OPHIUROIDEA OF THE HAWAIIAN ISLANDS

BY

AUSTIN H. CLARK

BERNICE P. BISHOP MUSEUM

BULLETIN 195

HONOLULU, HAWAII

PUBLISHED BY THE MUSEUM

1949

Issued March 18, 1949

CONTENTS

	Page
Introduction	3
Ophiuroidea	3
Appendix	5
Ophiuroidea	5
Appendix	69
The Hawaiian echinoderm fauna	69
Introduction	69
Records from the Hawaiian Islands	72
Species taken in shore collecting	117
Fanning Island	117
French Frigate Shoal	117
Gardner Island	117
Hawaii (Hilo, Honaunau, Kona Coast, Puako Bay)	117
Hawaiian Islands, without definite locality	118
Honolulu, reef	118
Johnston Island	119
Kauai (Koloa)	119
Kure (Ocean) Island	119
Lanai	119
Laysan Island	119
Lisiansky Island	119
Maui (Maalaea Bay)	120
Midway Island	120
Moku Manu (Bird Island)	120
Molokai	120
Necker Island	120
Nihoa	120
Niihau	120
Oahu (Black Point, Fort Armstrong, Haleiwa, Kahana Bay, Kahala, Kahuku, Kaneohe Bay, Kawela Bay, Kualoa, Maile Point, Pearl Harbor, Punaluu, Waikiki)	120
Palmyra Island	121
Pearl and Hermes Reef	121
?Penguin Bank (about 25 fathoms)	121
Wake Island	122
Bibliography	123
Index	125

Ophiuroidea of the Hawaiian Islands

with Appendix on the Echinoderm Fauna

By AUSTIN H. CLARK

UNITED STATES NATIONAL MUSEUM[1]

INTRODUCTION

OPHIUROIDEA

This account of the Ophiuroidea (brittle stars) of the Hawaiian Islands is based primarily upon the extensive collections made by the United States Fisheries steamer *Albatross* in 1902 and completes the series of reports on the echinoderms. The report on the Asteroidea was published by Professor Walter K. Fisher of Stanford University (18)[2]; that on the Holothuroidea, also by Professor Fisher (19); the account of the Echinoidea, by Mr. Alexander Agassiz and Dr. Hubert Lyman Clark (1), and after Mr. Agassiz's death was continued by Dr. Clark (7, 9); and the report on the Crinoidea was published by me (3).

Since these reports appeared, a few additional species have been recorded, three of which represent additional families—*Hyalinothrix millespina* Fisher (Ganeriidae), *Coronaster eclipes* Fisher (Pedicellasteridae), and *Naumachocrinus hawaiiensis* A. H. Clark (Phrynocrinidae). The last is the only stalked crinoid as yet known from the Hawaiian Islands. Parasites of another type of stalked crinoid have been dredged, but the crinoids themselves have not been collected.

The first notice of brittle stars from the Hawaiian Islands was published by Professor A. E. Grube who described two new species from "Woahu" and "Horolulu" (24). His two new species were included in Dujardin and Hupé's monograph (15), the localities being amended to Oahu and Honolulu. Dr. Axel Ljungman recorded eight species from the Hawaiian Islands (28). In his long series of contributions to the study of the Ophiuroidea (30-35), culminating in the *Challenger* report (36), Mr. Theodore Lyman recorded, in all, eight species from Hawaii, three of which he later placed in the synonymy of others; but in the *Challenger* report he mentioned only two.

Professor A. E. Verrill (38) listed two of Professor Grube's species from Honolulu, and noted that he had a specimen from Maui of Lyman's *Ophionereis porrecta,* described from ?Florida (30).

[1] Published with the permission of the Secretary of the Smithsonian Institution.

[2] Numbers in parentheses refer to Bibliography, page 123.

Professor René Koehler (27) recorded from the Hawaiian Islands three species that he found in the collection of the Paris Museum; but one of these, *Ophioderma panamense,* was undoubtedly incorrectly labeled.

Dr. Hubert Lyman Clark (8) recorded nine species from the Hawaiian Islands based partly on Lyman's material in the Museum of Comparative Zoölogy, and partly on specimens collected by himself. He recorded also 13 species from the more remote Hawaiian Islands, and from Johnston, Wake, and Fanning Islands (12).

Dr. Maximilian Holly recorded two species from Pearl and Hermes Reef (26), and Dr. Paul S. Galtsoff (23) recorded another from the same locality. In his excellent account of the reef and shore fauna of Hawaii, published in 1933, Dr. Charles H. Edmondson mentions 10 species (16). In his 1946 edition he mentions five more.

In his report on the shallow water Asteroidea and Ophiuroidea of Hawaii (17), Mr. Charles A. Ely recorded 15 species, including three new to science, one of these representing a new genus. Two species were said to be previously unknown from Hawaii, but one of these (*Ophiocoma parva* = *Ophiocomella clippertoni*) had been recorded in 1925 from Lisiansky, Laysan, and Pearl and Hermes Reef by H. L. Clark. One shallow water species (*Ophiacantha macroplaca* = *Ophiomastix asperula*) was overlooked.

This paper includes 55 species and recognizable forms of brittle stars from the Hawaiian Islands. But the list is far from complete, for many species that should occur in this area are not included.

The Hawaiian fauna, at the extreme northern periphery of the Indo-Pacific region and separated from the nearest island groups by wide stretches of deep water, would be expected to be poor in echinoderms, though by no means so poor as the records seem to indicate. The number of species known from the Philippines, in the zoogeographic center of the Indo-Pacific region, is 227, though here, also, many remain to be discovered. From tropical Australia, 160 species are known, but nearly all of these are from shallow water.

It is not easy to procure a complete collection of the littoral brittle stars of any tropical region. Shunning the brilliant sunlight, they hide away in chinks and holes, under stones, in coral heads or sponges, and among algae or arborescent animals, or bury themselves in mud or sand. Some, living concealed in the daytime, come out of hiding and wander about at night. In deeper water, with the gradual diminution of the intensity of the sunlight, brittle stars are increasingly inclined to live in the open, but in the sublittoral regions they are difficult to procure because of the coral and other detritus, stones, and arborescent organisms that litter the bottom.

The sea bottom about the Hawaiian Islands is, in most places, so rough as to make dredging operations hazardous. At many of the *Albatross* stations the depth varied so much from the beginning to the end of the haul that it is

impossible to say at just what depth the specimens listed were captured. In a few cases it would seem that different species in a single haul must have come from different depths. Most temperatures are to be regarded as approximate only, because the actual depth at which the thermometer was tripped was not recorded and the temperatures at the beginning and end of the haul must have differed considerably.

Professor Fisher accompanied the *Albatross* on the Hawaiian cruise and made many color and other notes on the specimens collected. These are included in this report, credited to him.

APPENDIX

The appendix (p. 69) includes a list of *Albatross* stations and other localities in the Hawaiian area, with the echinoderms of all classes recorded from each.

OPHIUROIDEA

OPHIOMYXIDAE

Ophiomyxa fisheri, new species (fig. 1, *a, b*).

The disk is 8 mm. in diameter and the arms are about 45 mm. long.

The disk is rather thickly set with scattered, small, rounded plates which in the oral interradial areas are very close together and form an almost complete covering. A narrow line of delicate elongate plates commonly runs along the edge of the disk between the arm bases, but this may be absent, or at least not distinguishable.

The upper arm plates are represented by broadly oval, delicate, perforated calcareous films crossing the arm from one side arm plate to the other just above the arm bones; these are connected by similar plates of about half their length and breadth.

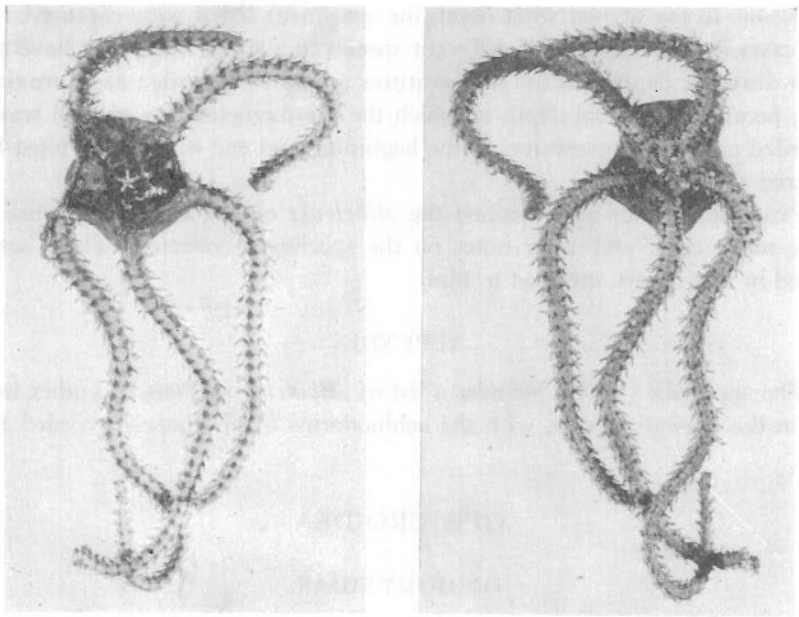
The arm spines are usually four, sometimes five, more rarely three, and are webbed at the base. The uppermost is slightly the longest and stoutest, about as long as an arm segment. The lowest is usually nearly as long as the uppermost but is slightly more slender. The two middle spines are similar, slightly shorter and more slender than the others.

The adoral shields do not quite meet beneath the oral shields, and the inner portions of adjacent jaw plates are separated by a V-shaped wedge so that there is a conspicuous diamond-shaped gap at the inner end of the oral shields and the outer ends of the jaw plates.

There are three or four mouth papillae on each jaw plate and a median unpaired one. The two outer are small, separated by about their own width, narrow, and often pointed. The innermost, or two innermost, and the unpaired terminal papilla, are large and broadly rounded with a finely serrate edge.

In life the disk was yellowish brown and the arms vermilion narrowly banded with cream color; the oral surface was cream color (Fisher).

This new species differs from *O. australis,* which has similar upper arm plates, in its fewer, more slender, markedly longer, and webbed arm spines, and in the smaller and more slender mouth papillae of which the one or two outermost are usually narrow, well-separated, and more or less pointed. The



a *b*

FIGURE 1.—*Ophiomyxa fisheri*, type specimen: **a**, aboral view, × 2, disk badly torn; **b**, oral view, × 2.

scales about the margin of the disk are much less solid and often wanting. The upper arm plates and the small plates connecting them are much less solid, being reduced to thin, filmy, perforated transparent disks.

In the number and proportions of the arm spines, in its mouth papillae, and in the frequent or usual absence of a line of definite plates along the edge of the disk, this species resembles *O. anisacantha* from southern Japan. But in that species the upper arm plates are absent, the disk is less heavily plated, the interradial areas on the oral side have only small scattered plates, and the radial shields are longer and narrower.

Type: cat. no. E.6856, USNM,[3] from *Albatross* station 4101.

Albatross station 4096; northern approach to the Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 77° 30′ W., 7.0 miles distant; 497-523 meters; bottom temperature 7.39° C.; fine gray sand; July 22, 1922 (1 specimen, USNM, E.6859).

Albatross station 4100; Pailolo Channel; Mokuhooniki Islet bearing N. 35° W., 3.1 miles distant; 238-276 meters; bottom temperature 16.11° C.; coral sand, shells, and Foraminifera; July 23, 1902 (1 specimen, USNM E.6857).

[3] United States National Museum.

Albatross station 4101; Pailolo Channel; Mokuhooniki Islet bearing N. 8° 30′ E., 4.8 miles distant; 261-223 meters; bottom temperature 15.39° C.; coral sand, shells, and Foraminifera; July 23, 1902 (11 specimens, including the type, USNM, E.6856, E.6858).

TRICHASTERIDAE

TRICHASTERINAE

Asteroschema tubiferum Matsumoto, Dobutsu Zasshi, Tokyo **23**: 617, 1911 (in Japanese); Acad. Nat. Sci. Philadelphia, Proc. **67**: 52, 1915 (Okino Se, a submarine bank in the Sagami Sea; also Sagami Sea).

Albatross station 4125; Kaieie Waho Channel, between Oahu and Kauai; Kahuku Point, Oahu, bearing S. 77° E., 12.0 miles distant; 1,760-2,055 meters; bottom temperature 2.44° C.; brown mud, Foraminifera, and rock; July 31, 1902 (1 specimen, USNM, E.6860).

Albatross station 4185; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 49° 30′ W., 8.4 miles distant; 1,828-2,462 meters; bottom temperature 2.55° C.; gray sand, mud, and Foraminifera; August 13, 1902 (1 specimen, USNM, E.6861).

Albatross station 4186; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 48° 15′ W., 7.1 miles distant; 1,247-929 meters; bottom temperature 3.39° C.; gray sand and Foraminifera; August 13, 1902 (1 specimen, USNM, E.6862).

The specimen from station 4125 is small. The specimen from station 4185 has the disk 10 mm. in diameter and the arms 250 mm. long. The specimen from station 4186 has the disk 12 mm. in diameter and the arms 210 mm. long.

Asteroschema caudatum (Lyman).

Ophiocreas caudatus Lyman, Mus. Comp. Zoöl., Bull. **8**(2): 64, pl. 16, figs. 439-442, 1879 (*Challenger* station 232; off Eno Shima, Japan; lat. 35° 11′ N., long. 139° 28′ E.; 345 fathoms); Challenger Reports, Zoology **5**(14): 281, pl. 32, figs. 5-8, 1882 (*Challenger* station 232).

Ophiocreas oedipus (not of Lyman) H. L. Clark, U. S. Nat. Mus., Bull. **75**: 283, 1911 (*Albatross* stations 4979, 5079).

Asteroschema (*Ophiocreas*) *caudatum* Matsumoto, Coll. Sci., Imp. Univ., Tokyo, Jour. **38**(2): 49, 1917 (*Ophiocreas oedipus* H. L. Clark, 1911, in synonymy).

Asteroschema caudatum var. **granulosum,** new variety (fig. 2, *a*).

In a specimen with the disk 20 mm. in diameter, the arms are about 400 mm. long.

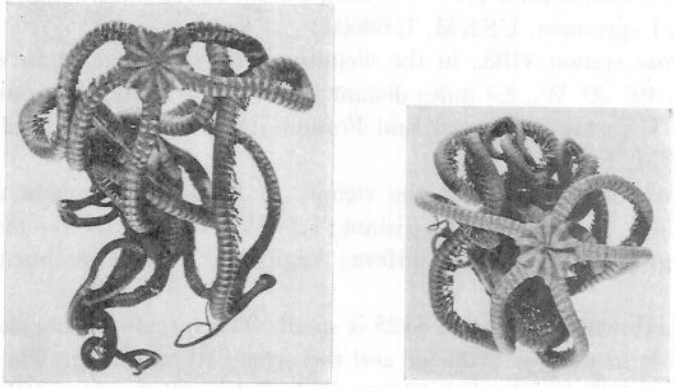
This variety differs from typical *A. caudatum* from southern Japan in having the granules on the disk and arm bases coarser. On the radial shields there are five to seven to a millimeter, whereas in the specimen of typical *A. caudatum* at hand there are about 10. In both forms the granules are completely isolated from each other, being closest

together on the radial shields. On the outer half of the arms the granulation becomes finer, more as in typical *A. caudatum,* but it is much more sparse and disappears earlier. Both forms, in life, are covered by a thick skin, the granules becoming evident only on thorough drying.

In life the arms were light ochraceous buff, becoming pinkish on the distal two-thirds, marked near the base for about an inch with light red. The disk is ochraceous buff marked with pale beryl green between the radial shields, and brown in the center. The oral side is much paler, with the tips of the tentacles and arms olive brown. The pitlike interradial areas are grayish (Fisher). Dried from alcohol the color is yellow brown, the narrow side arm plates and the oral surface light dull yellowish.

Type: cat. no. E.6863, USNM, from *Albatross* station 4178.

Albatross station 4018; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 57° W., 7.4 miles distant; 1,469-1,342 meters; bottom temperature 2.94° C.; Foraminifera, sand, and manganese fragments; June 21, 1902 (1, USNM, E.6865).



a *b*

FIGURE 2.—**a,** *Asteroschema caudatum* variety *granulosum,* type specimen, × 0.5; **b,** *A. caudatum* variety *obscurum,* type specimen, × 0.5.

Albatross station 4136; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 31° 45′ W., 6.9 miles distant; 539-643 meters; bottom temperature 6.77° C.; fine coral sand; August 1, 1902 (3, USNM, E.6864).

Albatross station 4178; in the vicinity of Niihau; Kawaihoa Point bearing S. 61° 30′ W., 17.6 miles distant; 583-691 meters; coral sand, rock, and pebbles; August 12, 1902 (1, USNM, E.6863).

The small specimen from *Albatross* station 4018 has the disk 8 mm. in diameter and the arms about 80 mm. long. The superficial deposits consist of minute rough, spongy, rounded, flattened plates concealed in the skin. These are not contiguous on the disk and become widely scattered on the arms, on which they disappear almost completely after the proximal third. They are absent from the oral surface. The color, dried, is yellow brown, the calcareous structures lighter.

The specimen of *Asteroschema caudatum caudatum* used for comparison is from *Albatross* station 5079, off Omai Saki, Japan, in 475 fathoms. It was recorded by H. L. Clark as *Ophiocreas oedipus* Lyman in 1911 (U. S. Nat. Mus., Bull. **75**: 283) and reidentified as *Asteroschema* (*Ophiocreas*) *caudatum* (Lyman) by Matsumoto in 1917 [Coll. Sci., Imp. Univ. Tokyo, Jour. 38 (2): 49].

Asteroschema caudatum var. **obscurum,** new variety (fig. 2, *b*).

The disk is up to 20 mm. in diameter and the arms are about 400 mm. long. The granules are somewhat larger than those of *A. caudatum* var. *granulosum,* about five to a millimeter on the radial shields, and are more numerous and more closely crowded, though not quite in contact, especially on the arms along which they persist quite to the tip, not disappearing in the outer portion as in *A. c. granulosum.*

In life the disk was brownish orange; an inch of the arms next to the disk was orange, the rest of the arms above purplish vinaceous, becoming purple terminally; the spines all along the arms were purple (Fisher).

Because of the more numerous and larger granules the color (dry) is lighter, more grayish, and more uniform than that of *A. c. granulosum.*

Type: cat. no. E.6866, USNM, from *Albatross* station 4107.

Albatross station 3992; in the vicinity of Kauai; Mokuaeae Islet bearing S. 54° E., 3.5 miles distant; 965 meters; bottom temperature 4.22° C.; fine gray sand and mud; June 12, 1902 (2, USNM, E.6869, E.6871).

Albatross station 4080; north coast of Maui; Puniawa Point bearing S. 23° E., 6.6 miles distant; 325-369 meters; bottom temperature 13.55° C.; gray sand and Foraminifera; July 21, 1902 (1, USNM, E.6873).

Albatross station 4107; Kaiwi Channel; Lae o Ka Laau Light, Molokai, bearing S. 34° 30′ E., 12.3 miles distant; 640-649 meters; bottom temperature 5.33° C.; coral sand and Foraminifera; July 24, 1902 (4, USNM, E.6866, E.6877, E.6872).

Albatross station 4108; Kaiwi Channel; Lae o Ka Laau Light, Molokai, bearing S. 21° E., 15.5 miles distant; 751-808 meters; bottom temperature 4.66° C.; coral sand and Foraminifera; July 24, 1902 (1, USNM).

Albatross station 4137; in the vicinity of Kauai; Hanamaulu warehouse bearing N. 65° 15′ W., 4 miles distant; 751-870 meters; bottom temperature 5.0° C.; coral and volcanic sand, Foraminifera, and rocks; August 1, 1902 (2, USNM, E.6868).

Albatross station 4171; in the vicinity of Moku Manu, or Bird Island; center of island bearing N. 75° 15′ E., 17.2 miles distant; 49-57 meters; bottom temperature 25.55° C.; coral; August 8, 1902 (1, USNM, E.6870).

Hawaiian Islands (1, USNM).

In its dense granulation this form suggests *A. mindorense* Döderlein from *Albatross* station 5367 in the Philippines in 180 fathoms; but the granules are coarser than in that species and are not so closely crowded, especially on the

oral side, where, in contrast to *A. mindorense,* they are sparse on the disk and lacking in the groove between the tentacles.

A specimen without definite locality has the disk 15 mm. in diameter and the arms about 250 mm. long.

A very small specimen from *Albatross* station 4107 with the disk 3.5 mm. in diameter and the arms 20 mm. long has a large circular central plate surrounded by five contiguous radial plates nearly as large, rounded and broader than long. The radial shields run from each side of the arm base to beneath the outer portion of the distal border of the corresponding radial plate.

Asteroschema edmondsoni, new species (fig. 3, *a*).

The disk is about 15 mm. in diameter. In a specimen with the disk 13 mm. in diameter the arms are 290 mm. long.

Between the radial shields the disk is covered with thick polygonal plates which in the outer portion become large and form a continuous pavement. The inner half of the radial ridges is covered with densely packed granules which in the outer half become larger and develop short sharp points. The arms are densely covered with closely packed polygonal plates swollen in the center, which bears a short sharp point. These plates show no regular arrangement. They gradually become smaller and more uniform in size after the basal 35 mm. of the arms, and in the terminal portion they lose the sharp points, becoming simply high rounded granules.

The oral surface of the disk has a continuous pavement of large rounded or flattened granules. These, becoming smaller, are continued along the groove between the tentacles. The first two pairs of tentacles are enclosed in tubes formed of small granules.

The arm bases, for a distance of 30 to 35 mm. in large specimens, are usually more or less swollen.

Type: cat. no. E.6880, USNM, from *Albatross* station 3989.

Albatross station 3981; in the vicinity of Kauai; Nawiliwili Light bearing N. 82° W., 4.2 miles distant; 1,163-757 meters; Globigerina ooze; June 10, 1902 (10, USNM, E.6875, E.6876).

Albatross station 3989; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 33° W., 9.5 miles distant; 914-704 meters; bottom temperature 3.05° C.; coral sand and rock; June 11, 1902 (1, USNM, E.6880).

Albatross station 4019; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 43° W., 8.1 miles distant; 1,342-748 meters; bottom temperature 3.22° C.; gray sand, Foraminifera, and rock; June 21, 1902 (8, USNM, E.6878, E.6882).

