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The Ectoprocta (Bryozoa) of Scammon's Lagoon, Baja California, Mexico

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INTRODUCTION

A short cruise to the Bahía de Sebastián Vizcaíno region aboard the schooner "Puritan" was made by John D. Soule of the University of Southern California and William K. Emerson of the American Museum of Natural History, between July 24 and July 31, 1959, at the kind invitation of the late Harry J. Bauer of Los Angeles, California. The present report is based on the collections of Ectoprocta made in Scammon's Lagoon by the junior author at that time.

Scammon's Lagoon, named for an English sea captain who used the area as a whaling station during the nineteenth century, is also known as Ojo de Liebre, which may be translated as "eye of a hare" or "hole of a coward," or some variation thereof. The Lagoon is between latitude 27° 35′ N. and latitude 28° 15′ N., longitude 113° 51′ W. and longitude 114° 20′ W., and extends in a roughly southeasterly direction from Bahía de Sebastián Vizcaíno on the Pacific side of Baja California, Distrito del Sur, Mexico (see maps, figs. 1, 2).

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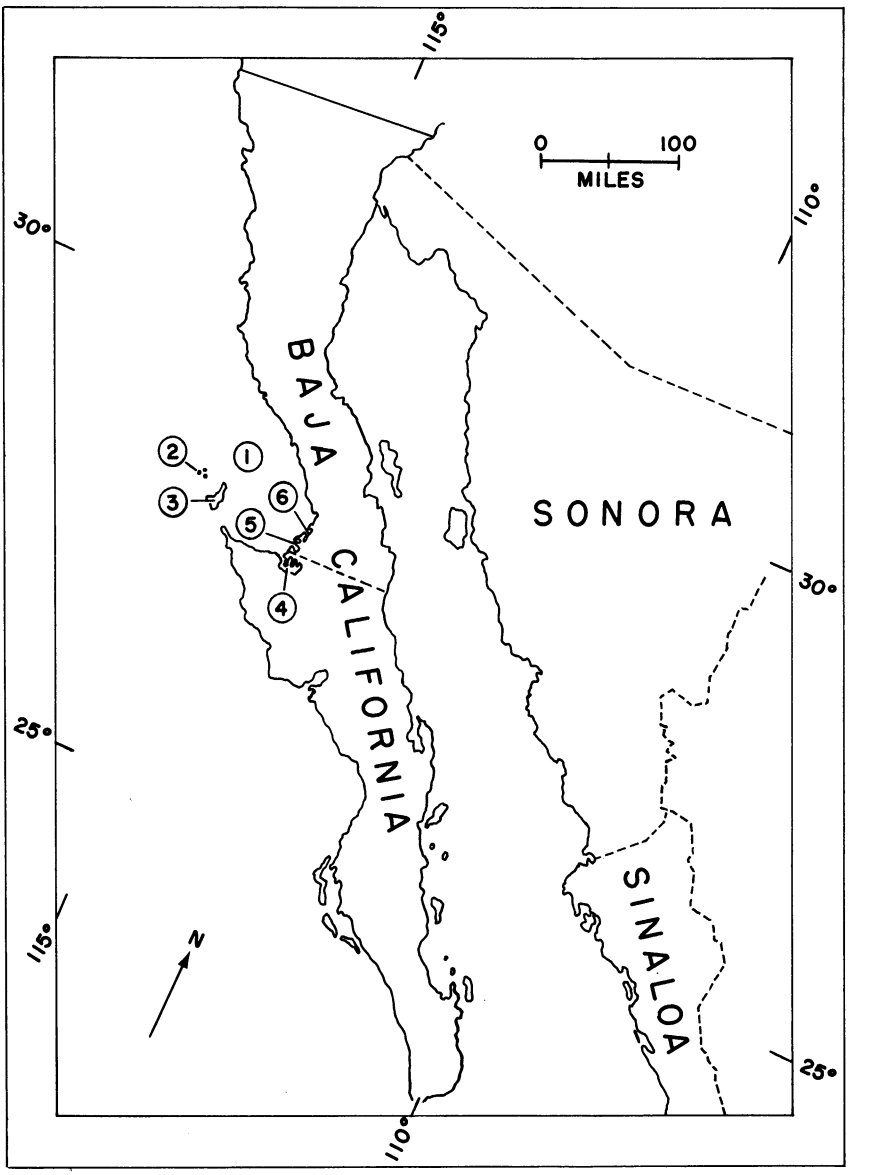

FIG. 1. Locality map. 1. Bahía de Sebastían Vizcaíno. 2. Islas San Benito. 3. Isla Cedros. 4. Scammon's Lagoon. 5. Laguna de Guerrero Negro. 6. Laguna Manuela.

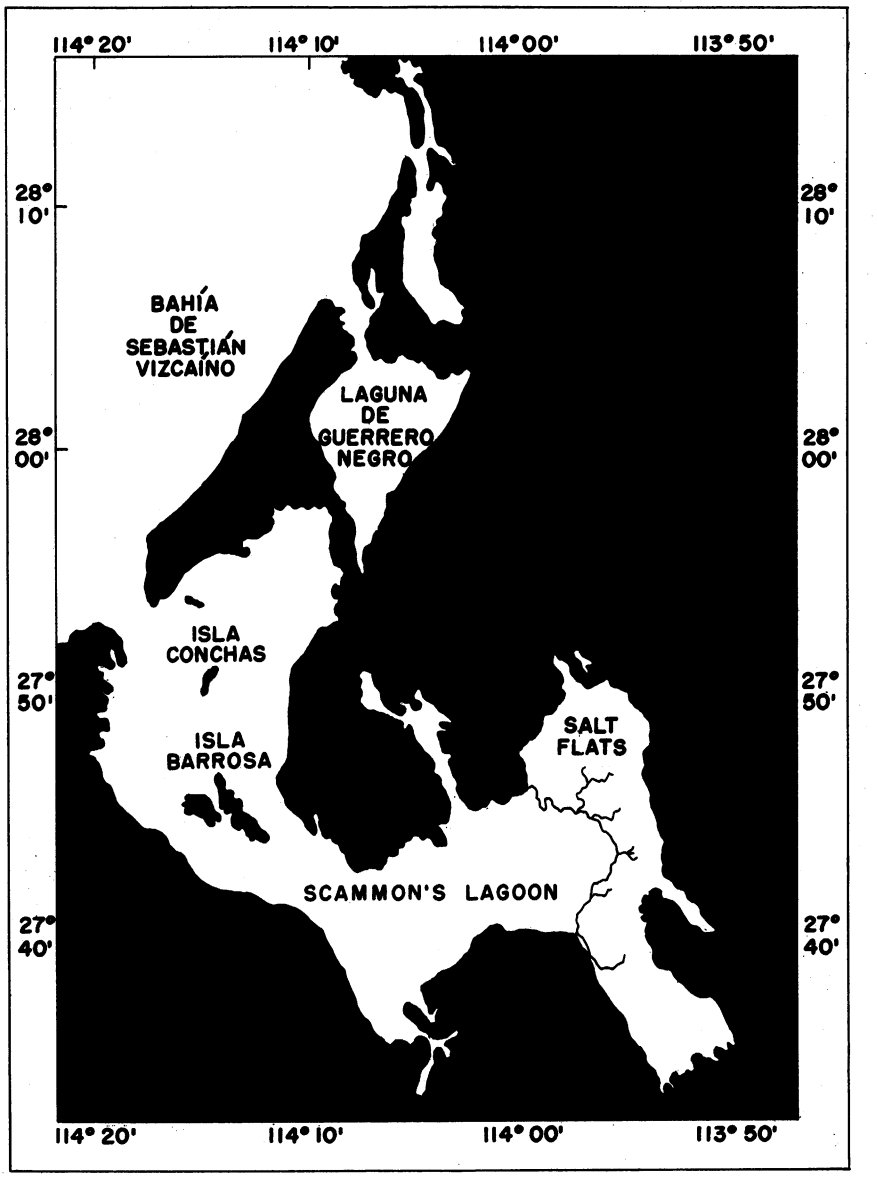

FIG. 2. Map of Scammon's Lagoon and environs.

The Lagoon is quite shallow, with many sand bars and spits which interfere with navigation, necessitating the use of small boats for most of the collecting in the area. The 102-foot "Puritan," with a local turtle fisherman acting as pilot, was able to enter the Lagoon and anchor at Isla Conchas, although she touched bottom in passing the bar at the entrance. Few charts are available of the area, which is subject to extreme shifting of the coarse sand bottom of the Lagoon. Even moderate winds may cause turbulence dangerous to small boats because of the "shallow basin effect," while the many small channels and lack of landmarks among the sand dunes add to the hazards of navigation.

Phleger and Ewing (1962) supplied many data on this area, including wind, temperature, salinity, current, depth profiles, sedimentology, and a few faunal assemblages. They reported maximum tidal currents of 2.5 knots in the inlet and lower channels, with considerable turbulence, tidal delay between the inlet and inner lagoon of approximately three hours, and a tidal range of 4 to 9 feet. Interestingly, the water temperature is isothermal, indicating complete mixing from surface to bottom, which results in increasing the heat storage capacity of the waters. Salinity increases from about 34 parts per thousand at the inlet to 42 to 47 parts per thousand in the inner basin, with seasonal variation depending on the rate of evaporation. Air temperatures range during the year from 0° C. to 39° C., with very little rainfall.

Data for the adjacent Bahía de Sebastián Vizcaíno, which differs considerably from Scammon's Lagoon, were reported by Wyllie (1961).

Collecting stations for this expedition are designated numerically, preceded by a P to denote the "Puritan" stations for the cruise of 1959, and are as follows:

P-1. Isla Conchas. Intertidal depth, surface water temperature 25° C. Outgoing tide, northwest wind. Bottom: Dead mollusk shells and coarse sand. Associated faunal elements: *Pecten*, *Astrea*, *Bulla*, *Tegula*.

P-2. Isla Conchas. Shore: Shell beach, predominantly *Pecten*.

P-3. 2.5 nautical miles southeast of Isla Conchas. Tide flats (6 inches to 3 feet). Air temperature 30.5° C., surface water temperature 26° C. Bottom: Coarse sand, shell. Associates: Sponge, *Pecten*, "turtlegrass."

P-4. Off south side of Isla Cholla. Depth 4 feet, water temperature 28° C., coarse sand bottom.

P-5. Off east side of Isla Conchas. Depth 4 feet, water temperature 26° C. Bottom: Coarse sand, scattered shell.

P-6. Isla Conchas anchorage. Water temperature 25° C.

P-7. Northeast end of Isla Conchas. Windrows of shell on beach.

P-8. Northeast end of Isla Conchas. Intertidal depth, water temperature 26° C. Bottom: Coarse sand and shell. Associates: Sponge.

P-9. Isla Barrosa, southern tip, west side. Intertidal depth, water temperature

26° C., air temperature 29°–30° C. Bottom: Sandstone rock. ("Barrosa" means muddy or reddish, "broza" means brushy; either is appropriate, and various spellings seem to be in use.)

P-9a. Isla Barrosa, shore. Ectoprocta, mollusks washed ashore in windrows. Some incrusted on eelgrass (*Zostera*).

A key to the higher taxa of bryozoans is presented below in order to orient persons unfamiliar with the field. The more technical references, which usually begin at the family level, may then be employed.

Following the key is a list of the Ectoprocta collected in Scammon's Lagoon and discussed in the systematic accounts. It will be noted that the term "division" originally used by Levinsen (1909) has been changed to the term "superfamily." Divisions represent no standard taxonomic level in zoology, while in the botanical field the term has been equated with phylum status; thus it is felt that the zoological term should be dropped. Other adjustments in the ranking of various groups have been made to reflect current thought. The elevation of the Ectoprocta and Entoprocta to phylum status has been widely accepted, following Hyman (1951, 1959). The term "Bryozoa" is used herein descriptively rather than taxonomically, to include both phyla.

The systematic accounts presented follow the format used by Soule (1959, 1961, 1963) for the reports on the Bryozoa (Ectoprocta and Entoprocta) of the "Puritan" expedition to the Gulf of California in 1957: (1) the original citation and the eastern Pacific synonymy; (2) a summary of salient diagnostic characteristics; (3) the occurrence in the Scammon's Lagoon collection; and (4) the distribution in the eastern Pacific, and elsewhere when pertinent.

This paper is based on a thesis submitted by the senior author in partial fulfillment of the requirements for the Master of Arts degree at Occidental College, Los Angeles, California. The junior author is responsible for revising the thesis for publication in the present form, as well as for verifying the identifications of the species.

Key to Higher Taxa of Bryozoans

1. a. Soft body parts (the polypide) stalked, unenclosed; anal opening within tentacle ring; tentacles rolling inward, non-retractile..... ..... Phylum Entoprocta
   b. Soft body parts (the polypide) enclosed in calcareous or chitinous case (zooecium); anal opening outside tentacle ring; tentacles retractile ..... Phylum Ectoprocta (2)
2. a. Horseshoe-shaped tentacle ring (lophophore); fresh water only..... ..... Class Phylactolaemata
   b. Circular tentacle ring (lophophore); marine.... Class Gymnolaemata (3)

3. a. Zooecium chitinous; aperture closed by puckering membrane; no ovicells or avicularia.....Order Ctenostomata (4)
   b. Zooecium calcareous; tubular aperture terminal, circular; not closed by operculum.....Order Cyclostomata (5)
   c. Zooecia of most species calcareous; aperture closed by movable operculum.....Order Cheilostomata (8)
4. Ctenostomata
   a. Zooids (individuals) separate, budded from creeping or erect stolons .....Suborder Stolonifera
   b. Zooids separate or contiguous, budded direct from adjacent zooids .....Suborder Carnosa
5. Cyclostomata
   a. Colony with joints, branching.....Suborder Articulata
   b. Colony without joints.....6
6. a. Colony discoid.....Suborder Rectangulata
   b. Colony erect or adnate.....7
7. a. Ovicell an inflated zooid.....Suborder Tubuliporina
   b. Ovicell a rounded expansion on dorsal side of colony..... .....Suborder Cancellata
   c. Ovicell a compound chamber through which peristomes protrude..... .....Suborder Ceriporina
8. Cheilostomata
   a. Flexible membranous frontal which performs hydrostatic function..... .....Suborder Anasca (9)
   b. Solidly bridged frontal with compensation sac (asc) beneath; sac fills through ascophore which lies within peristome or proximal to it; the most advanced bryozoans.....Suborder Ascophora
9. Anasca
   a. Zooids separate; uncalcified.....10
   b. Zooids contiguous; calcified 11
10. a. Zooids tubular; bases adherent simulating stolons..... .....Superfamily Inovicellata
    b. Zoarium (colony) plantlike, with uniserial or biserial branches..... .....Superfamily Scrupariina
11. a. Large, primitive frontal membrane uncalcified; operculum incompletely differentiated; cryptocyst vestigial.....13
    b. Cryptocyst (calcified shelf beneath frontal membrane) well developed..12
12. a. Cryptocyst usually extending to aperture, with notches or holes (opesiules) for muscles to frontal from dorsal wall.....Superfamily Coilostega
    b. Cryptocyst complete, no holes; ovicell separated, pore distal to aperture .....Superfamily Pseudostega
13. a. Zoarium incrusting.....Superfamily Malacostega
    b. Zoarium erect or reticulate, branching.....14
14. a. Membranous frontal unprotected, or with spines or scutes above frontal .....Superfamily Cellularina
    b. Spines united above frontal membrane to form costa or frontal shield (pericyst).....Superfamily Cribrimorpha[1]

[1] The superfamily Cribrimorpha represents a transitional group between the Anasca and

