	7	58	26			27		13	
30.	104	45	3994	2169	260	1901	510	23349	26	558	10286
31.			45	234				328			103
32.						20	17				
33.								7			

34.				143							
35.				13							
36.											26
37.			71	19				41			39
38.				17				20			
39.											
40.				30				7			78
41.			7					7			
42.			45	7				14			
43.								7			
44.											
45.								14			
46.			325								
47.		208	8117	433	2571	38860	1039	26794	519	123377	520
48.			3571			1039	519	1640			260
49.			1948					2734			520
50.		21	1948	974				10390			1818
51.			649	1407							
52.						519					
53.	138										
54.					104						
(c)	138	234	6333	3451	1091	3926	2687	29056	446	1260	11969
(d)	138	229	16233	2814	2571	40418	1559	41558	519	123377	3118

Detailed data concerning the geographical position of the stations and the time of sampling are given by Rakusa-Suszczewski (1988). Planktonic samples were taken in particular water layers determined earlier by hydrological soundings (STD) using a closed Nansen net of the mouth diameter of 70 cm and of a 200 μm mesh size gauze. Samples were preserved in a 4% formaline solution. "Large" calanoids were analyzed in the whole sample, but "small" calanoids of the families of Pseudocalanidae, Spinocalanidae and Scolecithricidae as well as Cyclopoida were determined in three subsamples; after dilution of the whole sample to the volume of 50 ml three 1 ml subsamples were analyzed. The species composition and abundance of Copepoda (ind. in 1000 m^3) are presented in Tab. 1.

3. Results and discussion

In the studied water column 50 following copepod taxa, belonging to three subordines, 26 families and 33 genera were found:

Suborder Calanoida

Family Calanidae

Calanus propinquus Brady, 1883
Calanus simillimus Giesbrecht, 1902
Calanoides acutus Giesbrecht, 1902

Family Eucalanidae

Eucalanus longipes Matthews, 1929
Rhincalanus gigas Brady, 1883

Family Pseudocalanidae

Clausocalanus spp.
Ctenocalanus vanus Giesbrecht, 1888
Microcalanus pygmaeus (Sars, 1900)

Family Spinocalanidae

Spinocalanus spp.
Drepanopsis frigidus Wolfenden, 1911
Stephus longipes Giesbrecht, 1888

Family Aetideidae

Euaetideopsis spp.
Chiridius sp.
Gaidius tenuispinus (Sars, 1900)
Gaidius intermedius Wolfenden, 1905
Snelliaetideus arcuatus Vervoort, 1949
Pseudochirella sp.
Pseudochaeta sp.
Voliviella sp.

Family Euchaetidae
Euchaeta antarctica Giesbrecht, 1902
Family Phaennidae
Phaenna sp.
Cornuealanus sp.
Family Scolecithricidae
Racovitzanus antarcticus Giesbrecht, 1902
Scolecithricella glacialis (Giesbrecht, 1902)
Scolecithricella dentipes Vervoort, 1951
Scolecithricella auropecten Giesbrecht, 1902
Scolecithricella spp.
Scaphocalanus brevicornis (Sars, 1900)
Scaphocalanus sp.
Family Metridiidae
Metridia gerlachei Giesbrecht, 1902
Metridia curcicauda Giesbrecht, 1889
Metridia lucens Boeck, 1963
Pleuromamma robusta (Dahl, 1893)
Pleuromamma robusta f. *antarctica* Steuer, 1931
Family Lucicutiidae
Lucicutia ovata Giesbrecht, 1889
Lucicutia curta Farran, 1929
Lucicutia frigida Wolfenden, 1911
Family Heterorhabdidae
Heterorhabdus austrinus Giesbrecht, 1902
Heterorhabdus farrani Brady, 1818
Heterorhabdus pustulifer Farran, 1929
Heterorhabdus sp.
Heterostylis major (Dahl, 1894)
Family Augaptilidae
Haloptilus oxycephalus (Giesbrecht, 1888)
Haloptilus ocellatus Wolfenden, 1905
Family Candaciidae
Candacia maxima Vervoort, 1957
Suborder Cyclopoida
Family Oithonidae
Oithona similis Claus, 1866
Oithona frigida Giesbrecht, 1902
Family Oncaeidae
Oncaea conifera Giesbrecht, 1891
Oncaea curvata Giesbrecht, 1902
Oncaea notopus Giesbrecht, 1891