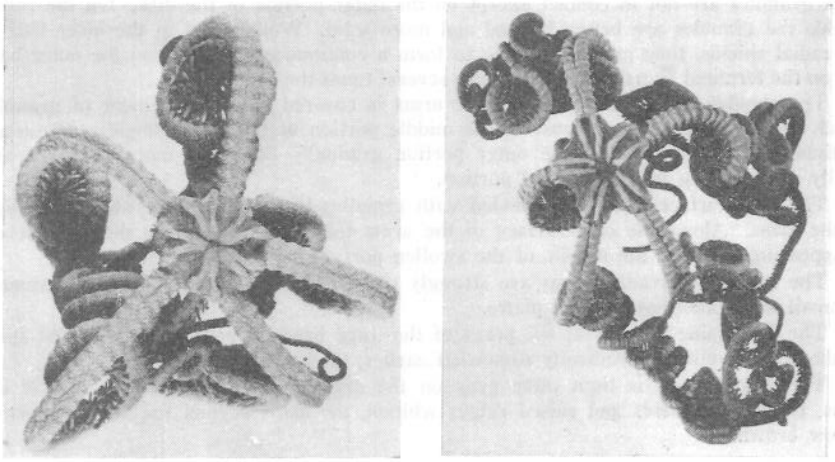
Albatross station 4037; west coast of Hawaii; Kawaihae Light bearing S. 78° E., 23.0 miles distant; 1,265-1,259 meters; bottom temperature 3.39° C.; gray mud, Foraminifera, and rock; July 10, 1902 (1, USNM, E.6881).

Albatross station 4134; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 35° 30′ W., 5.2 miles distant; 592-411 meters; bottom temperature 6.11° C.; coral and volcanic sand; August 1, 1902 (1, USNM).

Albatross station 4171; in the vicinity of Moku Manu Island; center of

island bearing N. 75° 15′ E., 17.2 miles distant; 49-57 meters; bottom temperature 25.55° C.; coral; August 8, 1902 (1, USNM, E.6879).

Albatross station 4172; in the vicinity of Moku Manu; center of island bearing N. 68° E., 21.0 miles distant; 1,373-632 meters; bottom temperature 3.33° C.; coarse coral sand, Foraminifera, and rock; August 8, 1902 (8, USNM, E.6877).



a *b*

FIGURE 3.—**a,** *Asteroschema edmondsoni,* type specimen, natural size; **b,** *A. ajax,* type specimen, natural size.

Albatross station 4182; in the vicinity of Kauai; Hanamaulu warehouse bearing N. 74° 30′ W., 5.6 miles distant; 1,227-1,749 meters; bottom temperature 3.55° C.; manganese nodules, stones, Globigerinae, and rock; August 13, 1902 (3, USNM, E.6874).

This species is related, though not very closely, to *A. ferox* Koehler from the Kei Islands and Moluccas in 208-240 meters. The plating of the disk and arms is much coarser and more irregular than in *A. ferox,* and the spiny tips of the granules are shorter. The same features separate it from *A. horridum* Lyman from the Kermadec Islands in 1,096 meters.

Asteroschema ajax, new species (fig. 3, *b*).

The disk is 13 mm. in diameter, and the arms are about 300 mm. long.

The disk is flat with strongly concave interradial borders, and the radial shields are narrow, strongly arched, and stand well above the general surface of the disk. They are usually parallel, close together, separated by about their own width or less, and short, not reaching the center of the disk.

The arms are greatly swollen in their basal portion. They are 2.5 mm. wide at the base, slowly increasing to a width of 3.5 or 4 mm. at about 10 mm. from the base, remaining of this width for some time, then rather abruptly tapering to a width of 1.5 mm., from this point on remaining very slender. The enlarged basal portion is crossed by 11 to 19 narrow well-spaced bands that, when dried, rise for some distance above the

general surface. In the basal swollen portion of the arm there are well-developed under arm plates. These are triangular with broadly rounded angles, from half again to twice as broad as long with the longest side distal, and occupy about the middle third of the arm. They separate the pairs of side arm plates, which meet broadly below them. They disappear in the slender distal portion of the arm. The narrow bands that run upward from the side arm plates usually just meet in the midradial line on the aboral surface.

Except in the central portion between the ends of the radial shields the disk is covered with very fine granules of rather loose and indefinite structure. Although very numerous, these granules are not in contact except on the outer portion of the disk. On the radial shields the granules are better formed and more solid. Well-spaced in the inner half of the radial shields, they gradually come to form a continuous pavement on the outer half, and on the terminal fourth they increase to several times the original size.

The swollen proximal portion of the arms is covered with a pavement of granules which are about the size of those in the middle portion of the radial shields. These are continued along the arm, in the outer portion gradually becoming more scattered and finally disappearing in the terminal portion.

The oral surface is thickly studded with granules like those on the swollen portion of the arms. Along the oral surface of the arms these rapidly become more scattered, disappearing at about the middle of the swollen portion.

The lateral interradial areas are strongly oblique and are covered with a pavement of small and somewhat swollen plates.

The first spine appears at the pores of the third brachial pair and the second spine at about the twelfth, sporadically somewhat earlier, often much later.

The color (dry) is light olive gray on the disk and swollen basal portion of the arms, the radial shields and raised ridges whitish, the arms beyond the swollen portion yellow brown.

Type: cat. no. E.6883, USNM, from *Albatross* station 4171.

Albatross station 3992; in the vicinity of Kauai; Mokuaeae Islet bearing S. 54° E., 3.5 miles distant; 965 meters; bottom temperature 4.22° C.; fine gray sand and mud; June 12, 1902 (2, USNM, E.6886).

Albatross station 4107; Kaiwi Channel; Lae o Ka Laau Light, Molokai, bearing S. 34° 30′ E., 12.3 miles distant; 640-649 meters; bottom temperature 5.33° C.; coral sand and Foraminifera; July 24, 1902 (1, USNM, E.6885).

Albatross station 4139; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 57° W., 5.2 miles distant; 936-620 meters; bottom temperature 4.61° C.; August 2, 1902 (2, USNM, E.6887).

Albatross station 4171; in the vicinity of Moku Manu; center of island bearing N. 75° 15′ E., 17.2 miles distant; 49-57 meters; bottom temperature 25.55° C.; August 8, 1902 (2, USNM, E.6883, E.6884).

This species appears to be related to *A. migrator* Koehler, but in that species the granules are much fewer, larger, and more widely scattered and do not extend beyond the swollen proximal portion of the arms. It appears to be related also to *A. oedipus* (Lyman), but the proximal swollen portion of the arms is much longer and more enlarged, and the under arm plates are entire. From *A. fastosum* Koehler and *A. ferox* Koehler, which also have the proximal portion of the arms swollen, it is easily distinguished by the much finer granulation which is not in the form of conical grains.

GORGONOCEPHALIDAE

Gorgonocephalus dolichodactylus Döderlein, Über japanische und andere Euryalae, 34, pl. 1, figs. 3, 4, pl. 7, figs. 3-4b, München, 1911 (Sagamibai, about 150 meters).

Hawaiian Islands: *Albatross,* 1902 (1 small specimen and 2 detached arms from a larger one, USNM, E.6888).

The disk is 26 mm. in diameter. The border is rather deeply concave in the interradial areas. The outer edge between the arm bases is marked by a band about as wide as the narrow radial ridges consisting of three or four irregular rows of plates of various sizes. The radial ridges and the peripheral band of plates are covered and concealed by a dense investment of small granules, which are very small and uniform on the marginal band, larger and of various sizes on the radial ridges. Granules similar to those on the radial ridges are rather thickly scattered over the surface of the disk and form an almost complete pavement over the oral interradial areas.

In life the radial ridges were white tinged with salmon pink, the areas between them orange varied with a dull blue; the arms were bright salmon pink. The color below was cream faintly tinged with pink, the oral interradial areas with a bluish cast. The detached arms from a larger individual were fawn color, the tubercles dark brown (Fisher).

The smaller specimen agrees with those described and figured by Döderlein (Über japanische und andere Euryalae, 34, 1911) and by Matsumoto [Coll. Sci., Imp. Univ. Tokyo; Jour. 38(2): 1917], except that the granulations on the disk are more numerous. These granules appear to be much more numerous in the specimen figured by Matsumoto than in those figured by Döderlein. In the present specimen they are even more numerous than in that figured by Matsumoto.

HEMIEURYALIDAE

OPHIOCHONDRINAE

Genus **Ophioleila,** new genus

A genus of Hemieuryalidae in which the oral and lateral portions of the disk are occupied by two large swollen sacks circular in cross section that run from the oral shields to the outer half of the lateral border of the radial shields on the aboral surface. The radial shields are large, occupying most of the aboral surface of the disk, and the upper and under arm plates are well-developed. The mouth armature consists of two mouth papillae on the adoral plate, one small one on the very small jaw plate, and a few long tooth papillae at the apex of the jaw angle.

Genotype: *Ophioleila elegans,* new species.

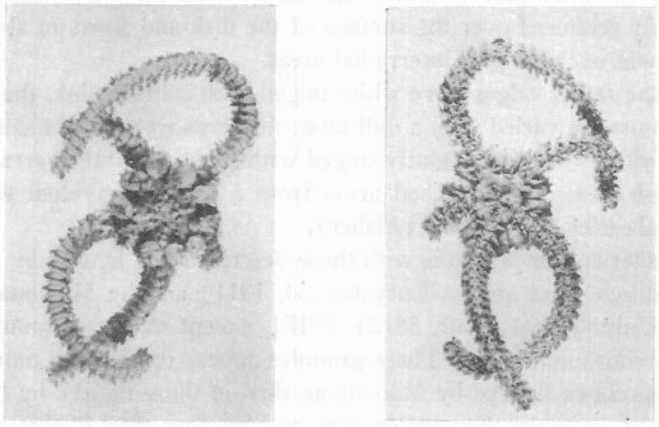
This new genus belongs to the subfamily Ophiochondrinae, including *Ophiochondrus, Ophiomoeris,* and *Ophiogyptis,* but it is not closely related to any of these.

Ophioleila elegans, new species (fig. 4, *a, b*).

The disk is 9 mm. in diameter and the arms are about 45 mm. long.

The outline of the disk is regularly 10-lobed, the circular periphery being surrounded by 10 approximately circular lobes the bases of which are narrower than the maximum width. These lobes, 2 mm. in diameter, are contiguous interradially, but radially are slightly separated over the arm bases.

The interradial areas on the oral side are divided by a deep and narrow median fissure on each side of which the surface is greatly swollen, rising into a kind of elongate sack, circular in cross section, which is covered with three to five irregular rows of large plates diminishing to two or three plates at the oral end, which is raised to the level of the oral surface of the arms and is separated from the oral and adoral shields by a deep cleft. Curving around the edge of the disk, these swollen sacks rise well above the aboral surface where they reach the radial shields along the border between the outer angle and the distal end. The aboral and upper part of the interradial surface of these sacks is studded with rather large scattered elongated subconical or truncated granules with a finely spinous summit, about one to each plate.



a *b*

FIGURE 4.—*Ophioleila elegans,* type specimen: **a,** aboral view, × 2; **b,** oral view, × 2.

The radial shields are large and triangular and extend inward for about two-thirds the distance from the margin of the disk to the center. Their outer angles, which are very slightly produced, are just in contact above the arm bases and their lateral angles are almost in contact in the interradial line. The radial shields of each pair are separated internally by a narrow line of plates, and the pairs are separated interradially by a similar narrow line of plates. These 10 narrow lines of plates converge to a group of moderate-sized plates about 2 mm. in diameter in the center of the disk. The plates in the center of the disk and in the 10 radiating lines are of moderate size and bear elongate granules tipped with numerous fine spinules resembling those on the plates of the interradial sacks but somewhat larger.

The peristomial area is circular. The oral shields are small, triangular, nearly half again as long as broad, and are widely separated from the first side arm plates by the adoral shields which are very large, trapezoidal, and not greatly longer than the maximum (outer) width. They are joined for a distance nearly or quite equal to the length of the triangular oral shields. The jaw plates are very small and short and are turned outward at an angle of 60 degrees or more to the surface of the adoral shields.

The adoral plates bear two mouth papillae. Each jaw plate bears a much smaller mouth papilla near the outer end, and each jaw pair bears a small group of four to six larger paired tooth papillae at the apex. These tooth papillae are about as long as the mouth papillae on the adoral shields but are not much more than half as thick.

The first under arm plate is small, almost an equilateral triangle, with one of its apices outward. It has a deep groove in the middle of the inner portion. The second is about twice as broad as long, broadly triangular with the apex proximal. It reaches across the arm and is separated from the first by the union of the first side arm plates. The following under arm plates are similar to the second; they are separated from each other by about half their length. Distally they become progressively smaller and more widely separated.

The upper arm plates are twice as broad as long with the distal edge straight and the proximal edge broadly rounded or with an obtuse angle in the middle, and the lateral angles rounded. They are separated from each other for a distance equal to about one-third of their length by the union of the side arm plates. As the proximal half of the side arm plates is depressed below the general surface of the arm, the upper arm plates and the raised distal portion of the side arm plates form raised bands across the arm separated by rather deep grooves with parallel sides.

The distal half of the side arm plates is elevated into a broad spine-bearing ridge, the aboral ends of these ridges being separated by the whole width of the arm.

The first side arm plate beyond the disk bears six arm spines of which the uppermost is the longest, somewhat longer than an arm segment. The others decrease in length to the lowest, which is shorter than an arm segment. The spines are set with numerous fine spinules, but the two uppermost are almost smooth. The spines on the following side arm plates are similar but somewhat shorter. On the side arm plates following they become shorter, considerably shorter than an arm segment, with the uppermost the shortest and the lowermost the longest. In the distal part of the arms the number of arm spines falls to four.

The single tentacle scale is rather large and broad with a broadly rounded tip. It is situated along the inner proximal border of the tentacle pore and is curved around it so that the scale is a segment of a hollow cylinder and is permanently erect. Beyond the third or fourth tentacle pores the inner distal edges of the scales on the same arm segment almost meet in the midline of the arm.

The color (dry) is white.

Type: cat. no. E.6889, USNM, from *Albatross* station 4019.

Albatross station 4019; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 43° W., 8.1 miles distant; 1,342-748 meters; bottom temperature 3.22° C.; gray sand, Foraminifera, and rock; June 21, 1902 (2, USNM, E.6889, E.6890).

Ophiomoeris inflata, new species (fig. 5, *a, b*).

The disk is 3 mm. in diameter and the arms are about 10 mm. long.

The disk is divided into five approximately heartshaped lobes separated by interradial notches that extend inward to about the inner end of the very large radial shields. Each lobe is strongly swollen and convex, curving downward from the center toward each side and also toward the center of the disk, which is deeply sunken. The center of the disk is occupied by a medium-sized pentagonal or rounded plate surrounded by five small, triangular, interradial plates lying between the inner ends of the radial lobes. The lobes are formed of two very large radial shields of which the outer ends meet in the midradial line, their inner ends diverging in a straight line and reaching the outer side of the lobe at the bottom of the interradial notch. The radial shields may be only just in contact at their outer ends, or they may be in contact for as much as half their length. The V-shaped area between the inner portions of the radial shields of each pair is occupied

by three or four large plates each of which bears one, more rarely two or three, or even four, elongated smooth subconical granules.

The lateral interradial areas and the narrow triangular areas between the lobes on the aboral side are covered by transparent skin which carries a few small scattered nodules. The genital plate, which is thick and conspicuous and about twice as long as broad with a broadly rounded lower end, extends downward from near the end of the radial shield and almost meets a similar but smaller plate that extends diagonally upward from the outer angle of the oral shield.

a *b*

FIGURE 5.—*Ophiomoeris inflata*, type specimen: **a**, aboral view, × 3; **b**, oral view, × 3.

The peristomial plates form a pentagonal figure with rounded angles and slightly convex sides. The rounded angles reach the inner ends of the interradial incisions between the lobes of the disk so that the sides of these lobes curve around from these angles to the distal border of the second under arm plates. No part of the lateral interradial areas is visible from the oral side.

As visible orally, the oral shields are broadly fan-shaped, about twice as broad as long. The outer end is usually curved upward, ending in a broadly obtuse angle invisible from below. They may just reach the first under arm plates on each side, or they may be separated from them. They are widely separated from the first under arm plates by the adoral shields, which are large, each of about the same area as the oral shields, and are more or less strongly convex on the outer border, less strongly convex on the inner.

The jaw plates are very small, narrowly triangular. Each bears three moderately stout pointed mouth papillae, the outermost somewhat larger than the others, and there is a somewhat larger unpaired papilla at the inner angle of the jaw.

The first under arm plate is rhombic with broadly rounded angles, longer than broad, with the outer end lying between the outer ends of the adjacent adoral shields. The second is transversely oblong, nearly three times as broad as long, and is separated from the first by about its own length. The third is similar to the second but smaller, and those following decrease in size and width and become more widely separated; they are minute in the outer portion of the arms.

The first upper arm plate, at the end of the radial lobes, is about three times as broad as long, with the convex distal border flattened in the middle. The second, which is not quite in contact with the first, is broadly fan-shaped and about twice as broad as long. Those following become gradually smaller, narrower, and more widely separated, and in the distal portion of the arm very small and widely separated.

The side arm plates are moderately projecting. The arm spines are four in number. At the base of the arms the two lowest are stouter and slightly longer than the others, the next is slightly more slender and shorter, and the topmost is considerably shorter and more slender. In the outer portion of the arms the arm spines become more slender and, with the increasing length of the arm segments, relatively longer.

The color (dry) is white.

Type: cat. no. E.6891, USNM, from *Albatross* station 3973.

Albatross station 3973; off French Frigate Shoal (lat. 23° 47′ 10″ N., long.

166° 24′ 55″ W.); 722-726 meters; bottom temperature 5.00° C.; coarse coral sand and shells; May 29, 1902 (20+, USNM, E.6891, E.6892).

OPHIACANTHIDAE

Ophiacantha bisquamata Matsumoto, Acad. Nat. Sci. Philadelphia, Proc. **67**: 62, 1915 (off Oshima, Sagami Sea; 75-85 fathoms).

Albatross station 4100; Pailolo Channel, betwen Maui and Molokai; Mokuhooniki Islet bearing N. 35° W., 3.1 miles distant; 238-276 meters; bottom temperature 16.11° C.; coral sand, shells, and Foraminifera; July 23, 1902 (1, USNM, E.6893).

The single specimen, unfortunately in poor condition, has the disk 9 mm. in diameter. Although considerably larger than Matsumoto's type, which measured only 6 mm. in disk diameter, this specimen does not differ from it in any significant feature. The distal ends of the narrow radial shields are visible in the only radial area not wholly devoid of granules. They are widely separated, one on each side of the arm base. There is some reason for believing that in life they were covered with granules somewhat more pointed than those of the disk. The first upper arm plate bears five slender well-spaced spines on its distal edge, and the second bears a similar median spine. The disk is circular, owing to the swollen interradial areas.

Ophiacantha prionota H. L. Clark, U. S. Nat. Mus., Bull. **75**: 213, 214, fig. 99, 1911 (*Albatross* station 4928; off southern Japan; lat. 29° 51′ 00″ N., long. 131° 02′ 30″ E.; 1,008 fathoms).

Albatross station 3865; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing S. 79° W., 6.9 miles distant; 468-517 meters; bottom temperature 7.11° to 7.22° C.; volcanic sand and rock; April 10, 1902 (1, USNM, E.6895).

Albatross station 4147; in the vicinity of Moku Manu; center of island bearing S. 2° W., 2.0 miles distant; 47 meters; bottom temperature 23.28° C.: coral and corallines; August 5, 1902 (1, USNM, E.6894).

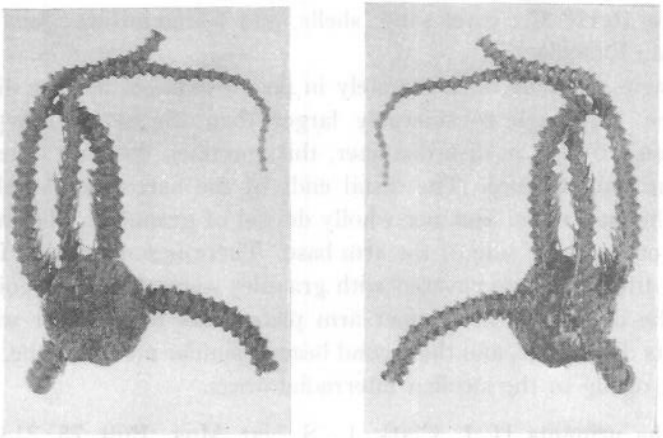
The specimen from *Albatross* station 3865 does not appear to differ in any way from the type specimen of *O. prionota* from *Albatross* station 4928 in Colnett Strait, southwestern Japan, in 1,008 fathoms. The disk is 9 mm. in diameter, as in the type specimen, and there are eight arm spines on the second side arm plate beyond the disk. In *O. prionota* there are seven or eight, not six as given in the original description. The stout and swollen mouth papillae and the large adoral plates, the surface of which forms an obtuse angle with that of the oral shields, giving the effect of a broad beveled edge, and the curiously close approach of the tentacle pores on the oral surface of the arms are as marked in this specimen as they are in the type.

The specimen said to be from *Albatross* station 4147 is probably mislabeled.

Ophiacantha dumosa, new species (fig. 6, *a, b*).

The disk is 7 mm. in diameter and the arms are about 50 mm. long.

This species is closely related to *O. adiaphora* H. L. Clark as represented by the large specimens from *Albatross* station 3480. The ends of the radial shields are visible as small triangles about half again as long as broad with the outer border broadly rounded lying opposite the ends of the middle third of the arm bases. The disk is thickly covered with delicate thorny stumps which are somewhat shorter and more slender than those of *O. adiaphora* with much longer terminal spinules of which the longest are considerably longer than the stalk. These thorny stumps also cover the lateral and oral interradial areas.



a *b*

FIGURE 6.—*Ophiacantha dumosa,* type specimen: a, aboral view, × 2; b, oral view, × 2.

