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HOLOPLANKTONIC POLYCHAETES OFF THE SOUTHWESTERN COAST OF BAJA CALIFORNIA, MEXICO, IN MARCH, 1977

María Ana Fernández-Álamo*

RESUMEN

Este trabajo está basado en el análisis de las muestras de zooplancton recolectadas frente a la costa occidental de Baja California (22°-26° N) por el Instituto Nacional de Pesca, México, del 1 al 14 de marzo de 1977. Se describe la composición específica de los poliquetos holoplantónicos y se relaciona la distribución y abundancia de cada especie con los tipos de agua indicados por los datos hidrográficos. Se encontraron 17 especies, de las cuales las más abundantes son *Tomopteris planktonis, Lopadorhynchus henseni, T.nationalis* and *Vanadis studeri.* Ninguna de las especies comunes, registradas en la literatura para la Corriente de California se observaron en el área de estudio, de lo cual se infiere una fuerte diferencia faunística.

Palabras clave: poliquetos pelágicos, porción sur del Sistema de la Corriente de California, riqueza de especies, biogeografía.

ABSTRACT

This study is based on the analysis of the zooplankton samples collected off the west coast of Baja California (22° -26° N) by the Instituto Nacional de Pesca, Mexico, during the cruise "Antonio Alzate 7702" in March 1-14, 1977. The specific composition of holoplanktonic polychaetes of these samples is described, and distribution and abundance of each species are explained by their relation with hydrographic data. There are 17 species, in which the most abundant are *Tomopteris planktonis, Lopadorhynchus henseni, T. nationalis* and *Vanadis studeri.* None of the common species from the California Current System, reported in the literature is recorded in the survey area from which, it is possible to infer a strong faunistic difference.

* Facultad de Ciencias UNAM, Laboratorio de Invertebrados, Apartado postal 70-371, 04510 México, D.F.

Key words: pelagic polychaetes, southern region of the California Current System, species richness, biogeography.

INTRODUCTION

Since the last two decades of the 19th century good correlations between the distribution of species of pelagic animals and the movements of water masses in the ocean has been found. Tebble (1958, 1960, 1962) confirms this fact in pelagic polychaetes. Stop-Bowitz (1948) found differences between the pelagic polychaetes fauna in the western and eastern parts of the North Atlantic, the first being richer, both in species and abundance. In addition some species occur in the eastern half, while they are absent in the western half or viceversa.

From an analysis of the distribution of pelagic polychaetes in the Pacific Ocean (Berkeley, 1930; Berkeley & Berkeley, 1957, 1958, 1960, 1961, 1963; Berkeley, 1967; Dales, 1955, 1957; Teeble, 1962; Fernández-Álamo, 1983) it is possible to note faunistic differences, particularly in some areas in the east region.

Information on geographical distribution of these polychaetes in the western Baja California region is scarce. There are only two records (Chamberlin, 1919) from the Albatross Expeditions: *Sagitella sp.* a, off Cabo San Lazaro (24° 55' N; 112°45' W) and *Tomopteris sp.* b, off Lower California (22°45' N; 110° 05' W) near Cabo San Lucas. Dales (1957) described and illustrated species from the northeastern Pacific (1949-1950) as part of the Marine Life Research Program of the Scripps Institution of Oceanography.

These collections included samples from the northwestern region of Baja California, southward to Punta Eugenia (27° N).

Cruise AA7702 was planned by the Instituto Nacional de Pesca (INP), Mexico, as part of a research project to study the northern anchovy and other commercial species of the southwestern coast of Baja California. Zooplankton samples and oceanographic measurements were obtained at 29 stations. The samples were donated to the Invertebrate Laboratory of the Faculty of Sciences, UNAM, Mexico for the study of invertebrate faunistic groups, after the icthyoplankton had been separated to be studied by the INP.

On this basis the purpose of this report is to assess the specific composition of the survey area, and describe the distribution of the holoplanktonic polychaetes in relation to their environment in the southern region of the California Current System.

MATERIAL AND METHODS

The plankton samples were collected by the R.V. "Antonio Alzate" of the Instituto Nacional de Pesca on Cruise AA7702 (March, 1-14, 1977). The positions of the

