A QUANTITATIVE STUDY OF THE BENTHIC POLYCHAETOUS ANNELIDS OF BAHIA DE SAN QUINTIN, BAJA CALIFORNIA[1]

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INTRODUCTION

Quantitative studies of the benthic invertebrates of the eastern Pacific Ocean have been limited geographically to Washington and California. In the Puget Sound region there were several earlier studies (Shelford, et al, 1935; Shelford and Towler, 1925; Weese, 1932; and Weese and MacNab, 1930). In San Francisco Bay, Packard (1918) studied the quantitative distribution of molluscans. Recently Filice (1958, 1959) and later Jones (1961) made quantitative samples in certain areas of the bay. In the past decade there has been considerable interest in the quantitative descriptions of the animals of the sea bottom of southern California. The initial paper dealing with the off-shore fauna was by Hartman (1955a), and since that date many additional papers have appeared dealing with the distribution of species and descriptions of animal communities (Barnard and Hartman, 1959; Barnard, Hartman, and Jones 1959; Barnard and Ziesenhenne, 1961; Hartman, 1960; Hartman and Barnard, 1958, 1960). The benthic fauna of southern California bays and harbors has been studied with possible reference to pollution (Anon. 1952a, b; Barnard, 1959; Reish, 1955, 1959b, 1959d, 1961; Reish and Winter, 1954).

Prior to the expeditions by the Beaudette Foundation to Bahía de San Quintín, no area south of California had been studied quantitatively. Accordingly, it was particularly interesting to participate in the study of this relatively undisturbed body of water lying within the same zoogeographic province as southern California.

The polychaetes of San Quintin Bay have not been studied previously. The *Velero IV* made some collections in the area in 1951. The author visited the bay in the spring of 1950 and collected a few polychaetes; one of these species was used in connection with other studies by Hartman (1957) [*Scoloplos* (*Leodamas*) *ohlini* (Ehlers)].

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[1]This study was supported in part by research grants NSF-G 11413 and NSF-G 16170 from the National Science Foundation

MATERIALS AND METHODS

Quantitative samples were taken by Dr. J. Laurens Barnard and associates at 95 stations (Fig. 1), in April 1960 using a modified, size-one, Hayward orange-peel bucket (Reish 1959). Samples were brought back to the base camp and washed through a screen with 32 openings to the inch (0.5 mm). The material retained on the screen was preserved in formaldehyde and later sorted into groups. The author received samples containing various groups of worms from which the polychaetes were separated. See Barnard (1962) for a more complete description of the techniques employed in the study as well as other descriptive data of the bay. The distribution charts were contoured by Barnard to conform with other papers being published on the San Quintin survey.

CHEMICAL AND PHYSICAL DATA

SALINITY: The salinity is relatively uniform and essentially that of normal sea water throughout much of San Quintin Bay. There is a slight increase in the upper reaches of the bay, but this is probably of minor biological importance.

SEDIMENTS: The mean diameters were determined for 82 of the 95 stations studied. These data are summarized in Table 1 and the distribution given in Figure 2. The analysis of the sediment was made by Dr. D. S. Gorsline utilizing the technique devised by Emery (*in* Barnes, 1959). On the basis of mean diameters, three types of sediments were encountered in Bahía de San Quintín: fine sands (250-125 μ), very fine sands (125-62.5 μ), and silts (62.5-3.9 μ). The silts were the most frequently encountered substrate type. They were widespread in the upper reaches of the bay and dominant in the middle areas. The fine and very fine sandy sediments occurred in patches, while the coarser types were located in the seaward portion and the southern shore of the bay.

DISCUSSION

The faunal affinities of San Quintin Bay are clearly related to southern California. All species but *Scoloplos* (*L.*) *ohlini* have been reported previously from southern California waters and 30 (63%) of these have been encountered previously in bays and harbors (Table 2). One new species, *Megalomma pigmentum*, was found widely distributed in San Quintin, but this polychaete had been recognized earlier in another locality.

RELATIONSHIP OF POLYCHAETES TO SEDIMENTS: As described above, three types of sediments, on the basis of mean diameters, were encountered (Fig. 2; Table 1). The relationships of the percentage occurrence and the average number of specimens per station of the principal polychaetes (based on presence at ten or more stations) to the general sediment type at stations for which data are available are given in Table 2. Since silts were found at approximately 60 per cent of the stations for which analyses were made, the occurrence of a species on a particular substrate type is given in percentage units rather than according to the number of times it

Fig. 1. Station location of benthic samples, Bahia de San Quintin, Baja California.

TABLE 1

Sediment Characteristics of Bahía de San Quintín, Baja California. Based on Mean Diameters.

Station	Mean Diam. μ	Station	Mean Diam. μ	Station	Mean Diam. μ
1	7	31	52	67	124
2	6	32	33	68	112
3	7	33	107	69	43
4	7	34	48	70	46
5	6	35	58	71	62
6	9	36	51	72	103
7	30	37	31	73	125
8	13	38	43	74	103
9	16	39	54	75	142
10	38	40	242	76	66
11	21	41	33	77	66
12	98	43	53	79	55
13	26	44	53	80	138
14	56	45	36	81	50
15	71	46	51	84	155
16	32	47	79	85	88
17	22	48	105	87	62
18	61	51	63	88	137
19	49	52	60	89	65
20	105	53	78	90	92
21	40	55	137	91	98
22	174	58	46	92	154
23	36	59	128		
24	13	60	54		
25	143	61	55		
26	19	62	62		
27	28	63	142		
28	9	64	48		
29	86	65	83		
30	19	66	56		

No data: Stations 42, 49, 50, 54, 56, 57, 78, 82, 83, 86, 93, 94.

was found. In this way the dominance of silts does not obscure the possible preference of a species for another substrate type. In addition, the average number of specimens per station gives further indication of substrate preference (or tendency). For example, the occurrence of *Scoloplos acmeceps* at 59 stations of which 32 were silt, 18 very fine sand, and 9 fine sand suggests an adaptation to silts. However, when the percentage occurrence for a particular substrate type is used, the figures are 64, 86, and 80 per cent, respectively, it suggests a preference for the fine and very fine sandy substrates. Furthermore, when the figure for average number of specimens per station is used, the respective numbers are 18, 33, and 25 specimens. On the basis of percent occurrence per substrate type, the most abundant species of polychaetes may be grouped as follows:

RELATIONSHIP TO SILT (6 SPECIES):

Brania clavata, Exogone verugera, Lumbrineris minima, Cossura candida, Armandia bioculata, and *Pista alata.*

RELATIONSHIP TO VERY FINE SAND (10 SPECIES):

Neanthes caudata, Platynereis bicanaliculata, Goniada littorea, Onuphis microcephala, Haploscoloplos elongatus, Scoloplos (L.) ohlini, S. acmeceps, Spiophanes missionensis, Scyphoproctus oculatus, and *Axiothella rubrocincta.*

RELATIONSHIP TO FINE SAND: None

RELATIONSHIP TO BOTH SILT AND VERY FINE SAND (7 SPECIES):

Nephtys caecoides, Prionospio malmgreni, Cirriformia luxuriosa, Capitita ambiseta, Chone mollis, Fabricia limnicola, and *Megalomma pigmentum.*

RELATIONSHIP TO FINE AND VERY FINE SAND (1 SPECIES):

Nerinides maculata.

NO APPARENT RELATIONSHIP (1 SPECIES):

Polydora (B.) uncata.

The data summarized above indicate that a large share of the dominant species of polychaetes show a relationship to very fine sandy sediments. On the other hand, these 10 species are found frequently and sometimes abundantly in the areas where silts predominate (Table 2). Only one species, *Polydora (B.) uncata,* does not show any indication of substrate relationship. The majority of species shows a relationship for a particular substrate as determined by the per cent occurrence and by the numbers of specimens per sample. The utilization of the mean diameters to characterize the substrate rather than the percentage occurrence of the different soil components is of greater value in determining the preference of a species for a particular type of sediment. Since many of the benthic polychaetes either engulf the substrate for food or use the material in constructing tubes, the size of the majority of the particles is of importance.

SUBSTRATE DOMINATION BY POLYCHAETES: The dominant polychaetes at each station were determined by noting the three or four species represented by the largest number of specimens. These data were then compared with the three sediment types to ascertain whether certain species dominate particular types of substrate. Six species of polychaetes constitute the dominant bay species on the basis of number of specimens. These are, in decreasing order of importance, *Prionospio malmgreni, Exogone verugera, Cossura candida, Capitita ambiseta, Scoloplos acmeceps,* and *Fabricia limnicola.*

Prionospio malmgreni is the dominant species on both silts and very fine sands. The remaining principal species on silts are *Exogone verugera,*

TABLE 2

The Relationship of the Principal Polychaetes to Sediment Type in Bahía de San Quintín, Baja California.
(Numerals in parenthesis indicate the number of stations at which the species was collected.)

Species	Silt (50)		Very Fine Sand (21)		Fine Sand (11)	
	Percent occurrence	Ave. no. per station	Percent occurrence	Ave. no. per station	Percent occurrence	Ave. no. per station
Brania clavata (29)	34	8	24	7	18	3
Exogone verugera (69)	90	205	62	36	36	104
Neanthes caudata (46)	50	14	62	31	36	8
Platynereis bicanaliculata (23)	20	13	43	3	9	4
Nephtys caecoides (25)	28	2	24	5	18	1
Goniada littorea (13)	4	2	29	1	9	1
Onuphis microcephala (13)	12	13	29	44	—	—
Lumbrineris minima (41)	58	10	29	5	27	1
Haploscoloplos elongatus (11)	2	10	24	16	9	2
Scoloplos (L.) ohlini (39)	38	6	54	13	36	2
S. acmeceps (65)	64	18	86	33	80	25
Polydora (B.) uncata (17)	20	3	14	5	27	1
Nerinides maculata (18)	8	5	33	8	45	5
Prionospio malmgreni (70)	78	107	86	57	63	8
Spiophanes missionensis (11)	8	1	19	3	9	1
Cirriformia luxuriosa (16)	22	9	19	7	9	3
Cossura candida (49)	66	101	48	21	9	4
Armandia bioculata (13)	16	13	14	4	9	2
Capitita ambiseta (47)	56	85	43	164	18	1
Scyphoproctus oculatus (18)	12	13	54	17	—	—
Axiothella rubrocincta (29)	36	3	43	10	18	1
Pista alata (35)	44	42	39	5	9	1
Chone mollis (43)	48	15	62	12	27	4
Fabricia limnicola (28)	32	101	39	42	9	34
Megalomma pigmentum (40)	48	17	58	5	9	1

TABLE 3

Distribution of 48 species of San Quintin polychaetes in bays and harbors of Southern California.

Benthic Polychaetes from San Quintin Bay	Los Angeles-Long Beach Harbors[1]	Alamitos Bay[2]	Newport Bay[3]
Lepidonotus caelorus			
Chrysopetalum occidentale			
Anaitides williamsi	x	x	x
A. nr. *multiseriata*			
Eteone dilatae		x	x
E. pacifica			
Hypoeulalia bilineata	x	x	
Ophiodromus pugettensis	x	x	x
Brania clavata			
Exogone verugera			
Trypanosyllis gemmipara			
Typosyllis variegata			
Neanthes caudata	x	x[4]	x
Platynereis bicanaliculata	x	x	x
Nephtys caecoides	x	x	x
Sphaerodorum minutum			
Glycera americana	x	x	x
Goniada littorea	x	x	x
Onuphis microcephala			
Marphysa sanguinea			
Lumbrineris erecta	x	x	x
L. minima	x	x	x
Arabella iricolor			
Dorvillea articulata	x	x	x
Haploscoloplos elongatus	x	x	x
Scoloplos (L.) ohlini			
S. acmeceps			
Polydora (B.) uncata		x	
Nerinides maculata			
Prionospio malmgreni			
P. pygmaeus			
Spiophanes missionensis	x	x	x
Cirriformia luxuriosa	x	x	
C. spirabrancha	x	x	
Cossura candida	x	x	x
Pherusa capulata		x	
Armandia bioculata	x	x	x
Polyophthalmus pictus		x[4]	
Capitella capitata	x	x	x
Capitita ambiseta	x	x	x
Notomastus magnus			
Scyphoproctus oculatus			x
Arenicola cristata			
Axiothella rubrocincta			x
Pista alata		x	x
Chone mollis	x		x
Fabricia limnicola			x
Megalomma pigmentum	x	x	x

Table 3 (Continued)

Number of species in common	21	24	24
Number of species from area	71	65	61
Percent in common to S.Q.	44%	50%	50%

[1]Data from Reish, 1959a.
[2]Data from Reish and Winter, 1954; Reish, 1961.
[3]Data from Reish, 1959b.
[4]Newly recorded herein.

Cossura candida, *Capitita ambiseta*, and *Fabricia limnicola*. *Exogone verugera* is the dominant polychaete in the upper reaches of the bay. *Prionospio malmgreni* dominates generally throughout the middle bay area. Many different species of polychaetes occupy the silts of the lower bay region, with *Capitita ambiseta* being the most frequent.

