HOLOPLANKTONIC POLYCHAETES FROM THE GULF OF CALIFORNIA: AUGUST–SEPTEMBER 1977

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ABSTRACT

This study is based on zooplankton samples collected by Instituto Nacional de Pesca, México (August–September 1977) with a standard open net, at 41 stations in the epipelagic region of the Gulf of California. The seventeen species of holoplanktonic polychaetes that were determined represent new records from this region. *Tomopteris planktonis*, with a relative abundance of 73%, and 85% of occurrence, was the dominant species.

With respect to their biogeographical affinities, most species belong to a subtropical-tropical pattern, three species are true cosmopolitans, and two have warm-water affinities. The data agree with the general patterns of distribution recorded for other groups of zooplankton in the epipelagic region of the Gulf of California.

RESUMEN

Este estudio se basó en las muestras de zooplancton recolectadas por el Instituto Nacional de Pesca, México, en agosto-septiembre de 1977, con una red estandar, en 41 estaciones en la región epipelágica del Golfo de California. Se determinaron diecisiete especies de poliquetos holoplantónicos, que constituyen nuevos registros para esta región. *Tomopteris planktonis* fue la especie dominante, con una abundancia relativa de 73% y una ocurrencia de 85%.

Por sus afinidades biogeográficas la mayoría de las especies pertenecen al patrón subtropical-tropical, tres especies son verdaderamente cosmopolitas, y dos tienen afinidad por aguas cálidas. Estos datos coinciden con los patrones generales de distribución observados en otros grupos del zooplancton en la región epipelágica del Golfo de California.

INTRODUCTION

Little information is available on the distribution of the pelagic polychaetes from the Gulf of California. Of the pelagic forms of benthic species, species of the families Nereidae and Syllidae were recorded by Gravier (1901), who described a Heteronereid form collected by Diguet between Loreto and Carmen islands; Treadwell (1929) described *Ceratonereis singularis* from San José and Carmen islands; and Steinbeck and Ricketts (1971) recorded pelagic forms of *Ceratonereis tentaculata*, *Platynereis poliscalma*, *P. agassizi*, *Perinereis* sp., *Neanthes* sp., and a pelagic form of *Amblyosyllis* sp. from La Paz and Cabo San Lucas.

No records of holoplanktonic species of the families Tomopteridae, Alciopidae, Lopadorhynchidae, Typhloscolecidae, Pontodoridae, and Iospilidae have been found.

In general, knowledge of the pelagic polychaetes in the Pacific Ocean is contained in a few papers. Dales (1957) included literature records and reported the distribution of the species in the northeast Pacific, from Cape Disappointment, Oregon (about 47°N), to Punta Eugenia, Mexico (about 27°N). Tebble (1962) analyzed the distribution of these animals in the North Pacific, and Fernández (1983) in the Eastern Tropical Pacific. The purpose of this report is to extend our knowledge of the distribution patterns of these annelids to the Gulf of California.

METHODS

The plankton samples examined were collected from the R/V *Antonio Alzate*, Instituto Nacional de Pesca, México, between August 27 and September 6, 1977, on Cruise AA-77-04 in the Gulf of California. The locations of the stations from which samples were collected are shown in figure 1. Oblique net tows were taken from the epipelagic region (0–200 m) with a standard open net (1-m diam., 0.5-mm mesh size) fitted with a flowmeter in its mouth. The samples were preserved in 4% seawater Formalin and neutralized with a borax-saturated solution. The pelagic polychaetes were sorted out from the total sample, identified, and counted. Estimates of abundance were standardized to 1000 m^3 of water strained; ranges of abundance follow Frontier (1969): 1–3, rare; 4–18, low; 19–80, intermediate; and 81–350, high.

A report containing hydrographic data has been issued for *Antonio Alzate* Cruise AA-77-04 by Alvarez (1988). The distribution of temperature and salinity isolines at 10-m and 50-m depths are shown in figures 2 and 3.

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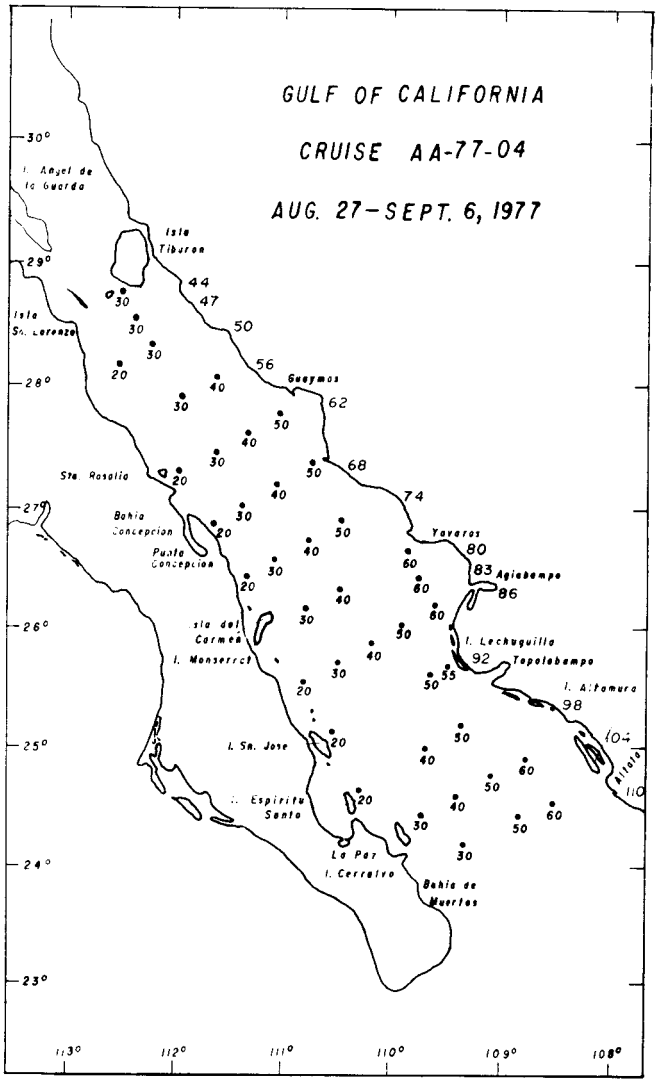