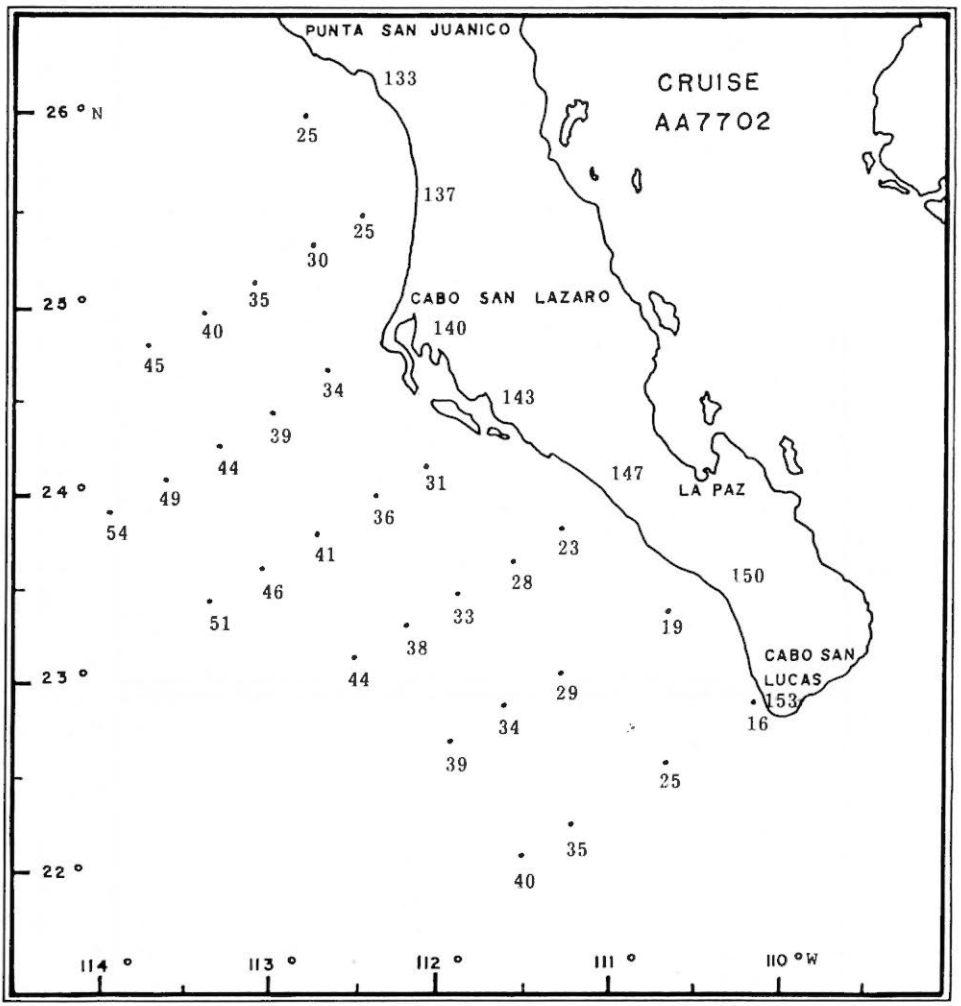
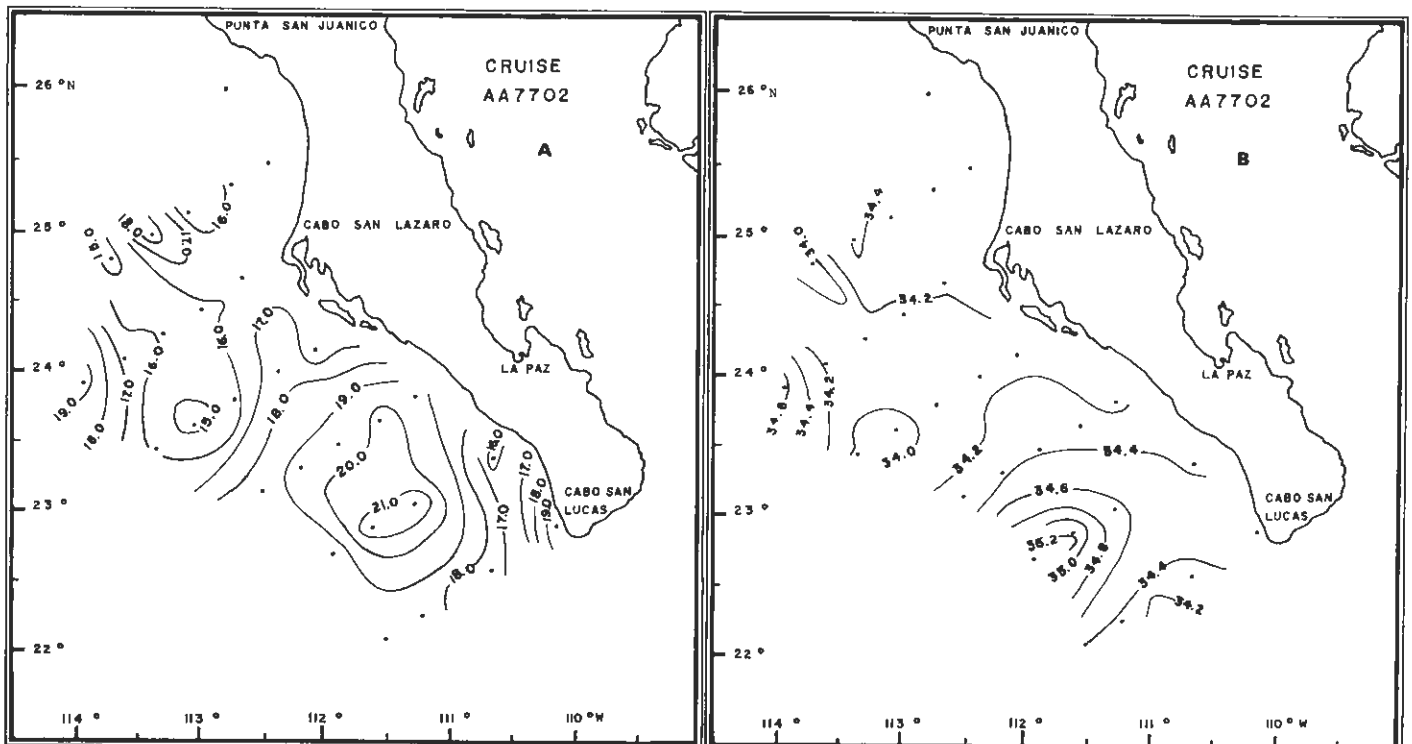