Scoloplos acmeceps, of lesser importance on silts, was second in dominance to *Prionospio malmgreni* on very fine sands. *Capitita ambiseta* was the third most important species from this substrate.

Although *S. acmeceps* (table 2) showed a relationship for very fine sands, it dominated fine sands along with occasional *Exogone verugera*. All species were found in smaller numbers from fine sands than silts but the decrease in numbers was to a greater extent for species other than *S. acmeceps*.

ZOOGEOGRAPHICAL CONSIDERATIONS: Since quantitative studies south of southern California had not been made previously, the distributions for 25 species were extended southward. No northern extensions in distribution are recognized; however, Bahía de San Quintín marks the most northern record for *Scoloplos (L.) ohlini* as reported by Hartman (1957). The majority of the species listed below was known from southern California, but a few had not been taken south of central California.

Distributions of the following are herein extended southward to Bahía de San Quintín: *Anaitides williamsi*, *Eteone dilatae*, *E. pacifica*, *Hypoeulalia bilineata*, *Sphaerodorum minutum*, *Goniada littorea*, *Lumbrineris minima*, *Dorvillea articulata*, *Haploscoloplos elongatus*, *Polydora (B.) uncata*, *Nerinides maculata*, *Prionospio pygmaeus*, *Spiophanes missionensis*, *Cirriformia spirabrancha*, *Cossura candida*, *Pherusa capulata*, *Armandia bioculata*, *Capitita ambiseta*, *Notomastus magnus*, *Scyphoproctus oculatus*, *Arenicola cristata*, *Axiothella rubrocincta*, *Pista alata*, *Chone mollis*, *Fabricia limnicola*, and *Megalomma pigmentum*, n. sp.

Table 3 lists the 48 species known from Bahía de San Quintín and indicates whether they have been reported from Los Angeles-Long Beach Harbors, Alamitos Bay, and Newport Bay. More species of polychaetes have been reported from these three areas than from Bahía de San Quintín. Although the largest number of species has been found in Los Angeles-

TABLE 4

Distribution of the 21 most abundant Benthic Polychaetes from Bays and Harbors of Southern California[1] and Bahía de San Quintín, Baja California.

Benthic Polychaetes	Los Angeles-Long Beach Harbors	Alamitos Bay	Newport Bay	San Quintin Bay
Exogone verugera	—	—	—	xx
Neanthes caudata	x	x[2]	x	xx
Nereis procera	xx	x	x	—
Lumbrineris erecta	x	xx	xx	x
L. minima	xx	xx	xx	xx
Dorvillea articulata	xx	xx	xx	x
Haploscoloplos elongatus	x	xx	xx	x
Scoloplos (L.) ohlini	—	—	—	xx
S. acmeceps	—	—	—	xx
Prionospio h. newportensis	x	xx	xx	—
Prionospio malmgreni	—	—	—	xx
Spiophanes missionensis	x	xx	x	x
Cossura candida	xx	xx	xx	xx
Tharyx parvus	xx	xx	xx	—
Armandia bioculata	x	x	xx	x
Capitita ambiseta	xx	xx	xx	xx
Axiothella rubrocincta	—	—	—	xx
Pista alata	—	x	x	xx
Chone mollis	x	—	x	xx
Fabricia limnicola	—	—	x	xx
Megalomma pigmentum	x	x	x	xx
Number of abundant species	6	9	9	13
Number of additional species present	8	5	7	5

xx Abundant organism
x Present
— Absent
1 Sources of data given in Table 3
2 Newly recorded herein

Long Beach Harbors, more in common were found for Alamitos Bay and Newport Bay. This difference may be attributable to the great alterations by man in Los Angeles-Long Beach Harbors or to more intensive sampling of the larger harbor area.

In Table 4 comparisons are made of the abundant species of polychaetes from these four areas. Twenty one were found to occur in dominant numbers in at least one of these protected bodies of water. *Lumbrineris minima*, *Cossura candida*, and *Capitita ambiseta*, were found to be the principal species in all four areas. *Dorvillea articulata* and *Tharyx parvus* were among the dominants in the three southern California regions, but only one specimen of *D. articulata* was taken from San Quintin and none of *T. parvus*. Five of the 13 most abundant species in San Quintin Bay have not been taken from the southern California bays. On the basis of

comparisons of equivalent species, the polychaetous annelids of San Quintin are more like those of Newport Bay than the other two areas. This is believed to be due to physical similarities between upper Newport Bay and San Quintin Bay, whereas the upper reaches of Alamitos Bay, consisting of small channels, and the largely polluted inner Los Angeles-Long Beach Harbors show marked dissimilarities (see Barnard and Reish, 1959; Reish and Winter, 1954; and Reish, 1959, for maps of these areas).

SYSTEMATICS

The most abundant species of polychaetes listed below are marked with an asterisk. Their relationship to sediments is shown in table 2 and so details of this relationship are not repeated.

Family POLYNOIDAE

Lepidonotus caelorus Moore

Berkeley and Berkeley, 1948: 9-10; Pettibone, 1953:15-16. Stas. 51 (1), 54 (1), 60 (1), 66(1), 67(1), 86(1), 92(1). The substrate was either a very fine sand or silt bottom. North Pacific Ocean from Japan to Alaska and Mexico.

Family CHRYSOPETALIDAE

Chrysopetalum occidentale Johnson

Hartman, 1961:56-57. Sta. 34(1). The specimen was taken from a silty bottom. This species is usually taken from intertidal rocky shores where it is associated with encrusting organisms (Hartman, 1961). Southern California south to western Mexico.

Family PHYLLODOCIDAE

Anaitides williamsi Hartman

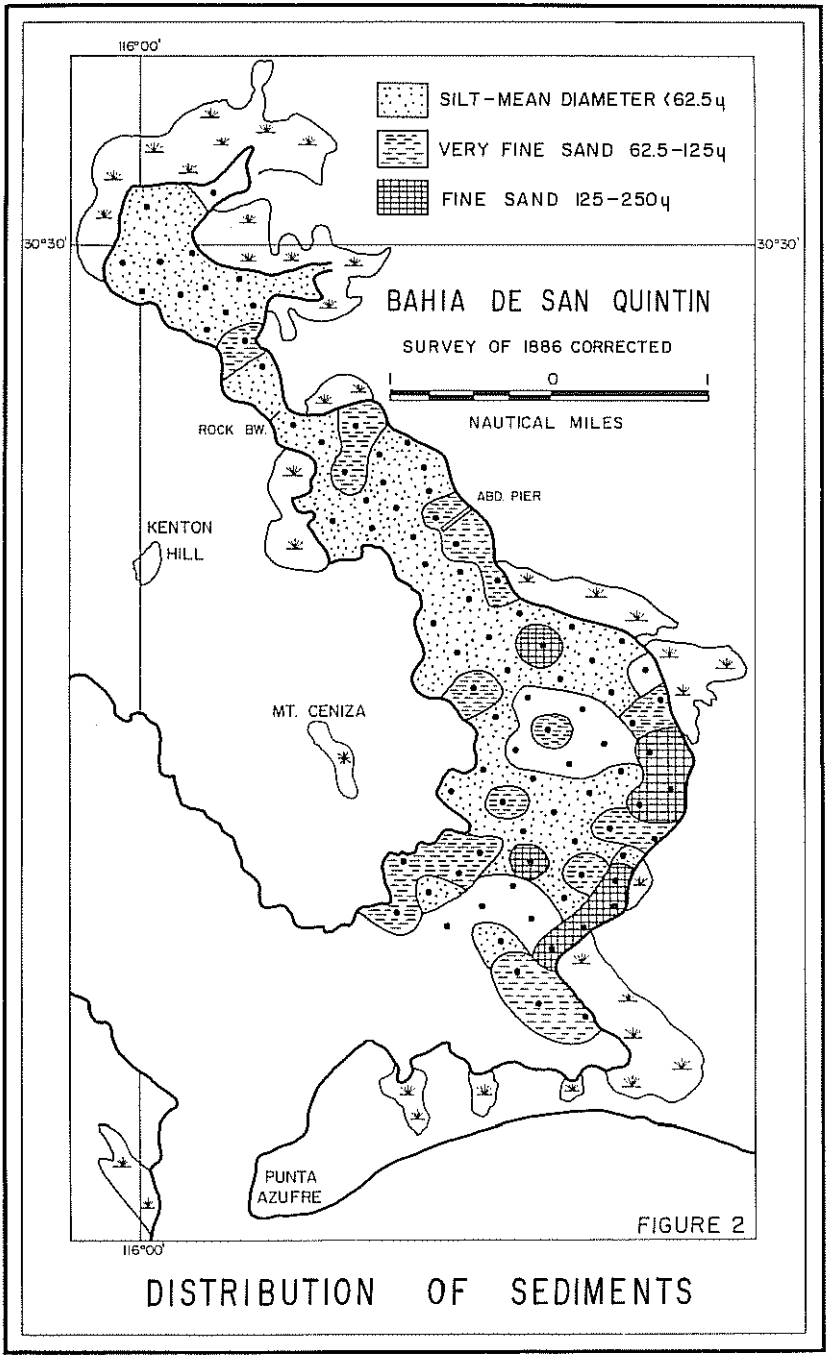
Hartman, 1936b:126-127; 1961:12; Hartman and Reish, 1950:11; Reish, 1959b:77. Sta. 44(3). Taken from a silty bottom. Previously known from Coos Bay, Oregon, to southern California.

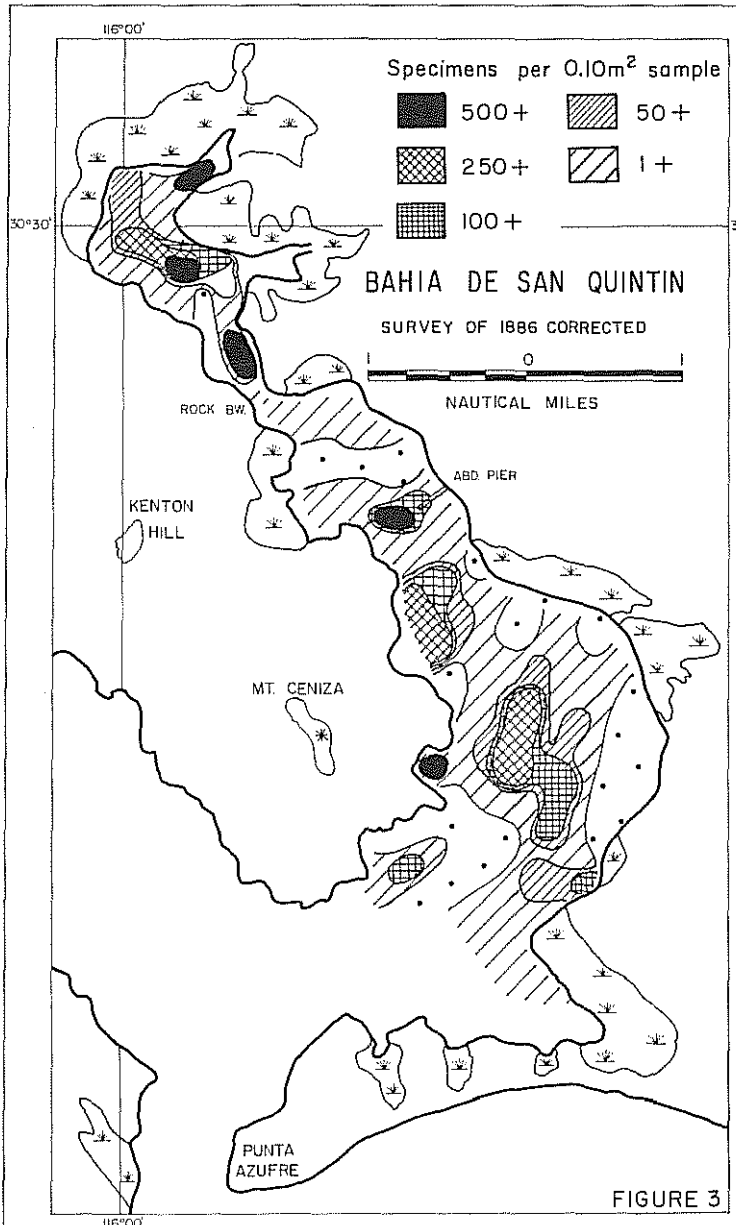
Anaitides nr. **multiseriata** Rioja

Hartman, 1961:62. *Phyllodoce* (*Anaitides*) *multiseriata* Rioja, 1941: 684-687. Stas. 65(4), 77(2). Hartman (1961) reported many specimens from southern California all differing from the original account by the possession of a nuchal papilla. The animals from Bahía de San Quintín agree with these.

