DISTRIBUTION PATTERNS OF PELAGIC POLYCHAETES IN THE SOUTHERN DRAKE PASSAGE AND BRANSFIELD STRAIT (JANUARY-FEBRUARY 1984)

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ABSTRACT

During the SIBEX investigations, in the austral summer 1983-1984, the R/V "Prof. W. Besnard" operated in the southern sector of Drake Passage and in the Bransfield Strait. Distribution patterns of pelagic polychaetes were analyzed in 172 vertical and oblique zooplankton samples collected at 46 oceanographic stations. Polychaetes were rather constant components of total zooplankton (present in 97,08% of stations and 75,00% of samples), though never abundant, with the exception of **Pelagobia longicirrata,** that reached densities up to 2,600 individuals per 1,000m³. Distribution patterns of ten holoplanktonic species and some larval and epitokal forms were analyzed in relation to hydrographic conditions. This analysis did not show sharp differences between individual or groups of species assigned to the warmer and less saline waters of the Drake Passage and to the colder and more saline Weddell and Bransfield waters. Most species were rare or even absent at the surroundings of the Weddell-Scotia Confluence and in the central sector of the Bransfield Strait. Distribution patterns of **Rhynchonereella bongraini** and **Pelagobia longicirrata** in the Bransfield Strait seemed to be somewhat affected by the intensity and extent of the inflow from Weddell Sea water. Particular species of pelagic polychaetes can not be considered entirely reliable indicators of water masses in the research area. Though

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polychaetes can show some definite distribution patterns at specific times and localities, these patterns seem to suffer seasonal and yearly changes.

Key Words: Pelagic polychaetes; Antarctica; distribution patterns

RESUMO

Padrões de distribuição de poliquetas pelágicos no setor sul da Passagem de Drake e no Estreito de Bransfield — Janeiro/Fevereiro de 1984. No decorrer das investigações do SIBEX, no verão austral de 1983-1984, o N. Oc. "Prof. W. Besnard" operou no setor sul da Passagem de Drake e no Estreito de Bransfield. Padrões de distribuição de poliquetas pelágicos foram analisados em 172 amostras zooplanctônicas. Poliquetas foram um componente constante do zooplâncton total, embora nunca abundantes, com a exceção de **Pelagobia longicirrata**, que alcançou densidades de até 2.600 inds/1000m^3. Os padrões de distribuição de dez espécies holoplanctônicas e de algumas formas larvais ou epítocas foram relacionados com as condições hidrográficas. Esta análise não mostrou diferenças marcantes entre espécies ou grupos de espécies referidas às águas quentes e menos salinas da Passagem de Drake ou às águas frias e mais salinas do Estreito de Bransfield e do Mar de Weddell. Poucas espécies foram registradas nas proximidades da Confluência Weddell-Scotia e no setor central do Estreito de Bransfield. Os padrões de distribuição de **Rhynchonereella bongraini** e **Pelagobia longicirrata** parecem ser afetados pela intensidade e extensão do fluxo da massa de água do Mar de Weddell. Espécies de poliquetas pelágicos não devem ser consideradas indicadores confiáveis de massas de água na região de estudo. Embora possam apresentar padrões de distribuição definidos em localidades e épocas específicas, esses padrões parecem sofrer alterações sazonais e anuais.

Palavras-chave: Poliquetas pelágicos; Antártica; padrões de distribuição.

INTRODUCTION

It is a well known fact that the richness and diversity of plankton vary greatly in different places and at different times in antarctic waters. In the western Atlantic sector of the Antarctic Ocean, the warmer and less saline waters of the oceanic Drake Passage meet the colder and more saline continental waters of Weddell origin, giving rise to the so-called Weddell-Scotia Confluence (Gordon, 1971). These adjacent water masses show some sharp differences in the abundance and constitution of plankton communities (Mackintosh, 1934; El-Sayed, 1971; Rakusa-Suszczewski, 1983). This trend seems to be also reflected on the distributional patterns of some species of pelagic polychaetes (Tebble, 1960; Jazdzewski **et al.**, 1982; Lana & Blankensteyn, in press). Structural diversity and patchiness in pelagic communities of antarctic waters, where nutrient content does not seem to be a factor limiting biological productivity have been tentatively attributed, among other factors, to ice conditions (pack ice heterogeneity) and variations in surface temperatures (Foster, 1981; Tranter, 1983).

In this paper, we examine the individual distribution of pelagic polychaetes in the southern Drake Passage and in the Bransfield Strait and try to relate the observed patterns to the hydrographic features of this area. This analysis may contribute to a better understanding of the occurrence and dispersal of antarctic communities in the southern ocean, during summer months.

MATERIAL AND METHODS

During the SIBEX investigations, in the austral summer 1983-1984, the Brazilian R/V "Professor Wladimir Besnard" operated in the southern part of the Drake Passage and in the Bransfield Strait (21/01 to 09/02/1984). 46 oceanographic stations were investigated in this sector as outlined in Figure 1 (Stations 4458 to 4503).

Standard temperature and salinity measurements were made down to 500 meters depth, following a routine previously

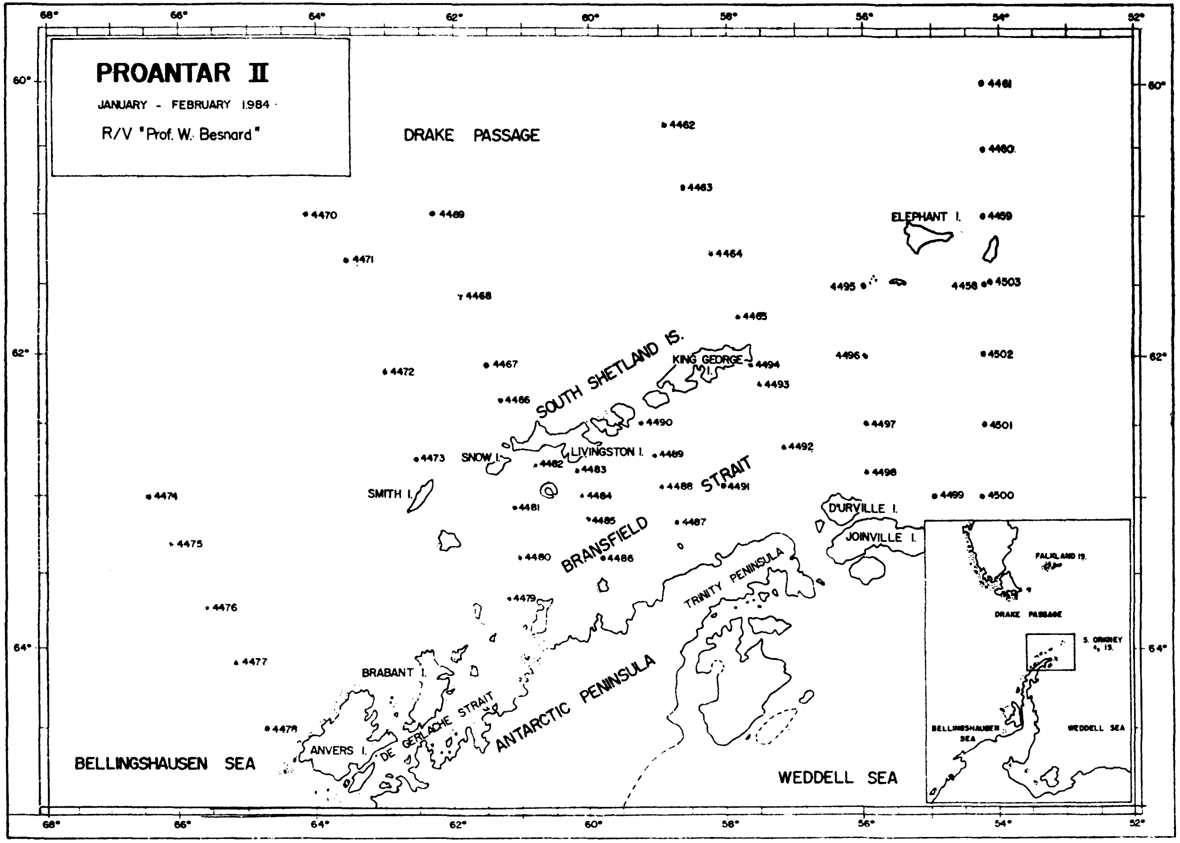

Fig. 1 — Positions of hydrographic stations occupied during January-February 1984 in the southern Drake Passage, Bransfield Strait and adjacent area using R/V "Prof. W. Besnard".

described by Ikeda **et al.** (1986). Zooplankton samples were collected at all stations, with the exception of St. 4495 due to bad weather conditions. Vertical samples were obtained with a closed net of 60cm mouth diameter and 200mμ mesh size, hauled in two layers (0-150m and 150-300m or to the bottom above the shelf), with a speed of ca. 1,0 m per second. Oblique samples were collected with an open Bongo net (mesh sizes 330 μm and 505 μm) towed down to 120-180 meters. Flowmeters of the General Oceanics type were used to assess filtered water volume. Samples were preserved in 4% formaldehyde and stored in plastic bottles or bags. Sorting and counting of pelagic polychaetes followed the routine methods for zooplankton research; no subsamples were taken. Samples swamped with krill and salps were carefully washed before the sorting of polychaetes. Identification to species level is by and large the same used by Tebble (1960). Population densities were expressed per 1,000 m^3 water volume filtered.