Systematic List of Ectoproct Fauna of Scammon's Lagoon

Order Cheilostomata Busk, 1852
- Suborder Anasca Levinsen, 1909
  - Superfamily Inovicellata Jullien, 1888
    - Family Aeteidae Smitt, 1868
      - *Aetea recta* Hincks, 1862
  - Superfamily Malacostega Levinsen, 1909
    - Family Membraniporidae Busk, 1854
      - *Membranipora tuberculata* (Bosc), 1802
      - *Conopeum commensale* Kirkpatrick and Metzelaar, 1923
    - Family Chaperiellidae Harmer, 1957
      - *Chaperiella condylata* (Canu and Bassler), 1930
  - Superfamily Coilostega Levinsen, 1909
    - Family Lunulariidae Levinsen, 1909
      - *Discoporella umbellata* (Defrance), 1823
  - Superfamily Cellularina Smitt, 1868
    - Family Scrupocellariidae Levinsen, 1909
      - *Scrupocellaria bertholleti* (Audouin), 1826
  - Superfamily Cribrimorpha Harmer, 1926
    - Family Cribrilinidae Hincks, 1880
      - *Colletosia radiata* (Moll), 1803
- Suborder Ascophora Levinsen, 1909
    - Family Hippothoidae Levinsen, 1909
      - *Hippothoa hyalina* (Linnaeus), 1767
      - *Hippothoa distans* (MacGillivray), 1869
    - Family Schizoporellidae Jullien, 1903
      - *Schizoporella unicornis* (Johnston), 1847
      - *Schizoporella cornuta* (Gabb and Horn), 1862
      - *Schizoporella occidentalae*, new species
      - *Escharina vulgaris* (Moll), 1803
    - Family Hippoporinidae Osburn, 1952
      - *Cleidochasma contracta* (Waters), 1899
      - *Aimulosia uvulifera* (Osburn), 1914
      - *Hippoporella gorgonensis* Hastings, 1930
      - *Hippoporidra spiculifera* (Canu and Bassler), 1930
    - Family Smittinidae Levinsen, 1909
      - *Porella rogickae* Soule, 1961
      - *Smittoidea prolifica* Osburn, 1952
      - *Parasmittina trispinosa* (Johnston), 1825
      - *Parasmittina crosslandi* (Hastings), 1930
      - *Parasmittina californica* (Robertson), 1908
      - *Parasmittina fraseri* Osburn, 1952
      - *Alismittina californiensis* (Robertson), 1908, new genus

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Ascophora, according to Harmer (1926). Silén (1942) concluded that the ascophoran compensation sac was formed from the primitive uncalcified frontal membrane and the pericyst, which formed above it, by the fusion of spines. This group has been assigned by some authors to the Ascophora as its most primitive representative.

Mucronella major (Hincks), 1884
Family Adeonidae Busk, 1884
Reptadeonella violacea (Johnston), 1847
Family Reteporidae Smitt, 1868
Rhynchozoon rostratum (Busk), 1855
Rhynchozoon spicatum Osburn, 1952
Family Cheiloporinidae Bassler, 1936
Hippopodinella adpressa (Busk), 1854
Watersipora nigra (Canu and Bassler), 1930
Hippaliosina rostrigera (Smitt), 1873
Family Lageniporidae Jullien, 1883
Lagenipora hippocrepis (Busk), 1855
Family Celleporidae Busk, 1852
Holoporella brunnea (Hincks), 1884
Trematooecia hexagonalis (Canu and Bassler), 1930
Order Cyclostomata Busk, 1852
Suborder Tubuliporina Hagenow, 1851
Family Tubuliporidae Johnston, 1838
Tubulipora pacifica Robertson, 1910
Suborder Rectangulata Waters, 1887
Family Lichenoporidae Smitt, 1866
Lichenopora buskiana Canu and Bassler, 1928
Lichenopora novaezealandiae (Busk), 1875

SYSTEMATIC ACCOUNTS

ORDER CHEILOSTOMATA BUSK, 1852

SUBORDER ANASCA LEVINSEN, 1909

SUPERFAMILY INOVICELLATA JULLIEN, 1888

FAMILY AETEIDAE SMITT, 1868

GENUS *AETEA* LAMOUROUX, 1812

Aetea recta Hincks, 1862

AE[*tea*] *recta* HINCKS, 1862, p. 25, pl. 7, fig. 3.
Aetea recta: OSBURN, 1950, p. 12, pl. 1, fig. 2. SOULE, 1959, p. 3.

Erect, finely annulated stalk, bearing narrow, spoon-shaped terminal area of a 4/1 length-to-width ratio. Basal portion adherent, variable in width, tubular; in some cases marked by cross striations or fine pitting. Spread in random arrangement across the smooth surfaces of mollusk shells.

OCCURRENCE: P-3, P-5, P-8, off Isla Conchas.

DISTRIBUTION: *Aetea recta* has been reported in temperate and tropical waters of the Atlantic and Pacific oceans, and in the Gulf of California.

SUPERFAMILY MALACOSTEGA LEVINSEN, 1909

FAMILY MEMBRANIPORIDAE BUSK, 1854

GENUS *MEMBRANIPORA* BLAINVILLE, 1830

Membranipora tuberculata (Bosc), 1802

Flustra tuberculata Bosc, 1802 [*partim*], p. 118.

Flustra tehuelcha d'Orbigny, 1847, p. 17, pl. 8, figs. 10–14.

Membranipora tehuelcha: Robertson, 1908, pp. 265–267, pl. 15, figs. 16, 17, pl. 16, fig. 18.

Membranipora tuberculata: Canu and Bassler, 1923, pp. 22, 23, pl. 33, figs. 3–5. Osburn, 1950, pp. 23, 24, pl. 2, figs. 4–6. Soule and Duff, 1957, pp. 88, 89. Soule, 1959, pp. 4, 5.

Nichitina tuberculata: Hastings, 1930, pp. 706, 707, pl. 3, figs. 9, 10.

The colonies form shining white grids, usually on algae stipes and blades. The zooecia are quadrangular, covered by a thin frontal membrane which must be removed by incineration for identification. Beneath the frontal membrane is a narrow mural rim which surrounds the large opening (opesium). A thin, inward extension of the rim forms a narrow shelf (cryptocyst) which widens somewhat at the proximal end. Small processes which may vary in size and shape project from the cryptocyst edge into the opesial opening. At the distal corners a pair of tubercles occur which are characteristic of the species. These may be quite small in the younger zooecia, but may increase in size, coalesce, or overhang the opesia in older colonies.

Occurrence: P-9, P-9a, Isla Barrosa.

Distribution: World-wide distribution in warm temperate and tropical seas has been recorded for *Membranipora tuberculata.* In the Gulf of California it was collected intertidally, and by dredge at 1–5 fathoms.

GENUS *CONOPEUM* GRAY, 1848

Conopeum commensale Kirkpatrick and Metzelaar, 1923

Conopeum commensale Kirkpatrick and Metzelaar, 1923, p. 985, pl. 1, figs. 1, 4–7, 9. Osburn, 1950, pp. 30, 31, pl. 2, figs. 12–15. Soule and Duff, 1957, p. 91. Soule, 1959, pp. 7, 8.

The colony forms a reticulate, yellow to brown incrustation on mollusk shells. The zooecia are roughly rectangular, covered with a thin, pigmented, frontal membrane which has a well-chitinized operculum set off by a heavy border. Minute, hair-like spinules arise from the membrane surface, especially at the periphery of the zooecia, and brown bands outline the individual zooecia. Incineration exposes the oval opesial opening surrounded by the beaded mural rim. The cryptocyst is narrow, widening at the proximal end, and bears a few minute projections which

extend over the opesium. Tubercles in the proximal corners have been reported on this species, but were absent from the present material.

OCCURRENCE: P-3, tide flats off Isla Concha.

DISTRIBUTION: Originally described from off West Africa, this species has been reported widely in warm temperate and tropical waters in the Atlantic and Pacific oceans, and in the Gulf of California.

FAMILY CHAPERIELLIDAE HARMER, 1957

GENUS *CHAPERIELLA* STRAND, 1928

Chaperiella condylata (Canu and Bassler), 1930

Chaperia condylata CANU AND BASSLER, 1930, pp. 44, 45, pl. 9, figs. 1–3.
Chapperia condylata: OSBURN, 1950, vol. 14, no. 1, pp. 90, 91, pl. 10, fig. 3.
Chaperiella condylata: SOULE, 1959, p. 22.

The zoaria are usually reddish brown, incrusting algae or other ectoprocts, such as *Discoporella*. They are in turn sometimes incrusted by rhynchozoons. The zooecia are moderate in size, rounded proximally, narrowed distally, and pear-shaped. The opening (opesia) beneath the frontal membrane is ovoid or circular, and the cryptocyst is wide proximally, narrowing distally. Two internal plates (occlusor laminae), which serve as attachments for the opercular retractor muscles, lie beneath the cryptocyst distally and are bounded by two knobs (condyles) that are apparently opercular denticles. The mural rim bears six erect spines. The avicularia vary in size and location. A large pair with long, triangular mandibles and in some cases elevated on a pedicel may occur on the proximal wall, appearing to be almost interzooecial. Small triangular avicularia may be situated laterally or distally. The ovicell is hyperstomial, hooded, and may have avicularia.

OCCURRENCE: P-8, intertidal, northeast end of Isla Conchas.

DISTRIBUTION: This species, originally described from the Galapagos Islands, was reported by Osburn (1952) from Catalina Island, California, to Colombia. Soule (1961) found it at three stations in the Gulf of California.

SUPERFAMILY COILOSTEGA LEVINSEN, 1909

FAMILY LUNULARIIDAE LEVINSEN, 1909

GENUS *DISCOPORELLA* D'ORBIGNY, 1852

Discoporella umbellata (Defrance), 1823

Lunulites umbellata DEFRANCE, 1823, vol. 27, p. 361, pl. 47, figs. 1, 1a, 1b.
Discoporella denticulata: GABB AND HORN, 1862, pp. 142, 143, pl. 20, fig. 25.

Cupularia canariensis: ROBERTSON, 1908, pp. 314, 315, pl. 24, figs. 90, 91.
Cupularia umbellata: CANU AND BASSLER, 1923, pp. 80–82, pl. 2, figs. 15–19; 1930, pp. 11, 12.
Cupularia robertsoniae CANU AND BASSLER, 1923, p. 82, pl. 34, figs. 5–7.
Discoporella umbellata: HASTINGS, 1930, pp. 718, 719, pl. 11, fig. 54. OSBURN, 1950, pp. 113, 114, pl. 11, figs. 7–10. SOULE AND DUFF, 1957, pp. 99, 100. SOULE, 1959, pp. 34, 35.

The colony (zoarium) is discoid, convex, and free-swimming, according to Osburn (1950); the original attachment is a small sand grain that is carried away by the growing colony. The surface, yellow to brown in color, is covered with whiplike vibracula. The zooecia are rhomboid, outlined in brown, and have a distinct operculum which gives the impression of a Gothic window design. Incineration removes the pigmented frontal membrane, exposing the thin mural rim and a well-developed granular cryptocyst. The cryptocyst forms from the fusion of spinous projections from around the opening, slanting downward from the proximal end. A variable number of openings (opesiules) remain around the edge of the cryptocyst through which the muscles pass to regulate the frontal membrane in controlling the hydrostatic pressure when the polypide is extended and retracted. Above the distal portion of each zooecium a long vibracular mandible arises from a semilunar chamber.

OCCURRENCE: P-3, P-10, off Isla Conchas, and outside the Lagoon entrance in Bahía de Sebastián Vizcaíno in dredge haul.

DISTRIBUTION: *Discoporella umbellata* is distributed around the world in warmer waters, ranging from Point Conception, California, to Ecuador on the Pacific coast and in the Gulf of California. It is commonly dredged between 20 and 40 fathoms (Osburn, 1950).

SUPERFAMILY CELLULARINA SMITT, 1868

FAMILY SCRUPOCELLARIIDAE LEVINSEN, 1909

GENUS *SCRUPOCELLARIA* VAN BENEDEN, 1845

Scrupocellaria bertholleti (Audouin), 1826

Acamarchis bertholleti AUDOUIN, 1826, p. 241, pl. 11, fig. 3.
Scrupocellaria bertholletii: HASTINGS, 1930, p. 703, pl. 1, figs. 1–5.
Scrupocellaria bertholetti: OSBURN, 1950, p. 133, pl. 15, figs. 7, 8, pl. 21, fig. 8.
Scrupocellaria bertholleti: SOULE, 1959, pp. 35, 36.

The zoaria (colonies) are erect, branching, and biserial, and have elongate zooecia. The oval opesia (opening) is covered by a thin frontal membrane, and the mural rim bears distally two to four erect outer spines and one to two inner spines. The most obvious characteristic of *S. ber-*

tholleti is the nature of the scutum, a lateral projection that arises on the mural rim and arches over the opesial area, dividing into two or three main branches which bear numerous smaller projections. Small triangular lateral avicularia and frontal avicularia, both large and small, may occur. Vibracular chambers are on the dorsal surface; these are small, triangular, and bear short processes. Ovicells, which are hyperstomial and perforate, were not present on lagoon specimens.

The key to the *Scrupocellaria* given by Osburn (1950, pp. 131, 132) is difficult to use because the first choice is based on the nature of the dorsal surface. Additionally, as in so many diagnoses, the absence of ovicells precludes one's following the key beyond that feature. Osburn's grouping by characteristics (1950, p. 132) is thus more helpful in the orientation of specimens among the many species in this genus.

OCCURRENCE: P-9, Isla Barrosa, intertidal depth.

DISTRIBUTION: Warm temperate to tropical, this species is found from southern California to the Galapagos and is common in the Gulf of California (Soule, 1959). It also occurs in the Red and Mediterranean seas and the eastern and western Atlantic.

SUPERFAMILY CRIBRIMORPHA HARMER, 1926

FAMILY CRIBRILINIDAE HINCKS, 1880

GENUS *COLLETOSIA* JULLIEN, 1886

Colletosia radiata (Moll), 1803

Eschara radiata MOLL, 1803, p. 63, pl. 4, figs. 17a–1.

Cribrilina radiata form *innominata:* HINCKS, 1883, pp. 442, 443.

Cribilina setosa WATERS, 1900, pp. 8, 9.

Puellina radiata forma *scripta:* CANU AND BASSLER, 1923, pp. 89, 90, pl. 15, fig. 12, pl. 35, fig. 1.

Puellina radiata forma *rarecosta:* CANU AND BASSLER, 1923, p. 90.

Cribrilina radiata: C. H. AND E. O'DONOGHUE, 1923, p. 172.

Puellina radiata: C. H. AND E. O'DONOGHUE, 1925, p. 101; 1926, p. 97. CANU AND BASSLER, 1930, p. 13.

Puellina innominata: CANU AND BASSLER, 1930, p. 13.

Puellina setosa: OSBURN, 1950, p. 186, pl. 29, fig. 4.

Colletosia radiata: OSBURN, 1950, pp. 187, 188, pl. 29, figs. 2, 2a. SOULE AND DUFF, 1957, pp. 105, 106. SOULE, 1959, pp. 47, 48.

The zoaria are incrusting. In the "Puritan" material only one specimen was found, a young colony superimposed upon a *Mucronella major* colony on a mollusk shell. The zooecia are very small, ovoid, and discrete except where crowded. Five spines stand erect above the aperture, which is semicircular, with a straight proximal border. A pair of tiny avicularia with setose mandibles flank the aperture. A distinctive feature is the con-

vex pericyst formed above the frontal membrane by the fusion of radiating costal spines, leaving rows of small pores between. This is characteristic of the cribrimorphs and represents an intermediate level of development between the anascans, such as *Scrupocellaria* with a frontal membrane and branched scutum overarching, and the ascophorans with calcified frontal and compensation sac beneath. According to Silén (1942, pp. 41–52), the compensation sac is probably formed from the membranous frontal below and the inner surface of the calcified frontal wall above. The calcified frontal would probably be homologous to the fused spines or scutes of the anascans.