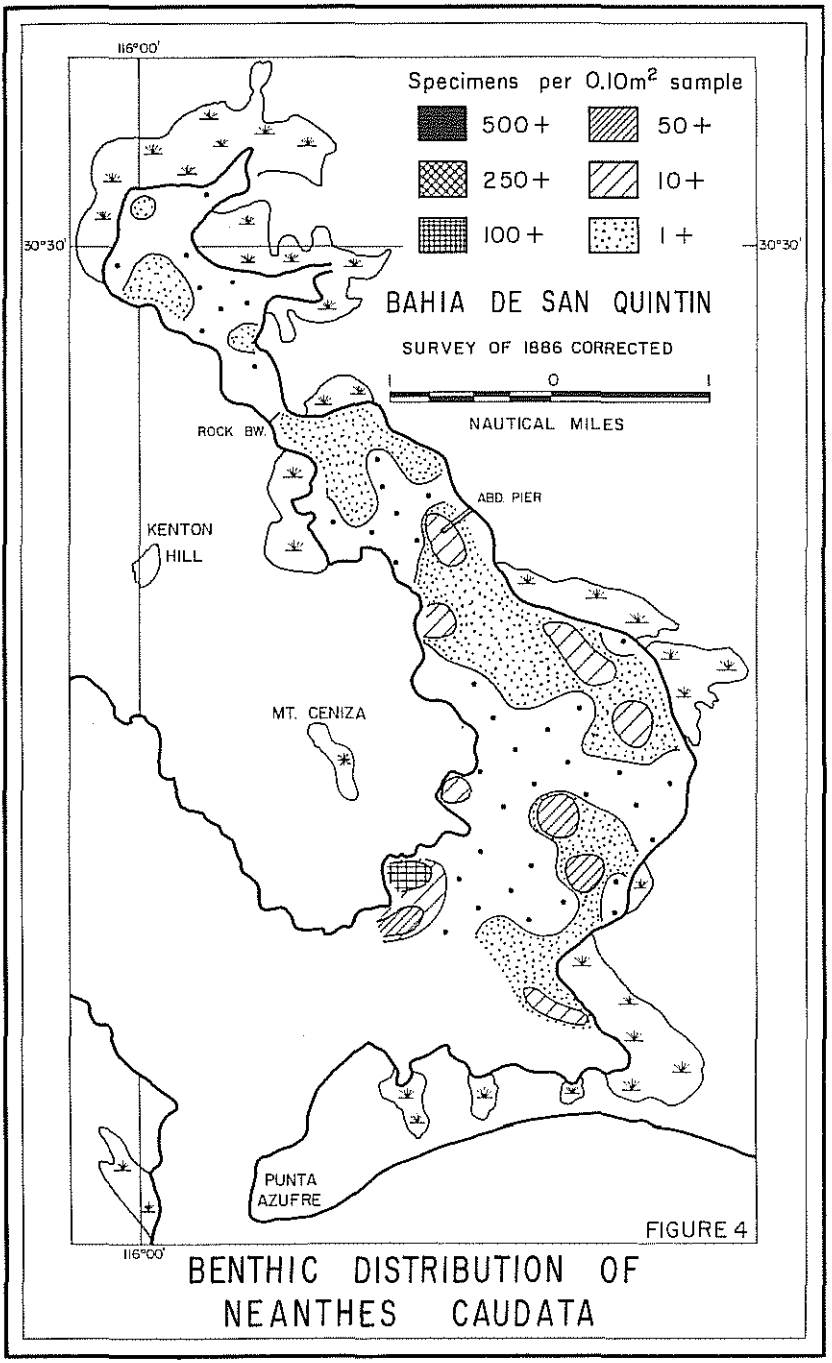
Eteone dilatae Hartman

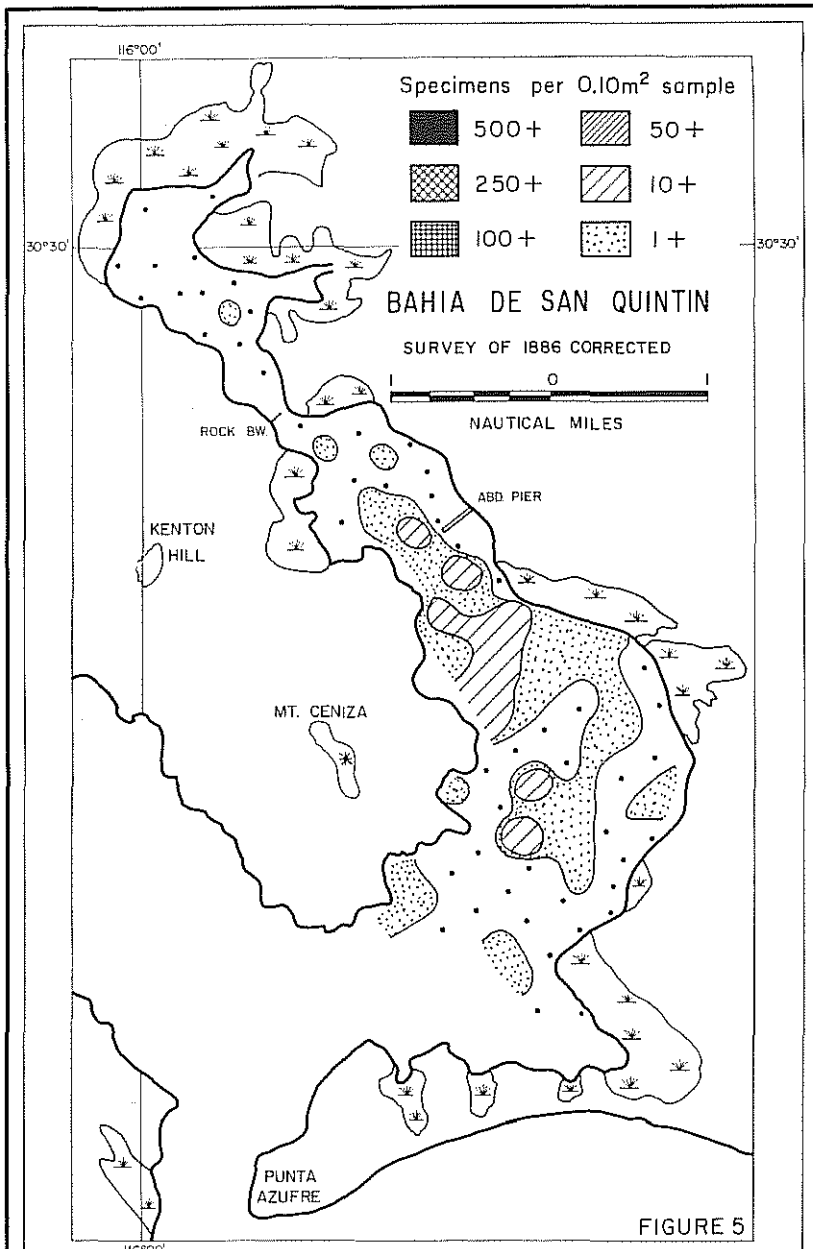
Hartman, 1936b:130-131; 1961:12; Reish, 1959b:78. Stas. 45 (1), 51(1), 73(1). Two specimens were taken from stations having primarily a sandy substrate, the third was taken from a silty bottom. Elsewhere *E. dilatae* has been more frequently taken from silty sands than other types of substrates (Hartman, 1961; Reish 1959b). Known previously from middle and southern California.

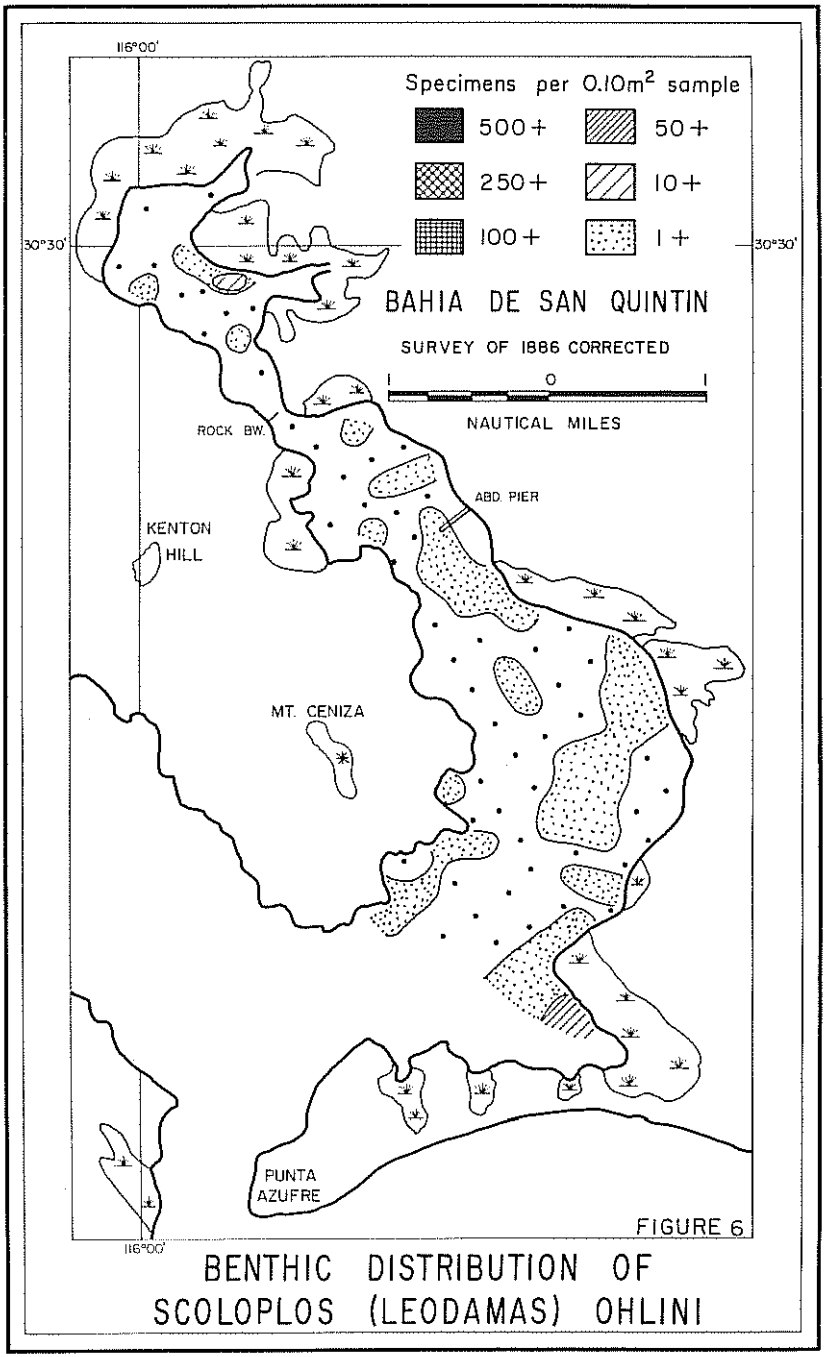

116°00'
30°30'
30°30'
SILT-MEAN DIAMETER <62.5μ
VERY FINE SAND 62.5-125μ
FINE SAND 125-250μ
BAHIA DE SAN QUINTIN
SURVEY OF 1886 CORRECTED
0
NAUTICAL MILES
ROCK BW.
ABD. PIER
KENTON HILL
MT. CENIZA
PUNTA AZUFRE
116°00'
FIGURE 2
DISTRIBUTION OF SEDIMENTS



