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

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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. Støp-Bowitz (Støp-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 Typhloscolecoidea.

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, 1875) 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 (Roden, 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

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Tehuantepec, Papagayo and Panama (Brandhorst, 1958; Cromwell, 1958; Barton *et al*., 1993; Trasviña *et al*., 1995; Chelton *et al*., 2000).

Reid and Blackburn (Reid, 1962; Blackburn, 1966), among others, have shown that the topography of the thermocline is noteworthy for its role in enriching the surface layer and for the distribution of the standing crop of zooplankton in this region, supporting the important fisheries. The mean thermocline depth presents three basic patterns. A deepening from east to west, an equatorial thermocline ridge coincident with the 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 taken from between ~200 m and the surface. Samples 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, the entire half sample was sorted, but sometimes it was sub-sampled. A total of 579 samples were analysed from five periods: January–April, April–May, June–July, and August–September 1967, and January–April 1968. Figure 1 shows the localities of the stations covered by the 12 cruises in this study. The detailed geographical localization of each one is reported in the EASTROPAC Atlases (Love, 1972–1978). 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 kowalewski* 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); 048(5); 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); 253(2); 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); 022(1); 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); 181(5); 189(3); 197(3); 205(2); 216(2); 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(5); 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,**

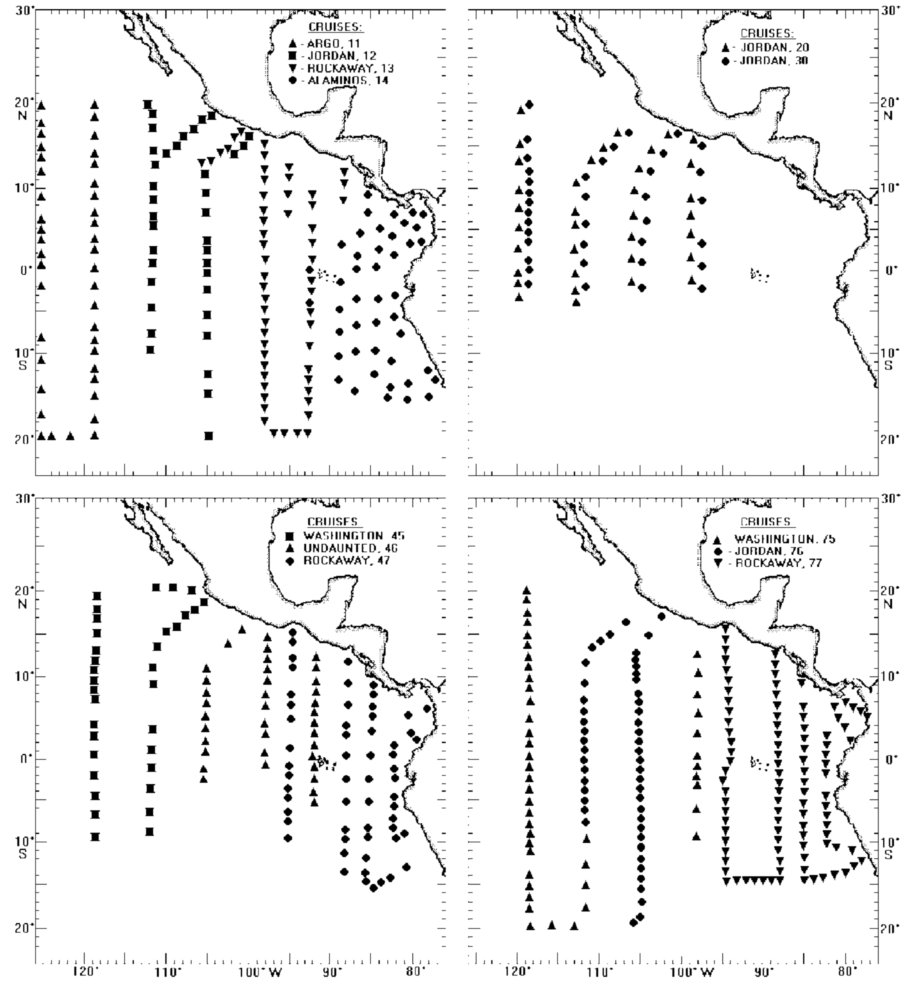

Fig. 1. Study area and geographical position of the sampling stations for 12 oceanographic cruises of EASTROPAC Program 1967–1968, analysed in this survey.

