Ser. Cient. INACH 35: 71-80, 1986

Composition and Relative Abundance of Antarctic zooplankton in the Bransfield Strait (SIBEX-Phase II, Chile)

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ABSTRACT

Results of composition and relative abundance of zooplankton from the Bransfield Strait during the austral summer 1985 are given.

In comparison with the previous season, an important zooplanktonic heterogeneity was found in Nelson Strait area and at the entrance of the Gerlache Strait, being copepods, euphausiids and chaetognaths the main groups. In the first area, copepods and euphausiids larvae were predominant, as long as in the second one, copepods and appendicularia were the most abundant groups.

RESUMEN

Se entregan resultados de composición y abundancia relativa del zooplancton del estrecho Bransfield durante el verano austral de 1985.

Al comparar los resultados con los de la temporada anterior se encontró mayor heterogeneidad zooplanctónica, predominando copépodos, eufáusidos y quetognatos, con máximas concentraciones en la zona del paso de Nelson y entrada del estrecho de Gerlache. En la primera de éstas predominaron copépodos y larvas de eufáusidos, mientras que en la otra copépodos y apendicularias fueron los grupos más abundantes.

INTRODUCTION

In consideration to the general objectives of the BIOMASS program and the recommendations established for the implementation and coordination of this program and the FIBEX and SIBEX projects, the Instituto Antártico Chileno, through a group of plankton experts from the Instituto de Fomento Pesquero, have developed a series of studies directed to attaining knowledge of the structure, distribution and dynamics of the principal zooplankton populations in the Bransfield Strait and adjacent zones, in order to enhance some more knowledge of the pelagic Antarctic ecosystem.

The recent results have revealed great between-year variations in the composition and abundance of the plankton populations, and have clearly established the dynamic nature of the ecosystem. The variables and interactions which regulate the Antarctic pelagic ecosystem remain unknown yet.

Within this context, and taking into consideration the importance of zooplankton in food web dynamics and its inclusion of the early developmental stages of economically important pelagic fish resources, the knowledge of zooplankton dynamics is exceedingly important for the eventual development of appropriate harvesting activities, conservation and resource management.

In this work we hope to contribute to the knowledge of the Antarctic zooplankton assemblage and its dynamics by providing information on the abundance and distribution of zooplankton taxonomic groups collected in the Bransfield Strait area during INACH SIBEX-Phase II, January-February 1985.

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MATERIALS AND METHODS

Fifty-four zooplankton samples were collected at 26 oceanographic stations in the Bransfield Strait and adjacent areas (Fig. 1), during the SIBEX-Phase II, cruise aboard the R/V Capitán Luis Alcázar, 24th January-12th February, 1985. Zooplankton samples were collected using bongo nets of 333 μm mesh, towed obliquely between 0-200m. Samples were preserved in a 5% formalin-sea water solution buffered with sodium tetraborate. Only one of the paired bongo samples was used for zooplankton analysis; the second was maintained as a reference in cases of great differences in water filtration volumes between the two nets.

For taxonomic analyses, euphausiids and larval fishes were removed from entire samples and all other components were analyzed from small samples; aliquots were made of the other components from larger samples using a Folsom plankton splitter. The abundance of each zooplankton taxonomic group was expressed as numbers per 1.000 m^3 water filtered.

Community parameters of constancy and numerical dominance were used to provide a quantitative evaluation of zooplankton faunal composition. Constancy was based on the percentage relation between the number of samples in which each group was encountered and the total number of samples taken, and was categorized according to the scale proposed by Boodenheimer (1955):

0.0 to 25.0%	"accidental"
25.1 to 50.0%	"accessory"
50.1 to 100.0%	"constant"

Numerical dominance was expressed as the percentage relation between the numbers of individuals of each taxonomic group and the total number of zooplankton individuals collected, and was categorized according to the Boodenheimer (1955) dominance scale:

0.0 to 2.5%	"accidental"
2.6 to 5.0%	"accessory"
5.1 to 100.0%	"dominant"

In order to decrease the magnitude of abundance, differences in graphical representations of zooplankton distribution, the mathematical expression $L = \sqrt[3]{N}$ was used, where L is the bar length and N is the number of specimens per 1.000 m^3 water filtered. This expression permits the use of the same scale for all zooplankton groups and facilitates between-figure comparisons.

