DISTRIBUTION AND ABUNDANCE OF EUPHAUSIIDS OFF ARGENTINA IN SPRING 1978

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ABSTRACT

Four species of euphausiids were recorded in the southwestern Atlantic off Argentina during spring 1978: **Euphausia lucens, E. vallentini, Nematoscelis megalops** and **Thysanoessa gregaria.** Ecological differences between shelf and slope environments lead to conspicuous differences in the frequency distributions of the larval stages in both water masses. A clearly differentiated environment was found in the Gulf of San Matias (41°-42°S), where **E. lucens, N. megalops** and **T. gregaria** encounter conditions which allow them to complete their life cycles without being expatriated.

Key Words: Zooplankton, Euphausiacea, SW Atlantic, distribution.

RESUMEN

Durante la primavera de 1978 se registraron en el Mar Argentino cuatro especies de eufáusidos: **Euphausia lucens, E. vallentini, Nematoscelis megalops y Thysanoessa gregaria.** Las diferencias ecológicas entre las aguas del talud y las aguas de la plataforma continental se manifiestan en diferentes dis-

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tribuciones de frecuencias de los estadios larvales de estos organismos. El golfo San Matias (41°-42° S) constituye un ambiente marcadamente distinto de las aguas que lo rodean. **E. lucens, N. megalops** y **T. gregaria** encuentran alli condiciones tales que les permiten completar su ciclo de vida sin ser expatriados.

Palabras clave: Zooplancton, Euphausiacea, Atlántico sudoccidental, distribución.

INTRODUCTION

Euphausiids represent an important link in the lower levels of marine trophic webs, reaching, in some oceanic areas, biomass values only comparable to those of the copepods. It is in the Antarctic region that these organisms attain maximum concentrations, and where most of the recent investigations are being carried on. Distribution studies of most Antarctic species, however, do not extend to the subantarctic sector; such is the case of **Euphausia superba,** a major component of krill stocks. The information concerning species restricted to the subantarctic region of the Southwestern Atlantic is scarce. The literature dealing with this subject is focused mainly on systematics (Sars, 1885; Lomakina, 1965; Ramirez, 1971), zoogeography (Ramirez, 1971, 1973; Montú, 1977) and reproductive biology (Ramirez and Dato, 1983), and only two of the above mentioned studies are based on quantitative data. Of these two, the most comprehensive survey (Ramirez and Dato, **op. cit.**) is restricted to the southernmost end of the area; thus, the information presented herein furnishes supplementary data on the distribution patterns of larvae and adults.

Hydrology of the area

The superficial and subsuperficial layers of the region encompassed by this study are influenced to a variable degree by subantarctic waters. Three different water masses can be identified, the boundaries of which vary seasonally and are

difficult to define: a) **Malvinas Current:** It is formed by purely subantarctic waters that branch off from the West Wind Drift. The core of this current moves along the continental slope with a NNE direction, up to 34°-35° S. At these latitudes, part of the stream changes its direction and turns eastward before mixing with subtropical waters to form the Transition Zone, while part sinks below the Brazil Current continuing its northward flow; b) **Coastal Waters:** These are located between the coast and the Malvinas Current. Their origin includes contributions from the Malvinas Current, South Pacific waters advected **via** the Strait of Magellan, and continental runoff. Its movement, though unsteady because of winds and tidal currents, is chiefly northward; c) **Rio de la Plata Influence Zone:** Its limits are highly variable according to the season, due to rain fluctuations in the Plata Basin. Its eastward extention can reach as far offshore as the western side of the slope.

MATERIAL AND METHODS

The 37 samples examined in the present work were collected during the VIIth cruise of the R/V "Shinkai Maru" (October 20th to November 11th, 1978; see Fig. 1) by means of a Bongo net of 60cm mouth diameter and 505 um mesh, hauled obliquely. General oceanographic data are summarized in Table I; for further information see Cousseau **et al.** (1979). Samples were preserved in 5-10% formaldehyde solution. Larvae (calyptopes and furciliae), juveniles and adults of all euphausiid species were identified and counted. Very large catches were split with a Folsom Plankton Splitter. Counts always exceeded 180 individuals, which yields a relative error of 26% (cf. Frontier, 1981).