HYDROGRAPHIC CONDITIONS IN JANUARY-FEBRUARY 1984

The studied area comprises oceanic waters of the Bellingshausen Sea and southern Drake Passage that interact towards the south with waters of the antarctic continental shelf, mainly of Weddell origin. Thermal and saline structures at surface, 150 m and 300 m are shown in Figures 2 and 3. Data were also plotted in a T, S diagram to evidentiate the local water masses (Fig. 4).

The southern Drake Passage was occupied down to 150-140 m depth by Antarctic Surface Water of the Circumpolar Antarctic Current that flowed in from the Bellingshausen Sea. Figures 2a, 2b, 3a, 3b and 4 show that well marked discontinuity layers were set up in ASW, with the development of an upper layer of warmer and less saline water ($0,80°C < T < 2,70°C$ and $33.30 < 3 < 34.00$) that reached down to 75m and a subsurface winter layer, colder and more saline ($-0.90°C < T < 0.70°C$ and $34.00 < S < 34.20$), which spread down to 150-400 m depth. This stratification is a common feature of austral summer, that brings about an increase of surface temperature and

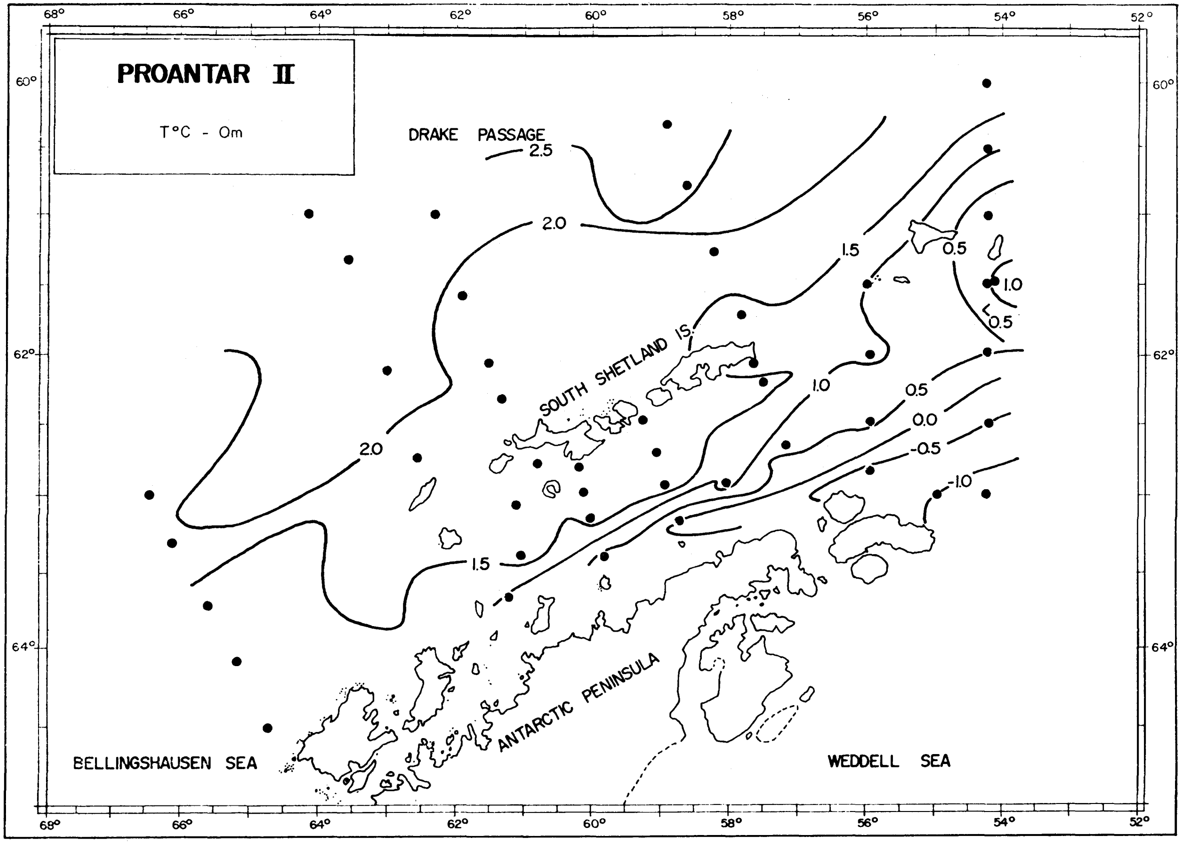

Fig. 2a. — Surface thermal structure of survey area in January-February 1984.

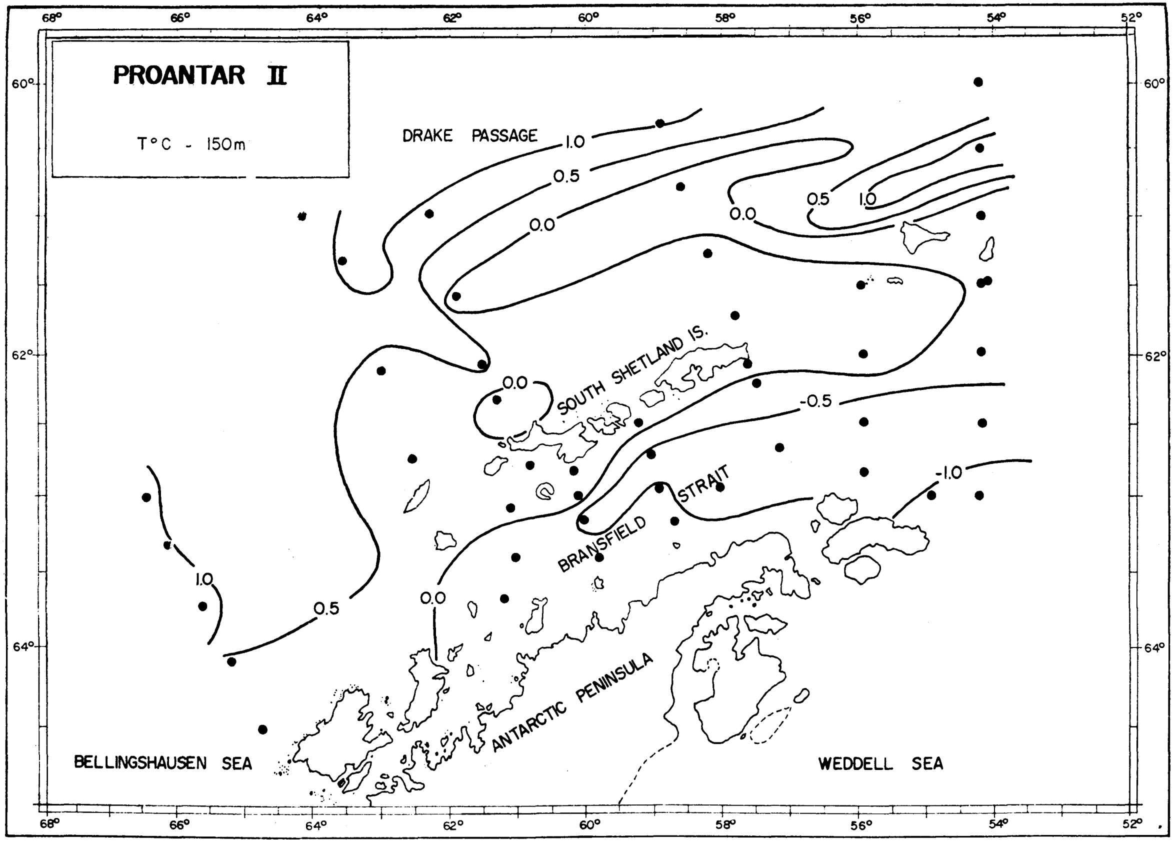

Fig. 2b. — Thermal structure of survey area at 150m depth in January-February 1984.