Suborder Harpacticoida
Family Tisbidae
Tisbe racovitzai Giesbrecht,

Despite such a diversified species composition of collected Copepoda, only few species occurred frequently and in abundance. One of the most frequent species was *Metridia gerlachei*, which occurred in more than 90% of samples; *Calanoides acutus*, *Rhincalanus gigas*, *Microcalanus pygmaeus* and *Oithona similis* were found in 75—90% of samples, while *Calanus propinquus*, *Stephus longipes*, *Euchaeta antarctica*, *Scolecithricella* spp. and *Oncaea curvata* were recorded in 50—74% of samples. Calanoida of the genus *Heterorhabdus*, *Metridia curcicauda*, *Racovitzanus antarcticus*, *Oithona frigida* and *Oncaea conifera* were less frequent and occurred in 25—49% of samples.

Copepoda belong to the most common and rich in species zooplankton groups. Vervoort (1965) presented a list of 126 Antarctic copepod species and new species were recently described (Björnberg 1967; Bradford 1969; Park 1978). In general the number of species increased with depth and the parallel decrease in abundance was noted (Tab. 1) in concordance with earlier observations by Hardy and Gunther (1935).

The study area was characterized by the presence of typically Antarctic copepod species, although single specimens of subantarctic species, such as *Calanus simillimus* (st. 46), *Eucalanus longipes* (st. 46) or *Metridia lucens* (st. 44, 47) were also recorded. The above mentioned stations were situated at the north-eastern border of the study area. Penetration of subantarctic species south of the Antarctic Convergence was noted among others by Brodskij (1967), Naumov (1973) and Żmijewska (1980). The presence of *C. simillimus* was also recorded in the coastal waters of the Antarctic (Bradford 1971; Zvereva 1972; Kaczmaruk 1983; Żmijewska 1983).

Metridia gerlachei was the most important component of the zooplankton of the investigated region, both in respect to the frequency and to the abundance. Its abundance in the water column varied widely and ranged from 26 ind. per 1000 m^3 to 23349 ind. per 1000 m^3. This copepod species clearly avoided surface waters; in the layer 0—100 m its abundance did not exceed 260 ind. per 1000 m^3 (Figs. 2, 3, 4). An exception was station 37 in transect III, where 3272 ind. per 1000 m^3 were recorded (Fig. 4). *Metridia gerlachei* in this station was dispersed in a whole water column that was probably due to the night time of sampling and the migration of this species at night to the upper layers (Hopkins 1985). In the investigated region *M. gerlachei* occupied mainly middle depths. In transect I in open waters this species concentrated in the layer of 200—600 m where it constituted 63.3% of its total abundance (st. 46), whereas in the off-shore station (st. 48) it concentrated in that station deepest layer (300—400 m), constituting 94.8% of its abundance at that station (Fig. 2).

The population structure of *M. gerlachei* was also diversified, changing according to the position of the station and the depth of the sampled layer. In the study area a wide age span of the *M. gerlachei* population was noted, ranging from copepodites II to the adult forms. In transect I, in station 46 copepodites III dominated (50.4% in the layer 200—600 m and 60% in the layer 600—1800 m). In more southerly stations the dominance of copepodites IV was noted (from 33.5 to 38.8%) with an increase of the importance of copepodites V (from 21.8 to 32.6% of the total population; Figs. 5 and 6). In transect III the dominance of copepodites IV was observed along with an importance increase of this stage from the north towards south — from 37.9% at st. 39 (100—400 m layer) to 51% at st. 37 (100—300 m layer). Along with the decrease of the share of copepodites III in the population an increase of the share of copepodites V and of adults was noted (Fig. 6).

Biology of *M. gerlachei* is not yet sufficiently known and satisfactory data on its reproductive period are still lacking. Vervoort (1965) is of the opinion that this species begins its reproduction at the end of the Antarctic summer. The results of studies on its population structure obtained by Żmijewska (1983, 1985) and Kaczmaruk (1983) indicate that *M. gerlachei* must either begin breeding much earlier or the breeding is very stretched in time.

