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The distribution of some Copepods (Crustacea) in the Southern Ocean and adjacent regions from 40° to 81° W long *

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RESUMO

Distribuição de alguns copépodos (Crustacea) no Oceano Austral e Adjacências entre 40° e 81° W.

A distribuição zoogeográfica das espécies de copépodos *Rhincalanus gigas, R. nasutus, R. cornutus, Pseudeuchirella hirsuta, Valdiviella insignis, V. brevicornis, Pseudeuchaeta brevicauda, Undeuchaeta major, U. intermedia, Euchaeta longicornis, E. marina, E. tenuis, Paraeuchaeta antarctica, P. aequatorialis, P. barbata, P biloba, P. birostrata, P. bisinuata, P californica, P. confusa, P dubia, P farrani, P. grandiremis, P hanseni, P. malayensis, P. pseudotonsa, P polita, P. rasa, P. sarsi, P. scotti, P. similis, P. tonsa, P weberi* foi estudada de 129 amostras coletadas do U.S.N.S. "Eltanin" em águas entre as latitudes 2°34' N e 67°28'S e longitudes 42°44' e 81°61'W. Onde possível a distribuição das espécies foi correlacionada com a profundidade, os meses do ano e as massas dágua ocorrentes na região. Um ciclo migratório foi proposto, e as espécies mais freqüentes, assim como as novas ocorrências, foram registradas.

ABSTRACT

The zoogeographical distribution of the copepod species *Rhincalanus gigas, R. nasutus, R. cornutus, Pseudeuchirella hirsuta, Valdiviella insignis, V brevicornis, Pseudeuchaeta brevicauda, Undeuchaeta major, U. intermedia, Euchaeta longicornis, E. marina, E. tenuis, Paraeuchaeta antarctica, P. aequatorialis, P barbata, P. biloba, P. birostrata, P. bisinuata, P californica, P confusa, P. dubia, P. farrani, P. grandiremis, P. hanseni, P. malayensis, P. pseudotonsa, P polita, P. rasa, P. sarsi, P. scotti, P. similis, P. tonsa, P weberi* was studied from 129 samples taken by the USNS "Eltanin" in waters between latitudes 2°34'N and 67°28'S and longitudes

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42°44' and 81°16'W. Where possible their distribution was correlated with the depth, the months of the year and the water masses. A possible migratory cycle was proposed, and the most frequent species, as well as the new occurrences, were registered.

INTRODUCTION

The study of the distribution of copepods to the South of South America, in part of the South Pacific, Antarctic and South Atlantic Oceans, between longitudes 40° to 90° W was done during various expeditions such as the "Challenger" (1873-1876), the "Belgica" (1897-99), the "Vikingen" (1929-39), and the "Discovery II" (1929-30). But, of these, only few have undertaken the study of the distribution of species in depth and per water mass. Even the works of Hardy and Gunther (1935), Mackintosh (1937), Omanney (1936) and Vervoort (1957) with interesting data on the biology of some Antarctic species, are restricted to collections made during a few Summer months and in waters not deeper than 1500 m. The "Eltanin" samples, here studied, were collected with modern equipment and new techniques generally from great depths and also during Winter for the U.S. Antarctic Research Program. Thanks to this material, kindly sent from the Smithsonian Institution in Washington, this work was made possible.

The common method frequently used to determine the distribution of species is by geographical limits of latitude and longitude and/or depth. But, marine plankton animals do not live restricted by these boundaries but by the characteristics of the waters in which they thrive (Bary, 1964). Thus, it is possible to understand why a species can be found far from the region where it normally lives, because it was probably carried in the water mass where it found adequate conditions for survival. These vary during each phase of its existence, as does its capacity of adaptation. This is especially so in forms of high latitudes, where the absence of the sun during Winter stops the renewal of the stock of food in the surface waters, obliging the larger specimens to migrate to other habitats so as to garantee their survival (Knox, 1970). The planktonts, because they lack efficient means of locomotion, simply let themselves fall from the surface to deeper water masses which move away from the Antarctic continent during this time and are thus carried into other latitudes. This is one more reason to study them relatively to the water masses and to determine simultaneously in which time of the year they were found so as to reconstruct their annual migratory cycle. For this the deep water samples are of great value.

According to Currie (1964), the Southern Ocean should not be considered as isolated, but as a border region to the water circulation of all oceans. The circumpolarity of its form should be etxended to its biological characteristics. The circumpolar water masses spread over the South Hemisphere in the deep layers (Murontsev, 1963; Sverdrup et. al., 1954). If we study the distribution of species per water mass it will be possible to prove or not the biological circumpolarity, besides determining up to where the polar species spread in smaller latitudes.

The aim of this work is to establish the zoogeographical distribution of some copepods in Antarctic, Subantarctic and Subtropical waters, off the Antarctic and neighbouring regions and to relate it to the existing water masses and their movements by means of the geographical and hydrological data collected in each area, also to verify the existence of the most frequent and abundant species in each water mass. For this our data were added to those obtained from the literature.

The conclusions here arrived at may or not be confirmed, with the addition of more data.

MATERIAL AND METHODS

The material here studied was collected during the cruises of the USNS "Eltanin", off the Peruvian, Chilean, Argentine and Antarctic coast in 129 stations situated between latitudes 2°34'N and 67°28'S and longitudes 42°44' to 81°16'W from April 1962 to March 1963. The depths sampled varied from the surface to 5948 m. For the calculations in this work 125 samples were chosen South of latitude 13°S, from June 1962 to March 1963 (List 1). The material of stations situated North was analysed only for comparative purposes and was not included in the calculations.

The sampling was made with different instruments such as: Blake trawl (5 f mouth opening) (3,BT), Blake trawl (10 f mouth opening) (10,BT), Menzies trawl (MT), Isaacs-Kidd-Midwater trawl (IK), Otter trawl 40' (OT), Emery rock sampler (a,E.), Campbell dredge (d,C.), Petersen dredge (d,P.), Rock dredge (d,r.), Plankton net with 1/4 m mouth diameter (1/4 pn.), Plankton net with 1/2 m mouth diameter (1/2 pn.), Clarke-Bumpus plankton net (CB), Phleger piston-corer (Ph.C.).

LIST — 1

Situation, hydrographical data, collecting instruments, and date of the samples used in this work.

Stat. number	Date	Latitude	Longitude	Sampling range (m)	Local depth (m)	Instrument used	Salinity (‰)	Temperature (°C)	Density
	1962	°N	°W						
27	2/6	4°53'	80°28'	2489	2489	CB	34,63	2,5	—
29	3/6	2°34'	81°16'	92	2965	1/2 pn	34,95	15,6	25,1
36	7/6	8°24'	81°04'	surface	6039	1/2 pn		19,0	—
38	8/6	8°05'	81°09'	5948	5948	MT	34,7	1,9	—
		°S							
43	12/6	13°19'	78°04'	2858	5325	MT	34,7	2,0	27,8
48	13/6	14°11'	77°08'	4004	4004	MT	34,7	2,0	>27,8
50	15/6	16°13'	74°41'	2858	2888	MT	34,7	2,0	>27,8
58	19/6	23°12'	71°30'	1980	4301	10,BT	34,65	2,5	27,7

LIST — 1 (cont.)

Stat. number	Date	Latitude	Longitude	Sampling range (m)	Local depth (m)	Instrument used	Salinity (‰)	Temperature (°C)	Density
		°N	°W						
61	20/6	23°32'	72°37'	306	3733	10,BT	34,73	10,0	26,7
	21/6	25°44'	70°58'	1966	1966	Ph.c	34,65	2,5	27,6
64	21/6	25°43'	70°58'	5	2033	1/2 pn	34,41	13,5	25,9
65	21/6	25°43'	71°07'	3257	3321	MT	34,07	2,0	27,81
67	22/6	25°32'	71°22'	5797	5942	MT	34,7	1,7	27,9
69	23/6	25°43'	71°07'	11	3440	1/2 pn	34,4	13,5	25,9
71	24/6	31°05'	71°44'	187	192	MT	34,5	10,2	26,5
72	24/6	31°10'	71°49'	933	970	MT	34,5	4,5	27,3
75	24/6	31°10'	71°56'	3142		Ph.c	34,7	2,0	27,8
81	5/7	32°05'	72°58'	less than 2	—	1/2 pn	34,5	10,2	26,5
83	5/7	32°01'	72°58'	3256	4606	a,E.	34,7	2,0	27,8
84	5/7	31°55'	72°55'	4634	4634	d,P	34,7	2,0	27,8
85	6/7	32°02'	72°40'	less than 18	5929	1/2 pn	34,45	11,0	26,4
87	6/7	32°	72°41'	5929	5911	MT	34,69	2,0	27,6
89	6/7	32°01'	72°40'	less than 2	5909	1/2 pn	34,45	11,0	26,4
94	8/7	39°02'	75°39'	less than 9	4154	1/2 pn	34,45	11,5	—
97	10-11/7	46°15'	76°18'	1830	3038	IK	34,62	2,4	—
98	12/7	51°07'	77°40'	6	3865	IK	33,93	7,0	26,59
99	12/7	51°07'	77°40'	1219	3848	IK	34,11	4,6	—
100	16/7	55°58'	61°53'	4035	3989	MT	34,69	0,03	27,83
108+	18/7	56°06'	60°54'	128	4090	IK	34,1	2,45	—
112	20/7	56°02'	61°56'	4008	4004	MT	34,65	<0,03	27,82
115	23/7	58°28'	60°38'	3093	3071	MT	(<34,7)	(<0,7)	(27,88)
120	28/7	57°06'	63°21'	3975	3991	MT	<34,7	<0,89	27,83
122+	28/7	57°01'	63°16'	306	3870	IK	34,19	3,93	27,
123	27/7	57°09'	63°43'	2439	4172	IK	34,72	1,3	27,81
124+	29/7	57°11'	62°49'	less than 915	3779	1/2 pn	34,48	2,5	27,58
125	29/7	57°14'	62°46'	1830	3788	IK	34,71	1,94	27,79
127	1/8	61°45'	61°14'	4758	4758	MT	(<34,67)	(<0,4)	27,84
131	3/8	61°24'	61°55'	609	3762	IK	34,67	1,95	27,73
132	3/8	61°29'	62°09'	1219	3762	IK	34,79	1,53	27,83
133	3-4/8	61°30'	62°10'	2196	3660	IK	(34,72)	0,52	27,87
134	5-6/8	62°01'	65°06'	275	3020	IK	34,64	1,66	27,64
135	6/8	62°40'	64°06'	3752	3779	MT	34,69	0,46	27,87
141+	10/8	58°56'	65°15'	915	3257	IK	34,69	1,93	27,76
142	10/8	60°01'	65°25'	1830	3203	IK	34,74	1,32	27,85
143	10/8	60°01'	65°20'	609	3953	IK	34,64	2,14	27,70

LIST — 1 (cont.)

