Distribution of holoplanktonic typhloscolecids (Annelida-Polychaeta) in the eastern tropical Pacific Ocean

MARÍA ANA FERNÁNDEZ-ÁLAMO*
LABORATORIO DE INVERTEBRADOS, FACULTAD DE CIENCIAS, UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO, A. P. 70–371, MÉXICO D. F., 04510, MÉXICO
*CORRESPONDING AUTHOR: mafa@hp.fciencias.unam.mx

Received on June 20, 2003; accepted on March 1, 2004; published online on March 30, 2004

The distribution and composition of the holoplanktonic species of the family Typhloscolecidae are reported from 579 samples obtained over an extensive area in the eastern tropical Pacific Ocean. The EASTROPAC Oceanographic Program collected the samples in twelve cruises during five periods made between January–September 1967 and January–April 1968. The 2105 specimens identified belonged to three genera and four species. Typhloscolex muelleri and Sagitella kowalewski were dominant together, accounting for 57–59% of the relative abundance and 36–49% of the occurrence. Travisiopsis dubia is recorded for the first time from the eastern tropical Pacific, and Travisiopsis lanceolata is reported in almost the same locality as its first record in the surveyed region.

INTRODUCTION

The family Typhloscolecidae Uljanin, 1878 comprises holoplanktonic worms with a fusiform and transparent body. Step-Bowitz (Step-Bowitz, 1948) considered the family to be aberrant, with uncertain relationships to other polychaetes, and Pleijel and Dales (Pleijel and Dales, 1991) referred them to the superfamily Typhloscolecoida.

The Typhloscolecidae has only three genera (Dales and Peter, 1972). Most studies on the group relate to their systematics and distribution, whereas almost nothing is known about their biology and ecology. On morphological grounds they have been considered to be ectoparasites, and are presumed to feed on soft-bodied or gelatinous animals such as chaetognaths, medusae and salps (Reibisch, 1895; Ushakov, 1972). Feigenbaum (Feigenbaum, 1979) observed specimens of Typhloscolex Busch, 1851 and Sagitella Wagner, 1872 feeding on chaetognaths, and Øresland and Pleijel (Øresland and Pleijel, 1991) reported ectoparasitism or predation of Typhloscolex sp. on the chaetognath Eukrohnia hamata (Möbius, 1873) in samples taken from Antarctic waters. Whether ectoparasites or predators, typhloscolecids may play an important role in the control of the chaetognaths and other gelatinous animals in the pelagic ecosystem.

METHOD

Study area

The eastern tropical Pacific was defined by the EASTROPAC Oceanographic Program as 20°N to 20°S, and from the coast of the American continents westward to longitude 126°W (Love, 1972–1978). This is a very important region from climatic, oceanographic and biological points of view that supports valuable fisheries. Its oceanographic aspects have been well characterized, starting mainly at the end of the 1940s (Reid, 1948) and continuing through the 1950s (Wooster and Cromwell, 1958; Cromwell and Bennet, 1959) and 1960s (Rodin, 1962; Bennet, 1963). Wyrtki (Wyrtki, 1967) compiled and summarized the information generated in these years. The eastern boundary Currents of California and Peru, the North and South Equatorial Currents, and the Equatorial Countercurrent form the main influences on the circulation patterns. The special dynamic aspects, with the redistribution of the water at the coasts and the wind force, in combination with the variation of the Intertropical Convergence produce a very complicated three-dimensional structure (Kessler et al., 1998; Kessler, 2002). In addition, the intense winds that flow through the gaps in the mountain system of Mexico and Central America generate complicated upwelling regions and eddies in the Gulfs of...
Thermocline ridge coincident with the equatorial cold basic patterns. A deepening from east to west, an equatorial fisheries. The mean thermocline depth presents three basic patterns. A deepening from east to west, an equatorial cold tongue, and a countercurrent thermocline ridge at ~10°N, 89°W associated with the important Costa Rica Dome upwelling (Wyrtki, 1964; Fiedler et al., 1991; Fiedler, 1994, 2002). Another distinctive feature in the hydrography of the eastern tropical Pacific is the oxygen minimum layer, which has important consequences for biological processes (Wyrtki, 1962; Reid, 1973). In the survey region the main surface water masses defined by the patterns of temperature and salinity are (i) Tropical Surface Water (>25°C, salinity <34), (ii) Equatorial Surface Water (<25°C, salinity <34), (iii) Subtropical Surface Water (15–28°C, salinity >34). Between depths of 600 and 900 m the Antarctic Intermediate Water mass covers the entire region (Wooster and Cromwell, 1958; Wyrtki, 1967).