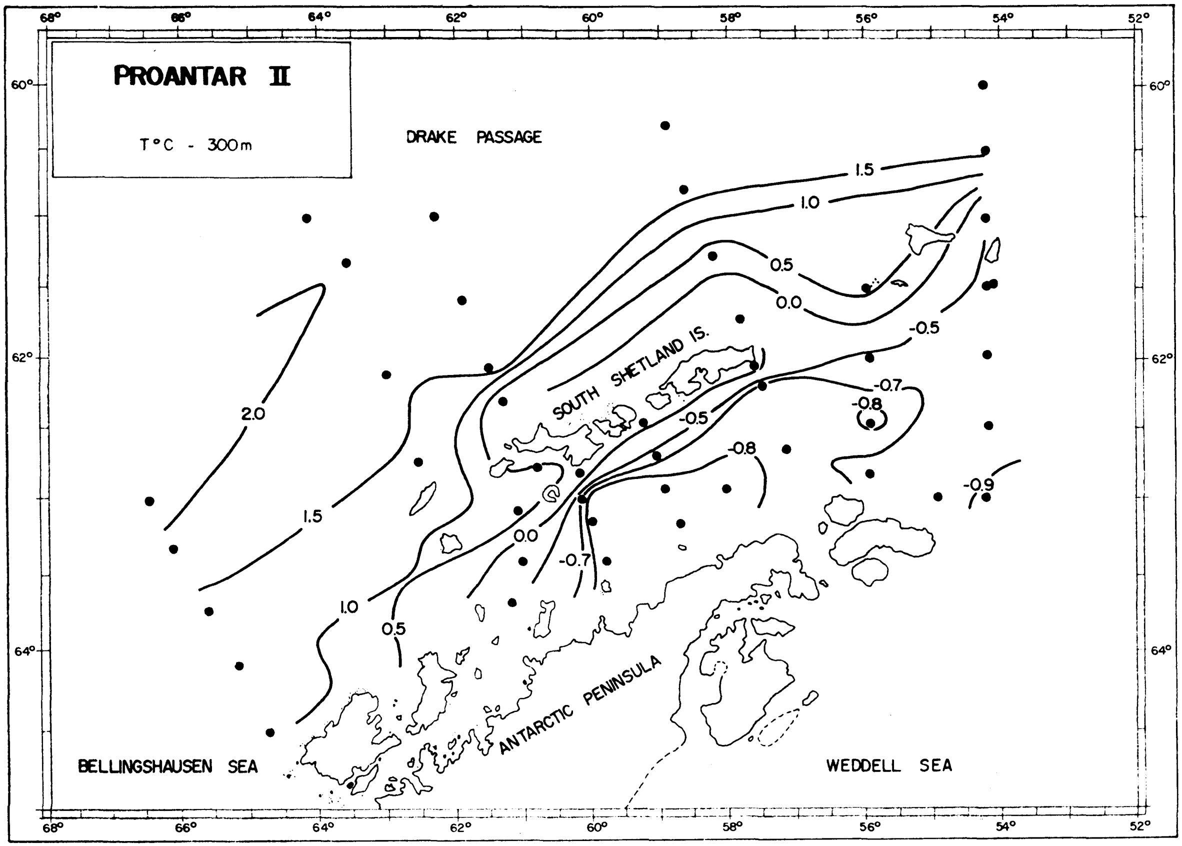

Fig. 2c. — Thermal structure of survey area at 300m depth in January-February 1984.

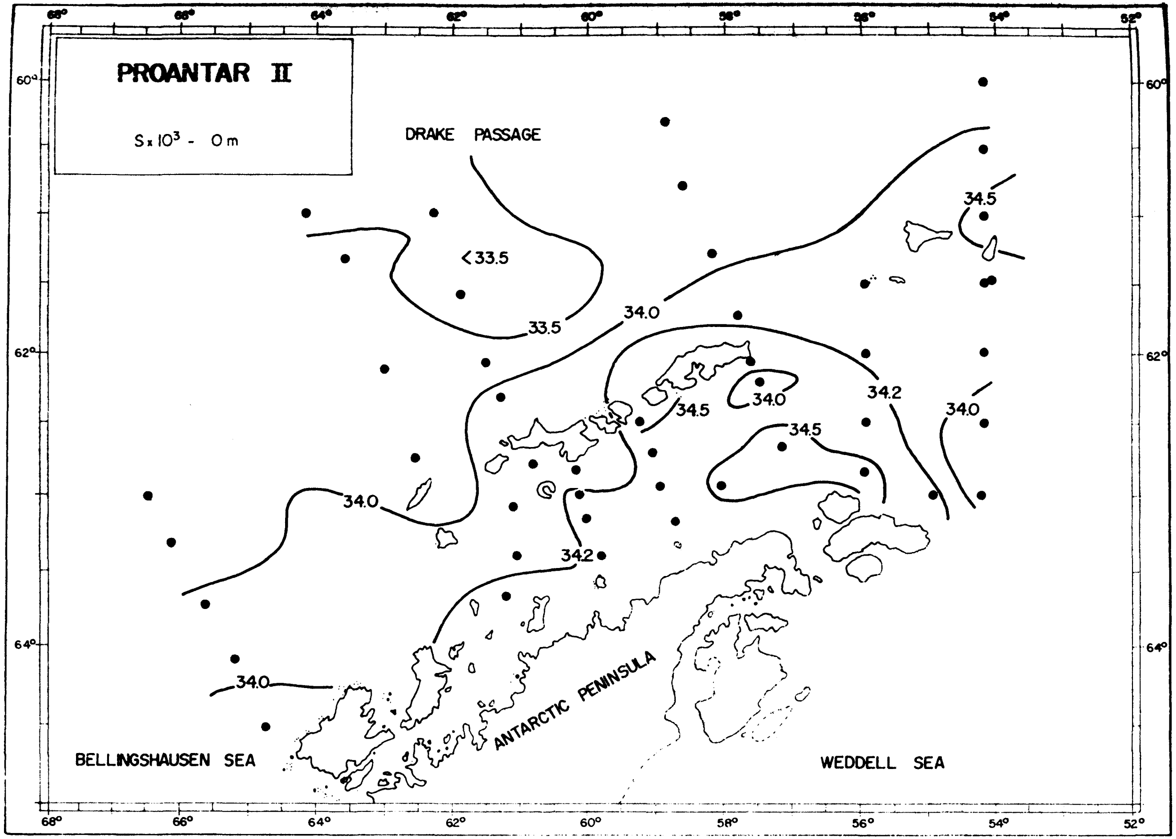

Fig. 3a. — Surface saline structure of survey area in January-February 1984.

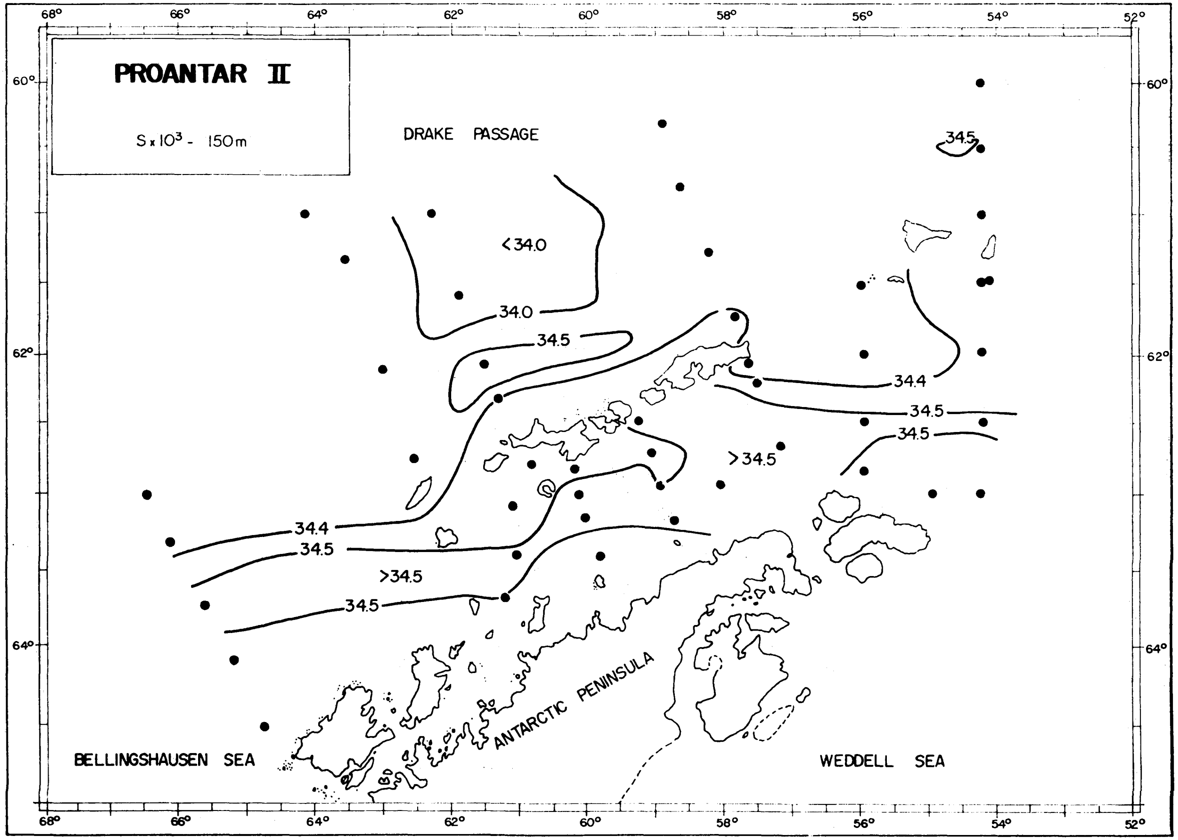

Fig. 3b. — Saline structure of survey area at 150m depth in January-February 1984.