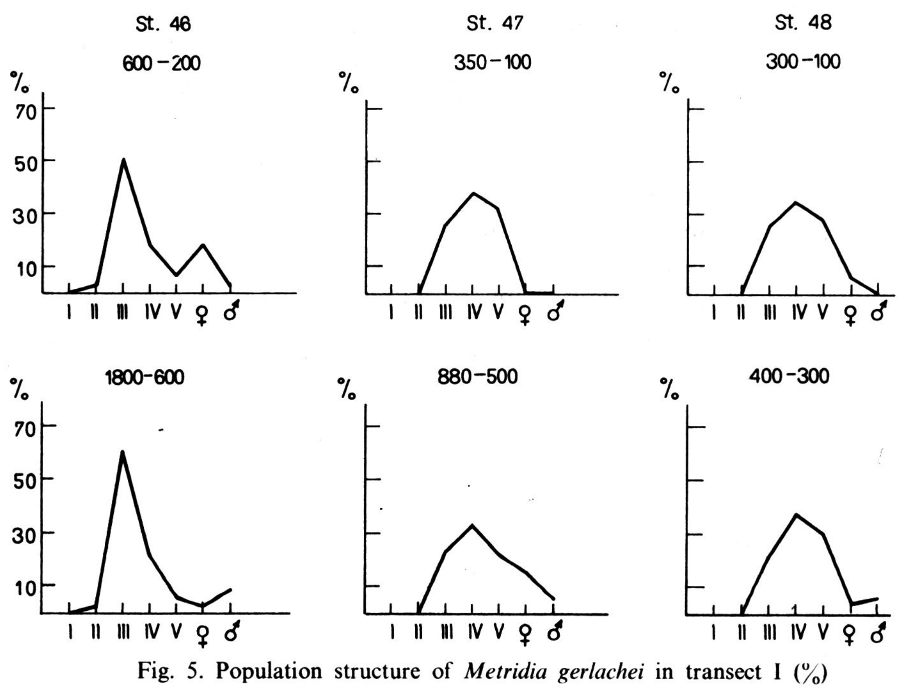

Fig. 5. Population structure of *Metridia gerlachei* in transect I (%)

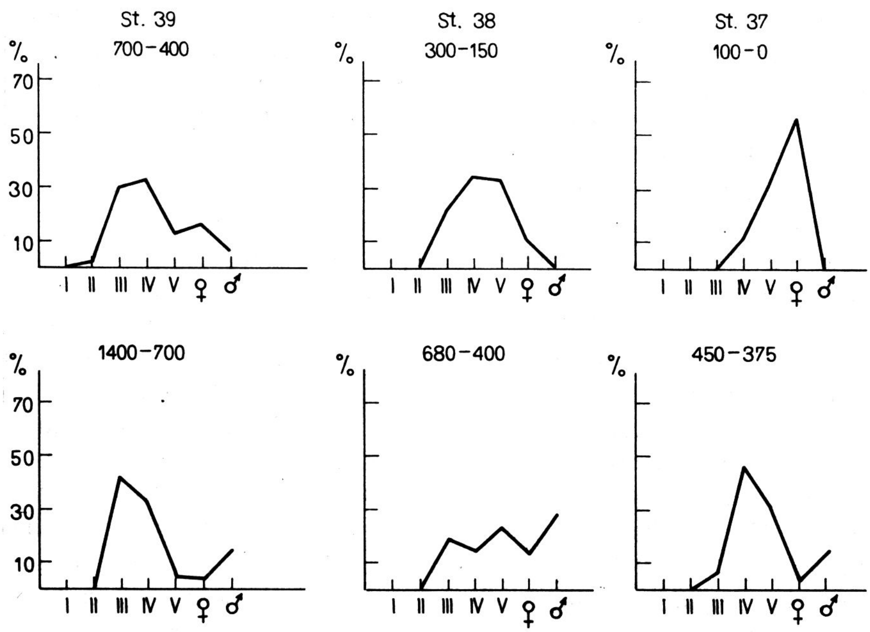

Fig. 6. Population structure of *Metridia gerlachei* in transect III (%)

In Antarctic waters interzonal large Calanoida: *Calanus propinquus*, *Calanoides acutus* and *Rhinocalanus gigas* play the most important roles. These three species constitute, on average, 78.4% of the copepod biomass (Voronina 1984).