RESULTS AND DISCUSSION

Zooplankton abundance demonstrated large between-tow variability, with values ranging between 525 and 202,587 individuals / 1,000 m^3. The mean value was 36,297, individuals / 1,000 m^3. These values were considerably larger than those reported by Mujica and Asencio (1985) for zooplankton in the same area during January-February, 1984. It is important to point out that these authors reported extreme dominance by *Salpa thompsoni*. Foxton 1961, which greatly influenced the numerical abundance of the zooplankton during 1984.

The largest zooplankton concentrations, with more than 100,000 individuals / 1,000 m^3, occurred at stations 4-4 and 6-0 in front of Nelson Strait and entrance of Gerlache Strait, respectively (Table 1). The first of these stations coincided with the area where highest sea surface temperatures were encountered (Kelly and Blanco, 1986); the second station was in a zone already known for high zooplankton productivity (Mujica and Torres, 1982; Mujica and Asencio, 1985). In general, largest zooplankton concentrations ocurred in the central part of the Bransfield Strait, connecting in a nort-south direction the previously mentioned stations, while the extreme south-east portion of the study area close to the Antarctic Peninsula had the lowest zooplankton densities (Fig. 2).

Copepods numerically dominated the zooplankton, and represented 54.0% of the individuals caught. Although this proportion was lower than that reported by Mujica and Asencio (1985), the number of individuals represented in terms of maximum and mean values, is much higher than the reported in 1985 values. Copepod abundances ranged between 32 and 52,833 individuals / 1,000 m^3, to difference reported in this paper (Table 1) which points out a maximum of 164,028 individuals / 1,000 m^3 in 1985. The numerical dominance by copepods has been reported by other authors for the Southern Ocean (Zmijewska, 1983; Goswami, 1983) and for the study area (Jazdzewski *et al.*, 1982), and it is directly related to the great number of species which form the group (Vervoort, 1965). The distribution of this principal taxonomic group coincided with that of the zooplankton in general.

Apendicularians comprised the second most abundant taxon and had a dominance factor of 35.8 (Table 2). The unusual abundance of this group ranged from 632 to 164,718 individuals / 1,000 m^3, but its distribution was limited to only five stations resulting in an "accidental" constancy rating (18.5%) (Table 2). This taxon was most abundant (95.4%) at the first three stations in the south-west part of the study area (six transect), near Trinidad Island (Table 1, Fig. 1). This area of maximum apendicularian abundance also had large surface layer concentration of phytoplankton cells. Similarly, Uribe (1982, 1985) found maximum concentrations of chlorophyll "a" in this area in previous years. This area was also distinguished by minimum surface water densities (sigma-t) (Kelly and Blanco 1986). Jazdzewski *et al* (1982) also found large concentrations of apendicularians in areas adjacent to this during February-March 1981, while Mujica and Torres (1982) and Mujica and Asencio (1985) encountered few numbers of individuals here.

Euphausiids comprised another dominant taxon and represented 7,9% of the zooplankton individuals (Table 2). This group, together with copepods and chaetognaths, occurred at all stations, and had densities ranging between 5 and 63,252 individuals / 1,000 m^3. Euphausiid distribution was generally similar to that of the total zooplankton, with high relative abundance in the central western portion of the Bransfield Strait. As with copepods maximum concentrations occurred at station 4-4, in front of Nelson Strait (Fig. 3). The number of euphausiids caught at this station far exceeded the maximum 1984 catches of 2,366 / 1,000 m^3 reported by Mujica and Asencio (1985) and Mujica (in press). It is possible that the large concentrations of *Salpa thompsoni* in 1984 in some way diminished the abundance of other phytophagous organisms.

The maximum abundance of euphausiids encountered in 1985 was substantially smaller than the maximum concentrations of *Euphausia superba* during austral summer 1981 (about 200,000 / 1,000 m^3) reported by Kittel and Jazdzewski (1982) and Mujica and Asencio (1983). However, the large concentrations reported by Kittel and Jazdzewski (1982) were located to the north of King George Island.

The other taxonomic groups collected were all categorized as "accidental" in numerical dominance. Among these, chaetognaths were collected in all samples (100% constancy), but they had a dominance of 0.76% (Table 2). This group had a relatively homogeneous distribution in the study area, and its abundance ranged between 3 and 2,219 individuals / 1,000 m^3, maximum concentrations ocurred 5-4, near Deception Island. During FIBEX sampling in this area (1981), Jazdzewski *et al.* (1982) and Mujica and Torres (1982) also found chaetognaths at most or all of the stations sampled, however their abundance was low compared to that found in 1985.