No vicarious avicularia or ovicells were present on the small colony from Scammon's Lagoon.

OCCURRENCE: P-3, tide flats off Isla Conchas.

DISTRIBUTION: *Colletosia radiata* has cosmopolitan distribution in cool temperate to tropical waters. It is abundant from British Columbia to Peru, in shallow water to 136 fathoms, and common in the Gulf of California. According to Soule (1959), Osburn's *Puellina setosa* is a junior synonym of *Colletosia radiata*. Whether other citations are also identical or not requires further investigation.

SUBORDER ASCOPHORA LEVINSEN, 1909

FAMILY HIPPOTHOIDAE LEVINSEN, 1909

GENUS *HIPPOTHOA* LAMOUROUX, 1821

Hippothoa hyalina (Linnaeus), 1767

Cellepora hyalina LINNAEUS, 1767, p. 1286.

Schizoporella hyalina: HINCKS, 1883, p. 445. ROBERTSON, 1900, p. 326; 1908, pp. 289, 290, pl. 19, figs. 43–45. C. H. AND E. O'DONOGHUE, 1923, pp. 177, 178.

Hippothoa hyalina: CANU AND BASSLER, 1923, pp. 92–94, pl. 35, figs. 5–8. C. H. AND E. O'DONOGHUE, 1925, p. 101; 1926, p. 100. HASTINGS, 1930, p. 720. OSBURN, 1952, p. 277, pl. 30, fig. 1–5. SOULE AND DUFF, 1957, pp. 106, 107. SOULE, 1961, p. 2.

Hippothoa hyalina var. *rugosa* CANU AND BASSLER, 1923, p. 94, pl. 35, fig. 9.

The family Hippothoidae apparently is not a natural grouping but an artificial association of primitive ascophorans based on their simplicity. The frontal is perforate or imperforate, but calcification occurs in a proximal to distal direction, leaving successive growth lines. Additionally, within the five genera some bear avicularia while others lack them, some have hyperstomial ovicells while others do not, and some have sinusoid apertures while others do not. None of these criteria provides indications for a more natural grouping, because of the distribution of the characters.

Hippothoa hyalina forms incrusting colonies on shell, algae, and other available surfaces. Young zooecia are transparent and glassy (hyaline), with a convex frontal that is imperforate and transversely wrinkled. Individuals are tapered and rounded (terete), multiserial, and separated by narrow peripheral fenestrae. The aperture is small, rounded distally, and has a sinus proximally. A thin apertural rim or peristome is present, and in some cases a small umbo. Older colonies become whitened, rough, and multilaminar. The ovicells are large, perforate, and raised, so that a mature zoarium may appear to be composed only of ovicells, the reproductive zooecia being quite reduced.

OCCURRENCE: P-9a, Isla Barrosa, shore.

DISTRIBUTION: A cosmopolitan species, *Hippothoa hyalina* is abundant in the Arctic, well represented on the Pacific coast, and was also found in the Gulf of California.

Hippothoa distans MacGillivray, 1869

Hippothoa distans MACGILLIVRAY, 1869, p. 130. HINCKS, 1883, p. 450. SOULE, 1961, pp. 3, 4.

Hippothoa flagellum: OSBURN, 1952, p. 278, pl. 30, figs. 7, 8.

Delicate, uniserial colonies incrust in random pattern on the smooth surfaces of mollusk shells. The zooecium is reduced proximally to a narrow, annulated, translucent tube, and is expanded distally into an ovoid, tapered, convex frontal of glassy appearance. The aperture is rounded distally and has a thin, low, apertural rim bearing a small proximal notch. The ovicells are hyperstomial and umbonate.

OCCURRENCE: P-3, P-5, P-8, off Isla Conchas, intertidal.

DISTRIBUTION: This species is world wide in warm temperate and tropical waters.

FAMILY SCHIZOPORELLIDAE JULLIEN, 1903

GENUS *SCHIZOPORELLA* HINCKS, 1877

Schizoporella unicornis (Johnston), 1847

Lepralia unicornis JOHNSTON, 1847, pp. 320, 321, pl. 57, fig. 1.

Schizoporella unicornis: OSBURN, 1952, pp. 317, 318, pl. 37, figs. 1, 2. SOULE, 1961, p. 9.

The zoaria are incrusted on mollusk shells, with the zooecia large, distinct, rectangular, and usually arranged in straight linear sequence. The slightly raised frontal is perforated by large pores which are covered by a thin, transparent cuticle. The aperture is rounded distally, straight proximally and has a wide, U-shaped sinus. The frontal does not en-

croach on the peristomal area, which remains distinct, with a low mural rim. One or a pair of avicularia may occur lateral to the sinus; an umbo proximal to the aperture is usually present. The ovicells are erect, standing high above the frontal, and are hyperstomial, perforate, and have radiating ridges.

OCCURRENCE: P-8, Isla Conchas. Only one specimen was found.

DISTRIBUTION: According to Osburn (1952), *Schizoporella unicornis* was probably introduced to the California coast in relatively recent years. It is widely distributed in the North Atlantic, Indian, and western Pacific oceans in temperate to tropical waters. Osburn first reported it from the California coast, while Soule (1961) found it in the Gulf of California. Apparently this species has been introduced in localities where east coast oysters have been imported for cultivation.

Schizoporella cornuta (Gabb and Horn), 1862

Reptescharellina cornuta GABB AND HORN, 1862, pp. 147, 148, pl. 20, fig. 31.

Schizoporella biaperta: HINCKS, 1883, pp. 445, 446; 1884a, pp. 57, 58, 211, 212. ROBERTSON, 1908 [*partim*], pp. 287, 288, pl. 19, fig. 41. C. H. AND E. O'DONOGHUE, 1923, p. 177; 1925, p. 102. HASTINGS, 1930, p. 721.

? Schizoporella biaperta: ROBERTSON, 1900, p. 326.

Stephanosella biaperta: CANU AND BASSLER, 1923 [*partim*], pp. 99–101, pl. 16, figs. 4–8.

Schizopodrella (*Stephanosella*) *biaperta:* CANU AND BASSLER, 1930, pp. 16, 17, pl. 2, figs. 1, 2.

Schizoporella cornuta: OSBURN, 1952, pp. 320, 321, pl. 37, figs. 9-11. SOULE AND DUFF, 1957, pp. 109, 110. SOULE, 1961, pp. 11, 12.

Colonies incrust on mollusk shells and are unilaminar. The zooecia are ovoid and distinct. The frontal is an inflated tremocyst, with pores varying from fine to coarse. The aperture is rounded distally, straight proximally, and has a well-defined, V-shaped notch and slight apertural rim. No umbo is present. Paired lateral avicularia occur somewhat proximal to the aperture, directed distolaterally. Raised frontal avicularia also occur, and in older, more crowded areas of the colony large avicularia appear to supplant entire zooecia. The ovicells are prominent, only partly submerged, imperforate, with a secondary layer forming grooves except for a thin area on the top.

OCCURRENCE: P-8, off Isla Conchas.

DISTRIBUTION: Abundant in eastern Pacific waters, *Schizoporella cornuta* ranges from Alaska to the Galapagos and the Gulf of California. The species has been confused with *Stephanosella biaperta* in the literature pertaining to west coast records, according to Osburn (1952), the difference being in the tremocyst frontal of *Schizoporella cornuta*.

Schizoporella occidentalae, new species

Figures 3, 4

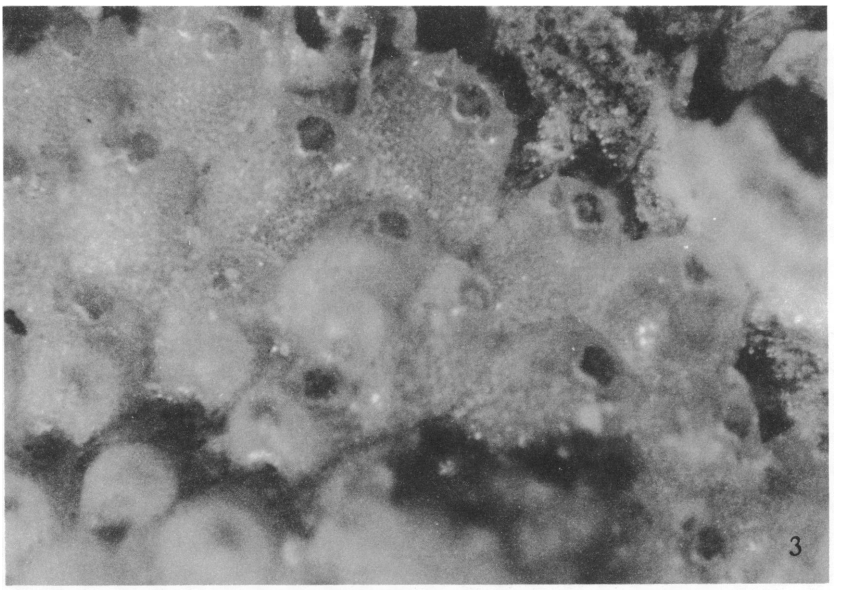
DIAGNOSIS: Zoaria incrusting, generally unilaminar, growth radial. Zooecia small, distinct, hexagonal. Frontal inflated, a tremocyst with small pores. Aperture rounded distally, straight proximally, with a narrow, V-shaped sinus. Avicularia occur lateral to sinus singly, in pairs, or may be absent. Small suboral umbo usually present. Two fragile oral spines present in some very young zooecia. Occasional frontal avicularia.

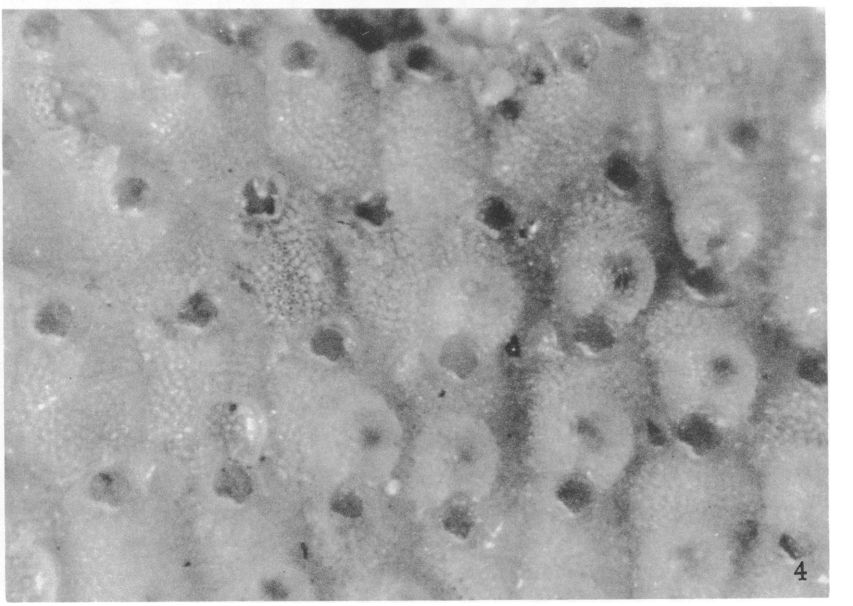
DESCRIPTION: Zoaria translucent white to pale tan, incrusting, usually unilaminar, growth circular, radiating from ancestrula. Ancestrula ovoid, transparent, with a large semicircular aperture which is unnotched and surrounded by small, delicate spines. Zooecia hexagonal, frontal a tremocyst with small pores, inflated so that aperture slants downward distally. Two oral spines on some young zooecia at edge of colony; growth of inflated frontal of succeeding zooecia appearing to push spines off. Aperture rounded distally, straight proximally, with a V-shaped or narrow U-shaped notch. Operculum thin, transparent to pale yellow. Small suboral umbo usually present. Avicularia may occur on either side of aperture, on both sides, or be absent altogether. Avicularia small, raised, with pointed mandible directed distolaterally, and with a rounded base. Rarely, one avicularium is modified into a large spine longer than zooecium and pointed upward. Ovicells hyperstomial, perforated, thin on top so that contents of ovicell show through, giving pinkish appearance to colony.

Schizoporella occidentalae resembles *Schizoporella unicornis* in general morphology. However, comparisons show *S. occidentalae* to be considerably smaller, with a much narrower sinus on the aperture. The frontal is much inflated so that the aperture slants downward distally, becoming sunken, particularly when ovicells are present. Whereas the zooecia of *S. unicornis* are primarily rectangular and occur in linear sequence, with little separation proximally and distally and with almost straight grooves separating the zooecia laterally, *S. occidentalae* is markedly hexagonal and the rows are alternated, making the lateral grooves form a zigzag pattern, with proximal and distal separations distinct. *Schizoporella unicornis*, except where distorted by crowding, grows almost flat, with ovicells perched high, while the ovicells of *S. occidentalae* protrude only slightly above the inflated frontals, and are less prominently ridged.

This species is named for Occidental College in Los Angeles, California.

HOLOTYPE: Deposited in the Allan Hancock Foundation, University of Southern California, Los Angeles, California.





FIGS. 3, 4. *Schizoporella occidentalae*, new species. 3. Young colony with spines on growing edge. 4. Colony with ripe ovicells.

PARATYPES: Deposited in the American Museum of Natural History, New York City; Allan Hancock Foundation, Los Angeles, California; and Occidental College, Los Angeles, California.

TYPE LOCALITY: Off Isla Conchas, Scammon's Lagoon, Baja California, Mexico.

OCCURRENCE: P-3, P-5, P-8, off Isla Conchas.

GENUS *ESCHARINA* MILNE-EDWARDS, 1836

Escharina vulgaris (Moll), 1803

Eschara vulgaris MOLL, 1803, p. 55, pl. 3, figs. 10a, 10b.

Schizoporella vulgaris: HINCKS, 1880, p. 244. CANU AND BASSLER, 1923, pp. 108, 109, fig. 16, pl. 35, fig. 10. OSBURN, 1952, p. 335, pl. 38, fig. 13.

Escharina vulgaris: SOULE, 1961, p. 15.

The zoaria are incrusting, white to tan in color; the zooecia, elongate to ovoid. The frontal is a tremocyst perforated by very fine pores and covered by a thin membrane which gives it a granular appearance. The zooecia are distinct proximally and distally, with deep lateral grooves bordered by four or more areolar pores. The aperture is rounded distally, straight laterally, and has a keyhole-shaped notch in the proximal border. The mural rim surrounding the aperture rises in the notch area, and four small oral spines may be present. The paired lateral avicularia beside or proximal to the sinus are very distinctive, having a rounded base with complete hinge bar and long, vibraculoid mandibles which can be pointed proximally or distally by the opening or closing of the avicularium. The ovicells are raised, globose, perforate, and closed by the operculum. The vibraculoid mandible and the opercular closing of the ovicell separate the genus *Escharina* from the genus *Schizoporella.*

OCCURRENCE: P-3, off Isla Conchas.

DISTRIBUTION: Osburn (1952) recorded *Escharina vulgaris* from two stations in the Gulf of California and remarked that the species previously had been known, as living, only from the eastern Atlantic and the Mediterranean, in temperate and tropical waters. Canu and Bassler (1923) found it in the Pleistocene fossil deposits of Santa Barbara, California, while Soule (1961) also found it living in the Gulf of California. It is apparently rare.

FAMILY HIPPOPORINIDAE OSBURN, 1952

GENUS *CLEIDOCHASMA* HARMER, 1957

Cleidochasma contracta (Waters), 1899

Lepralia contracta WATERS, 1899, p. 11, pl. 3, figs. 4–6.

Perigastrella contracta: HASTINGS, 1930, p. 722, pl. 11, fig. 60.
Hippoporina contracta: OSBURN, 1952, pp. 346, 347, pl. 41, figs. 4, 5.
Cleidochasma contracta: SOULE, 1961, pp. 19, 20.