Figure 1. Locations of stations for zooplankton sampling. Numbers along the coast designate latitudinal transects.

RESULTS

Seventeen species were determined from the samples; they belong to twelve genera and five families of holoplanktonic polychaetes, which are listed in table 1. Dales and Peter (1972) provide a synopsis of the species belonging to these families. These species had not been previously recorded from the Gulf of California; their ranges of distribution have now been extended to this biogeographically important region.

One species, *Tomopteris planktonis*, clearly dominated in the survey area, being the most abundant and widespread; it showed an overall relative abundance of 73%, and an occurrence of 85% (figure 4). In most samples *T. planktonis* had intermediate abundance, but at four localities in the center of the middle region of the gulf, it had high abundance (figure 5).

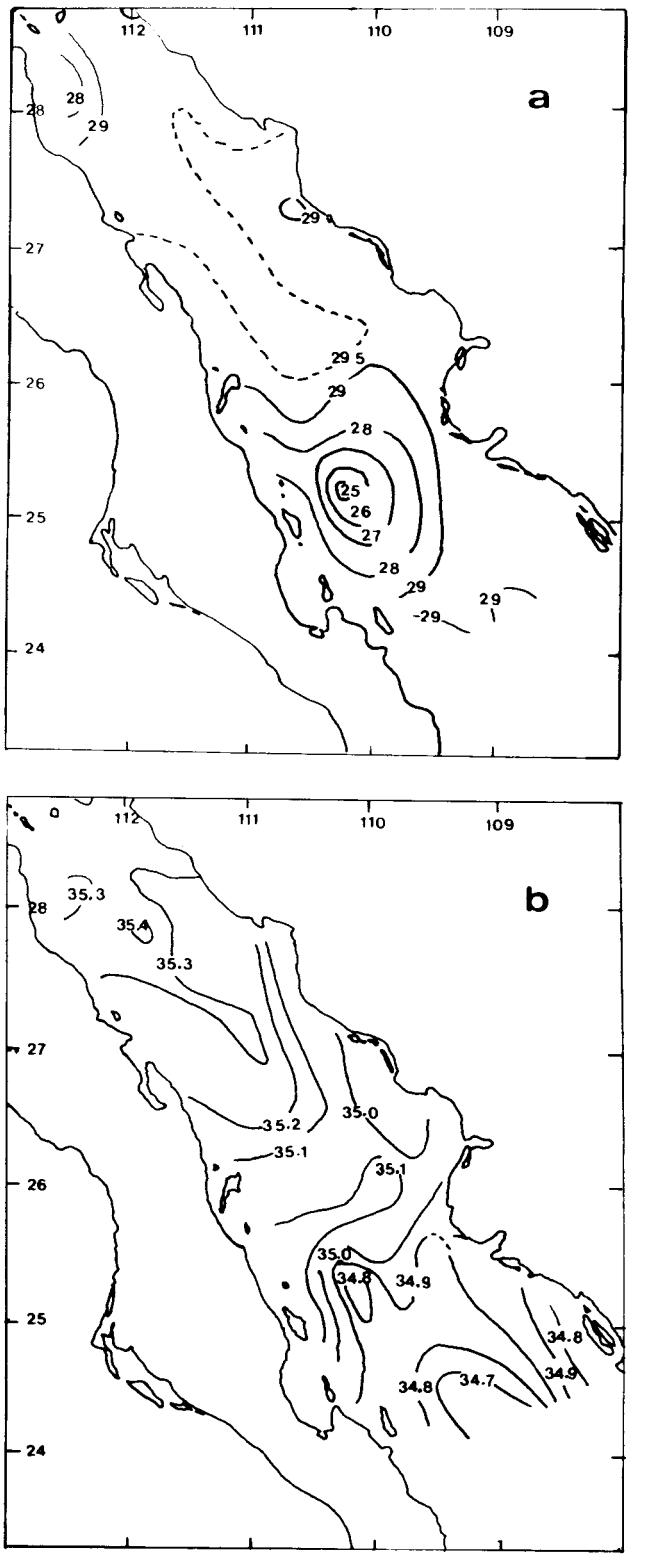

Figure 2. Distribution of isolines at 10-m depth in the Gulf of California: *a*, temperature; *b*, salinity (from Alvarez 1988).