Stat. number	Date	Latitude	Longitude	Sampling range (m)	Local depth (m)	Instrument used	Salinity (‰)	Temperature (°C)	Density
144	11/8	60°02'	64°58'	less than 915	3752	1/2 pn	34,69	1,93	27,76
147	11/8	60°02'	64°51'	less than 9	3550	1/2	33,9	−1,34	27,31
148	12/8	59°44'	65°15'	1226	3376	IK	34,72	1,74	27,79
149	12/8	58°31'	65°17'	2105	3404	IK	34,71	1,72	27,80
150+	12/8	58°28'	65°43'	128	2928	IK	34,10	2,98	27,20
152	15/8	56°10'	63°51'	4209	4209	10,BT	34,71	0,92	27,84
154	16-17/8	56°43'	64°28'	2105	3999	IK	34,72	1,45	27,82
155	17/8	56°34'	63°18'	3927	3940	MT	34,71	0,94	27,84
165	24/8	47°26'	76°40'	732	3444	IK	34,25	4,44	27,13
169	25/8	44°41'	76°04'	366	1583	IK	34,30	6,76	26,43
171	26/8	42°30'	75°58'	less than 13		CB	33,72	10,24	25,94
175	27/8	40°46'	76°48'	2893	3730	IK	34,66	1,80	27,73
177	28/8	39°20'	74°34'	less than 33	2864	1/2 pn	33,7 34,0	11,50	—
179	28/8	39°20'	74°37'	less than 13	1922	CB	34,0	11,50	25,62
183	28/8	39°20'	74°06'	less than 33	1546	1/2 pn	34,04	11,50	25,62
196	31/8	35°28'	73°34'	—	1464	d,P	34,54	3,35	27,55
197	31/8	35°31'	73°29'	less than 20	1254	1/2 pn	34,06	13,33	25,64
201	31/8	35°36'	73°18'	less than 33	970	CB	34,08	13,28	25,62
203	31/8	35°39'	73°08'	436	439	d,P	34,43	7,34	26,94
208	11/9	37°29'	73°55'	957	957	d,C.	34,33	4,30	27,25
209	11/9	37°27'	73°52'	183	439	1/2 pn	34,53 33,67	9,6	26,56 26,76
212	12/9	41°01'	74°58'	183	2159	1/2 pn	34,21	9,20	26,61
213	13/9	41°05'	74°54'	606	1804	IK	34,27	4,91	27,12
216	16/9	52°52'	75°36'	1190	1263	MT	34,47	2,57	27,61
217	23/9	54°22'	64°42'	110	110	40,OT	34,29	4,02	27,24
219	23/9	55°47'	66°17'	115	115	d,P.	34,13	4,92	27,05
225	28/9	57°02'	69°26'	207	4575	CB	34,15	4,83	27,06
228	28/9	57°04'	69°21'	648	4575	CB	34,19	4,34	27,15
230	29/9	57°07'	69°17'	4191	4191	MT	34,71	<1,24	27,82
232	30/9 1/10	56°57'	68°56'	4310	4310	10,BT	<34,71	<1,24	27,82
233	1/10	57°35'	68°30'	surface	—	—	34,16	5,00	27,13
235	2/10	59°06'	67°59'	1830	3733	IK	34,72	1,80	27,80
236+	2/10	59°20'	68°04'	60	3678	IK	34,09	2,22	27,27

LIST — 1 (cont.)

Stat. number	Date	Latitude	Longitude	Sampling range (m)	Local depth (m)	Instrument used	Salinity (‰)	Temperature (°C)	Density
247	5/10	59°29'	68°01'	1830	3660	IK	34,74	1,73	27,80
248	5/10	59°56'	69°00'	1373	3770	IK	34,62	2,18	27,68
253+	7/10	59°05'	69°28'	961	3843	IK	34,53	2,33	27,60
254+	10/10	59°49'	68°52'	622	622	10,BT	34,36	2,55	27,43
259	12/10	62°00'	68°01'	2615	3876	IK	34,69	0,74	27,83
260	18/10	62°11'	68°05'	3781	3781	MT	34,71	0,51	27,87
262	19/10	62°26'	67°45'	2428	3532	IK	34,70	0,84	27,84
265	19/10	62°59'	67°45'	3693	3693	MT	34,70	0,49	27,86
269	21/10	64°65'	68°27'	4	410	1/2 pn	33,91	−1,50	27,31
273	21/10	66°55'	68°12'	168	448	IK	34,47	−0,59	27,45
274	22/10	66°22'	71°48'	1876	3294	IK	34,71	0,68	27,85
275	22/10	66°28'	72°37'	1885	3404	IK	34,71	0,64	27,85
276	23/10	66°58'	74°58'	3042	3042	MT	34,70	0,51	27,83
279	23-24/10	67°17'	74°54'	681	3203	IK	34,71	1,53	27,81
280	24/10	67°28'	74°39'	2577	2521	IK	34,70	<0,80	>27,81
281	24/10	67°11'	75°08'	708	2946	IK	34,71	1,48	27,80
282	24-25/10	67°04'	75°19'	1830	3386	IK	34,70	0,63	27,83
283	25/10	66°23'	74°50'	3693	3693	MT	34,67	<0,44	>27,82
285	25-26/10	66°31'	74°43'	708	3673	IK	34,70	1,77	27,76
292	27-28/10	65°08'	70°35'	619	3230	IK	34,66	1,77	27,77
295	28/10	63°58'	71°10'	5	3532	1/2 pn	33,93	−1,33	27,35
296	28-29/10	63°57'	71°19'	2489	3477	IK	34,68	0,83	27,82
297	29/10	63°41'	71°16'	2255	3629	IK	34,69	0,88	27,83
298	29/10	63°08'	71°11'	3777	3777	MT	34,70	<0,57	27,85
305	1/11	59°59'	70°43'	2827	2827	MT	34,73	1,48	27,80
306+	2/11	60°06'	70°08'	757	4355	IK	34,32	2,40	27,42
309	3/11	59°01'	70°46'	3842	3843	d,r	34,70	1,00	27,83
311	3/11	58°00'	71°00'	4099	4099	MT	34,71	0,91	27,84
313	4/11	58°00'	70°40'	802	3800	IK	34,22	3,88	27,20
318	5/11	57°14'	70°57'	262	3966	IK	34,21	4,80	27,10
322	7/11	56°04'	71°13'	2013	2013	MT	>34,65	<2,83	>27,70
325	7/11	56°06'	71°14'	983	4280	IK	34,31	3,46	27,31
333	27/11	42°56'	75°36'	—	3655	d,C.	34,70	1,69	27,78
337	2/12	52°45'	66°34'	92	92	40,OT	33,98	5,86	26,76
342	3/12	53°41'	59°09'	44	1135	IK	34,02	5,60	26,95
348	4/12	54°40'	58°58'	644	2635	IK	34,20	3,67	27,19
350	4/12	55°03'	58°57'	2452	2452	MT	34,67	1,92	27,73
355	5-6/12	55°43'	58°53'	3025	4502	IK	34,72	1,44	27,81

Stat. number	Date	Latitude	Longitude	Sampling range (m)	Local depth (m)	Instrument used	Salinity (‰)	Temperature (°C)	Density
359+	6-7/12	56°19'	58°10'	842	3989	IK	34,29 34,45	2,30 2,55	27,41
360	7/12	56°29'	58°25'	1885	4240	IK	34,68	2,08	27,73
364+	8-9/12	57°34'	59°06'	849	3294	IK	34,51	2,47	27,56
375	20/12	53°00'	55°50'	933	1826	IK	34,30	3,23	27,38
382	23/12	55°23'	55°45'	1257	3514	IK	34,48	2,67	27,50
281	22-23/12	55°09'	55°28'	1867	3312	IK	34,64	2,18	27,70
383	24/12	55°52'	56°03'	1821	4291	IK	34,69	1,92	27,75
397	30/12 1963	59°27'	56°12'	2269	3569	IK	34,72	0,75	27,86
440	10/1	63°38'	62°29'	81	302	IK	34,25	−0,32	—
437	9/1	62°50'	60°40'	311	311	5,BT	34,56	−0,36	—
494	19/2	60°42'	42°50'	1226	1281	d,r.	<34,63	−0,01	>27,84
499	20/2	62°06'	45°08'	485	489	d,r.	34,52	—	>27,75
541	7/3	60°03'	49°06'	3623	3706	d,r.	<34,66	<−0,22	<27,87

\+ Samples collected in the Convergence zone, where several water masses pushed by different currents meet and mix or change their direction (Sverdrup et al., 1954; Pickard, 1968).

The data between brackets indicate values which are not precise (Friedman, 1964).

Details about the collection of the samples can be found in Savage and Caldwell (1965). As samples were taken from different depths in each season, and the representatives of a certain species were found in samples taken from greater depths and not in the samples taken from lesser depths it was concluded that the species was absent from the lesser depths during that season.

Most of the analysed samples were collected by trawl nets. The sampling instrument was lowered vertically and then pulled horizontally at the greatest depth of the haul and, then pulled horizontally with an apropriate velocity for sampling, before being hauled in vertically or obliquely. It has therefore been assumed here that the majority of the copepods in each sample was collected at the greatest depht, while the collecting instrument was being pulled horizontally over the bottom or at a certain depth before it was hauled in. It is possible that I have wrongly interpreted when I admit that the species occur at the greatest depth in which the samples were collected because, after collecting in that depth, the nets were hauled in with their mouths open from the depth of the sampling to the surface, crossing several water layers (Mohr, 1966). Further studies with perfectioned sampling methods will or not confirm the correctness of this assumption.

The species of the genera *Euchaeta* and *Paraeuchaeta* (Family Euchaetidae), *Valdiviella, Pseudeuchaeta, Undeuchaeta* and *Pseudeuchirella* (family Aetideidae), *Rhincalanus* (family Eucalanidae) were chosen for the present study. Mori (1964) was followed for the identification of the genera belonging to the Aetideidae.

Though Vervoort (1957) and Fontaine (1967) do not separate the two genera, *Euchaeta* and *Paraeuchaeta* are here considered as distinct, because I have been able to observe in many animals some of the differential characteristics cited by Scott (1909), Sewell (1947) and Tanaka (1958).

The comparison of the absolute numbers of the animals for the study of the distribution of the species is of no value in this case because the samples are not quantitative and their number per water mass is also unequal. Therefore, I calculated for each species female, male and/or juvenile specimens, the percentage frequency in the total number of samples from each depth interval (R1) and from each water mass (R3). The depth data are useful so as to present a general idea of the vertical migration of the species and to help in the interpretation of the distribution per water mass.

The following percentage relations were calculated:

$$R1 = \frac{\text{n.}^{\text{o}} \text{ of samples in which a species occurred in a certain depth interval}}{\text{Total n.}^{\text{o}} \text{ of samples analysed from this depth interval}} \times 100$$

$$R2 = \frac{\text{n.}^{\text{o}} \text{ of samples containing the species from a depth interval during a certain month}}{\text{Total n.}^{\text{o}} \text{ of samples analysed from this depth during this month}} \times 100$$

$$R3 = \frac{\text{n.}^{\text{o}} \text{ of samples containing a species from one water mass}}{\text{Total n.}^{\text{o}} \text{ of specimens analysed from this water mass}} \times 100$$

$$R4 = \frac{\text{n.}^{\text{o}} \text{ of samples in which the species occurred from a water mass in a certain month}}{\text{Total number of samples analysed from this water mass and this month}} \times 100$$

The relations R2 and R4 show the different habitats in which the species may appear during different months, furnishing data for the reconstruction of their migratory cycles.

The water masses sampled were delimited based on the depth of the collecting and on the salinity and temperature data observed at the sampling stations visited during the expedition (Friedman, 1964), and by afterwards comparing them with other hydrographic studies made in the same regions (Deacon, 1937; Sverdrup, *et al.*, 1954; Brodie, 1965), also by consultation of the maps of Folio 6 (Gordon, 1967) with some of the most recent data on the distribution of water masses South of 50°S.