The under arm plates differ considerably in shape from those of *O. adiaphora.* In *O. adiaphora,* the lateral borders of the under arm plates are parallel with each other and with the longitudinal axis of the arm, and the tentacle pores lie beyond the proximal angles so that the distally rounded tentacle scales lie on each side of the under arm plate. In the new species the lateral portions of the under arm plates are strongly excavated by the tentacle pores so that their proximal end is much narrower than in *O. adiaphora,* and the tentacle scales lie over the under arm plate the lateral edges of which extend for some distance beyond it. In *O. adiaphora* the tentacle scales would have the tips well-separated from each other if turned inward, whereas in the new species the tentacle scales which are narrower and more pointed, would overlap. In the new species, the under arm plates, which are proportionately longer than in *O. adiaphora* with the distal end much more strongly rounded, are less widely separated than in *O. adiaphora,* and the first eight or nine may be either in contact or slightly separated.

The upper arm plates are slightly smaller and more widely separated from each other than those of *O. adiaphora,* though of the same shape.

The side arm plates resemble those of *O. adiaphora.* The spine-bearing ridges of the second beyond the disk meet in the midradial line at an angle of about 120 degrees instead of in a straight line as in *O. adiaphora,* and the ridges of the following side arm plates similarly make a very broadly obtuse angle with each other. The second side arm plates bear 10 spines, there being nine in the largest specimen of *O. adiaphora.*

In one specimen (the type) the oral shields are nearly twice as broad as long with the outer border strongly and regularly convex and the two inner edges straight. In the other specimen they are almost regularly pentagonal and nearly as long as broad.

The adoral shields are markedly shorter and broader than those of *O. adiaphora*, about twice as long as the greatest width, with rather strongly converging sides. They do not extend beyond the lateral angles of the oral shields as they do in *O. adiaphora*. The color (dry) is very light brownish, lighter on the oral side.

Type: cat. no. E.6896, USNM, from *Albatross* station 3865.

Albatross station 3865; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing S. 79° W., 6.9 miles distant; 468-517 meters; bottom temperature 7.11° to 7.22° C.; volcanic sand and rock; April 10, 1902 (2, USNM, E.6896, E.6897).

Ophiothamnus otho, new species (fig. 7, *a, b*).

The disk is 3 mm. in diameter and the arms are about 7 mm. long.

The disk is circular, indented in the interradial areas. The radial shields are triangular, about twice as long as broad, and reach about half way from the edge of the disk to the center. The two of each pair are in contact at the edge of the disk, diverging inwardly. The outer angle is produced into a short truncate process denser than the rest of the surface. The disk is covered with uniform rounded scales about half, or most, of which bear short, long-conical, unjointed spines ending in a few minute spinelets or in a sharp point. These spines are uniform in size and are evenly distributed over the surface of the disk. The interradial areas below are covered with small scales a few of which, in the central portion, bear spines.

a *b*

FIGURE 7.—*Ophiothamnus otho,* type specimen: **a,** aboral view, × 3; **b,** oral view, × 3.

The oral shields are diamond-shaped, very small, and lie in the central third of the V formed by the large adoral plates. These are slightly wider distally than proximally, about three times as long as the distal width. The distal end, which is on the level of the distal end of the first under arm plate, is straight and at right angles to the two adjoining sides. The jaw plates are very narrow, forming a thin line along the radial side of the adoral plates. They bear three mouth papillae of which the innermost is usually pointed, somewhat longer than broad at the base, the next is truncate and slightly higher than broad, and the innermost is very broad, about three times as broad as high. There is a very large, triangular, unpaired papilla at the end of the pair of jaw plates, beneath which are three large, rounded, well-spaced teeth.

The first under arm plates are oblong, slightly longer than broad, reaching from the outer ends of the outermost mouth papillae to the outer ends of the adoral plates. The second under arm plate is separated from the first by about the length of the latter; it is nearly three times as large, about as long as broad, with the distal and lateral edges straight, the former with a slight median notch, and the proximal border forming a broadly obtuse angle. The third under arm plate is smaller than the second with a strongly bilobed distal edge, the lateral edges concave, and the proximal edge straight; it is separated from the second by about its own length. The following under arm plates are similar, decreasing in size, in the outer portion of the arms being about as long as one-third of the distance between them.

The upper arm plates are broader than long, about two-thirds as broad as the arm, with a proximal angle; they are situated on the ridges just distal to the row of spines. They remain of considerable size to the tips of the arms.

The side arm plates, which are very long and in contact for most of their length, form pairs which are much constricted centrally with flaring ends, giving the arm a strongly knotted or moniliform appearance. The first side arm plate beyond the disk bears five or six arm spines of which the two uppermost are about as long as three arm segments, the others much shorter. The next side arm plate bears five spines which are similar, but the uppermost are not quite so long. The arm plates following bear three spines which are about as long as a single segment. There is a single spiniform tentacle scale.

Type: cat. no. E.6898, USNM, from *Albatross* station 4096.

Albatross station 4096; northeast approach to the Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 77° 30′ W., 7.0 miles distant; 523-497 meters; bottom temperature 7.39° C.; fine gray sand; July 22, 1902 (2, USNM, E.6898, E.6899).

Ophiomitra semele, new species (fig. 8, *a, b*).

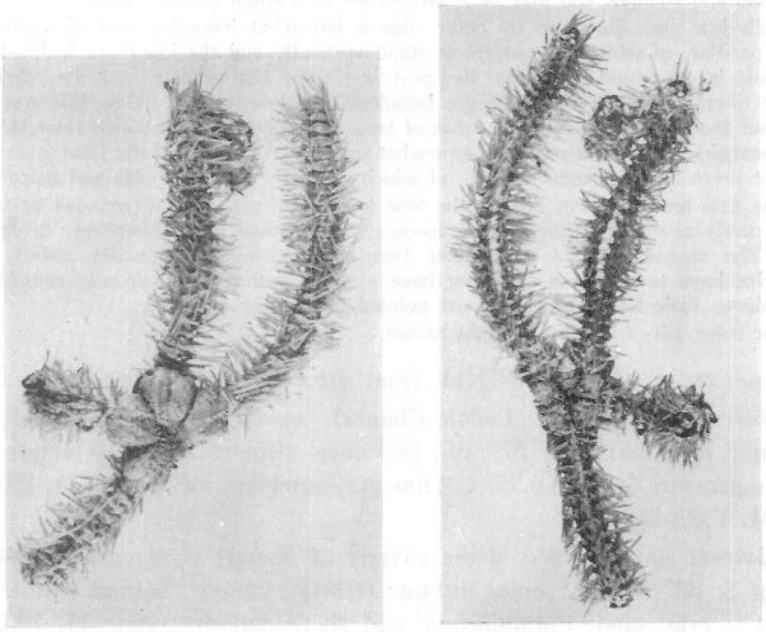
The disk is 14 mm. in diameter, thick, 5 mm. high at the radial shields, and the arms are about 120 mm. long.

The disk (dry) is deeply incised in the interradial areas, and on the aboral surface the central and interradial portions are deeply depressed. The aboral surface of the radial shields is more or less concave. The radial shields, which reach from the border considerably more than half way to the center, are long and rather narrow. They are two and one-half to three times as long as broad with the outer ends broadly rounded and the inner ends sharply pointed. They are in contact in the outer third, their radial edges thence diverging slowly. Their abradial borders are usually somewhat convex in the outer portion, becoming straight inwardly. The central portion of the disk is covered with an irregular pavement of scales of various sizes many of which bear short, thick, swollen-cylindrical stumps ending in a somewhat flaring group of a few short spines. In the lateral portion of the interradial areas the scales in the midline are small, about like those in the center of the disk, and are without thorny stumps. These are followed by much larger laterally elongate scales that border the radial shields. There is usually a line of intermediate scales between the large ones bordering the radial shields and the small ones in the midline. The interradial areas below are covered with more or less uniform medium-sized scales resembling those in the interradial midline. They do not bear thorny stumps.

The oral shields are diamond-shaped, half again as broad as long, reaching the first side arm plates on each side; their inner angle is slightly produced and their surface is slightly concave. The adoral shields are large and broad, with the sides nearly parallel. They abut against both the first under arm plate and the first side arm plate. One or both are frequently divided into two or more plates. In one specimen (from *Albatross* station 3986), the adoral shields are represented by three plates, a median plate and a slightly smaller one on each side; the outer border of the median plate is straight, truncating the inner angle of the oral shield.

The first under arm plate is very small, broader than long. It may be just in contact with the second under arm plate, or it may be separated from it by the produced and almost contiguous inner angles of the first side arm plates, or by a small plate lying between these inner angles. The second under arm plate is triangular with the base outward, twice as broad as long or even broader, reaching almost entirely across the arm. One or both of the lateral angles, as far as the middle of the tentacle pore, may be separated by a suture from the rest of the plate. The third under arm plate is similar and is separated from the second by the rather broad union of the side arm plates

below it. The following under arm plates are similar, but the outer border is regularly convex, later becoming a broadly rounded obtuse angle. The lateral portions are occasionally separated from the rest of the plate by suture.



a *b*

FIGURE 8.—*Ophiomitra semele,* type specimen: **a,** aboral view, natural size; **b,** oral view, natural size.

The first upper arm plate is trapezoidal, slightly shorter than the proximal width, which is a little more than half the distal, and occupies about the middle third of the arm. The second upper arm plate is much smaller, triangular, twice as broad as long, and occupies about the middle fourth of the arm. It is separated from the first by about its own length through the broad union of the side arm plates. The following upper arm plates are similar, distally becoming somewhat narrower with the distal border convex, those in the outer portion of the arms becoming rhombic and widely separated.

The first side arm plates are irregularly trapezoidal and make an angle of about 45 degrees with the longitudinal axis of the arm. They carry three arm spines. The second side arm plates are much larger with the distal half raised into a high broad ridge bearing three rough spines of which the outermost is the longest and lies at right angles to the longitudinal axis of the arm. The third side arm plate is similar, and bears four or five spines. The fourth side arm plate, the first beyond the disk, bears seven arm spines of which the two uppermost, the longest, are 7 mm. long. The three uppermost spines, which are approximately equal, are about half again as long as the others, which decrease slowly to the lowest, which is the shortest. The spines carry minute well-spaced spinules which are more numerous on the lower shorter ones. In the terminal portion of the arm the number of spines falls to six, with the topmost shorter and more slender than the others.

The jaw plates are rather large, triangular, with the outer (adradial) edge the longest, the apposed inner edges about two-thirds as long, and the edge abutting on

the adoral shields, which is concave, the shortest. The pair of jaw plates is bent outward so that most of their surface makes an angle of roughly 60 degrees with the basal portion and the surface of the adoral shields. The outer angle of the jaw plate is usually broadened and rounded and may be separated off as a small separate plate.

Each jaw plate bears on its outer edge a somewhat irregular row of usually five mouth papillae, of which the outermost stand vertically and the inner are inclined. The outermost is stout and prismatic, the next is similar but smaller, and the others are narrow when viewed aborally but are broadened dorsoventrally. Below this row there are about four additional irregular rows of crowded mouth papillae which resemble those of the marginal row but are mostly somewhat smaller. At the tip of the jaws is a column of about seven broadly rounded teeth, of which some are usually double and paired.

The first tentacle pores beyond the first under arm plate are surrounded by usually three (rarely as many as five) broad, spoon-shaped tentacle scales commonly of different sizes. The second tentacle pores have two large spoon-shaped scales, rarely three. The third have two. Those following have a single rather broad distally rounded and very spinous scale which becomes more pointed toward the arm tips.

The color (dry) is white or light brown.

Type: cat. no. E.6900, USNM, from *Albatross* station 3986.

Albatross station 3868; Pailolo Channel, betwen Molokai and Maui; Mokuhooniki Islet bearing S. 57° W., 14.3 miles distant; 537-1,250 meters; bottom temperature 6.44° to 6.95° C.; fine gray sand and rock; April 11, 1902 (1, USNM, E.6905).

Albatross station 3986; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 37° W., 6.5 miles distant; 662-100 meters; bottom temperature 5.44° C.; gray sand, Foraminifera, and shore deposits; June 11, 1902 (1, USNM, E.6900).

Albatross station 3992; in the vicinity of Kauai; Mokuaeae Islet bearing S. 54° E., 3.5 miles distant; 965 meters; bottom temperature 4.22° C.; fine gray sand and mud; June 12, 1902 (3, USNM, E.6902).

Albatross station 4016; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 62° W., 2.2 miles distant; 581-558 meters; bottom temperature 6.05° C.; black sand; June 20, 1902 (1, USNM, E.6904).

Albatross station 4107; Kaiwi Channel; Lae o Ka Laau Light, Molokai, bearing S. 34° 30′ E., 12.3 miles distant; 640-649 meters; bottom temperature 5.33° C.; coral sand and Foraminifera; July 24, 1902 (1, USNM, E.6901).

Albatross station 4136; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 31° 45′ W., 6.9 miles distant; 539-643 meters; bottom temperature 6.77° C.; fine coral sand; August 1, 1902 (1, USNM, E.6903).

A small specimen from *Albatross* station 3992 with the disk 9 mm. in diameter has the basal tentacle pores with only a single tentacle scale (the inner) and three or four mouth papillae, in addition to the terminal unpaired one, arranged in a regular row. Only three supplementary papillae, all on one pair of jaw plates, have appeared. The column of teeth is quite regular. A still smaller specimen with the disk 6 mm. in diameter is similar. These two small specimens might easily be mistaken for a different species.

This species is related, though not very closely, to *O. lithosora* (H. L. Clark) from the Eastern Sea off Gwaja [Gaja?] Shima in 361 fathoms with which it agrees in having three scales on the first tentacle pores. It is easily distinguished by the longer and broader radial shields which have a thin sharp ridge along the interradial borders, and the much smaller upper arm plates which are widely separated instead of being contiguous. In *O. semele* the spine-bearing portion of the side arm plates is raised into a prominent broad high ridge, and these ridges and spine rows are continuous across the aboral surface of the arms, whereas in *O. lithosora* the spine rows are interrupted for a distance equal to nearly the whole width of the aboral surface of the arms.

Ophioplinthaca athena, new species (fig. 9).

The disk is 14 mm. in diameter and the arms are about 110 mm. long.

The disk is circular with narrow incisions in the interradial areas. The radial shields are long and narrow, about 4 mm. long and 1 mm. broad, with the sides more or less parallel and the ends rounded. The outer ends are almost in contact, and the adjacent sides diverge slowly inward. Their surface is concave so that they are slightly sunken beneath the general aboral surface of the disk. The disk is covered with imbricating plates which are small and irregular in the center and in the interradial lines, becoming much larger between the interradial lines and the radial shields and much larger and radially elongate between the radial shields of each pair. On the broadly rounded edge of the disk there is a group of very large plates between the radial shields and the interradial line, the plates of which are here also much enlarged. These plates decrease in size in the oral interradial areas, but are much larger than those on the aboral surface. The genital plate is broad and prominent. The center of the disk bears numerous elongate granules with a few radiating spinules at the summit. Farther out these become much more scattered and the tip is pointed, without the radiating spinules. On the outer ends of the radial shields and on the immediately adjacent arm plates there are a few slightly elongate smooth granules, and these also occur sparingly on the large plates between the radial shields and the interradial line. They do not occur on the plates on the oral surface.

The oral shields are fan-shaped, about as long as broad, with the distal border regularly convex or with an obtuse central angle, and the lateral borders slightly concave. The distal half of the oral shields is turned downward (orally) at an angle of about 90 degrees. The lateral angles of the oral shields are in contact with the first side arm plates.

The adoral shields are large, half again as broad outwardly as at their apposed borders beneath the angle of the oral shield; they abut about equally against the first under arm plate and the first side arm plate.

The jaw plates are sharply triangular, about twice as long as broad; the inner portion is turned up at an angle of about 60 degrees. Each jaw plate bears four or five rather long, sharp, laterally flattened mouth papillae, of which the three or four distal ones are of about the same size and the subapical one is smaller. There is a terminal unpaired papila much larger and stouter than the others.

The first under arm plate is usually about as long as broad, with the distal border strongly convex. The second is fan-shaped, broader than long, and is just in contact with the first by its proximal angle. The third is similar but proportionately shorter, twice as broad as long, and reaches almost across the oral surface of the arm; it is in contact with the second by its proximal angle. The following under arm plates are similar, but are not quite in contact; they become gradually more widely separated distally, beyond the middle of the arm by about their own length; in the distal portion of the arm they become smaller and more widely separated.

The upper arm plates are large, reaching nearly across the arm. They are nearly twice as broad as long with the distal edge gently, the proximal strongly, convex, the latter with a median obtuse angle. They are just in contact. In the outer portion of the arm they become longer and more nearly fan-shaped, still remaining in contact. In the terminal portion they become slightly separated, and at the arm tip they are separated by their own length or more.

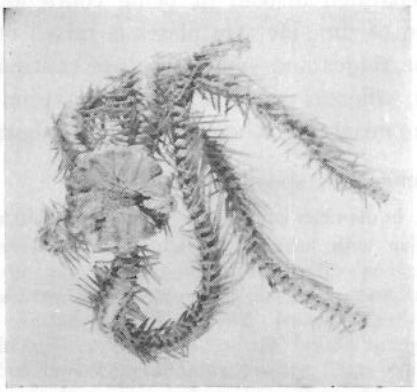


FIGURE 9.—*Ophioplinthaca athena,* type specimen, aboral view, natural size.

The distal half of the side arm plates is elevated into a broad spine-bearing ridge which is not especially high or conspicuous; these spine-bearing ridges are widely separated on the aboral side of the arms. At the arm bases there are five arm spines of which the uppermost is the longest, about as long as two arm segments, and almost smooth. On the first three side arm plates following the disk the next spine is often similar and of the same length. The other spines are shorter, the lowest the shortest, and are roughened with numerous short and slender spinules. Beyond the proximal third of the arm the number of spines falls to four, of which the uppermost is slender and smooth, not so long as two arm segments, the next is much longer and stouter, about as long as four segments, and smooth, the third is about as long as the uppermost but somewhat stouter, smooth or roughened, and the lowest is slightly shorter and roughened.

The first tentacle pore has two tentacle scales, a large, broad, and pointed one on the inner side, and a smaller one on the lower side. The following pores have a single scale, which at first resembles the larger scale on the first pore, after the basal third of the arm gradually transforming into a slender spine.

The color (dry) is white.

Type: cat. no. E.6906, USNM, from *Albatross* station 3996.

Albatross station 3996; in the vicinity of Kauai; Kapuai [Nohili] Point bearing S. 23° 15′ W., 15.5 miles distant; 1,866-2,157 meters; bottom temperature 2.29° C.; gray sand and rock; June 13, 1902 (1, USNM, E.6906).

Ophioplinthaca clothilde, new species (fig. 10, *a, b*).

The disk is 7 mm. in diameter and the arms are about 50 mm. long.

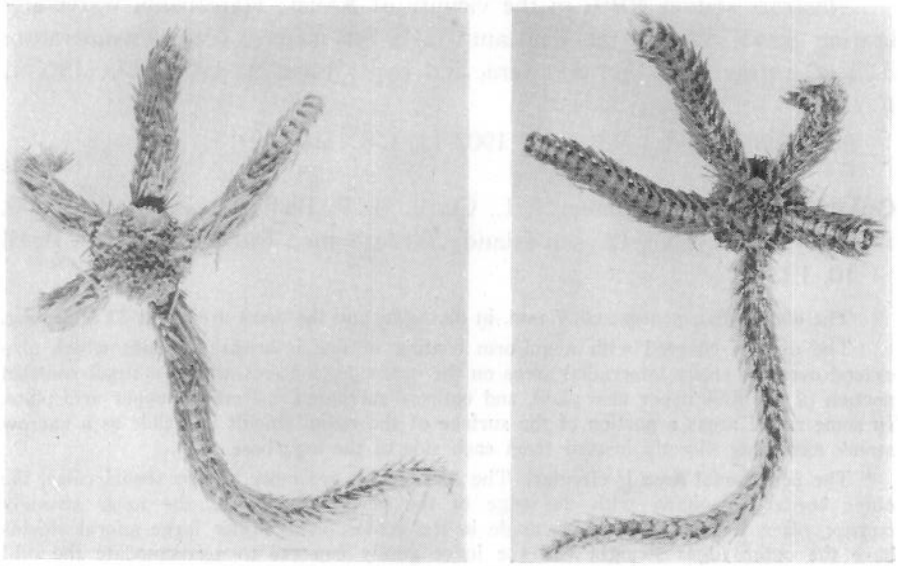
The disk is incised in the interradial areas. The center of the disk is covered with moderate-sized scales which extend outward in the interradial lines; in the radial areas and on each side of the interradial lines the scales become larger, those on the border of the disk adjoining the radial shields being very large. The aboral surface of the

disk, except for the radial shields, and the midline of the lateral and interradial areas, are thickly beset with stumps terminating in a flaring irregular crown of a dozen or more spinules. Some of these in the middle of the disk may be compound, a single base ending in two or three crowns.

The radial shields are small, their length not much more than one-third the distance from the edge of the disk to the center, triangular with convex sides or more or less ovoid, and about half again as long as broad. They are joined in the outer fourth, their adjacent borders diverging widely in the inner three-fourths. The inner ends of the radial shields of each pair are separated by a triangular plate that usually does not bear a thorny stump.

The oral shields are about twice as broad as long, rhombic with slightly concave sides. They are in contact with the first side arm plates. The adoral shields have the outer border rather strongly convex and the inner slightly concave. They join about equally the first under arm and side arm plates.

The jaw plates are small, narrowly triangular, and bear usually three, sometimes four, and occasionally five stout and pointed mouth papillae of which the outermost is slightly larger than the others, which are subequal. At the jaw angle there is an unpaired papilla, larger than the others, beneath which is a column of teeth.



a *b*

FIGURE 10.—*Ophioplinthaca clothilde,* type specimen: **a,** aboral view, × 2; **b,** oral view, × 2.

The first under arm plate is small, slightly broader than long, oblong or with a broadly obtuse angle on the distal border. The second is much larger, triangular, half again as broad as long, extending almost the whole way across the arm. It is just in contact with the first by its proximal angle. The following under arm plates are rhombic, twice as broad as long, extending almost entirely across the arm, and are separated from each other.

The upper arm plates are triangular, about as long as broad, with the distal border well-rounded, and are just in contact until far out on the arm where they become longer and are separated by the union of the aboral ends of the side arm plates.