Identification of adult specimens was based on Lomakina (1965) and Ramirez (1971), while those of the larvae on Frost (1935), John (1936), Bary (1955), Mauchline (1971) and Casanova (1974). No stages younger than calyptopis I were found, probably due to the large mesh aperture. Larvae of **E. lucens** were not distinguished from those of **E. vallentini,** for which both taxa are considered jointly (Table I).

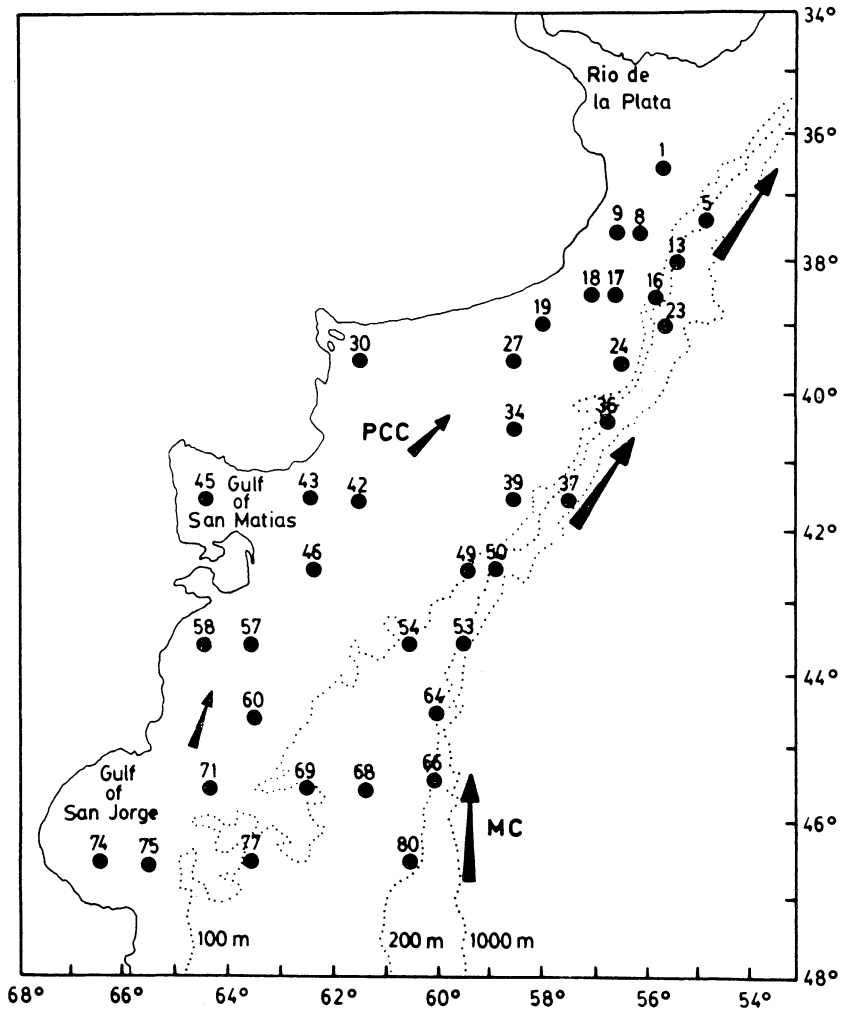

Figure 1 — Location of stations of the VIIth cruise of R/V 'Shinka Maru" in the SW Atlantic. MC: Malvinas Current; PCC: Patagonian Coastal Current.