The zoaria are incrusting and multilaminar. The zooecia are covered by a thick, shining, chitin-like material, with only the yellow opercula distinguishable. Vigorous incineration is needed to remove the coating and reveal the skeletal characteristics. The zooecia are ovate, with an imperforate frontal which is thickened and in some cases umbonate; separated by 12 large areolar pores. The aperture is horseshoe-shaped distally ("*Hippo*"-*porina*), with cardelles somewhat bifid, and a rounded sinus proximally, giving the opening a keyhole appearance. Six oral spine scars are present. The avicularia vary, being oral or frontal, in some cases mounted on processes, and in being small and blunt or large and pointed. The ovicells are globular, becoming embedded with advanced calcification, with a thin, elliptical frontal which may be destroyed by erosion or incineration.

Harmer erected the genus *Cleidochasma* in 1957, and included it in the family Schizoporellidae, but it appears that he had not taken Osburn's new family Hippoporinidae (1952) into consideration. It seems desirable that the Schizoporellidae be limited to those species with a perforate, tremocyst frontal and that the Hippoporinidae include those with an olocyst or pleurocyst frontal.

OCCURRENCE: P-1, Isla Conchas.

DISTRIBUTION: While *Cleidochasma contracta* is abundant in the Atlantic from Massachusetts to Brazil, it is known in the eastern Pacific only in tropical waters.

GENUS *AIMULOSIA* JULLIEN, 1888

Aimulosia uvulifera (Osburn), 1914

Figure 5

Lepralia uvulifera OSBURN, 1914, p. 210, figs. 19, 20.
Aimulosia uvulifera OSBURN, 1952, pp. 352, 353, pl. 45, figs. 16, 17. SOULE, 1961, pp. 20, 21.

Osburn's original description of *Lepralia uvulifera* in 1914 was based on one small specimen from the Tortugas Islands. He described the colony as being small, smooth, shining, and covered by small knobs. The ooecia were described as being large, heavily calcified, and covered with knobs like those of the zooecia, with an umbo on top.

In Osburn's original specimen, the zooecia bear three to five marginal pores, and only one avicularium was seen on the colony, a small lateral one

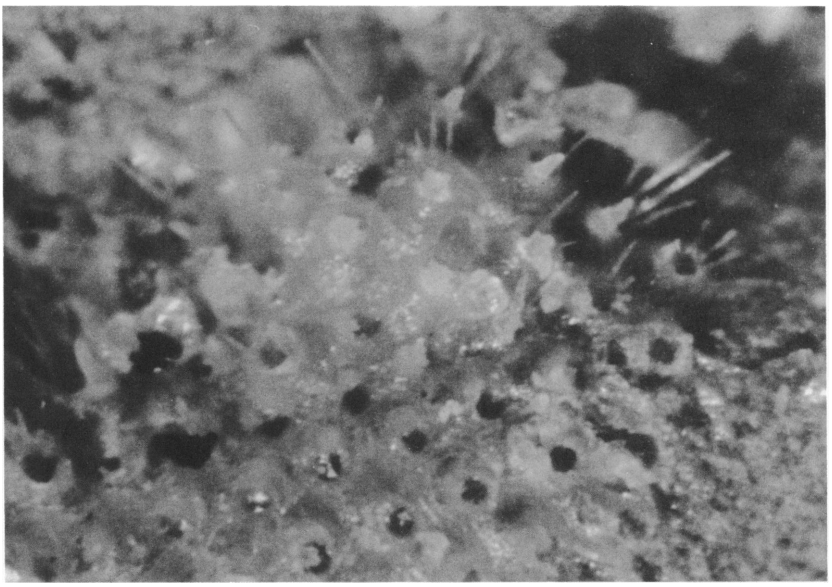


FIG. 5. *Aimulosia uvulifera*, young colony with decorated ovicells.

directed proximally. The orifice is rounded distally and bears six small spines, nearly straight on the proximal border. A mucronate process (umbo) rises proximal to the peristome and, in complete calcification, is divided at the tip into three sharp spines. The ooecial opening is high and wide, and in some cases a small projection extends downward which resembles the uvula of the human palate. A single pore occurs on each side of the ooecial opening.

In 1952, Osburn added to this description the fact that the zooecia were about 0.25 to 0.30 mm. long by 0.20 mm. in width, distinct only when young, with a thick, porcelaneous pleurocyst, elevated distally, with areolar pores few and difficult to observe except when calcined (incinerated). He also noted that a minute oral avicularium is in some cases present beneath the overhanging umbo, and that small triangular avicularia may be scattered over the frontal area, while small erect processes may flank the umbo.

Osburn's figures (19 and 20) in his publication in 1914 are quite true to the original description. In his publication in 1952, however, he shows many areolar pores (from 10 to 13), no spines, slight indication of the uvula, and a single avicularium which is lateral-oral, directed distally (pl. 45, figs. 16, 17). As a result this species has become confused with

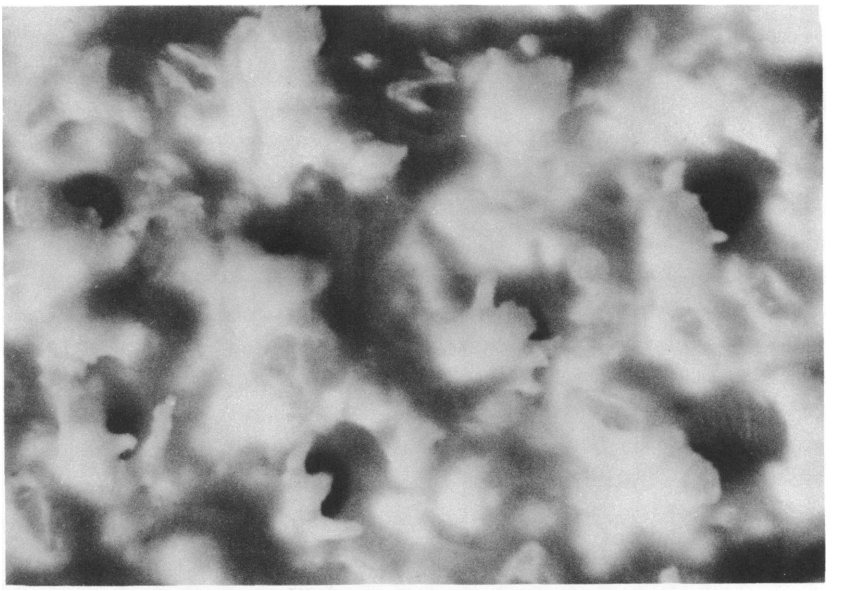


FIG. 6. *Hippoporella gorgonensis*, incinerated, with trifid umbos.

Hastings' *Hippoporella gorgonensis*, so that reference should be made to the discussion of that species.

OCCURRENCE: P-1, P-3, P-5, P-8, common around Isla Conchas.

DISTRIBUTION: Described from the Tortugas by Osburn (1914), *Aimulosia uvulifera* was later reported elsewhere in the Caribbean and in the eastern Pacific off Mexico and Central America by Osburn. Soule (1961) found it in the Gulf of California as far north as San Marcos Island. Its occurrence in Scammon's Lagoon is the northernmost record.

GENUS *HIPPOPORELLA* CANU, 1917

Hippoporella gorgonensis Hastings, 1930

Figure 6

Hippoporella gorgonensis HASTINGS, 1930, pp. 723, 724, pl. 1a, figs. 62–72, pl. 17, figs. 119, 121. OSBURN, 1952, pp. 348, 349, pl. 45, figs. 10–12. SOULE AND DUFF, 1957, pp. 112, 113. SOULE, 1961, p. 20.

Hastings' original description (1930), of *Hippoporella gorgonensis* from the island of Gorgona off Colombia, reported the colony as being a thick crust with knobs and processes. The zooecia have two to four spines, a granular frontal with fair-sized lateral pores, and usually a median process

proximal to the orifice. Increased calcification reduces the pore size and granulation, while the umbo increases and may branch. An unbranched process may appear on each side of the orifice. The ovicell is shallow, roughened, in some cases with a knob or process on top. Two types of opercula are intermixed on the specimens, and the avicularia show great diversity. Hastings noted that one or both of the lateral processes may be replaced by avicularia directed distolaterally, and small avicularia may occur along the sides of the orifice; in some cases large or small, sharp-pointed frontal avicularia are present, and occasionally the areolar pores are replaced by small, raised, rounded avicularia.

Hastings remarked that a wide range of variation occurs but that the intergradation seemed to render subdivision impossible. Her figures (1930, figs. 62–70) show this variation, and she stated that, if subdivision were made, she considered the specimen illustrated in figure 62 to be the type species. Unfortunately this one appears to be identical to Osburn's (1914) *Lepralia uvulifera.*

Osburn (1952) added to Hastings' description the zooecial dimensions: 0.40 to 0.50 mm. long by 0.25 to 0.40 mm. wide. He remarked that the vestibular arch is often delicately beaded and that the spines usually disappear with advancing calcification. His illustrations of *H. gorgonensis* in 1952, however, show six spines instead of the described two to four, only a few areolar pores, and a membrane on the upper edge of the ovicell, which neither he nor Hastings had mentioned. It seems evident that an error was made by Osburn (1952) in the identifications and illustrations of *Aimulosia uvulifera* and *Hippoporella gorgonensis.*

Extensive examination of the specimens identified by Osburn in the Hancock collections and in the "Puritan"-American Museum collection by Soule (1961) indicates that there has been great difficulty in distinguishing between the two species. It seems probable that the specimen of *H. gorgonensis* that Hastings indicated to be most typical is synonymous with *Aimulosia uvulifera,* while the specimens that she illustrated as the variations are indeed another species, with the characteristics that have most commonly been identified as those of *H. gorgonensis.* This name must be abandoned if examination of the type material, which is not presently available, should bear out these observations. If so, the new species could well be named for Dr. Anna B. Hastings, in recognition of her valuable contributions to the bryozoan literature. Possibly the genera should also be re-evaluated.

For the present, until type material can be examined, the following distinctions should be maintained:

Aimulosia uvulifera has small zooecia with few pores, six spines which

disappear with increasing calcification, small, rounded, or triangular frontal avicularia, and in some cases a suboral avicularium beneath the umbo.

Hippoporella gorgonensis should be employed for specimens in which the zooecia have eight to 13 areolar pores, two to four spines, and scattered zooecia in the colony bearing one or more large, pointed avicularia directed proximally from the umbo.

Both species share the following characteristics: a bell-shaped aperture; a suboral umbo which may be single, bifid, or trifid, depending on the area of the colony; a large, wide-open ovicell which in some cases has a thin membrane partly closing it; and a knob or process on top. A single process may occur on either or both sides of the umbo, or either may be replaced by a small triangular avicularium directed distolaterally. Attempts to identify small, fragmentary colonies are perilous, for such small areas may not include the long frontal avicularia which seem to be a definitive characteristic. A large number of specimens from Osburn's material in the Hancock collection, the "Puritan"-American Museum material, and the Scammon's Lagoon material were tabulated on the basis of 16 characteristics in order to establish a differentiation between the two species.

OCCURRENCE: P-3, P-5, P-8, common.

DISTRIBUTION: Hastings reported *Hippoporella gorgonensis* from the eastern Pacific off Colombia and Panama and the Galapagos Islands. Osburn (1952) gave the range from about latitude 34° N. to a little south of the equator, while Soule (1961) reported it extensively in the Gulf of California. The distribution, therefore, is warm temperate to tropical.

GENUS *HIPPOPORIDRA* CANU AND BASSLER, 1927

Hippoporidra spiculifera (Canu and Bassler), 1930

Hippotrema spiculifera CANU AND BASSLER, 1930, p. 43.
Hippoporidra spiculifera: OSBURN, 1952, p. 356, pl. 55, figs. 8–10.

The zoaria are incrusting, nodular, or erect. The zooecia are cumulate, small, ovoid, indistinct except when young. The frontal is a costate pleurocyst with one or two rows of areolar pores. The aperture is raised and elongate, with the proximal border arched. The peristome bears six long, crooked, slender spines, while the frontal has a tall umbo and in some cases additional processes which may be bifid. The ovicell is prominent, hyperstomial, with a rounded area above the opening and may have processes on top. Small pointed avicularia occur on the frontal, directed randomly. In many respects this species resembles *A. uvulifera* and *H.*

gorgonensis; incineration is needed to reveal the double row of areolar pores and the costate frontal.

OCCURRENCE: P-5, off Isla Conchas.

DISTRIBUTION: Described from the Galapagos Islands, this species has been infrequently reported along the coast of Mexico and from the Gulf of Panama. Because so few specimens are available, possibly it is actually merely an extravagant display, owing to optimum protected growing conditions, of another species. Further investigation is in order.

FAMILY SMITTINIDAE LEVINSEN, 1909

GENUS *PORELLA* GRAY, 1848

Porella rogickae Soule, 1961

Figure 7

Porella rogickae SOULE, 1961, pp. 30–32, fig. 1.

The zoarium forms large, unilaminar, hyaline encrustations on mollusk shells; colony growth is radiate from the ancestrula. The zooecia are distinct, ovoid, with a slightly inflated imperforate frontal, and there are six to eight large areolar pores at the margins. The primary aperture is deeply immersed, surrounded by a moderately tall peristomal collar, rounded distally, and has a low median denticle (lyrula) which is typical of the smittinids. A low median suboral umbo is topped by an oval avicularium chamber with a proximally directed mandible and four marginal pores. The ovicells are hyperstomial and imperforate, with an ovoid depression in the center of each.

OCCURRENCE: P-8, Isla Conchas.

DISTRIBUTION: *Porella rogickae* was described by Soule in 1961, from the vicinity of Tiburón Island in the Gulf of California, and was found by him in several other locations in the Gulf. This is the first record of the species outside the Gulf.

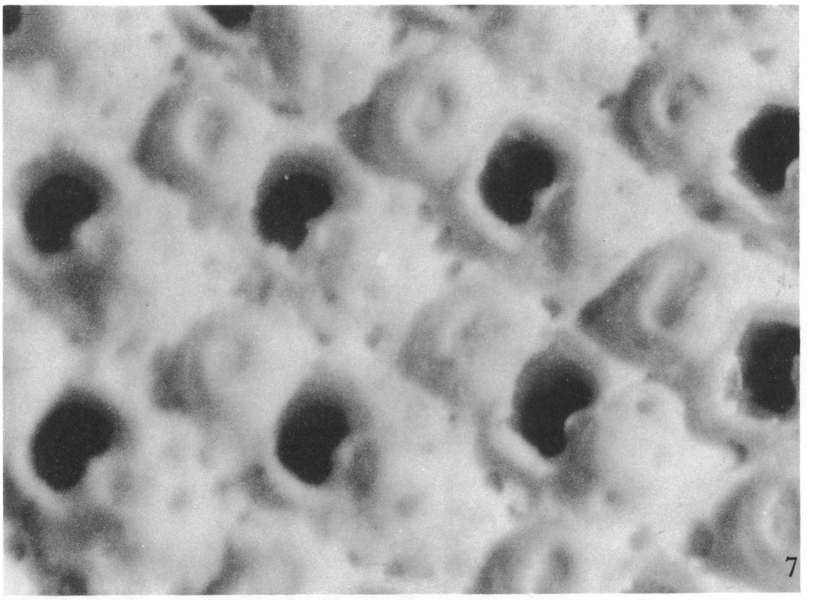
GENUS *SMITTOIDEA* OSBURN, 1952

Smittoidea prolifica Osburn, 1952

Smittia reticulata: ROBERTSON, 1908, p. 306, pl. 23, figs. 75, 76.

Smittoidea prolifica OSBURN, 1952, pp. 408, 409, pl. 48, figs. 7, 8. SOULE, 1961, pp. 33, 34.