1967): stations 011(1); 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); 446(6); 450(16); 462(4); 478(6); 509(2); 525(2); 527(1). **Washington 75 (February 15 to April 15, 1968**): stations 014(1); 015(1); 019(4); 025(1); 027(1); 032(1); 044(3); 048(4); 064(6); 073(3); 077(1); 086(2); 088(2); 094(9); 096(8); 100(1); 101(8); 108(1); 109(1); 112(4); 113(3); 120(2); 124(3); 188(7); 192(2); 209(53); 223(9); 225(3); 233(2); 239(5). **Jordan 76 (February 19 to April 5, 1968**): stations 040(1); 049(2); 067(2); 073(5); 076(1); 085(2); 126(5); 136(3); 138(3); 146(1); 148(1); 158(4); 172(3); 176(4); 184(1); 198(3); 205(1). **Rockaway 77 (January 20 to April 28, 1968**): stations 013(1); 017(3); 039(1); 057(1); 068(1); 092(2); 121(1); 125(2); 135(2); 141(3); 144(1); 153a(1); 153b(1); 177(3); 208(1); 216(2); 240(1); 315(1); 327(1); 339(1); 354(6); 358(2); 362(3); 370(2); 378(2); 386(3); 394(3); 426(5); 429(3); 432(1); 435(2); 438(2); 442(1); 444(3); 452(1); 476(2); 482(1); 499(4); 491(2); 515(2); 523(2); 527(4); 531(2); 535(3).

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. phyllodes* 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 Arnho 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 subarctic and subtropical 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. Rioja (Rioja, 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-Álamo (Fernández-Álamo, 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-Álamo (Vicencio-Aguilar and Fernández-Álamo, 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

Typhloscolex 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.

Argo 11 (January 24 to March 6, 1967): stations 025(2); 048(1); 088(1); 128(1); 136(10); 142(2); 144(1); 150(1); 159(3); 181(1); 187(2); 213(3); 221(5); 246(3); 262(1); 278(4); 287(4); 289(3); 297(1); 320(1); 322(4); 328(1). **Jordan 12 (February 7 to March 24, 1967**): stations 032(7); 043(1); 059(2); 075(1); 094(2); 118(5); 126(2); 142(1); 158(2); 164(2); 184(2); 192(1); 200(1); 212(4); 224(2); 235(1); 244(3); 246(2); 252(1); 260(3); 276(1); 282(2); 284(2). **Rockaway 13 (January 20 to March 31, 1967**): stations 019(1); 034(1); 040(3); 048(3); 056(1); 071(3); 119(2); 121(1); 127(2); 129(1); 135(1); 137(2); 169(1); 175(7); 179(5); 191(5); 195(6); 207(3); 211(2); 227(1); 245(1); 263(1); 268(1); 320(1); 328(2). **Alaminos 14 (January 21 to April 10, 1967**): stations 001(1); 022(1); 027(1); 043(8); 051(4); 110(1); 120(2); 128(1); 132(1); 138(1); 146(4); 154(5); 172(2); 199(3); 213(2); 240(1); 255(2); 263(1); 303(1); 318(1); 326(5). **Jordan 20 (April 10 to May 31, 1967**): stations 008(1); 040(2); 058(1); 064(5); 066(1); 072(2); 073(3); 075(2); 092(2); 100(3); 108(1); 116(1); 124(1); 173(4); 181(9); 189(2); 197(4); 216(2); 224(3); 232(2); 240(2); 248(1). **Jordan 30 (June 14 to August 2, 1967**): stations 010(1); 036(1); 043(2); 057(1); 065(1); 067(3); 075(1); 088(2); 104(3); 112(3); 151(1); 167(3); 175(1); 183(1); 191(6); 207(1); 223(4); 231(5); 239(1); 246(2). **Washington 45 (August 3 to September 25, 1967**): stations 018(1); 023(2); 024(3); 053(2); 067(2); 078(2); 094(2); 110(1); 125(5); 133(1); 140(5); 167(2); 175(2); 187(5); 198(1); 289(5); 305(3); 325(1). **Undaunted 46 (August 6 to September 27, 1967**): stations 026(1); 034(1); 044(5); 052(4); 057(1); 065(1); 067(3); 086(2); 094(3); 102(1); 155(1); 161(1); 163(1); 185(5); 187(2). **Rockaway 47 (July 31 to September 29, 1967**): stations 028(1); 035(3); 049(3); 053(4); 065(1); 082(1); 105(1); 137(3); 145(1); 147(1); 173(2); 240(3); 242(11); 250(2); 254(6); 283(1); 322(5); 338(4); 351(10); 430(6); 436(4); 438(10); 446(12); 450(8); 462(1); 466(1); 478(2); 509(1); 517(1). **Washington 75 (February 15 to April 15, 1968**): stations 004(2); 006(1); 010(2); 011(1); 025(1); 027(1); 034(1); 044(1); 048(4); 064(3); 073(1); 077(2); 086(3); 088(1); 094(5); 096(11); 100(4); 101(7); 104(8); 108(3); 109(4); 112(9); 113(5); 116(1); 124(3); 129(3); 133(2); 137(1); 141(1); 188(3); 192(1); 198(7); 223(5); 225(7); 239(3). **Jordan 76 (February 19 to April 5, 1968**): stations 040(1); 049(1); 055(1); 058(4); 064(2); 067(4); 073(6); 076(7); 080(6); 085(1); 092(1); 108(1); 115(2); 119(2); 124(1); 126(11); 136(5); 138(2); 146(1); 148(1); 172(1); 176(1); 184(2); 213(4). **Rockaway 77 (January 20 to April 28, 1968**): stations 012(1); 022(1); 057(4); 062(1); 068(2); 070(1); 074(1); 125(1); 144(1); 159(1); 171(1); 192a(1); 220(2); 224(2); 232(2); 240(3); 315(1); 318(1); 327(1); 330(1); 354(1); 362(1); 378(2); 394(2); 426(1); 438(1); 440(1); 442(1); 446(1); 450(1);