Sta.	Lat.S	Long.W	E. lucens + E. vallentini C1	C2	C3	F1	F2	F3	F4	F5	F6	J	E.l. Ad.	E.v. Ad.	T. gregaria C2	C3	F1	F2	F3	Ad.	C. megalops C2	C3	F1	F2	F3
1	36°27'	55°30'	----	----	16	83	16	----	----	----	----	----	----	----	580	1200	9300	580	2900	----	580	5200	5200	580	----
5	37°20'	54°41'	3500	41000	76000	49000	16000	1700	7000	800	----	----	----	----	----	----	210	160	52	----	----	----	----	----	----
8	37°30'	56°01'	52	3300	5600	1500	100	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9	37°28'	56°28'	----	190	190	140	30	20	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
13	37°59'	55°23'	4	24	85	88	100	65	110	73	----	----	4	----	----	4	----	----	16	----	----	----	4	----	4
16	38°31'	55°41'	----	130	420	330	380	----	16	62	16	----	47	----	----	----	----	----	----	----	----	----	----	----	----
17	38°30'	56°30'	810	4000	9300	36000	19000	4800	11000	2400	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
18	38°30'	57°00'	----	----	450	2700	3300	190	510	64	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
19	38°59'	57°59'	----	82	80	220	120	25	25	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
23	38°57'	55°32'	4600	11000	4700	2200	1800	550	440	----	----	----	----	----	----	----	330	----	330	----	----	----	110	110	----
24	39°34'	58°24'	370	8000	1800	440	300	74	74	74	----	----	150	----	----	----	----	----	----	----	----	----	----	----	----
27	39°29'	58°30'	----	8800	15000	7500	3100	1100	670	----	----	----	----	----	----	220	----	220	220	----	----	----	----	----	----
30	38°31'	61°31'	----	37	12	----	37	37	----	----	----	----	----	----	----	----	12	----	----	----	----	----	----	----	----
34	40°28'	58°29'	----	1800	1800	380	270	78	190	150	38	----	110	----	----	----	----	----	78	----	----	----	----	----	----
36	40°24'	58°40'	48	510	350	280	240	12	84	170	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
37	41°25'	57°24'	----	1800	18000	58000	11000	220	990	110	----	----	----	----	----	----	220	110	110	----	----	----	----	----	----
39	41°31'	58°33'	200	3200	2300	3600	1100	39	39	----	----	----	1700	----	----	----	39	39	39	----	----	39	----	120	----
42	41°27'	61°29'	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
43	41°24'	62°24'	----	----	10	10	----	10	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
45	41°30'	64°24'	29	910	720	170	130	120	72	58	14	380	100	----	----	----	14	43	140	14	----	----	180	14	14
46	42°30'	62°28'	----	4	16	4	8	----	4	----	----	----	38	4	----	----	----	----	4	----	----	----	----	----	----
49	42°30'	59°29'	130	800	430	33	11	22	----	----	----	----	140	----	----	----	----	----	11	----	----	----	----	----	----
50	42°30'	58°51'	8	88	78	280	340	110	310	----	8	----	8	----	----	----	----	----	8	18	----	----	----	----	----
53	43°28'	59°33'	780	1300	280	45	----	9	----	----	----	----	----	230	----	45	110	----	----	180	----	----	----	----	----
54	43°30'	60°30'	850	1500	210	420	120	18	95	----	----	----	----	----	18	38	95	----	----	----	----	----	----	----	----
57	43°35'	63°29'	----	48	35	83	42	14	----	----	----	----	----	----	----	----	14	28	100	----	----	7	42	56	230
58	43°31'	64°31'	----	1200	2300	2000	3400	940	1500	87	130	----	----	----	----	----	340	400	740	----	----	----	----	----	----
60	44°32'	63°31'	----	----	80	430	530	88	150	130	----	----	210	----	----	----	----	----	40	----	----	----	28	----	----
64	44°28'	60°04'	28	71	68	140	20	8	17	----	----	----	43	43	----	----	----	3	3	140	----	----	----	----	----
66	45°22'	60°02'	2700	22000	18000	4800	----	----	----	----	----	----	----	----	----	----	3200	----	730	81	----	----	----	----	----
68	45°28'	61°25'	29	1300	730	280	180	44	----	----	----	----	----	----	----	----	----	15	28	----	----	----	----	----	----
69	45°30'	62°28'	----	2000	8400	8000	4500	1200	860	----	340	340	----	----	----	----	----	----	----	----	----	----	340	----	170
71	45°29'	64°22'	----	----	----	310	810	50	170	65	21	----	----	----	----	----	----	----	100	----	----	----	----	----	----
74	46°25'	66°30'	7	22	----	22	15	----	----	----	----	----	7	7	----	----	7	15	640	----	----	----	----	----	----
75	46°31'	65°27'	----	----	----	----	----	----	----	----	----	----	13	13	----	----	----	----	----	----	----	----	----	----	13
77	46°29'	63°32'	----	----	3	17	3	7	----	----	----	----	180	3	----	----	----	----	----	----	----	----	10	----	7
80	46°28'	60°33'	8	120	130	83	24	4	4	----	4	----	----	12	----	4	32	----	----	64	----	----	----	----	----