The zoaria incrust on mollusk shells. The zooecia are small, distinct, and ovate, and have a smooth, imperforate frontal and 16 to 18 large areolar pores which give a costate appearance to the lateral areas. The aperture is rounded and has a median denticle (lyrula) on the proximal



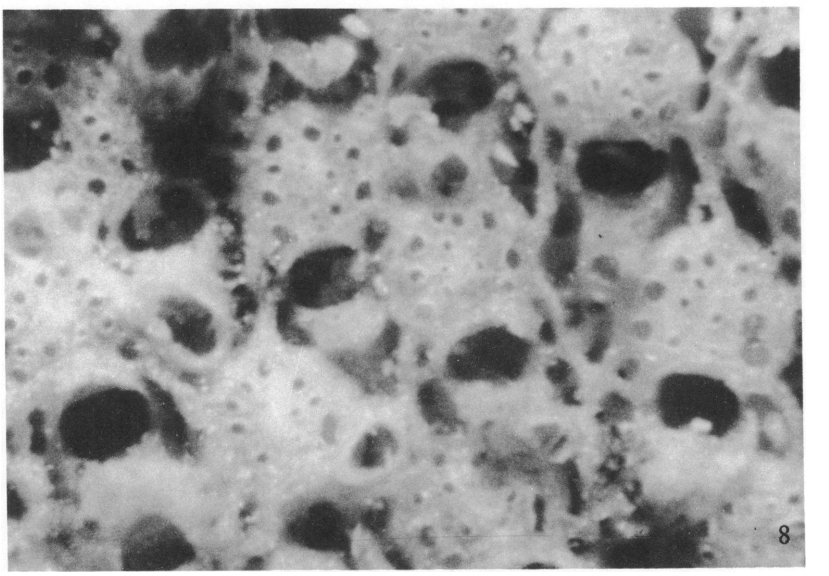


FIG. 7. *Porella rogickae*, incinerated, showing depression in ovicell, umbo, and ascopore.

FIG. 8. *Parasmittina californica*, with perforate ovicells, lateral and large frontal avicularia.

border and lateral cardelles. In some cases four slender spines are present on the distal border. The peristomal collar is low distally, rising on the sides and forming a high sinus proximally which surrounds a small, median avicularium. The ovicells are abundant, globular, perforate, and prominent.

OCCURRENCE: P-8, Isla Conchas.

DISTRIBUTION: *Smittoidea prolifica*, first described from waters off southern California by Osburn (1952), was also reported by him from Laguna San Ignacio, on the Pacific coast of Baja California, which is south of Scammon's Lagoon and probably was connected to it in geologic periods of submersion. Soule (1961) found it in the Gulf of California.

GENUS *PARASMITTINA* OSBURN, 1952

Parasmittina trispinosa (Johnston), 1825

Discopora trispinosa JOHNSTON, 1825, p. 222.

Lepralia trispinosa: BUSK, 1855, p. 3; 1856, p. 178.

Smittia trispinosa: HINCKS, 1884a, p. 51; 1884b, pp. 361, 362. ROBERTSON, 1900, p. 327; 1908, pp. 302, 303, pl. 22, figs. 68–70. C. H. AND E. O'DONOGHUE, 1923, p. 185; 1925, p. 105; 1926, pp. 113, 114. CANU AND BASSLER, 1930, pp. 27–29, pl. 4, figs. 1–5. HASTINGS, 1930, p. 726, pl. 11, fig. 55.

Parasmittina trispinosa: OSBURN, 1952, pp. 412–414, pl. 49, figs. 7, 8. SOULE AND DUFF, 1957, pp. 121, 122. SOULE, 1961, pp. 35, 36.

The colonies incrust on mollusk shells and are unilaminar or multilaminar. The young zooecia grow in parallel series with raised, separating lines; older zooecia vary greatly in size and orientation. The frontal is a pleurocyst, granular, and has a row of large areolar pores and in some cases additional frontal pores. The aperture is circular to oval, with a median denticle (lyrula) on the proximal border. The apertural collar (peristome) is thin, high, and notched on the proximal border, sloping downward to the distal rim where there are three slender spines or their scars. The high peristome in some cases hides the lyrula. A large, distinctive, raised avicularium with a long triangular mandible directed distally occurs frequently along one side of the aperture. Other small frontal avicularia may be present. The ovicell is globose and prominent, with large perforations.

OCCURRENCE: P-3, tide flats off Isla Conchas.

DISTRIBUTION: A cosmopolitan species, *Parasmittina trispinosa* has been reported frequently in the eastern Pacific, from Point Barrow, Alaska, to the Galapagos Islands (Osburn, 1952), and in the Gulf of California (Soule, 1961). The many variations suggest that more than one species is involved, according to Osburn (1952).

Parasmittina crosslandi (Hastings), 1930

Smittina crosslandi HASTINGS, 1930, pp. 726, 727, pl. 13, figs. 75–79, pl. 17, fig. 122.

Smittina trispinosa: CANU AND BASSLER, 1930 [*partim*], pp. 27–29, pl. 4, figs. 1–5.

Parasmittina crosslandi: OSBURN, 1952, p. 418, pl. 48, fig. 12. SOULE, 1961, p. 37.

The incrusting colonies may be broad, unilaminar, or raised in nodules and stems, or multilaminar. The zooecia are somewhat quadrate, irregular, and distinct, with separating lines when young but merging into a crust with increased calcification. The frontal is a granular pleurocyst with large areolar pores. The aperture is rounded except in the area of the lyrula proximally. The peristome rises high on the sides to form a spout-like sinus proximally; there are three to five oral spines distally on the marginal zooecia. The avicularia vary in size and shape, including small ligulate or long pointed ones along one side of the aperture, all directed proximally. Light incineration may be necessary to reveal the distinguishing characteristics. The ovicells are rounded and protruding and have small perforations.

OCCURRENCE: P-3, P-5, off Isla Conchas.

DISTRIBUTION: A tropical species, *Parasmittina crosslandi* occurs from Colombia northward to Tiburón Island in the Gulf of California.

Parasmittina californica (Robertson), 1908

Figure 8

Mucronella californica ROBERTSON, 1908, pp. 308, 309, pl. 23, fig. 80.

Parasmittina californica: OSBURN, 1952, pp. 415, 416, pl. 51, figs. 8–11. SOULE AND DUFF, 1957, p. 122. SOULE, 1961, pp. 36, 37.

The zoaria incrust, are multilaminar, and grow in alternate lines when young. The zooecia are ovate to rectangular, separated by grooves with a dividing calcified ridge. The frontal is pleurocyst, with large areolar pores plus a few scattered frontal pores. The aperture is round, with a thin peristome which may rise proximally, and has a medium-sized lyrula. Short oval avicularia are scattered over the frontals, usually directed laterally. The most notable feature, as mentioned in Robertson's original description (1908), is the large spatulate[1] avicularia which occur at irregular intervals at one side of the orifice, curving distally and

[1] Confusion has sometimes arisen over the use of the descriptive words "spatulate" and "spathulate." In the past the terms have been used interchangeably and refer to an old style spatula that was shaped like a wooden spoon and not the modern, straight-sided instrument.

directed obliquely upward, and which, by their large size, push the orifice to one side, giving it an asymmetrical position. The ovicell is globose, little erected, and punctured by seven to 10 large pores. While this species resembles *P. trispinosa* in many respects, the giant avicularia are much more gross, and distort the aperture.

OCCURRENCE: P-3, tide flats southeast of Isla Conchas.

DISTRIBUTION: Osburn (1952) indicated that all the specimens from southern California were collected at less than 50 fathoms, while those in Mexican waters came from between 50 and 60 fathoms, and those at the Galapagos between 100 and 150 fathoms. Soule (1961), however, found *Parasmittina californica* in the Gulf of California from 13 to 45 fathoms, and the present specimen was collected on tide flats.

Parasmittina fraseri Osburn, 1952

Parasmittina fraseri OSBURN, 1952, pp. 419, 420, pl. 49, fig. 15. SOULE, 1961, p. 38.

The colonies are incrusting, white, and shining. The zooecia are small, distinct when young, and have a pleurocyst which is somewhat granular. The areolar pores are moderate in size and are separated by costae. The aperture is rounded and has a broad, deep-set lyrula which almost fills the proximal border. A collar extends around the aperture, rising proximally to two points which enclose a small sinus and almost obscure the lyrula. The ovicell is small, perforate, and immersed. Small avicularia are scattered over the frontal, with an occasional large pointed one. Only one colony was collected in Scammon's Lagoon. This was heavily calcified and bore one or two large, pointed, frontal avicularia on almost every zooecium, appearing to arise from a lateral pore and pointing toward the aperture. Osburn's material in the Hancock collection, while less heavily calcified, bore scars indicating similar avicularia.

OCCURRENCE: P-3, tide flats southeast of Isla Conchas.

DISTRIBUTION: *Parasmittina fraseri*, described by Osburn (1952) from Clarion Island, Mexico, was also reported by him as ranging southward to Ecuador and northward to the San Benitos Islands off Vizcaíno Bay, Baja California. Soule (1961) collected it in the Gulf of California.

ALISMITTINA, NEW GENUS

The frontal is a pleurocyst with one row of areolar pores, plus other frontal pores, and with occasional giant avicularia which entirely replace individual zooecia in the colony. In some cases a median umbo with a small suboral avicularium is present. The ovicells are globose and per-

forated by from two to eight medium-sized pores.

This genus is closely allied to *Parasmittina* Osburn, 1952, in which the avicularia are described as being various in size, form, and distribution but not median and suboral, and in some cases interzooecial. Osburn, however, did not give any species description that mentioned interzooecial avicularia except for his "?*Smittia californiensis* Robertson, 1908" which he included but felt should be dropped from the literature as an error since Robertson's description did not apply to any smittinid presently found off southern California. One colony that fits Robertson's description and figure exactly was found in the Scammon's Lagoon material. If this were to be included in the genus *Parasmittina*, we would then have both *Parasmittina californica* (Robertson), which was formerly *Mucronella californica* Robertson, 1908, and *Parasmittina californiensis* (Robertson), which was formerly *Smittia Californiensis* Robertson, 1908—a very confusing situation. (Genus *Smittia* Hincks, 1879, is preoccupied by Holmgren, 1869.) Also, Osburn specified that avicularia in *Parasmittina* were not median and suboral, while Robertson reported that her species *Smittia californiensis* had a median umbo which in some specimens bore a small avicularium.

In view of the fact that Osburn based much of his revision of the Smittinidae on the location of the avicularia, it seems necessary to construct the genus *Alismittina* (Latin, *alius*, other) for those species that have the unusual giant avicularia supplanting entire zooecia and that in some instances bear median suboral avicularia and an umbo. While the genus *Mucronella* shows an umbo, it has no avicularia and its ovicell is imperforate. The genus *Smittoidea* has median avicularia, a perforate ovicell and good lyrula, as does *Alismittina*, but does not have interzooecial avicularia or an umbo.

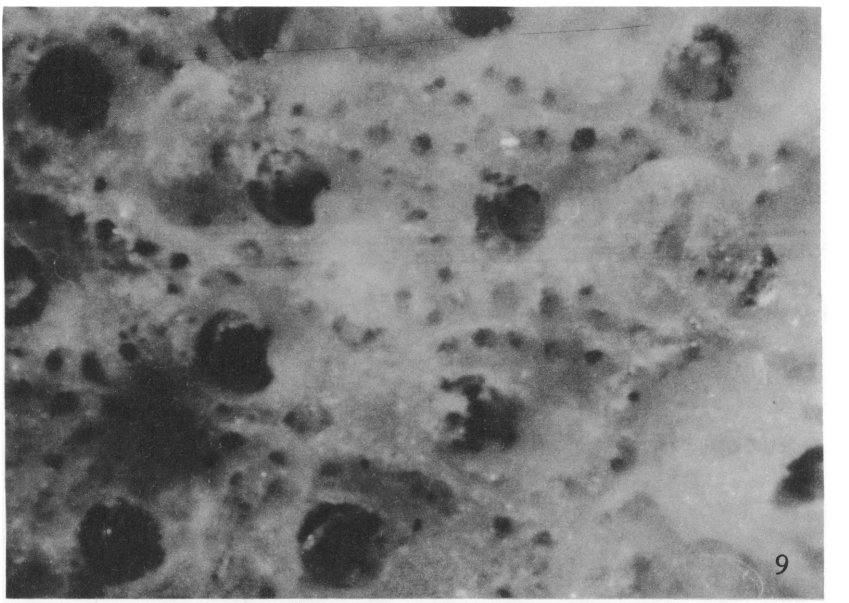
TYPE SPECIES: *Smittia californiensis* Robertson, 1908.

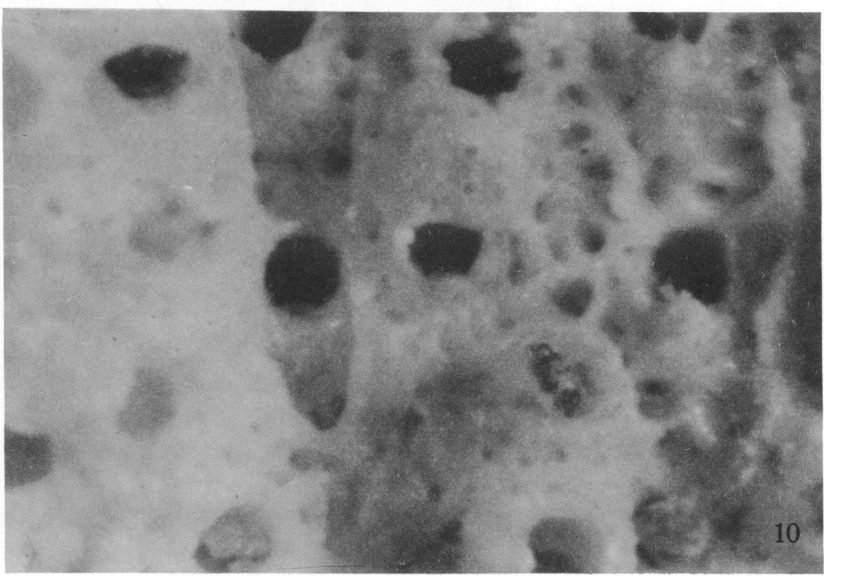
Alismittina californiensis (Robertson), 1908

Figures 9, 10

Smittia californiensis ROBERTSON, 1908, pp. 303, 304, pl. 22, fig. 71.
?Smittia californiensis: OSBURN, 1952, pp. 421, 422.

The zoarium forms a thick, spiny crust on mollusk shells and kelp. The zooecia are large, rhomboidal, and in alternate rows when young but become distorted with advanced calcification. The frontal is a pleurocyst with a row of large areolar pores plus additional frontal pores which in some cases are numerous enough to make two complete rows. The aperture is rounded, bears a dark operculum, and has a median





FIGS. 9, 10. 9. *Alismittina californiensis*, type species of *Alismittina*, new genus. 10. Interzooecial avicularium scar, perforate ovicell, small umbo.

lyrula and a pair of cardelles. The peristome is low distally, bears two to four spine scars, and rises proximally to a high umbo which in some cases bears a minute suboral avicularium. At the side of the aperture may be mound-like avicularian chambers, and there may be scattered small frontal avicularia. Interspersed between the zooecia are large, raised spatulate avicularia similar in size to the zooecia and occupying the place of one. Robertson did not find ovicells. Our specimen has excellent ones, globose, somewhat raised, with two to eight medium-sized pores.

OCCURRENCE: P-3, tide flats southeast of Isla Conchas. One colony was collected, which was completely covered by a heavy incrustation of *Parasmittina fraseri*, and was only accidentally discovered when the superficial colony was removed. While the colony of *Alismittina californiensis* had undoubtedly been dead for some time, it was well preserved in spite of being incrusted, and had escaped severe erosion.