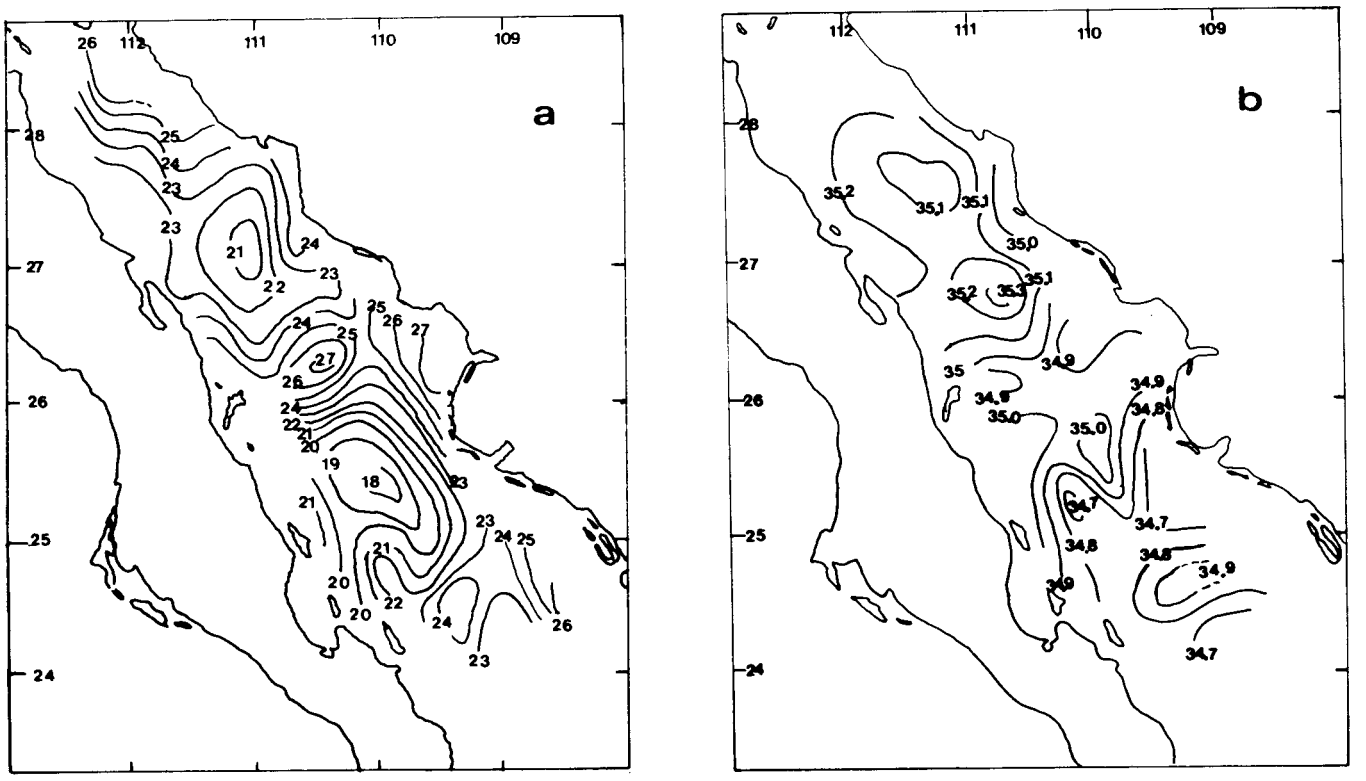

Figure 3. Distribution of isolines at 50-m depth in the Gulf of California: *a*, temperature; *b*, salinity (from Alvarez 1988).