Table I — Data on the stations of the VIIth cruise of R/V "Shinkai Maru" in the SW Atlantic and estimated abundance (in individuals per 1000m^3 of waterfiltered) of the euphausiids registered. Latitudes and longitudes are expressed in degrees and minutes. Ad.; adults; BD: bottom depth (m); C: calyptopis; E.l.: **Euphausia lucens; E.v.: Euphausia vallentini;** F: furcilia; J: juveniles; S: surface salinity (‰); T: surface temperature (°C); TD: tow depth (m).

RESULTS AND DISCUSSION

All of the species recorded (**Euphausia lucens, E. vallentini, Nematoscelis megalops** and **Thysanoessa gregaria**) are subantarctic and their distribution patterns in the area are mainly influenced by the Malvinas Current.

E. lucens is present over most of the continental shelf, except for the innermost sector north of 42°S (Fig. 2). Highest abundances of adults reached 1700 indiv./1000m^3 (Sta. 39). The distribution of **E. vallentini** in neritic waters is restricted mainly to the Patagonian sector, reaching as far north as the Gulf of San Jofge (Fig. 3). At lower latitudes it is found on the continental slope and only occasionally in shelf waters (Ramirez, 1973). Adults were sparsely distributed; highest densities were only 200 indiv./1000m^3 (Sta. 53).

The overall distribution of **N. megalops** is similar to that of **E. lucens** (iFg. 4). Furciliae were more widely spread than calyptopes, furcilia I being the most abundant stage (Table I). According to Gopalakrishnan (1974), adults of **N. megalops** thrive below 200m during the daytime; thus, the overall absence of adults in our material may be due to the fact that most tows did not exceed 100m deep.

For **T. gregaria** (Fig. 5), the analysis of the distribution patterns of the various developmental stages shows that older individuals have progressively ampler ranges, furcilia III occupying almost the entire area (Table I). Abundance shows a similar trend. Adults are restricted to the Patagonian slope, with the exception of station 45, located in the center of a cyclonic ring in the Gulf of San Matias (Piola and Scasso, 1988; Fig. 1). This gulf was found to host the most complete series of developmental stages when considering all species as a whole (see Table I). Also, the number of species was higher in the Gulf than in the rest of the stations (see Table I). Considering the low rate of renewal of water between the Gulf and the surrounding zone (Carreto **et al.**, 1974; Scasso and Piola, 1988) the results of this study may indicate that conditions within San Matias are especially favorable for these euphausiids, allowing them to complete their life cycles without being expatriated.