Fig. 1. Stations sampled during AA7702 Cruise of the Instituto Nacional de Pesca, Mexico (March 1-14, 1977). Numbers along the coast designate latitudinal transects.

collecting stations are shown in Fig. 1. An account of the cruise, including the position of the stations and the hydrographic data, can be found in Secretaría de Pesca (1988).

Oblique net tows were taken to a depth of about 200 m, using a bongo net with mesh apertures nominally of 0.33 mm width. The samples were preserved in 4% sea-water formalin and neutralized with a saturated borax solution.

All specimens of polychaetes were sorted, identified and counted. Identification of the species was based in Stop-Bowitz (1948), Dales (1957) and Tebble



Fg. 2. Distribution of A) temperature, °C, and B) salinity (‰) at 10 m depth, during March 1-14, 1977 (Secretaría de Pesca , Mexico 1988).

(1960, 1962). Species of the genus *Lopadorhynchus* were determined following the criteria of Kim (1967). Synonymies of the species can be found in Dales & Peter (1972). No data were available on the volumes of filtered water. However, estimates based on previous experience are in the range of 500-600 m^3 per tow (E. Brinton, Scripps Inst. Oceanogr. UCSD *pers. com.*), and the species abundance is expressed in number of organisms per 1000 m^3 of filtered water.

RESULTS

Hydrographic conditions

Horizontal maps show salinity and temperature at 10 m depth (Fig. 2) and 75 m depth (Fig. 3) throughout the surveyed region. The values of the temperature and salinity at 10 and 75 m depth, along stations lines can be seen in profile in figures 4 and 5. These show the pronounced variability of this region to which several water masses contribute: the California Current, the tropical water, coastal upwelling centers, and the offshore Central Pacific. In general, the distribution of temperature at the near-surface level shows a gradient which increases from about 18-19° C at the north to 22-23° C at the south (Fig. 2A).

At the 75 m level (Fig. 3A) there is a southward extension of cool (< 16°C) temperatures reaching 23.5° N, offshore. This patch with a relatively shallow thermocline is associated with low salinity water (<34 ‰, Fig. 3B) indicating upward displacement of California Current water, possibly in a cyclonic gyre centered near Station 143.46.

Farther south, the opposite takes place offshore on lines 147 and 150 (22.5-23.5° N), with highest temperatures (>20° C) and highest salinities (34.6-35.2 ‰) at 75 m, suggesting tropical water in an anticyclonic eddy with a deeper thermocline. The transition zone is between lines 143 and 147. Along the coast there is some evidence of upwelling on most lines and of northward extension of warm water at the south (Figs. 3A, 5).

Systematics

A total of seventeen species representing eleven genera and five families were determinated.

TOMOPTERIDAE Grube

Polychaetes characterized by parapodial reduction to biramous achaetous paddles with notopodia and neuropodia modified for swimming into membranous structures named pinnules. These structures may carry various types of glands includ-