Sampling

The studied specimens were collected in 12 expeditions of the EASTROPAC oceanographic program during 1967 and 1968. Physical and biological properties, nutrient chemistry and meteorological data are found in the 11 volumes of the EASTROPAC Atlas edited by Love (Love, 1972–1978). Zooplankton oblique hauls were taken with nets with a 0.50 m mouth diameter, a length of 3.5 m in a paired-frame that were constructed throughout of Nitex nylon with a mesh aperture of 0.333 mm. The hauls were preserved at sea in 4% buffered formaldehyde in sea water (Laurs, 1972), and split into 50% aliquots with one set deposited and sorted at the Smithsonian Oceanographic Sorting Center. In general most samples were taken at night (87%) and 13% were taken during diurnal periods. Diurnal samples were obtained only during August–September 1967 and January–April 1968.

RESULTS

The 2105 specimens identified were assigned to three genera and four species. *Typhloscolex muelleri* and *Sagitella hawkesi* were dominant, with 57–59% of the relative abundance and 36–49% of the occurrence. *Travisiopsis dubia* was recorded for the first time from the eastern tropical Pacific, and *Travisiopsis lanceolata* was reported again, in almost the exact locality as its first record in the survey region.

*Typhloscolex muelleri* Busch, 1851

Family Typhloscolecidae Uljanin, 1878.

Genus *Typhloscolex* Busch, 1851.

*Typhloscolex muelleri* Busch, 1851.

Type locality: Trieste, Adriatic Sea.

Material examined: 1200 specimens from the cruises.

**Argo 11** (January 24 to March 6, 1967): stations 046(3); 060(3); 068(2); 072(1); 084(4); 088(2); 102(3); 114(4); 128(6); 136(9); 142(3); 144(3); 150(1); 159(2); 167(1); 197(2); 213(1); 221(6); 246(9); 258(1); 262(3); 278(9); 287(3); 289(1); 297(3); 306(2); 314(1); 320(3).

**Jordan 12** (February 7 to March 24, 1967): stations 002(2); 043(1); 059(1); 067(4); 075(2); 084(2); 094(2); 106(1); 118(8); 126(3); 142(3); 150(2); 164(1); 200(2); 212(1); 224(6); 235(4); 244(2); 252(1); 260(4); 268(1).

**Rockaway 13** (January 20 to March 31, 1967): stations 019(1); 034(1); 040(3); 045(3); 056(1); 071(2); 097(2); 103(1); 105(1); 119(4); 121(1); 127(2); 129(1); 135(1); 137(2); 153(1); 159(1); 169(2); 175(11); 179(5); 191(5); 195(6); 207(4); 211(2); 227(2); 232(5); 255(1); 261(1); 266(3); 276(2); 282(5); 284(2); 320(1); 322(2); 338(2).

**Alaminos 14** (January 21 to April 10, 1967): stations 006(3); 018(3); 021(2); 027(2); 043(3); 051(2); 081(1); 099(1); 124(3); 128(1); 132(2); 146(2); 154(7); 164(1); 172(1); 188(2); 199(2); 213(2); 240(3); 247(3); 255(1); 280(6); 303(4); 310(1); 318(7); 326(4).

**Jordan 20** (April 10 to May 31, 1967): stations 016(2); 024(1); 056(1); 058(1); 064(2); 066(1); 072(3); 073(11); 075(7); 084(4); 092(5); 100(7); 108(5); 116(4); 124(3); 140(1); 165(1); 173(1); 185(1); 189(3); 197(3); 205(2); 212(6); 224(2); 232(5); 240(1); 248(4).

**Jordan 30** (June 14 to August 2, 1967): stations 010(1); 018(1); 026(3); 034(3); 036(5); 041(1); 043(14); 051(3); 057(4); 065(4); 067(4); 075(1); 088(2); 096(2); 104(5); 112(5); 120(7); 128(1); 144(1); 151(2); 159(2); 167(3); 175(2); 183(4); 191(12); 199(3); 207(1); 223(1); 231(4); 239(9); 246(3); 262(2).

**Washington 45** (August 3 to September 25, 1967): stations 018(1); 023(2) 024(1); 039(10); 051(3); 053(9); 058(14); 060(4); 067(9); 078(10); 094(6); 110(4); 125(12); 133(6); 140(1); 167(1); 175(4); 198(2); 289(13); 305(10); 341(1); 358(1); 371(2); 379(2); 387(2).