Most of the other zooplankton taxa were infrequently caught ("accidental" in constancy). Notable among these were salps, apendicularia, medusae and larval decapods. During the preceding summer, salps (represented by one species, *Salpa thompsoni)* constituted more than 90% of the zooplankton individuals caught in the central portion of Bransfield Strait, and it was classified as both constant and dominant (Mujica and Asencio 1985), it was also reported as being the most abundant macrozooplankton taxon in the South Shetland Islands area during this time (Piatkowski, 1985). During 1985, salps were collected only at two stations, 1-2 and 4-4, in concentrations of 514 and 36 individuals / 1,000 m^3, respectively.

Medusae and larval decapod crustaceans were present at four stations, three of which were in common. These taxa were of minor relative abundance, and were "accidental" in numerical dominance as well as constancy (Tables 1 and 2). Larval decapods were represented by the advanced zoea stage of one caridean species previously reported from this area by Mujica and Torres (1982) and Mujica and Asencio (1985) reported that this larva has characteristics similar to the adult form of *Notocrangon antarcticus.*

Larval cirripeds and echinoderms were the only taxa to exhibit "accessory" constancy in samples, with values of 33.3% and 44.4% respectively, and accidental dominance. Larval cirripeds did not exhibit a uniform distributional pattern, and larval echinoderms were collected only at stations in the central Bransfield Strait.

The ichthyoplankton (composed only of larvae) was "constant", ocurring at 63.0% of the stations, however, due to its low abundance, the taxon was classified only as "accidental" in numerical dominance (Table 2). Larval fish abundance in samples ranged between 2 to 30 / 1,000 m^3. These concentrations are lower than those encountered in the same area during 1984 (Mujica and Asencio, 1985). Ichthyoplankton distribution was limited to the western area and both coasts of the Bransfield Strait, with greatest concentrations ocurring at stations 6-1 and 5-4, near Deception and Trinidad Islands, respectively (Fig. 4). The relatively high larval abundance at the Deception Island stations was located in area of high primary productivity (Uribe, 1986). *Notothenia* (represented by four species) was the most common genus represented; *Notothenia larseni* and *N. kempi* were the most abundant species and greatly influenced the general distribution of the ichthyoplankton group (Asencio and Mujica, 1986).

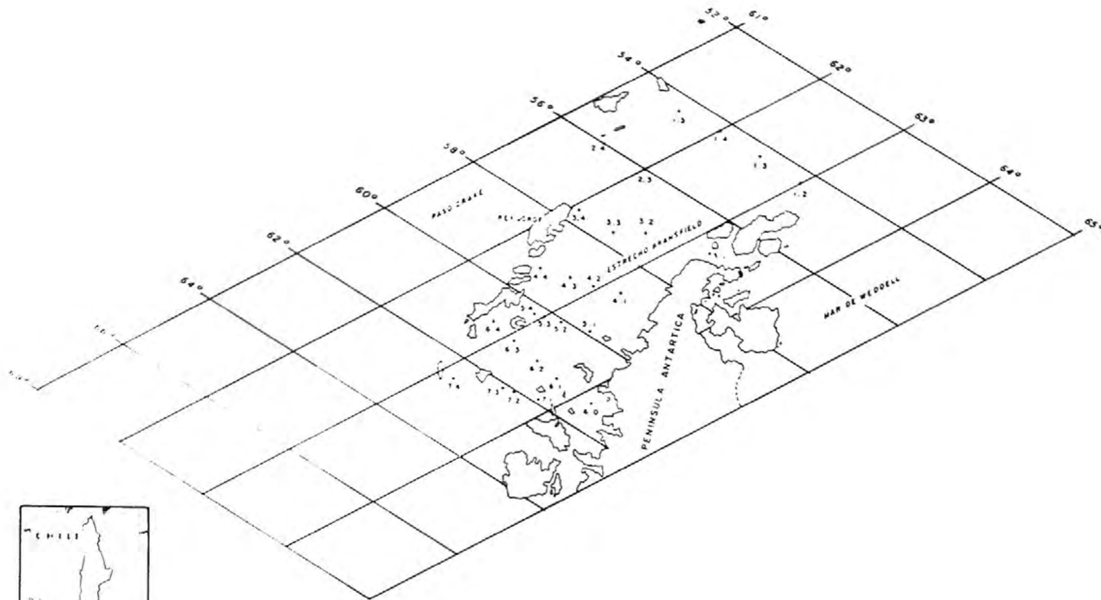
In general, the fact that most of the taxa were present at low and homogeneous concentrations in a high percentage of the sampled stations, indicates that a fraction of the zooplanktonic community, shows a uniform pattern higher than that found in previous years. Most abundant zooplanktonic groups are excluded because of their high species diversity or relative abundances. The results, related to those from previous years (Mujica and Asencio, 1985), also indicated the great interannual variability of the zooplankton community structure in the study area.