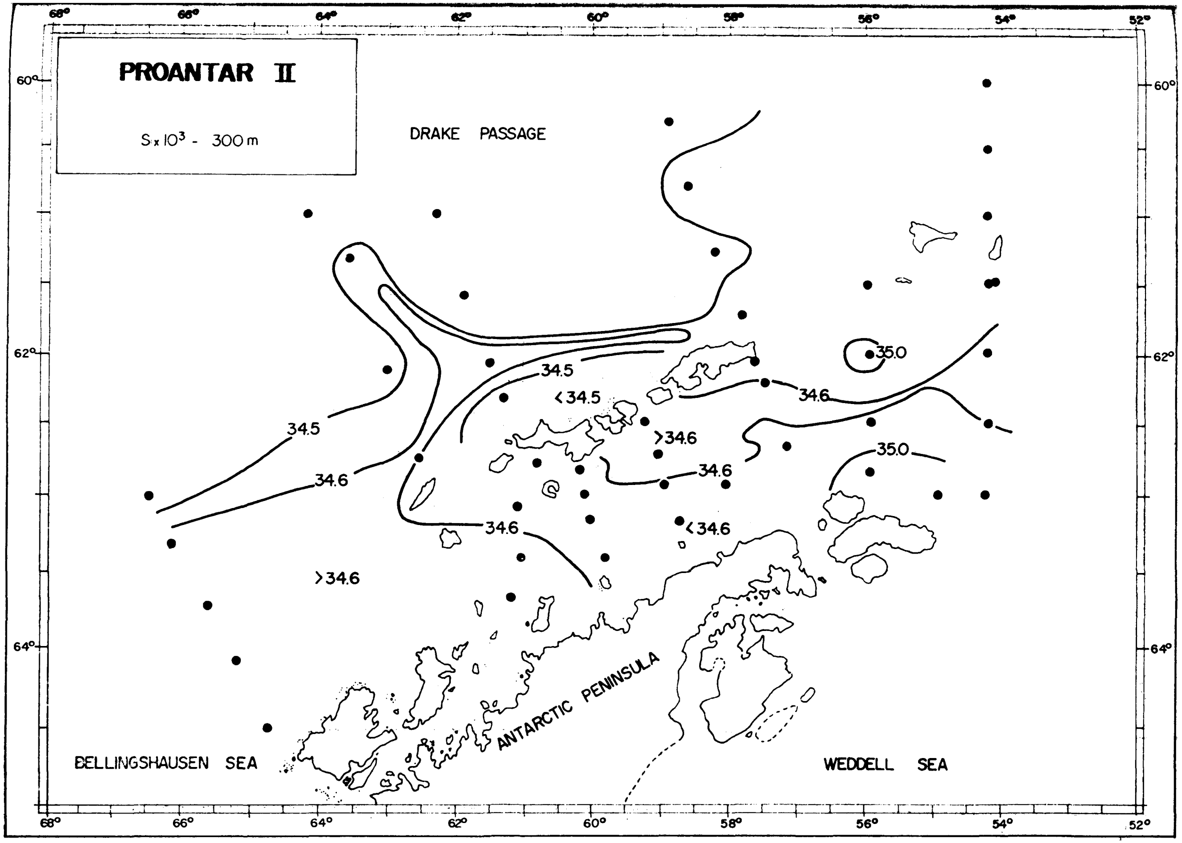

Fig. 3c. — Saline structure of survey area at 300m depth in January-February 1984.

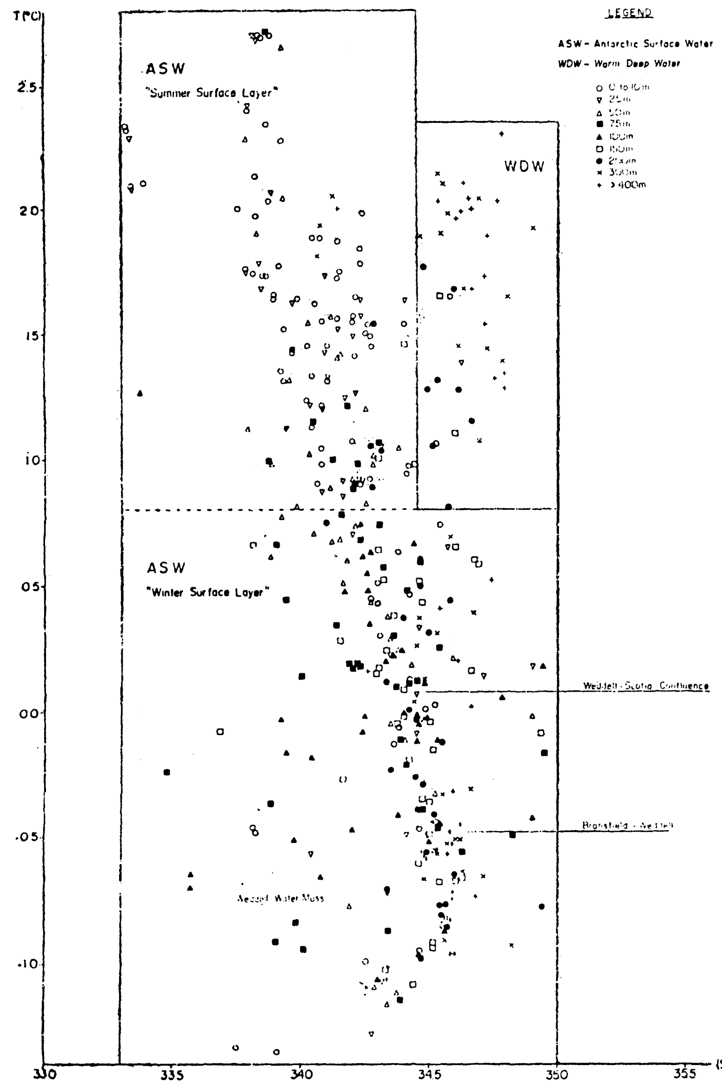

Fig. 4 — T,S diagram for Bransfield Strait and southern Drake Passage (January-February 1984).

pack ice melting. The upper warmed layer was detected in the Bellingshausen Sea (St. 4474 to 4478), in the southern sector of Drake Passage (St. 4460 to 4472) and along the northern sector of Bransfield Strait (St. 4480 to 4485, 4488 to 4491 and 4493 to 4496), where it was slightly colder and more saline (up to 34.50). Antarctic Surface Water of Weddell origin was much colder and saline, with temperature minima of -1.35°C and salinities up to 35.00. It flowed into Bransfield Strait, along the shelf of Antarctic Peninsula (Fig. 2a). Summer mixing was weak in areas under Weddell influence, as shown in stations 4499 and 4500 (Fig. 2a and 2b). The Weddell-Scotia Confluence, where Weddell colder waters sink below warmer Drake waters, is clearly evidenced in Fig. 2b, at 150m, depth, in the eastern sector of the studied area (St. 4460 to 4464).

Figures 2c, 3c and 4 show the influence of Warm Deep Water, always detected below 150m depth, between stations 4460 and 4478, with subsurface temperature maxima up to 2.30.°C and salinities up to 34.90. Its influence was weak just north of the South Shetland Islands (St. 4464, 4465 and 4466) probably on account of a steep continental slope, that would avoid its rise to the continental shelf. Warm Deep Water was also missing inside Bransfield Strait and south of the Weddell-Scotia Confluence.

DISTRIBUTION PATTERNS OF PELAGIC POLYCHAETES

Pelagic polychaetes were rather constant components of total zooplankton in the studied area (present in 97,8% of stations and 75,0% of analyzed samples, as shown in Table I), though never abundant, with the exception of **Pelagobia longicirrata,** that reached densities up to 2,600 individuals per 1,000m^3 (fine mesh sample of Bongo net in Station 4470).

Ten holoplanktonic species were identified, namely **Tomopteris septentrionalis, T. planktonis, T. carpenteri, Rhynchonereella bongraini, Vanadis antarctica, Pelagobia longicirrata, Typhloscolex muelleri, Maupasia caeca, Travisiopsis levinseni and Phalacrophorus pictus.** Larvae and epitokal forms of Spionidae, Polynoidae (**Herdmanella gracilis**) and Syllidae (**Syllides articulo-**

	Bongo 505 µm net	µm net Bongo 330	Vertical 0-150m	Vertical 150-300 m	Total
Number of analysed samples	45	45	43	39	172
Samples with polychaetes	34	33	31	31	129
Percentage	75,5	73,3	72,1	79,5	75,0

Table I — Frequency of polychaetes in oblique and vertical zooplankton samples.

sus, Exogone heterosetosa and **Polybostrichus** and **Sacconereis** stages of **Autolytus** sp) were also present. Distribution maps of the most abundant species, obtained with the analysis of vertical and/or oblique samples, are shown in Figures 5 to 13. With a few exceptions, species of pelagic polychaetes were better represented in vertical samples.

Tomopteris septentrionalis was collected throughout the studied area (Fig. 5), both in the surface and subsurface layers, though never very common (highest recorded density of 81 inds/1,000m^3 in Station 4474). The species was recorded both in the Warm Deep Water and Antarctic Surface Water. In a former study conducted in January-February 1983, **T. septentrionalis** was found to be chiefly confined to the colder Weddell water mass, in the eastern part of Bransfield Strait (Lana & Blankensteyn, in press). This pattern was not confirmed by the present findings.