**Undaunted 46** (August 6 to September 27,
1967: stations 011(3); 034(2); 036(4); 042(3); 044(7); 050(1); 052(13); 057(2); 065(5); 079(5); 086(3); 094(5); 102(4); 110(1); 112(4); 118(2); 120(2); 126(1); 128(1); 145(1); 153(3); 155(1); 161(6); 163(6); 169(4); 179(1); 185(1).

Rockaway 47 (July 31 to September 29, 1967): stations 028(2); 035(7); 040(3); 049(4); 053(7); 065(1); 105(1); 137(1); 139(1); 145(1); 147(2); 173(3); 179(1); 209(5); 225(9); 240(3); 242(3); 254(2); 272(1); 283(3); 292(5); 306(16); 310(13); 322(4); 338(4); 351(5); 362(1); 364(2); 430(18); 436(11); 438(17); 450(2); 462(4); 478(6); 509(2); 525(2); 527(1).

Remarks

Tebble (Tebble, 1962) noted an ecotypic variant (large sizes of 13–21 mm) of *T. muelleri* inhabiting the subarctic region of the North Pacific. The size of the specimens from the survey area ranged from 1.0 to 7.5 mm with a mean of 2.7 mm, sizes that are similar to almost all previous records.
from subtropical and tropical regions. Tebble (Tebble, 1960) suggested that *T. phyloides* and *T. leuckarti*, both described by Reibisch (Reibisch, 1895), are synonymous with *T. muelleri*, a treatment that is followed here.

**Distribution in the Pacific Ocean**

The first record of *T. muelleri* in the tropical region was by Chamberlin (Chamberlin, 1919), with one specimen collected from the Gilbert Islands, off Arno Reef. It was subsequently reported by Berkeley (Berkeley, 1930) off the west coast of Vancouver Island, by Fauvel (Fauvel, 1936) from the Bellingshausen Sea and west of Alexander I Island, and by Treadwell (Treadwell, 1943) from material collected by the Carnegie Expedition in 1928–1929. It is commonly recorded in tropical and subtropical waters of both hemispheres, and from some localities in the subarctic region. Ushakov (Ushakov, 1952, 1955, 1957a, 1957b, 1972) reported it as the most common holoplanktonic polychaete in the Okhotsk, Bering and Barents Seas. It also occurs off south-eastern Kamchatka, in subtropical and subarctic regions, and in high Arctic waters at 80°N, 180°W. Dales (Dales, 1955, 1957) found it in the Monterey Bay and the California Current. Berkeley and Berkeley (Berkeley and Berkeley, 1957, 1960) observed it in the subarctic region, ranging from 50°27′ to 55°43′N, and from 129°08′ to 167°58′W, and also from 40°N 175°W. Tebble (Tebble, 1962) reported it from subarctic and subtropical regions across the North Pacific. Roja (Roja, 1962) found it north of the Cedros Island off the Baja California peninsula. Berkeley and Berkeley (Berkeley and Berkeley, 1964) observed it off the coast of Peru, and Reish (Reish, 1968) recorded it from Bahía de los Angeles, in the Gulf of California. Fernández-Alamo (Fernández-Alamo, 1987, 1989, 1991, 1992, 1996) reported it from the Gulf of Tehuantepec, the Gulf of California, and the south-western coast of Baja California, and Vicencio-Aguilar and Fernández-Alamo (Vicencio-Aguilar and Fernández-Alamo, 1996) from the Costa Rica Dome in Central America.

Distribution and abundance of this species in the survey area are shown in Figure 2.

**General distribution**

*Tytthosolex muelleri* is a cosmopolitan species that has been reported from all explored water masses (Tebble, 1962).

**Sagitella kowalewski** Wagner, 1872

Genus *Sagitella* Wagner, 1872.

*Sagitella kowalewski* Wagner, 1872.

Type locality: Tropical Atlantic Ocean.

Material examined: 758 specimens as follows.

**T. muelleri**

Type locality: Tropical Atlantic Ocean.

Wagner, 1872.
Remarks
Tebble (Tebble, 1962) found this species in large numbers at all explored depths in the subtropical region of the North Pacific. It is evidently capable of reaching a wide distribution in deep as well as surface waters. The same wide distribution in the epipelagic region is observed in the survey area.