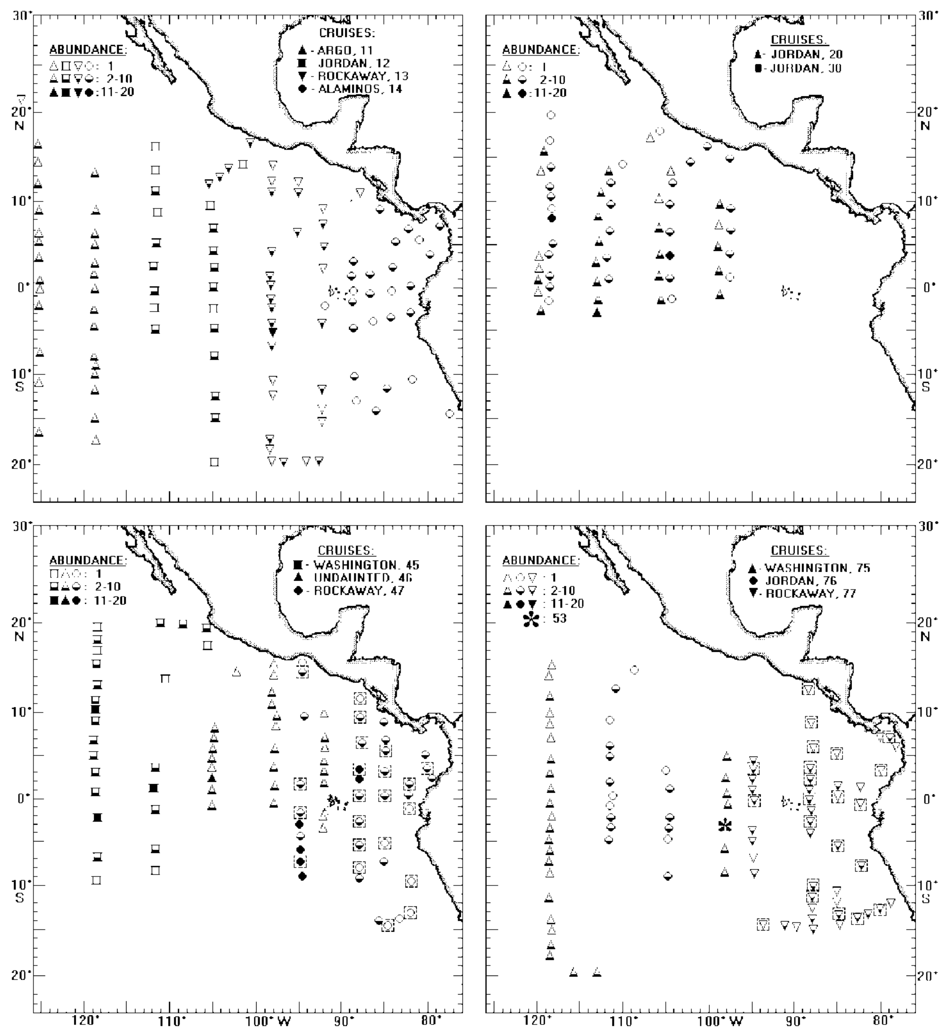

Fig. 2. Geographical distribution and abundance of *Typhloscolex muelleri* in the eastern tropical Pacific Ocean. Day stations □.