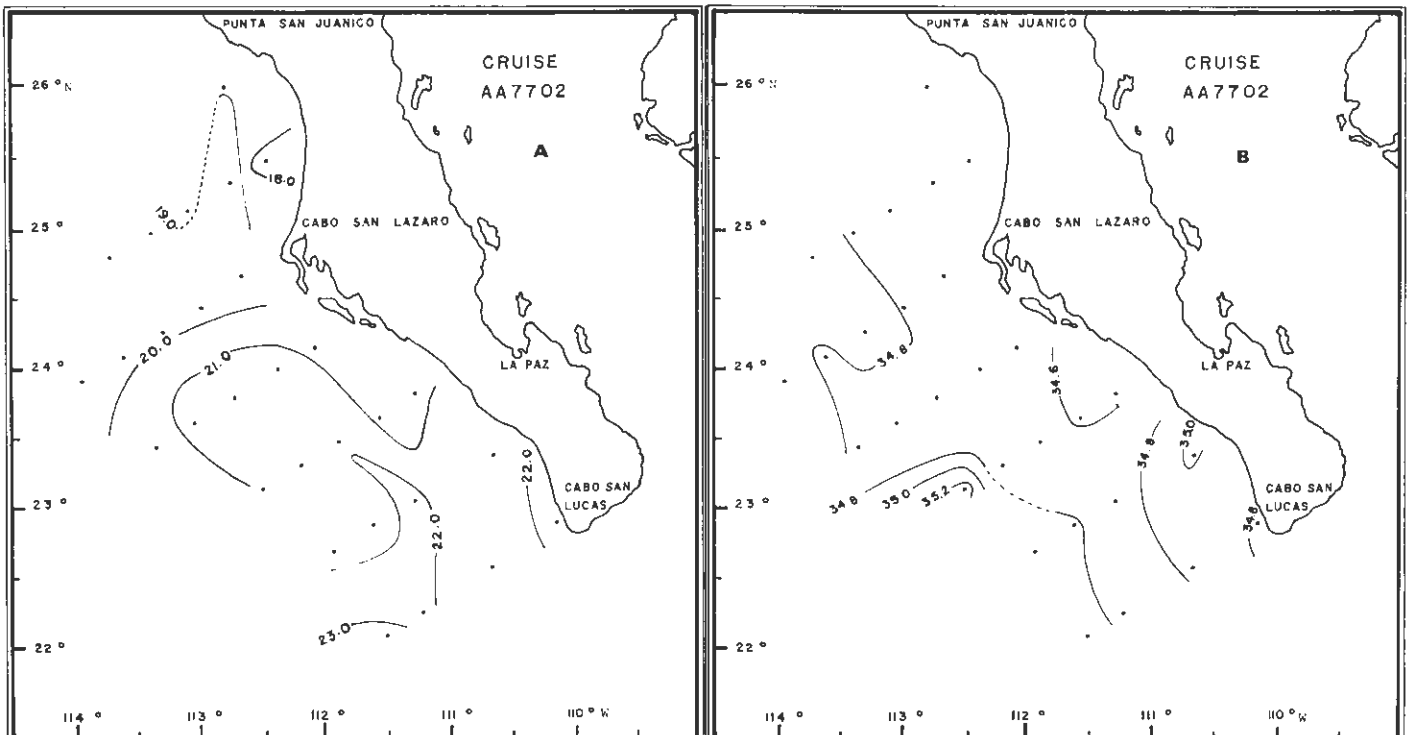


Fig. 3. Distribution of A) temperature, °C and B) salinity (‰) at 75 m depth, during March 1-14, 1977 (Secretaría de Pesca, Mexico 1988).

ing chromophils, hyalines, rosettes and spurs. Dales (1957) gives a good description of these organs.

Very little information about the biology of the members of this family is available. In general, nothing is to be seen in the transparent gut. Ushakov (1972) believes that they are voracious predators.

In the survey area four species belong to the Tomopteridae: *Tomopteris planktonis* Apstein, 1900; *T. nationalis* Apstein, 1900; *T. elegans* Chun, 1887; *T. euchaeta* Chun, 1887.

LOPADORHYNCHIDAE Claparède

Worms with body flattened. Prostomium broad with four antennae, no palps and poorly developed eyes. Eversible proboscis, simple and unarmed. With three tentacular cirri on the first one or two segments which may lack setae. Parapodia uniramous with dorsal and ventral cirri. Setae mainly compound. Pygidium without cirri.

Practically nothing is know of the biology of this group. None have ever been found with food in its gut, but certainly they do not feed on phytoplankton (Day, 1967). Uschakov (1972) mentions that the simple hook-shaped setae of the first modified parapodia of *Lopadorhynchus* might hold the prey.

Five species of this family are reported here: *Lopadorhynchus henseni* Reibisch, 1893; L. *krohni* (Claparède), 1870; *L. uncinatus* Fauvel, 1915; *Maupasia coeca* Viguier, 1886; *Pelagobia longicirrata* Greeff, 1895.

ALCIOPIDAE Ehlers

The main diagnostic character of the members of this family is a single pair of large and complex eyes. Prostomium small with four, five or six antennae. There are three, four or five pairs of tentacular cirri and an eversible proboscis, with short papillae or long terminal horns. Body slender and elongate with numerous segments, almost always broken into fragments. A pair of anal cirri.

It is assumed by the presence of eversible muscular proboscis, sometimes provided with a pair of lateral projections for grasping prey, that alciopids are predators, however the nature of the prey is unknown (Day, 1967). By the presence of this structure, their complex eyes, and their behavior Ushakov (1972) thinks they are active predators. Rice (1987) describes the behavior, *in situ*, of some species of this family from the Bahamas Islands in the Western Atlantic Ocean. He gives new information of morphology using electron microscopy and discusses aspects of reproduction, systematics and evolution of alciopids.