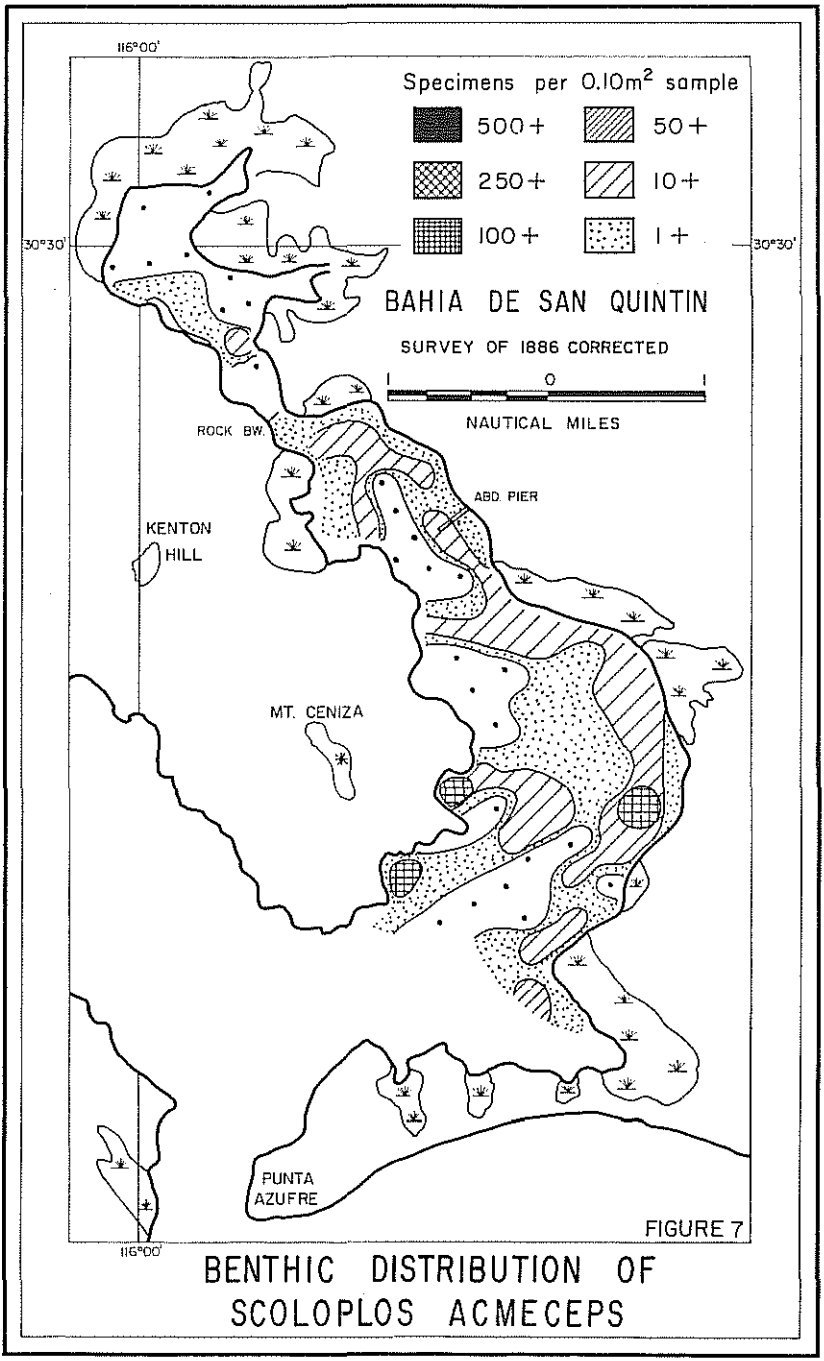
BENTHIC DISTRIBUTION OF EXOGONE VERUGERA


116°00'
30°30'
Specimens per 0.10m² sample
500+
250+
100+
50+
10+
1+
BAHIA DE SAN QUINTIN
SURVEY OF 1886 CORRECTED
0
1
NAUTICAL MILES
ROCK BW.
ABD. PIER
KENTON HILL
MT. CENIZA
PUNTA AZUFRE
FIGURE 4
BENTHIC DISTRIBUTION OF NEANTHES CAUDATA

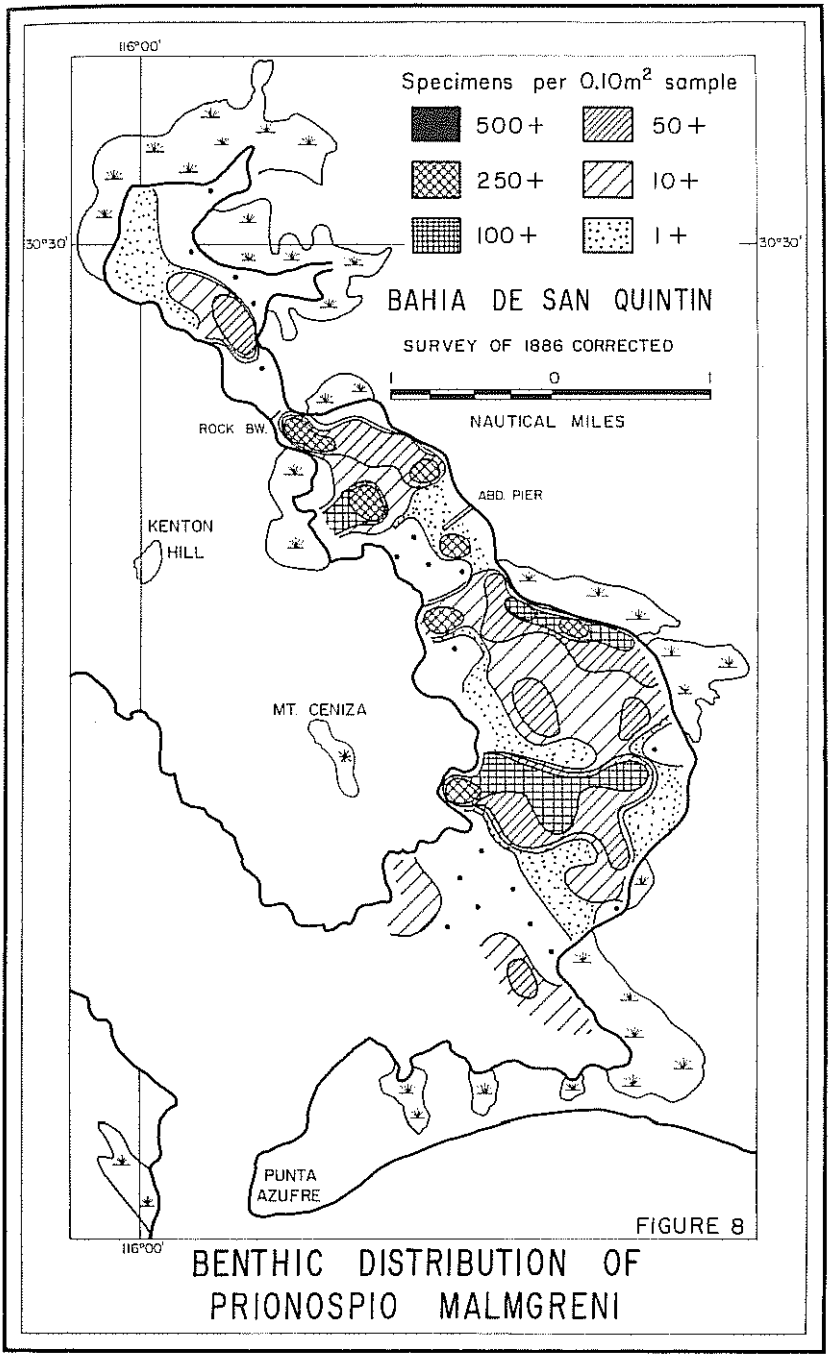

116°00'
30°30'
Specimens per 0.10m² sample
500+
250+
100+
50+
10+
1+
BAHIA DE SAN QUINTIN
SURVEY OF 1886 CORRECTED
0
NAUTICAL MILES
ROCK BW.
ABD. PIER
KENTON HILL
MT. CENIZA
PUNTA AZUFRE
FIGURE 5
BENTHIC DISTRIBUTION OF LUMBRINERIS MINIMA