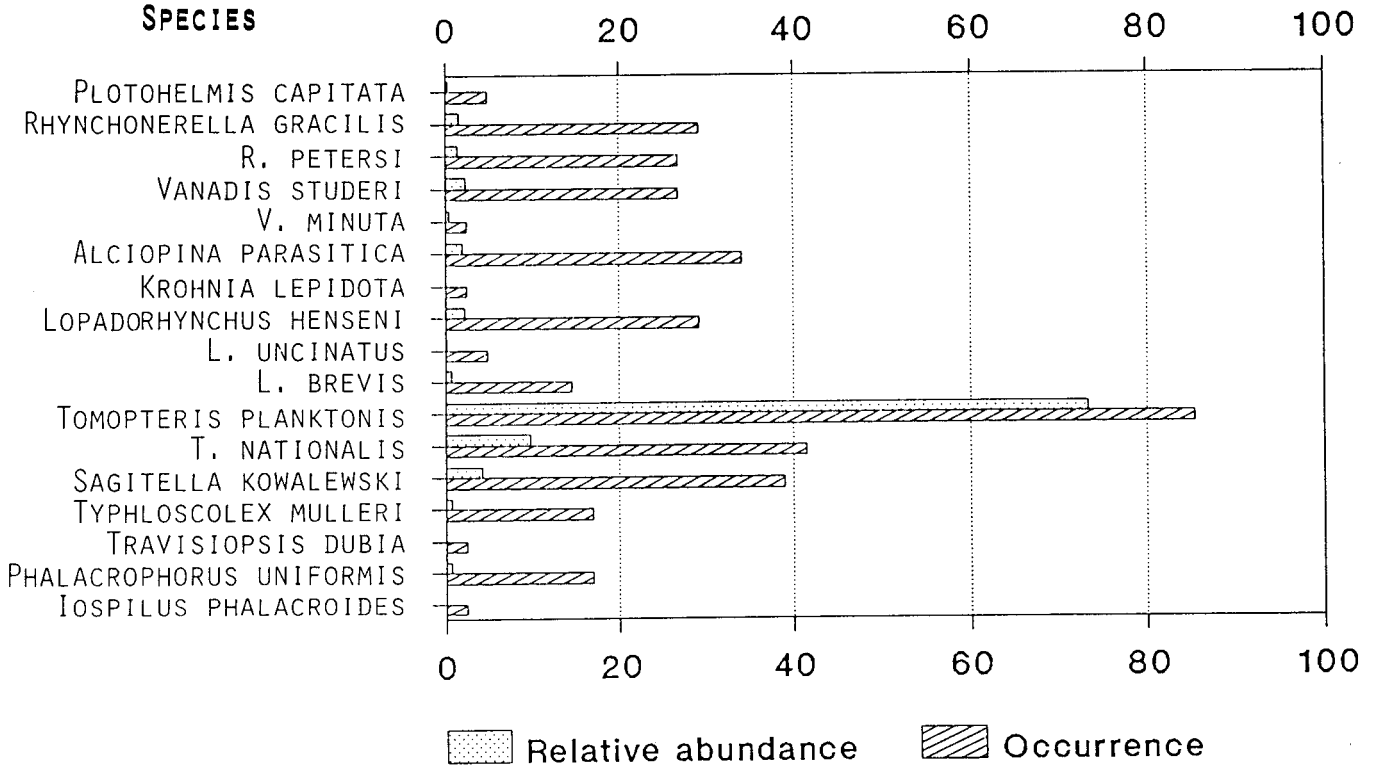

Figure 4. Relative abundance and occurrence of the species of holoplanktonic polychaetes from the Gulf of California during August–September 1977.

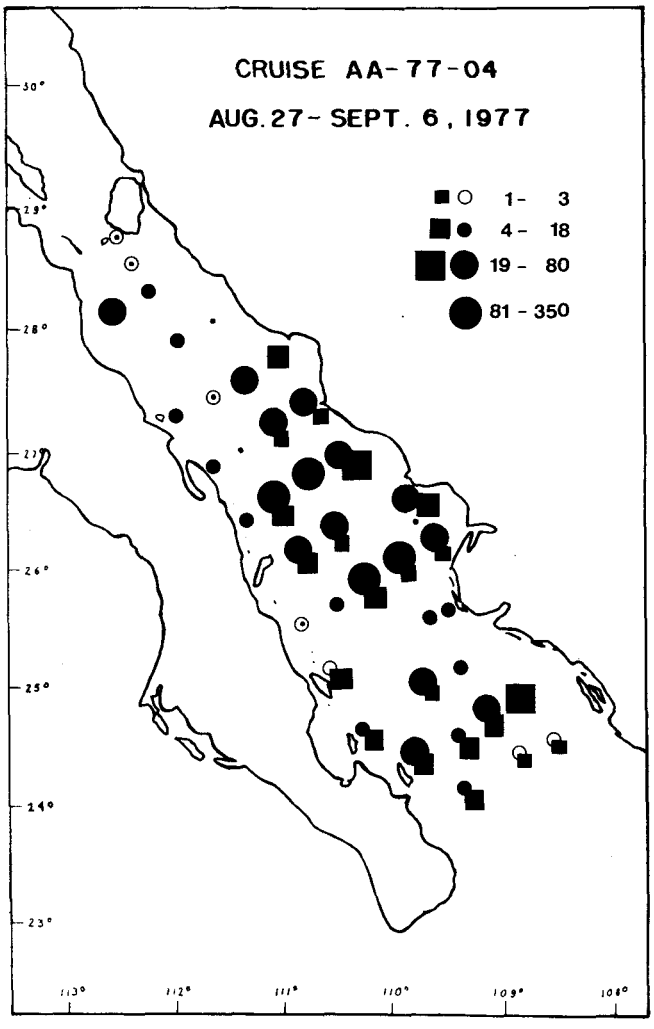

Figure 5. Distribution and density (individuals/1000 m³) of *Tomopteris planktonis (circles)* and *T. nationalis (squares)*.