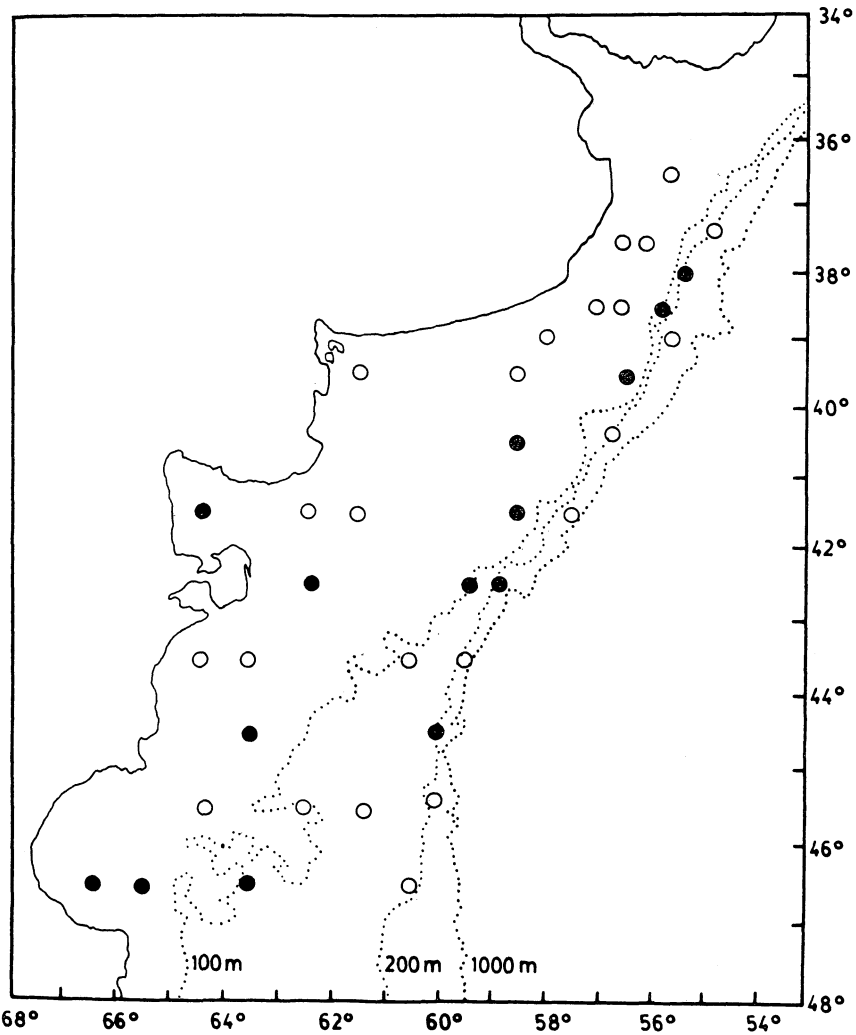

Figure 2 — Distribution of adult **Euphausia lucens**. Filled circles indicate occurrence.