CONCLUSIONS

The results of this study compared with those from previous years demonstrate the temporal and spatial variability of different populations in the Antarctic zooplankton. This supports the necessity of long-term studies of this type, where populations are treated in an independent manner with the aim of identifying the taxonomic components, developmental states or species aggregations which form assumed populations. This is necessary for correlations of ecological parameters, with environmental and biological factors, to approach in the most consistent form a global vision of a determined group. On the other hand, it is necessary to determine the factors which regulate the dynamics of these populations, so that the integration of this type of study permits the definition of the so-called zooplankton "community".

ACKNOWLEDGEMENTS

The authors express their appreciation to the Instituto Antártico Chileno by financing the present study, to the Instituto de Fomento Pesquero by providing laboratory facilities, essential for the work, and to Dr. Valerie Loeb by her useful suggestions for the text of this paper.



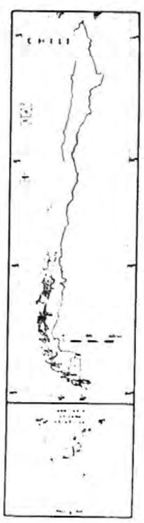


Figure 1.—Geographic position of zooplanktonic stations.

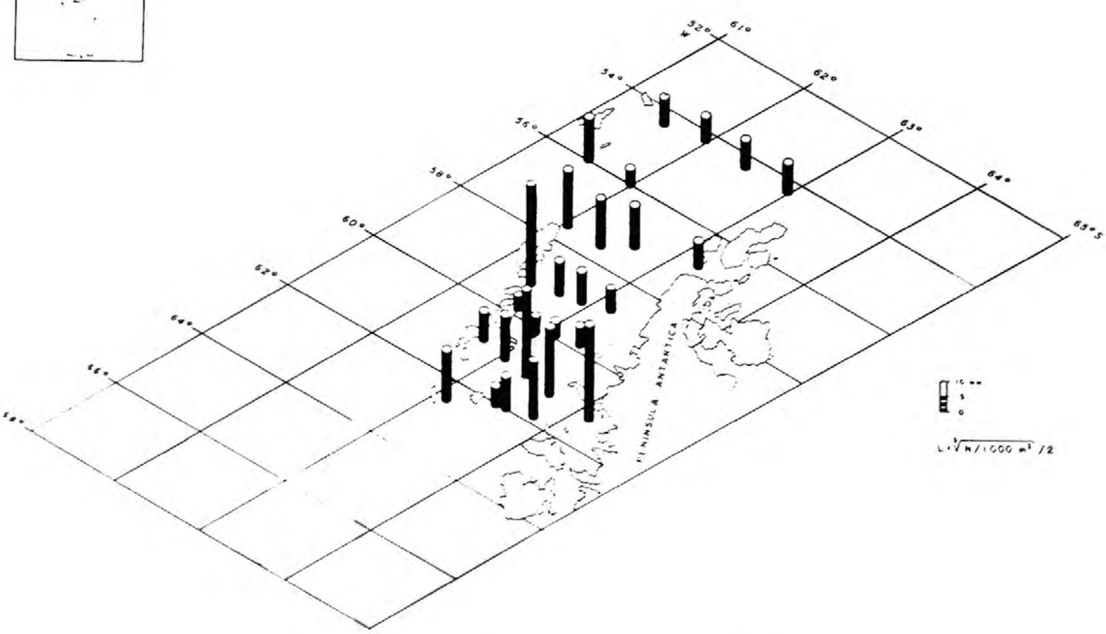


Figure 2.—Distribution and relative abundance of zooplankton.