The salinity and temperature limits used as characteristics of the water masses were the following:

Water masses	F	PI	PS	IA	AS	SS	ST
S‰	34,7	34,69	34,40 34,74	34,1 34,6	33,5 34,6	33,95 35,2	34,6 36,3
T°C	10 or less	0,6 2,5	1,7 +2,5	2,5 7,0	−1,95 3,0	0,00 15,00	10,0 20,0
Dt	27,86 ±0,02	27,80 27,85	27,60 27,70	26,8 27,0	27,01 27,1	25,12 26,9	24,29 26,59

Abbreviations: S‰ = salinity; T°C = degrees centigrade of temperature; Dt = density; F = Bottom Antarctic Water; PI = Lower Deep Water; PS = Upper Deep Water ;IA = Intermediate Antarctic Water; AS = Antarctic Surface Water; SS = Subantarctic Surface Water; ST = Subtropical Water.

The data on the salinity and the temperature of the waters sampled did not always coincide with those mentioned above. It is known that in days with an overcast sky or with brilliant sunshine, with heavy rains or strong winds, surface or coastal waters may show temporary fluctuations in salinity and temperature (Dahl, 1960; Murontsev, 1963; Pickard, 1968). The Antarctic Ocean is considered a ballanced system of a great variety of water masses, each one maintaining its own characteristics (Brodie, 1965). As the water masses move away from their "core", where their characteristics are constant, they mix with other water masses, and intermediate values of salinity and temperature appear (Gordon, 1967; Murontsev, 1963). According to Pickard (1968) the waters from a specific zone are influenced by outside waters, which are brought in by current systems from other regions. As the density is responsible for the producing of water flux (Pickard, 1968), to determine which water mass had been sampled this feature as well as the data of salinity and temperature were used, also when intermediate. In these cases I used the distribution maps of the core layers and the T-S diagrams in Sverdrup *et al.* (1954), Brodie (1965) and Gordon (1967).

LIST — 2

Species, species abbreviation, and collection numbers

Rhincalanus gigas Brady, 1883 — R.g — 43, 83, 97, 99, 112, 115, 120, 122-125, 127, 131-135, 141-144, 148-150, 152, 154, 155, 165, 169, 175, 203, 216, 219, 228, 235, 236, 233, 230, 247, 253, 259, 260, 262, 265, 274-276, 279-283, 285, 292, 296, 297, 298, 305, 306, 309, 311, 313, 318, 322, 325, 337, 342, 348, 350, 355, 359, 360, 364, 375, 381, 383, 397, 437. 440.

Rhincalanus nasutus Giesbrecht, 1888 — R.n — 27, 61, 67, 75, 84, 94, 97, 99, 100, 112, 120, 123, 125, 133, 135, 149, 152, 165, 169, 175, 177 179, 196, 197, 209, 219, 259, 274, 275, 318, 333, 348, 355, 359, 381, 437.

Rhincalanus cornutus (Dana, 1849) — R.c — 29, 169, 183.

Pseudeuchirella hirsuta (Wolfenden, 1905) — Pl.hi — 97, 99, 112, 123, 132, 133, 142, 154, 213, 248, 253, 259, 275, 297, 359, 383.

Valdiviella insignis Farran, 1908 — V.in — 97, 112, 175, 274, 355, 381.

Valdiviella brevicornis Sars, 1905 — V.br — 97, 175, 274, 275, 282, 296, 297, 255, 360, 381, 397

Pseudeuchaeta brevicauda Sars, 1905 — Pt.b — 282.

Undeuchaeta major Giesbrecht, 1888 — U.ma — 75, 359.

Undeuchaeta intermedia A. Scott, 1909 — U.in — 61, 97.

Euchaeta longicornis Giesbrecht, 1888 — E.lo — 38.

Euchaeta marina (Prestandrea, 1833) — E.ma — 29, 36, 43, 58.

Euchaeta tenuis Esterly, 1906 — E.te — 58.

Pareuchaeta antarctica Giesbrecht, 1902 — P.an — 112, 123, 125, 132-135, 141-143, 148, 149, 154, 235, 246, 253, 259, 262, 275, 279-283, 285, 292, 296, 297, 298, 305, 348, 355, 359, 360, 364, 383, 397

Pareuchaeta aequatorialis Tanaka, 1958 — P.ae — 297, 248.

Pareuchaeta barbata (Brady, 1883) — P.ba — 97, 122, 123, 125, 141, 142, 148, 149, 154, 175, 247, 248, 262, 274, 275, 282, 283, 348, 383.

Pareuchaeta biloba (Farran, 1929) — P.bi — 97, 99, 100, 115, 120, 125, 133, 134, 141, 144, 148, 149, 152, 154, 165, 169, 175, 212, 213, 216, 235, 230, 247, 248, 253, 262, 275, 280, 281, 285, 298, 305, 306, 311, 313, 318, 322, 325, 348, 350, 355, 359, 360, 375, 381, 382, 383, 397.

Pareuchaeta birostrata Brodsky, 1950 — P.br — 155, 175.

Pareuchaeta bisinuata Sars, 1907 — P.bs — 65.

Pareuchaeta californica (Esterly, 1906) — P.ca — 175.

Pareuchaeta confusa Tanaka, 1958 — P.co — 75, 175, 297.

Pareuchaeta dubia Esterly, 1906 — P.du — 97, 175, 313, 359.

Pareuchaeta farrani With, 1915 — P.fa — 97, 99, 132, 133, 142, 235, 259, 292, 296, 297, 311, 348, 355, 359, 364, 381, 383, 397

Pareuchaeta grandiremis Giesbrecht, 1888 — P.gr — 58.

Pareuchaeta hanseni (With, 1915) — P.ha — 213.

Pareuchaeta malayensis Sewell, 1929 — P.ma — 58, 127, 141, 175, 297.

Pareuchaeta pseudotonsa Fontaine, 1967 — P pt — 97, 99, 175, 313, 348, 355, 359, 375.

Pareuchaeta polita Tanaka, 1968 — P po — 360.

Pareuchaeta rasa Farran, 1929 — P.ra — 132, 133, 148, 149, 165, 203, 235, 248, 259, 260, 262, 274, 275, 276, 279, 280, 282, 285, 292, 297 298, 305, 309, 313, 348, 355, 359, 360, 364, 381, 382, 383, 397.

Pareuchaeta sarsi Farran, 1908 — P.sa — 97, 99, 112, 175, 235, 253, 259, 262, 274, 305, 313, 325, 383.

Pareuchaeta scotti Farran, 1908 — P.sc — 99, 123, 141, 144, 154, 253, 285, 291, 325, 348, 375, 383.

Pareuchaeta similis Wolfenden, 1911 — P.si — 281.

Pareuchaeta tonsa Giesbrecht, 1895 — P to — 165, 360, 383.

Pareuchaeta weberi (A. Scott, 1909) — P we — 72, 75, 97, 165, 175, 213.

Young Euchaetids — Eu.j — 29, 38, 58, 61, 97, 98, 112, 123-125, 127, 131-135, 143, 148, 149, 154, 155, 165, 169, 175, 212, 213, 219, 230, 235, 236, 247, 248, 253, 259, 260, 262, 275, 279, 281, 282, 283, 292, 296-298, 305, 309, 313, 348, 350, 355, 359, 360, 375, 381, 382, 383, 397

The 125 samples were grouped according to the water mass from which they were taken, abbreviated as follows: F = Bottom Antarctic (18 samples); PI = Lower Deep (31 samples); PS = Upper Deep (20 samples); IA = Intermediate Antarctic (20 samples); AS = Antarctic Surface (9 samples); SS = Subantarctic Surface (13 samples); ST = Subtropical Water (14 samples).

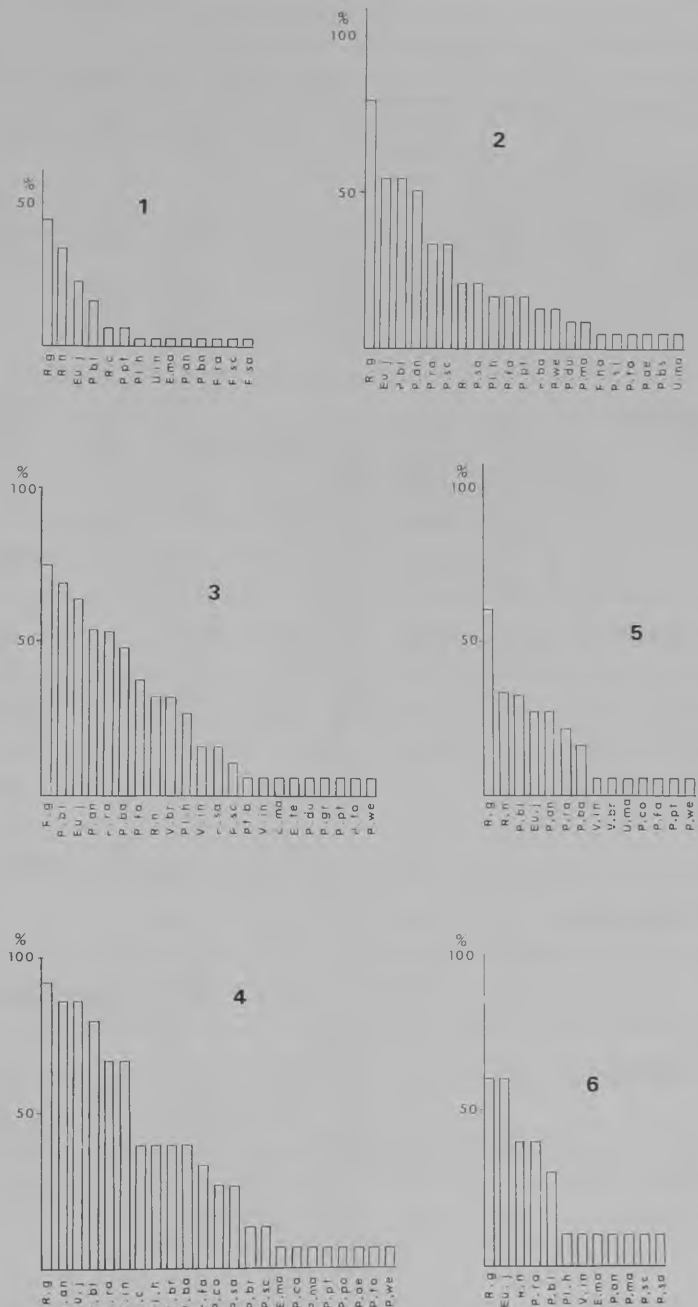
The samples were also separated by depth interval (in meters) with the following numbers: 1 = 0-500 (39 samples); 2 = 600-999 (24 samples); 3 = 1000-1999 (19 samples); 4 = 2000-2999 (15 samples); 5 = 3000-3999 (18 samples); 6 = more than 4000 (10 samples).

RESULTS

Results (R_1, R_2, R_3 and R_4) are shown in Tables 1, 2, 3, in Graphs I, II, II and IV and in List 2. In the following tables and lists the "depth interval" corresponds to the deepest layers sampled during the collection time at each position.