In this study five species belong to the Alciopidae: *Vanadis studeri* Apstein, 1893; *V. minuta* Treadwell, 1936; *Rhynchonerella angelini* (Kinberg, 1866); *Plotohelmis capitata* Greeff, 1876; *Alciopina parasitica* Claparede & Panceri, 1867.

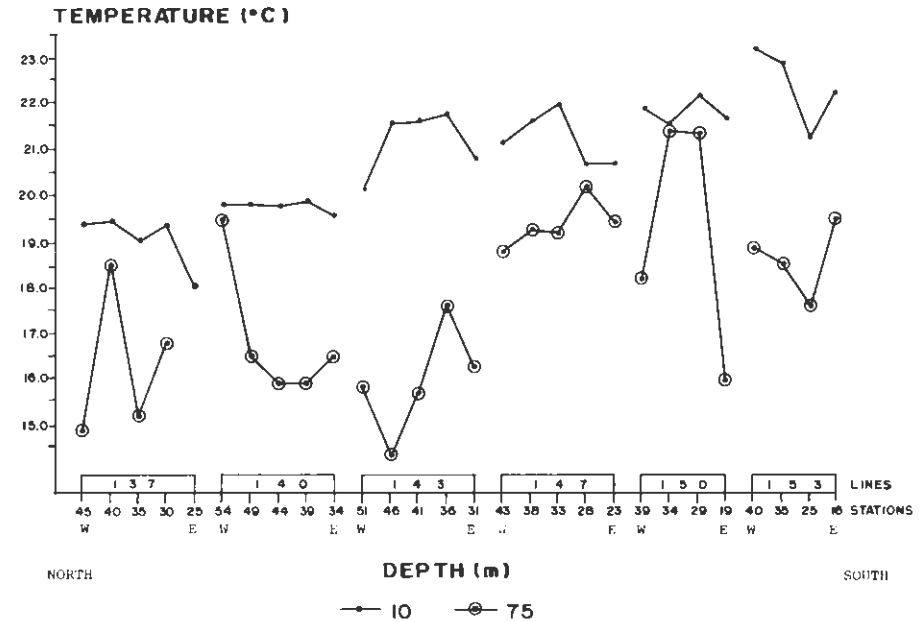


Fig. 4. Vertical distribution of temperature along the lines of the survey area, during March 1-14, 1977.

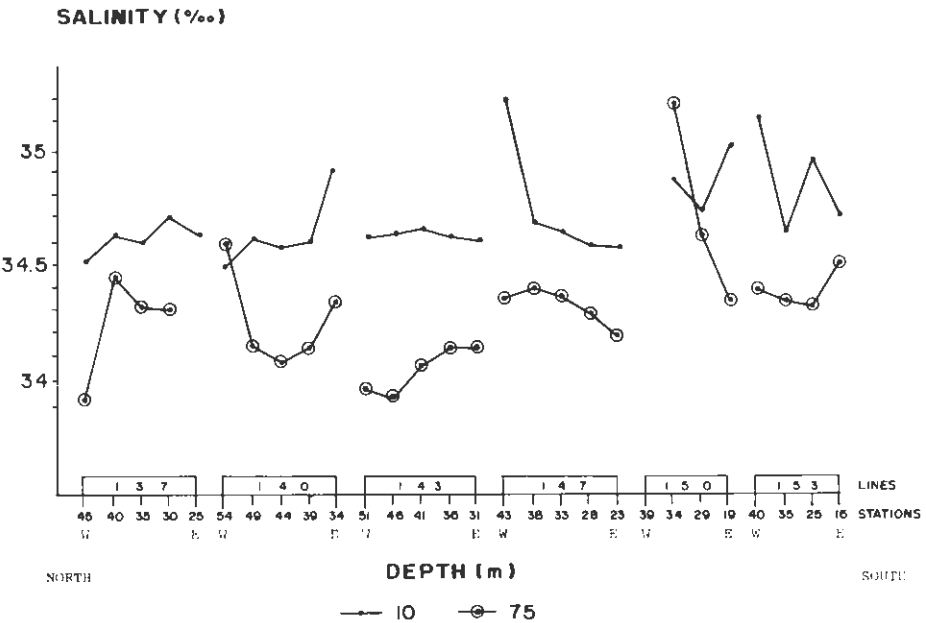


Fig. 5. Vertical distribution of salinity along the lines of the survey area, during March 1-14, 1977.

TYPHLOSCOLECIDAE Uljanin

Worms highly specialized, with fusiform and transparent body. Prostomium indistinct to the rest of the body and projected forward into a small papilla. Without eyes, with well developed nuchal organs which often form free posterior projections. Pygidium with a pair of flattened anal cirri.