Tomopteris planktonis was chiefly confined to the Bellingshausen Sea and to the southern Drake Passage (Fig. 6). It was almost absent in the central waters of Bransfield Strait and in the Weddell water mass, as previously recorded by Lana & Blankensteyn (in press). There is some evidence that this species is preferably associated to warmer water masses. In the oceanic waters of Drake Passage, it was more frequent in the warmed surface layer, while near the Antarctic Peninsula it occurred mainly in the subsurface layer.

Tomopteris carpenteri was collected only with the open Bongo net, being virtually absent in vertical samples. This was probably due to avoidance reactions. It was common but never abundant in the warmed surface layer of the Bellingshausen Sea and southern Drake Passage (Fig. 7). Average densities became lower at the surroundings of the Weddell-Scotia Confluence and the species was not collected in the Weddell water mass. It was recorded only three times in the central waters of the Bransfield Strait, always in low densities. Its scarceness in the Bransfield Strait waters had been previously observed by Mackintosh (1934) and Lana & Blankensteyn (in press). **Rhynchonereella bongraini** was recorded throughout the studied area, being better represented in oblique Bongo samples (Fig. 8). It

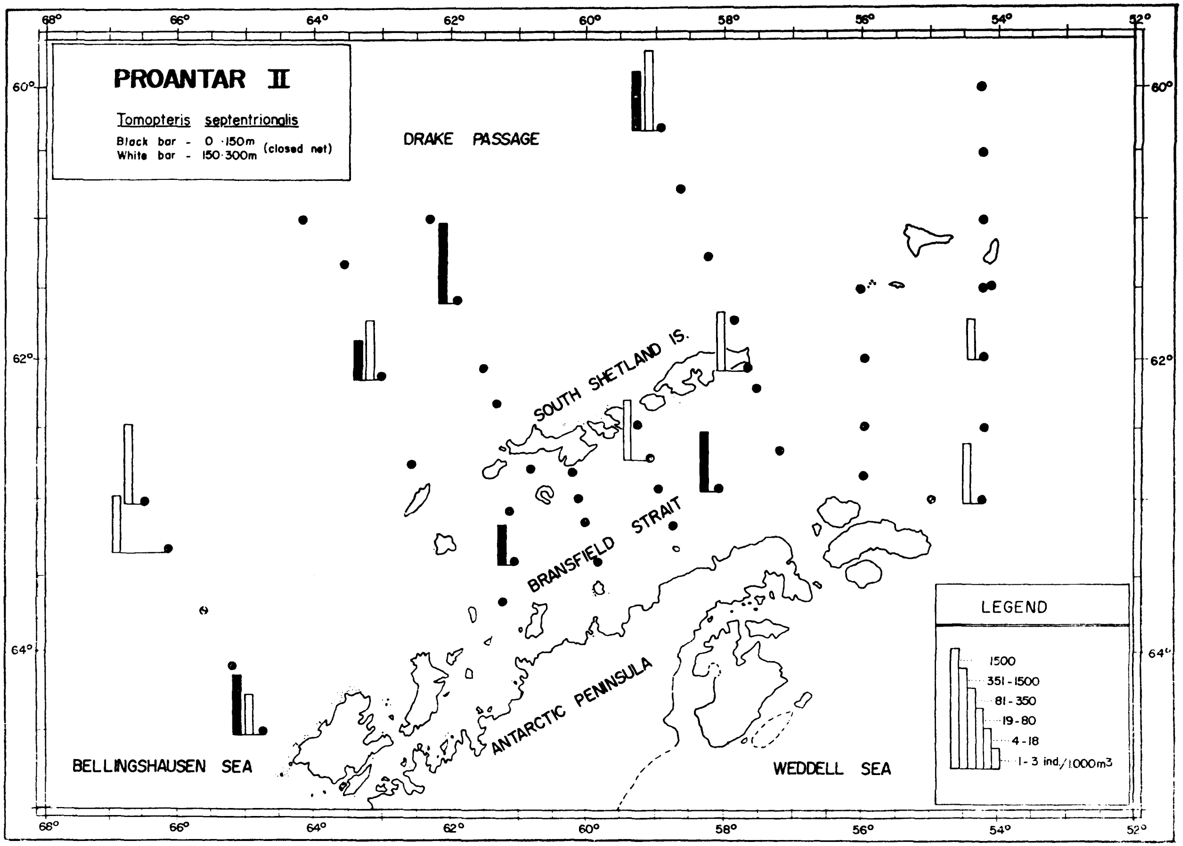

Fig. 5 — Distribution and abundance of **Tomopteris septentrionalis** in survey area.

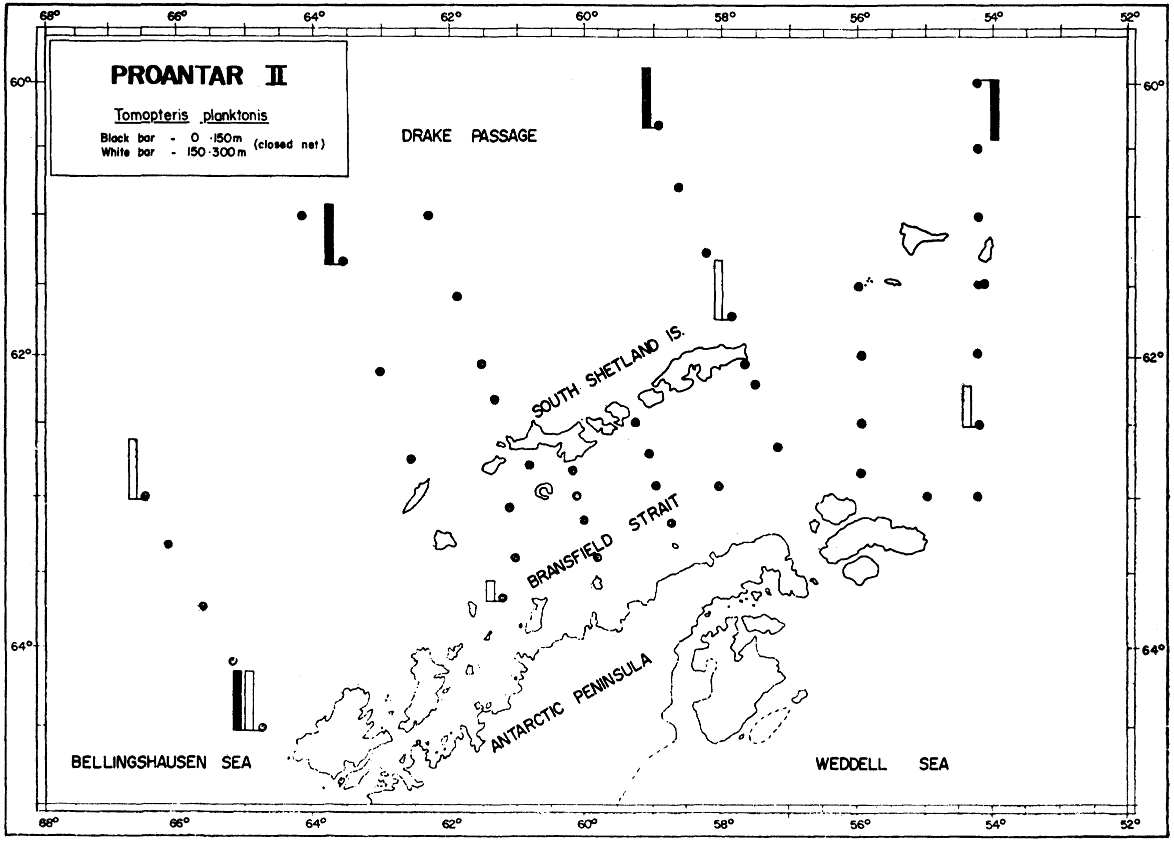

Fig. 6 — Distribution and abundance of **Tomopteris planktonis** in survey area.