Distribution in the Pacific Ocean
The first record of *S. kowalewski* was made by Chamberlin (Chamberlin, 1919) in the tropical region, from a locality between the Galápagos and Paumotu Islands at 13°47'S, 114°22'W. Additional records include the north-west coast of Vancouver Island (Berkeley, 1930), and off Japan (Okuda, 1937, 1938). Sogitella kowalewski was recorded by Treadwell (Treadwell, 1943) as *Plotobia paucichata* in the Pacific between 45°N and 40°S, by Dales (Dales, 1955, 1957) in Monterey Bay and the California Current; by Ushakov (Ushakov, 1955, 1957a, 1972) in the subarctic region (south-east of Kamchatka, near the Kurile Islands at 4000 m, and off Kamchatka to about 57°N, and in one locality at 51°N) and also in subtropical regions down to 45°N, by Berkeley and Berkeley (Berkeley and Berkeley, 1957, 1960, 1964) from the north-eastern region of the North Pacific (50°01'N, 145°W and 43°42'N, 136°W), and off the coast of Peru at 21 stations ranging from 3°24'S to 16°42'S, by Rioja (Rioja, 1962) in Baja California, by Tebble (Tebble, 1962) from transition and subtropical regions across the North Pacific, by

Fig. 2. Geographical distribution and abundance of *Typhloscolex muelleri* in the eastern tropical Pacific Ocean. Day stations □.

452(1); 473(3); 479(1); 485(1); 499(4); 491(5); 503(1); 507(2); 515(6); 523(1); 531(1); 535(3); 553(1); 556(4); 559(2).

The distribution and abundance of this species in the survey area are shown in Figure 3.

**General distribution**

*Sagitella kowalewski* has been considered a cosmopolitan species by various authors (Dales and Peter, 1972; Fernández-Alamo, 1987, 1991, 1992; Chambers, 1991). However, Tebble (Tebble, 1962) reported that the southern boundary of the Subartic Zone marks the northern limit of the distribution of this species in the North Pacific, and considered it to be limited to tropical and subtropical waters. Therefore, it is possible that polar or subpolar records of *S. kowalewski* represent extensions of warm-water masses.

**Travisiopsis dubia** Støp-Bowitz, 1948

Genus *Travisiopsis* Levinsen, 1885.

*Travisiopsis dubia* Støp-Bowitz, 1948.

Type locality: North Atlantic (39°30′N, 49°42′W).

Material examined: 145 specimens as follows.

- **Argo 11** (January 24 to March 6, 1967): stations 068(1); 088(1); 278(2); 314(1).
- **Jordan 12** (February 7 to March 24, 1967): stations 008(1); 018(1); 032(5); 033(1); 043(1); 051(1); 075(1); 142(2).
- **Rockaway 13** (January 20 to March 31, 1967): stations 056(1); 105(1); 276(1); 322(1); 338(1).
- **Alaminos 14** (January 21 to April 10, 1967): stations 006(3); 010(1); 022(1); 051(2); 188(1); 224(1); 247(1); 280(1).
- **Jordan 20** (April 10 to May 31, 1967): stations 108(1); 140(1); 181(1);

---

Fig. 3. Geographical distribution and abundance of *Sagitella kowalewski* in the eastern tropical Pacific Ocean. Day stations □.
Jordan 30 (June 14 to August 2, 1967): stations 034(3); 036(2); 043(1); 112(1); 128(2); 144(2); 151(3); 175(2); 191(1); 199(3); 231(1); 262(3). Washington 45 (August 3 to September 25, 1967): stations 039(7); 067(1); 078(2); 333(1); 341(2); 348(3); 350(2); 356(4); 358(1); 371(1); 379(2).

Undaunted 46 (August 6 to September 27, 1967): stations 004(2); 011(1); 034(1); 044(1); 052(1); 110(1); 118(3); 120(2); 126(3); 147(1); 153(1); 155(1); 161(1); 169(1). Rockaway 47 (July 31 to September 29, 1967): stations 028(1); 145(1); 147(3); 209(2); 225(1); 292(2); 306(5); 310(2); 322(2); 478(1); 507(2); 527(1). Washington 75 (February 15 to April 15, 1968): stations 011(1); 014(1); 044(1). Jordan 76 (February 19 to April 5, 1968): station 205(1). Rockaway 77 (January 20 to April 28, 1968): stations 141(1); 310(1); 402(1); 426(2); 446(2).