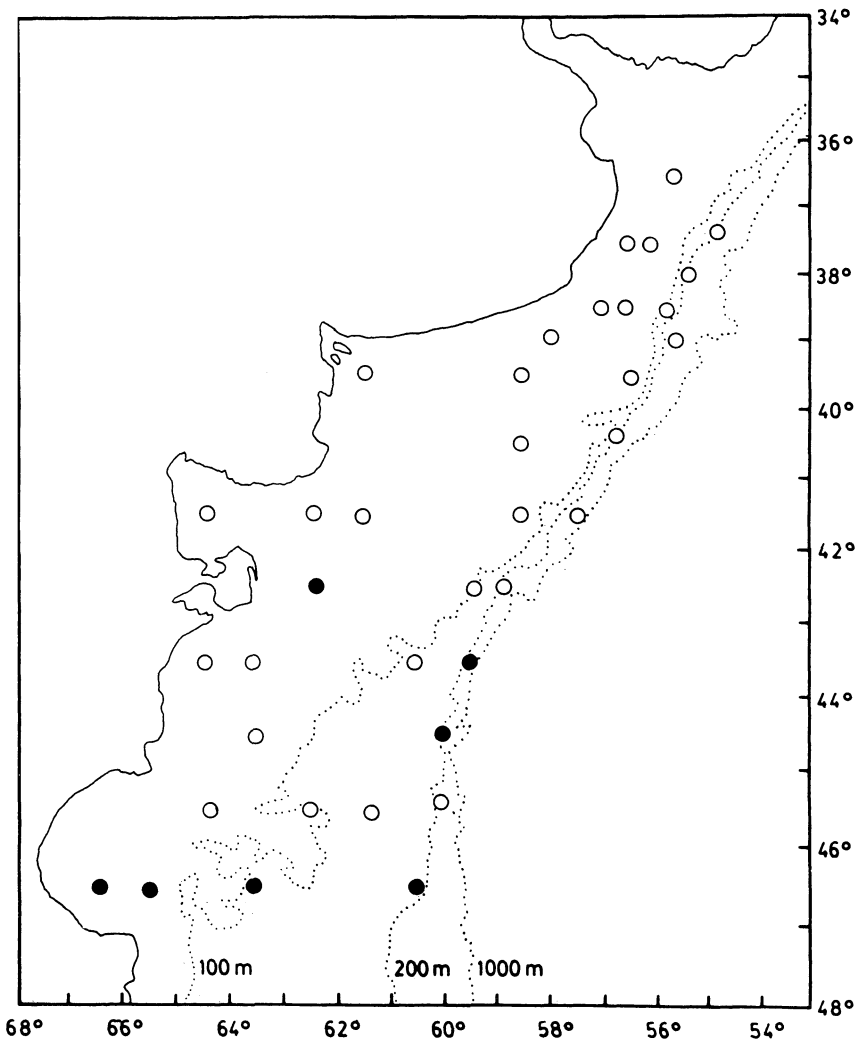

Figure 3 — Distribution of adult **Euphasia vallentini.** Filled circles indicate occurrence.