Species	Depth interval (in metres)					
	0 - 500	600- 999	1000- 1999	2000- 2999	3000- 3999	+4000
R. gigas	40,6	79,8	74,2	92,4	60,5	60,0
R. nasutus	31,9	21,0	31,8	39,6	33,0	40,0
R. cornutus	5,8	-	-	-	-	-
P. hirsuta	2,9	16,8	26,5	39,6	-	10,0
V. insignis	-	-	15,9	66,6	5,5	10,0
V. brevicornis	-	-	31,8	39,6	5,5	-
P. brevicauda	-	-	5,3	-	-	-
U. major	-	4,2	-	-	5,5	-
U. intermedia	2,9	-	5,3	-	-	-
E. marina	2,9	-	5,3	6,6	-	10,0
E. tenuis	-	-	5,3	-	-	-
P. antarctica	2,9	50,4	53,3	85,8	27,5	10,0
P. aequatorialis	-	4,2	-	6,6	-	-
P. barbata	2,9	12,6	47,7	39,6	16,5	-
P. biloba	14,5	54,6	68,9	79,2	33,3	30,0
P. birostrata	-	-	-	13,2	-	-
P. bisinuata	-	4,2	-	-	-	-
P. californica	-	-	-	6,6	-	-
P. confusa	-	-	-	26,4	5,5	-
P. dubia	-	8,4	5,3	-	-	-
P. farrani	-	16,8	37,1	33,0	5,5	-
P. grandisremis	-	-	5,3	-	-	-
P. hanseni	-	4,2	-	-	-	-
P. malayensis	-	8,4	-	6,6	-	10,0
P. pseudotonsa	5,8	16,8	5,3	6,6	5,5	-
P. polita	-	-	-	6,6	-	-
P. rasa	2,9	33,6	53,0	66,6	22,0	40,0
P. scotti	2,9	33,6	10,6	13,2	-	10,0
P. sarsi	2,9	21,0	15,9	26,4	-	10,0
P. similis	-	4,2	-	-	-	-
P. tonsa	-	4,2	5,3	6,6	-	-
P. weberi	-	12,6	5,3	6,6	5,5	-
Juvenile Euchaetid	20,3	54,6	63,6	85,8	27,5	60,0
Total nº of species	13	20	21	22	13	12

TABLE 1 — Percentage frequency of the species per depth interval



GRAPH 1 — Percentage frequency of the species per depth interval. (1), (2), (3), (4), (5) and (6) are depth intervals respectively of 0-500 m; 600-999 m; 1000-1999 m; 2000-2999 m; 3000-3999 and of more than 4000 m. For the abbreviations used see List 2. The depths considered are the depths sampled during the longest time interval of the collection.

Species	Month	Depth interval (in metres)					
		0-500	600-999	1000-1999	2000-2999	3000-3999	+4000
R. gigas	VI	-	-	-	-	-	50,0
	VII	25,0	100,0	100,0	100,0	100,0	25,0
	VIII	30,8	100,0	75,0	100,0	100,0	100,0
	IX	25,0	33,3	100,0	-	-	50,0
	X	40,0	85,7	80,0	100,0	80,0	-
	XI	100,0	100,0	-	50,0	66,6	-
	XII	100,0	100,0	75,0	66,6	100,0	-
	I	100,0	-	-	-	-	-
R. nasutus	VI	25,0	-	-	-	33,3	50,0
	VII	25,0	-	100,0	100,0	66,6	50,0
	VIII	30,8	20,0	50,0	75,0	50,0	50,0
	IX	50,0	33,3	-	-	-	-
	X	-	-	40,0	20,0	-	-
	XI	100,0	33,3	-	-	33,3	-
	XII	-	50,0	25,0	-	100,0	-
	I	50,0	-	-	-	-	-
P. hirsuta	VII	12,5	-	50,0	100,0	-	25,0
	VIII	-	-	25,0	50,0	-	-
	IX	-	33,3	-	-	-	-
	X	-	14,2	40,0	40,0	-	-
	XII	-	25,0	25,0	-	-	-
V. insignis	VI	-	-	50,0	-	-	25,0
	VII	-	-	50,0	100,0	-	-
	X	-	-	20,0	20,0	-	-
	XII	-	-	25,0	-	100,0	-
V. brevicornis	VI	-	-	50,0	-	-	-
	VII	-	-	50,0	-	-	-
	VIII	-	-	-	25,0	-	-
	X	-	14,2	40,0	60,0	-	-
	XII	-	-	50,0	33,3	100,0	-
P. antarctica	VII	-	-	50,0	100,0	-	25,0
	VIII	7,7	40,0	50,0	50,0	50,0	-
	X		28,4	80,0	100,0	60,0	-
	XI	-	33,3	-	50,0	-	-
	XII	-	75,0	50,0	33,3	100,0	-
P. barbata	VII	12,5	-	100,0	100,0	-	-
	VIII	-	20,0	25,0	75,0	-	-
	X	-	28,4	60,0	-	20,0	-
	XII	-	25,0	50,0	-	-	-

TABLE 2 — Percentage frequency of species per depth interval and per month (in roman numerals).

Species	Month	Depth interval (in metres)					
		0–500	600–999	1000–1999	2000–2999	3000–3999	+4000
P. biloba	VII	12,5	-	100,0	100,0	100,0	25,0
	VIII	15,4	60,0	25,0	100,0	50,0	50,0
	IX	25,0	33,3	100,0	-	-	50,0
	X	-	42,6	80,0	40,0	20,0	-
	XI	100,0	100,0	-	50,0	33,3	-
	XII	-	100,0	100,0	66,6	100,0	-
P. rasa	VII	-	-	-	-	-	25,0
	VIII	-	20,0	50,0	50,0	-	50,0
	IX	-	-	-	-	-	50,0
	X	-	71,0	80,0	100,0	60,0	-
	XII	-	50,0	100,0	33,3	100,0	-
P. scotti	VII	12,5	-	-	-	-	-
	VIII	-	40,0	-	50,0	-	-
	X	-	42,6	-	-	-	-
	XI	-	33,3	-	-	-	-
	XII	-	50,0	25,0	-	-	-
P. sarsi	VII	12,5	-	50,0	-	-	25,0
	VIII	-	-	-	25,0	-	-
	X	-	85,2	40,0	20,0	-	-
	XI	-	66,6	-	50,0	-	-
	XII	-	50,0	25,0	-	-	-
P. farrani	VII	12,5	-	50,0	-	-	-
	VIII	7,7	-	-	25,0	-	-
	X	-	22,2	-	-	-	-
	XII	-	75,0	100,0	33,3	100,0	-
P. pseudotonsa	VII	12,5	-	50,0	-	-	-
	VIII	7,7	-	-	25,0	-	-
	XI	-	22,2	-	-	-	-
	XII	-	75,0	-	-	-	-
Juvenile Euchaetid	VI	25,0	-	-	-	-	-
	VII	12,5	100,0	100,0	100,0	-	25,0
	VIII	51,4	80,0	100,0	100,0	50,0	100,0
	IX	50,0	-	-	-	-	50,0
	X	20,0	71,0	-	80,0	60,0	-
	XI	-	33,3	-	50,0	33,3	-
	XII	-	75,0	100,0	66,6	100,0	-

TABLE 2 — (Cont.)

INTERPRETATION AND DISCUSSION

1 *Water Circulation in the region*: In the Southern Ocean all the water from the surface to the depths is pushed by the surface winds (Pickard, 1968) and by the Circumpolar Current from West to East, excepting in high latitudes, because of the rotation movement of the Earth (Vervoort, 1965). The Current moves through the Drake Passage towards the Scotia Sea. It branches off to the North, off West Africa, in the Indian Ocean, between Australia and New Zealand, in the Malaysian Sea and off West South America where it originates the Peru Current (Sverdrup *et al.*, 1954; Gordon, 1967; Pickard, 1968). The Circumpolar Current is thus one of the most important agents of expansion of the circumpolar waters into other oceans of the world.

The circulation of the water masses and their depth are represented in Gordon (1967) relatively to the Antarctic Continent. In the Indian and Atlantic Oceans the Deep Waters run towards the Antarctic region, that is, to the South (Gordon, 1967). In the Pacific the Lower Deep Water flows in the same direction as the Bottom Antarctic Water and as the Intermediate Antarctic Water, that is, to the North. The only water mass flowing to the South is the Upper Deep Water (Murontsev, 1963) which is also influenced by the Earth's rotation movement from West to East.

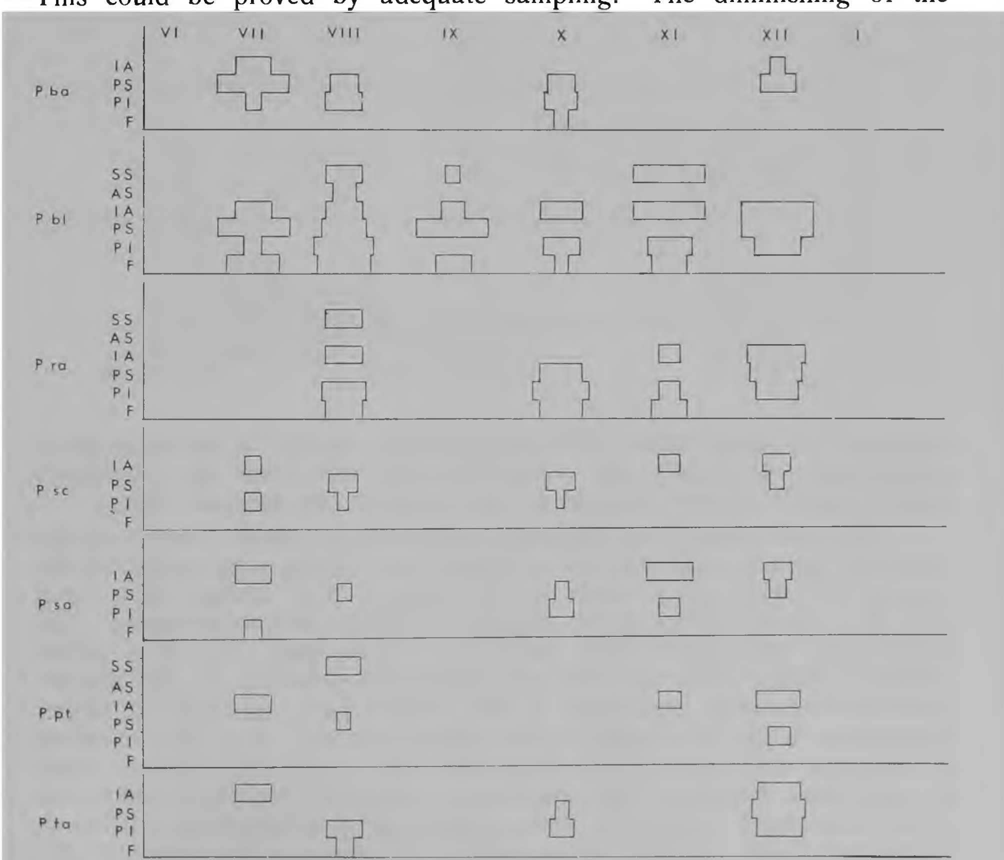
The Bottom Antarctic Water circulates in the high latitudes, contrary to the general flow of the waters from the Scotia Sea to the Drake Passage. It is formed in the Weddell Sea and reaches the Argentine Basin. It may circulate in the Atlantic Ocean moving South to the Scotia Sea, passing through the canyons with greater depths than 3,000 m and entering the Drake Passage also from the South, always limited by the submarine crests and by the warm Deep Waters. Though a great portion of this water does not enter the Pacific Ocean, part of it may reach the South Pacific Basin. It is believed that this Bottom Water, originated from the Weddell Sea, has a great influence in the World Ocean.

The circulation of the water masses also depends on the local topography. The Scotia Sea presents specific characteristics in the Southern Ocean. The Deep Waters do not circulate parallel to the contour lines of the bottom topography as in other regions, but by "flowing uphill" (Sverdrup et al., 1954). Thus, it is possible to find the waters of great depths more at the surface in this region.