The side arm plates have the distal half raised into a moderately high spine-bearing ridge; the ridges of the two plates of each pair are rather widely separated on the aboral side. The first side arm plates beyond the disk bear seven arm spines of which the uppermost is about as long as four arm segments, the next two are slightly shorter, and the lower four are considerably shorter. All the spines are very rough, being abundantly supplied with small prickles directed diagonally outward. In the outer part of the arm the number of spines falls to five of which the uppermost is slender and short, about as long as a single arm segment, the next is long and stout, as long as three and a half arm segments, the next is about half as long, and the two lowest are shorter.

The first tentacle pore has two large and broad scales of about equal size. Those following have a single narrower and sharply pointed scale with numerous prickles about its tip.

Type: cat. no. E.6907, USNM, from *Albatross* station 3981.

Albatross station 3981; in the vicinity of Kauai; Nawiliwili Light bearing N. 82° W., 4.2 miles distant; 1,163-757 meters; Globigerina ooze; June 10, 1902 (2, USNM, E.6907, E.6908).

Albatross station 4019; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 43° W., 8.1 miles distant; 1,342-748 meters; bottom temperature 3.22° C.; gray sand, Foraminifera, and rock; June 21, 1902 (17, USNM, E.6909).

Hawaiian Islands; *Albatross*, 1902 (1, USNM, E.6910).

Ophiologimus quadrispinus H. L. Clark, B. P. Bishop Mus., Bull. **27**: 90, 1925 (description; Laysan Island, 200 fathoms; *Tanager* station 4, April 10, 1923).

The disk is flat, pentagonal, 7 mm. in diameter, and the arms are about 30 mm. long.

The disk is covered with a uniform coating of fine imbricating scales which also extend over the entire interradial areas on the oral side, conceals all but a small rounded portion of the first upper arm plate, and entirely surrounds the second upper arm plate. In some radial areas a portion of the surface of the radial shields is visible as a narrow streak extending directly inward from each side of the arm base.

The peristomial area is circular. The oral shields are more or less semicircular, the outer border coinciding with the edge of the peristomial circle, the inner strongly convex, often with a very obtuse angle in the center. The rather large adoral shields have the outer edges straight and the inner gently concave to accommodate the oral shields; the inner angle on the outer end of the adoral shields is more or less produced inward around the ends of the oral shield, separating it from the first side arm plate.

The jaw plates are triangular, rather large, and bear seven small, pointed mouth papillae of which the innermost and outermost are somewhat larger than the others. At the outer end the row of mouth papillae is continued by two tentacle scales.

The first under arm plate is very small, variously shaped, mostly from rounded to squarish. The next two or three are much larger, squarish with slightly concave lateral borders, and those following become longer than broad; in the outer part of the arm, twice as long as broad. Terminally the proximal end gradually narrows to a point so that the under arm plates become narrowly fan-shaped. The under arm plates are in contact with each other throughout.

The upper arm plates are spatulate with the distal end semicircular and passing into the straight and converging sides; the proximal angle is truncated by the plate preceding.

The side arm plates are large and are without a raised spine-bearing ridge.

There are four smooth and evenly tapering arm spines of which the uppermost is the longest, about as long as a segment and a half, the others decreasing gradually to the lowermost, which slightly overlaps the base of the corresponding spine on the following side arm plate. In the terminal portion of the arms the number of spines falls to three, of which the uppermost and lowermost are similar and about as long as an arm segment and the median is slightly shorter and more slender.

The two tentacle scales are very delicate, subequal, longer than broad, with a broadly rounded tip.

Albatross station 4096; northeast approach to the Pailolo Channel between Maui and Molokai; Mokuhooniki Islet bearing S. 77° 30′ W., 7.0 miles distant; 497-523 meters; bottom temperature 7.39° C.; fine gray sand; July 22, 1902 (1, USNM, E.6911).

Albatross station 4100; Pailolo Channel; Mokuhooniki Islet bearing N. 35° W., 3.1 miles distant; 238-276 meters; bottom temperature 16.11° C.; coral sand, shells, and Foraminifera; July 23, 1902 (4, USNM, E.6912).

Tanager station 4; Laysan Island; 366 meters; April 10, 1923 (1, the type specimen, BM,[4] 478).

This species differs from *O. hexactis* from southern Japan in 83-158 fathoms in having the radial shields visible, at least in certain areas; in having five instead of six arms; in its larger upper arm plates, which are twice as large as the aboral portion of the side arm plates and are evenly and broadly rounded distally; in having four instead of three arm spines; and apparently in the finer scaling of the disk.

AMPHIURIDAE

Amphiura dino, new species (fig. 11, *a, b*).

The disk is 6 mm. in diameter, evenly concave in the interradial margins, and the arms are about 40 mm. long.

The radial shields are low triangular and extend somewhat more than halfway from the border of the disk to the center. They are about three times as long as broad, the greatest width being at the rounded obtuse angle in the middle of the outer side. They are just in contact at their outer ends, the inner borders from that point being parallel and very close together, separated by an exceedingly narrow line of plates.

There are four arm spines of which the lowermost is the longest, the uppermost is nearly as long, and the two central are shorter. In the attenuated distal portion of the arms the number of arm spines falls to three, of which the lowest is much longer than the central, which is slightly longer than the uppermost, and later to two, the lower half again as long as the upper.

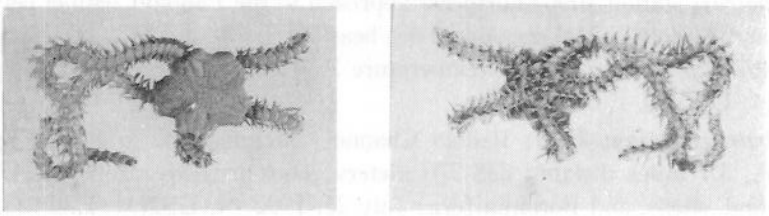
Type: cat. no. E.6913, USNM., from the Hawaiian Islands, collected by the *Albatross* in 1902.

Albatross station 4021; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 28° 30′ W., 9.5 miles distant; 523-729 meters; bottom temperature 6.66° C.; coral sand and Foraminifera; June 21, 1902 (2, USNM, E.6914).

[4] Bishop Museum.

Hawaiian Islands; *Albatross,* 1902 (1, USNM, E.6913).

Except for the broader radial shields, which are closer together, this species seems not to differ from *A. iris* Lyman from southern Japan in 420-775 fathoms, which has also been reported by Koehler [Siboga-Expeditie (15): 81, 1904] from betwen the Lucipara and Schildpad [Turtle] Islands in 1,595 meters. It may eventually prove to be merely a form of *A. iris.*



a *b*

FIGURE 11.—*Amphiura dino,* type specimen: **a,** aboral view, × 2; **b,** oral view, × 2.

Amphiura immira Ely, B. P. Bishop Mus., Bull. **176**: 35, 36, fig. 6, *a, b,* 1942 (Black Point, Oahu).

Albatross station 3984; in the vicinity of Kauai; Nawiliwili Light bearing N. 30° 30′ W., 3.5 miles distant; 433-300 meters; bottom temperature 8.44° C.; fine coral sand; June 10, 1902 (2, USNM, E.6915).

Black Point, Oahu (Ely).

In the larger specimen the disk is 8 mm. in diameter with the interradial borders rather deeply notched, slightly convex between the median notch and the arm bases. It is rather finely scaled, the scales becoming smaller toward the interradial borders and larger about the radial shields. The radial shields are separated by a very long, narrowly triangular plate that reaches from their distal ends almost to their bases, proximal to which are some smaller plates, not a single one as figured by Ely.

In the larger specimen the oral surface of the disk in the central portion is covered with numerous thin scales, leaving a more or less naked band above and below, bordering the edge of the disk and the oral shield. In the smaller specimen the oral interradial areas are naked except for a few small scattered scales below the central portion of the edge of the disk.

Immediately beyond the disk there are six arm spines, of which the lowest is the longest and stoutest, the next two are shorter, the two following are of the same length but more slender, and the uppermost is about as long as the lowest but more slender. The number soon drops to five with the next to the lowest the longest, markedly broadened and somewhat flattened and tapering to a sharp point, and the uppermost the smallest, scarcely half as long as the

longest. In the distal part of the exceedingly long arms there are three arm spines, of which the lowest is about as long as an arm segment, the uppermost is half as long, and the central one is intermediate.

The differences between these specimens and those described by Ely seem to be correlated with their much greater size, Ely's type specimen having been only 2.5 mm. in diameter of disk and being obviously immature, with the large primary plates still evident.

Ely found this species associated with *Distichophis clarki.*

Amphipholis squamata (Delle Chiaje).

Asterias squamata Delle Chiaje, Anim. sans Vert. Napoli, Mem. **3**: 74, 1828 (Naples).

Amphipholis squamata H. L. Clark, Mus. Comp. Zoöl., Mem. **25**(4): 242, 1915 (Hilo); B. P. Bishop Mus., Bull. **27**: 90, 1925 (Laysan Island, at water's edge, and two fathoms; Wake Island).—Edmondson, B. P. Bishop Mus., Special Pub. **22**: 69, 1933 (Laysan Island).—Ely, B. P. Bishop Mus., Bull. **176**: 36, 1942 (Black Point, Oahu; Laysan).

Laysan Island (H. L. Clark, Edmondson, Ely); same, 4 meters (H. L. Clark).

Oahu, Black Point (Ely).

Hawaii, Hilo (H. L. Clark).

Amphioplus cythera, new species (fig. 12, *a, b*).

The disk is 3.5 mm. in diameter and the arms are 20 mm. long.

The disk is circular, rather strongly convex, covered with rounded, subequal, thickened, slightly imbricated plates of which there are nine or 10 in a line from the center of the disk to the margin. The margin of the disk is delimited by the edges of the uppermost plates in the oral interradial areas which, though not produced, form a definite thin line. The radial shields are long-triangular, about three times as long as broad, and reach somewhat less than half way to the center of the disk. They are not quite in contact at the arm bases, and diverge slightly inward, their inner ends being about three times as far apart as the outer. They are separated by usually three plates of equal length but increasing in width inwardly.

The oral interradial areas are covered with plates similar to those of the aboral surface but much more strongly imbricated so that only the outer half is visible.

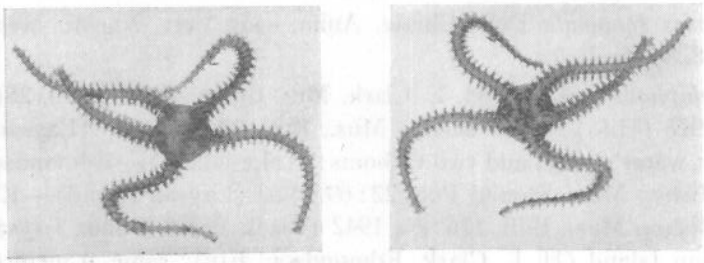
The oral shields are rhombic with the lateral angles broadly rounded, half again as broad as long. The adoral shields are rather narrow with parallel sides and the outer end broadened, the interradial angle being produced and curved around the end of the oral shield so as to separate it from the first side arm plate.

The jaw plates are triangular, smaller than the adoral shields. There are usually four mouth papillae of which the three outermost are subequal, rather large, about as broad as high, and well-rounded. The outermost is placed at right angles to the other two, and the two outermost are situated on the adoral shield. All three function as tentacle scales about the first tentacle pore. The innermost mouth papilla (sometimes two) is much smaller than the others. In addition to these mouth papillae there is, below (as viewed orally) the innermost of the large papillae, and on the inner side of the tentacle pore, a spine-like papilla directed parallel with the interradial axis toward

the center of the mouth. At the tip of the jaw there are four large well-rounded teeth.

The first under arm plate is trapezoidal, twice as broad as long, with the longest side distal. The following under arm plates are much larger, broadly fan-shaped with the sides incised by the tentacle pore. They are just in contact as far as the fifth, beyond which they become slightly separated by the side arm plates, this separation slowly increasing distally until in the outer portion of the arms they become five-sided, longer than broad, with the two lateral sides the longest, the straight distal end shorter, and the two proximal sides meeting at an obtuse angle.

The upper arm plates are triangular, twice as broad as long, with the distal edge broadly convex, and are slightly separated from each other. Distally they gradually become fan-shaped with broadly rounded lateral angles, relatively longer, somewhat swollen, and more widely separated.



a *b*

FIGURE 12.—*Amphioplus cythera*, type specimen: **a**, aboral view, × 3; **b**, oral view, × 3.

The side arm plate at the edge of the disk bears four arm spines which are about as long as an arm segment, subequal, the two lowest slightly stouter than the others. The next two side arm plates also bear four spines of which the uppermost is the longest, about as long as a segment and a half, evenly tapering, and the others are about as long as a segment, and swollen in the proximal two-thirds. The following side arm plates carry three spines, the uppermost evenly tapering, the two lower swollen in the proximal two-thirds. Farther out the uppermost and lowest are evenly tapering, the middle one much broadened and flattened in the basal two-thirds with a bluntly rounded tip beset with minute spinules.

There are two tentacle scales, that on the side arm plate about twice as large as that on the under arm plate.

The color in life was deep cadmium yellow, the disk marked with greenish.

Type: cat. no. E.6916, USNM, from the Hawaiian Islands, collected by the *Albatross* in 1902.

Albatross station 4066; Alenuihaha Channel, between Hawaii and Maui; Ka Lae o ka Ilio [Kailio] Point, Maui, bearing N. 79° 30′ W., 3.5 miles distant; 322-90 meters; bottom temperature 11.39° C.; rocky bottom; July 18, 1902 (2, USNM, E.6918).

Hawaiian Islands; *Albatross*, 1902 (10+, USNM, E.6916, E.6917).

This species appears to be allied to *A. ancistrota* (H. L. Clark), from which it differs in its much smaller size, fewer and more uniform scales, especially below, much broader mouth shields, and fewer arm spines, none of which are in the form of a hook.

In the specimens from *Albatross* station 4066 the first two arm segments beyond the disk bear four arm spines, those following, three. The second arm spine from the bottom is stouter than the others, swollen in the basal portion, at the tip with a minute point directed toward the disk at an angle of 90 degrees with the main axis.

Amphioplus caelatus Ely, B. P. Bishop Mus., Bull. **176**: 39, fig. 8, 1942 (Black Point, Oahu).

Black Point, Oahu. Found in a coral head with *Distichophis clarki* and *Amphiura immira* (Ely).

?**Amphiodia,** sp. H. L. Clark, B. P. Bishop Mus., Bull. **27**: 89, 1925 (Oahu; Waikiki Beach).

Clark recorded several specimens from Oahu, one of which was from Waikiki Beach. He said the species represented is "a short-armed *Amphiodia,* probably; the specimens are too young for certain generic determination. The smallest, with disk less than a millimeter in diameter, has no tentacle-scale and four arm spines; the others, which are only a trifle larger, have one tentacle-scale and five arm spines. It is therefore possible that two species are represented, but I think it more likely that simply growth stages of a single species are involved."

Amphiurid H. L. Clark, B. P. Bishop Mus., Bull. **27**: 89, 1925 (near Laysan Island; 200 fathoms).

Clark recorded an unidentified species dredged by the *Tanager* near Laysan Island in 200 fathoms. He said that "only arm fragments were preserved and these are obviously an amphiurid with excessively long arms."

OPHIACTIDAE

Ophiactis savignyi (Müller and Troschel).

Ophiolepis savignyi Müller and Troschel, System der Asteriden, 95, 1842 (Aegypten = Egypt).

Ophiolepis sexradiata Grube, Archiv für Naturgesch., Jahrg. 23, **1**: 343, 1857 (Horolulu = Honolulu).—Dujardin and Hupé, Histoire nat. zoophytes, Échinodèrmes, 244, 1862 (Honolulu [Sandwich]; from Grube).

Ophiactis sexradia Lyman, Illus. Cat. Mus. Comp. Zoöl. **1**: 12, 115, 1865 (Sandwich Islands).

Ophiactis savignyi Koehler, Bull. scient. de la France et de la Belgique, **41**: 311, 1907 (iles Sandwich).—H. L. Clark, Mus. Comp. Zoöl., Mem. **25**(4): 265, 1915 (Hawaiian Islands; also Pearl Harbor); B. P.

Bishop Mus., Bull. **27**: 91, 1925 (Wake Island; Johnston Island; Oahu).—Edmondson, B. P. Bishop Mus., Special Pub. **22**: 69, 70, fig. 32,*a*, 1933 (Kaneohe Bay; Pearl Harbor).—Ely, B. P. Bishop Mus., Bull. **176**: 42, fig. 10, *a, b*, 1942 (Kaneohe Bay; Pearl Harbor).

Albatross station 3872; Auau Channel, between Maui and Lanai; Mokuhooniki Islet bearing N. 3° E., 16.6 miles distant; 79-58 meters; bottom temperature 23.66° C.; yellow sand, pebbles, and coral; April 12, 1902 (4, USNM, E.6921).

Albatross station 3876; Auau Channel; Lahaina Light, Maui, bearing N. 60° 45′ E., 1.6 miles distant; 51-79 meters; bottom temperature 23.33° C.; sand and gravel; April 14, 1902 (11, USNM, E.6920, E.6922).

Oahu, Pearl Harbor: *Albatross,* April 23, 1902 (100+, USNM, E.6919, E.6925); Dr. McGrew's estate, Aiea; *Albatross,* July 8, 1902 (20+, USNM, E.6924).

Hawaii, Puako Bay: *Albatross,* July 12, 1902 (1, USNM, E.6923).

Previous records: Oahu (H. L. Clark, Edmondson), Honolulu (Grube, Dujardin and Hupé), Kaneohe Bay (Edmondson, Ely), Pearl Harbor (H. L. Clark, Edmondson, Ely). Hawaiian Islands (Lyman, Koehler).

The specimens from *Albatross* station 3872 all have five arms and slender arm spines; the color is light pinkish buff. There seems to be no reason, however, for considering these as specifically different from the others.

Some large specimens from Pearl Harbor, where this species abounds in the interstices of sponges, have the disk 5 mm. in diameter and the arms 32 mm. long; there are seven arm spines on the basal arm segments, the four uppermost very stout and conical. The specimen from Puako Bay has the disk 3 mm. in diameter and the five arms about 15 mm. long. The specimens from *Albatross* station 3876 have five arms and six arm spines.

Ophiactis dyscrita H. L. Clark, U.S. Nat. Mus., Bull. **75**: 137, fig. 52,*a-c*, 1911 (*Albatross* station 4937; Kagoshima Gulf, Japan, lat. 31° 13′ 00″ N., long. 130° 43′ 10″ E.; 58 fathoms).

Albatross station 4070; northeast coast of Maui; Puniawa Point bearing S. 81° 30′ E., 6.4 miles distant; 82-95 meters; bottom temperature 21.55° C.; fine gray sand; July 19, 1902 (2, USNM, E.6928).

Albatross station 4096; northeast approach to the Pailolo Channel; Mokuhooniki Islet bearing S. 77° 30′ W., 7.0 miles distant; 497-523 meters; bottom temperature 7.39° C.; fine gray sand; July 22, 1902 (14, USNM, E.6926).

Oahu: Pearl Harbor, Dr. McGrew's estate, Aiea; *Albatross,* July 8, 1902 (7, USNM, E.6927).

The disk is up to 4 mm. in diameter and the six arms are up to 20 mm. long. These specimens agree well with Clark's description. There are more scales on the disk, as would be assumed from the larger size. At the arm bases the three arm spines are of about the same length, the middle one slightly stouter than the others. Rarely are there four spines on the basal segments. On regenerating arms the middle spine is longer than the others, as described and figured by Clark in the smaller type specimen. In the extremely attenuated and flattened terminal portion of the arms the lowest arm spine is the longest and ends in a minute glassy hook. At the arm tips the spines are reduced to two, the lower much the larger and ending in a minute hook, at the base of which is a small accessory tooth followed by a row of smaller teeth or fine serrations.

Ophiactis modesta Brock, Zeitschr. für wiss. Zool. **47**(3) : 482, 1888 (Amboina).—Döderlein, Jena. Denkschr. **8** : pl. 15, figs. 5-5b, 1898 (Amboina). —Ely, B. P. Bishop Mus., Bull. **176** : 40, 1942 (Pearl Harbor, Kaneohe Bay).

Albatross station 3823; south coast of Molokai; Lae o Ka Laau Light bearing N. 34° W., 5.1° C.; 146-406 meters; bottom temperature 20.55° C.; fine sand and pebbles; April 1, 1902 (4, USNM, E.6930).

Albatross station 3876; Auau Channel, between Maui and Lanai; Lahaina Light, Maui, bearing N. 60° 45′ E., 1.6 miles distant; 51-79 meters; bottom temperature 23.33° C.; April 14, 1902 (11, USNM).

Albatross station 4066; Alenuihaha Channel, between Hawaii and Maui; Ka Lae o ka Ilio Point, Maui, bearing N. 79° 30′ W., 3.5 miles distant; 322-90 meters; bottom temperature 11.39° C.; rocky bottom; July 18, 1902 (11, USNM, E.6929, E.6932).

Albatross station 4070; northeast coast of Maui; Puniawa Point bearing S. 81° 30′ E., 6.4 miles distant; 82-95 meters; bottom temperature 21.55° C.; fine gray sand; July 19, 1902 (1, USNM, E.6933).

Albatross station 4076; northeast coast of Maui; Puniawa Point bearing S. 72° 30′ E., 6.7 miles distant; 104-124 meters; bottom temperature 21.22° C.; coarse sand, shells, and Foraminifera; July 21, 1902 (1, USNM, E.6931).

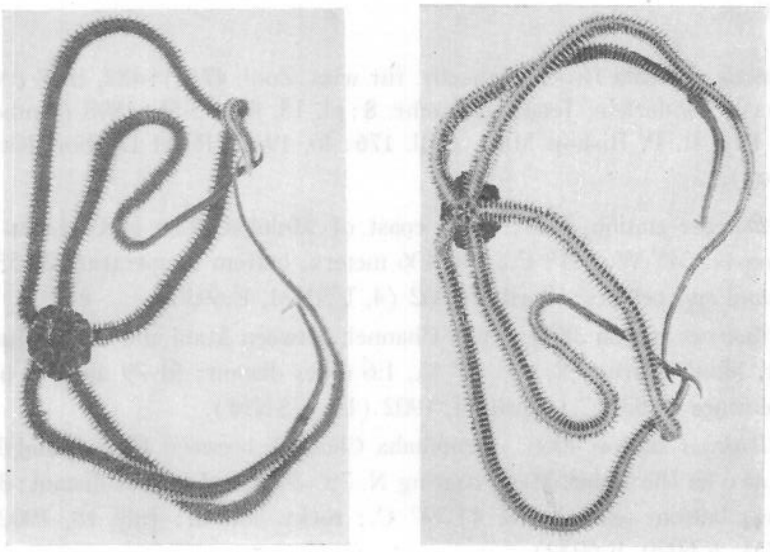
Oahu, Pearl Harbor and Kaneohe Bay (Ely).