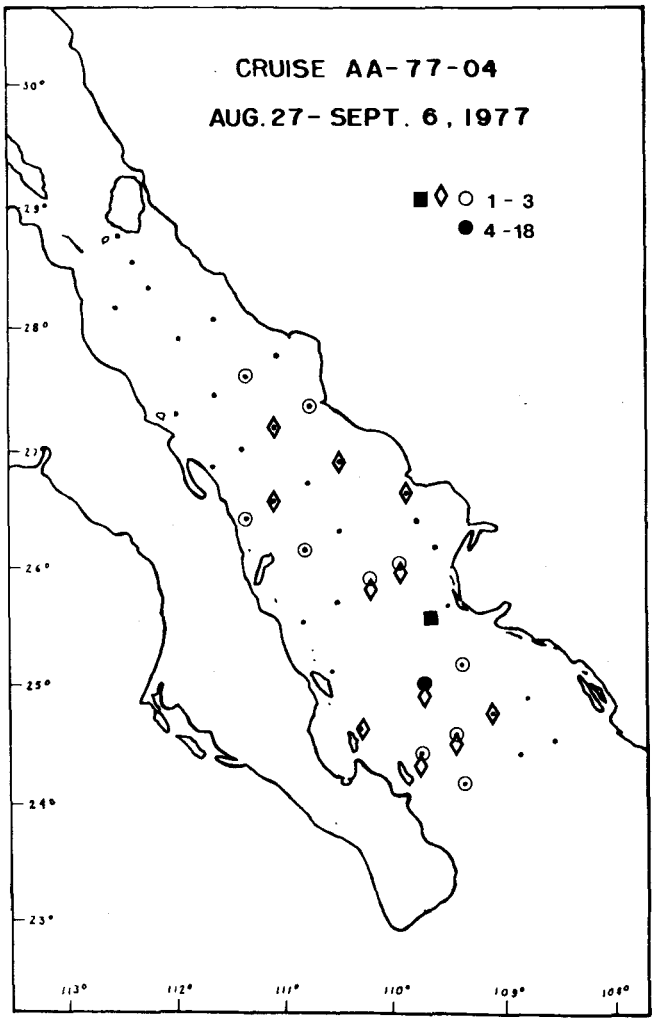

Figure 6. Distribution and density (individuals/1000 m³) of *Sagitella kowalewski (circles)*, *Typhloscolex mulleri (diamonds)*, and *Travisiopsis dubia (squares)*.

TABLE 1
New Records of Holoplanktonic Polychaeta from the Gulf of California

Family Tomopteridae	Family Lopadorhynchidae
Tomopteris planktonis	*Lopadorhynchus henseni*
T. nationalis	*L. brevis*
Family Typhloscolecidae	*L. uncinatus*
Typhloscolex mulleri	Family Iospilidae
Sagitella kowalewski	*Iospilus phalacroides*
Travisiopsis dubia	*Phalacrophorus uniformis*
Family Alciopidae	
Alciopina parasitica	
Rhynchonerella petersi	
R. gracilis	
Vanadis studeri	
V. minuta	
Plotohelmis capitata	
Krohnia lepidota	

Second in order of abundance and of occurrence (50%) was another species of Tomopteridae, *T. nationalis* Apstein, 1900; this was found between Guaymas (28°N, eastern side of gulf), and the southernmost transects of the survey area (across the gulf, more or less between 23°40′ and 24°40′N) where it was consistently present. Abundance was low at most stations, but at an eastern locality—offshore of Altamura Island (25°N)—it had an intermediate abundance (figure 5). Although most Pacific Ocean records treat *T. nationalis* as *T. apsteini* Rosa, 1908, Day (1967) has stated that *T. apsteini* is probably synonymous with *T. nationalis*, and Fernández (1983) has agreed with this opinion.

Third in order of occurrence (39%) in the study region was *Sagitella kowalewski*. This species had a distribution similar to that of *T. nationalis* and was usually present in low abundance; it was somewhat more abundant at a few stations from the mid-gulf region (figure 6).

The following species had a range of occurrence between 15% and 31%, and were low in abundance:

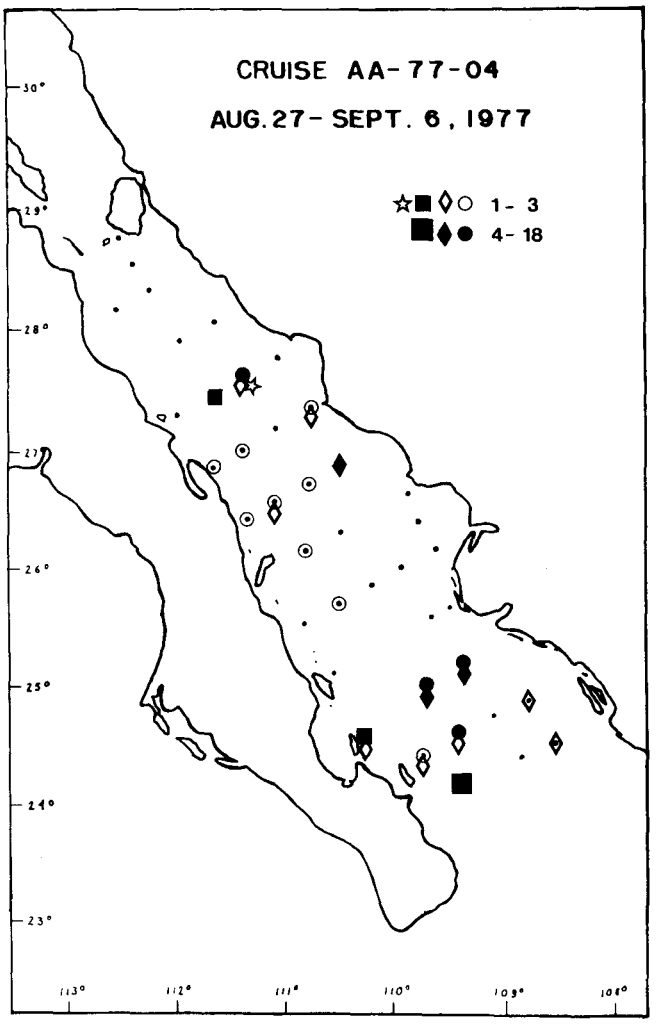

Figure 7. Distribution and density (individuals/1000 m³) of *Alciopina parasitica (circles), Plotohelmis capitata (squares), Vanadis studeri (diamonds),* and *Krohnia lepidota (star).*