2. *Distribution of the species in depth and per water mass*: Table 1 and Graph 1 show that at the time of the sampling, the frequency and the variety of the studied species were larger (28) between 600 and 3,000 m depth, in the Deep Waters, and that the variety was smaller at the surface and below 3,000 m (Table 3 and Graph III).

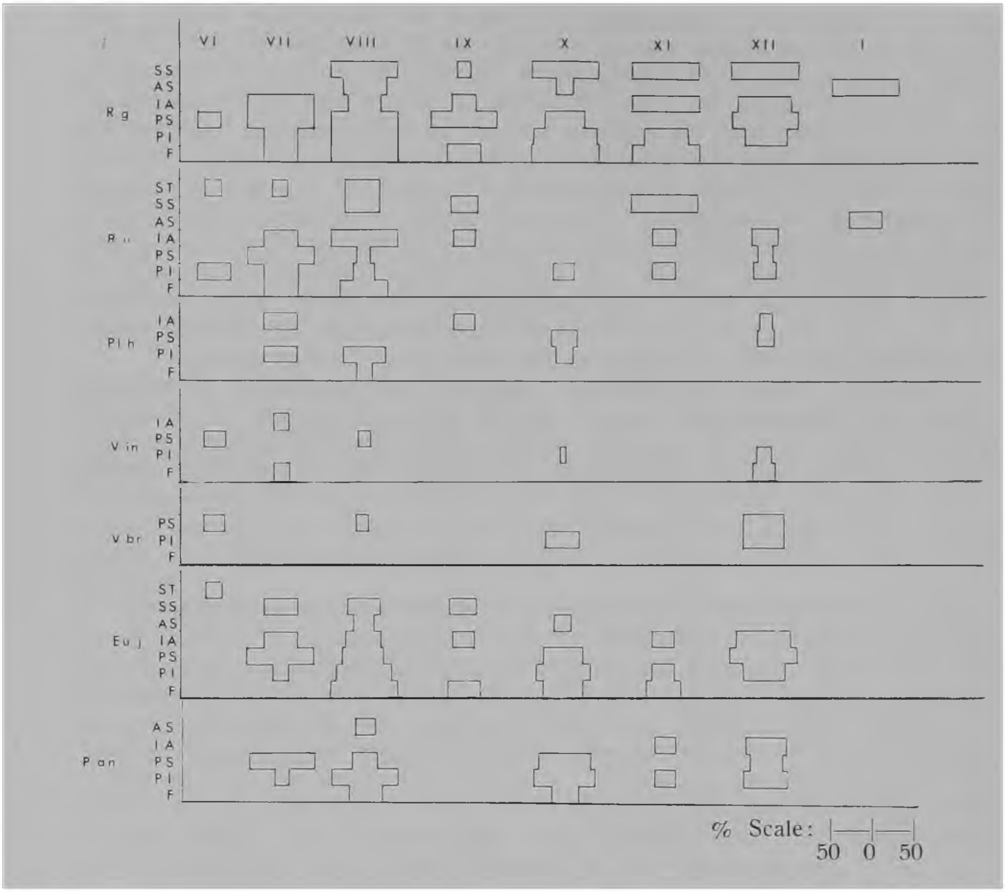
On comparing the depth distribution of the species here considered, with their occurrence in other regions (Vervoort, 1963; Grice & Hülsemann, 1967; Tanaka 1958; Tanaka and Omori, 1968; Decker and Mombeck, 1965; Hopkins, 1966), we find: *Euchaeta bilota, E. bisinuata, E. gracilis, E. sarsi, E. barbata, E. hebes, E. spinosa* in 2 samples collected more or less at 600 m in the Equatorial Atlantic, near West Africa; *R. gigas,* *R. nasutus, Pseudeuchirella hirsuta, Valdiviella insignis, E. dubia, E. farrani, E. gracilis, E. malayensis, E. tonsa,* in hauls from 0-1650 and 0-3,500 m in the Indian Ocean collected by the Isaacs-Kidd-Mid-Water-Trawl either in one or in both hauls; *P. barbata, P. elongata, P. birostrata, P. hanseni, P dubia, P. tonsa, P. scotti, P. malayensis, P. bisinuata, P. confusa, P. californica, P. aequatorialis, P. sarsi,* in samples from 0-1000 and 0-2,300 m depth off the coast of Japan in the North Pacific; *P. barbata, P. bilota, P. dubia, P. diegenensis, P exigua, P. gracilis, P hanseni, P. malayensis, P. norvegica, P. sarsi, P scotti, P. tonsa,* at 600-1300 m depth near to Madagascar, in the Antarctic Intermediate Water. Hopkins' results in the South Pacific off Australia show that the percentage of animals larger than 4 mm (our species are also usually larger) captured by the Isaacs-Kidd-Mid-Water-Trawl is maximum at the 675 m depth, diminishing gradually in depths below 1000 m and at the surface.

Hopkins (1966) considers the relatively low percentage of biomass formed by animals larger than 4 mm in the surface layer as a consequence of the escape-to-capture reaction of these animals during day time. This could be proved by adequate sampling. The diminishing of the



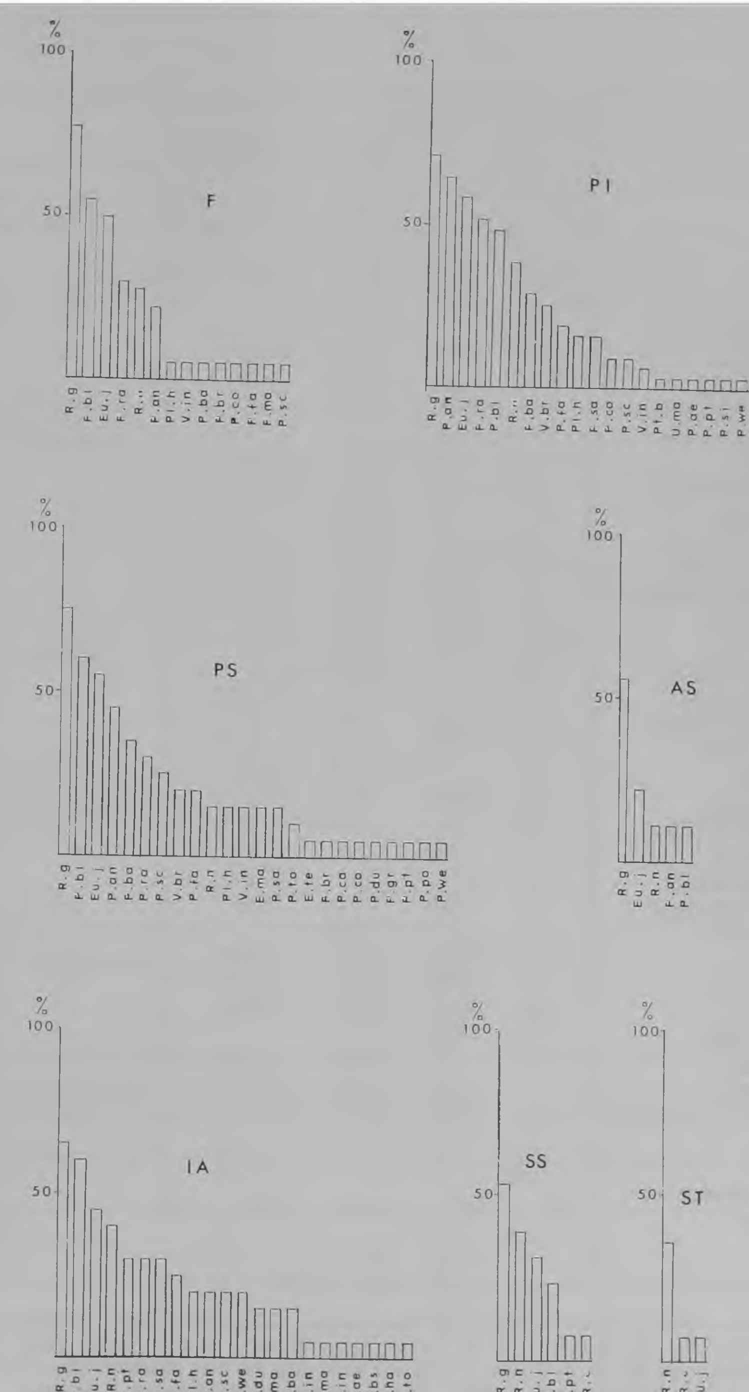
GRAPH 2 — Percentage frequency of species per water mass and month (Roman numbers). For abbreviations see List 2, and Table 3.

GRAPH 2 (cont.)



frequency in depths below 2250 m is possibly caused, by the scarcity of populations. At Spring time when the catch was made the considered species would be more frequent in the Antarctic Intermediate Water.

The small variety and frequency of species in surface waters of the Antarctic regions, most marked in Winter and Spring, may be due to the structure of the surface water in two layers. The surface layer from 0 to 50 m depth suffers great changes in salinity and temperature. The sub-surface layer varies little during the whole year, but, it is colder (Deacon, 1937). The species here considered probably do not survive great environmental variations, or they would have appeared in higher frequencies in the 37 samples of the surface region. The few registered in this layer were found in the subsurface (50 to 275 m). In some cases the maximum frequency was observed in the upper region (Surface Antarctic Water and Subtropical Water) but then the situation was different, the latitude lower and the environmental features were consequently different. The preference for Deep Waters may be caused by the fact that these waters are warmer and richer in food (microzooplankton and dis-



GRAPH 3 — Percentage frequency of species per water mass. For abbreviations see List 2, and Table 3.

Species	WATER MASSES						
	F	PI	PS	IA	AS	SS	ST
R. gigas	77,7	71,0	75,0	65,0	55,5	53,6	-
R. nasutus	27,6	38,8	15,0	40,0	11,1	38,8	35,7
R. cornutus	-	-	-	-	-	7,6	7,1
P. hirsuta	5,5	16,2	15,0	20,0	-	-	-
V. insignis	5,5	6,5	15,0	5,0	-	-	-
V. brevicornis	-	25,8	20,0	-	-	-	-
P. brevicauda	-	3,2	-	-	-	-	-
U. major	-	3,2	-	5,0	-	-	-
U. intermedia	-	-	-	5,0	-	-	-
E. marina	-	-	15,0	-	-	-	-
E. tenuis	-	-	5,0	-	-	-	-
P. antarctica	22,2	64,6	45,0	20,0	11,1	-	-
P. aequatorialis	-	3,2	-	5,0	-	-	-
P. barbata	5,5	29,1	35,0	15,0	-	-	-
P. biloba	55,5	48,5	60,0	60,0	11,1	23,1	-
P. birostrata	5,5	-	5,0	-	-	-	-
P. bisinuata	-	-	-	5,0	-	-	-
P. californica	-	-	5,0	-	-	-	-
P. confusa	5,5	9,7	5,0	-	-	-	-
P. dubia	-	-	5,0	15,0	-	-	-
P. farrani	5,5	19,4	20,0	25,0	-	-	-
P. grandiremis	-	-	5,0	-	-	-	-
P. hanseni	-	-	-	5,0	-	-	-
P. malayensis	5,5	-	-	15,0	-	-	-
P. pseudotonsa	-	3,2	5,0	30,0	-	7,6	-
P. polita	-	-	5,0	-	-	-	-
P. rasa	30,0	51,7	30,0	30,0	-	-	-
P. scotti	-	9,7	25,0	20,0	-	-	-
P. sarsi	5,5	16,2	15,0	30,0	-	-	-
P. similis	-	3,2	-	-	-	-	-
P. tonsa	-	-	10,0	5,0	-	-	-
P. weberi	-	3,2	5,0	20,0	-	-	-
Juvenile Euchaetid	50,0	58,1	55,0	45,0	22,2	30,8	7,1
Total number of species	14	20	24	22	5	6	3