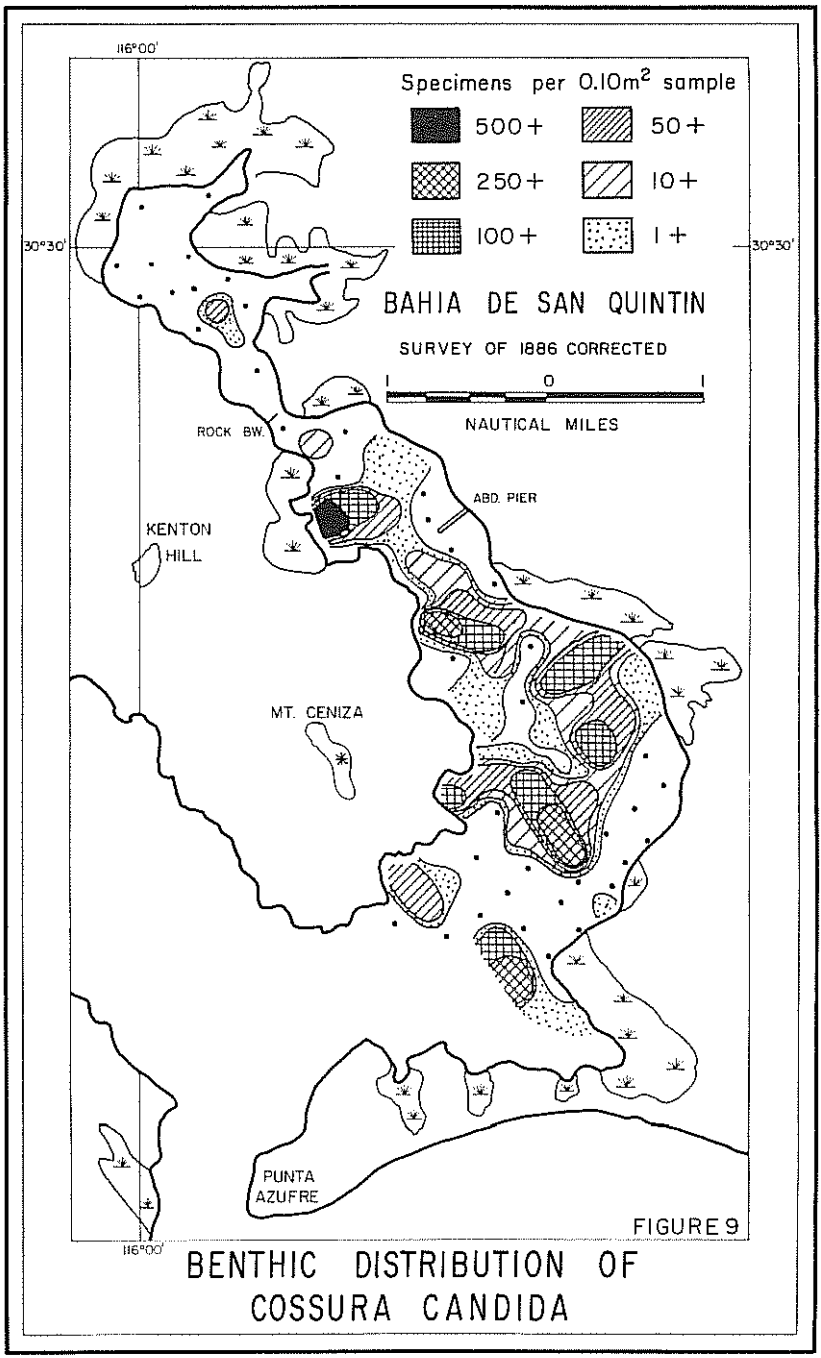
BENTHIC DISTRIBUTION OF SCOLOPLOS (LEODAMAS) OHLINI



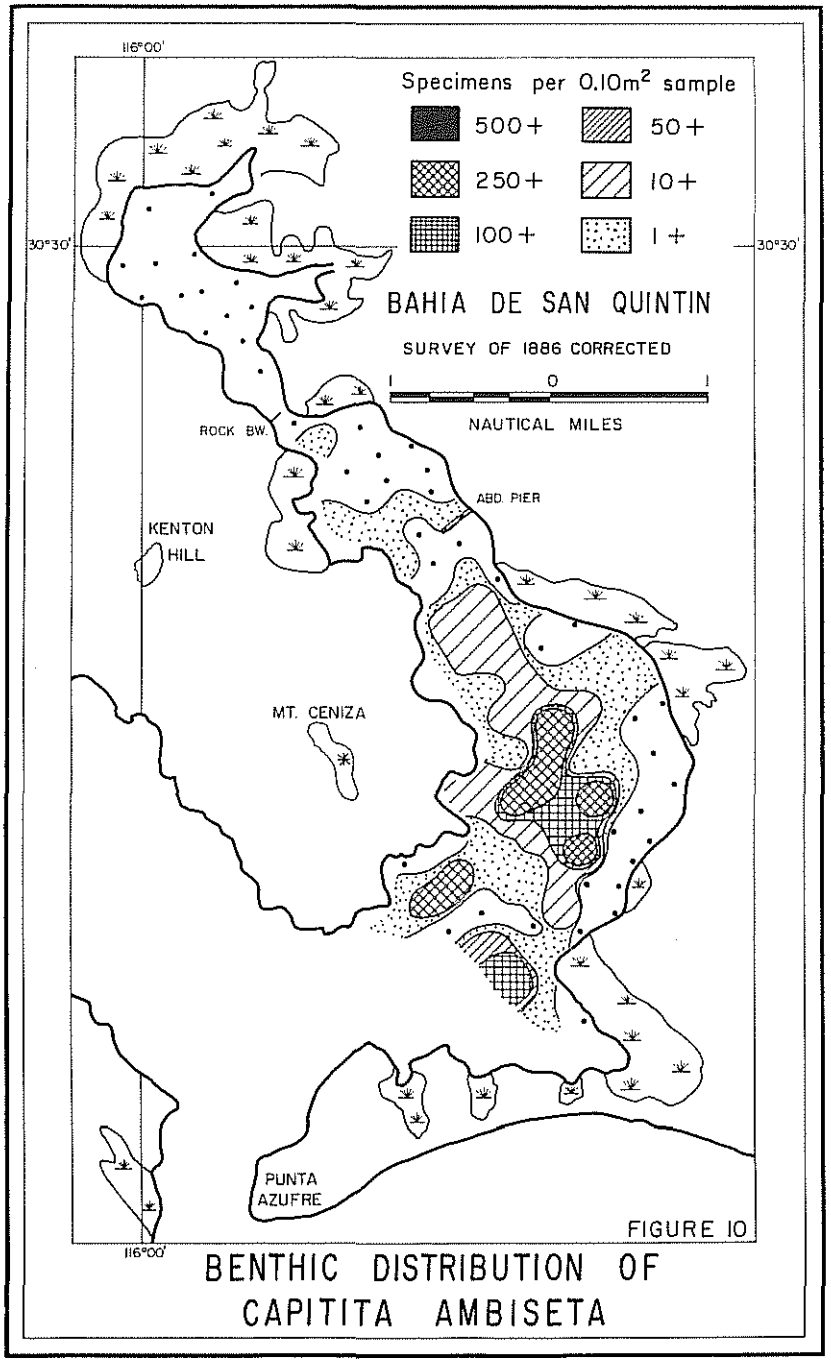
BENTHIC DISTRIBUTION OF
SCOLOPLOS ACMECEPS



BENTHIC DISTRIBUTION OF PRIONOSPIO MALMGRENI



BENTHIC DISTRIBUTION OF
COSSURA CANDIDA


116°00'
30°30'
Specimens per 0.10m² sample
500+
250+
100+
50+
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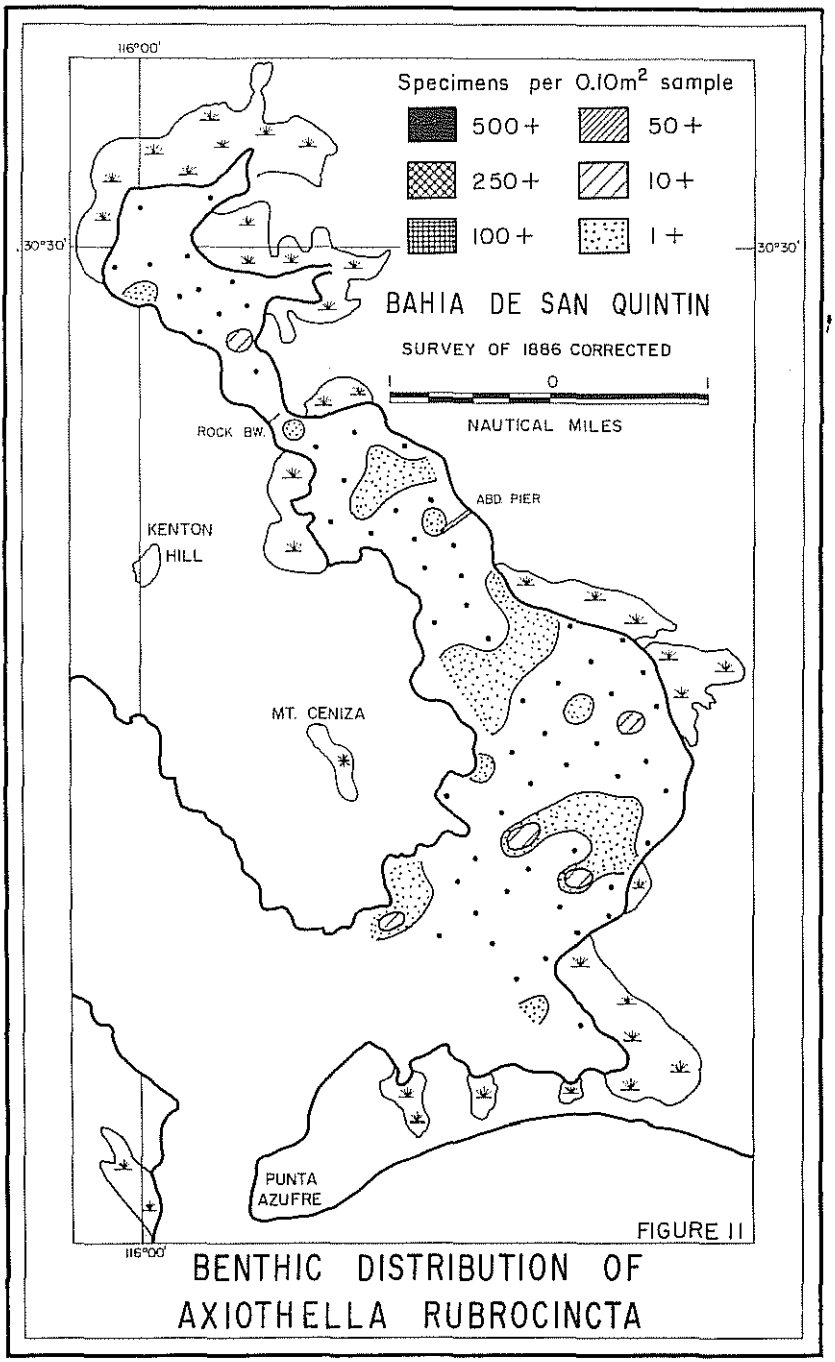
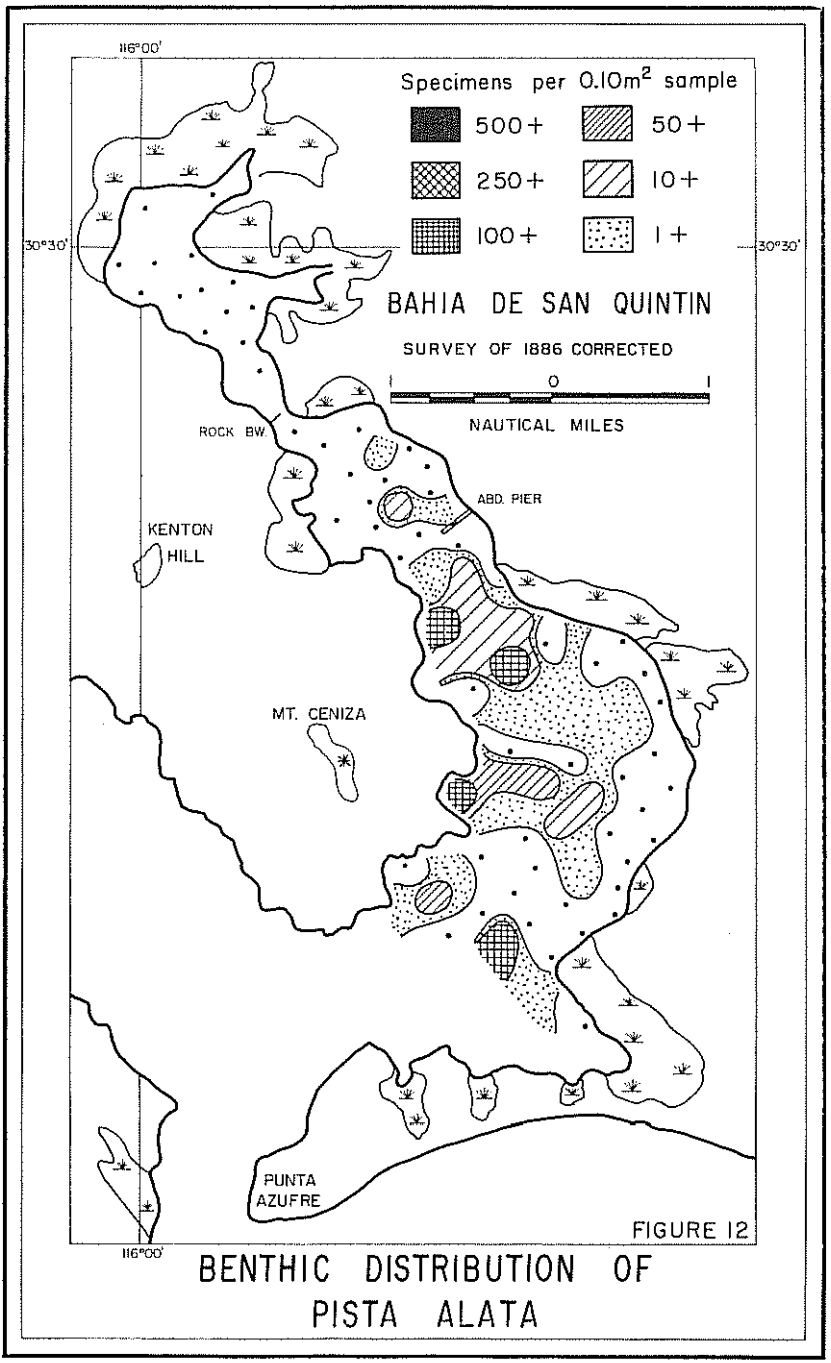
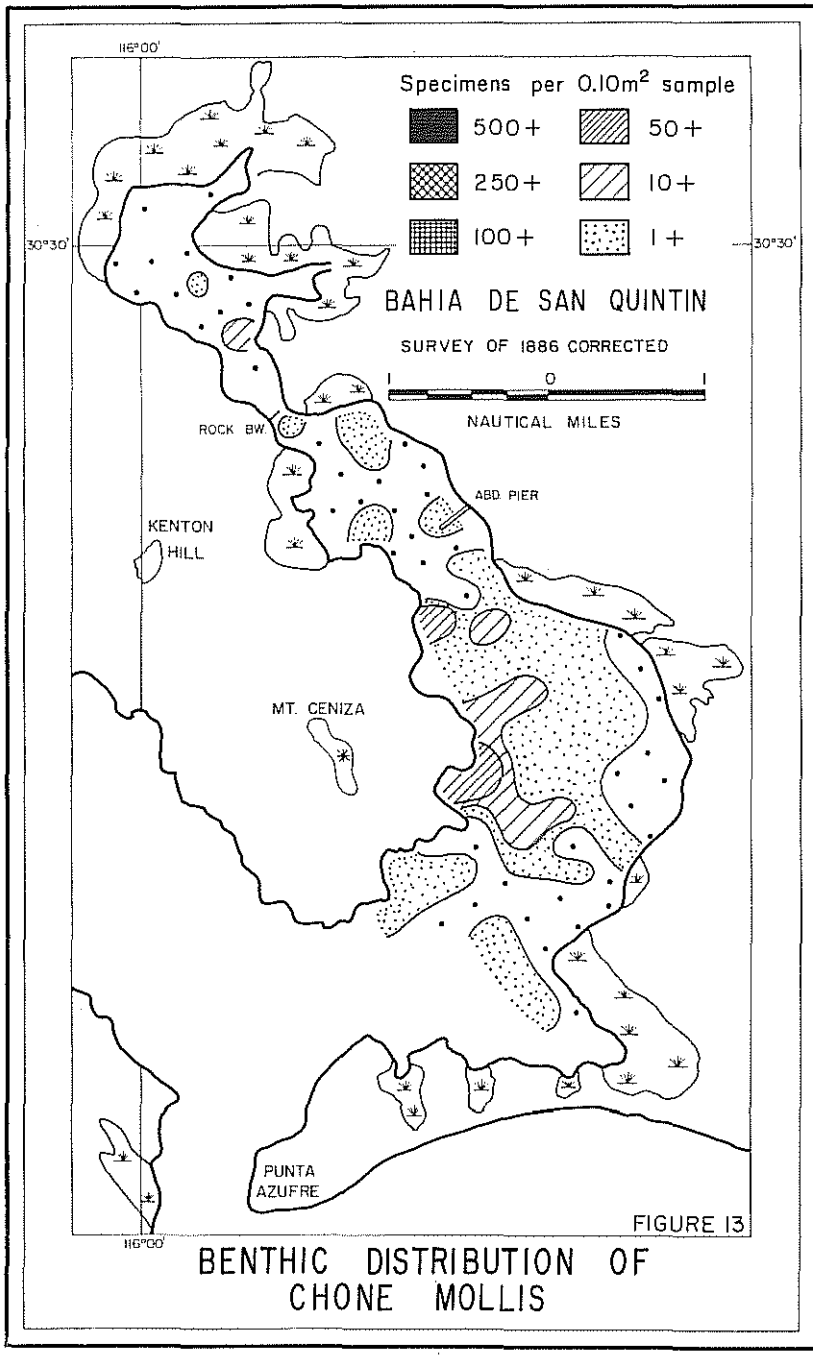
1+
BAHIA DE SAN QUINTIN
SURVEY OF 1886 CORRECTED
0
NAUTICAL MILES
ROCK BW.
ABD. PIER
KENTON HILL
MT. CENIZA
PUNTA AZUFRE
FIGURE 10
BENTHIC DISTRIBUTION OF CAPITITA AMBISETA