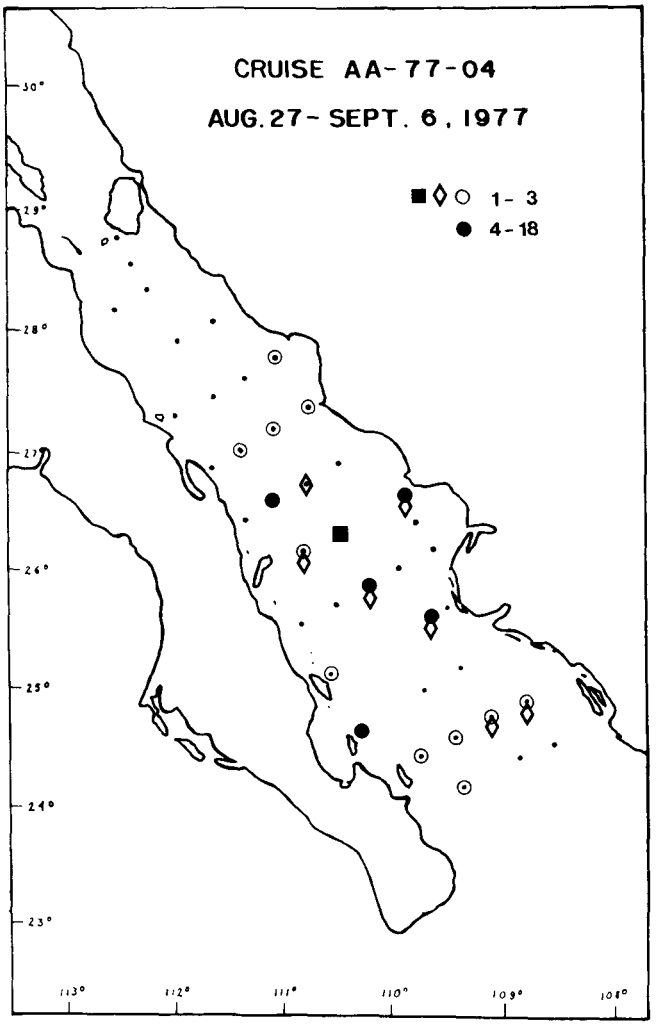

Figure 8. Distribution and density (individuals/1000 m³) of *Rhynchonerella gracilis (circles), R. petersi (diamonds),* and *Vanadis minuta (square).*

Alciopina parasitica, *Lopadorhynchus henseni*, *Rhynchonerella petersi*, *R. gracilis*, *Vanadis studeri*, *Phalacrophorus uniformis*, *Typhloscolex mulleri*, and *Lopadorhynchus brevis*. Some of these were distributed mainly in two areas: the middle region of the gulf (26°–27.5°N) over the Guaymas Basin, and the southern region (24°–25.5°N) encompassed by lines of stations between Espíritu Santo and San Ignacio islands and between Cerralvo and Altamura islands (figures 7–9). The intermediate area between these two regions showed significant temperature variations at 10-, 30-, and 50-m depths, as compared to the generally warmer temperatures of the rest of the survey region during the sampling period (figures 2 and 3). In this study *T. mulleri* and *Alciopina parasitica* were restricted to the two southern thirds of the survey area (figures 6 and 7).

Plotohelmis capitata, with low abundance, was found at three stations: the first was midway between Santa Rosalía and Guaymas; the others were in the southwestern part of the gulf (figure 7). This species was first recorded in the Pacific Ocean as *Rhynchonerella fulgens* (Izuka 1914).

Lopadorhynchus uncinatus, *Vanadis minuta*, *Krohnia lepidota*, *Iospilus phalacroides*, and *Travisiopsis dubia* were each found at one or two localities, in low abundance. Of these five species, only *K. lepidota* was present in the northern region, in one sample collected west of Guaymas (figure 7). The rest of the above species were mainly restricted to the southern two-thirds of the survey area (figures 6–9).

DISCUSSION

Tomopteris planktonis is a cosmopolitan species known from all explored water masses in the world. However, in the North Pacific Ocean, Tebble (1962) found it only in the Subtropical and Transition zones, restricted in the latter to the southern bound-