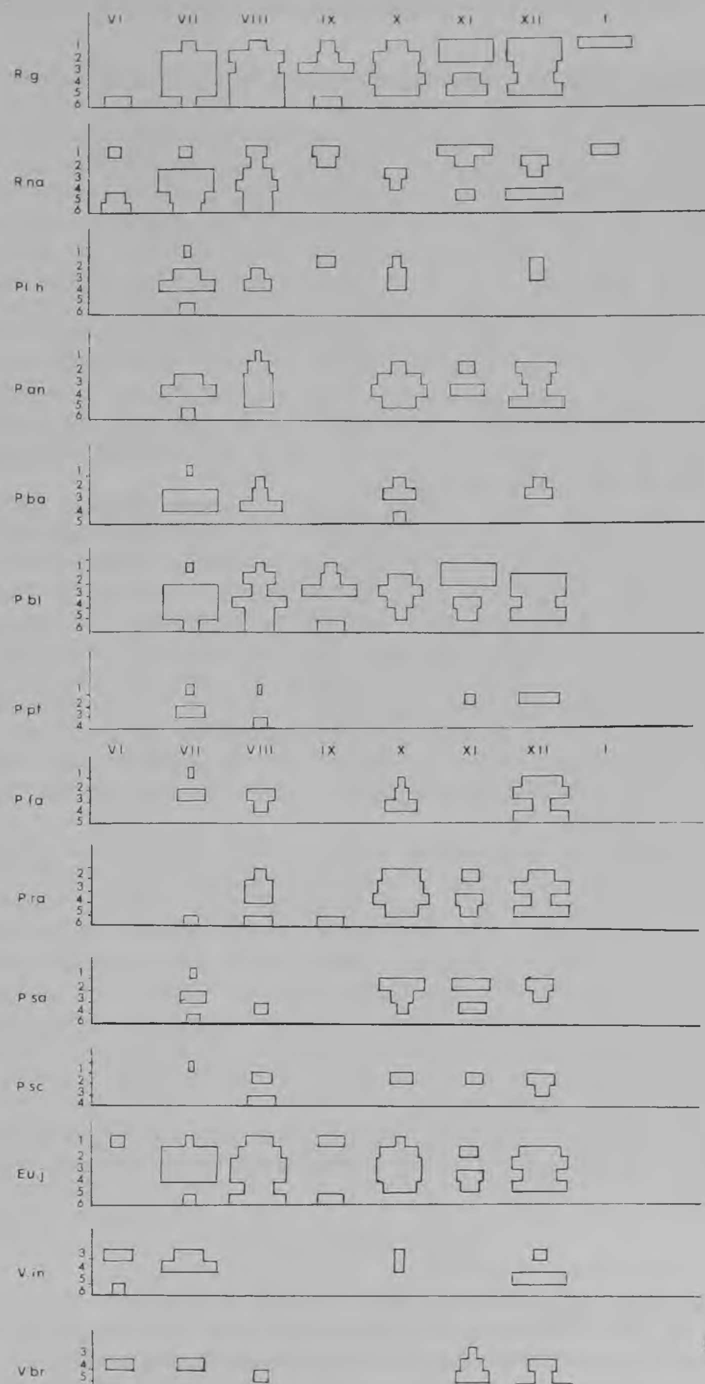
TABLE 3 — Percentage frequency of the species per water mass. Abbreviations: F = Botton Antarctic Water; PI = Lower Deep Water; PS = Upper Deep Water; IA = Intermediate Antarctic Water; AS = Antarctic Surface Water; SS = Surface Subantarctic Water; ST = Subtropical Water.

Species	Month	WATER MASSES						
		F	PI	PS	IA	AS	SS	ST
R. gigas	VI	-	-	33,3	-	-	-	-
	VII	50,0	50,0	100,0	100,0	-	-	-
	VIII	100,0	100,0	100,0	50,0	66,6	100,0	-
	IX	50,0	-	100,0	33,3	-	20,0	-
	X	100,0	90,9	60,0	-	25,0	100,0	-
	XI	100,0	66,6	-	100,0	-	100,0	-
	XII	-	66,6	100,0	80,0	-	100,0	-
	I	-	-	-	-	100,0	-	-
R. nasutus	VI	-	50,0	-	-	-	-	25,0
	VII	50,0	50,0	100,0	50,0	-	-	25,0
	VIII	75,0	33,3	20,0	100,0	-	50,0	50,0
	IX	-	-	-	33,3	-	40,0	-
	X	-	36,6	-	-	-	-	-
	XI	-	33,3	-	33,3	-	100,0	-
	XII	-	33,3	25,0	40,0	-	-	-
	I	-	-	-	-	50,0	-	-
P. hirsuta	VII	-	50,0	-	50,0	-	-	-
	VIII	25,0	66,6	-	-	-	-	-
	IX	-	-	-	33,3	-	-	-
	X	-	27,2	40,0	-	-	-	-
	XII	-	-	25,0	20,0	-	-	-
V. insignis	VI	-	-	33,3	-	-	-	-
	VII	25,0	-	-	25,0	-	-	-
	VIII	-	-	20,0	-	-	-	-
	X	-	9,1	-	-	-	-	-
	XII	33,3	25,0	-	-	-	-	-
V. brevicornis	VI	-	-	33,3	-	-	-	-
	VIII	-	-	20,0	-	-	-	-
	X	-	54,5	-	-	-	-	-
	XII	-	66,6	66,6	-	-	-	-
P. antarctica	VII	-	25,0	100,0	-	-	-	-
	VIII	50,0	100,0	40,0	-	33,3	-	-
	X	40,0	90,9	80,0	-	-	-	-
	XI	-	33,3	-	33,3	-	-	-
	XII	-	66,6	50,0	60,0	-	-	-
P. barbata	VII	-	25,0	100,0	50,0	-	-	-
	VIII	-	50,0	40,0	-	-	-	-
	X	20,0	45,4	40,0	-	-	-	-
	XII	-	-	50,0	20,0	-	-	-

TABLE 4 — Percentage frequency of the species per month (Roman numbers) of sampling in each water mass. (See Table 3 for abbreviations).

Species	Month	WATER MASSES						
		F	PI	PS	IA	AS	SS	ST
P. biloba	VII	75,0	25,0	100,0	50,0	-	-	-
	VIII	75,0	83,3	60,0	50,0	33,3	50,0	-
	IX	50,0	-	100,0	33,3	-	20,0	-
	X	20,0	54,5	60,0	-	-	-	-
	XI	50,0	66,6	-	100,0	-	100,0	-
	XII	-	66,6	100,0	100,0	-	-	-
P. rasa	VIII	50,0	66,6	-	50,0	-	50,0	-
	X	60,0	81,8	60,0	-	-	-	-
	XI	50,0	33,3	-	33,3	-	-	-
	XII	-	66,6	75,0	80,0	-	-	-
P. scotti	VII	-	25,0	-	25,0	-	-	-
	VIII	-	16,6	40,0	-	-	-	-
	X	-	9,0	40,0	-	-	-	-
	XI	-	-	-	33,3	-	-	-
	XII	-	-	25,0	40,0	-	-	-
P. sarsi	VII	25,0	-	-	50,0	-	-	-
	VIII	-	-	20,0	-	-	-	-
	X	-	36,4	20,0	-	-	-	-
	XI	-	33,3	-	66,6	-	-	-
	XII	-	-	25,0	40,0	-	-	-
P. pseudotonsa	VII	-	-	-	50,0	-	-	-
	VIII	-	-	20,0	-	-	50,0	-
	XI	-	-	-	33,3	-	-	-
	XII	-	33,3	-	60,0	-	-	-
P. farrani	VII	-	-	-	50,0	-	-	-
	VIII	25,0	50,0	-	-	-	-	-
	X	-	36,4	20,0	-	-	-	-
	XII	-	66,6	75,0	60,0	-	-	-
Juvenile Euchaetid	VI	-	-	-	-	-	-	25,0
	VII	-	25,0	100,0	50,0	-	50,0	-
	VIII	100,0	83,8	60,0	50,0	33,3	50,0	-
	IX	50,0	-	-	33,3	-	40,0	-
	X	60,0	81,8	60,0	-	25,0	-	-
	XI	50,0	33,3	-	33,3	-	-	-
	XII	-	66,6	100,0	80,0	-	-	-

TABLE 4 — (Cont.)



GRAPH 4 — Percentage frequency of species per depth interval and per month of sampling. For abbreviations see List 1 and Table 3. Roman numerals = months.
Frequency scale (%) |——|——|
50 0 50

solved organic matter) than the Antarctic Waters which are cold and less productive at this time of the year.

Graphs 3 and 4 show that nearly all species occur in more than one water mass in the same place and month, proving that they move vertically.

The vertical movement may be passive and/or active. In the first place convergence and divergence are frequently the cause of the movement (Banse, 1964). The transformation of water into ice is an important factor in the Antarctic zone for it may cause vertical movements of the waters because of the changes in the density of the waters (Pickard, 1968). A typical case in which the topography has influence on these aspects is the Scotia Sea, as has been mentioned before. It is also known that divergences and convergences suffer displacement during different seasons of the year (Gordon, 1967). All these factors may determine the vertical distribution of the species as well as alter it suddenly, isolating some species, which then become endemic.

The active movement is here called migration (Banse, 1964). The migration for many species is seasonal. But for those here considered, which live (nearly all) in average depths of 1000 to 3000 m, the seasonal changes in light, temperature, etc. at the surface can not be felt. Thus, the migration of these species is not due to the change of season but to physiological phenomena, including the endogenous rhythms (Banse, 1964). Reproduction time or the reaching of a certain stage of development may also determine the migration. In this case it is endogenetic. The appearance, f.i, of *P. rasa* and *Pseudeuchirela hirsuta* in Intermediate Antarctic Water, respectively in August and September, and, of *Paraeuchaeta antarctica* in Antarctic Surface Water in August may be due to endogenous factors.

The ontogenetic migrations, those related to the vital cycle of the organisms are generally related to seasonal changes and are as important in the determination of the animal biogeography (Banse, 1964) as they are in the local biomass in several levels and in different times of the year. Thus, Conover (1962, *in* Banse, 1964) noted that *Calanus hyperboreus* remains at the surface till copepodite stages IV and V are reached, after which it migrates to inferior layers. At the reproduction time the adults move to the surface layers where they produce their young. These remain in the surface waters till the copepodite IV or to the adult stage of development. Then they migrate down.

This ontogenetic migratory phenomenon may happen in *R. gigas* and explains the occurrence of young Euchaetidae in the surface layers.

Notes on the species

Rhincalanus gigas Brady, 1883: female = 6.8 to 1 0 mm; male = 6.1 to 7.0 mm. Occurrence: latitudes between 13°S and 67°S and longitudes from 55° to 77°W; depth range 0 to more than 4,000 m. A markedly frequent species in all the water masses cited in this work, with exception of the Subtropical Water where *R. nasutus* seems to be more common. *R. gigas* can also be considered the most abundant of the species studied here. It is among the most cited Calanoida for Antarctic waters and Mackintosh (1937) was the one who studied it best of all, giving interesting information on its biology and distribution. It lives (op. cit.) during Summer (September to December) in the surface layers between 100 and 250 m and in Winter it is abundant at 500 m depth. Similar data are cited by Vervoort (1957 and 1965) and Voronina (1970). Schmaus and Lehnhofer (1927) indicated the presence of *R. gigas* on the Atlantic side of the American continent in depths from the surface to 2500 m and only to the South of latitude 42°S. The different opinion of the authors as to the distribution in depth of the species can be explained because the first analysed samples were collected to the depth of 1,500 m and the other mentioned samples were caught at great depths, such as 4,000 m.