The abundance of *Calanoides acutus* in the whole study area was relatively low ranging from 5 to 575 ind. per 1000 m^3 (Tab. 1). In transect I this species was most abundant in station 47, where 62.7% of its population inhabited the deepest layer (500—880 m; Fig. 7). In transect II the abundance of *C. acutus* was slightly lower and in station 44 65% of the population occupied the layer 250—700 m (Fig. 8). In transect III the abundance distribution in general was similar to that in transect I, but *C. acutus* occupied somewhat shallower layers (Fig. 9).

The age structure of *C. acutus* was characterized by the presence of only the past year generation. In transect I its population was in its final developmental phase and adult forms dominated. They were mainly females, which constituted from 58.3 to 74.4% of the population, along with single males. The importance of copepodites IV increased with depth (Fig. 10). In transect III the age structure of *C. acutus* population was quite similar (Fig. 11).

In terms of abundance *Rhincalanus gigas* yielded to *C. acutus*. It was most abundant in station 48 (229 ind. per 1000 m^3) and more frequently

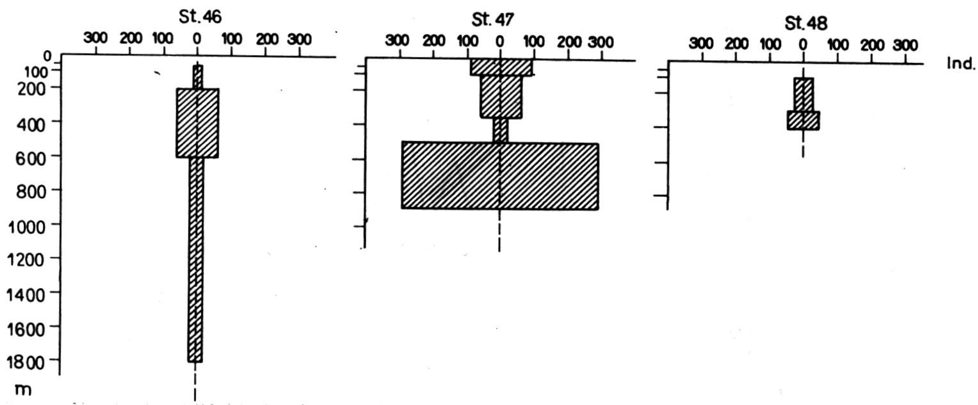

Fig. 7. Distribution of *Calanoides acutus* in a water column in transect I (ind. per 1000 m³)

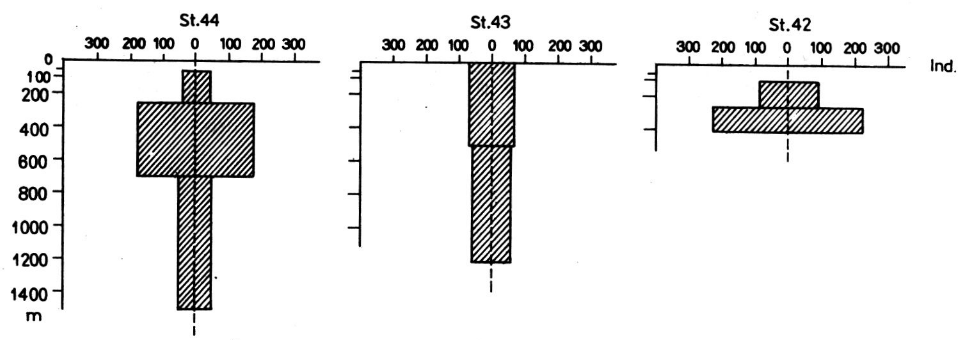

Fig. 8. Distribution of *Calanoides acutus* in a water column in transect II (ind. per 1000 m³)

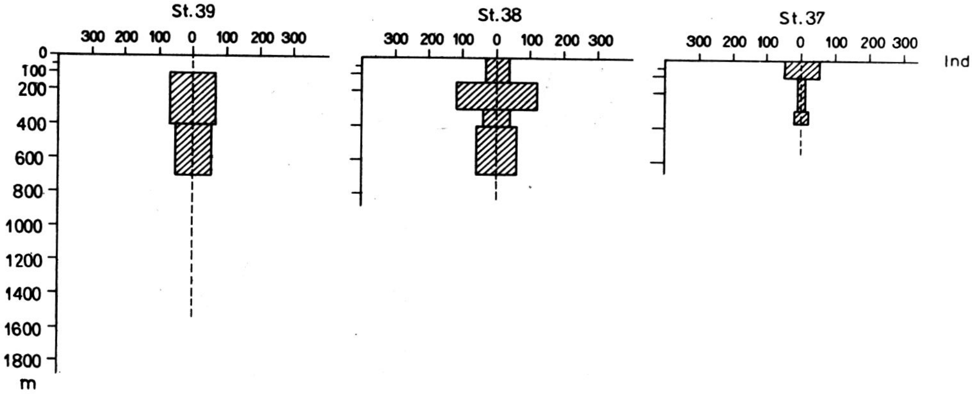

Fig. 9. Distribution of *Calanoides acutus* in a water column in transect III (ind. per 1000 m³)