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

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). *Sagitella kowalewski* was recorded by Treadwell [(Treadwell, 1943); as *Plotobia paucichaeta*] 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

Fernández-Álamo (Fernández-Álamo, 1987, 1991, 1992, 1996) from the Gulf of Tehuantepec, the Gulf of California, and off the south-western coast of Baja California, and by Vicencio-Aguilar and Fernández-Álamo (Vicencio-Aguilar and Fernández-Álamo, 1996) from the Costa Rica Dome in Central America.

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-Álamo, 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);

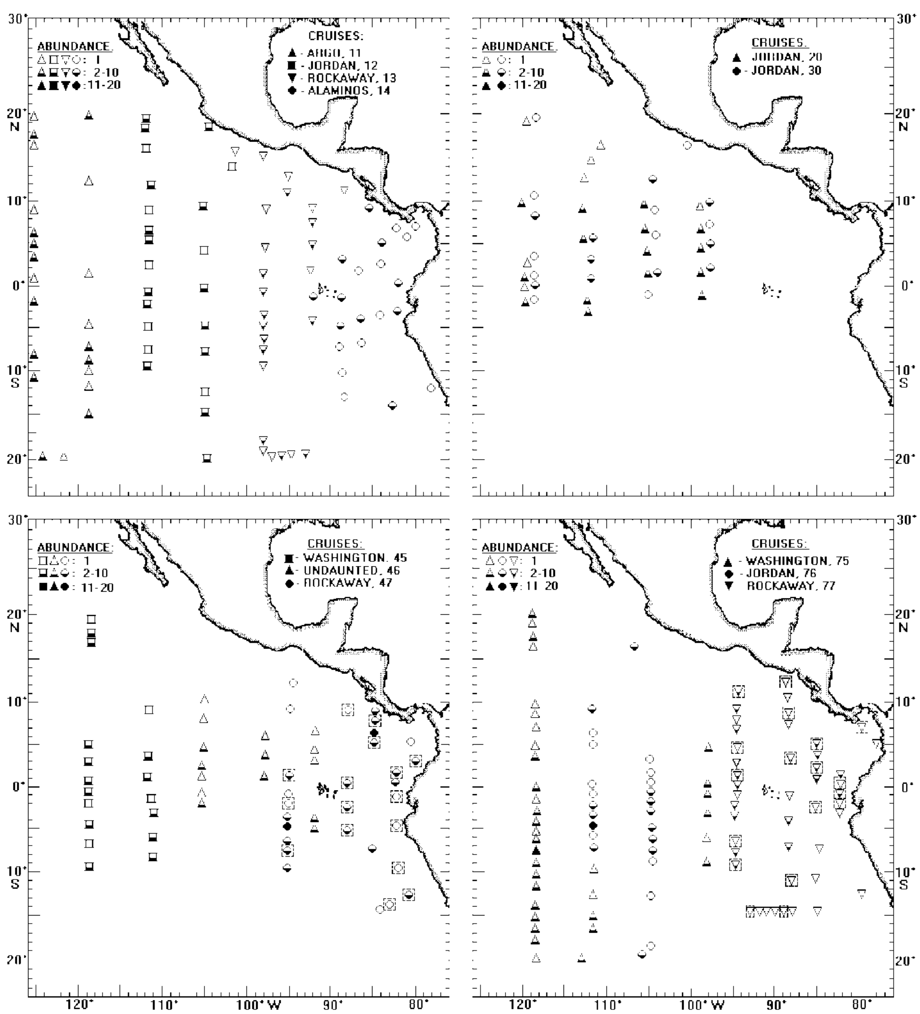

Fig. 3. Geographical distribution and abundance of *Sagitella kowalewski* in the eastern tropical Pacific Ocean. Day stations □.

248(1); 256(1). **Jordan 30 (June 14 to August 2, 1967**): stations 034(3); 036(2); 043(1); 112(2); 120(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-Álamo, 1983). Following Tebble (Tebble, 1962) it may be under-represented 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-Álamo (Fernández-Álamo, 1991).