These worms have been considered to be ectoparasites of gelatinous animals, as chaethognaths or medusa. By their characteristic suction apparatus instead of a proboscis, they could be considered to he semi-parasites (Ushakov, 1972). Feigenbaum (1979) has regarded the possibility that typhloscolecids are predators of chaethognaths.

In the survey area the typhloscolecids are represented by two species: *Typhloscolex mulleri* Bush, 1878; *Sagitella kowalewski* Wagner, 1872.

IOSPILIDAE Bergström

Small worms with prostomium rounded, without antennae. Two minute palps and two eyes. Proboscis eversible, with or without a pair of lateral chitinous hooks. First two or ten segments of the body with reduced parapodia. Later parapodia uniramous with short dorsal and ventral cirri, a longer setigerous lobe and compound spinigerous setae.

Day (1967) mentions that species of the genus *Iospilus* include some of the few holoplanktonic polychaetes which feed on diatoms, and species of *Phalacrophorus* which have chitinous hooks are possibility predators. Ushakov (1972) thinks that these jaws are developed as adaptive structures to the pelagic life, for catching rapidly moving planktonic organisms.

Only one species was found in the survey area: *Phalacrophorus uniformis* Reibisch, 1895.

Distribution of species

Relative overall abundances of the species, their percentage of occurrence at stations and zoogeographic affinities are found in Table 1.

The total number of specimens caught was 995; *Tomopteris planktonis*, and *Lopadorhynchus henseni*, accounted for almost 85% of this taxocenosis, followed by *Vanadis studeri* and *T. nationalis* for almost 9%. These four species also had the highest frequency, with 90, 82, 65 and 52% of occurrence, respectively. Following, in order of frequency, were *Sagitella kowalewski* (28%) and *Pelagobia longicirrata* (21%) with percent abundance of 1.6 and 1.2, respectively.

Typhloscolex mulleri, *Plotohelmis capitata* and *Rhynchonerella angelini* had lower percent abundance values (lower than 1%). The rarest eight species occurred at

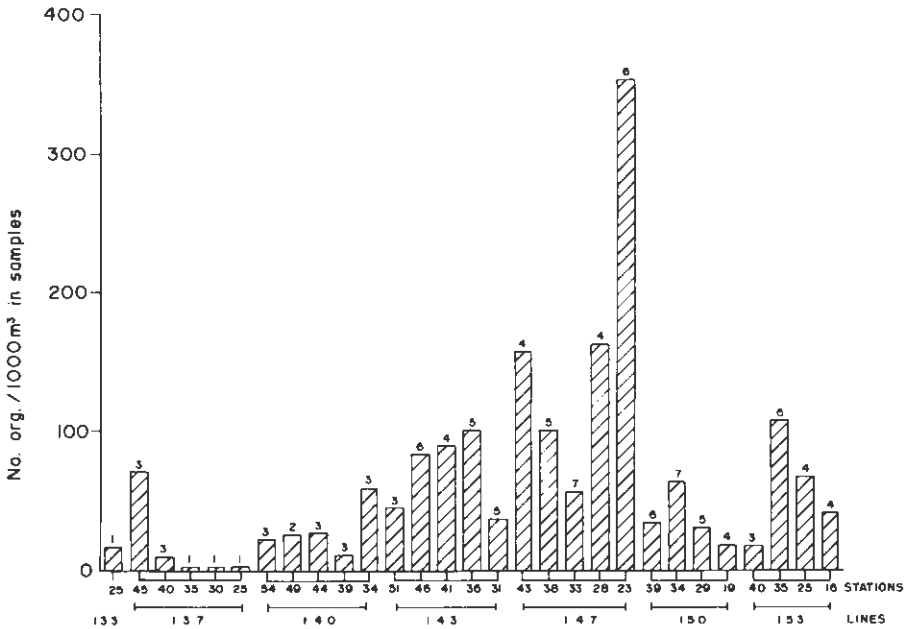


Fig. 6. Distribution of the estimated abundance of holoplanktonic polychaetes in the southwest region of Baja California, Mexico. Volume of water strained is estimated at 500-600 m^3. Numbers above each column represent the richness of species.

only one locality, with one or two specimens, except *Tomopteris elegans* which was represented by 15 specimens.

The general distribution and species richness in the survey area, are shown in Fig. 6. Distribution of the four most abundant species, in each line, appear in Fig. 7.

DISCUSSION

The survey area is part of the southern region of the California Current System whose hydrographic characteristics were described by Reid *et al.* (1958), Wyllie (1966), Lynn *et al.* (1982) and Lynn and Simpson (1987). In general, salinity and temperature above 75 m depth in March, 1977, were similar to values in summer (June and August, 1964), as recorded from nearly the same area by Longhurst (1967). This similarity may be attributed to consistently above average temperatures in the California Current System during 1976-1977 (McLain *et al.* 1985). Particularly high salinity values, above 35 ‰, are unusual in the upper water layers of this region and are expected to indicate a tropical water type. There was one observation of near-surface salinity higher than 35 ‰ in the region between Punta Eugenia and Bahía Magdalena during February-March and September, 1983 (Cervantes & Hernández-Trujillo, 1989).