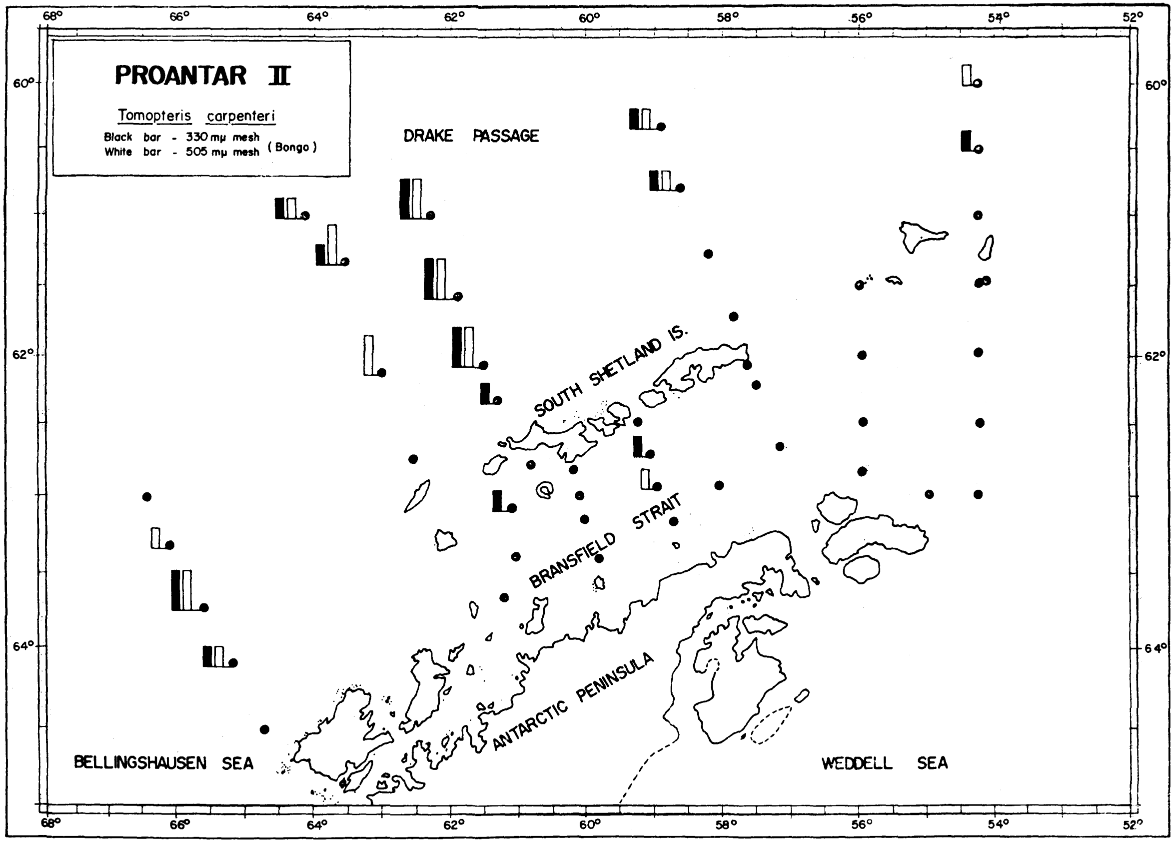

Fig. 7 — Distribution and abundance of **Tomopteris carpenteri** in survey area.

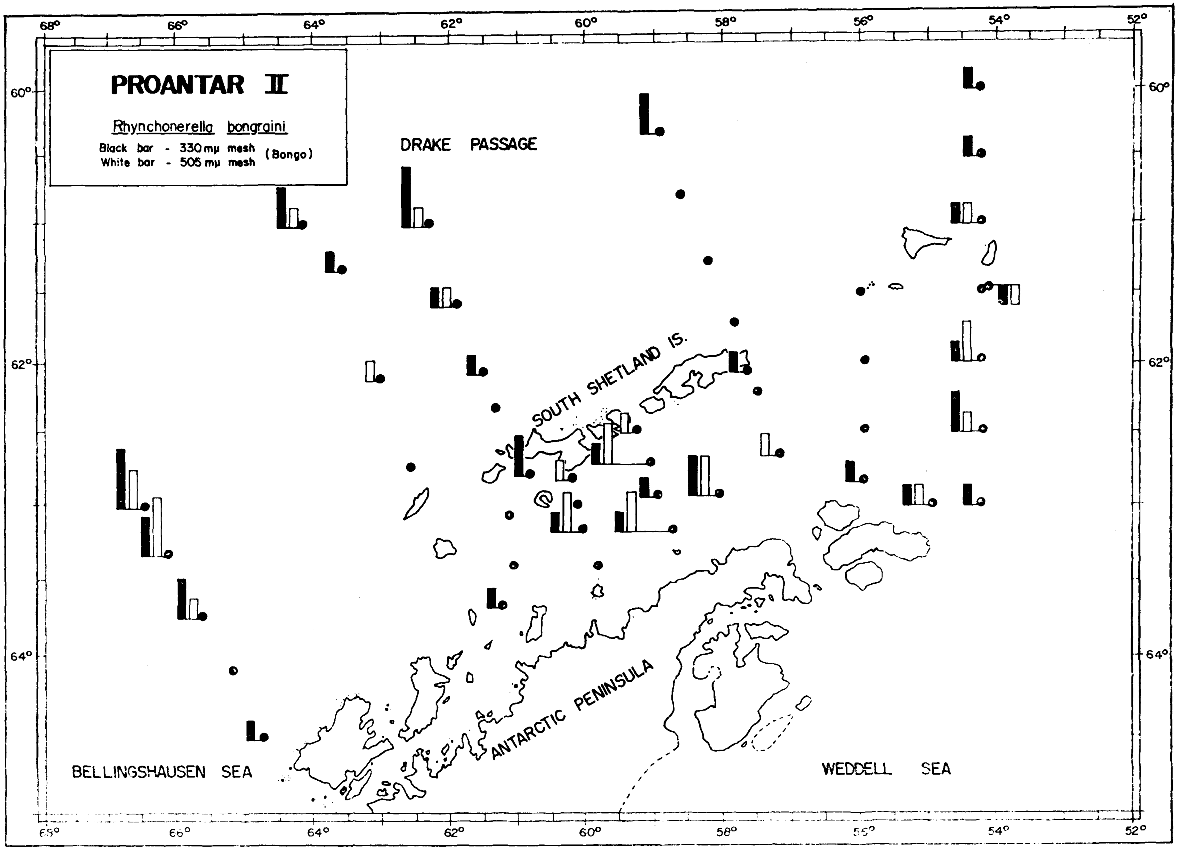

Fig. 8 — Distribution and abundance of **Rhynchonereella bongraini** in survey area.

was more common in Antarctic Surface Water, both of Weddell and Bellingshausen origin and less frequent in Warm Deep Water. It was along with **Pelagobia longicirrata** the only common species in the central waters of Bransfield Strait, both in the surface and subsurface layers. Its distribution inside the Strait is congruent with the penetration of the Weddell water mass. Its affinity for colder water masses in this region was previously appointed by Lana & Blankensteyn (in press). Average densities were also lower at the Weddell-Scotia Confluence, which was considered to be its northern limit of distribution by Tebble (1960).

Pelagobia longicirrata was the most common and spread polychaete species in the whole area, being well represented in oblique and vertical samples (Figs. 9 and 10). It was collected both in Antarctic Surface Water and Warm Deep Water. Its highest density (2,600 inds/1,000m^3) was recorded in ASW, in the southern Drake Passage (Fig. 9). Mean size of individuals was clearly smaller in ASW of Bellingshausen and southern Drake Passage and bigger in the Bransfield and Weddell water masses, as show in Fig. 9 — in these areas, practically all individuals were collected by the 330mμ Bongo net. It is impossible to know, with the available data, if the species constitutes separated populations in the two sectors or if reproduction takes place in oceanic waters, with the development to adult stages nearshore, in the colder waters of the continental antarctic shelf. The occurrence of **P. longicirrata** in the Bransfield Strait was related to the penetration of the colder Weddell water mass. Contrary to Jazdzewski **et al.** (1974) findings, **P. longicirrata** was common both at surface and subsurface in the central waters of the Bransfield Strait. It was absent in the Weddell-Scotia Confluence (Figs. 9 and 10).

Typhloscolex muelleri was a rare species (Fig. 11); it was recorded both in Warm Deep Water and in the subsurface layer of Antarctic Surface Water.

Maupasia caeca, Travisiopis levinseni, Vanadis antarctica and **Phalacrophorus pictus** were only sporadically collected. It is difficult to draw a reliable analysis of their distribution on account of the patchiness of records.