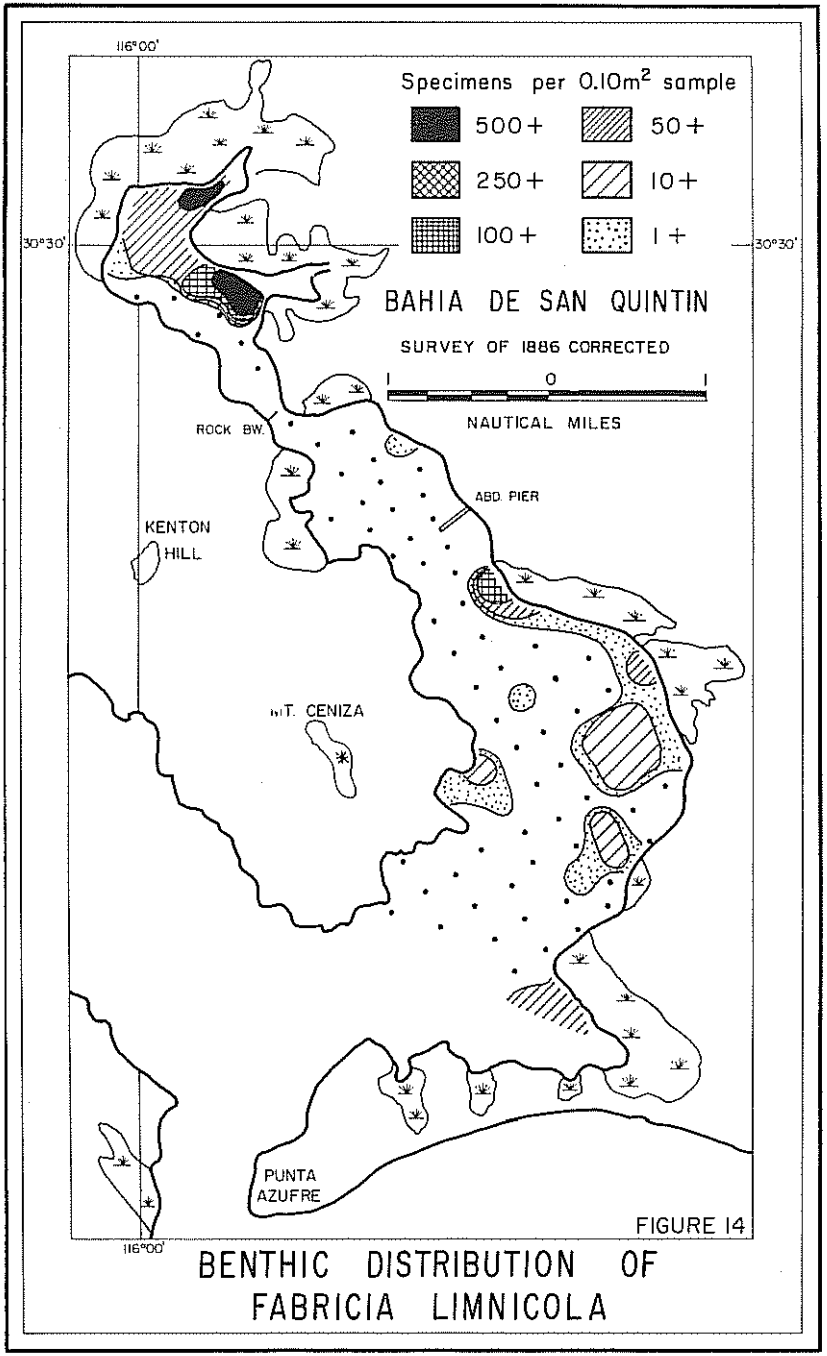


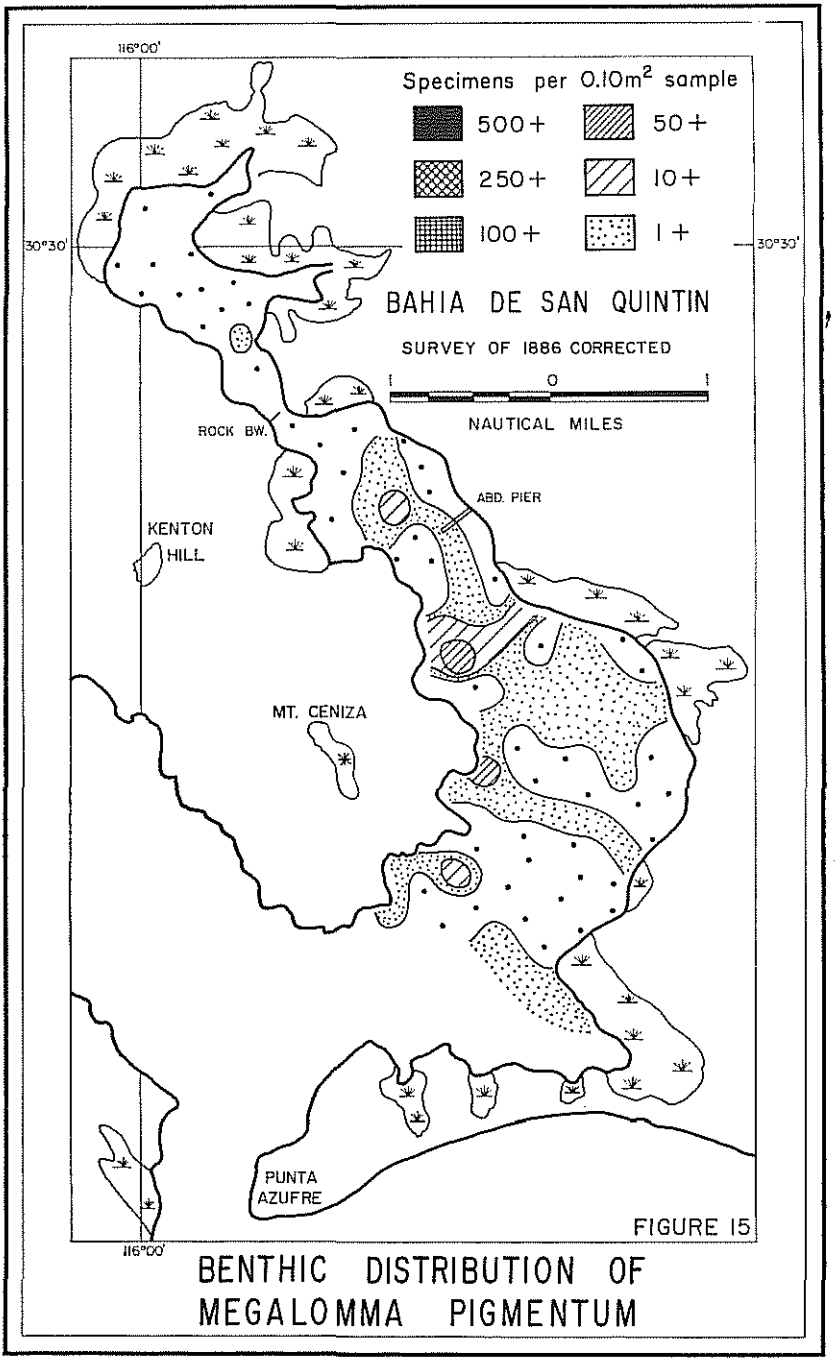
BENTHIC DISTRIBUTION OF
AXIOTHELLA RUBROCINCTA


116°00'
30°30'
Specimens per 0.10m² sample
500+
250+
100+
50+
10+
1+
BAHIA DE SAN QUINTIN
SURVEY OF 1886 CORRECTED
0
NAUTICAL MILES
ROCK BW.
ABD. PIER
KENTON HILL
MT. CENIZA
PUNTA AZUFRE
FIGURE 12
BENTHIC DISTRIBUTION OF PISTA ALATA



BENTHIC DISTRIBUTION OF CHONE MOLLIS


116°00'
30°30'
Specimens per 0.10m² sample
500+
250+
100+
50+
10+
1+
BAHIA DE SAN QUINTIN
SURVEY OF 1886 CORRECTED
0
NAUTICAL MILES
ROCK BW.
ABD PIER
KENTON HILL
MT. CENIZA
PUNTA AZUFRE
FIGURE 14
BENTHIC DISTRIBUTION OF FABRICIA LIMNICOLA



BENTHIC DISTRIBUTION OF MEGALOMMA PIGMENTUM

Eteone pacifica Hartman

Hartman, 1936a:31; 1961:12. Stas. 14(1), 58(1), 60(1), 64(1), 74(3), 90(1), 91(2). Specimens were taken from either a silt or very fine sandy substrate. Previously known from Western Canada to central California.

Hypoeulalia bilineata (Johnston)

Bergström, 1914:165; Hartman and Reish, 1950:12; Hartman, 1961: 13; *Eulalia bilineata* Johnston. Fauvel, 1923:162-163; Berkeley and Berkeley, 1948:48. Sta. 53(2). Collected from a very fine sandy substrate. Reported previously from western Europe and from British Columbia south to California.

Family HESIONIDAE

Ophiodromus pugettensis (Johnson)

Hartman, 1961:67-68; *Podarke pugettensis* Johnson, 1901:397-398; Berkeley and Berkeley, 1948:56-57; Reish, 1959b:78-79. Sta. 81(1). Taken from a silty bottom. This species may be either free living or commensal with starfish or pagurid crabs (Berkeley and Berkeley, 1948). Known from the Eastern Pacific Ocean from British Columbia to Peru; Japan.

Family SYLLIDAE

***Brania clavata** (Claparède)

Rioja, 1943:215-217; Hartman, 1944a:338; *Grubea clavata* (Claparède). Fauvel, 1923:296-298. Stas. 10(1), 15(10), 18(1), 20(2), 29 (3), 33(6), 34(1), 36(8), 37(5), 38(30), 41(1), 42(18), 43(7), 45 26(26), 46(1), 47(1), 49(31), 50(1), 51(2), 54(2), 55(3), 58(6), 60 (3), 64(13), 69(30), 76(13), 86(1), 91(5). Known from Europe, New England and Pacific Mexico.

***Exogone verugera** (Claparède)

Figure 3 (distribution)

Fauvel, 1923:307-308; Rioja, 1943:221-222; Berkeley and Berkeley, 1948:78; Hartman 1961:16. Stas. 0(630), 1(72), 2(29), 3(200), 4(304), 5(1,196), 6(82), 7(12), 8(1), 10(3), 11(3), 12(5), 13(570), 14(8), 15(5), 16(3), 17(4), 18(2), 23(13), 24(13), 25(256), 26(1), 27(2), 28(4,120), 29(30), 30(20), 31(20), 32(18), 34(209), 35(8), 36(6), 38(432), 41(3), 42(11), 43(409), 44(6), 45(73), 46(20), 49(37), 50 (19), 51(7), 52(1), 53(317), 54(89), 57(16), 58(3), 60(45), 61(243), 62(105), 64(511), 65(22), 66(33), 67(1), 69(10), 70(96), 74(39), 75(10), 77(15), 79(92), 80(143), 81(162), 85(6), 87(9), 88(8), 89 (20), 90(3), 91(3), 92(1). Reported from Europe, Mediterranean Sea, Arctic Ocean, Japan, Australia, British Columbia, California, Baja California, and western Mexico.

Trypanosyllis gemmipara Johnson

Hartman, 1944c:249; Berkeley and Berkeley, 1948:71. Sta. 12(1). Collected from a very fine sandy bottom. Eastern Pacific Ocean from Alaska south to Mexico.

Typosyllis variegata (Grube)

Fauvel, 1923:263; Hartman, 1961:17. Stas. 13(140), 18(2). The substrate was composed of silt at both stations. Cosmopolitan.

Family NEREIDAE

***Neanthes caudata** (della Chiaje)

Figure 4 (distribution)

Fauvel, 1923:347-348; Reish, 1957:216-228; 1959b:81; Rioja, 1959: 255-257. Stas. 1(1), 4(2), 8(8), 10(18), 12(5), 14(4), 15(10), 16(4), 17(5), 19(5), 20(1), 23(9), 25(28), 29(12), 31(2), 32(1), 33(6), 35(5), 36(21), 38(28), 41(35), 42(7), 43(8), 44(4), 45(4), 46(1), 47(4), 49(3), 51(33), 54(1), 55(2), 64(44), 66(73), 67(4), 70(9), 71(4), 74(98), 76(112), 81(28), 84(1), 85(58), 87(16), 88(1), 89(6), 90(48), 91(23). Europe, South Africa, California, Baja California, and western Mexico.

***Platynereis bicanaliculata** (Baird)

Hartman, 1954:36-39; 1961:19; Reish, 1959b:82. Stas. 34(11), 35 (1), 51(1), 53(15), 54(3), 57(2), 60(3), 61(9), 62(42), 65(1), 67(1), 70(3), 73(4), 74(1), 77(1), 79(24), 81(28), 83(5), 85(4), 87(3), 89(4), 90(3), 91(1). Typically this species is found in association with algae or eel grass (Reish, 1959b). Eel grass was present at 16 stations in Bahía de San Quintín and *P. bicanaliculata* was living at 7 of these. Western Canada south to Baja California; Hawaii and Australia.