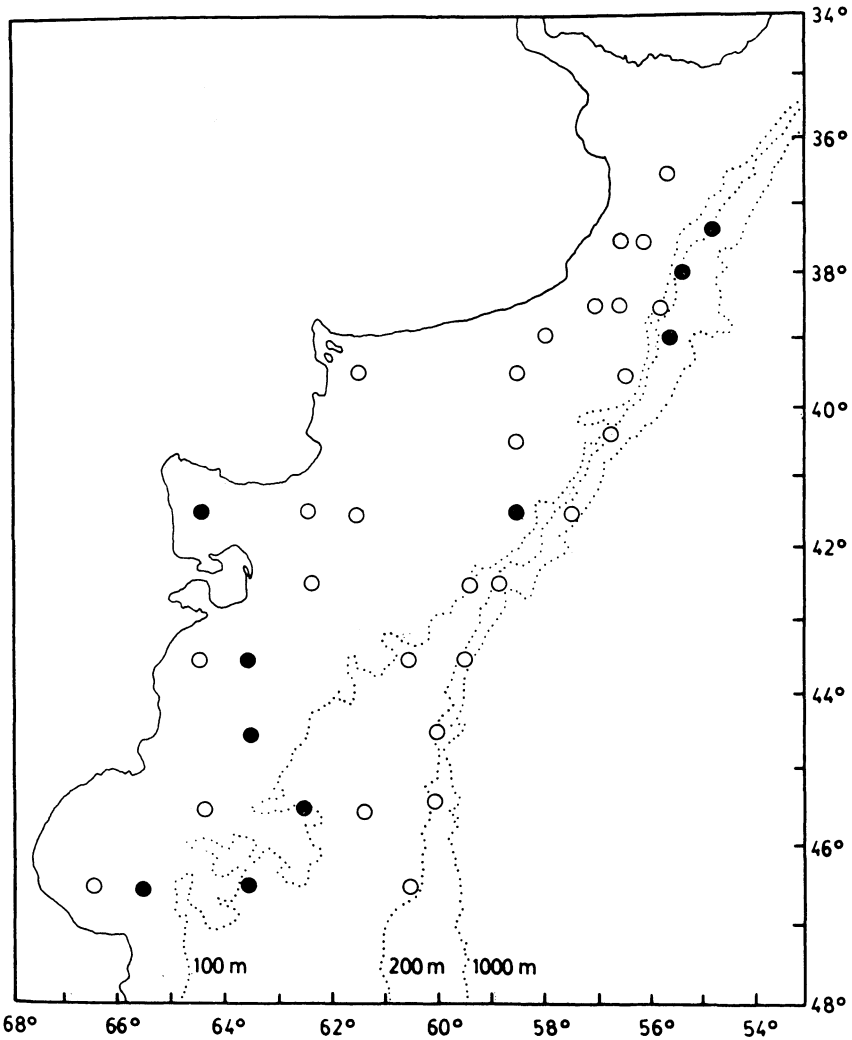

Figure 4 — Distribution of **Nematoscelis megalops.** Filled circles indicate occurrence.

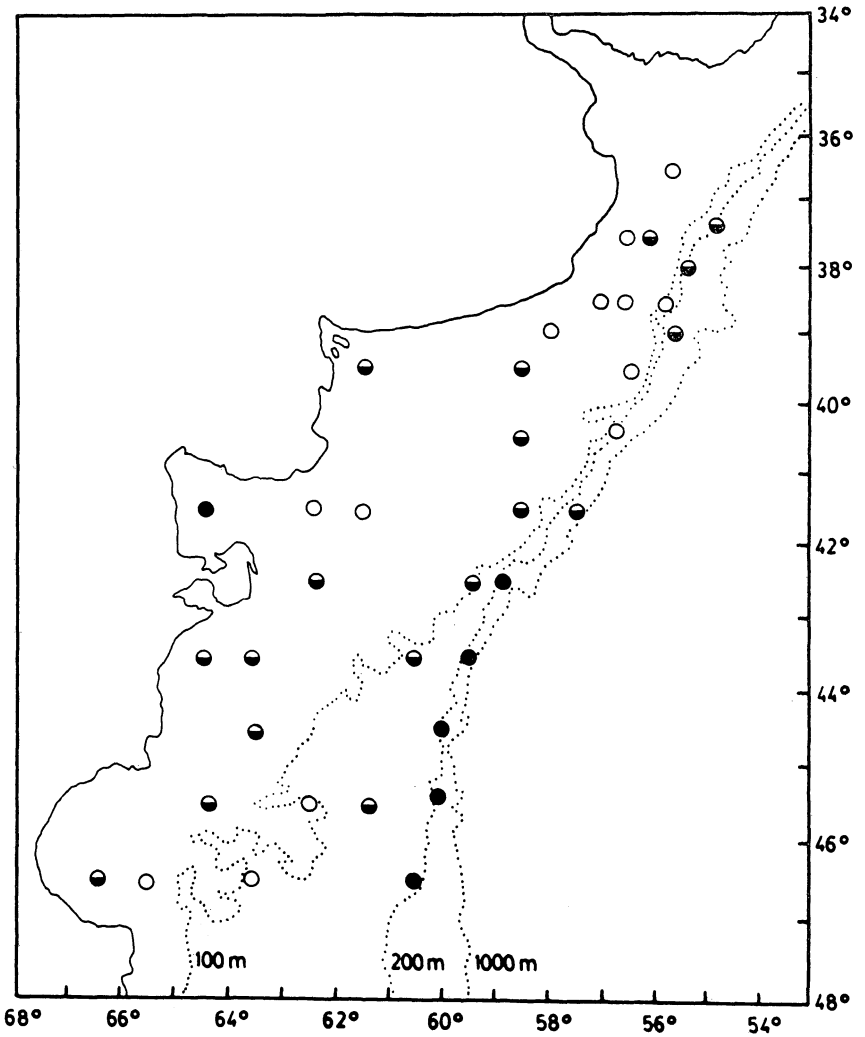

Figure 5 — Distribution of **Thysanoessa gregaria.** Filled circles indicate occurrence of larvae and adults; half-filled circles indicate occurrence of larvae only.