Remarks
This report validates the first record of this species in the eastern tropical region of the Pacific Ocean; it was identified in an unpublished thesis (Fernández-Alamo, 1983). Following Tebble (Tebble, 1962) it may be underrepresented in the literature, since it is easily overlooked and also easily confused with *S. kowalewski*.

Distribution in the Pacific Ocean
There are very few Pacific records of *Tr. dubia*. Dales (Dales, 1960) first recorded it from Malaya and Indonesia; subsequently Tebble (Tebble, 1962) found it in only eight stations across the subtropical region of the North Pacific, and it was recorded from a single locality in the Gulf of California by Fernández-Alamo (Fernández-Alamo, 1991). Figure 4 shows the distribution and abundance of this species in the survey area.
General distribution
Stop-Bowitz (Stop-Bowitz, 1948) originally described this species from two localities (39°30’N, 49°42’W and 48°24’N, 36°33’W) in the North Atlantic Ocean. Day (Day, 1967, 1975) found it in the Agulhas and Mozambique Currents, in the south-west region of the Indian Ocean. Orensanz and Ramírez (Orensanz and Ramírez, 1973) recorded it from four localities ranging from 28°S to 31°S, in the south-west Atlantic. Travisiopsis dubia is known from very few records, all of which are from tropical and subtropical waters (Tebble, 1962).

Travisiopsis lanceolata Southern, 1910
Genus Travisiopsis Levinsen, 1885.
Travisiopsis lanceolata Southern, 1910.
Type locality: South-west Ireland (51°12’N, 11°55’W).
Material examined: only two specimens from the cruise Washington 75 (February 15 to April 15, 1968): station 100.

Remarks
This species was observed in the survey area in only one locality (9°12’S, 118°57’W), almost the same region as Chamberlin’s 1919 record (Chamberlin, 1919), as Plotobia simplex. Stop-Bowitz (Stop-Bowitz, 1948) suggested that Plotobia simplex, as described by Chamberlin, is indistinguishable from Tr. lanceolata, and Tebble (Tebble, 1962) agreed with him and listed it in synonymy. The specimens of the present survey were compared with specimens from the collections of Pelagic Polychaeta from the South Atlantic Ocean taken during the ‘Discovery’ cruises, which are deposited at the British Museum of Natural History [Reg. 1941:1:1:102(6), and Reg. 1955: 6:2:805/813]. The two sets of material present similar morphological characters, even though the Atlantic specimens are larger.

Distribution in the Pacific Ocean
The first record of this species in this ocean was in the tropical region, by Chamberlin [(Chamberlin, 1919); as Plotobia simplex], between the Galápagos and Paumotu Islands in three localities: 9°31’S, 106°30’W; 11°13’S, 109°29’W, and 9°02’S, 123°20’W. Treadwell (Treadwell, 1936, 1941a) reported it as Tr. atlantica from the coasts of Panama, from the Galápagos and Cocos Islands (7°N to 1°S, and 80°W to 91°W), and from 20 miles south-west of Morro de Puerco, Panama. Treadwell recorded Tr. lanceolata in three localities in the subarctic region and one near Juan Fernandez Island in the southeast Pacific [(Treadwell, 1943); recorded as Plotobia simplex]. Tebble (Tebble, 1962) collected it at only nine stations (most of these were by nets closing at depth) in the North Pacific, mainly in the subtropical zone; Ushakov (Ushakov, 1972) found this species in some localities in the subtropical and subarctic regions of the north-western part of the Pacific.

Figure 4 shows the localization of Tr. lanceolata (marked with a star) in the survey area.

General distribution
Most records of this species are from the North Atlantic Ocean, where it has been reported from subarctic and subtropical regions by various authors (Southern, 1911; Fauvel, 1916, 1932; Wesenberg-Lund, 1933, 1936, 1939, 1950, 1951; Stop-Bowitz, 1948). In the tropical region this species was recorded as Tr. atlantica by Treadwell (Treadwell, 1936, 1941b). In the South Atlantic Ocean records of Tr. lanceolata are not numerous, but it has been collected in the tropical and subtropical regions by Ehlers and Monro as Sagitella cornuta (Ehlers, 1913; Monro, 1930), and by others as Tr. lanceolata (Monro, 1939; Friedrich, 1950; Tebble, 1960; Day, 1967). Hartman (Hartman, 1971) found it in the Mozambique Basin of south-east Africa in the abyssal region between 2469 and 4540 m. This species is considered to be eurybathic by Stop-Bowitz (Stop-Bowitz, 1948).