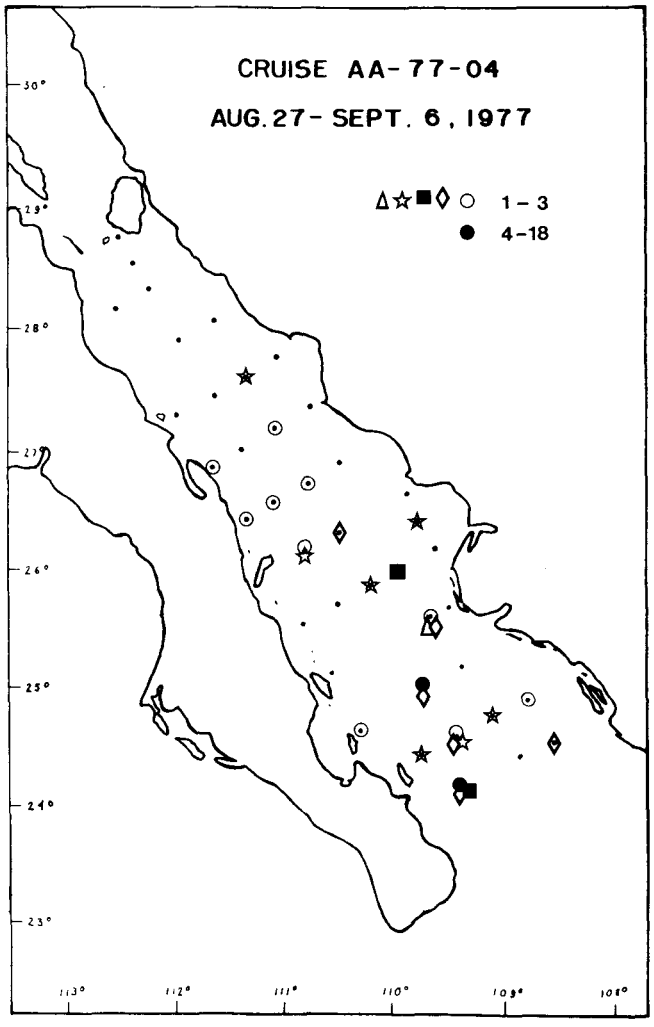

Figure 9. Distribution and density (individuals/1000 m³) of *Lopadorhynchus henseni (circles), L. brevis (diamonds), L. uncinatus (squares), Phalacrophorus uniformis (stars),* and *Iospilus phalacroides (triangles).*

ary of the Subarctic zone. It is also interesting to note that he found it to be absent from the California Current region. However, Tebble (1962) stated that the first record of *T. planktonis* from the North Pacific was made by Dales (1955), as *T. cavalii* from Monterey Bay; under the same name, Dales (1957) reported it as being sparsely distributed in surface waters throughout the California Current, generally most common 400–500 km offshore. Fernández (1983) found *T. planktonis* widely distributed in the Eastern Tropical Pacific during all bimonthly working periods (1967–68) of the EASTROPAC Program. It was most abundant in the equatorial region, especially near the Galápagos Islands.

Tomopteris nationalis was first recorded from the Pacific Ocean by Dales (1957). He reported a single specimen from the California Current, at 28°40.5'N and 122°46'W. In that paper he did not report *T. apsteini*, but noted that it was found by Rosa (1908) off the Mexican coast. However, in Rosa's report the name "*Tomopteris apsteini* nom. nov." was used only to redescribe specimens from Messina, Italy, belonging to the Hamburg Museum. Rosa (1908) had recorded *Tomopteris (Johnstonella) Aloysii Sabaudiae* Rosa, 1907, from off Acapulco, Mexico (13°24'N and 97°22'W) indicating that "questa specie sembra affine alla *T. nationalis*, forma atlantica". Tebble (1962) also mistakenly attributed to Rosa (1908) the first record of *T. apsteini* in the North Pacific on the basis of the collection from off Mexico. He found this species in few stations across the North Pacific in the Subtropical zone, between 135°W and the Japan coasts. Izuka (1914) reported *T. apsteini* from Misaki, Japan, but his description does not mention particular diagnostic characters (rosettes, spur gland on the ventral side of the neuropodia). Because of this, Imajima and Hartman (1964) questioned the specific identity of Izuka's specimens. Fernández (1983) found *T. nationalis* in the Eastern Tropical Pacific during the five bimonthly working periods of the EASTROPAC Program, with scattered distribution and moderate abundance.

Sagitella kowalewski is a true cosmopolitan species, and has been reported from the Pacific Ocean by Berkeley (1930), Okuda (1937, 1938 as *Plotobia pacichaeta*), Treadwell (1943), Uschakov (1955, 1957a, 1972), Dales (1957), Berkeley and Berkeley (1960), Tebble (1962), and Fernández (1983).

Typhloscolex mulleri is a cosmopolitan species recorded from all regions of the world. It is widespread in the Pacific Ocean (Treadwell 1943; Uschakov 1952, 1955, 1957a, 1957b; Berkeley and Berkeley 1948, 1957, 1960; Dales 1951; Tebble 1962; and Fernández 1983).

Alciopina parasitica has also been found in the Pacific Ocean, mainly in the tropical region; in the subtropical region it is only known from extensions of warm waters. Chamberlin (1919) recorded it (as *Corynocephalus paumotamus*) from the Eastern South Pacific Ocean. Treadwell (1943) reported a wider distribution, between 40°N and 40°S. Uschakov (1972) cited four localities off Japan and at 45°N, 165°E, possibly in an extension of the Kuroshio Current. Recently, Fernández (1983) showed that it has a wider distribution in the Eastern Tropical Pacific. This species was not recorded in the California Current by Dales (1957) or in the North Pacific by Tebble (1962).

Rhynchonerella petersi, R. gracilis, Phalacrophorus uniformis, and *Lopadorhynchus brevis* are widely distributed in tropical and subtropical regions of the Pacific Ocean. Several authors have recorded them from

various locations: *R. petersi*, Uschakov (1957a, as *Callizona setosa*), Tebble (1962), and Fernández (1983); *R. gracilis*, Izuka (1914, as *Callizona japonica*), Uschakov (1957a, as *C. nasuta*), Berkeley and Berkeley (1960), Tebble (1962), and Fernández (1983); *P. uniformis*, Treadwell (1943, as *P. attenuatus*), Tebble (1962), and Fernández (1983); *L. brevis*, Chamberlin (1919, as *L. parvum*), Dales (1957), Berkeley and Berkeley (1958), Tebble (1962), and Fernández (1983).