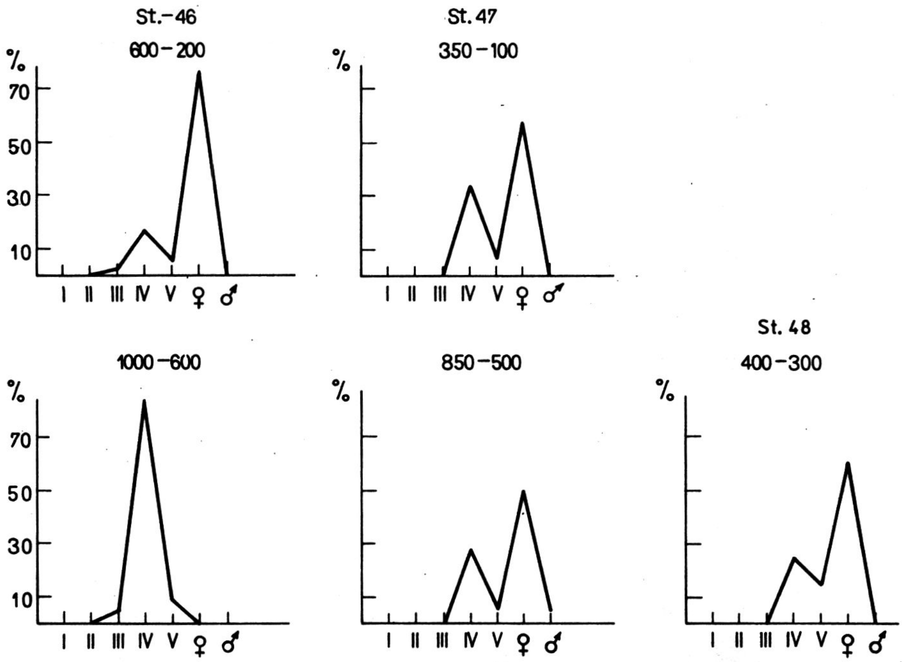

Fig. 10. Population structure of *Calanoides acutus* in transect I (%)

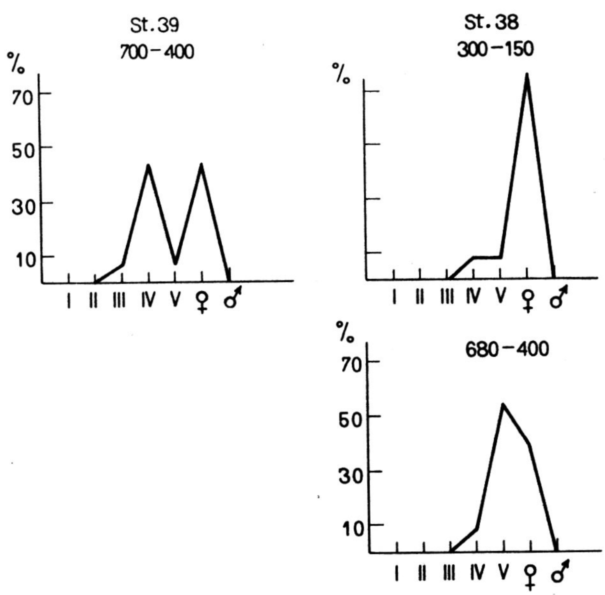

Fig. 11. Population structure of *Calanoides acutus* in transect III (%)

occupied surface waters (0—100 m) with a tendency to increase in abundance in middle water layers. A slight decrease of its abundance from the east towards west was also observed (Figs. 12, 13 and 14). In the whole study area the age distribution of *R. gigas* was characterized by the exclusive presence of the winter generation. Copepodites II and III constituted from 40.9 to 73.9% of the population. A clear stratification of the population in the water column occurred, younger copepodites occupied surface layers, the oldest forms, dominated by females — the deeper ones (Fig. 15). High share of the adult forms of *R. gigas* could indicate that the winter breeding is extended in time or that not all females do breed in winter.