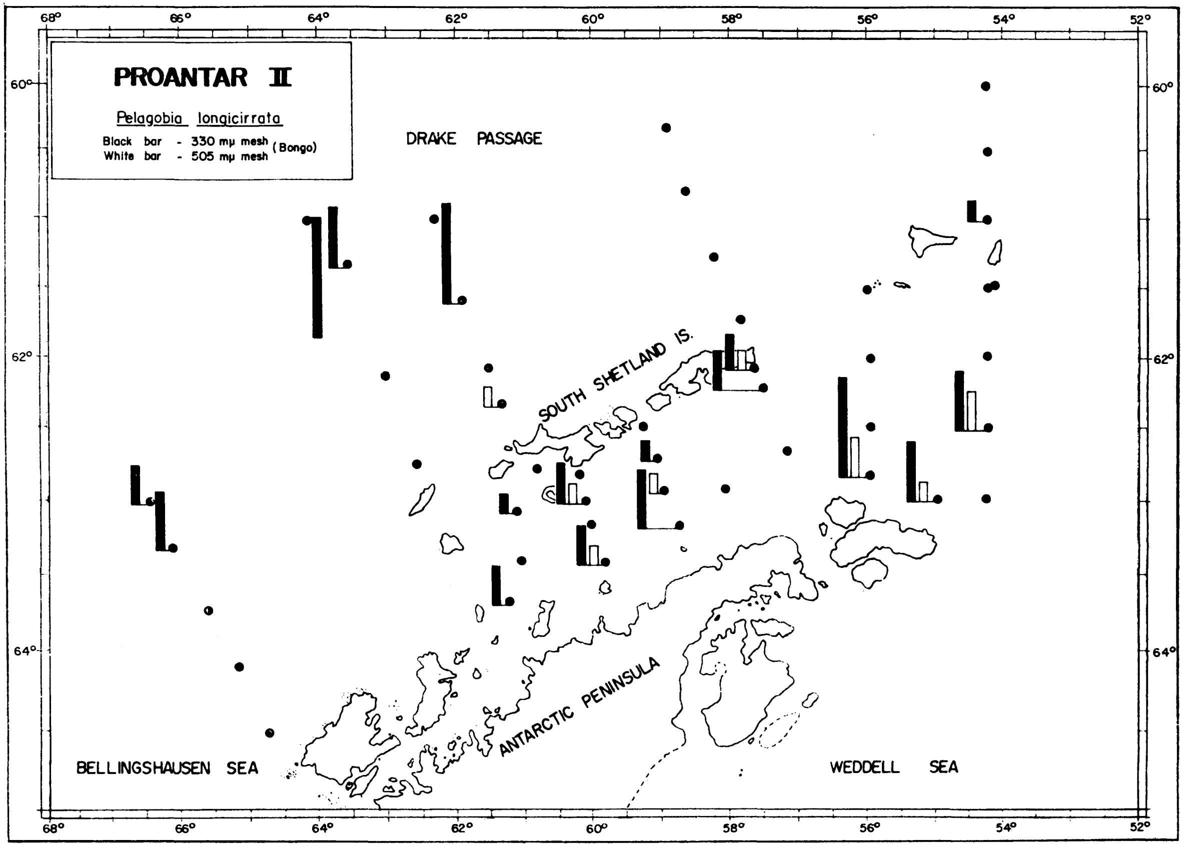

Fig. 9 — Distribution and abundance of **Pelagobia longicirrata** (Bongo net) in survey area.

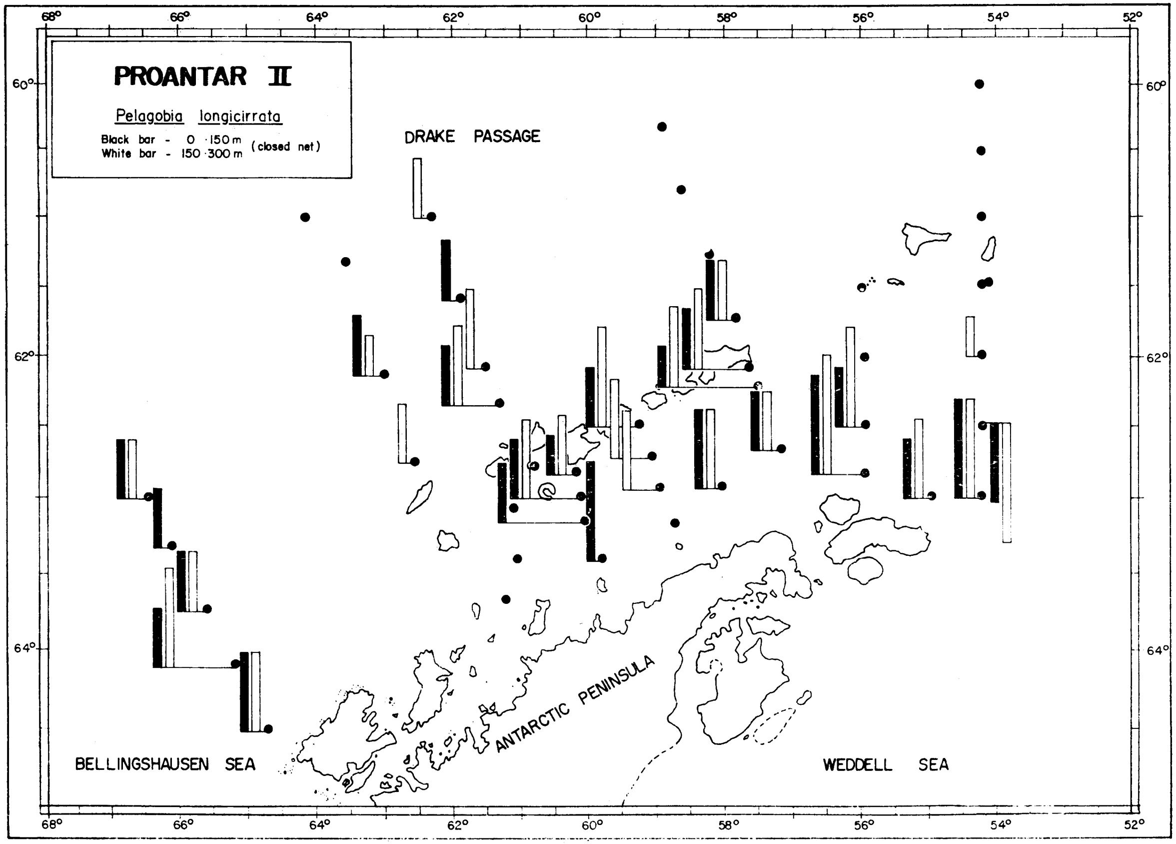

Fig. 10 — Distribution and abundance of **Pelagobia longicirrata** (closed net) in survey area.

Larval or epitokal forms of **Syllides articulosus, Herdmanella gracilis, Exogone heterosetosa** and **Autolytus** sp were, in general, more frequent in shallow stations of the continental shelf, just northeast of Trinity Peninsula. The greater abundance of larval forms in this area was previosuly remarked by Mujica & Torres (1982) and Lana & Blankensteyn **(in press).**

Chaetosphaera (Fig. 12) and later Spionid larvae (Fig. 13), belonging to one or more unidentified species, were rather frequent forms in the subsurface layers of the Bellingshausen Sea and in the southern Drake Passage, being absent or scarce in the more oceanic stations and in the Weddell-Scotia Confluence. Intermediate or low densities were recorded in the central waters of the Bransfield Strait and northeast of Trinity Peninsula, areas influenced by the Weddell water mass. Contrary to our personal observations, made in January-February 1983, records of Spionid larvae were scarce in the surface layers. It is possible that larvae keep nearer to the bottom, as summer goes on, following the development to adult stages.

The zonation of waters at Drake Passage was investigated by Nowlin **et al.** (1977) and Whitworth (1980). The studied area comprises the so-called Antarctic (Antarctic Surface Water of the Antarctic Circumpolar Current, in the Drake Passage) and Continental (shelf waters north of the South Shetland Islands and Weddel, Bransfield and Bellingshausen waters) Zones, separated by the Continental Water Boundary, that lies grossly paralel to the 500m isobath, close to the southern continental shelf. The composition and biomass of zooplankton communities are known to vary largely between these two zones (Mackintosh, 1934; Jazdzewski **et al.**, 1982; Rakusa-Suszczewski, 1983). Pelagic polychaetes were previously considered to be indicators of some hydrographic features of this area. **Pelagobia longicirrata** was found to be a faunistic indicator of the subsurface layer (150-300m) of the Bransfield Strait (Jazdzewski **et al.**, 1982), "predatory Polychaeta" of a transitional area between Antarctic and Continental Zones (Rakusa-Suszczewski, 1983) and **Rhynchonereella bongraini,** of the winter layer of Antarctic Surface Water, mainly of Weddell origin (Lana & Blankensteyn, in press).

None of these conclusions were supported by the present

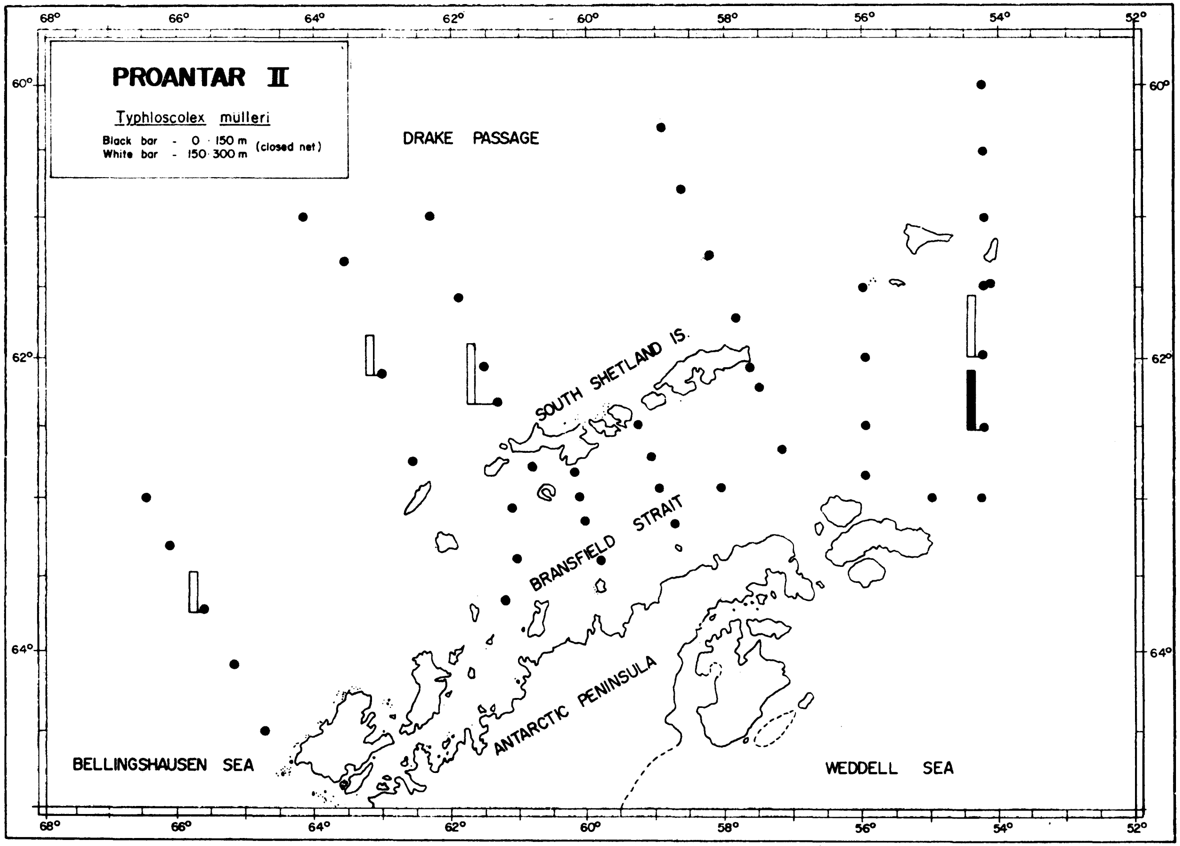

Fig. 11 — Distribution and abundance of **Typhloscolex muelleri** in survey area.