Table 1. Holoplanktonic polychaetes from the southwest region of Baja California during March 1-14, 1977

Species	F	Relative abundance	OCC %	Biogeography affinity
Tomopteris planktonis	T	52.26	90	Cosmopolitan
T. nationalis	T	3.32	65	Trop-subtropical
T. elegans	T	1.51	03	Trop-subtropical
T. euchaeta	T	0.10	03	Trop-subtropical
Lopadorhynchus henseni	L	32.66	82	Trop-subtropical
L. krohni	L	0.20	03	Trop-subtropical
L. uncinatus	L	0.10	03	Trop-subtropical
Maupasia coeca	L	0.10	03	Trop-subtropical
Pelagobia longicirrata	L	1.21	21	Cosmopolitan
Rhynchonerella angelini	A	0.20	07	Trop-subtropical
Vanadis studeri	A	5.53	52	Tropical
V. minuta	A	0.10	03	Trop-subtropical
Plotohelmis capitata	A	0.20	07	Tropical
Alciopina parasitica	A	0.20	03	Tropical
Typhloscolex mulleri	TY	0.60	10	Cosmopolitan
Sagitella kowalewski	TY	1.61	28	Cosmopolitan
Phalacrophorus unifromis	I	0.10	03	Trop-subtropical

T= Tomopteridae; L= Lopadorhynchidae; A= Alciopidae; TY= Typhloscolecidae; I= Iospilidae

The most abundant and widespread species, *Tomopteris planktonis* is a true cosmopolitan species. In general, it was most abundant in stations with the highest values in surface temperature, except in the southern line 153. And it was least abundant in stations with evidence of upwelling water, both in the north and in the south (Fig. 7).

Tomopteris planktonis was also dominant in the Gulf of California in the summer of 1977 (Fernández-Álamo, 1991). However, Dales (1957) found it (as *T. cavalli*) sparsely distributed in the surface waters from the California Current during 1949-1950, and he writes "In July (1949), for example, maximum numbers of 25-50 worms in 1000 m^3 were found, but over most of the area surveyed this species has been found in much smaller numbers. It was found to be more numerous in deeper hauls taken in Monterey Bay (Dales, 1955)".

Lopadorhynchus henseni and *Vanadis studeri*, have been confused with *L. krohni* and *V. minuta*, respectively. A careful revision of their distributions in the North Pacific is necessary. Tentatively, they have been considered to have warm-water affinities (Fernández-Álamo, 1991). *T. nationalis* has a tropical-subtropical distribution, but Dales (1957) recorded only one specimen from the California Current. The three species cited above have better distribution in Lines 147 to 153, associated with tropical water (Figs. 3A, 3B).