Some of the samples here analysed are from depths below 5,000 m. *R. gigas,* according to "Eltanin" data, occurs in layers from 2,500 to 3,000 m and it is more frequent in Bottom and Deep Waters, thus, more according to Schmaus and Lehnhofer's data.

Comparing Mackintosh's (1937) results from September, October, November, December and March and interpolating my data from July, August and September, I conclude that *R. gigas* migrates seasonally, but in Winter the species is predominantly in Deep Waters, not in the Antarctic Intermediate as mentioned by Mackintosh. In Summer it moves into upper layers. From March on, the species would begin its migration into warmer waters, to the North, through the Antarctic Intermediate Water, and then to the Deep Waters. In these Waters it would give origin to the "Winter generation", the copepodites of which would migrate to the surface, mostly in low latitudes (in the August samples more than half are young specimens). In September, the "Winter generation", finishes its development in Deep Waters and comes to higher latitudes through the Upper Deep Water, so as to reach the surface layers in November, near to latitude 50°S. The frequency of *R. gigas* is larger in October in the Subantarctic Surface Water, at latitude 50°S, at the time of one of the phytoplankton peaks. The species remains in these waters during November and December, when productivity reaches its maximum. It occurs with high frequency in January in Surface Antarctic Water (near to 55° to 65°S), coinciding with the maximum primary productivity in this latitude. It then procriates forming the "Summer generation" (the surface Antarctic samples in December contain many young specimens). The presence of a few copepodites in samples taken in all different months may indicate that there is reproduction during all year round. For *R. gigas* there are probably two times of the year in which there are clearly peaks of maximum reproduction rates, one in Winter and one in Summer, as Bogorov found for *C. plumchrus* (1957).

Thus, the biology of *R. gigas* as explained by Mackintosh is a little different or incomplete, but justified in view of the fact that he did not have samples from very deep layers collected at other months of the year. His observations on the distribution of the species down to 1500 m depth, correspond to mine, taken at the same depth and time of the year. More recent studies of Voronina (1970) about *R. gigas* are here confirmed.

Rhincalanus nasutus Giesbrecht, 1888: female = 4.8 to 7.0 mm; male = 3.4 to 6.0 mm. Occurrence: Latitudes between 2°N to 67°S and longitudes from 55°W to 80°W; depths from 0 to more than 4000 m. It is frequent in the surface water from June to December. In the cold epoch, it appears in surface waters to the North of the Subtropical Convergence. In Antarctic Surface Water it is present only in January, in Summer and when phytoplankton production has increased considerably. On the contrary of its sister species, which is abundant in cold waters, this one is numerous and frequent in lower latitudes. It also occurs in high latitudes, reaching the Circumpolar Current through which it is taken into the other oceans.

Paraeuchaeta antarctica Giesbrecht 1902: female = 6.5 to 10.0 mm; male = 6.12 to 7.0 mm. Occurrence: from latitude 55°S to 67°S and from longitude 56°W to 75°W; in depths from 270 to more than 4000 m. The Antarctic Convergence zone seemed to be its northern limit, but now it is known that the species reaches lower latitudes. In Winter it remains with more frequency in the Deep Waters, and it may migrate to the surface layers at night (sample 134). But, as in August the absence of light is complete, both by day and at night, the migration must be caused by upwelling of the water or by endogenous factors. In December it appears in the Scotia Sea, brought by the Upper Deep Water. The alternate occurrence of the species in Lower Deep and Upper Deep Waters from July to December indicates that the species moves slowly towards the South. In November and December it occurs in the Intermediate Antarctic Water, to where it migrates in Summer, probably because of the abundance of herbivores in this layer. The species migrates constantly up to 100-250 m at night (Hardy and Gunther, 1935), and down to deeper layers by day. The species may reach the Antarctic Convergence travelling in surface waters, from where it would descend to Intermediate Antarctic Water, which would take it away from the Scotia Sea. Up to now it has only been found in the South Hemisphere.

Paraeuchaeta barbata Brady 1883: female = 9.0 to 10.4 mm; male = 8.3 mm. Occurrence: from latitude 40° to 60°S and from longitude 56° to 76°W; depth 0 to 4000 m. It occurs mostly in Deep Waters from July to October included, migrating to Intermediate Antarctic Water in December. Besides this in October it appears near to the Antarctic continent, South of the Drake Passage. The data show that from July to October, the species gradually moves from the Chilean coast to the Divergence zone arriving in the Scotia Sea in December. From here it probably moves to the East by the Circumpolar Current, and it may spread to other seas to the North, chiefly by means of the Antarctic Intermediate Water.

Paraeuchaeta biloba Farran, 1929: female = 5.5 to 5.8 mm; male = 4.0 to 4.8 mm. Occurrence: latitude 40° to 67°S and longitude 55° to 77°W; depth 0 to more than 4000 m. It is homogeneously distributed and with high frequency in nearly all the water masses, apparently migrating constantly, passing from one water mass to another in one month. Probably the especies occurs in July in the Subantarctic region, and it may be brought to the surface by the local divergence of waters.

It reaches the Subtropical Convergence, and there submerges to the deep layers through which it moves to the South. At 55°S and 55°W more or less, in December, it would migrate again to the Intermediate Antarctic Water, which would take it to other regions. Mazza (1966) thinks it possible that these specimens acquired the phytophagous habit because the frequency of the males is high and they appear in surface waters when the phytoplankton bloom is maximum in the latitudes from 50 to 55°S. There are few carnivorous Euchaetids which appear in surface waters with such high frequency at his time of the year.

Paraeuchaeta farrani With, 1915: female = 9 1 to 10.9 mm. Ocurrence: latitude 46° to 65°S and longitude 55° to 77°W; depth from 600 to 4000 m. In July it was found in the Antarctic Intermediate Water in low latitudes (46°S). From there it must descend to Deep Waters and reach the South, the Scotia Sea, where it appers in the Intermediate Water.

In the Atlantic this Water may take it to the Northern Hemisphere. It may also be carried by the Circumpolar Current to the Indian Ocean and adjacent seas.

Paraeuchaeta pseudotonsa Fontaine, 1967: female 6.2 to 6.75 mm. Occurrence: latitude 40° to 58°S and longitude 55° to 76°W; depth 366 to 3025 m. It is a species predominantly found in intermediate waters, with its southern limit near to the Antarctic Convergence. In July, it has reached the Subtropical Convergence Zone, off the Chilean coast, taken by the Intermediate Antarctic Water. In August it is in the Subantarctic zone, in the sub-surface layer, through which it arrives at the Antarctic Convergence, where it submerges to the Deep Upper Water, and, through this it reaches the Scotia Sea, in December. Here the species is found again in the Intermediate Antarctic Water through which it can spread to the Atlantic Ocean.

Paraeuchaeta rasa Farran, 1929: female = 5 1 to 6.5 mm; male = 5.2 to 5.8 mm. Occurrence: from latitude 35° to 67° and from longitude 55° to 76°W; between depths of 450 m and more than 4000 m. The species occurs predominantly in Lower Deep Water. It migrates to the Subantarctic Surface Water and from this again to the Deep Waters where it stays for a longer time, from Winter to Spring included. Through the Upper Deep Water it moves to the South, till the Scotia Sea, where it is found again in the Intermediate Antarctic Water in December. From there it can be taken to the Atlantic or to the Indian Ocean or travel around the Antarctic continent, remaining in the South. It has not yet been found in the Northern Hemisphere and, from the evidence, its northern limit of distribution is at the Subtropical Convergence probably.

Paraeuchaeta sarsi Farran, 1900: female = 7.5 to 11.3 mm; male = 7.8 to 8.0 mm. Occurrence: from latitude 40° to 66°S and from longitude 56° to 77°W; between depths of 0 to more than 4,000 m. It does not usually occur in surface waters. In July it lives in the Intermediate Antarctic Water, from where it may have migrated in August to the Deep Waters. In these it remains till November moving South in the Upper

Deep Water. When in the Scotia Sea, it is found again in the Antarctic Intermediate Water and through this it reaches the other mentioned environments. It is a species with wide distribution and probably not endemic.

Paraeuchaeta scotti (Farran, 1908): female = 5.8 to 6 1 mm; male = 4.8 mm. Occurrence: from latitude 50° to 67°S and from longitude 55° to 77°W; in depths from 0 to more than 4000 m. It does not usually occur in the Antarctic Bottom Water nor in the Surface Water. In July it was collected in the Intermediate Antarctic Water and afterwards it must have sunken to the Deep Waters to move South in the Upper Deep Water to the Scotia Sea where it is found in December, in the Intermediate Antarctic Water or in the Circumpolar Current which carry it to other oceans.

Juvenile Euchaetidae: Occurrence: latitudes 2°N to 67°S and longitudes 55° to 81°W; depth from 6 to more than 4000 m. The high frequency of juvenile Euchaetidae, here considered copepodites V, in Deep Waters would be far more significant if it were possible to identify them to species. These data would help to explain the migratory cycles of at least some species. Distribution graphs were made of adults and young per month of collecting and per water mass (Graph IV). From the examination of these the following conclusions were arrived at: the laying of eggs is in the South, the offspring would grow quickly in Summer when the maximum quantity of food is available.

In Autumn the specimens now in a more advanced stage, seem to migrate with the Antarctic Intermediate Water to warmer regions or to the Deep Waters to complete their development. There they seem to stay till they become adult and then they return to the colder regions for reproduction. Thus, juveniles very much like the adult *Paraeuchaeta rasa* were found in an August sample (n.° 132) from Lower Deep Water, and, exhuviae, possibly of the last copepodite stage of *Paraeuchaeta antarctica,* in October (n.° 276). If we sum both data, the conclusion is that the development of the juveniles to the adult stage is very slow at this time of the year. As it is Winter and beginning of Spring, it is quite possible that the rate of growth is retarded to economize energy, for food is probably scarce. Conover (1962, *in* Banse, 1964) proved that the copepods really diminish their metabolism in Winter. There must be an individual variation, but, all would reach sexual maturity in December, when they would have reached the South. Egg-laying time would coincide with the beginning of the maximum production of phytoplankton.

Valdiviella insignis Farran, 1909: female = 8.0 to 10.8 mm. Occurrence: from latitude 40° to 66°S; from longitude 55° to 76°W; in depths from 1000 to 3000 m. In July and August it is present in Intermediate Antarctic Water, in low latitudes, probably taken by the Peru Current which branches off from the Circumpolar Current and moves up the Chilean coast.

From there it moves down to the Upper Deep Water and thus, towards the Scotia Sea where it arrives in December. From this Sea it may be taken to all other oceans by the Circumpolar Current.

Valdiviella brevicornis Sars 1905, female 6.2 to 7.0 mm. Occurrence: latitude 40° to 67°S, longitude 55° to 77°W; 1000 to 4000 m depth. It occurred only in Deep Waters, thus an exception among the other species. In June it is found in lower latitudes and in December near to the Antarctic Continent. The Circumpolar Current takes it into the other Oceans. Its absence off the West Coast of Africa may be caused by the fact that it does not occur in the Antarctic Intermediate Water.