Because *Vanadis studeri* may have been confused with *V. minuta* (Orensanz y Ramírez 1973), and because *Lopadorhynchus henseni* may resemble *L. krohni* (Kim 1967), their geographical distributions should be examined more carefully. However, they may have warm-water affinities.

Plotohelmis capitata is a common species in the Malacca Strait (Fauvel 1939). Also it has been reported as *P. capitata* (Dales 1960) from the Malacca Strait and South China Sea, and as the most common species off Peru (Berkeley and Berkeley 1961, 1964). It has a wide distribution in the Eastern Tropical Pacific (Fernández 1983). As in the case of *A. parasitica*, it was not recorded from the California Current by Dales (1957) or from the North Pacific by Tebble (1962).

In general, there are few records for the following species in the Pacific Ocean: *Lopadorhynchus uncinatus* was reported by Treadwell (1943, as *L. varius*), Dales (1955, 1957), Berkeley and Berkeley (1958, 1960), Tebble (1962), and Fernández (1983); *Vanadis minuta* by Treadwell (1906), Dales (1957), Tebble (1962), and Fernández (1983); *Krohnia lepidota* was recorded by Chamberlin (1919, as *Rhynchonerella cincinnata*), Treadwell (1943, as *Callizona pigmenta*), Tebble (1962), and Fernández (1983); *Travisiopsis dubia* was reported by Dales (1960), Tebble (1962), and Fernández (1983). There are few records of *Iospilus phalacroides*, and its world distribution is not well known.

The biogeographical affinities of the taxa are those to be expected for the Gulf of California. Most species show a subtropical-tropical pattern; three are truly cosmopolitan taxa; and two are warm-water species. No species from cold or temperate water were recorded (table 2). Species with a subtropical-tropical pattern are also prominent among the gulf's foraminifera, chaetognaths, calanoid copepods, hyperiid amphipods, and euphausiids (Brinton et al. 1986).

Tomopteris planktonis was the dominant polychaete and the only widely distributed species within the area of study. Its distribution extended northward in the gulf to at least Tiburón Island, where sharp annual temperature gradients are developed. Its distribution is probably due to broad ecological tolerance, as inferred from its cosmopolitan pattern. The remaining sixteen species were distributed from the Santa Rosalía–Guaymas transect southwards.

TABLE 2
Relative Abundance, Occurrence, and Biogeographical Affinities of Holoplanktonic Polychaetes from the Gulf of California

Species	Relative abundance	Occurrence (%)	Biogeogr. types
Tomopteris planktonis	73.0	85	Cosmopolitan
T. nationalis	10.0	50	Subtropical-tropical
Sagitella kowalewski	4.5	39	Cosmopolitan
Alciopina parasitica	2.0	34	Tropical
Lopadorhynchus henseni	2.0	29	Tropical ?
Rhynchonerella gracilis	1.5	29	Subtropical-tropical
R. petersi	1.4	27	Subtropical-tropical
Vanadis studeri	2.3	27	Tropical ?
Phalacrophorus uniformis	2.0	17	Subtropical-tropical
Typhloscolex mulleri	2.0	17	Cosmopolitan
Lopadorhynchus brevis	1.5	14	Subtropical-tropical
Plotohelmis capitata	0.5	7	Tropical
Lopadorhynchus uncinatus	0.1	4	Subtropical-tropical
Vanadis minuta	0.1	4	Subtropical-tropical
Krohnia lepidota	0.1	4	Subtropical-tropical
Travisiopsis dubia	0.1	4	Subtropical-tropical

The warm-water species *Alciopina parasitica* and *Plotohelmis capitata* were found nearly to 28°N, near Guaymas. This distribution may be explained by the summer circulation pattern, in which tropical water moves inwards from the Eastern Pacific Ocean (Roden 1958; Roden and Groves 1959; Alvarez-Borrego and Schwartzlose 1979). Both species are widely distributed in the Eastern Tropical Pacific (Fernández 1983). Similar summer intrusions have been observed among other zooplanktonic taxa such as tropical species of euphausiids (Brinton and Townsend 1980).

Summer water temperatures could be responsible for the complete absence of cold- and temperate-water species in these samples; temperatures in the epipelagic zone are highest during the summer (Robinson 1973; Alvarez 1988). Temperate species may be replaced in surface water by tropical taxa and submerge to deeper layers as do certain calanoid copepods (Fleminger, in Brinton et al. 1986).

An interesting feature of the general distribution of most members of the family Alciopidae is their absence from stations along the transect San José Island–Punta San Ignacio (25°N). Their distribution is apparently interrupted (figures 7 and 8). In this area water temperatures have a strong gradient (18°–27°C in the 50–0-m layer), according to data from Alvarez (1988), as shown in figures 2 and 3.

All seventeen species collected in the Gulf of California have also been recorded from the Eastern Tropical Pacific Ocean (Fernández 1983); twelve are known from the subtropical, transition, and subarctic regions of the North Pacific (Tebble 1962); and seven are reported from the California Current (Dales 1955, 1957). These data are in agreement with those for a number of other pelagic animals when the Gulf of California is defined as part of the Tropical Eastern Pacific faunistic region (e.g., Walker 1960).

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