Family NEPHTYIDAE

***Nephtys caecoides** Hartman

Hartman, 1950:101-102. Stas. 25(1), 35(1), 38(4), 39(5), 41(1), 43(3), 46(2), 48(3), 50(5), 53(2), 54(1), 61(4), 64(1), 65(9), 66(1), 69(1), 70(3), 73(1), 77(11), 79(4), 81(1), 87(2), 90(1), 93(1), 94(1). Generally in small quantity on silt or very fine sands with the highest numbers on the latter. Hartman found it associated with muddy sands in bays and lagoons. Limited to the eastern Pacific Ocean from British Columbia south to Baja California.

Family SPHAERODORIDAE

Sphaerodorum minutum (Webster and Benedict)

Berkeley and Berkeley, 1948:27-28; Hartman, 1961:80. Sta. 13(1). Taken from a silty sediment bottom. Known previously from New England, British Columbia, and southern California.

Family GLYCERIDAE

Glycera americana Leidy

Hartman, 1950:73-75; 1961:20; Reish, 1959b:82. Stas. 43(1), 45(1), 53(1), 60(1), 69(1), 77(1), 93(2). On silt or very fine sand at all stations. Hartman (1961) stated that it is generally found in sandy or mixed sediments. Atlantic Ocean from New England south to Brazil; Gulf of Mexico; Pacific Ocean from British Columbia south to Peru.

Family GONIADIDAE

***Goniada littorea** Hartman

Hartman, 1950:23-26; 1961:21; Reish, 1959b:83. Stas. 43(3), 53(1), 54(1), 65(1), 67(1), 73(1), 77(1), 81(1), 83(2), 90(2), 92(2), 93(3), 94(2). Taken from four stations composed of very fine sand, three stations of silt, and one of fine sand. Hartman (1961) found it associated with sandy substrates in southern California. Known previously only from southern California.

Family ONUPHIDAE

***Onuphis microcephala** Hartman

Hartman, 1944b:78-80, 1961:22. Stas. 35(3), 47(185), 51(4), 53(6), 54(1), 60(6), 66(43), 70(3), 71(1), 76(45), 81(23), 85(4), 90(17). This species was described from material collected in Sonora, Mexico; it has also been reported from Pacific Guatemala, southern California, and North Carolina.

Family EUNICIDAE

Marphysa sanguinea (Montagu)

Hartman 1944b:127-128; 1961:84-85; Reish, 1959b:83. Stas. 7(1), 10(11), 11(1), 13(6), 14(2), 19(4), 23(2), 30(8), 31(2). This species is found in the upper third of San Quintin Bay in silty substrates. Cosmopolitan, especially in the warmer seas.

Family LUMBRINERIDAE

Lumbrineris erecta (Moore)

Hartman, 1944b:149-150; Reish, 1959b:83. Stas. 53(1), 61(3), 77(1). Four specimens of *L. erecta* were taken from a silt substrate and one from a bottom of very fine sand. In southern California it has been found in coarse as well as fine sediments. Southern California south to western Mexico.

***Lumbrineris minima** Hartman

Figure 5 (distribution)

Hartman, 1944b:155-156; Reish, 1959b:83-84. Stas. 9(1), 17(1), 18(2), 23(1), 24(3), 27(6), 28(23), 30(1), 31(3), 32(17), 34(4), 35(16), 36(4), 37(3), 38(25), 39(10), 40(1), 41(3), 43(4), 44(42), 45(5), 46(1), 48(15), 49(1), 51(1), 52(55), 54(6), 59(1), 61(16), 62(3), 63(1), 64(6), 66(2), 69(40), 70(6), 74(6), 76(1), 81(2), 85(1), 87

(7), 89(5). In southern California *L. minima* has been found associated with muddy sands (Hartman, 1944; Reish, 1959b) and muds (Reish and Winter, 1954; Reish, 1959b). Heretofore known only from bays and shallow off-shore waters of southern California.

Family ARABELLIDAE

Arabella iricolor (Montagu)

Fauvel, 1923:438-439; Hartman, 1944b:173. Stas. 8(1), 19(2), 23(1), 25(1), 31(1), 72(1). Four of the six collections from silt. Cosmopolitan.

Family DORVILLEIDAE

Dorvillea articulata (Hartman)

Hartman, 1944b:189; Reish, 1955:1171, 1173; 1959b:84-85. Sta. 34(1). The substrate at station 34 consisted of silt. Elsewhere *D. articulata* is generally associated with silt or silty sand substrates. Previously known only from central and southern California.

Family ORBINIIDAE

***Haploscoloplos elongatus** (Johnson)

Berkeley and Berkeley, 1952:97-98; Hartman, 1955a:174; Reish, 1959b:85. Stas. 48(11), 65(27), 69(10), 72(6), 73(2), 77(24), 78(2), 83(6), 92(5), 93(13), 94(6). The majority of the specimens was collected from the stations characterized by very fine sands. It has been found to be associated with similar type substrates elsewhere. The known distribution of *H. elongatus* has been extended southward to San Quintin Bay. It has been taken as far north as Alaska.

***Scoloplos (Leodamas) ohlini** (Ehlers)

Figure 6 (distribution)

Hartman, 1957:287-289. Stas. 2(1), 3(30), 10(3), 12(3), 15(10), 19(1), 21(5), 25(1), 27(15), 29(9), 31(1), 32(7), 33(2), 34(1), 35(3), 37(2), 42(1), 44(1), 46(4), 47(3), 49(1), 51(2), 54(8), 57(1), 58(8), 62(6), 64(4), 66(2), 67(2), 72(2), 74(5), 75(2), 81(5), 84(1), 85(16), 88(3), 89(1), 90(13), 91(82). There are slight indications that the distribution (Fig. 6) of *S. ohlini* is related to the occurrence of very fine sands. Known only from Chile and Bahía de San Quintín, Baja California. It had been collected from this site in Baja California in 1950 by the author, as reported by Hartman, 1957.

***Scoloplos acmeceps** Chamberlin

Figure 7 (distribution)

Hartman, 1957:282-283. Stas. 5(1), 8(3), 10(10), 11(4), 12(24), 14(8), 15(50), 16(5), 17(12), 18(19), 19(17), 20(6), 22(1), 23(10), 25(54), 26(1), 27(19), 29(12), 33(13), 34(7), 35(7), 36(29), 37(10), 38(58), 39(35), 40(20), 41(4), 42(12), 45(5), 46(11), 47(52), 49(13), 50(6), 51(10), 53(2), 54(3), 55(24), 56(1), 58(3), 59(9), 60(23), 61(24), 62(6), 63(101), 64(111), 66(28), 67(15), 68(27), 69(10), 71(60), 72(2), 74(55), 76(193), 77(3), 79(8), 80(3), 81(1), 84(36),

85(6), 87(9), 88(46), 89(4), 90(62), 91(10), 93(1). Known only from the eastern Pacific Ocean from Alaska south to Mazatlán, Mexico.

Family SPIONIDAE

*Polydora (Boccardia) uncata Berkeley

Berkeley and Berkeley, 1952:14-15. Stas. 1(5), 3(40), 4(8), 8(1), 16(2), 19(1), 23(3), 25(1), 29(9), 36(4), 41(1), 42(3), 43(4), 63(1), 74(1), 75(1), 76(5). This polychaete constructs mud tubes at scattered stations throughout much of the bay in all three substrate types. Reported previously from British Columbia, Japan and California.

*Nerinides maculata Hartman

Hartman, 1961:91-92. Stas. 6(1), 39(2), 49(1), 55(2), 59(5), 63 (11), 65(7), 67(15), 68(4), 71(13), 74(1), 76(24), 79(4), 80(2), 84 (5), 88(5), 90(2), 91(7). Taken more frequently from the fine sandy substrates and then in a decreasing frequency to the stations with finer sediments. Hartman (1961) reported *N. maculata* from gray sandy sediments in southern California. Known from two widely separated localities: Redondo Canyon in southern California, and the northern Gulf of California at San Felipe.

*Prionospio malmgreni Claparède

Figure 8 (distribution)

Fauvel, 1927:61-62. Stas. 1(10), 4(6), 5(13), 7(2), 8(24), 9(67), 10(1), 11(13), 12(75), 14(304), 15(50), 16(91), 17(260), 18(83), 19 (356), 20(11), 21(11), 22(2), 23(369), 24(46), 25(9), 26(162), 27 (16), 29(393), 33(53), 34(27), 35(210), 36(319), 37(147), 38(381), 39(53), 40(1), 41(87), 42(77), 44(33), 45(32), 46(44), 47(112), 48(2), 49(127), 50(25), 51(76), 52(5), 53(89), 54(25), 56(1), 58(99), 59(6), 60(96), 61(252), 62(81), 64(330), 65(34), 66(96), 67(51), 68(1), 69(50), 71(67), 73(1), 74(30), 76(35), 77(36), 79(8), 81(41), 84(2), 85(20), 87(6), 89(61), 90(17), 91(15). *Prionospio malmgreni* is the most widely distributed polychaete in San Quintin Bay as shown by its occurrence at 70 of the 95 stations. The average number of specimens per station increased with the fineness of the sediment. Cosmopolitan.

Prionospio pygmaeus Hartman

Hartman, 1961:93-95. Stas. 72(8), 83(6), 89(6), 92(2), 93(5), 94(4). The substrate is known for only three of these stations: two of very fine sand and one of fine sand. Known heretofore from Hartman's recently described southern California material.

*Spiophanes missionensis Hartman

Hartman, 1941:296-298; Reish, 1959b:88. Stas. 43(1), 52(2), 60(1), 61(3), 65(5), 66(1), 72(1), 73(1), 77(1), 89(1), 94(1). Not heretofore known outside of southern California.

Family CIRRATULIDAE

***Cirriformia luxuriosa** (Moore)

Hartman, 1944c:263; Reish, 1955:1173; 1959b:47. Stas. 9(3), 19(2), 23(1), 24(1), 26(66), 28(3), 29(14), 34(1), 36(6), 38(6), 40(3), 43 (1), 45(4), 47(1), 51(11), 67(1). Heretofore known only from central and southern California.

***Cossura candida** Hartman

Figure 9 (distribution)

Hartman, 1955b:44-45; Reish 1959b:89. Stas. 9(97), 12(3), 16(1), 17(40), 18(8), 19(2), 21(5), 23(112), 24(58), 26(515), 27(44), 28(1), 31(31), 32(45), 35(85), 36(44), 37(105), 38(267), 39(153), 41(163), 42(6), 44(33), 45(100), 46(56), 47(2), 48(2), 50(26), 51(48), 52(5), 53(3), 54(153), 56(1), 58(37), 60(57), 61(153), 62(78), 64(22), 66 (245), 69(10), 70(300), 76(63), 77(3), 80(4), 81(96), 87(105), 89 (271), 90(10), 91(1). Associated with silt substrates; taken from fewer of the coarser-sediment stations; *C. candida* has been reported from silty sediments (Hartman, 1961) and muddy sands (Reish, 1959). Known from southern California and Lower California.

Family FLABELLIGERIDAE

Pherusa capulata (Moore)

Trophonia capulata Moore, 1909:284-286. *Pherusa capulata* (Moore). Hartman, 1961:33. Stas. 13(1), 18(2), 28(3). These stations were characterized by a silty substrate. Elsewhere it has been reported from mixed sediments (Hartman, 1961). Known previously only from southern California.

Family OPHELIIDAE

***Armandia bioculata** Hartman

Hartman, 1938b:105-106; 1961:33; Reish, 1959b: 91. Stas. 44(6), 53(2), 61(30), 62(9), 65(2), 66(4), 69(30), 70(15), 73(2), 78(4), 81(6), 87(5), 89(7). Mostly on silty sediments in accord with findings at Newport Bay (Reish, 1959b). Known previously only from central and southern California.

Polyophthalmus pictus (Dujardin)

Fauvel, 1927:1937-1938; Hartman, 1961:34. Stas. 73(1), 74(3), 81(1), 85(4). Taken from all three substrate types. Cosmopolitan.

Family CAPITELLIDAE

Capitella capitata (Fabricius)

Hartman, 1947a:404-405; Reish, 1959b:91-92. Stas. 25(140), 29(87), 43(6). Taken from two stations (29,43) with a silt substrate and from one with a very fine sandy bottom. Two of these stations (25, 29) had eel grass present. This cosmopolitan species has been found to be associated with domestic outfall sewers in southern California (Reish 1957). Cosmopolitan.

***Capitita ambiseta** Hartman

Figure 10 (distribution)

Hartman, 1947: 409-410; 1954b:11; Reish, 1959b:92. Stas. 17(1), 24(1), 25(1), 26(2), 27(3), 30(12), 32(3), 34(48), 35(3), 37(1), 38(21), 39(49), 41(2), 42(1), 43(21), 44(39), 45(5), 46(1), 48(2), 49(46), 50(13), 52(19), 53(387), 54(4), 56(4), 57(6), 58(9), 60(12), 61(759), 62(417), 64(41), 65(228), 66(105), 69(60), 70(306), 72(6), 73(1), 77(381), 78(2), 79(92), 81(380), 85(3), 87(74), 88(1), 89 (247), 90(21), 93(16). While the percentage occurrence of *C. ambiseta* was slightly lower from the very fine substrate stations, the number of specimens per station (128) was nearly twice as high as from the silt stations. Two specimens from as many stations were present in the fine sands, in accord with this earlier description by Reish (1959) and Hartman (1961). Known heretofore only from bays and shallow offshore waters of southern California and San Francisco Bay.