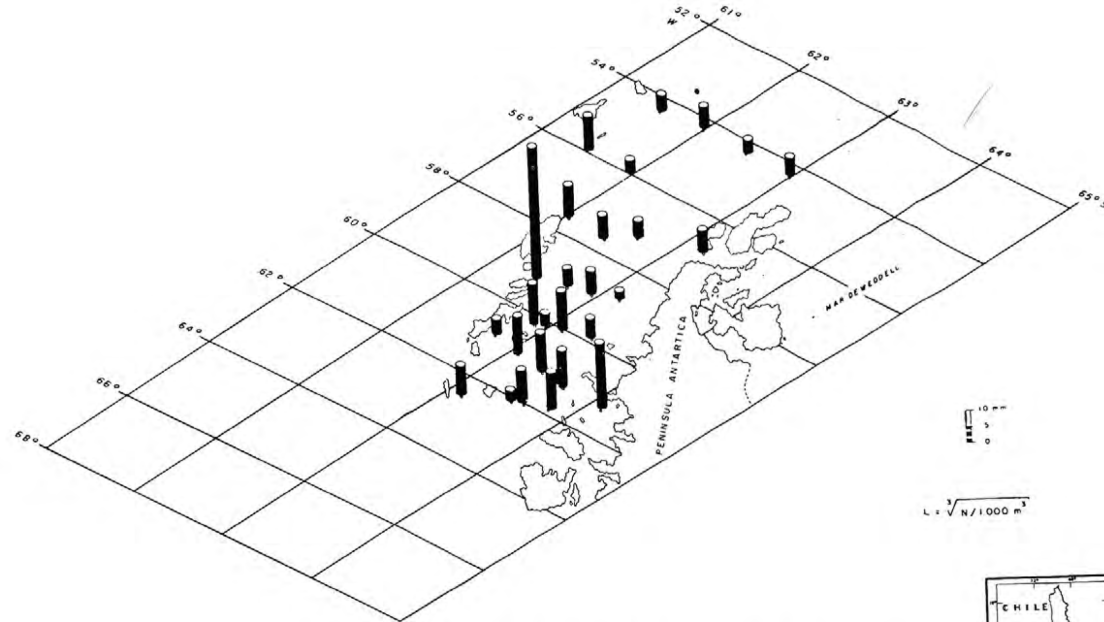
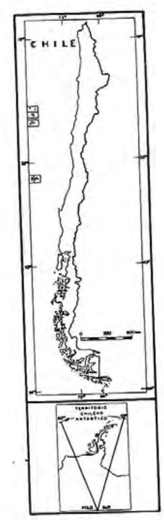


Figure 3.—Distribution and relative abundance of euphausiid.



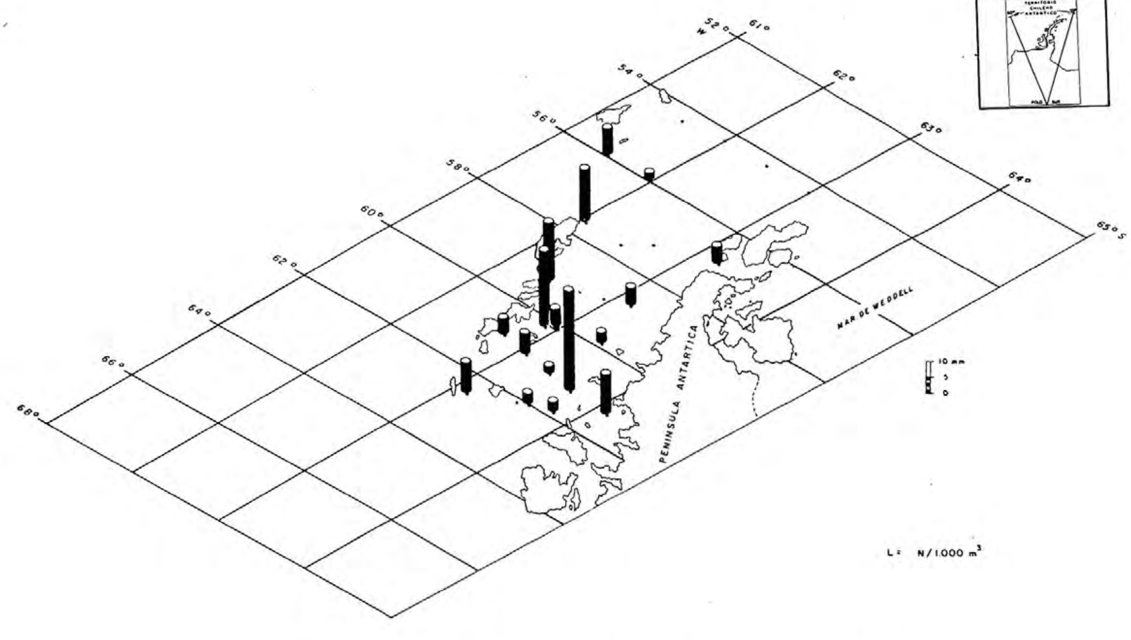


Figure 4.—Distribution and relative abundance of ichthyoplankton.