DISTRIBUTION: Alice Robertson described *Smittia californiensis* in 1908, as being common in many localities on the southern California coast. However, it had not been collected apparently since 1908, leading Osburn (1952) to suppose that she had mistaken it for *Holloporella brunnea*, which also has dark opercula, interzooecial avicularia, and is umbonate, but does not have the lyrula and smittinid peristome that she illustrated. Robertson was an extremely careful worker whose papers are very good, in spite of the fact that she was handicapped by a limited library and a lack of reference material. It is gratifying to confirm the existence of her species.

In other animal groups it has been demonstrated that the temperature fluctuations along the coast have caused the disappearance of species once common to the area (Hubbs, 1948; Radovich, 1961). Possibly such happened in the present instance. That the variability of the California counter current may be responsible for the variation in the range of pelagic larvae was postulated by Berner (1960) and by Berner and Reid (1961).

GENUS *MUCRONELLA* HINCKS, 1877

Mucronella major (Hincks), 1884

Mucronella spinosissima form *major* HINCKS, 1884a, pp. 53–55, 213, pl. 3, fig. 3.
Phylactella spinosissima var. *major:* CANU AND BASSLER, 1923, pp. 170, 171, pl. 39, figs. 8, 9.
Mucronella major: OSBURN, 1952, pp. 438, 439, pl. 52, figs. 4, 5. SOULE, 1961, pp. 38, 39.

The zoaria form large, white incrustations on mollusk shells. The

zooecia are large, distinct, raised distally, and have a flask-shaped appearance. The inflated frontal is a pleurocyst with marginal pores which move upward in development, giving a perforate effect. The primary aperture is round, with a collar of eight to 10 long spines, and a lyrula on the proximal border. According to Osburn (1952), the pleurocyst first develops an umbonate process proximally which develops into a tube, fusing the spines until they are completely incorporated. Of course the spines, being rather fragile, may also be lost by erosion. There are no avicularia. The ovicells are globose, reclining on succeeding zooecia, and perforate at maturity in the manner of the frontal.

OCCURRENCE: P-3, P-9, off Isla Conchas and Isla Barrosa.

DISTRIBUTION: Originally described from the Queen Charlotte Islands, British Columbia, this species ranges southward from cool temperate waters to tropical waters in the Galapagos Islands, and in the Gulf of California. Interestingly, one young colony from Scammon's Lagoon had *Hippothoa distans* growing around the low areas at the bases of some of the zooecia, with *Colletosia radiata* and *Schizoporella occidentalae* superimposed on others.

FAMILY ADEONIDAE BUSK, 1884

GENUS *REPTADEONELLA* BUSK, 1884

Reptadeonella violacea (Johnston), 1847

Lepralia violacea JOHNSTON, 1847, pp. 325, 326, pl. 56, fig. 9.

Adeona violacea: HASTINGS, 1930, p. 728. OSBURN, 1952, pp. 441, 442, pl. 58, figs. 6, 7.

Reptadeonella violacea: SOULE, 1961, p. 39.

The zoaria are incrusting and range in color from light lavender to dark iridescent purple. The zooecia are regular, hexagonal, in alternating series, and raised distally where not crowded. The frontal is a roughened pleurocyst bordered by a row of areolar pores; in a center depression lies a prominent ascopore with the frontal inflated around it, which is characteristic of the genus. The aperture is transversely oval, surrounded by a low peristome. Between the aperture and the ascopore lies a median suboral avicularium with pointed mandible directed distally.

OCCURRENCE: P-3, tide flats off Isla Conchas.

DISTRIBUTION: *Reptadeonella violacea* is known around the world in warmer waters. In the eastern Pacific it is common in the Gulf of California and off the coast of Mexico, extending south to Colombia.

FAMILY RETEPORIDAE SMITT, 1868

GENUS *RHYNCHOZOON* HINCKS, 1895

Rhynchozoon rostratum (Busk), 1855

Lepralia rostrata BUSK, 1855, p. 4; 1856, pp. 178, 179.

Schizoporella tumulosa HINCKS, 1882a, p. 252. ROBERTSON, 1908, p. 293, pl. 20, fig. 53. C. H. AND E. O'DONOGHUE, 1923, p. 37; 1926, p. 56.

Rhynchozoon rostratum: HASTINGS, 1930, pp. 728, 729, pl. 14, figs. 84, 85, 93–96. OSBURN, 1952, pp. 456–458, pl. 54, figs. 1–3. SOULE, 1961, pp. 43, 44.

Rhynchozoon tumulosum: OSBURN, 1952, pp. 458, 459, pl. 54, figs. 4, 5, 12.

The zoaria form irregular, white to yellowish or tan incrustations; older colonies are multilaminar, with a honeycombed or spiny appearance. The young marginal zooecia show a thin transparent olocyst with an almost terminal aperture and many areolar pores. The frontal thickens into a pleurocyst with the formation of heavier costate ridges which arise between the marginal pores and gradually extend into the central area. Medially, below the aperture, a large bulbous chamber arises which develops a raised suboral avicularium directed laterally and with a pointed, hooked mandible. At this stage, as has not previously been reported, two to four oral spines may occur on the distal edge of the aperture of marginal zooecia. The aperture progresses from being lateral-oval in shape to being larger and rounded; subsequently it develops a wide, shallow sinus which may become narrowed as crowding occurs and the attachments of the operculum strengthen. The vestibular arch is beaded. The peristome, which is at first low and thin, rises with the increasing calcification until the operculum is deeply recessed; colony growth seems to be vertical as much as lateral. An umbo usually arises above the base of the suboral avicularium, and additional tubercles may appear lateral to it, with notches in the peristome between them.

Frontal avicularia appear with increased development and calcification; they may be widely triangular or longer and more pointed. On the colonies that resemble a honeycomb, the frontal avicularia appear to be the only surface ornaments, with everything else subsurface. The ovicell is wide and shallow, with a distinctive, whitened, striated area above the aperture; this becomes immersed in the encroaching frontals so that it resembles a thick tongue lying against the side of the depression.

Confusion over the identification of *Rhynchozoon rostratum* and *R. tumulosum* has arisen, no doubt partly because of the geographical location of the original citations. Because *Lepralia rostrata* Busk (1855) was described from Mazatlán and the type specimen was available to Hastings (1930) in London when she identified the Crossland collection from Panama, a comparison was made and the species was revived. Hastings

mentioned the noticeable greenish color of the ectocysts of the specimens, although Busk did not. Color appears to vary considerably, depending on local conditions, in many species.

Meanwhile, Hincks (1882a) had described *Schizoporella tumulosa* from British Columbia, and that species was identified by Robertson (1908) in California, and by O'Donoghue and O'Donoghue (1923, 1926) in the Vancouver Island region. [Further confusion was added when Osburn introduced *Cellepora verruculata* Smitt (1873) from the Gulf of Mexico into the world-wide synonymy of *R. rostratum;* it was described as being bluish and as differing from *R. verruculatum* (Waters) of the Mediterranean in the structure of the avicularium mandible.]

Comparisons of *R. rostratum* and *R. tumulosum* in Osburn's Hancock collections, in Soule's Gulf of California collection, and in the present material indicated that the two species are identical, the variability being determined by the age and degree of calcification. The only differences for *R. rostratum* indicated by Osburn were the slightly wider sinus, hooking on the process at the base of the suboral avicularium, and the submersion of the ovicell, with the "labellum" only occasionally visible. In *R. tumulosum* Osburn noted the wide triangle of the frontal avicularium mandible, and "often a short labellum" on the ovicell. It is evident from notations on some of his slides that he was doubtful about the distinction between the two. Some of his material also bears the oral spines on the margins; no doubt his familiarity with the species caused him to overlook these. Certainly there is no reason to erect yet another species for so transitory a characteristic when the adult colonies are identical.

Examination shows that the structure of the wide, triangular, avicularium mandible of his *R. tumulosum* is identical with Hastings' illustration of *R. rostratum* in having a curved line below the lucida where the muscle is inserted.

OCCURRENCE: P-1, P-3, P-8, off Isla Conchas, common.

DISTRIBUTION: Ranging from southern California to the Galapagos Islands, *Rhynchozoon rostratum*, as now defined, inhabits cool temperate to tropical waters in both the Atlantic and Pacific.

Rhynchozoon spicatum Osburn, 1952

Rhynchozoon spicatum OSBURN, 1952, pp. 460, 461, pl. 55, figs. 1–3, pl. 54, fig. 10.

The zoarium is incrusting and may be multilaminar. The zooecia are ovoid, with deep separating grooves and a row of areolar pores; growth gives a tilted appearance to the individuals. The frontal is costate, and the center of the young zooecia is smooth and translucent. The aperture is round and beaded and has a slight shallow sinus. The operculum is

sharply indented at the corners of the sinus. A tall umbo rises proximal to the aperture on many zooecia, with a very small suboral avicularium hidden at its base, and in some cases there are additional small umbonate processes flanking the aperture. A large, bulbous, frontal, avicularian chamber bears an elevated avicularium which flares out distolaterally or hooks over distally. Other frontal avicularia are rare. Two to four spines occur on the marginal zooecia. The ovicell is rounded and has a semicircular frontal area. The zooecia are of about the same size as those of *R. rostratum*.

OCCURRENCE: P-3, tide flats southeast of Isla Conchas.

DISTRIBUTION: *Rhynchozoon spicatum* was described by Osburn (1952) from Anacapa Island at 77 fathoms, and reported from other southern California areas at 16 fathoms or deeper. It has also been reported from off Isla San Benito, Baja California, in 44 fathoms.

FAMILY CHEILOPORINIDAE BASSLER, 1936

GENUS HIPPOPODINELLA BARROSO, 1924

Hippopodinella adpressa (Busk), 1854

Lepralia adpressa BUSK, 1854, p. 82, pl. 102, figs. 3, 4; 1855, p. 5; 1856, p. 178.
Hippopodinella adpressa: HASTINGS, 1930, p. 729. OSBURN, 1952, p. 467, pl. 57, fig. 6. SOULE AND DUFF, 1957, p. 126. SOULE, 1961, pp. 45, 46.

The zoaria incrust on mollusk shells. The zooecia are distinct and diamond shaped. The frontal is a porous tremocyst covered by a shining membrane. The aperture is elongate, bell-shaped, with strong cardelles, and bears a low peristome. Occasional small avicularia occur on the frontal or around the aperture, contrary to the generic description, which should be emended, since *Lepralia adpressa* Busk is the type species. The ovicells are endozooecial. Incineration is helpful in identification.

OCCURRENCE: P-5, off Isla Conchas.

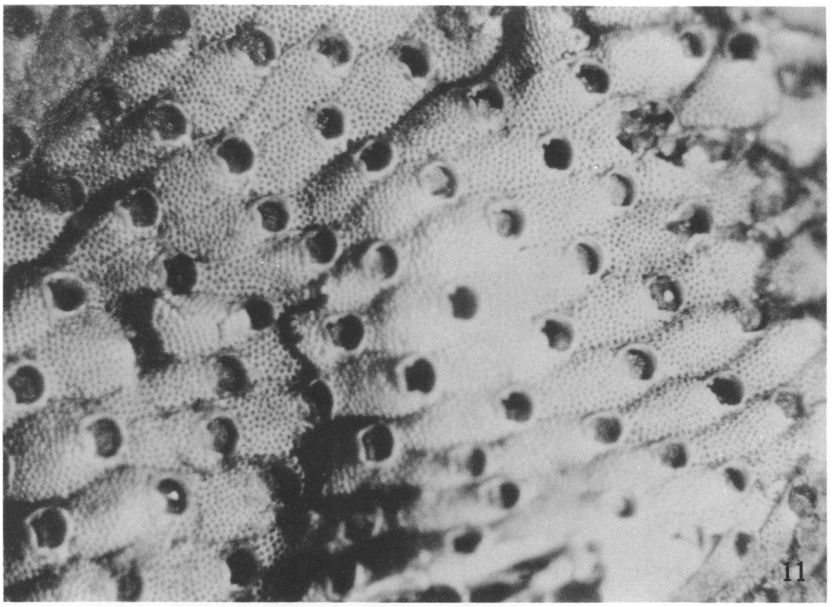
DISTRIBUTION: *Hippopodinella adpressa* was described by Busk from Chile and reported by him from Mazatlán. Soule (1961) gave the range as extending from the Gulf of California southward to the Galapagos Islands and Chile. The present record is the first for the species on the Pacific coast of Baja California.

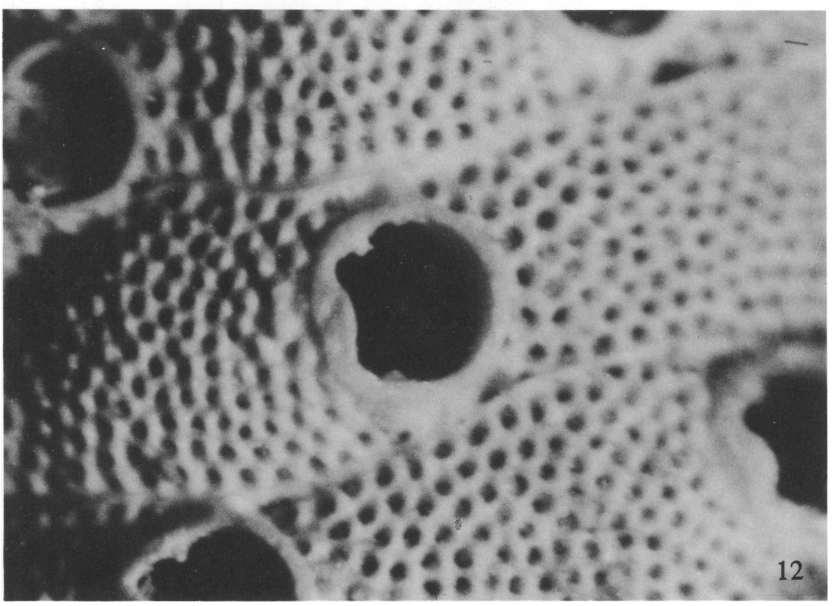
GENUS *WATERSIPORA* NEVIANI, 1895

Watersipora nigra (Canu and Bassler), 1930

Figures 11, 12

Pachycleithonia nigra CANU AND BASSLER, 1930, pp. 25–27, fig. 6, pl. 4, figs. 9–13.





FIGS. 11, 12. *Watersipora nigra.* 11. Colony, incinerated. 12. Arched lip of aperture, differentiating the species from *Watersipora cucullata.*

Watersipora cucullata: HASTINGS, 1930 [*partim*], pp. 729, 730, pl. 15, fig. 101. OSBURN, 1952 [*partim*], pp. 472, 473, pl. 56, figs. 3, 5.
Watersipora nigra: SOULE, 1961, p. 47.

The zoaria form large brown or black multilaminar incrustations of paper-like consistency. Incineration removes the heavy ectocyst, revealing the diagnostic characteristics. The zooecia are large, rectangular to hexagonal, distinct, and regular. The arched frontal is a tremocyst with many large pores. The aperture is large, widely rounded distally, with strong condyles at the proximal corners. The peristome has a liplike fold which is extended upward on the proximal border, giving a sharply curved appearance. There are no avicularia or spines. The ovicell is endozooecial.

OCCURRENCE: P-1, P-3, P-8, P-9; all at intertidal depth at Isla Conchas and Isla Barrosa.

DISTRIBUTION: This species was undoubtedly included in *Watersipora cucullata* (Busk), 1854. According to Hastings (1930) Busk's type specimen is of the variety that has a U-shaped sinus, but his collection included also the type with the protruding lip, and some specimens are quite large in comparison to others. In general, *W. nigra* is about 600 to 900 microns in length while *W. cucullata* may be from 1000 to 1500 microns in length. The smaller *W. nigra*, however, has larger pores than does *W. cucullata*. While *W. cucullata* has been reported as world-wide in tropical and subtropical waters, *W. nigra* has been recognized only in the Galapagos Islands, the Gulf of California, and Scammon's Lagoon, but it may occur elsewhere, having been included with *W. cucullata*.