Calanus propinquus occurred in the studied region in all stations but its abundance was low and ranged from 2 to 102 ind. per 1000 m^3. This species occupied the whole water column without clear preference for particular layer (Tab. 1). *C. propinquus* was represented only by the past year generation, dominated by copepodites IV with low share of copepodites III and much higher share of the adult forms.

The presented above results concerning the vertical distribution, abundance and population structure of *C. acutus*, *C. propinquus* and *R. gigas* confirm the earlier data on their successive start towards the euphotic layer and on the asynchrony of the ontogenetic development within their populations (Voronina 1978) as well as on the bivoltine life cycle of *R. gigas* (Ommaney 1936; Żmijewska 1983, 1985).

A comparatively low abundance of the above mentioned calanoid species was due to the nearly exclusive presence of one generation but this abundance increases very quickly after the appearence of new generations in December—January (Żmijewska 1985) or in February—March (Jażdżewski, Kittel and Łotocki 1982).

Euchaeta antarctica was a constant component of zooplankton. Its maximal abundance — 191 ind. per 1000 m^3 — was recorded in station 47. This species was dispersed in the whole studied area clearly avoiding the surface waters. *E. antarctica* was represented by two generations — the wintering one and a new one; younger copepodites (I—III) dominated the spring generation accompanied by single females.

Small copepods of the family Pseudocalanidae — *Microcalanus pygmaeus* and *Ctenocalanus vanus*, deserve attention due to their considerable abundance in the investigated region (Tab. 1). A decrease in their abundance from the west towards east was observed. *C. vanus* in general avoided the surface waters, whereas *M. pygmaeus* was distributed in the whole water column. Older copepodites (IV—V) and adult forms contributed to the populations of these both species.

The other species of Calanoida being common in the investigated area were of little importance for the functioning of planktonic community

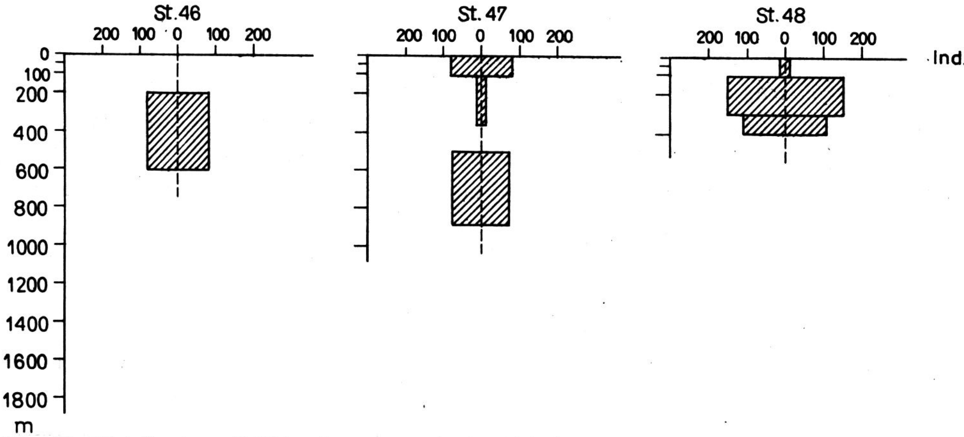

Fig. 12. Distribution of *Rhincalanus gigas* in a water column in transect I (ind. per 1000 m^3)

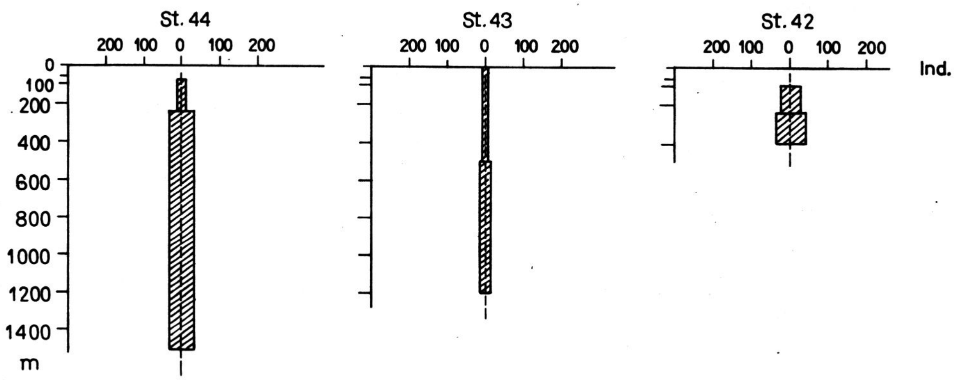

Fig. 13. Distribution of *Rhincalanus gigas* in a water column in transect II (ind. per 1000 m^3)