Table 1

RELATIVE ABUNDANCE OF ZOOPLANCTONIC TAXA (N/1000 m^3)

Station	Copepods	Amphipods	Ostracods	Isopods	Cirriped Larvae	Decapods Larvae	Euphausiids	Polychaets	Molusc Larvae	Chaetognaths	Echinoderm Larvae	Apendicu-laria	Salps	Medusa	Siphonophores	Fish Larvae
1.5	3891	28	324	2			73	63		148						
1.4	2751	43	3	3			114	3		31						
1.3	2724	4	15				18	106	18	977					44	
1.2	2205		20	6	49	6	89	1222	37	49			514	9		
2.4	15106	10			2		459	36	6	99					2	8
2.3	393		17				25	5	17	12						2
3.4	25020	24					498	57	5	30	43	15389			3	16
3.3	21427	33		3			201	182	19	3	339					
3.2	14175	11	106	4			102	45	4	999	117				147	
3.1	2230			5	5		291	349		63	11				26	5
4.1	1949	15	89	7		2	5	275	225	134	2	632			20	5
4.2	5569	57		3			196	34	3	7	24				20	
4.3	7193	73	39	4			81	18	6	684	26				89	
4.4	164028	147	170	5	5	2	63252	1364	2	414	16		36	2	2	18
5.1	1417	16	5				126	33	36	208	3				5	3
5.2	55	14		10			1321			14	42					
5.3	1292	20	11	9			23	20	3	9						6
5.4	17050	574					1358	94		492					23	23
6.0	106586	76	1839		12	6	4866	2154	140	402	47	95923		35	52	12
6.1	5123	81	24	14	8		680	398	11	208	14	73910			43	30
6.2	24700	73	17	5	2		648	390	15	511		164718			10	2
6.3	20104	207					510	20		157					3	6
6.4	5644	215					140	10		35						5
7.1	39859	39	27		24		1018	766	24	1149					192	3
7.2	6978	30	10				593	89	3	387					7	3
7.3	2490	56	8		8		29	5	3	40				3	24	
7.4	27501	20	119				345	46		185					46	9
Total	529463	1867	2844	80	114	16	77059	7784	578	7446	682	350572	550	48	759	156

Table 2

NUMERICAL CONSTANCY AND DOMINANCE OF ZOOPLANCTONIC TAXA

Taxonomic groups	Specimens total number	Positive stations numbers	Constancy (%)	Classification	Dominance (%)	Classification
COELENTERATES						
Medusas	48	4	14.8	Accidental	.0	Accidental
Shiphonophores	759	19	70.4	Constant	0.1	Accidental
ECHINODERMS						
Larvae	682	12	44.4	Accesory	0.1	Accidental
CHAETOGNATHS	7446	27	100.0	Constant	0.8	Accidental
MOLUSCS						
Pteropods and larvae	578	19	70.4	Constant	0.1	Accidental
ANNELIDS						
Polychaetous	7784	26	96.3	Constant	0.8	Accidental
ARTHROPODS (Crustaceans)						
Decapods larvae	16	4	14.8	Accidental	.0	Accidental
Cirriped larvae	114	9	33.3	Accesory	.0	Accidental
Isopods	80	14	51.9	Constant	.0	Accidental
Euphausiids	77059	27	100.0	Constant	7.9	Dominant
Amphipods	1867	24	88.9	Constant	0.2	Accidental
Copepods	529463	27	100.0	Constant	54.0	Dominant
Ostracods	2844	18	66.7	Constant	0.3	Accidental
CHORDATES						
Appendicularia	350572	5	18.5	Accidental	35.8	Dominant
Salps	550	2	7.4	Accidental	0.1	Accidental
FISHES						
Eggs and larvae	156	17	63,0	Constant	.0	Accidental

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