GENUS *HIPPALIOSINA* CANU, 1918

Hippaliosina rostrigera (Smitt), 1873

Escharella rostrigera SMITT, 1873, p. 57, pl. 10, figs. 203–205.
Hippaliosina rostrigera: HASTINGS, 1930, p. 729. OSBURN, 1952, p. 475, pl. 56, fig. 9. SOULE, 1961, pp. 47, 48.

The zoarium forms a shining yellowish crust, with only the darker opercula evident. Incineration shows the zooecia to be distinct, widely curved distally, and narrowed and rectangular proximally. The frontal is a pleurocyst with areolar pores, plus frontal pores, which occupy all but a central ridge or thickening. The aperture varies considerably from round to oval to bell-shaped, all on the same colony. The peristome is low, rising on the distal margin, and strong cardelles project into the aperture laterally. Paired avicularia lie distolateral to the aperture, with the mandibles directed distomedially. The ovicells are endozooecial.

OCCURRENCE: P-1, P-3, area of Isla Conchas.

DISTRIBUTION: Described from waters off Florida, *Hippaliosina rostrigera* was found only in a few tropical Pacific localities; by Hastings (1930) in Panama, and by Osburn (1952) at Angel de la Guarda Island in the Gulf of California. Soule (1961) reported it from 12 stations in the Gulf. The present record is the first at any other location in the eastern Pacific.

FAMILY LAGENIPORIDAE JULLIEN, 1883

GENUS *LAGENIPORA* HINCKS, 1877

Lagenipora hippocrepis (Busk), 1855

Lepralia hippocrepis BUSK, 1855, p. 4; 1856, p. 177, pl. 8, figs. 2a, 2b.
Costazia hippocrepis: HASTINGS, 1930, p. 731, pl. 15, figs. 105–107.
Lagenipora hippocrepis: OSBURN, 1952, p. 489, pl. 60, figs. 5, 6. SOULE, 1961, p. 52.

The zoaria incrust on shells and stems; the color is translucent to opaque white. The zooecia are distinct and flask-shaped (lageniform) and have a high, tubular, ridged peristome which is inclined distally. The frontal is a tremocyst with large perforations. The primary aperture, deeply set within the peristome, is ovoid and has a broad proximal sinus. The peristome rim bears a pair of small triangular avicularia, like handles on a vase. The ovicell, which is distal to the base of the peristome and opens into it above the primary aperture, lies upon the frontal of the succeeding zooecium. The imperforate hood bears a semicircular, perforate, frontal area.

OCCURRENCE: P-9a, on Isla Barrosa.

DISTRIBUTION: Busk (1855) described *Lagenipora hippocrepis* from Mazatlán, and Hastings (1930) found it in the Galapagos Islands material but placed it in the family Celleporidae. Osburn (1952) reported it from southern California; Soule (1961), from the Gulf of California.

It is obvious that there has been considerable difficulty in the placing of this genus, Osburn (1952) transferring it from the Celleporidae to the Phylactellidae, and Soule (1961) following the system of Harmer (1957), who separated it into the family Lageniporidae Jullien, 1883.

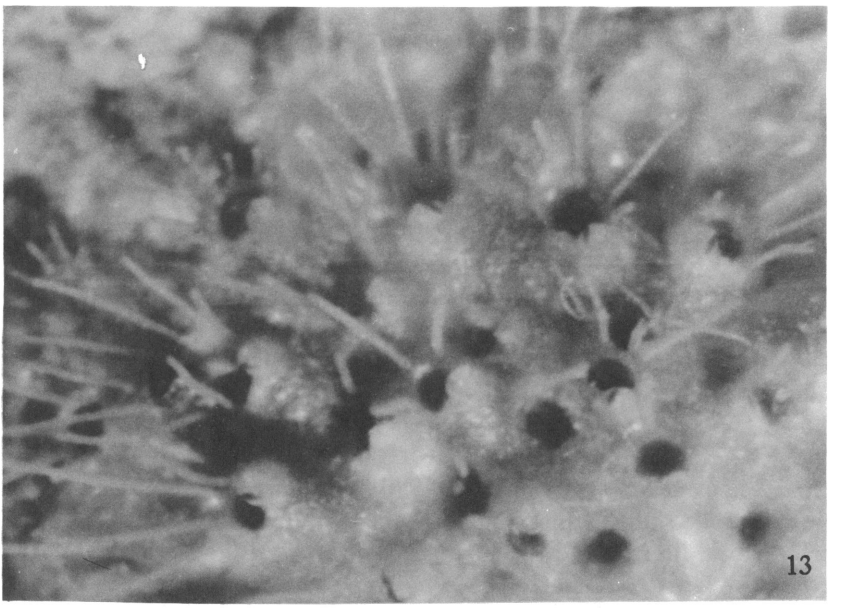
FAMILY CELLEPORIDAE BUSK, 1852

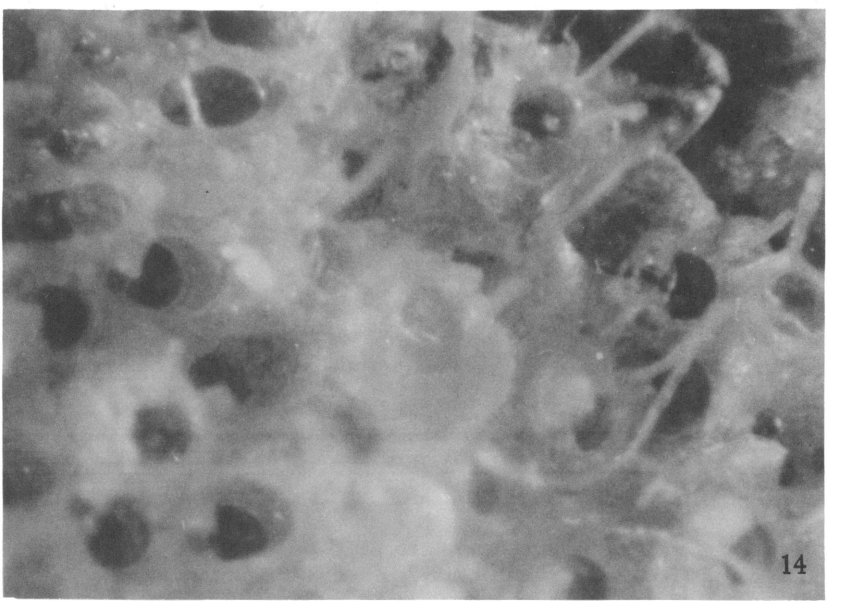
GENUS *HOLOPORELLA* WATERS, 1909

Holoporella brunnea (Hincks), 1884

Figures 13, 14

Cellepora brunnea HINCKS, 1884a, p. 56. C. H. AND E. O'DONOGHUE, 1926, p. 121.
Holoporella brunnea: HASTINGS, 1930, pp. 731, 732, pl. 16, figs. 108–110. OSBURN,





FIGS. 13, 14. *Holoporella brunnea*. 13. Growing area of colony, showing many spines. 14. Oval and spatulate avicularia.

1952, pp. 496, 497, pl. 62, figs. 10–12. SOULE, 1961, pp. 55–57.

Holoporella quadrispinosa CANU AND BASSLER, 1930, pp. 37, 38, figs. 8c–e. OSBURN, 1952, p. 502, pl. 55, fig. 12. SOULE, 1961, p. 57.

The zoaria form brown or grayish white incrustations on mollusk shells and rocks, in some cases with erect branches. The zooecia are indistinct and disoriented, overgrowing without definite layering. Moderate in size, the zooecia are thin-walled when young, making the dark brown opercula quite noticeable. The frontal is smooth, becoming granular, in some cases costate, with 14 to 16 small areolar pores. The aperture is rounded distally, with a small notch in the straight proximal border and small cardelles; the shape of the operculum does not follow the notch. The thin peristome may bear two strong spines with black jointed bases, but the young zooecia may have three, or four, rarely five. Proximal to the aperture lies an umbo which bears a small avicularium on its distal side. The most distinctive feature of the species is the large interzooecial avicularia which are subspatulate, with the mandible showing a dark brown, spade-shaped thickening (columella). The ovicells are hooded, smooth, and imperforate.

Holoporella quadrispinosa has been incorporated into *H. brunnea*, because young areas of the latter often agree perfectly with the description of *H. quadrispinosa*, while older areas agree with *H. brunnea*. A small fragment could easily be misinterpreted. Soule, in reviewing his Gulf of California specimens of *H. brunnea*, noted that he had marked several colonies that showed intergradation, as does the one colony Osburn assigned to *H. quadrispinosa* in the Hancock collections.

OCCURRENCE: P-1, P-3, P-8, Isla Conchas area.

DISTRIBUTION: *Holoporella brunnea* is one of the most abundant species occurring in Pacific collections. It ranges from British Columbia, where it was first described by Hincks (1884a), to Ecuador, and in the Atlantic. Soule (1961) found it to be the most abundant species in the Gulf of California. In the Hancock collections it is represented at 21 stations in the Galapagos Islands. The Galapagos are Canu and Bassler's type locality for *H. quadrispinosa*.

GENUS *TREMATOOECIA* OSBURN, 1940

Trematooecia hexagonalis (Canu and Bassler), 1930

Holoporella hexagonalis CANU AND BASSLER, 1930, pp. 38, 39, pl. 7, fig. 1.

Trematooecia hexagonalis: OSBURN, 1952, pp. 503, 504, pl. 60, fig. 7. SOULE, 1961, pp. 59, 60.

The zoaria form tan, porcelaneous incrustations on shells and coralline algae. The zooecia are erect, distinct or immersed, hexagonal, with two

rows of areolar pores plus additional small pores distal to the aperture. The aperture is centered, circular, and has lateral cardelles. The peristome is somewhat thickened, rounded, and bears four or more stout umbonate processes which lack avicularia. Scattered small oval frontal avicularia occur which have short, rounded mandibles. The ovicells are globose, with pores which may later become closed over.

OCCURRENCE: P-3, tide flats southeast of Isla Conchas.

DISTRIBUTION: Described from the Galapagos Islands, *Trematooecia hexagonalis* ranges northward to about latitude 30° N., and into the Gulf of California.

ORDER CYCLOSTOMATA BUSK, 1852

SUBORDER TUBULIPORINA HAGENOW, 1851

FAMILY TUBULIPORIDAE JOHNSTON, 1838

GENUS *TUBULIPORA* LAMARCK, 1816

Tubulipora pacifica Robertson, 1910

Tubulipora pacifica ROBERTSON, 1910, pp. 248, 249, pl. 22, figs. 27, 28. C. H. AND E. O'DONOGHUE, 1923, p. 150; 1926, p. 71. OSBURN, 1953, pp. 652, 653, pl. 68, fig. 1. SOULE, 1963, pp. 6, 7.

The colonies, incrusted on shells, algae, and rocks, are white, irregular, and fan-shaped or circular depending on the substrate. The zooecia are all on the frontal surface of the colony in radial or biradial series. Submerged for part of their length, they rise into slender tubules with round terminal apertures. The tubules may be attached contiguously (connate) or free and are finely perforate over the entire surface. Because of variability among the Cyclostomata, the ovicells form the most reliable criterion for identification. The ovicell is a low, lobate swelling lying among several zooecial rows. The ooeciostome is short, curving away laterally from the adjacent tubule, and has a flaring, narrowly ovoid aperture.

OCCURRENCE: P-1, Isla Conchas.

DISTRIBUTION: Described from off southern California, *Tubulipora pacifica* occurs in cool temperate, warm temperate, and tropical waters of the eastern Pacific.

SUBORDER RECTANGULATA WATERS, 1887

FAMILY LICHENOPORIDAE SMITT, 1866

GENUS *LICHENOPORA* DEFRANCE, 1823

Lichenopora buskiana Canu and Bassler, 1928

Lichenopora buskiana CANU AND BASSLER, 1928, p. 164, pl. 34, figs. 7, 8. OSBURN, 1953, pp. 704, 705, pl. 14, figs. 1, 2. SOULE, 1963, p. 12.

Not *Unicavea californica* d'Orbigny, 1853, p. 972.

Lichenopora californica: CONRAD, 1855, p. 441. GABB AND HORN, 1862, p. 176, pl. 21, fig. 68. ROBERTSON, 1910, pp. 261, 262, pl. 25, figs. 48, 49. CANU AND BASSLER, 1923, p. 203, pl. 44, figs. 4–7.

This species was misidentified by early workers as d'Orbigny's *Unicavea californica*, which has uniserial rays, while *L. buskiana* has biserial rays.

The zoaria are small, circular, convex, with new colonies frequently budded from the edges; they are usually attached to algae. The central area appears reticulate, being divided into cavities called "alveoli" or "cancelli," which bear "pinhead" spicules on their margins. The zooecial tubules are in radiate rows, high and erect near the center, biserial and connected (connate), except that the first tubule in a row may stand alone. The apertures are somewhat irregular and about the same size as the cancelli. The ovicell lies beneath the central portion of the colony, slightly inflated, with small perforations. The ooeciostome is a short tube with an oval, flaring aperture, usually occurring at the edge of the central portion.

OCCURRENCE: P-9a, on Isla Barrosa piled in windrows.

DISTRIBUTION: *Lichenopora buskiana*, common in the shallow waters off southern California, is now known to extend into tropical waters in a few instances (Osburn, 1953; Soule, 1963).

Lichenopora novaezealandiae (Busk), 1875

Discoporella novae-zealandiae BUSK, 1875, p. 32, pl. 30, fig. 2.

Lichenopora radiata: ROBERTSON, 1910, pp. 262, 263, pl. 24, figs. 46, 47.

? Lichenopora radiata: CANU AND BASSLER, 1923, pp. 204, 205, pl. 44, fig. 10.

? Lichenopora radiata: C. H. AND E. O'DONOGHUE, 1923, p. 157.

? Lichenopora radiata: C. H. AND E. O'DONOGHUE, 1926, p. 74.

Lichenopora novae-zealandiae: OSBURN, 1953, pp. 705–707, pl. 74, fig. 4. SOULE, 1963, pp. 12, 13.

The colonies incrust on eelgrass; dead colonies were piled in windrows on the beach. The zoaria are round to oval, separate, and have a saucer-shaped basal disc which is thin and transparent. The tubules radiate in uniserial rows from the center of the colony, high in the central portion and tapering down at the edges. The tubules (zooecia) are connected laterally up to the tops (connate), with the openings laterally compressed and rising to a point at the central and distal ends and keel-shaped (carinate). The reticulate surfaces between the bases of the tubules (cancelli) vary in size, some of the divisions being small, while some are larger than the apertural openings of the tubules. The cancelli are

covered by a thin calcified layer perforated by small pores; small pinhead spicules project from the margins of the cancelli above the calcified layer. The ovicell lies beneath the central area, covered by a thin calcified membrane, also perforate, and by secondary cancelli; the ooeciostome is short, with a flaring aperture.

OCCURRENCE: P-1, P-3, P-9, P-9a, Isla Conchas and Isla Barrosa.

DISTRIBUTION: Originally described from New Zealand by Busk (1875), this species was recorded at various locations in the western Pacific (Harmer, 1915), but had not been reported in the eastern Pacific until Osburn (1953) concluded that it was identical to *L. radiata*. It has been found in warm temperate to tropical waters in the eastern Pacific from off southern California to the Galapagos Islands. O'Donoghue and O'Donoghue's reports of it seem to be in doubt. Soule (1963) found it at many locations in the Gulf of California, and it was collected by the sackful on Isla Barrosa in Scammon's Lagoon.