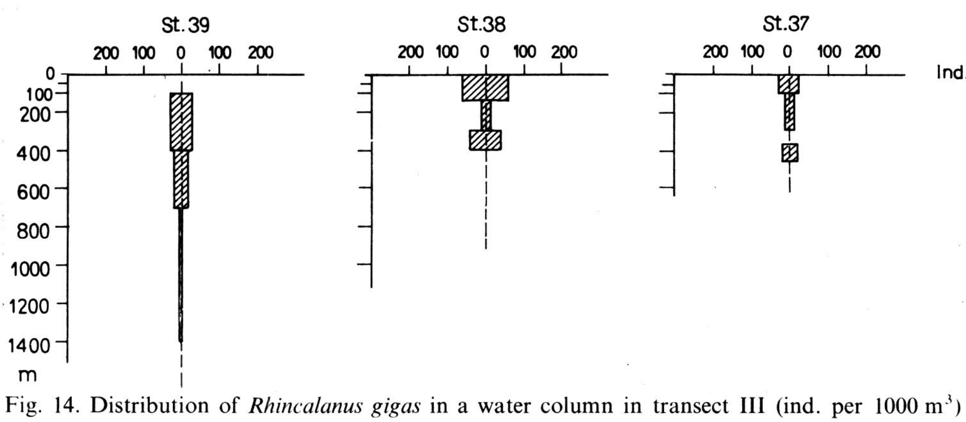

Fig. 14. Distribution of *Rhincalanus gigas* in a water column in transect III (ind. per 1000 m^3)

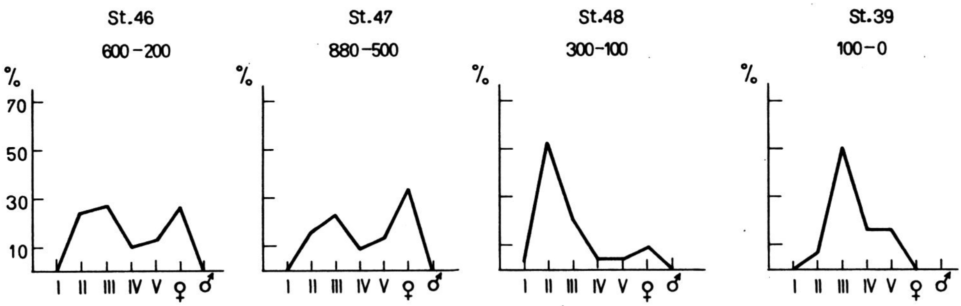

Fig. 15. Population structure of *Rhincalanus gigas* in transects I and III (%)

because of their low abundance (Tab. 1). On the other hand Cyclopoida were an important zooplankton component of this study region. *Oithona similis* was the most important cyclopoid reaching a maximal abundance of 124675 ind. per 1000 m^3 in station 38. It occurred in the whole water column but it was usually most abundant in the layer 100—300 m (Tab. 1). The distribution of *O. frigida* was similar, but it occurred less frequently and in lower abundance (maximally 3571 ind. per 1000 m^3; Tab. 1). Populations of both species were characterized by a high share of older copepodites (IV—V) and by the presence of adult forms.

Copepoda of the genus *Oncaea* occurred in all stations, in general inhabiting deeper layers than the representatives of the genus *Oithona*. *Oncaea curvata* reached its maximal abundance (10390 ind. per 1000 m^3) in transect I (st. 47), similarly as *Oncaea conifera* (2734 ind. per 1000 m^3; Tab. 1). *Oncaea* species were in the final stage of their development; copulating pairs of *Oncaea conifera* were recorded.