The specimens from *Albatross* station 3823 have five arms and four or five arm spines. Those from *Albatross* station 3876 all have five arms; there are five or six arm spines. Of the specimens from *Albatross* station 4066, two have five arms, the remainder six; all have four arm spines. The specimen from *Albatross* station 4070 has six arms. That from *Albatross* station 4076 has six arms and four arm spines.

Ophiactis lethe, new species (fig. 13, *a, b*).

There are five arms. In one specimen the circular disk is 7 mm. in diameter, and the arms are 70 mm. long. In another the disk is 6 mm. in diameter and the arms are 60 mm. long.

The circular disk is covered with subequal scales of moderate size which become somewhat larger along the outer border of the radial shields and somewhat smaller toward the interradial edge. The radial shields extend about half way from the edge of the disk to the center of the aboral surface, considerably more if the disk shrinks in drying. They are narrow, about three times as long as broad. From their distal ends they increase slowly in width to about the middle, then taper regularly to a sharp inner angle. Their inner borders are straight, in contact at the outer end and diverging slightly inwardly. They are separated usually by three long and very narrow plates. There are ordinarily no spines on the disk, though in some specimens there may be a few.



a *b*

FIGURE 13.—*Ophiactis* lethe, type specimen: **a**, aboral view, × 1.5; **b**, oral view, × 1.5.

The oral interradial areas are naked. In the outer portion beneath the edge of the disk there are a few, perhaps 10 or 12, scattered small plates, each of which bears a sharp spine.

The oral shields are small, twice as broad as long, diamond-shaped with the lateral angles broadly rounded. The madreporite is much larger than the others, larger than the second under arm plate, and circular. The adoral shields are slightly larger than the oral shields and of approximately the same shape, not quite meeting below the oral shields; the inner borders of those of each pair lie in an almost straight line. The jaw plates are long, boomerang-shaped, the rounded inner angles separated by a wedge below the inner ends of the adoral shields. There are one or two rather large well-rounded or more or less pointed mouth papillae at the base of each jaw plate. There are seven teeth, the uppermost small and triangular and on a level with the outer surface of the jaw plates, the others larger and stouter with broadly truncated ends and increasing in size outward. The column of teeth is bordered laterally on each side by a prominent ridge on the jaw plate.

The arms are flattened and break away from the disk easily. The first under arm plate is three-lobed, about as long as broad. The two lateral lobes adjoin the ends of the jaw plates, and the distal lobe separates the ends of the adoral shields. There is a broad, rounded, median furrow in the proximal half. The second under arm plate is much larger and approximately circular. The following under arm plates are regularly octagonal, in the terminal portion of the arms becoming fan-shaped and slightly separated from each other.

The upper arm plates are very short, nearly four times as broad as long, with the proximal and distal borders straight and parallel and the lateral ends very roundedly pointed. In the terminal portion of the arms they become longer, rounded diamond-shaped, broader than long, and at the same time they decrease rapidly in size, becoming widely separated from each other.

At the base of the arms are seven arm spines, of which the second from the aboral end is the longest, about as long as two arm segments, and is slightly swollen in the basal portion. The uppermost is slightly shorter and more slender. The third is nearly the size of the second. The others are shorter, decreasing in length to the lowest, which is not much longer than the tentacle scale. The topmost spine gradually becomes shorter, and after about 20 segments is scarcely half the length of the second, and is conical in shape and roughened. The number of spines falls to six and then to five with the uppermost small, rough and peglike.

There is a single large rounded tentacle scale which in the terminal portion of the arms becomes narrower and pointed.

The color (dry) is brownish gray, the arms frequently and narrowly banded with darker, lighter on the oral side. The oral interradial areas are black. The colors in life were recorded as "variegated brown."

Type: cat. no. E.7009, USNM, from *Albatross* station 4072.

Albatross station 3849; south coast of Molokai; Lae o Ka Laau Light bearing N. 71° W., 21.9 miles distant; 133-79 meters; bottom temperature 19.77° C.; coarse sand, broken shells, and coral; April 8, 1902 (5, USNM, E.7014).

Albatross station 3850; south coast of Molokai; Lae o Ka Laau Light bearing N. 74° 15′ W., 22.2 miles distant; 79-121 meters; bottom temperature 22.05° C.; coarse sand, broken shells, and coral; April 8, 1902 (10, USNM, E.7011).

Albatross station 3875; Auau Channel, between Maui and Lanai; Mokuhooniki Islet bearing N. 14° 30′ E., 13.7 miles distant; 119-62 meters; bottom temperature 21.55° C.; fine gray sand; April 12, 1902 (64, USNM, E.7016).

Albatross station 4066; Alenuihaha Channel, between Hawaii and Maui; Ka Lae o ka Ilio Point, Maui, bearing N. 79° 30′ W., 3.5 miles distant; 322-90 meters; bottom temperature 11.39° C.; rocky bottom; July 18, 1902 (2, USNM, E.7013).

Albatross station 4070; northeast coast of Maui; Puniawa Point bearing S. 81° 30′ E., 6.4 miles distant; 82-95 meters; bottom temperature 21.55° C.; fine gray sand; July 19, 1902 (8, USNM, E.4010).

Albatross station 4071; northeast coast of Maui; Puniawa Point bearing S. 78° 30′ E., 95-102 meters; bottom temperature 22.73° C.; fine coral and volcanic sand; July 19, 1902 (5, USNM, E.7012).

Albatross station 4072; northeast coast of Maui; Puniawa Point bearing S. 74° 30′ E., 7.1 miles distant; 102-108 meters; bottom temperature 23.00° C.; coarse coral sand and Foraminifera; July 19, 1902 (48, USNM, E.7009, E.7017, E.7018).

Hawaiian Islands, *Albatross,* 1902 (1, USNM, E.7015).

The specimens from *Albatross* station 3875 were labeled "found in sponges," and those from station 4071 were said to be "from a big sponge."

Small individuals with the disk 3 mm. in diameter and the arms 20 mm. long have the oral interradial areas completely covered with rounded plates, each with a slender spine. The under arm plates are squarish or a little longer than broad with rounded angles; the upper arm plates are relatively longer than in larger individuals. There are six arm spines on the basal arm segments.

This species is closely related to *O. hemiteles* H. L. Clark, from Torres Strait, from which it differs in the much shorter upper arm plates, longer arm spines (of which the second from the aboral surface, instead of the third or fourth, is the longest), and in the color, the arms being dark with usually three rather large rounded spots on every third upper arm plate, giving a narrowly banded appearance.

Ophiactis kröyeri Lütken, Vidensk. Meddelelser, 24, 1856 (Callao, Peru).—H. L. Clark, Mus. Comp. Zoöl. Mem. **25**(4) : 262, 1915 (Honolulu).

Ophiactis fragilis Ljungman, Öfv. K. Vet.-Akad., Förh. **23**(6) : 164, 1866 (ad insulas havaicas).

Ljungman recorded this species simply from the Hawaiian Islands. H. L. Clark listed a specimen from Honolulu in the Museum of Comparative Zoölogy.

Ophiactis kröyeri is common on the west coast of South America from Payta, Peru, south to Talcahuano, Chile. Clark wrote that "there is no doubt that the specimens on which *O. fragilis* is based and which were said to be from the Hawaiian Islands are identical with South American specimens. If *O. kröyeri* really occurs at the Hawaiian Islands, it was probably introduced on the bottom of some ship. So far as I know there are no recent records." It is most probable that the original specimens of *O. fragilis* were mislabeled.

Amphiactis lycidas, new species (fig. 14, *a, b*).

The disk is 3.5 mm. in diameter, pentagonal with broadly rounded angles, flat. The arms are all broken off near the disk.

The disk is covered with rather large scales of various sizes of which there are five or six under a line from the center to the interradial border. The radial shields are short and broad, irregularly rounded triangular, from slightly longer than broad to about half again as long as broad. They are in contact for one-fourth to one-half their length, inwardly diverging at an angle of somewhat more than 45 degrees. Their inner spines are

separated by a single triangular plate of the same size as the larger plates of the aboral surface of the disk.

The oral interradial areas are covered by rather large subequal imbricating plates, usually about half of each being visible.

The oral shields are triangular with the lateral angles broadly rounded, broader than long.

The adoral shields are large, wedge-shaped or with parallel sides, broadly joined below the oral shields; the outer adradial angle usually very slightly separates the oral shield from the first side arm plate.

The jaw plates are small, triangular, and extend outward somewhat less than half the length of the adoral shields. They carry three or four mouth papillae of which the outermost is large and rounded, the next is somewhat smaller and more sharply rounded, and the innermost one or two are much smaller.

The teeth are large and pointed.

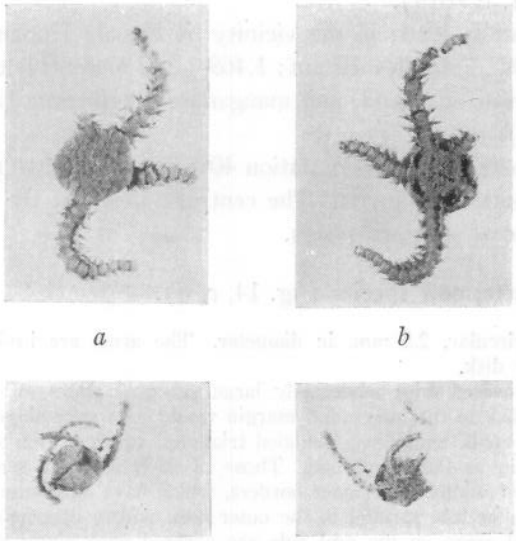


FIGURE 14.—**a, b,** *Amphiactis lycidas,* type specimen: *a,* aboral view, × 3; *b,* oral view, × 3. **c, d,** *A. astarte,* type specimen; *c,* aboral view, × 3; *d,* oral view, × 3.

The first under arm plate is small, broader than long, and is variously shaped. The second is much larger, nearly twice as broad as long, with the proximal border in the form of an obtuse angle and only about one-third as long as the convex distal border; the lateral border is deeply excavated by the tentacle pore. The following under arm plates are similar, distally slowly becoming longer with the proximal border forming an angle of about 90 degrees, and less distally. The second under arm plate is just in contact with the first; those following are very slightly separated, the degree of separation slowly increasing distally.

The first upper arm plate that is wholly visible beyond the disk is broadly fan-shaped, twice as broad as long, and is not quite in contact with that preceding, partially visible beyond the edge of the disk. The following upper arm plates are similar, slowly becoming relatively longer and more widely separated distally.

The side arm plates have the outer half rather abruptly produced into a spine-bearing ridge. The side arm plate just visible beyond the disk bears three subequal spines which are about as long as an arm segment and are swollen in the proximal half. The next two side arm plates bear four spines, of which the uppermost is half again as long as the others, which are subequal and about as long as an arm segment, and is proportionately stouter. The following side arm plates bear three subequal spines which are swollen in the basal half.

There are two tentacle scales of which the outer, on the side arm plate, is larger than the inner, on the under arm plate. The latter slowly decreases in size distally and finally disappears.

Type: cat. no. E.7019, USNM, from *Albatross* station 3981.

Albatross station 3981; in the vicinity of Kauai; Nawiliwili Light bearing N. 82° W., 4.2 miles distant; 1,163-757 meters; Globigerina ooze; June 10, 1902 (1, USNM, E.7019).

Albatross station 4018; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 57° W., 7.4 miles distant; 1,469-1,342 meters; bottom temperature 2.94° C.; Foraminifera, sand, and manganese fragments; June 21, 1902 (1, USNM, E.7020).

The specimen from *Albatross* station 4018 is smaller than the type, the disk being only 2.3 mm. in diameter. The central portion of the disk is occupied by a large rosette of subequal plates.

Amphiactis astarte, new species (fig. 14, *c, d*).

The disk is circular, 2.5 mm. in diameter. The arms are broken off at varying distances from the disk.

The disk is covered with moderately large subequal plates, of which a line from the center of the disk to the interradial margin would pass over about eight. The radial shields are rather small, irregularly rounded triangles, varying from slightly longer than broad to half again as long as broad. Those of each pair are separated distally for nearly or quite their width, their inner borders, which have an obtuse angle at about the middle, being more or less parallel in the outer half, widely divergent in the inner half.

The interradial areas on the oral side are covered with plates resembling those of the aboral surface which are smaller along the borders than in the central portion.

The oral shields are triangular with broadly rounded lateral angles, distinctly broader than long. From the rounded lateral angles the outer border runs inward at an angle of about 45 degrees with the interradial axis for a short distance to the straight median portion, which is equal in length to the two oblique portions combined.

Along the inner sides of the oral shields the adoral shields are very narrow with the sides parallel or nearly so, but at the lateral angles of the oral shields they become greatly expanded so that the outer portion extends from the first under arm plate, the entire lateral margin of which it borders, to the genital slit; the adoral shields, therefore, border the oral shields all around except for the straight central portion of the distal edge. The adradial border of the expanded ends of the adoral shields runs from the first side arm plate inward along the entire side of the first under arm plate, and the abradial border, which is about half as long, separates the oral shield from the first side arm plate. The distal border, which is about as long as the adradial border, is straight and at right angles to both the adradial and abradial borders.

The jaw plates are rather large, triangular, about three times as long as high. There is a prominent tubercle just proximal to the inner angle of the oral shield at the junction of the two adoral shields and the two jaw plates.

There are four mouth papillae, the outermost, which is large and oval, situated on the adoral shield, the others which, though broad and in lateral contact, are smaller and more or less pointed, are situated on the jaw plate. The teeth are small and sharply pointed.

The first under arm plate is small and very narrow, twice as long as broad, crowded between the expanded ends of the adoral shields. The second is much larger, broader distally than proximally, the proximal border an obtuse angle, the lateral borders strongly excavated by the tentacle pores, and the distal border straight or with a slight median notch. It is separated from the first. The following under arm plates are similar, soon becoming longer, much longer than broad, and rather widely separated.

The upper arm plates are fan-shaped, at first about as broad as long, and are well-separated from each other. They rather rapidly decrease in size, becoming broader than long and separated by their own length, and in the outer part of the arm separated by twice their length or more.

The lateral profiles of the pairs of side arm plates diverge slowly and regularly so that the distal ends of each pair slightly overlap the bases of the next pair.

The side arm plates at the base of the arm bear three arm spines of which the uppermost, which is the longest, is somewhat less than an arm segment in length, the lowermost is of about the same length but slightly stouter, and the middle one is shorter. Farther out along the arm are two slender arm spines which are about half as long as an arm segment.

There is a single large oval tentacle scale, rarely two on the first pore.

The color (dry) is white.

Type: cat. no. E.7021, USNM, from *Albatross* station 4100.

Albatross station 4100; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing N. 35° W., 3.1 miles distant; 238-276 meters; bottom temperature 16.11° C.; coral sand, shells, and Foraminifera; July 23, 1902 (1, USNM, E.7021).

OPHIOTRICHIDAE

Ophiothrix demessa Lyman, Boston Soc. Nat. Hist., Proc. **8**: 82,1861 (Sandwich Islands; Kingsmill Islands).—Lyman, Illus. Cat. Mus. Comp. Zoöl. **1**:13, 172, 1865 (Hilo; French Frigate Shoal; Maui).—H. L. Clark, Mus. Comp. Zoöl., Mem. **25**(4): 270, 1915 (Hilo; Maui; French Frigate Shoal); B. P. Bishop Mus., Bull. **27**: 91, 1925 (Pearl and Hermes Reef; Laysan Island, 12-20 fathoms; Oahu; Molokai).—Edmondson, B. P. Bishop Mus., Special Pub. **22**: 69, 1933 (Hawaii; widely distributed among the islands).—Ely, B. P. Bishop Mus., Bull. **176**: 44, 45, fig. 11,*a,b,* 1942 (Black Point; Waikiki).

Albatross station 3873; Auau Channel, between Maui and Lanai; Mokuhooniki Islet bearing N. 5° E., 58-66 meters; bottom temperature 23.66° C.; coral and pebbles; April 12, 1902 (1, USNM, E.7024).

Albatross station 3962; in the vicinity of Laysan Island; Laysan Island Light bearing N. 56° E., 5.2 miles distant; 29 meters; white sand and coral; May 22, 1902 (1, USNM, E.7033).

Albatross station 3968; off French Frigate Shoal (lat. 23° 46′ 00″ N., long. 166° 18′ 55″ W.); 26-30 meters; coarse sand and coral; May 29, 1902 (5, USNM, E.7026).

Albatross station 3969; off French Frigate Shoal (lat. 23° 45′ 50″ N., long. 166° 20′ 15″ W.); 27-29 meters; coarse sand, shells, and coral; May 29, 1902 (6, USNM, E.7034).

Albatross station 4032; Penguin Bank, off south coast of Oahu; Diamond Head Light bearing N. 19° W., 20.0 miles distant; 49-53 meters; fine coral sand and Foraminifera; July 9, 1902 (10, USNM, E.7022).

Albatross station 4033; Penguin Bank; Diamond Head Light bearing N. 19° W., 20.8 miles distant; 53-51 meters; fine coral sand and Foraminifera; July 9, 1902 (3, USNM, E.7025).

Albatross station 4034; Penguin Bank; Diamond Head Light bearing N. 19° W., 21.5 miles distant; 51-26 meters; fine coral sand and Foraminifera; July 9, 1902 (7, USNM, E.7023).

Albatross station 4146; in the vicinity of Moku Manu; center of island bearing S. 62° W., 0.5 mile distant; 42-47 meters; bottom temperature 25.94° C.; corallines, coarse sand, and Foraminifera; August 5, 1902 (2, USNM, E.7030).

Albatross station 4147; in the vicinity of Moku Manu; center of island bearing S. 21° W., 2.0 miles distant; 47 meters; bottom temperature 23.28° C.; coral and corallines; August 5, 1902 (3, USNM, E.7027).

Albatross station 4160; in the vicinity of Moku Manu; center of island bearing S. 83° E., 3.8 miles distant; 57-71 meters; bottom temperature 25.55° C.; coral and corallines; August 7, 1902 (1, USNM, E.7029).

Albatross station 4161; in the vicinity of Moku Manu; center of island bearing S. 75° E., 5.0 miles distant; 71-334 meters; bottom temperature 23.28° C.; coral and corallines; August 7, 1902 (1, USNM, E.7031).

Albatross station 4167; in the vicinity of Moku Manu; center of island bearing N. 78° 30′ E., 11.6 miles distant; 33-37 meters; coral sand; August 8, 1902 (3, USNM, E.7032).

Hawaii: Puako Bay, *Albatross,* July 12, 1902 (1, USNM, E.7028).

Oahu (H. L. Clark, 1925); Black Point (Ely, 1942); Waikiki (Ely, 1942).

Hawaii: Hilo (Lyman, 1865; H. L. Clark, 1915).

Maui (Lyman, 1865; H. L. Clark, 1915).

Molokai (H. L. Clark, 1925).

Laysan Island, 12-20 fathoms (H. L. Clark, 1925).

Pearl and Hermes Reef (H. L. Clark, 1925).

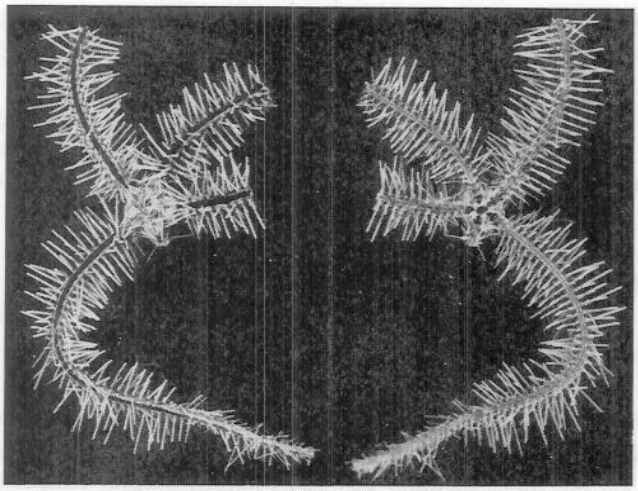
French Frigate Shoal (Lyman, 1865; H. L. Clark, 1915).

Hawaiian Islands (Lyman, 1861; Edmondson, 1933).

Ely (17) says that this species is found within coral heads at Black Point and Waikiki but is not common. Edmondson (16) writes that it is widely distributed among the Hawaiian Islands. Fisher says that in the specimens from station 4032 the disk was greenish with a small red central pentagon from which red radial lines proceeded to the arm bases; the arms were yellowish banded with coral red.

Ophiothrix lepidus hawaiiensis, new subspecies (fig. 15, *a, b*).

The disk is stellate, up to 10 mm. in diameter. This subspecies, in general, resembles *O. lepidus lepidus*, but the radial shields are narrower; the concretions on the disk are much smaller, and all bear a long slender spine; the brown middorsal line on the arms is much broader; and the arm spines, the uppermost of which at the base of the arms reach 9 mm. in length, are glassy white and unbanded.



a *b*

FIGURE 15.—*Ophiothrix lepidus hawaiiensis,* type specimen: **a,** aboral view, natural size; **b,** oral view, natural size.

The radial shields are 4 mm. long and 1 mm. broad at the point of greatest width, which is about one-third the distance from the inner to the outer end; the border from the angle marking the greatest width to the distal end is less strongly concave than it is in *O. l. lepidus*. Except for the radial shields the disk is naked and is sparsely studded with small oval concretions, all of which bear a long slender spine with a few minute and widely scattered spinules. In *O. l. lepidus* the disk is rather thickly studded with much larger concretions of which those in the central portion and between the radial shields of each pair bear long spines, those beyond the outer angles of the radial shields mostly bearing only small knobs or bosses. The interradial areas below are naked except for a few scattered small more or less conical concretions.