Figure 4 shows the distribution and abundance of this species in the survey area.

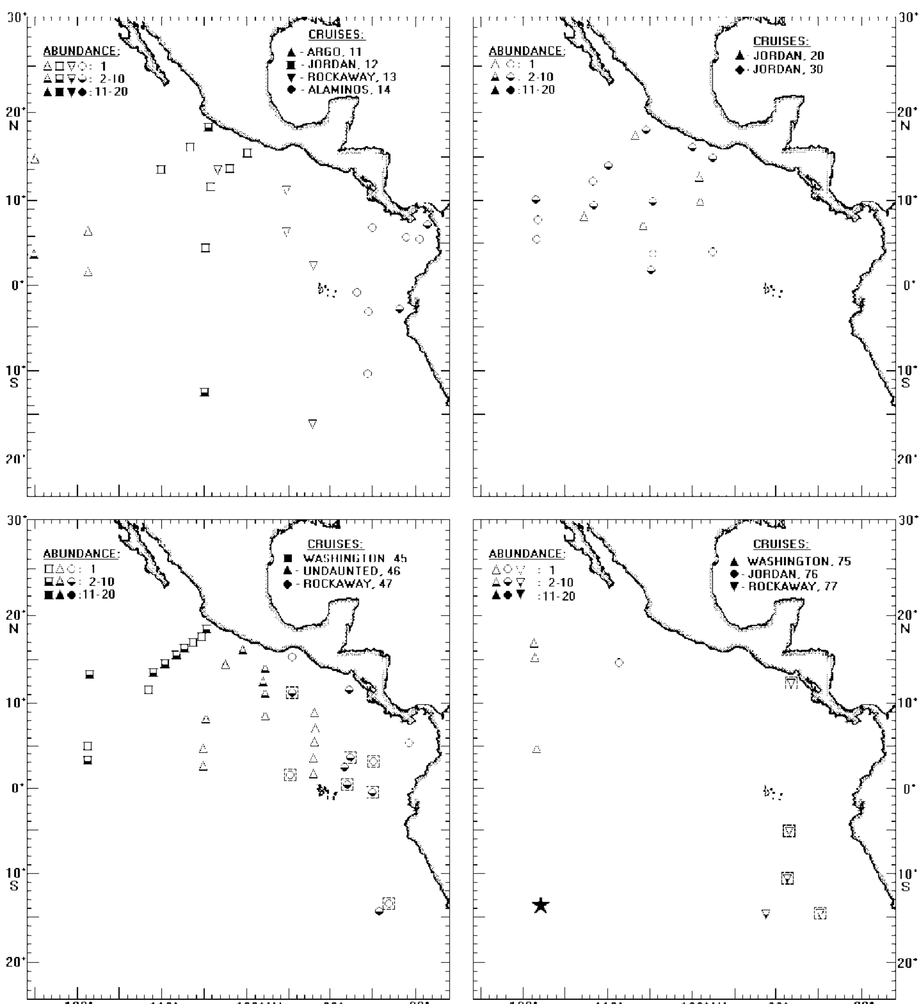

Fig. 4. Geographical distribution and abundance of *Traviopsis dubia* and *Tr. lanceolata* (marked by a star, in only one locality) in the eastern tropical Pacific Ocean. Day stations □.

General distribution

Støp-Bowitz (Støp-Bowitz, 1948) originally described this species from two localities (39°30′N, 49°42′W and 48°24′N, 36°53′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*. Støp-Bowitz (Støp-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 Puercos, Panama. Treadwell recorded *Tr. lanceolata* in three localities in the subarctic region and one near Juan Fernandez Island in the south-east 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, 1935, 1936, 1939, 1950, 1951; Støp-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 Støp-Bowitz (Støp-Bowitz, 1948).

DISCUSSION

The distribution of the four typhloscolecid 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 (Støp-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 longicirrata*, respectively (Fernández-Álamo, 1983, 2000, 2002)]. The second dominant species was *S. kowalewski*, which is also widely distributed in the Atlantic (Støp-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 (Støp-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 only eight localities. The present report demonstrates the wide distribution of *Tr. dubia* and confirms its tropical–subtropical affinity proposed by Tebble (Tebble, 1962). *Travisiopsis 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 35 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; Støp-Bowitz, 1948; Tebble, 1960, 1962). However, its previous records in the tropical regions of the Pacific (Treadwell 1936, 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. kowalewski* 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).

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