DISCUSSION
The distribution of the four typhlosolecid species examined in this report coincides with their previously observed zoogeographical affinities. In this very complex oceanographic survey region the dominant species was the cosmopolitan T. muelleri, which agrees with its occurrence in all explored water masses. For example, it has been recorded from the North Atlantic Ocean (Stop-Bowitz, 1948) and the South Atlantic (Tebble, 1960). Also it was found in all water masses across the North Pacific (Treadwell, 1943; Ushakov, 1957a; Tebble, 1962). The same pattern was recorded in the eastern tropical Pacific together with other cosmopolitan species of holoplanktonic polychaetes of the families Tomopteridae and Lopadorhynchidae [of which the dominant species were Tomopteris planktonis and Pelagobia longisserrata, respectively (Fernández-Alamo, 1983, 2000, 2002)]. The second dominant species was S. kowalewski, which is also widely distributed in the Atlantic (Stop-Bowitz, 1948) and in the tropical, subtropical and subarctic regions of the Pacific Ocean (Chamberlin, 1919; Okuda, 1937, 1938; Treadwell, 1943; Ushakov, 1952, 1957a, 1957b; Tebble, 1962; Berkeley and Berkeley, 1964).

Tebble (Tebble, 1962) has discussed the cosmopolitan distribution of this species; he considered them to be tropical–subtropical and suggested that their polar and subpolar records could indicate extensions of warm-water masses. The dominance of S. kowalewski in the
survey region supports its tropical affinity. There are very few records of *Tr. dubia* which has been recorded from the subtropical region of the North Atlantic (Stop-Bowitz, 1948) in only two localities. Subsequently, this species was recorded in the tropical region of the Indo Pacific (Dales, 1960), and in the subtropical region of the North Pacific (Tebble, 1962) in eight localities. The present report demonstrates the wide distribution of *Tr. dubia* and confirms its tropical–subtropical affinity proposed by Tebble (Tebble, 1962). *Trachelaspis lanceolata* was restricted to only one locality, where the 15°C isotherm was at a depth of 150 m and salinity from the surface to 200 m ranged from 33 to 35.5 p.s.u. These features define the Subtropical Surface Water that occupies the region in the South Pacific where this species was collected (Figure 4). It has been observed most frequently in the subtropical regions of the North and South Atlantic, and Pacific (Treadwell, 1943; Stop-Bowitz, 1948; Tebble, 1960, 1962). However, its previous records in the tropical regions of the Pacific (Treadwell 1956, 1941a) occur in relation with upwelling areas along the coasts of Panama, the Galápagos, and Cocos Islands.

Although the seasonal variability in the eastern tropical Pacific has been well documented, seasonal local changes in biological communities are usually rather small, except in regions where upwelling phenomena occur (Blackburn et al., 1970). This situation is reflected in the distributions of *T. muelleri*, *S. kazakevelski* and *Tr. dubia* studied here, since they did not show remarkable seasonal variation (Figures 2, 3 and 4). In addition, it is not possible to define variations between diurnal and night periods because most samples (87%) were taken at night. Only during the cruises of August–September 1967, and January–April 1968 were some samples taken during the day (13% of the total); however, it was not possible to identify differences in either abundance or distribution (Figures 2, 3 and 4).

ACKNOWLEDGEMENTS

I express my sincere gratitude to Dr Frank Ferrari from the Smithsonian Oceanographic Sorting Center and Dr Angeles Alvarino from the National Marine Fisheries Service, who kindly provided the material upon which this study is based. Thanks to Dr J. David George, Curator of the Polychaeta and Porifera Section of the British Museum of Natural History for permitting me to examine the specimens included in their collection of pelagic Polychaetes in July, 1985, and to Dr Fredrik Pleijel for his constructive criticism of the manuscript. Thanks are also due to Maricela Vicencio Aguilar and Ivette Ruiz Boisjeanoue in its preparation; and Agustin Fernandez Irriarte and Gerardo Rivas for the preparation of the figures. Also, thanks to Dr Mark E. Olson for review and improving the English, and to the two anonymous referees for their helpful comments on this manuscript.

REFERENCES


Reisch, D. J. (1968) A biological survey of Bahia de los Angeles, Gulf of California, México. II Benthic polychaetous annelids.

Reisch, D. J. (1966) A biological survey of Bahia de los Angeles, Gulf of California, México. II Benthic polychaetous annelids.