Notomastus magnus Hartman

Hartman, 1947:412-415. Stas. 23(2), 31(3), 34(2), 45(2), 61(1), 66(1). This large capitellid was found to be limited to a silty-type substrate in San Quintin Bay. Hartman reported it from sandy mud flats and in zones covered by the surf grass, *Phyllospadix sp.* Known previously only from California.

***Scyphoproctus oculatus** Reish

Reish, 1959a:78-80; Reish, 1959b:93; Hartman, 1961:36. Stas. 10 (52), 12(56), 15(75), 20(3), 32(13), 33(2), 35(6), 36(3), 51(16), 60(6), 63(1), 67(6), 68(3), 74(4), 77(1), 85(18), 87(1), 90(1). It occurred on either sand or shell bottoms at Newport Bay, here largely on fine sand. Previously known only from Newport Bay and shallow offshore waters in southern California.

Family ARENICOLIDAE

Arenicola cristata Stimpson

Berkeley and Berkeley, 1941:49; Hartman, 1945:37; 1961:36; Healy and Wells, 1959:315. Stas. 61(1), 64(2), 81(2). Collected from silts. Known previously from Japan, California, and the eastern United States.

Family MALDANIDAE

***Axiothella rubrocincta** (Johnson)

Figure 11 (distribution)

Berkeley and Berkeley, 1952:51-52; Reish, 1959b:93. Stas. 10(1), 12(16), 14(1), 18(4), 19(3), 21(1), 23(1), 25(1), 33(2), 35(6), 40(1), 43(1), 44(9), 48(3), 50(1), 51(11), 52(1), 60(6), 62(3), 63(2), 66(1), 67(5), 69(10), 71(1), 74(16), 76(4), 81(1), 85(25), 90(4). Associated with very fine sands. This species constructs sandy tubes extending down into the substrates. Heretofore known only in the Eastern Pacific Ocean from British Columbia to southern California.

Family TEREBELLIDAE

***Pista alata** Moore

Figure 12 (distribution)

Berkeley and Berkeley, 1941:53; Reish, 1959b:95. Stas. 18(4), 23 (21), 25(1), 31(1), 32(12), 34(12), 35(30), 36(1), 38(121), 39(14), 43(13), 44(108), 45(3), 46(1), 49(1), 50(2), 51(2), 52(3), 53(5), 54(10), 60(67), 61(54), 62(24), 64(212), 65(2), 66(14), 70(6), 74(7), 77(13), 81(67), 85(5), 87(103), 89(5), 90(2). *Pista alata* constructs tubes from fine sediments. Known previously from southern California.

Family SABELLIDAE

***Chone mollis** (Bush)

Figure 13 (distribution)

Hartman, 1944c:279-280; 1961:42; Reish, 1959b:95. Stas. 5(1), 12 (21), 14(3), 15(5), 18(8), 25(8), 27(2), 32(2), 33(2), 35(8), 36(3), 38(88), 39(38), 40(2), 41(1), 43(4), 44(1), 45(4), 46(6), 48(5), 49 (20), 51(4), 52(10), 53(2), 54(28), 60(49), 62(6), 64(67), 65(26), 66(23), 67(6), 69(15), 71(4), 73(1), 74(2), 76(4), 81(9), 85(11), 87(2), 89(1), 90(14), 92(5). *Chone mollis* constructs a fine-sandy tube lined with mucus; it can leave this tube when disturbed and build another (Hartman, 1944). Previously known only from central and southern California.

***Fabricia limnicola** Hartman

Figure 14

Hartman, 1951:384-386; Reish, 1959b:95. Stas. 0(1340), 1(50), 2(21), 3(480), 4(20), 5(141), 6(667), 7(1), 16(1), 33(147), 35(88), 36(2), 37(4), 42(90), 47(7), 49(3), 51(29), 54(66), 55(34), 58(23), 60(21), 64(3), 65(1), 67(13), 74(2), 90(88), 91(49). Station O had 1340 specimens present, but the substrate was not analyzed. Previously reported only from Newport Bay and Anaheim Slough, southern California.

***Megalomma pigmentum,** new species

Figure 15 (distribution), Figure 16, A-I

Megalomma sp. Reish 1959a:38; 1959b:96; 1961:87. Stas. 12(1), 18(10), 21(5), 23(1), 24(21), 25(1), 27(5), 29(1), 32(1), 34(1), 35 (18), 36(5), 38(36), 39(11), 41(2), 43(43), 44(3), 45(8), 46(2), 47 (1), 49(3), 50(5), 51(9), 52(1), 53(2), 54(3), 58(2), 60(50), 64(8), 65(11), 66(24), 67(1), 71(1), 76(2), 77(36), 85(7), 87(9), 88(16), 90(3), 91(2).

A total of 471 specimens from 40 stations was collected from Bahía de San Quintín. Station 43 was selected as the type locality; nine complete individuals from this sample constitute the holotype and paratypes.

DIAGNOSIS: Maximum length 46 mm including branchial length of 8 mm; 8 thoracic and maximum of 58 abdominal setigerous segments; branchiae with 13-15 radioles per side, dorsal ones with reddish brown

eyes at distal end (Fig. 16,C), barbs of radioles extending to within 1 mm of tip, four reddish-brown pigment bands; collar (Fig. 16, A and B) extending from mid-segmental line of first setigerous segment diagonally, forming a pocket, to lateral sides, ventrally produced into two triangular lobes with overlapping flaps near mid-ventral line; only 15-20 double winged capillary setae (Fig. 16, D), to notopodium of first setigerous segment, no neuropodium; thoracic notopodial segments 2-8 with about 10 similar capillary setae and about 20 spatulate setae (Fig. 16, E); thoracic neuropodial segments 2-8 with about 25 pennoned setae (Fig. 16, F) and about 25 uncini (Fig. 16, H); abdominal neuropodium with about 14 double winged capillary setae (Fig. 16, I); pygidium a dorsal triangular extension with a dorsal pair of small pigmented spots (?eye spots); brownish-red pigmentation heavy in anterior thoracic region (Fig. 16, A and B) which may or may not extend through abdominal region.

REMARKS: Hartman (1959) lists 19 species, plus one unassigned species, belonging to the genus *Megalomma*. The majority of these species have four or more eyes near the end of the radioles. Previously only three species have been described with one pair of eyes: *Megalomma roulei* (Gravier, 1910) from Peru, *M. mushaensis* (Gravier, 1906), from the Red Sea, and *M. bioculatum* (Ehlers, 1887) from Florida. The number of eyes, especially in those species with only a few, is a convenient characteristic for rapid identification. However, Day (1955) stated that *M. mushaensis* (2 eyes) should be referred to *M. quadrioculatum* (Willey) (4 eyes) since they differ only in this character. Hartman (1938a) considered *M. burrardum* (Berkeley) (4 to 8 eyes) as a synonym of *M. splendida* (Moore) (no eyes *fide* Moore, 1905; 2 spiralled eyes *fide* Hartman, 1938, in her re-examination of the type specimens of *M. splendida*). Accordingly, although number of eyes may not be a consistently reliable character, all of the 471 specimens of *M. pigmentum* examined from San Quintin Bay, and also the additional ones from southern California, possessed two eyes. *Megalomma pigmentum* may be distinguished from these bioculate species and the other species of the genus on the basis of the collar (all species have the same types of setae but slight morphological differences occur), and by the pigmentation pattern.

ECOLOGY: This sabellid was present at approximately one-half of the very-fine-sand and the silt stations. The average number of specimens per station was 17 from the silt stations and only 5 from those of very fine sand. The distribution of *M. pigmentum* in San Quintin Bay is shown in Figure 15.

TYPE MATERIAL: The holotype and nine paratypes have been deposited in the U.S. National Museum.

TYPE LOCALITY: Bahía de San Quintín, Baja California.

GEOGRAPHICAL DISTRIBUTION: Collected elsewhere from the Ventura County Marina, Los Angeles-Long Beach Harbors, Alamitos Bay, and Newport Bay, by the author.

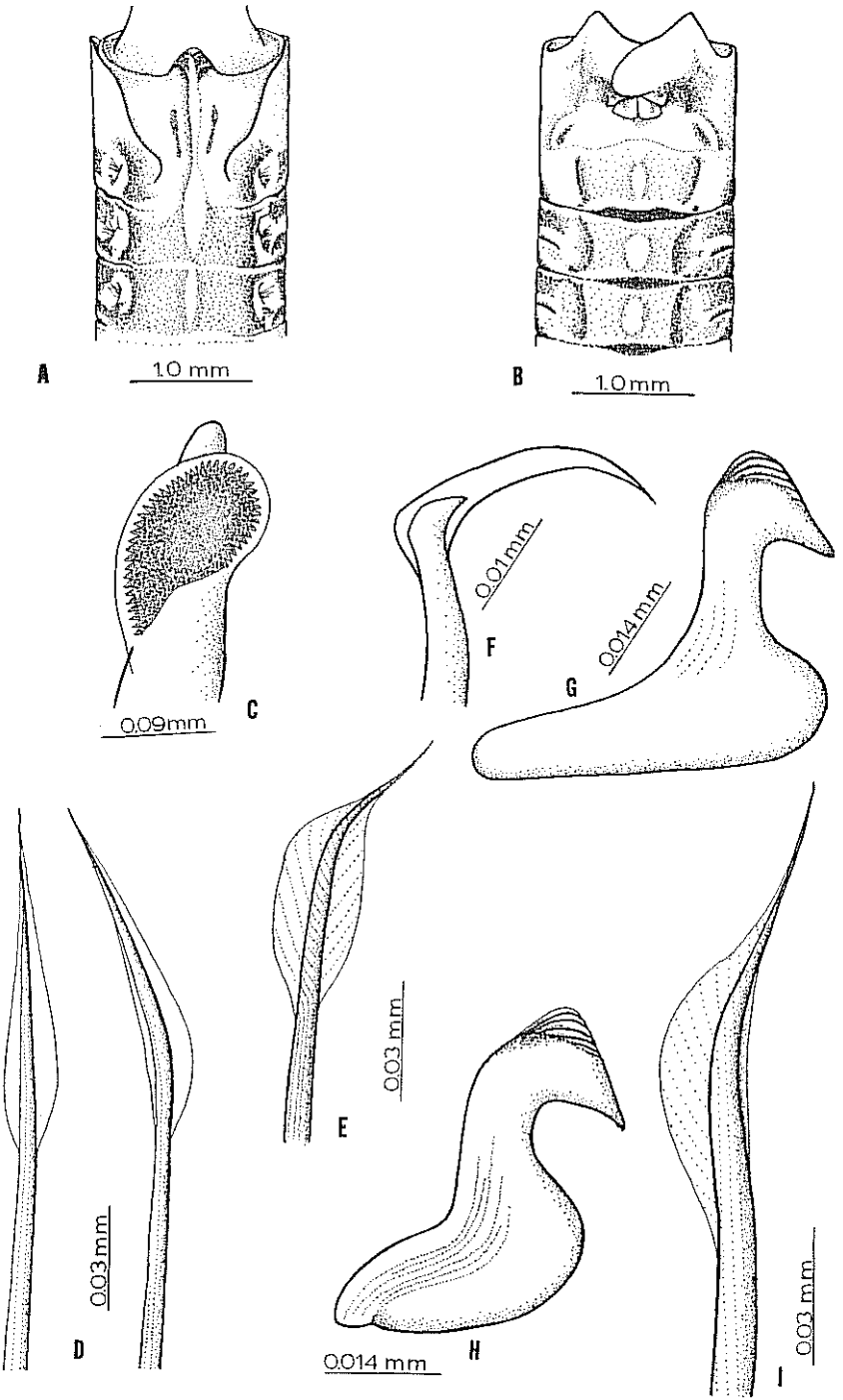

A
1.0 mm
B
1.0 mm
0.09mm
C
0.01mm
F
0.014mm
G
0.03 mm
E
0.03mm
D
0.014 mm
H
0.03 mm
I

Fig. 16. *Megalomma pigmentum* n. sp. A, anterior end, dorsal view. B, anterior end, ventral view. C, Distal end of radiole bearing eye. D, double winged capillary setae from the first thoracic notopodium. E, spatulate setae from the third thoracic notopodium. F, pennoned setae from the third thoracic neuropodium. G, uncinus from the third thoracic neuropodium. H, uncinus from the fourth abdominal notopodium. I, winged capillary seta from the fourth thoracic neuropodium. Magnifications indicated for each figure separately.

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