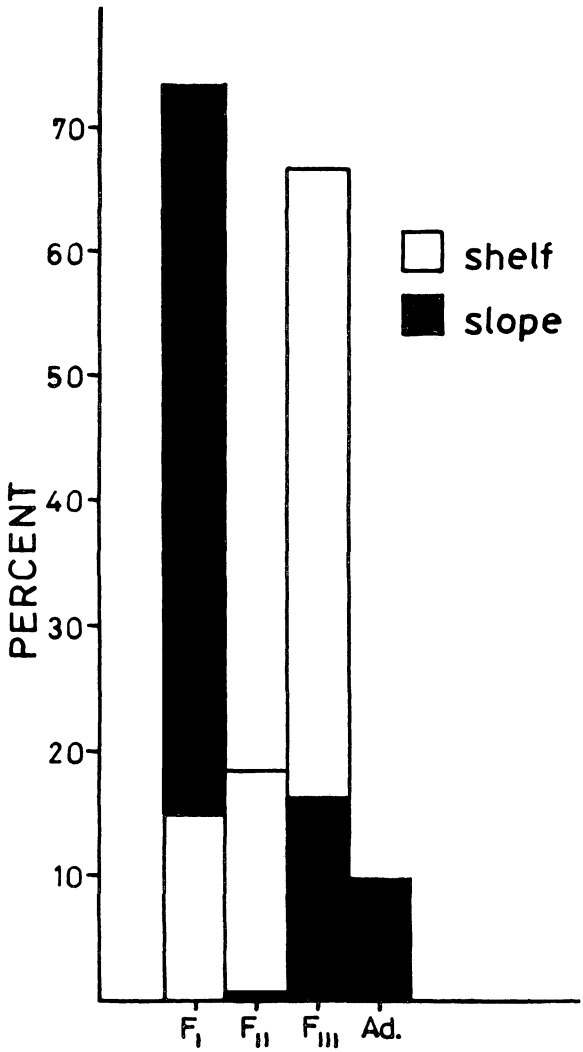

Figure 6 — Developmental stage frequency of **Thysanoessa gregaria** in shelf waters (Sta. 57, 58, 60, 71, 74 and 75) and in slope waters (Sta. 53, 54, 64, 66, 68 and 80).

Detailed analysis of the frequency distribution of the developmental stages was strongly limited by the sampling design. Nevertheless, some general trends could be put in evidence with the data available.

According to Ramirez and Dato (1983), some euphausiid species reach ovarian maturity by the end of the winter (**i.e., T. gregaria** in June, **E. lucens** in August), while in spring the numbers of larvae peak noticeably over most of the area (Montú, 1977). According to our data, surface water populations are characterized by the dominance of furciliae during October and November (Table I).

In the particular case of **T. gregaria,** the highest values of abundance correspond to furciliae I and III which, when considering shelf stations vs. slope stations, the latter contribute with most of the furciliae I, while furciliae III prevail in the former (Fig. 5). Environmental differences between shelf and slope are sharp: slope waters belong to the Malvinas Current (Fig. 1), with physico-chemical and biological characteristics largely known as quite different from those of typical neritic waters (Brandhorst and Castello, 1971; Boltovskoy, 1981; and many others). Since the bimodality observed may be due to several causes (different growth rates in both water masses, different current velocities, etc.) which cannot be determined on actual data, it is suggested as a most interesting subject of research for future investigations.

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