Pseudeuchirella hirsuta (Wolfenden, 1905), female 8.7 to 9.1 mm. Occurrence: latitude 40° to 66°S; longitude 56° to 77°W; 800 to 4000 m depth. In July it is in the Antarctic Intermediate Water and Lower Deep Water. In October it is moving South and in December it is in the Antarctic Intermediate Water. It does not apparently reach latitudes lower than the Subtropical Convergence, but it is found in the other oceans leaving the Scotia Sea via Antarctic Intermediate Water.

The other species have the following distribution, when the data of this work are considered together with those of Vervoort (1963), Decker and Mombeck (1965), Grice & Hülsemann (1967) and Tanaka and Omori (1968) and Tanaka (1958):

Euchaeta marina (female 3.2 to 4.0 mm; male 2.5 to 3.4 mm) in circumtropical, intermediate and surface waters; *P. weberi* (female 6.8 to 7.6 mm) is more frequent in waters near to the subtropical region, because of its higher frequency in samples from medium latitudes; *P. malayensis* (female 6.5 to 7.2 mm) has a wide distribution, occurring in the four ocans mostly in the 1000 m layer. From the data of this work it lives in the Bottom Antarctic Water in Winter and in the Intermediate Antarctic Water in Summer. *P. dubia* (female 8.8 to 10.0 mm; male 7.8 to 8.1 mm) is more frequent between the Deep Waters and the Intermediate Antarctic. From the Pacific where it was found it reaches the Southern Ocean by the Upper Deep Water and from there through the Antarctic Intermediate Water it is taken to the coast of Guinea and to the Indian Ocean.

Wolfenden (1908) and Vervoort (1957) found *P. similis* (female 10.5 mm) in abundance, but in the samples examined here it was rare. The adults may be frequent in longitudes opposed to those analysed here.

CONCLUSIONS

The *Euchaeta* were present in samples collected North to latitude 23°S and the *Paraeuchaeta* were frequent South to 30°S. The first seem to be frequent in waters of Equatorial or tropical origin and the others in those of Antarctic origin.

New occurrences for the Antarctic and Subantarctic region, taking Vervoort (1965) into consideration, are: *Paraeuchaeta aequatorialis* (females 6.0 to 6.7 mm), *P. barbata, P. birostrata* (female 7.25 mm), *P. bisinuata* (female 5.3 mm); *P. confusa* (female 7.0 to 7.5 mm); *P. dubia; P. hanseni* (female 9.8 mm; male 8.5 mm); *P. malayensis; P. pseudotonsa; P. sarsi; P. tonsa* (female 6.5 to 8.3 mm); *Valdiviella brevicornis* and *Undeuchaeta intermedia.*

When different times of the year are considered in the oceans many of the studied species, when adult, show a higher frequency in the layer between 600 and 3,000 m depth, that is between the Deep Lower and the Intermediate Antarctic Waters, and a smaller frequency at the surface layer. The results obtained in this paper for Winter, Spring and the beginning of Summer, those of Grice & Hülsemann (1967) for Winter, those of Vervoort (1963) for Summer, and those of Hopkins (1966) for Spring, lead to the conclusion that the majority of the species studied live during Winter in the deepest layer of the mentioned depth interval, and, at the end of Spring, they come to the upper layers of the same depth interval, which correspond to the Intermediate Antarctic Water.

Observing the sampling dates in this work and their respective localization, it becomes evident that all the species studied are caught from June to December, in latitudes gradually higher, that is, more to the South. Besides this, Graphs II and IV show that from July to October the studied species nearly always occur in Waters below the Antarctic Intermediate. These species should be carried to the South by the Upper Deep Water, because this is the only deep water which moves South. The high frequency of the species in the Bottom Antarctic Water and in the Lower Deep Water would indicate movement in the opposite direction becouse both are directed to the North. Though slow because of these currents flowing in opposite direction the movement of the species is in the direction of the Upper Deep Water pushed by currents which flow more rapidly than the other waters.

When Vervoort's (1963), Tanaka and Omori's (1967) and the present data are put together, the conclusion is that the horizontal distribution of many species here studied is seasonal. In general, from Winter to Spring they live in deep waters, far from the cold regions. In Summer they probably reach the Antarctic continent and the Scotia Sea through the Upper Deep Water. In this circumpolar region they remain mostly living in the intermediate layers, making use of the richness of food. The Intermediate Antarctic Water where they are found in December would gradually take them away from the Antarctic continent, so that in Winter they are again far from the cold region. The strong Circumpolar Current may push the species to the East and, by means of tongues, to the North to other Oceans, or back to the Chilean coast, on the West side of the continent. Bogorov (1957) noted that the boreal species also move away from glacial regions in Winter.

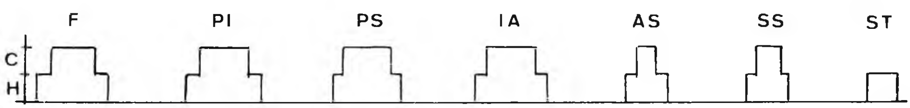
Among the deep water species the endemisms are rare, because these waters spread horizontally into all the oceans of the world (Tanaka and Omori, 1967). There is therefore a similarity in the deep water fauna of the Pacific, Atlantic and Indian Oceans (Grice and Hülsemann, 1967; Decker and Mombeck, 1965).

Several factors may determine the occurrence and the distribution of the species: the physical, the geographical, the trophical and the intrinsic factors. Foxton (1964, *in* Knox, 1970) gives greater importance to the physical factors of the environment in determining the concentration of the primary production and consequently of the zooplankton. El Sayed and Mandelli (1965, *in* Knox, 1970) and El Sayed (1968, *in* Knox, 1970) think it more probable that the concentrations of nutrients, the temperature, the light, and the balance of the surface waters are of greater influence.

In all the cases here analysed, the movement of the species is related to the seasonal changes. Dunbar (1970) is right when he says that the adaptation of ecossystems in the polar marine environments is significantly influenced by the seasonal changes in the habitat. Though each of the factors should be considered separatedly, the occurrence of one species in one place certainly varies in accordance with its adaptability and resistance to the total environmental conditions. If the species tolerates them and adapts to them it may live in that environment.

The abundance or high frequency of herbirores in surface layers may be a good bait to the carnivores which live till then in deep waters, in which probably food already begins to diminish when in high latitudes. This, perhaps explains the enlarged frequency of carnivores in the Antarctic Intermediate Water in December. This water is formed in the Antarctic Convergence zone, from Surface Antarctic Water which submerges and mixes a little with the Subantarctic Surface Water (Deacon, 1957; Pickard, 1968) bringing to this subsurface layer a great abundance of herbivores from the surface layers.

Adding the frequency of herbivores and that of the carnivores and averaging the sums per water mass, graph 5 is obtained.



GRAPH 5 — Frequency of carnivores and herbivores in different ãater masses. Abbreviations: C = carnivores; H = herbivores; F = Bottom Water; IA = Intermediate Antarctic Water; AS = Antarctic Surface Water; SS = Subantarctic Surface Water; ST = Subtropical Water. % Scale: |———|———| 50 0 50

According to Conover (1964 *in* Dunbar, 1970) the animals depending on phytoplankton for survival seem to find a secondary food source in the microzooplankton and in the organic matter dissolved in water, during the seasons of low productivity. *R. gigas,* filter feeder, seems to look for this kind of food at the bottom. In Winter and in Spring, the carnivores show a larger frequency in the Deep Waters, with expection of some species. This is because the herbivores also live there.

Thus, partially the trophic factor causes the distributions of these animals, which, directly conditioned to their necessities behave in such a way so as to limit their vital space seasonally.

In all the analysed samples with very rare exceptions the male carnivores are scarce, absent or not recognizable. Mazza (1966) explains this. Mazza (1966) verified that in the males the mouth appendages suffer involution at the last male copepodite stage by causes unknown, indicating a possible change in the feeding regime, that is, they change from carnivores to herbivores. Till then the number of males, which was the same as that of females, diminishes considerably. Mazza concluded, from these observations, that the smaller number of males in the adult stage is caused partially by the difficulty which they would have to find adequate and sufficient food in the depths. The species which live in the intermediate or subsurface layers would present a greater number of males than the essentially bathypelagic species, because in these layers the quantity of phytoplankton is so great that the males would be able to eat even with few buccal appendages.

One of the consequences of this phenomenon is the variation of the "sex-ratio" in the different layers which may induce the specimens to migrate so as to favour the meeting of the sexes.

SUMMARY

1) The circulation of the water masses in the Southern Ocean, South Ocean, South of South America and in the Scotia Sea, as well as the topographic characteristics of this region were reviewed so as to permit a clearer idea of the distribution of species in the area.

2) A greater number of species (28) here studied were found in the Deep Waters. This may be explained because of the relatively more favourable conditions of this environment, especially during Winter and beginning of Spring (higher temperature), than in the Antarctic waters, and more food because of its Equatorial origin. There is more food at this time of the year in the tropics than in the Antarctic. The surface Waters contain a smaller variety and usually a smaller frequency of the species here studied during Witer and beginning of Spring. The severe environmental conditions at the surface are probably responsible for this. The few species identified were found in the layer situated immediately below the surface where the variations are less marked during the year. The maximum frequency in surface waters was noted in the Subantarctic Surface and in the Subtropical Waters where, because of the lower latitudes in which they occur, the temperature is higher.

3) In the period of time considered the majority of the studied species gradually moved South. On comparing the distribution in different oceans of some of the species studied here, nearly all occurred always in depths below 500 m, with rare exceptions and, some from deep waters spread into all the oceans of the World.

4) Several factors may influence the distribution of species favourably or not, determining it or altering it to the point of isolating some species, and causing phenomena of endemism. These factors may be physical, geographical, trophic, and endogenous. Recent data seem to demonstrate that the seasonal changes are those with greater influence on this distribution.

5) The frequencies of herbivores and carnivores in the different water masses take the aspect of a food-chain pyramid in which the frequency of the herbivores is always larger than that of carnivores, confirming Hardy and Gunther (1935). In low primary productivity

periods at the surface, the herbivore species would move to the bottom to find nutrition in the form of microzooplankton and organic material (Conover *in* Dunbar 1970).

6) Considering Mazza's (1966) experiments, the vertical migrations would ensure the encounter of the sexes for the males of Aetideidae and Euchaetidae living predominantly in surface and intermediate waters.

7) The frequent species were: *Rhincalanus gigas, R. nasutus, Pseudeuchirella hirsuta, Pareuchaeta antarctica, P barbata, P biloba, P. farrani, P. pseudotonsa, P. sarsi, P scotti, P rasa, Valdiviella insignis* e *V brevicornis.*

8) New occurrences in the Antarctic and Subantarctic regions, based on Vervoort (1965) were: *Paraeuchaeta aequatorialis, P. barbata, P. birostrata, P. bisinuata, P. confusa, P. dubia, P. hanseni, P malayensis, P pseudotonsa, P. sarsi, P. tonsa, Valdiviella brevicornis* e *Undeuchaeta intermedia.*

9) The *Euchaeta* seem to be more frequent in Equatorial or Tropical waters and the *Paraeuchaeta* in those of Antarctic origin.

10) *Rhincalanus gigas* was the most frequent and abundant species. Its biology had been described anteriorly by various authors, but here it was concluded that the species moves to Deep Waters, thus deeper than to the Intermediate Antarctic Water. Its migratory anual cycle was confirmed again.

11) Considering the obtained data on the most frequent species, a possible migratory cycle was proposed for the species here studied.

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