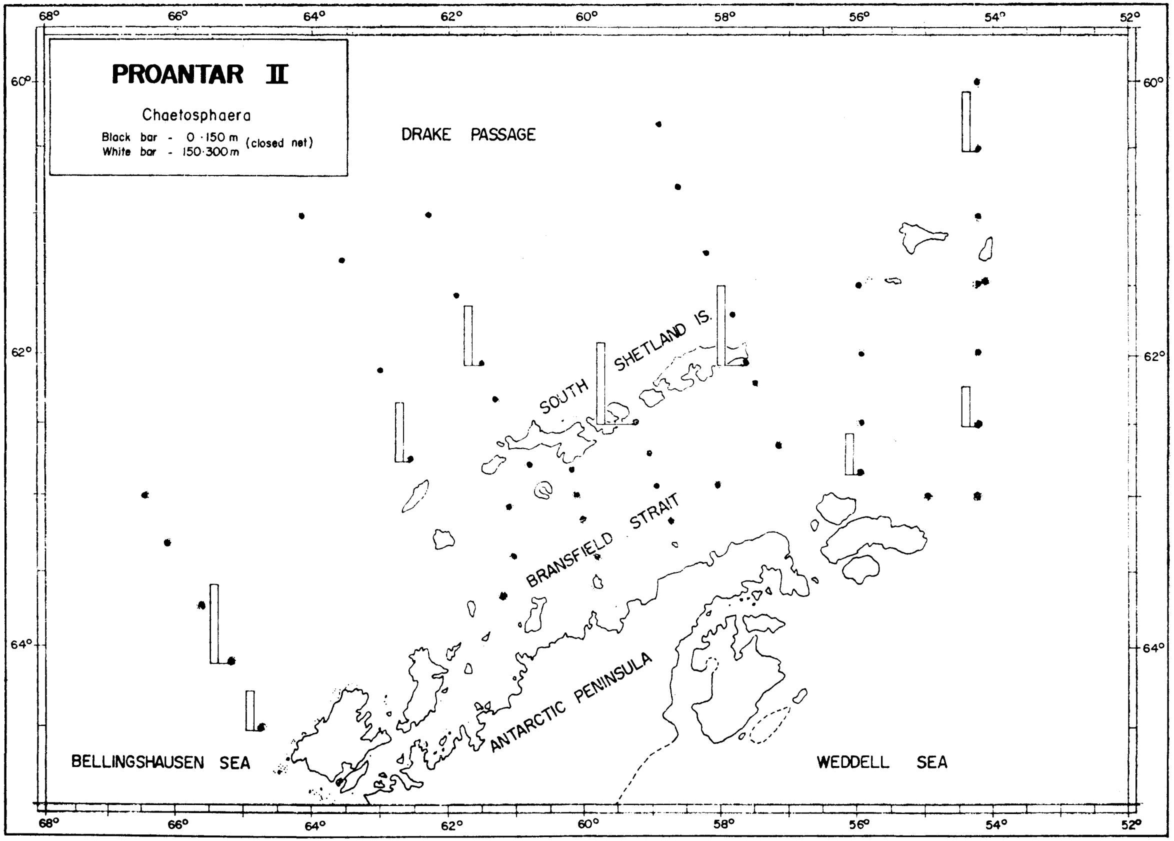

Fig. 12 — Distribution and abundance of Chaetosphaera in survey area.

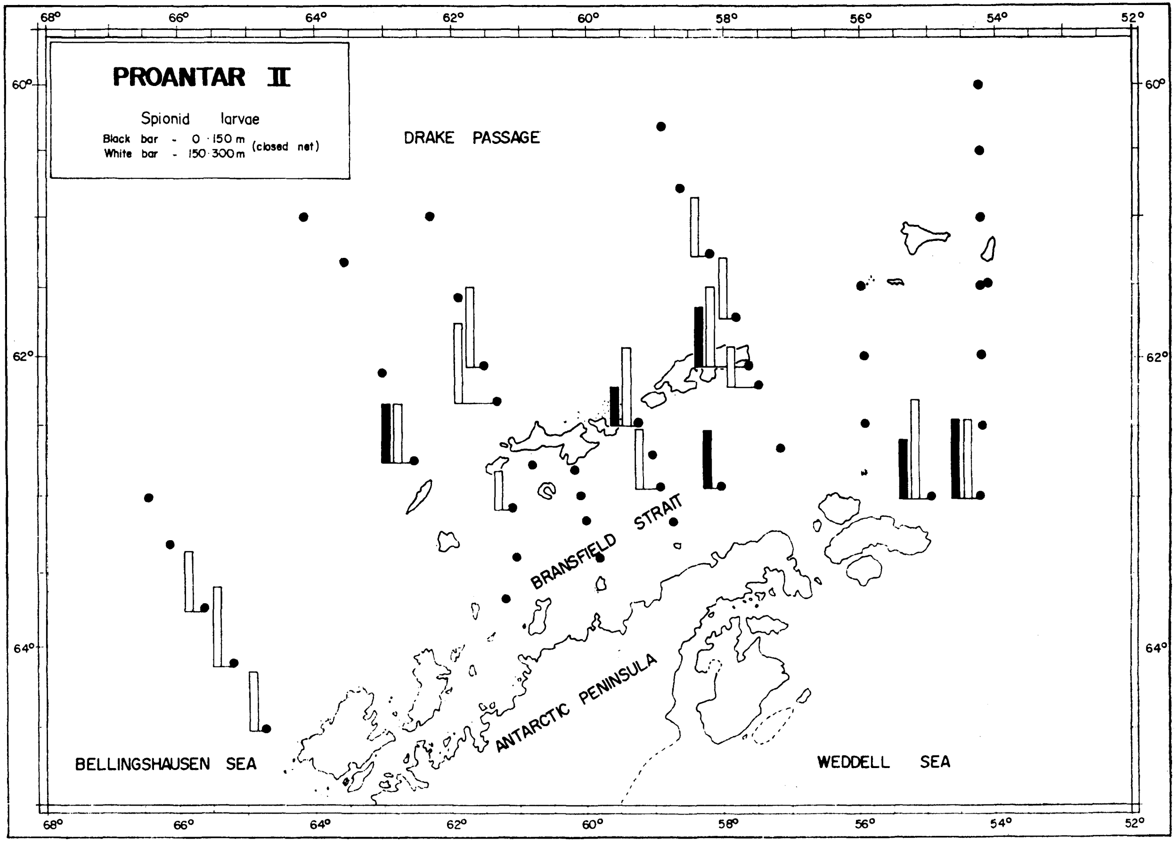

Fig. 13 — Distribution and abundance of Spionid larvae in survey area.

findings. During January-February 1984, no pelagic polychaete species showed exclusive or definite preference for particular water masses in the two zones of research and most of them were rare or even absent at the surroundings of the Weddell-Scotia Confluence and in the central waters of the Bransfield Strait. **Tomopteris carpenteri** was an exception, being more frequent in the Antarctic Zone; any way, this species is known to occur in all explored antarctic water masses at different depths (Tebble, 1960).

Distribution patterns of pelagic polychaetes were somewhat affected by the Weddell water mass. The dispersal of **Rhynchonereella bongraini** and **Pelagobia longicirrata** in the central waters of the Bransfield Strait was related, to a certain extent, to the penetration of that colder and more saline water mass. This fact, together with the observed scarceness of polychaetes in the meeting boundary of Weddell and Drake waters, seems to support Rakusa-Suszczewski's views (1983) about zooplankton distribution in this area, supposedly affected by the intensity and extent of the inflow from Weddell Sea water.

The basic conclusion to be drawn from our own and previous works on the subject is that particular species of pelagic polychaetes are not entirely reliable indicators of water masses in the investigated area. Though they can show some definite distribution patterns at specific times and localities, these patterns seem to suffer seasonal and yearly changes.

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