In Antarctic Ocean a very high peak of the abundance attain small copepods: Calanoida of the genera *Ctenocalanus*, *Microcalanus* and *Clausocalanus* as well as Cyclopoida (*Oithona*, *Oncaea*), which constitute up to 80% of the copepods smaller than 1 mm (Voronina 1984). Hopkins (1985), basing on the study in the Croker Passage in April, determined the copepod biomass distribution as a polymodal one with a high share of animals smaller than 1 mm (nauplii and copepodites of *Oncaea*, *Metridia* and *Microcalanus* which are collected by the Nanson net) and a high share of animals of size 4—5 mm (*C. acutus* and *M. gerlachei*). However, according to the same author (Hopkins 1985) the biomass of the Antarctic zooplankton is dominated by the species: *C. acutus*, *M. gerlachei* and *E. antarctica*, which constitute up to 74% of zooplankton biomass and therefore they deserve particular attention.

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5. Streszczenie

W niniejszym opracowaniu przedstawiono wyniki badań Copepoda między wyspami King George i Elephant, w okresie wczesno-wiosennym w 1986 roku. Celem pracy było określenie składu gatunkowego Copepoda, ich liczebności oraz analiza struktury wiekowej. Praca jest kontynuacją polskich badań planktonowych w ramach międzynarodowego programu BIOMASS. Materiał planktonowy pobierany był warstwowo zamykaną siecią planktonową typu Nansena — z kolumny wody (Tab. 1). Skład jakościowy i ilościowy opracowano analizując wszystkie duże Calanoida w próbie, jedynie drobne Calanoida i Cyclopoida badano metodą trzech podprób, używając stampla planktonowego o pojemności 1 ml. Liczebność Copepoda przedstawiono jako liczbę osobników w 1000 m^3 wody (Tab. 1).

W rejonie badań stwierdzono obecność 50 taksonów Copepoda. Najwyższą frekwencją i liczebnością charakteryzował się *Metridia gerlachei* (maks. 23349 osob. w 1000 m^3 wody). W 75—90% prób rejestrowano *Calanus propinquus*, *Rhincalanus gigas*, *Microcalanus pygmaeus* i *Oithona similis*. Stwierdzono wzrost liczby gatunków wraz z głębokością, przy spadku ich liczebności (Tab. 1). *M. gerlachei* występował głównie na średnich głębokościach (rys. 2—4). Gatunek ten zdecydowanie omijał wody powierzchniowe.

Analiza struktury populacji wykazała, że stopień rozwoju populacji jest zróżnicowany (rys. 5—6).

Liczebność *Calanoides acutus* wahała się od 3 do 575 osob. w 1000 m^3 wody. Gatunek ten skupiał się głównie na średnich głębokościach (rys. 7—9) i charakteryzował się obecnością wyłącznie zimującej generacji w końcowym etapie rozwoju osobniczego (rys. 10—11).

Rhincalanus gigas był gatunkiem mniej licznym niż *C. acutus* (rys. 12—14) i reprezentowany był przez młodsze kopepodity (II—III) oraz formy dojrzałe ubiegłorocznego pokolenia (rys. 15).

Calanus propinquus zasiedlał całą kolumnę wody. Jego liczebność wahała się od 2 do 102 os. w 1000 m^3 (Tab. 1). W populacji tego gatunku przeważały wcześniejsze stadia rozwojowe niż w przypadku *C. acutus*.

Drobne widłonogi takie, jak *Microcalanus pygmaeus* oraz *Ctenocalanus vanus* występowały liczniej w zachodniej części rejonu badań. *C. vanus* omijał wody powierzchniowe, zaś

M. pygmaeus zasiedlał całą kolumnę wody (Tab. 1). W skład populacji tych gatunków wchodziły kopepodity IV—V oraz formy dorosłe.

Euchaeta antarctica występował w wodach głębszych, a reprezentowany był przez dwie generacje, ubiegłoroczną i nowe pokolenie.

Cyclopoida z rodzaju *Oithona* stanowiły stały element planktonu na całym obszarze badań, koncentrując się głównie w warstwie 100—300 m. Widłonogi z rodzaju *Oncaea* zajmowały wody głębsze niż te z rodzaju *Oithona*.

Śladowy udział nauplii i najmłodszych kopepoditów przy dominacji najstarszych kopepoditów i osobników dojrzałych wskazuje na wczesną fazę rozwoju zespołu planktonowego.