The situation in the family Lichenoporidae is one of confusion; apparently a great many descriptions have been made on the basis of few or badly worn specimens. Attempts were made to associate eastern Pacific forms with European or western Pacific forms, with only meager descriptions and illustrations being given and no actual comparison of specimens. It is, of course, not unknown for Ectoprocta to be world wide in distribution. However, it seems risky to equate a common California species with one from New Zealand and Japan without comparative examinations. Much difficulty has arisen in the past because of such procedures, and it would seem to be much easier to synonymize different names on the basis of later data than it is to differentiate between identical names in use on different continents for specimens that have proved not to be identical. This is not to say that each continent should have its own fauna without regard to that of the others, but only that caution is needed when such intercontinental correlations are made.

DISCUSSION

DISTRIBUTION

One of the interesting developments in the distributional pattern of the Scammon's Lagoon Ectoprocta is the small proportion of cheilostome Anasca present in comparison to those of the Gulf of California collections. Soule (*in* Osburn and Soule, 1953; 1959, 1961, 1963) reported a total of 159 different ectoproct species in the Gulf, slightly more than four times the number (37) in the present collection, or about a 4/1 ratio. The cheilostome Ascophora show approximately a 3/1 ratio, and the Cyclostomata show about a 5/1 ratio. The Anasca, however, show a 8/1 ratio,

with only seven species represented in the Lagoon collections. No ctenostomes were found.

The significance of the scarcity of anascans is difficult to evaluate. Whether the admittedly brief collecting time or the methods used are in part responsible, or whether this is a true distributional picture, is certainly open to question. The Cheilostomata, which arose latest in evolutionary sequence, have been the most successful of the ectoprocts, especially the Ascophora. If Scammon's Lagoon represents a marginal environment because of unfavorable temperature and salinity, lack of suitable substrate, or some other factor, then the proportions shown in this collection are valid and reflect these conditions.

It is apparent that endemism rarely, if ever, occurs in the bryozoans. Occasionally a species described will remain unidentified elsewhere for years, only to be subsequently reported a continent away. The pelagic larvae are carried by currents over wide areas, while ships and other artificial transport serve to introduce the adults to new areas. Survival is apparently keyed primarily to temperature; those that tolerate the widest range are most successful. The calcified frontal of the ascophorans, together with their probably more efficient hydrostatic mechanism, may offer them maximum adaptability.

Most of the Ectoprocta have been known to exist in more than one temperature zone, so that their distribution is herein totaled on the basis of their occurrence in each of their thermal locations. Tropical waters are defined as those in which the minimum winter water temperature does not fall much below 20° C., and the summer maximum is above 25° C. Warm temperate waters are defined as those in which the winter minimum is between 10° and 20° C., and the summer maximum is close to 25° C. Cool temperate waters are those in which the winter minimum is below 10° C., but not as low as 0° C., and the summer maximum may approach 20° C. Frigid waters are those in which the minimum is below 0° C. and the maximum is about 10° C. (Stephenson, 1953).

Within the above specifications, the 36 species of known distribution are counted once for each temperature zone in which they occur, making a total of 73 occurrences. On this basis (following Soule, 1960), 48.6 per cent of the occurrences of the Scammon's Lagoon material are tropical, 37.1 per cent are warm temperate, and 14.3 per cent are cool temperate to frigid. (See table 1.) These data are comparable to those of Soule (1960, 1963) for adjacent areas of Baja California and the Gulf of California (table 3).

Approximately 25 per cent of the tropically distributed species do not occur outside tropical waters, with about 17 per cent limited to the

TABLE 1

DISTRIBUTION OF ECTOPROCTA BY THERMAL AFFINITIES
(Species marked with an asterisk have not been previously reported from the Pacific coast of Baja California.)

	Tropical	Warm Temperate	Cool Temperate	Arctic
**Aetea recta*	x	x	—	—
Conopeum commensale	x	x	—	—
Chaperiella condylata	x	x	—	—
Discoporella umbellata	x	x	—	—
Scrupocellaria bertholleti	x	x	—	—
Colletosia radiata	x	x	x	—
**Membranipora tuberculata*	x	x	—	—
Hippothoa hyalina	x	x	x	x
**Hippothoa distans*	x	x	x	—
Schizoporella unicornis	x	x	x	—
Schizoporella cornuta	x	x	x	x
**Schizoporella occidentalae*, new species	—	—	—	—
**Alismittina californiensis*	—	x[a]	—	—
**Escharina vulgaris*	x	x	x	—
**Hippoporidra spiculifera*	x[b]	—	—	—
**Cleidochasma contracta*	x	x	—	—
Hippoporella gorgonensis	x	x	—	—
Aimulosia uvulifera	x	—	—	—
**Porella rogickae*	x[b]	—	—	—
**Smittoidae prolifica*	x	x	—	—
Parasmittina trispinosa	x	x	x	x
**Parasmittina crosslandi*	x[b]	—	—	—
Parasmittina californica	x	x	—	—
Parasmittina fraseri	x[b]	—	—	—
Mucronella major	x	x	x	—
**Reptadeonella violacea*	x	—	—	—
Rhynchozoon rostratum	x	x	—	—
Rhynchozoon spicatum	—	x[a]	—	—
**Watersipora nigra*	x[b]	—	—	—
**Hippaliosina rostrigera*	x	—	—	—
**Hippopodinella adpressa*	x	—	—	—
**Lagenipora hippocrepis*	x	x	—	—
Holoporella brunnea	x	x	x	—
Trematooecia hexagonalis	x[b]	—	—	—
Tubulipora pacifica	x	x	x	—
Lichenopora buskiana	x	x	—	—
**Lichenopora novaezealandiae*	x	x	—	—

[a] Previously unreported in tropical waters.
[b] Tropical Pacific only.

TABLE 2

FAUNAL AFFINITIES OF THE ECTOPROCTA OF SCAMMON'S LAGOON

	Indo-Pacific	West Indies	Eastern Pacific[a]	Panamic
Aetea recta	x	x	x	x
Conopeum commensale	—	x	—	x
Chaperiella condylata	—	—	x	x
Discoporella umbellata	x	x	x	x
Scrupocellaria bertholleti	—	x	x	x
Colletosia radiata	x	x	x	x
Membranipora tuberculata	x	x	x	x
Hippothoa hyalina	x	x	x	x
Hippothoa distans	x	x	x	x
Schizoporella unicornis	x	x	x	x
Schizoporella cornuta	—	—	x	x
Schizoporella occidentalae, new species	—	—	—	—
Alismittina californiensis	—	—	x	—
Escharina vulgaris	—	—	x	x
Hippoporidra spiculifera	—	—	—	x
Cleidochasma contracta	—	x	—	x
Hippoporella gorgonensis	—	—	x	x
Aimulosia uvulifera	—	x	—	x
Porella rogickae	—	—	—	x
Smittoidea prolifica	—	—	x	x
Parasmittina trispinosa	x	x	x	x
Parasmittina crosslandi	—	—	—	x
Parasmittina californica	—	—	x	x
Parasmittina fraseri	—	—	—	x
Mucronella major	—	—	x	x
Reptadeonella violacea	x	x	—	x
Rhynchozoon rostratum	—	x	x	x
Rhynchozoon spicatum	—	—	x	x
Watersipora nigra	—	—	—	x
Hippaliosina rostrigera	—	x	—	x
Hippopodinella adpressa	x	—	—	x
Lagenipora hippocrepis	—	—	x	x
Holoporella brunnea	—	x	x	x
Trematooecia hexagonalis	—	—	—	x
Tubulipora pacifica	—	—	x	x
Lichenopora buskiana	—	x	x	x
Lichenopora novaezealandiae	x	—	x	x

[a] Except Panamic.

tropical Pacific. Whether this latter limitation represents species that have arisen after the isolation of the Pacific basin or indicates the relative lack of collecting, or both, is open to question. Only two species were

collected that were previously limited to warm temperate waters; both are poorly known. No cool temperate or arctic species occurred that are not also known in warmer waters. Three species are cosmopolitan in distribution.

Stated in yet another way statistically, 94 per cent of the species have a tropical distribution, 72 per cent also have a warm temperate range, 28 per cent extend into cool temperate waters, and 8 per cent also occur in frigid areas.

All but three of the species represented in the collection have previously been reported elsewhere in the Panamic faunal province, and all but six have been reported from other faunal provinces. In decreasing order, 64.8 per cent are of the northeastern Pacific exclusive of the Panamic fauna, 45.9 per cent are representatives of the West Indies (Amphi-American), and 29.7 per cent are Indo-Pacific in occurrence (table 2). Similar results were reported for the Gulf of California by Soule (1963).

According to Keen (1958), Cedros Island north of Point Eugenio is the absolute northern limit for mollusks that are strictly Panamic. A transition zone ranges between Cedros Island and Magdalena Bay in which the incidence of the Panamic fauna increases steadily with southerly progression. Soule's findings (1960), based on a correlation of his data from the Gulf of California with Osburn's (1950, 1952, 1953) Pacific coast data, are in keeping with those of Keen. It must be pointed out that a number of authors recognize the existence of a transition zone but draw the Panamic line of demarcation at one or another position without indicating the zone itself. It is, in most cases, true that faunal assemblages exhibit gradations rather than abrupt and complete changes as they reach their distributional limitations.

Since Scammon's Lagoon lies near the absolute northern limit of the Panamic province, it is noteworthy that almost the entire population therein is Panamic, a fact that certainly is indicative of the warmer temperatures of the shallow Lagoon. While Wyllie (1961) found the temperatures in Sebastián Vizcaíno Bay immediately outside Scammon's Lagoon to be 18° C. in August, and Soule recorded it to be 22° C. in that location, the temperatures inside the Lagoon ranged from 25° C. to 28° C. during the collecting trip in July, 1959. Wyllie indicated that temperatures may change considerably in the Bay with a cessation of the prevailing winds which cause upwelling. Warmer waters then enter the southern portion of the Bay.

Comparison with Adjacent Ectoproct Faunas

The work of Osburn (1950, 1952, 1953) and of Soule (1959, 1960,

1961, 1963) has indicated a pattern of distribution for the Gulf of California and for the west coast of Baja California, although the latter area has been much less thoroughly collected. The data assembled by Soule may thus be compared with the distributional pattern of the Scammon's Lagoon collection (table 3).

TABLE 3

THERMAL DISTRIBUTION, IN PER CENT, OF ECTOPROCTA BY AREAS OF BAJA CALIFORNIA

	Tropical	Warm Temperate	Cool Temperate
Pt. Conception to Pt. Eugenio, 28° N.	27	42	31
Pt. Eugenio to Magdalena Bay, 25° N.	43	42	16
Magdalena Bay to Cabo San Lucas	50	34	16
Scammon's Lagoon	49	37	14
Head of Gulf to 28° N.	45	32	23
28° N. to 26° N., Gulf	46	39	15
26° N. to Cabo San Lucas, Gulf	52	34	14

On the basis of the presently available data it appears that the ectoproct fauna of Scammon's Lagoon is most comparable to that of the area of Magdalena Bay to Cabo San Lucas, showing a similar proportion of tropical species, slightly more warm temperate inhabitants, and slightly fewer that also inhabit cool temperate waters. The area below Magdalena Bay is definitely a tropical one and an integral part of the Panamic province. It is of course necessary to keep in mind that statistics based on small samplings offer a comparatively large margin of error.

GEOLOGIC AND HYDROGRAPHIC EFFECTS

The ectoproct line is believed to have arisen in Precambrian times and was already showing divergence in the Ordovician. During the Paleozoic, the Cryptostomata and Trepostomata flourished, and they became extinct near the beginning of the Mesozoic. During the Mesozoic, the Cyclostomata were the dominant group, with the Cheilostomata arising in the Jurassic and flourishing during the Cretaceous as the Cyclostomata declined. During the Cretaceous, much of the western Americas was covered by tropical seas, with vast waterways such as the Mexican Seaway, the Andean Geosyncline, and the Amazon Seaway open for the maximum dispersal of a wide variety of animals. At the close of the Cretaceous, widespread extinction occurred in many animal groups, as

seas withdrew and temperatures apparently dropped. The tropical zone was correspondingly diminished. Those organisms that remained in the restricted tropical areas, or were able to adjust to cooler environments, escaped extinction.

The Tertiary saw many variations in sea level that affected Baja California, at times isolating lower portions of the peninsula as islands. The variations in level facilitated the distribution of species between the Gulf of California and the Pacific coast.

The formation of the land bridge that separates the Atlantic and Pacific had occurred permanently by the advent of the Pleistocene, preventing further interchange in that area. The fact that 45.9 per cent of the Scammon's Lagoon species also are present in the West Indies may be indicative of the early speciation of the Ectoprocta.

The present current system of the eastern Pacific is such that the California Current serves to carry cooler water of low salinity southward toward Sebastián Vizcaíno Bay, passing beneath the water mass of the central bay and appearing at the surface off the mouth of Scammon's Lagoon (Wyllie, 1961). The California counter current, usually in winter, brings warmer water of higher salinity northward as far as Point Eugenio where it swings outward toward Cedros Island, passing around a large cold upwelling area which lies off Point Eugenio. For as yet unknown reasons, the counter current may in some years persist into the summer and reach as far north as Monterey Bay, where southern species may find refuge and persist in warm inshore pockets of water, at least for a time (Reid, Roden, and Wyllie, 1958; Reid, 1960; Radovich, 1961).

Thus the mechanism exists for cool temperate species to be carried as pelagic larvae or incrusted on floating debris from the north to the area of Scammon's Lagoon. If these species are capable of adjusting to water temperatures of from 5° to 8° C. higher, they may become part of the Lagoon fauna.

The mechanism also exists for tropical fauna to be carried northward to the Point Eugenio-Cedros Island area. From there, the species must be capable of surviving at least some cooler water transit in passing the upwelling areas, or await a season of warmer temperatures and stronger counter current in order to arrive at the Lagoon. Once at the Lagoon, having survived the possible rigors of transit, most of the southern species would presumably find some areas with conditions similar to their previous environment; brackish water or extreme salinity are not well tolerated by the ectoprocts.

It seems reasonable to assume, on the basis of the observed distribution, that far more species at Scammon's Lagoon either represent a relict

population from the Gulf of California, or are tropical arrivals from the south, than represent species that arrive from the north and must modify their environmental temperature requirements permanently to a large degree.

Additional collecting on the critical west coast of Baja California is definitely needed, since only cursory examination in a few separate areas has been undertaken for the ectoprocts. Statistics based on small samplings could very well be misleading. A thorough zoogeographic study of the area of the Bahía de Sebastián Vizcaíno, including Scammon's Lagoon, would be rewarding.

SUMMARY

Thirty-seven species of Ectoprocta representing 17 families are reported in the present collection from Scammon's Lagoon, Baja California, the first bryozoan collection reported from this region. Seventeen of the species had not previously been recorded from the Pacific coast of Baja California. One new species, *Schizoporella occidentalae*, is described. One new genus is erected, *Alismittina*, for *Smittia californiensis* Robertson, 1908, which has been rediscovered on the Pacific coast after having been unreported for more than 50 years. (*Smittia* is preoccupied.) The generic description of *Hippopodinella* Barroso, 1924, is emended to include: occasional small avicularia on the frontal or around the aperture. These are present on the type species of *Lepralia adpressa* Busk, 1854, now *Hippopodinella adpressa*. *Rhynchozoon tumulosum* has been synonymized under *Rhynchozoon rostratum*, and *Holoporella quadrispinosa* has been placed in synonymy with *Holoporella brunnea*. Clarification of the status of *Hippoporella gorgonensis* and *Aimulosia uvulifera* is undertaken.

The distributional pattern of the species represented in the collection indicates that 48.6 per cent are tropical in occurrence, 37.1 per cent are also found in warm temperate waters, and 14.3 per cent also occur in cool temperate waters. Since many of the species are found in more than one zone, these figures should not be interpreted as indicating species that are restricted specifically to each area. This pattern is closely comparable to that of the ectoprocts found between Cabo San Lucas and Magdalena Bay on the west coast of Baja California, rather than to the assemblages immediately adjacent to Scammon's Lagoon.

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