Fisher wrote concerning the specimens from station 4046 that in life the upper surface of the disk was dark madder brown in the central part with a rim of coral red; a line along each side of the star on the disk and the lateral portions of the arms were yellow; the stripe along the center of the arms was dark umber; the spines were glassy, on one specimen giving a grayish cast to the top of the disk. The under side was pale "light red" (Winsor and Newton).

The largest of the specimens from station 4072 had the disk pinkish brown with a star in the center reaching to the arm bases. The star was outlined with lines of white, inside of which was a band of orange, the center of the marking being purplish. The arms of the specimens from this station were brown above with yellow spots at the bases of the white spines. On the largest individual these spots were pink. Small specimens had the same markings, but were greenish in the center of the disk, and the disk as a whole was light greenish and brown.

Type: cat. no. E.7041, USNM, from *Albatross* station 3845.

Albatross station 3845; south coast of Molokai; Lae o Ka Laau Light bearing N. 69° 30′ W., 18.1 miles distant; 110-117 meters; bottom temperature 21.66° C.; coarse sand, pebbles, and shells; April 8, 1902 (2, USNM, E.7041, E.7042).

Albatross station 3846; south coast of Molokai; Lae o Ka Laau Light bearing N. 69° 45′ W., 19.1 miles distant; 117-110 meters; bottom temperature 21.94° C.; coarse brown sand, shells, and gravel; April 8, 1902 (1, USNM, E.7038).

Albatross station 3939; in the vicinity of Laysan Island; Laysan Island Light bearing S. 89° 30′ E., 8.1 miles distant; 298-108 meters; bottom temperature 14.17° C.; white sand, broken shells, and rock; May 16, 1902 (2, USNM, E. 7039).

Albatross station 4046; west coast of Hawaii; Kawaihae Light bearing N. 52° E., 3.4 miles distant; 269-130 meters; bottom temperature 15.00° C.; coral sand and Foraminifera; July 11, 1902 (8, USNM, E.7035, E.7037).

Albatross station 4072; northeast coast of Maui; Puniawa Point bearing S. 74° 30′ E., 7.1 miles distant; 102-108 meters; bottom temperature 23.00° C.; coarse coral sand and Foraminifera; July 19, 1902 (4, USNM, E.7036).

Albatross station 4076; northeast coast of Maui; Puniawa Point bearing S. 72° 30′ E., 6.7 miles distant; 104-124 meters; bottom temperature 21.22° C.; coarse sand, shells, and Foraminifera; July 21, 1902 (1, USNM, E.7040).

The specimen from station 4076 is noted as having been taken from a sponge.

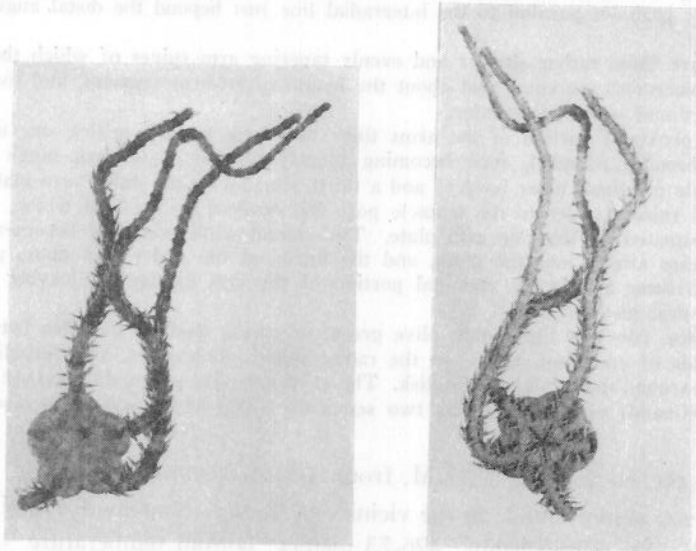
Fisher wrote that "There was a distinct respiratory movement on the disk of these animals [from station 4046]. The top of the disk rose and fell as the interior was filled, in a more or less rhythmic manner."

OPHIOCHITONIDAE

Ophioplax melite, new species, (fig. 16, *a, b*).

The disk is 4.5 mm. in diameter and the arms are 23 mm. long. The disk is lobate with a slight notch in the middle of each interradius, broadly and evenly rounded between the notches. It is covered with medium-sized subequal thin imbricating plates, about 15 of which would lie under a line from the circular central plate, which is markedly larger than the others, to the interradial notch. The radial shields are small and short, more or less triangular, from half again to twice as long as broad, and are separated by about their own width, their inner borders being parallel. On the edge of the disk

between the radial shields is a large plate spanning the whole distance between the shields and extending inward for one-third to one-half the length of the shields. This is followed by smaller plates resembling those on the general surface of the disk. The edge of the disk is densely covered with granules which pass in a narrow band over the arm bases and extend inward for a short distance in the middle of the interradial areas.



a *b*

FIGURE 16.—*Ophioplax melite,* type specimen: **a,** aboral view, × 3; **b,** oral view, × 3.

The oral interradial areas, including the genital plates, are densely covered with granules, which reach to the oral shields.

The oral shields are rounded triangular, about as long as broad. The adoral shields are very narrow, and their attenuate apices do not quite meet beneath the inner angle of the oral shield. Their outer ends are broadened, with the interradial angle produced and passing around the lateral angle of the oral shield, separating it from the first side arm plates.

The jaw plates are triangular and of moderate size.

There are five mouth papillae of which the outermost, attached to the outer end of the adoral shield, borders the first under arm plate and, running upward into the mouth cavity, is produced into a point at about the middle of the second. The second is about as long as broad or somewhat longer than broad, and is rounded oblong. The other three are much smaller, subconical and more or less sharply pointed; the innermost is the smallest. There is a median, terminal, unpaired papilla resembling those on either side. There are three large broad teeth with the inner edge almost straight.

The first under arm plate is triangular, slightly broader than long. The next is much larger, about as broad as long or somewhat broader than long, with the lateral sides somewhat excavated by the tentacle pore, the proximal border straight or very slightly concave, and the distal border slightly convex. The following under arm plates are longer than broad with the proximal border an obtuse angle, the lateral borders strongly concave, and the distal border moderately convex. After about the sixteenth the under arm plates may become very slightly separated by the side arm plates, and their length slowly increases.

The upper arm plates are fan-shaped with broadly rounded lateral angles and a broadly truncated proximal angle, somewhat broader than long. They become slowly longer, finally longer than broad, and in the distal portion of the arm are slightly separated.

The side arm plates are of moderate size. The lateral borders are parallel in the proximal half and divergent in the distal so that the outer end of each pair overlaps the base of the pair following. The first side arm plate bears an isolated and conspicuous row of three granules parallel to the interradial line just beyond the distal angle of the adoral shield.

There are three rather slender and evenly tapering arm spines of which the uppermost and lowermost are equal and about the length of an arm segment, and the middle one is longer and somewhat stouter.

In the proximal portion of the arms there are three tentacle scales, one unusually large and broadly rounded, soon becoming bluntly pointed; a second, much smaller, situated at its proximal inner border; and a third, situated on the under arm plate, forming a broad raised border to the tentacle pore and covered by the first which, with the second, is situated on the side arm plate. The second scale gradually becomes smaller and disappears after about the tenth, and the third, on the under arm plate, gradually becomes narrower and in the terminal portion of the arm disappears, leaving only the large scale first mentioned.

The color (dry) is light, dull, olive green, becoming dark in the area between the radial shields of each pair, white on the radial shields themselves, and very light in a broad band around the border of the disk. The arms are olive green, darker than the disk, with darker bands usually involving two segments which are separated by about three segments.

Type: cat. no. E.7043, USNM, from *Albatross* station 4100.

Albatross station 3982; in the vicinity of Kauai; Nawiliwili Light bearing N. 68° W., 1.6 miles distant; 426-73 meters; bottom temperature 9.17° C.; coarse brown coral sand and shells; June 10, 1902 (1, USNM, E.7045).

Albatross station 4066; Alenuihaha Channel, between Hawaii and Maui; Ka Lae o Kailio Point, Maui, bearing N. 79° 30′ W., 3.5 miles distant; 322-90 meters; bottom temperature 11.39° C.; rocky bottom; July 18, 1902 (1, USNM, E.7044).

Albatross station 4100; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing N. 35° W., 3.1 miles distant; 238-276 meters; bottom temperature 16.11° C.; coral sand, shells, and Foraminifera; July 23, 1902 (1, USNM, E.7043).

It is possible that in life the aboral surface of the disk was covered with granules, but there is no evidence of this, and the distinctive color pattern would seem to suggest that it was normally naked, as in *O. lamellosa* Matsumoto.

As in *O. lamellosa,* the primary plates in this species may be made out, though they are not very noticeable. *Ophioplax melite* differs from *O. lamellosa* in the less widely separated radial shields, those of each pair having fewer scales between them; the much narrower adoral shields; the narrower and well-spaced inner mouth papillae; the presence of two evident tentacle scales (plus another concealed) for some distance out along the arm; and, apparently, in having somewhat longer arm spines.

Ophionereis porrecta Lyman, Boston Soc. Nat. Hist., Proc. **7**: 261, 1860 (?Florida).—Lyman, Illus. Cat. Mus. Comp. Zoöl. **1**: 147, 148, figs. 14, 15, 1865 (detailed descriptions; ?Atlantic coast of America).—Verrill, Boston Soc. Nat. Hist., Proc. **12**: 390, 1869 (Maui).—Lyman, Mus. Comp. Zoöl., Bull. **1** (10): 312, 1869, footnote (Verrill has shown that *O. porrecta* is from the Pacific Islands).—Lyman, Challenger Reports, Zoology **5** (14): 162, 305, 1882 (Honolulu reefs).—H. L. Clark, Mus. Comp. Zoöl., Mem. **25** (4): 289, 1915 (Honolulu, 18 fathoms; Maui; Hilo).—H. L. Clark, B. P. Bishop Mus., Bull. **27**: 91, 1925 (Ocean Island; Kawela Bay, Oahu).—Edmondson, B. P. Bishop Mus., Special Pub. **22**: 70, 1933 (Hawaiian Islands; Kure [Ocean Island]).—Ely, B. P. Bishop Mus., Bull. **176**: 49, 50, fig. 13,*a,b,* 1942 (no Hawaiian localities given).

Ophionereis squamata Ljungman, Öfv. K. Vet.-Akad. Förh. **23** (9):310, 1866 (Honolulu).

Albatross station 3939; in the vicinity of Laysan Island; Laysan Island Light bearing S. 89° 30′ E., 8.1 miles distant; 298-108 meters; bottom temperature 14.17° C.; white sand, broken shells, and rock; May 16, 1902 (1, USNM, E.7055).

Albatross station 4031; Penguin Bank, south coast of Oahu; Diamond Head Light bearing N. 20° W., 18.0 miles distant; 49-51 meters; fine coral sand, Foraminifera, and coral; July 9, 1902 (1, USNM, E.7053).

Albatross station 4032; Penguin Bank; Diamond Head Light bearing N. 19° W., 20.0 miles distant; 49-53 meters; fine coral sand and Foraminifera; July 9, 1902 (2, USNM, E.7049, E.7054).

Albatross station 4033; Penguin Bank; Diamond Head Light bearing N. 19° W., 20.8 miles distant; fine coral sand and Foraminifera; July 9, 1902 (4, USNM, E.7046).

Albatross station 4034; Penguin Bank; Diamond Head Light bearing N. 19° W., 21.5 miles distant; 51-26 meters; fine coral sand and Foraminifera; July 9, 1902 (2, USNM, E.7050).

Albatross station 4146; in the vicinity of Moku Manu; center of island bearing S. 62° W., 0.5 mile distant; 42-47 meters; bottom temperature 25.94° C.; coralline, coarse sand, and Foraminifera; August 5, 1902 (3, USNM, E.7047).

Albatross station 4147; in the vicinity of Moku Manu; center of island bearing S. 21° W., 2.0 miles distant; 47 meters; bottom temperature 23.28° C.; coral and corallines; August 5, 1902 (5, USNM, E.7048).

Albatross station 4160; in the vicinity of Moku Manu; center of island bearing S. 83° E., 3.8 miles distant; 57-71 meters; bottom temperature 25.55° C.; coral and corallines; August 7, 1902 (2, USNM, E.7052).

Albatross station 4167; in the vicinity of Moku Manu; center of island bearing N. 78° 30′ E., 11.6 miles distant; 33-37 meters; August 8, 1902 (1, USNM, E.7051).

Oahu: Mokuleia, shallow water on reef (Otto Degener, 1938) (1, USNM, E.5699); Honolulu (Ljungman, 1866); Honolulu reefs (Lyman, 1882); Honolulu, 18 fathoms (H. L. Clark, 1915); Kawela Bay (H. L. Clark, 1925).

Hawaii: Hilo (H. L. Clark, 1915).

Maui (Verrill, 1869; H. L. Clark, 1915).

Kure (H. L. Clark, 1925; Edmondson, 1933).

Hawaiian Islands (Edmondson, 1933; Ely, 1942).

The uppermost arm spine is usually much broader than the others, with parallel sides or more or less spatulate, and with a broadly rounded tip.

Fisher noted that in the specimen from station 4031 the disk was greenish, the arms barred with light brown. In one of the specimens from station 4032 the disk is mottled with greenish, and the arms are cream above, barred with pale brown. In the specimens from station 4033 the disk is plain light to heavily mottled, and the arms are lightly to heavily barred.

Ophionereis dubia (Müller and Troschel).

Ophiure Savigny, Description de l'Égypte, Échinodèrmes, pl. 1, fig. 3, 1809-1825.

Ophiolepis dubia Müller and Troschel, System der Asteriden, 94, 1842 (Aegypten).

Ophionereis crassispina Ljungman, Öfv. K. Vet.-Akad., Förh. 23 (9): 311, 1866 (Honolulu).

Ophionereis dubia Koehler, Bull. scient. de la France et de la Belgique 41: 315, 1907 (îles Sandwich).

Oahu, Honolulu (Ljungman).

Hawaiian Islands (Koehler).

Ophiodesmus degeneri, new species (fig. 17, *a, b*).

The disk is 5 mm. in diameter, circular, slightly convex, covered with large and slightly swollen scales, of which there are 12-14 from the center to the interradial border. In the center of the disk, in an area 1.5-2 mm. in diameter, the scales imbricate outwardly. From this area a single or partially double row of similar scales, imbricating outwardly, runs along the center of each interradius to the border of the disk. Bordering this line the scales imbricate laterally, toward the radial areas. From the arm bases, an irregular double line of scales, somewhat larger than the others on the disk, and imbricating outwardly, run about half way to the center. The marginal scales are scarcely, or not at all, larger than those adjacent. In the center of the disk there is a circular central scale surrounded by, and partially overlapping, five similar scales interradially placed.

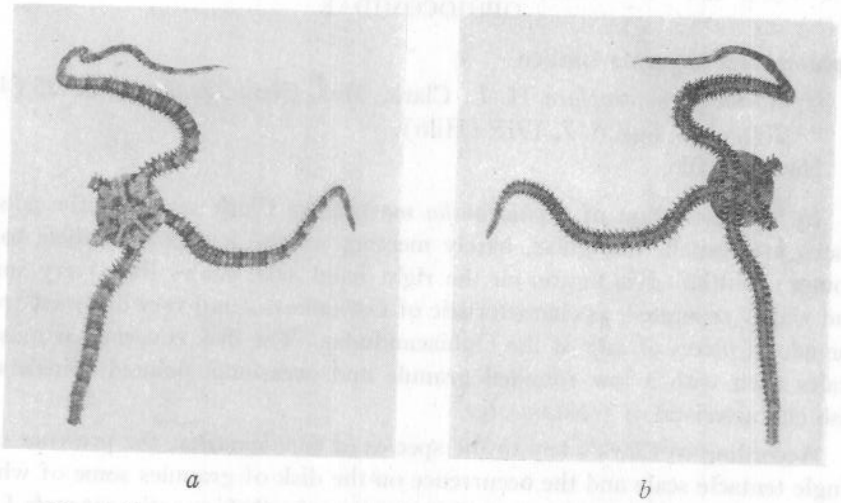
On the oral interradial areas the scales in the median line imbricate toward the mouth, the lateral scales, which decrease slowly in size toward the genital slits, imbricating toward the latter. The genital slits are bordered by a row of closely set small papillae, and there is a scattered group of about a dozen papillae on the inner end of the interradial areas just beyond the oral shields.

The arms are short, about 33 mm. long. They increase gradually in width to about the tenth upper arm plate, thence tapering distally. The upper arm plates are about twice as broad as long with the lateral edges strongly rounded and passing smoothly into the slightly convex distal border. The supplementary arm plates have the distal border strongly and evenly rounded, and passing smoothly over into the less strongly convex outer border. The side arm plates are very short, wholly lateral, and not visible aborally.

Arm spines three, about the same length, as long as a segment, the lowest somewhat more slender and less roughened than the other two.

Mouth papillae four, closely set, the outermost twice as large as the others and trapezoidal.

The color (dry) is brownish white, the disk sparsely to heavily mottled with pale brown, the arms with frequent narrow brown cross bands.



a *b*

FIGURE 17.—*Ophiodesmus degeneri*, type specimen: a, aboral view, × 2; b, oral view, × 2.

Type: cat. no. E.7056, USNM, from *Albatross* station 4160.

Albatross station 3969; off French Frigate Shoal (lat. 23° 45′ 50″ N., long. 166° 20′ 15″ W.); 27-29 meters; coarse sand, shells, and coral; May 29, 1902 (1, USNM, E.7059).

Albatross station 4033; Penguin Bank, south coast of Oahu; Diamond Head Light bearing N. 19° W., 20.8 miles distant; 53-51 meters; fine coral sand and Foraminifera; July 9, 1902 (1, USNM, E.7057).

Albatross station 4160; in the vicinity of Moku Manu; center of island bearing S. 83° E., 3.8 miles distant; 57-71 meters; bottom temperature 25.55° C.; coral and corallines; August 7, 1902 (1, USNM, E.7056).

Oahu (F. E. Lewis, September 11, 1939) (1, USNM, E.6329); shallow water on reef at Mokuleia (Otto Degener, 1938) (1, USNM, E.7058).

From *Ophiodesmus amphilogus* Ziesenhenne, from Cerros Island, Lower California in 10-15 fathoms, the type and only other known species of the

genus, *O. degeneri* differs in the shorter and broader upper arm plates; the larger supplementary arm plates; the narrower radial shields; the uniform size of the plates in the interbrachial areas on the oral surface; the much shorter under arm plates, which are nearly twice as broad as long instead of longer than broad; and the shield-shaped, instead of rather sharply triangular, oral shields. In *O. degeneri* the disk is bordered interradially by a row of subequal plates of the same size as those of the disk that imbricate outward from the center of the row. Such plates are not mentioned in the description of *O. amphilogus.*

OPHIOCOMIDAE

Ophiomastix asperula Lütken.

Ophiocantha macroplaca H. L. Clark, Mus. Comp. Zoöl., Mem. **25** (4): 200, pl. 1, figs. 6, 7, 1915 (Hilo).

Hawaii: Hilo.

In his description of *Ophiocantha macroplaca* Clark says that the adoral plates are "small, triangular, barely meeting within, longer than their basal (outer) width." His figure, on the right hand side, shows them very small and widely separated, as characteristic of *Ophiomastix* and very different from the adoral plates of any of the Ophiacanthidae. The disk covering of minute scales each with a low rounded granule and occasional pointed spinelets is also characteristic of *Ophiomastix.*

According to Clark's key to the species of *Ophiomastix,* the presence of a single tentacle scale and the occurrence on the disk of granules some of which are elongated into spinelets place this specimen in *Ophiomastix asperula* Lütket, described from Fiji and known also from Amboina, the east coast of Borneo, and the Murray Islands in Torres Strait.

Ophiocoma erinaceus Müller and Troschel, System der Asteriden, 98, 1842 (Red Sea; Indian Ocean).—Lyman, Illus. Cat. Mus. Comp. Zoöl. **1**: 11, 85, 1865 (Sandwich Islands).—Lyman, Challenger Reports, Zoology **5** (14): 170, 305, 1882 (Honolulu reefs).—H. L. Clark, B. P. Bishop Mus., Bull. **27**: 92, 1925 (Kure; Laysan; Necker; Johnston; Wake; Oahu; Palmyra Islands).—Edmondson, B. P. Bishop Mus., Special Pub. **22**: 71, 1933 (Hawaiian Islands).—Ely, B. P. Bishop Mus., Bull. **176**: 52, 53, fig. 14, *a, b,* 1942 (leeward side of Oahu).

Ophiocoma variabilis Grube, Archiv für Naturgesch., Jargh. 23, **1**: 342, 1857 (Woahu).—Dujardin and Hupé, Hist. nat. des zoophytes, Échinodèrmes, 268, 1862 (Oahu [iles Sandwich]).

Ophiocoma tartarea Lyman, Boston Soc. Nat. Hist., Proc. **8**: 78, 1861 (Sandwich Islands).

Ophiocoma erinacea H. L. Clark, Mus. Comp. Zoöl., Mem. **25** (4) : 291, 1915 (Hawaiian Islands; also Hilo).

Albatross station 3834; south coast of Molokai; Kaunakakai landing bearing N. 22° E., ⅜ mile distant; 15 meters; coral, rock, sand, and shells; April 2-3, 1902 (34, USNM, E.7060, E.7069).

Albatross station 4044; west coast of Hawaii; Kawaihae Light bearing S. 80° 30′ E., 5.2 miles distant; 426-362 meters; bottom temperature 6.33° C.; fine gray sand; July 11, 1902 (1, USNM, E.7062).

Albatross station 4146; in the vicinity of Moku Manu; center of island bearing S. 62° W., 0.5 mile distant; 42-47 meters; bottom temperature 25.94° C.; coralline, coarse sand, and Foraminifera; August 5, 1902 (3, USNM, E.7064).

Albatross station 4167; in the vicinity of Moku Manu; center of island bearing N. 78° 30′ E., 11.6 miles distant; 33-37 meters; coral sand; August 8, 1902 (3, USNM, E.7065).

Albatross station 4168; in the vicinity of Moku Manu; center of island bearing N. 80° E., 13.0 miles distant; 37-38 meters; bottom temperature 25.72° C.; coral sand and Foraminifera; August 8, 1902 (3, USNM, E.7063).

Albatross station 4169; in the vicinity of Moku Manu; center of island bearing N. 81° E., 14.3 miles distant; 38-40 meters; bottom temperature 25.88° C.; coral; August 8, 1902 (3, USNM, E.7070).