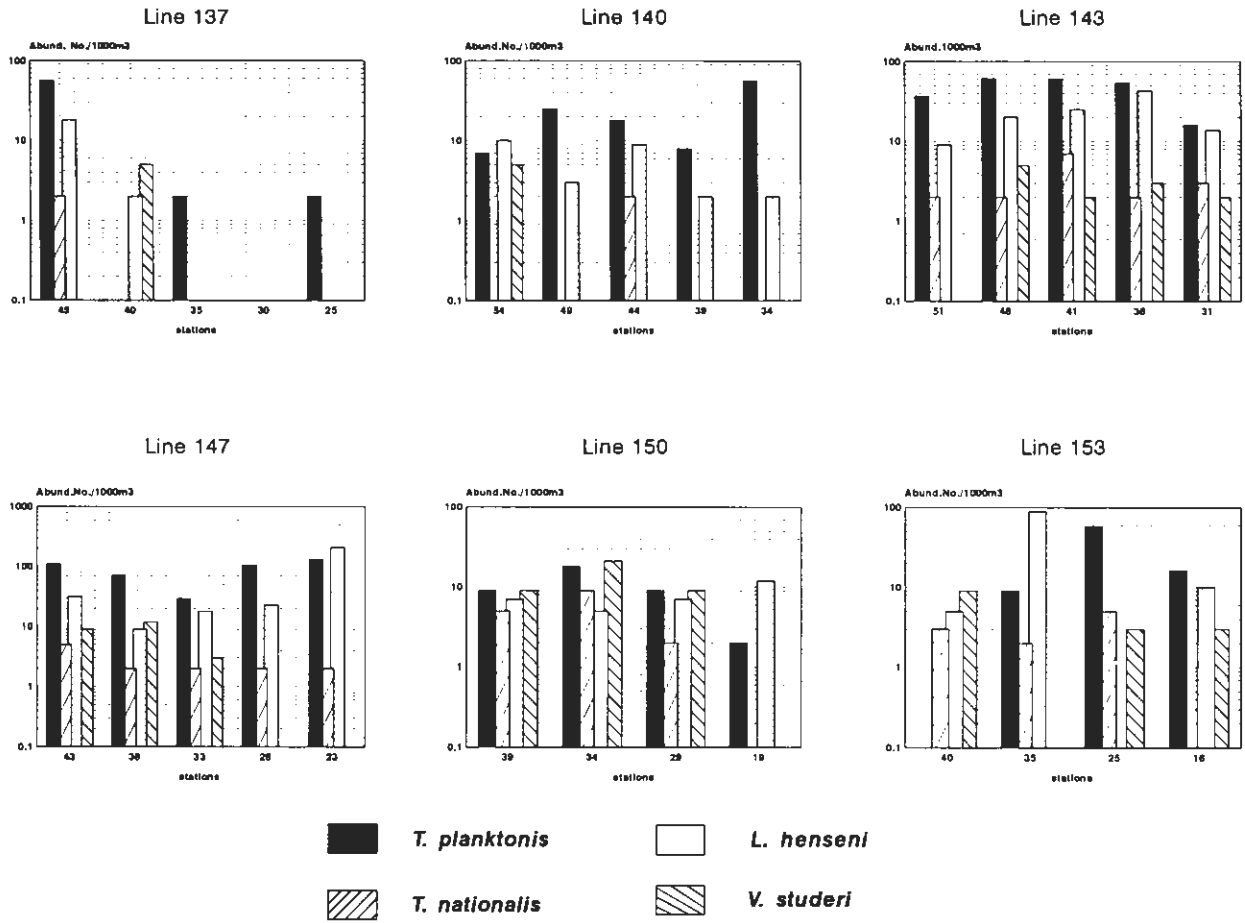


Fig. 7. Distribution of the estimated abundance of *Tomopteris nationalis*, *T. planktonis*, *Lopadorhynchus henseni*, and *Vanadis studeri* during March 1-14, 1977 in the southwestern region of Baja California, Mexico.

Also, *Plotohelmis capitata* and *Alciopina parasitica* occurred only in stations with surface temperatures between 21.5 and 21.9°C and salinities between 34.6 and 35 ‰ ; these species are considered as having warm-affinities, at least in the eastern Pacific (Fernández-Álamo, 1983). Their presence (in August, 1977) in the Gulf of California agrees with the summer pattern of water circulation (Fernández-Álamo, 1991). In general, all of these surface characteristics agree with temperature and salinity features of the Central Pacific Water and Tropical Surface Water (Longhurst, 1967).

Tomopteris euchaeta was collected at only one locality in the southern transect, with high surface temperature (22.8°C) and intermediate salinity (34.6 ‰). This species (referred as *Enapteris euchaeta*) was recorded from the North Atlantic by Stop-Bowitz (1948) and he considered that it belongs to the warmer parts of this Ocean. *T. euchaeta* was previously recorded from the eastern Tropical Pacific by Fernández-Álamo (1983), where it was observed through five periods between 1967 and 1968, showing sparse distribution.

Plotohelmis capitata, Alciopina parasitica and *Tomopteris euchaeta* were not recorded in the California Current by Dales (1957) or in the North Pacific by Tebble (1962). Apparently their occurrences in the survey area supports that they have warm-water affinity, agrees with the results of Fernández-Álamo (1991)in the Gulf of California.

Another interesting feature of the study region is a southward increment in both abundance and species richness. Similar results have been recorded in other zooplankton groups, in the southwestern region of Baja California e.g., Longhurst (1967) for copepods, euphausids, chaetognaths; Funes-Rodríguez & Hernández-Trujillo (1988) for myctophids larvae and copepods; Sánchez-Hidalgo (1989) for holoplanktonic gastropods; Hernández-Trujillo (1989a, b) for copepods; Haro (1991)for copepods, chaetognaths, siphonophores and fish larvae. In general the highest values of abundance and specific richness were found in line 147, which had the most homogeneous features in salinity and temperature in the vertical profile at 75 m depth.

In addition to these results it must be stressed that none of the common species of holoplanktonic polychaetes reported by Dales (1957) in the California Current, is recorded in this study, for example *Torrea candida, Naiades cantraini, Vanadis formosa, V. crystallina* or *Plotohelmis tenuis.*

From these results, and from the reports of the holoplanktonic polychaetes species in the north and central regions of the California Current System (Moore, 1908; Berkeley, 1930; Treadwell, 1943; Berkeley & Berkeley, 1957, 1958, 1960; Dales, 1955, 1957; Tebble, 1962), it is possible to infer a strong faunistic difference among portions of the Current System. In view of the possibilities of correlation of distributions of some species of pelagic polychaetes with the movements of water masses (Stop-Bowitz, 1948; Tebble, 1958, 1960, 1962; McGowan, 1960), further studies on the distribution of those animals in the California Current System should contribute to the understanding of this oceanographic region.

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