Hawaii: Puako Bay, *Albatross,* July 12, 1902 (3, USNM, E.7061, E.7066, E.7068).

Laysan Island, *Albatross,* 1902 (5, USNM, E.7067).

Oahu (Grube, 1857; Dujardin and Hupé, 1862; H. L. Clark, 1925); leeward side (Ely, 1942); Honolulu reefs (Lyman, 1882).

Hawaii: Hilo (H. L. Clark, 1915).

Laysan Island (H. L. Clark, 1925).

Kure (H. L. Clark, 1925).

Necker Island (H. L. Clark, 1925).

Wake Island (H. L. Clark, 1925).

Palmyra Island (H. L. Clark, 1925).

Johnston Island (H. L. Clark, 1925).

Hawaiian Islands (Dujardin and Hupé, 1862; Lyman, 1865; H. L. Clark, 1915; Edmondson, 1933).

Two young individuals with the disk 7 and 10 mm. in diameter from *Albatross* station 3834 have the disk finely scaled and wholly devoid of granules. The radial shields are small, triangular, about twice as long as broad, parallel, widely separated, one on each side of the arm base. The edge of the disk is marked by a regular row of scales beyond which is a thin and slightly raised line formed by the edges of the scales of the oral interradial areas. A specimen with the disk 12 mm. in diameter has the disk completely granulated.

The specimen from *Albatross* station 4044 has the disk circular, 28 mm. in diameter; the color is uniform gray, lighter below.

In the two largest specimens from *Albatross* station 4146 the radial shields are visible as small bare oval areas, one on each side of the arm base just within the border of the disk. The color of the largest in life was deep seal brown, lighter below, with the tentacles red.

A specimen from Puako Bay, Hawaii, with the disk 7 mm. in diameter and the arms 20 mm. long has the disk finely scaled without granulation. At the base of the arms there are four arm spines, of which the uppermost is half again as long as the others and is much swollen.

Ophiocoma insularia Lyman, Boston Soc. Nat. Hist., Proc. **8**: 80, 1861 (Sandwich Islands; Kingsmill Islands).—Lyman, Illus. Cat. Mus. Comp. Zoöl. **1**: 11, 89, 1865 (Sandwich Islands).—H. L. Clark, Mus. Comp. Zoöl., Mem. **25** (4): 291, 1915 (Hawaiian Islands; also, Hilo; Lahaina, Maui).—Galtsoff, B. P. Bishop Mus., Bull. **107**: 19, 1933 (Pearl and Hermes Reef).—Ely, B. P. Bishop Mus., Bull. **176**: 57, 58, fig. 17, *a, b,* 1942 (Hawaiian Islands; no definite localities).

Ophiocoma brevipes var. *insularia* H. L. Clark, B. P. Bishop Mus., Bull. **27**: 92, 1925.

Oahu: Honolulu reef, *Albatross,* June 6, 1902 (3, USNM, E.7073); Waialua, *Albatross,* July 25, 1902 (1, USNM, E.7072).

Hawaii: Puako Bay *Albatross,* July 12, 1902 (1, USNM, E.7071); Hilo (H. L. Clark, 1915).

Maui: Lahaina (H. L. Clark, 1915).

Pearl and Hermes Reef (Galtsoff, 1933).

Hawaiian Islands (Lyman, 1861, 1865; H. L. Clark, 1915, 1925; Ely, 1942).

Ophiocoma insularia var. **variegata** E. A. Smith.

Ophiocoma variegata E. A. Smith, Ann. Mag. Nat. Hist. IV, **18** (103): 39, 1876 (Rodriguez).

Ophiocoma brevipes var. *variegata* H. L. Clark, B. P. Bishop Mus., Bull. **27**: 92, 1925 (Laysan; Kure; Necker and Oahu Islands).—Holly, B. P. Bishop Mus., Occ. Papers **10** (1): 8, 1932, Pearl and Hermes Reef).—Edmondson, B. P. Bishop Mus., Special Pub. **22**: 70, fig. 32, *c,* 1933 (Hawaiian Islands).

Ophiocoma insularia var. *variegata* Ely, B. P. Bishop Mus., Bull. **176**: 60, 1942 (Pelew [Palau] Islands; Hawaiian Islands).

Oahu (H. L. Clark, 1925).

Laysan Island (H. L. Clark, 1925).

Necker Island (H. L. Clark, 1925).

Kure (H. L. Clark, 1925).
Pearl and Hermes Reef (Holly, 1932).
Hawaiian Islands (Edmondson, 1933; Ely, 1942).

Ophiocoma pica Müller and Troschel, System der Asteriden, 101, 1842 (locality unknown).—Lyman, Illus. Cat. Mus. Comp. Zoöl. **1**: 11, 90, 1865 (Sandwich Islands).—H. L. Clark, Mus. Comp. Zoöl., Mem. **25** (4): 293, 1915 (Hawaiian Islands; also Maui and Hilo).—H. L. Clark, B. P. Bishop Mus., Bull. **27**: 92, 1925 (Pearl and Hermes Reef; Laysan; Kure; Wake; Johnston Islands; Honolulu Harbor, 10 fathoms).—Holly, B. P. Bishop Mus., Occ. Papers **10** (1): 8, 1932 (Pearl and Hermes Reef).—Edmondson, B. P. Bishop Mus., Special Pub. **22**: 70, 71, fig. 32, *d*, 1933 (Hawaiian Islands).—Ely, B. P. Bishop Mus., Bull. **176**: 54, fig. 15, *a, b*, 1942 (closely associated with *O. erinaceus*, but much less common; Pearl and Hermes Reef; Laysan, Kure, Wake, and Johnston Islands).

Ophiocoma sannio Lyman, Boston Soc. Nat. Hist., Proc. **8**: 81, 1861 (Sandwich Islands; Kingsmill Islands).

Albatross station 3834; south coast of Molokai; Kaunakakai landing bearing N. 22° E., ⅜ mile distant; 15 meters; coral, rock, sand, and shells; April 2-3, 1902 (2, USNM, E.7077, E.7078).

Albatross station 3968; off French Frigate Shoal (lat. 23° 46′ 00″ N., long. 166° 18′ 55″ W.); 26-30 meters; coarse sand and coral; May 29, 1902 (1, USNM, E.7080).

Albatross station 4031; Penguin Bank, south coast of Oahu; Diamond Head Light bearing N. 20° W., 18.0 miles distant; 49-51 meters; fine coral sand, Foraminifera, and coral; July 9, 1902 (2, USNM, E.7074).

Albatross station 4033; Penguin Bank; Diamond Head Light bearing N. 19° W., 20.8 miles distant; 53-51 meters; fine coral sand and Foraminifera; July 9, 1902 (2, USNM, E.7075, E.7076).

Albatross station 4044; west coast of Hawaii; Kawaihae Light bearing S. 80° E., 5.2 miles distant; 426-362 meters; bottom temperature 8.33° C.; fine gray sand; July 11 ,1902 (1, USNM, E.7079).

Oahu: Honolulu Harbor, 10 fathoms (H. L. Clark, 1925).
Hawaii: Hilo (H. L. Clark, 1915).
Maui (H. L. Clark, 1915).
Laysan Island (H. L. Clark, 1925; Ely, 1942).
Pearl and Hermes Reef (H. L. Clark, 1925; Holly, 1932; Ely, 1942).
Kure (H. L. Clark, 1915; Ely, 1942).
Johnston Island (H. L. Clark, 1925; Ely, 1942).
Wake Island (H. L. Clark, 1925; Ely, 1942).
Hawaiian Islands (Lyman, 1861, 1865; H. L. Clark, 1915; Edmondson, 1933).

One of the specimens from *Albatross* station 3834 has the disk 18 mm. in diameter. The specimens from station 4033 in life were, in general, dark brown mottled with light terracotta.

Ely writes that this species is closely associated with *O. erinaceus,* but is much less common.

Ophiocoma scolopendrina (Lamarck).

Ophiura scolopendrina Lamarck, Hist. nat. des Animaux sans Vertèbres **2**: 544, 1816 (l'Isle-de-France = Mauritius).

Ophiocoma scolopendrina Koehler, Bull. scient. de la France et de la Belgique **41**: 326, 1907 (iles Sandwich).—H. L. Clark, B. P. Bishop Mus., Bull. **27**: 92, 1925 (Palmyra Island).—Ely, B. P. Bishop Mus., Bull. **176**: 52, 1942 (Black Point, Oahu; Palmyra; Lahaina, Maui).

Ophiocoma variabilis Grube, Archiv. für Naturgesch., Jahrg. 23, **1**: 342, 1857 (Woahu = Oahu).

Albatross station 3828; south coast of Molokai; Lae o Ka Laau Light bearing N. 46° W., 11 miles distant; 583-514 meters; bottom temperature 6.55° C.; broken shells and gravel; April 1, 1902 (1, USNM, E.7089).

Albatross station 3861; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing N. 13° 15′ W., 7.4 miles distant; 55-95 meters; fine sand, small pebbles, and coral; April 10, 1902 (3, USNM, E.7082).

Albatross station 3872; Auau Channel, between Maui and Lanai; Mokuhooniki Islet bearing N. 3° E., 16.6 miles distant; 79-58 meters; bottom temperature 23.66° C.; yellow sand, pebbles, and coral; April 12, 1902 (2, USNM, E.7085).

Albatross station 3876; Auau Channel; Lahaina Light, Maui, bearing N. 60° 45′ E., 1.6 miles distant; 51-79 meters; bottom temperature 23.33° C.; sand and gravel; April 14, 1902 (1, USNM, E.7093).

Albatross station 3968; off French Frigate Shoal (lat. 23° 46′ 00″ N., long. 166° 18′ 55″ W.); 26-30 meters; coarse sand and coral; May 29, 1902 (2, USNM, E.7091).

Albatross station 3969; off French Frigate Shoal (lat. 23° 45′ 50″ N., long. 166° 20′ 15″ W.); 27-29 meters; coarse sand, shells, and coral; May 29, 1902 (2, USNM, E.7092).

Albatross station 3982; in the vicinity of Kauai; Nawiliwili Light bearing N. 68° W., 1.6 miles distant; 426-73 meters; bottom temperature 9.17° C.; coarse brown coral sand and shells; June 10, 1902 (1, USNM, E.7088).

Albatross station 4146; in the vicinity of Moku Manu; center of island bearing S. 62° W., 0.5 mile distant; 42-47 meters; bottom temperature 25.94° C.; coralline, coarse sand, and Foraminifera; August 5, 1902 (1, USNM, E.7086).

Albatross station 4147; in the vicinity of Moku Manu; center of island bearing S. 21° W., 2.0 miles distant; 47 meters; bottom temperature 23.28° C.; coral and coralline; August 5, 1902 (2, USNM, E.7083, E.7084).

Albatross station 4160; in the vicinity of Moku Manu; center of island bearing S. 83° E., 3.8 miles distant; 57-71 meters; bottom temperature 25.55° C.; coral and coralline; August 7, 1902 (2, USNM, E.7087, E.7094).

Albatross station 4167; in the vicinity of Moku Manu; center of island bearing N. 78° 30′ E., 11.6 miles distant; 33-37 meters; coral sand; August 8, 1902 (1, USNM, E.7081).

Laysan Island, *Albatross*, 1902 (1, USNM, E.7090).

Oahu (Grube, 1857); Black Point (Ely, 1942).

Maui: Lahaina (H. L. Clark, in Ely, 1942).

Palmyra Island (H. L. Clark, 1925; Ely, 1942).

Hawaiian Islands (Koehler, 1907).

Ophiocoma brevipes Peters, Monatsb. K. Preuss. Akad. Wiss. Berlin, 465, 1851; Archiv für Naturgesch. **1**: 85, 1852 (Querimba Islands, coast of Mozambique).—Koehler, Bull, scient. de la France et de la Belgique **41**: 325, 1907 (iles Sandwich).—H. L. Clark, Mus. Comp. Zoöl., Mem. **25** (4): 291, 1915 (Hawaiian Islands; also Hilo).—H. L. Clark, B. P. Bishop Mus., Bull. **27**: 91, 1925 (Pearl and Hermes Reef, Southeastern Island; Midway, Kure, Laysan Islands).—Edmondson, B. P. Bishop Mus., Special Pub. **22**: 71, 72, fig. 32, *b*, 1933 (general throughout the Hawaiian Islands).—Ely, B. P. Bishop Mus., Bull. **176**: 56, fig. 16,*a,b*, 1942 (Hawaiian Islands).

Albatross station 4167; in the vicinity of Moku Manu; center of island bearing N. 78° 30′ E., 11.6 miles distant; 33-37 meters; coral sand; August 8, 1902 (1, USNM, E.7095).

Hawaiian Islands (William A. Bartos, July 1, 1944) (1, USNM, E.6757).

Hawaii: Hilo (H. L. Clark, 1915).

Midway (H. L. Clark, 1925).

Kure (H. L. Clark, 1925).

Pearl and Hermes Reef, Southeastern Island (H. L. Clark, 1925).

Laysan Island (H. L. Clark, 1925).

Hawaiian Islands (Koehler, 1907; H. L. Clark, 1915; Edmondson, 1933; Ely, 1942).

Ely (17) says that "This species is found underneath stones which conceal large numbers of other ophiocomas. Curiously, only one or two individuals are found underneath one stone."

The specimen from *Albatross* station 4167 is plain white. That labeled simply "Hawaiian Islands" is white with the disk sparsely marbled with green.

Ophiocomella clippertoni A. H. Clark.

Ophiocoma parva Edmondson, B. P. Bishop Mus., Special Pub. **22**: 71, 1933 (Hawaiian Islands; Pearl and Hermes Reef; Lisiansky, Laysan, Palmyra, and Wake Islands).—Ely, B. P. Bishop Mus., Bull. **176**: 60, 1942 (Oahu; Pearl and Hermes Reef; Lisiansky, Laysan, Wake, and Palmyra Islands).

Ophiocomella clippertoni A. H. Clark, Smithsonian Misc. Coll. **98** (11): 7, pl. 1, figs. 1, 2, 1939 (Clipperton Island).

Oahu: Waikiki, in coral on reef, Charles A. Ely, August 21, 1941 (6, USNM, E.6605).

Hawaiian Islands (William A. Bartos, July 1, 1944) (3, USNM, E.6759).

Oahu (Ely, 1942).

Laysan Island (Edmondson, 1933; Ely, 1942).

Pearl and Hermes Reef (Edmondson, 1933; Ely, 1942).

Palmyra Island (Edmondson, 1933; Ely, 1942).

Wake Island (Edmondson, 1933; Ely, 1942).

Lisiansky Island (Edmondson, 1933; Ely, 1942).

The specimens from the Hawaiian Islands at hand, and others from the Tuamotus (USNM, E.644), agree well with those from Clipperton Island. It is quite possible that *O. clippertoni* is the same as *O. parva* from Australia, but the description of *O. parva* indicates certain differences, and the figures are too vague for comparison. *Ophiocomella clippertoni* differs from *O. schultzi* from Canton Island in lacking the additional arm spine at the aboral end of the second side arm plate beyond the disk, and from *O. schmitti* from the Galapagos Islands in the finer, more numerous, and shorter spinules on the disk.

OPHIODERMATIDAE

Distichophis clarki Ely, B. P. Bishop Mus., Bull. **176**: 47, 1942 (Black Point, Oahu).

Distichophis clarkii Ely, B. P. Bishop Mus., Bull. **176**: 47, fig. 12,*a,b,* 1942.

Albatross station 3969; off French Frigate Shoal (lat. 23° 45′ 50″ N., long. 166° 20′ 15″ W.); 27-29 meters; coarse sand, shells, and coral; May 29, 1902 (1, USNM, E.7097).

Oahu, Black Point; in coral heads (Ely, 1942).

Ophiarachnella parvispina H. L. Clark, B. P. Bishop Mus., Bull. **27**: 93, pl. 10, figs. *a,b,* 1925 (Wake Island).

This species is still known only from the type specimen from Wake Island, in the collection of Bishop Museum (no. 477).

Ophiopezella spinosa (Ljungman).

Ophiaracna spinosa Ljungman, Öfv. K. Vet.-Akad. Förh. 23 (6) : 305, 1867 (Foua).

Ophiopezella spinosa Edmondson, B. P. Bishop Mus., Special Pub. 22 :71, 1933 (Waikiki and Kahala, Oahu).

Oahu: Waikiki and Kahala (Edmondson, 1933).

OPHIOLEPIDIDAE

Ophiura kinbergi Ljungman.

Ophiura (vel. *Ophioglypha*) *kinbergi* Ljungman, Öfv. K. Vet.-Akad. Förh. 23 (6) : 166, 1866 (Sidney, Novae Hollandiae = Sydney, New South Wales).

Albatross station 3876; Auau Channel, between Maui and Lanai; Lahaina Light, Maui, bearing N. 60° 45′ E., 1.6 miles distant; 51-79 meters; bottom temperature 23.33° C.; sand and gravel; April 14, 1902 (1, USNM, E.7102).

Albatross station 3939; in the vicinity of Laysan Island; Laysan Island Light bearing S. 89° 30′ E., 8.1 miles distant; 298-108 meters; bottom temperature 14.17° C.; white sand, broken shells, and rock; May 16, 1902 (2, USNM, E.7100).

Albatross station 3962; in the vicinity of Laysan Island; Laysan Island Light bearing N. 56° E., 5.2 miles distant; 29 meters; white sand and coral; May 22, 1902 (1, USNM, E.7101).

Ophiura monaria, new species (fig. 18, *a, b*).

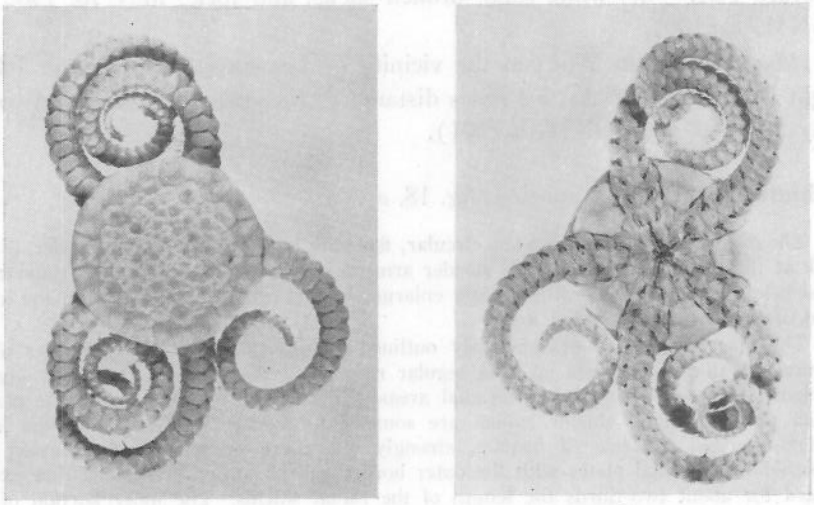
The disk is 13 mm. in diameter, circular, flat with an abruptly swollen border, 3 mm. thick at the interradial edges. The slender arms are about 30 mm. long. The interradial areas below are occupied by the greatly enlarged oral shields, which also form the lower third of the lateral interradial areas.

The circular disk is conspicuously outlined by a prominent swollen border about 1.5 mm. broad which stands up as a regular ring about the aboral surface and slightly overhangs the vertical lateral interradial areas. This border is composed of the closely united pairs of radial shields, which are somewhat broader than long with the inner borders, beyond the line of contact, strongly and more or less evenly convex, and trapezoidal interradial plates with the outer border and inner border parallel that extend inward for about two-thirds the length of the radial shields. The inner portion of the radial shields, beyond the inner margin of the interradial plates, curves abruptly downward and lies in the plane of the general surface of the disk. Proximal to the radial shields is a five-sided plate rather more than half as large as a radial shield the outer angle of which, a right angle, lies on the line of union of the shields and separates their outer portion; the two adjacent sides of this plate converge moderately, and the inner end, connecting these two sides, is more or less strongly convex. Just within the interradial plates is a plate slightly less in area with its outer straight border coinciding with the entire inner border of the interradial plate and the inner border strongly and more or less evenly convex. This is joined to the midradial five-sided plate on each side by a regularly pentagonal plate of about half its area. The area within this interior ring is occupied by a number of irregularly polygonal plates, mostly about the size of the

regularly pentagonal plate just described. These are irregularly arranged, except that in some cases there is a central plate surrounded by five larger interradial and five smaller radial plates. This rosette is subject to great variation, and in many specimens cannot be made out. The plates between the inner ring and the center may be wholly irregular, or there may be discerned two or three alternating rings between the inner ring and a central rosette.

The oral surface of the disk is usually more or less concave, though sometimes flat. The interradial areas from the adoral shields outward are occupied by the greatly enlarged oral shields, the much thickened and swollen outer border of which is joined to the outer border of the aboral interradial plate by a regularly oblong plate nearly four times as broad as high, at each end of which is the large, approximately semicircular, genital plate. The adoral shields are rhombic, twice as long as broad, in contact along their inner lower sides. The jaw plates are of about the same size with broadly rounded outer ends. They bear on their outer border a row of six mouth papillae of which the innermost is long and conical, the next is much shorter with a pointed or truncate end, and the remainder are low, much broader than high, in close lateral contact, with their truncated outer edges forming a continuous line. The inner end of the jaws carries a column of three conical teeth similar to the innermost mouth papilla but larger.

The first under arm plate is regularly pentagonal, or with its inner side slightly longer than the others. The second is regularly hexagonal, with its proximal angle in contact with the distal angle of the first. Those following are six-sided, broader than long, and are not in contact, later becoming transversely oval and widely separated, and very small in the terminal portion of the arms.



a *b*

FIGURE 18.—*Ophiura monaria,* type specimen: a, aboral view, × 2; b, oral view, × 2.

The first side arm plates are approximately triangular, slightly smaller than the adoral shields. The second, at the edge of the disk, are nearly twice as large and swollen. The third are smaller again. The second bears two or three slender, sharp spines on the lower portion of the lateral border. The third bears five or six slender, sharp spines of about half its length evenly spaced along the distal border. In the distal part of the arm the spines commonly become reduced to four, and increase somewhat in length. In the slender terminal portion, the lowest spine is the longest, the next is transformed into

a short glassy hook with an accessory tooth, and the two or three uppermost are shorter than the lowest. Still farther out there are only three spines, of which the upper and the lower are of about the same length and the central one is in the form of a stout hook, about as long as the others.

The proximal upper arm plates are roundedly six-sided, about twice as broad as long, rather broadly in contact and markedly swollen. They shortly become more rhombic than six-sided but remain in contact until near the arm tip, where they become fan-shaped and rather widely separated, and very widely separated at the arm tips.

The first tentacle pore, opening at the outer end of the jaw plate and at some distance from the mouth slits, has five delicate rounded tentacle scales on each side. The next few have four or five. On the third side arm plate beyond the disk the number is reduced to three, the outermost the longest and somewhat spinelike. Farther out there are two, then one; in the terminal portion of the arms there are no tentacle pores.

Type: cat. no. E.7111, USNM, from *Albatross* station 3474.

Albatross station 3474; south of eastern Oahu (lat. 21° 12′ 00″ N., long. 157° 38′ 30″ W.); 685 meters; fine white sand; December 6, 1891 (24, USNM, E.7103, E. 7111).

Albatross station 3995; in the vicinity of Kauai; Mokuaeae Islet bearing S. 69° 30′ E., 11.5 miles distant; 780-1,236 meters; bottom temperature 4.77° C.; fine gray sand and rock; June 13, 1902 (4, USNM, E.7106).

Albatross station 4028; in the vicinity of Kauai; Ukula Point bearing S. 82° 30′ E., 812-874 meters; bottom temperature 4.44° C.; gray sand and Globigerinae; June 24, 1902 (5, USNM, E.7110).

Albatross station 4041; off the west coast of Hawaii; Kawaihae Light bearing S. 67° 30′ E., 10.0 miles distant; 698-462 meters; bottom temperature 5.33° C.; gray mud and Foraminifera; July 11, 1902 (2, USNM, E.7107).

Albatross station 4091; northeast approach to the Pailolo Channel between Maui and Molokai; Mokuhooniki Islet bearing S. 66° 15′ W., 21.3 miles distant; 563-559 meters; bottom temperature 6.55° C.; fine gray sand; July 22, 1902 (2, USNM, E.7108).

Albatross station 4123; southwest coast of Oahu; Barbers Point Light bearing S. 78° E., 3.2 miles distant; 643-653 meters; bottom temperature 5.72° C.; fine gray sand and mud; July 26, 1902 (1, USNM, E.7104).

Albatross station 4139; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 57° W., 5.2 miles distant; 936-620 meters; bottom temperature 4.61° C.; August 2, 1902 (1, USNM, E.7109).

Albatross station 4140; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 39° W., 4.9 miles distant; 620-799 meters; bottom temperature 6.33° C.; fine gray sand; August 2, 1902 (1, USNM, E.7105).

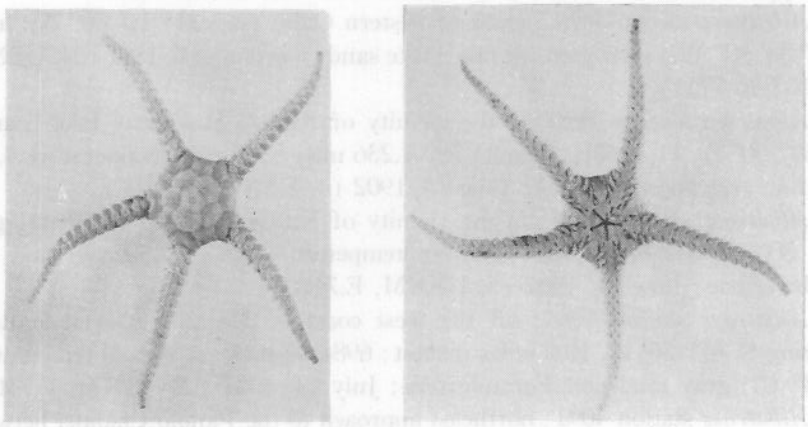
Ophiura ursula, new species (fig. 19, *a, b*).

The disk is pentagonal with straight interradial borders, 8 mm. in diameter and 4 mm. high, slightly convex aborally, orally flat with the peristomial region slightly sunken, and the arms are about 20 mm. long.

This species is closely related to *O. turgida* Koehler from the Kei Islands but is smaller with the disk much less convex. The upper arm plates are smaller; the second

and third arm plates are not in contact, and those following are widely separated, the distal becoming very small.

The aboral and oral surfaces resemble those of *O. turgida*. The sides of the disk between the oral shields and the large interradial plate on the aboral surface adjoining the central rosette (composed of a central plate and five radial plates) is covered by a number of plates as follows. The interradial plate on the aboral surface of the disk is followed by a smaller roughly semicircular plate that curves over the edge of the disk. On each side of this are usually three, sometimes two, much smaller plates, the uppermost the largest, that separate it from the radial shields and the genital plate; below it are two irregular plates, larger than the lateral ones, which are separated from the oral shield by a row of three to five (usually four) smaller plates of varying size. In *O. turgida* the interradial plate at the edge of the disk is separated from the oral shield by a single pair of plates which are higher than broad, instead of by numerous plates.



a *b*

FIGURE 19.—*Ophiura ursula*, type specimen: **a**, aboral view, × 1.5; **b**, oral view, × 1.5.

Type: cat. no. E.7112, USNM, from *Albatross* station 4101.

Albatross station 4101; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing N. 35° W., 3.1 miles distant; 238-276 meters; bottom temperature 16.11° C.; coral sand, shells, and Foraminifera; July 23, 1902 (77, USNM, E.7112, E.7113).

Albatross station 4102; Pailolo Channel; Mokuhooniki Islet bearing N. 25° E., 5.6 miles distant; 223-241 meters; fine gray sand and Foraminifera; July 23, 1902 (29, USNM, E.7114).

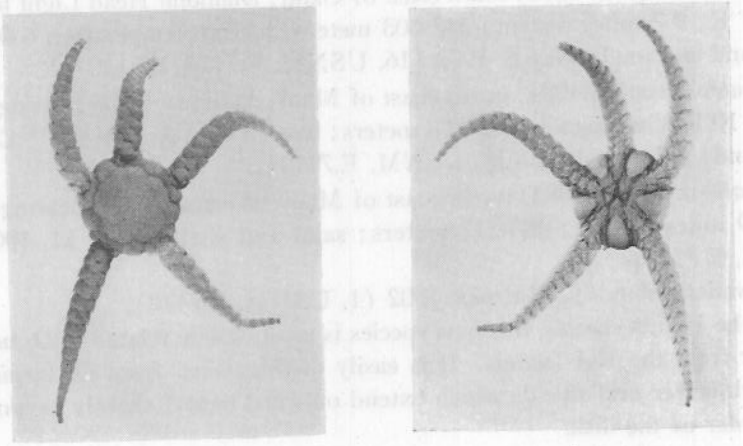
A small specimen from *Albatross* station 4102 has the interradial plate at the edge of the disk with a small approximately oval plate on each side, opposite the suture between it and the large interradial plate adjoining the central rosette. In the interradial areas on the side of the disk the marginal interradial is separated from the oral shield by a pair of plates each of which is about as long as broad. This small specimen differs from *O. turgida* only in having two

small accessory plates at the ends of the sutures between the aboral and marginal interradial plates. It would seem, therefore, that in spite of its larger size *O. turgida* represents, so far as its interradial plates are concerned, an early stage in the ontogeny of *O. ursula*.

Ophiura fisheri, new species (fig. 20, *a, b*).

The disk is 7 mm. in diameter and 3.5 mm. high; the short and rapidly tapering arms are 13 mm. long.

This species is closely related to the West Indian *O. coronata* which it appears to represent in the Pacific. The disk is gently convex, considerably less elevated than in *O. coronata* though composed of the same plates in the same proportions, and the arms are narrower and lower at the base. The first upper arm plate is very small, much less than half the size of the second instead of nearly as large as in *O. coronata*. The second upper arm plate is small, rounded pentagonal, about as long as broad instead of nearly twice as broad as long as in *O. coronata*. The third upper arm plate, somewhat smaller than the second, is not quite in contact with it, and those following are widely separated. In *O. coronata* the first five upper arm plates are much larger and are in contact. The basal upper arm plates are only slightly swollen, not greatly swollen as in *O. coronata*.



a *b*

FIGURE 20.—*Ophiura fisheri*, type specimen: **a**, aboral view, × 2; **b**, oral view, × 2.

The genital plate bearing the comb ends at the under side of the radial shield in a straight line, its aboral edge forming an acute angle with its outer border. In *O. coronata* it ends in a strongly concave line that curves inward about the outer end of the radial shield.

The oral surface is similar to that of *O. coronata*, but the oral shields and the first under arm plates are not so swollen, so that the peristomial area is not so deeply sunken, and the first under arm plates are narrower, twice as long as the greatest (distal) width.

In the lateral interradial areas between the arm bases there are, on the upper edge of the oral shield, two very small triangular plates with their outer bases lying against the genital plates and their inner apices usually widely separated. Occasionally

similar plates occur at the ends of the suture between the radial shields and the median lateral interradial plate, usually only on one side. Very rarely these plates are enlarged and are in contact by their angles below and at each side of the median lateral interradial plate. These plates do not occur in *O. coronata*. In one specimen from *Albatross* station 3865 the oral shields are separated from the aboral interradial plate by 8 to 10 very irregular plates instead of by the usual large, oblong, median lateral, interradial plate.

Type: cat. no. E.7115, USNM, from *Albatross* station 3916.

Albatross station 3818; south coast of Oahu; Diamond Head Light bearing N. 59° E., 4.3 miles distant; 536-538 meters; bottom temperature 6.83° C.; fine coral sand with black specks; March 31, 1902 (3, USNM, E.7122).

Albatross station 3836; south coast of Molokai; Lae o Ka Laau Light bearing N. 58° 30′ W., 11.8 miles distant; 435-466 meters; bottom temperature 8.88° C.; green and gray mud and sand; April 3, 1902 (1, USNM, E.7121).

Albatross station 3865; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing S. 79° W., 6.9 miles distant; 468-517 meters; bottom temperature 7.11° to 7.22° C.; volcanic sand and rock; April 10, 1902 (9, USNM, E.7117).

Albatross station 3916; south coast of Oahu; Diamond Head Light bearing N. 40° E., 9.7 miles distant; 547-603 meters; bottom temperature 6.66° C.; gray sand and mud; May 6, 1902 (16, USNM, E.7115, E.7120).

Albatross station 4084; north coast of Maui; Puniawa Point bearing S. 3° 15′ E., 10.1 miles distant; 462-488 meters; bottom temperature 6.17° C.; fine gray sand; July 21, 1902 (16, USNM, E.7119).

Albatross station 4085; north coast of Maui; Puniawa Point bearing S. 2° E., 10.9 miles distant; 488-517 meters; sand and shells; July 21, 1902 (1, USNM, E.7116).

Hawaiian Islands; *Albatross*, 1902 (1, USNM, E.7118).

Of the Pacific species, this new species is most closely related to *O. turgida* Koehler from the Kei Islands. It is easily distinguished from *O. turgida* by the much larger oral shields which extend outward to and slightly beyond the oral border of the disk.

Ophiura ponderosa (Lyman).

Ophioglypha ponderosa Lyman, Mus. Comp. Zoöl., Bull. **5**: 93, pl. 2, figs. 52-54, 1878 (*Challenger* station 232; 340 fathoms).—Lyman, Challenger Reports, Zoology **5** (14): 69, pl. 7, figs. 7-9, 1882 (*Challenger* station 232; off Enoshima, Japan, lat. 35° 11′ N., long. 139° 28′ E.; 345 fathoms).

The disk is 30 mm. in diameter, pentagonal with slightly concave sides and rounded angles, the interradial borders vertical, 3 mm. high. The plates on the aboral surface are much swollen, those on the oral surface less swollen. The arms in cross section are equilateral triangles with sharp angles and the lateral borders slightly concave; the upper arm plates are situated directly above the corresponding side arm plates. The arm spines are minute and are confined to the base of the side arm plates.

The center of the disk is occupied by a pentagonal plate 3 mm. in diameter, the angles radially situated, on each of the five sides of which is a triangular plate about as high as the radius of the central pentagonal plate. Between each two of these triangular plates is an irregularly hexagonal plate not quite so large as the central plate which is followed, in the radial line, by a narrowly oval plate 6 mm. long that extends outward between the inner halves of the radial shields. The radial shields are of moderate size, 8 mm. long and 4 mm. wide, those of each pair in contact in their distal half, their proximal halves being separated by the oval plate just described. The outer border of the radial shields is more or less evenly convex. In the interradial line the triangular plate adjoining the pentagonal central plate is followed by a roughly diamond-shaped plate, in four of the five interradii on its right side, on each of the two outer sides of which is a somewhat larger polygonal plate that abuts against the inner third of the oval plate separating the radial shields. Beyond this pair of plates is a six-sided plate, broader than long, that on each side abuts against the inner portion of the radial shields. This is followed by two plates, side by side, and these by three, a smaller one opposite the line of junction between the two preceding, and on each side of this a larger one which borders the outer portion of the radial shield except for the tip. All the plates of the aboral surface are swollen. The oval plates separating the inner halves of the radial shields are conspicuously elevated, their sides forming with each other an angle of 90 degrees or even less. The radial shields rise rather rapidly to a maximum height about one-third the distance from the radial to the interradial border. All the plates are evenly studded with small tubercles, and bordered with a band of minute and densely packed tubercles.

In the interradial areas on the oral side the oral shields are followed by a narrow plate separating two much larger and laterally elongate plates that reach to the genital plates. Beyond the narrow median plate is a pentagonal plate on each side of which are two larger plates which extend across the outer borders of the plates previously mentioned and inwardly meet above the distal apex of the pentagonal median plate.

The arm comb consists of about 14 oblong plates of which the five or six lowest are much broader than high, the remainder about as long as high. The plates of the comb are in close lateral contact, and the outer edge forms an even line. Orally the comb is continued as a line of similar but lower plates running to the oral shields.

The oral shields are narrow, nearly or quite twice as long as broad, rather strongly constricted in the middle at the end of the genital slits. The distal half is subcircular, the proximal half arrowhead-shaped. The sides at the narrowest point are much thickened. The adoral shields are large, enclosing the oral shields as far as the constricted middle portion. They are asymetrical, one of each pair reaching a line from the apex of the oral shield to the middle of the jaw plate, and thus being produced into the angle between the two jaw plates. The other reaches only halfway down the jaw plate. One of the adoral shields is divided into two plates. The jaw plates are short and broad; they reach about halfway up the adoral shields. They bear four or five mouth papillae of which the innermost is long and pointed and the outermost are small, about as high as broad, with broadly rounded ends. There is a column of five narrow, sharp, flattened teeth.

The first under arm plate is approximately oblong, nearly four times as broad as long; in two cases it is divided into two plates by a median suture. The second under arm plate is twice as long, six-sided with the two distal lateral edges about half as long as the two proximal. The distal edge is slightly concave, and the two distal lateral edges are also concave. The following under arm plates become narrower and fan-shaped with the proximal edge narrow, the lateral edges strongly concave, and the distal edge strongly and evenly convex, the latter later becoming obtusely angled; beyond the middle of the arm the under arm plates lose contact with each other, in the outer part of the arm becoming transversely rhombic with truncated acute angles, and widely separated.

The first side arm plate, adjoining the adoral shields, is narrow and short, slightly curved, and almost parallel with the midradial line. The second is about twice as large, subtriangular, about twice as broad as high, and makes a greater angle with the midradial line. The third is still larger and higher. Those beyond the disk are bent at an angle of 60 degrees so that about one-third of their surface is oral and about two-thirds aboral. The aboral portion is about twice as broad as long with parallel proximal and distal edges and the upper edge strongly curved in the proximal third, then running straight and somewhat downward to the distal end. On the oral surface the distal border is strongly curved inward and proximally. The portion about the rather sharply rounded angle is produced outward and somewhat swollen, and overlaps the base of the following side arm plate. The upper arm plates are in the form of a sharp gable, the sides of which, at the base of the arms, are somewhat broader than long. They decrease distally in width until toward the end of the arm they are, in lateral view, about three times as long as broad.

The third side arm plate bears three minute arm spines of which the outermost is somewhat larger than the other two. The fourth side arm plate bears four or five spines, the outermost small, the others minute. The side arm plate just beyond the disk bears six very small arm spines of which the outermost is the largest. The fifth side arm plate beyond the disk bears two small arm spines, the upper somewhat smaller than the lower, and below these on the oral surface a row of minute spines running to the tentacle scales. Farther out there are two small spines just above the angle and three or four very short closely set spines between these and the tentacle scales. Still farther out the minute spines disappear, leaving only a short spine at the angle and a minute one above it.

The arms are about 95 mm. long.

The first tentacle pore, at the mouth angle, has a row of seven oblong tentacle scales that continue the row of mouth papillae but are larger, and opposite this a row of five or six small scales. The second-fourth tentacle pores have a row of five scales on the abradial side. At the edge of the disk the number falls to four, then to three, and on the fourth side arm plate beyond the disk to two, the scales at the same time becoming short stubby spines. In the outer portion of the arm they become more spine-like, and the outer becomes about twice as long as the inner. Everywhere beyond the edge of the disk the tentacle scales resemble arm spines, especially in the outer portion of the arms where the outer tentacle scale is considerably longer than the arm spines above it.

In life the disk is dark grayish sepia, the arms light grayish sepia; the tube feet are rose pink (Fisher). The color of the dry specimen is white.

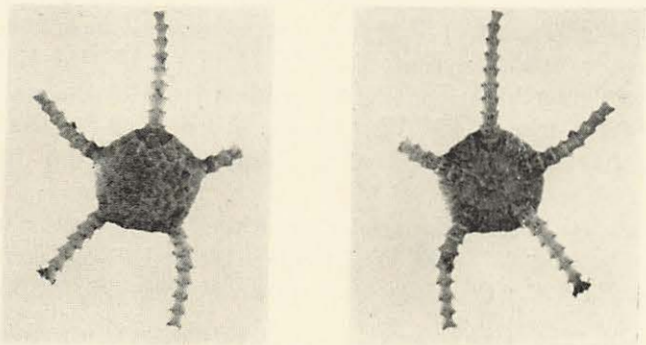
Albatross station 4044; west coast of Hawaii; Kawaihae Light bearing S. 80° 30′ E., 5.2 miles distant; 426-362 meters; bottom temperature 8.33° C.; fine gray sand; July 11, 1902 (1, USNM, E.7123).

Ophiomusium elii, new species (fig. 21, *a, b*).

The disk is pentagonal, 6 mm. in diameter, rather thick, flat aborally with rather broadly rounded interradial margins. The plates on the aboral surface are numerous and irregular in arrangement, the aboral surface as a whole showing a rather close superficial similarity to that of the Arctic *Ophiura robusta.*

The center of the disk is occupied by a circular plate surrounded by an irregular rosette of smaller plates, typically about five small plates and beyond them, and alternating with them, five larger. All the plates are somewhat thickened and imbricate outward. Beyond the irregular central rosette the disk is covered, except for the radial shields and the marginal interradial plates, by numerous plates of various sizes, some as large as the central plate, others as small as the small plates immediately surrounding it. These plates are irregularly arranged. A line from the central rosette to the inter-

radial marginal plate would cross about three, and a line from the central rosette to the base of an arm would cross about five. The radial shields are small, triangular, about half again as long as broad, and extend inward considerably less than halfway from the arm base to the outer border of the central rosette. Their inner edges do not quite meet at the arm base, and diverge rather rapidly inwardly. The radial shields of each pair are separated inwardly by a trapezoidal plate, the base outward, at the arm base, which truncates the inner angles of the radial shields; a narrowly triangular plate which extends to about the middle of the radial shields; and a much larger trapezoidal plate that reaches to the inner ends of the radial shields. The central portion of the interradial margin of the disk is occupied by a prominent plate about half the size of the radial shields which is separated from the radial shields by usually two long and narrow plates on each side. On the inner border of the interradial plate there is commonly a small plate, somewhat larger than most of those on the aboral surface that may be in contact with it, or may be separated from it by some smaller plates.



a *b*

FIGURE 21.—*Ophiomusium elii,* type specimen: a, aboral view, × 2; b, oral view, × 2.

The interradial areas on the oral surface are bordered by broad genital plates that extend almost to the oral shields, to which the latter are joined by a plate of the same width which is slightly longer than broad. In the middle of the interradial areas is a column of plates consisting of a narrow plate just beyond the oral shields, just beyond which is a much larger plate occupying about the middle third of the area between the arm bases, between which and the interradial marginal plate of the aboral surface are one to three (usually two) smaller plates. Between this central column of plates and the genital plates there is usually on each side a regular row of about four medium-sized plates. But the arrangement of the plates in these interradial areas is commonly more or less irregular.

The genital slits are short, extending from the corners of the oral shields to the proximal border of the second pair of tentacle pores.

The mouth shields are of moderate size or rather large, five-sided, the distal side straight, the distal third of the lateral edges making a right or somewhat obtuse angle with it, and the proximal two-thirds of the lateral edges converging, parallel with the mouth slits, to a point. The adoral shields have slightly converging sides and meet broadly below the oral shields. The mouth plates are small, triangular, and are bordered by five mouth papillae which decrease in size from the outermost to the innermost and completely conceal the mouth slits.

The first upper arm plate is half again as broad as long with an obtuse distal angle. The second is half again as long as broad, four-sided, with an obtuse distal and acute

proximal angle; it is widely separated from the first. The following arm plates are similar but decrease in size; they continue nearly or quite to the arm tips.

The side arm plates are very large, long, meeting broadly above and below, the lateral borders of each pair diverging so that the distal borders rather strongly overlap the base of the following pair. The arm spines at the base of the arms are four, the two lowest close together; the second from the bottom has the tip pointed, glassy, and more or less recurved in the form of a hook. Farther out on the arm the number drops to three, the uppermost largest, hooklike, with an accessory tooth, the middle one smaller and less perfectly hooklike, and the lowest straight, slender, and pointed.

There are usually three, rarely two, pairs of tentacle pores, each with a large rounded tentacle scale.

The under arm plates resemble those of related species.

Type: cat. no. E.7124, USNM, from *Albatross* station 4096.

Albatross station 3818; south coast of Oahu; Diamond Head Light bearing N. 59° E., 4.3 miles distant; 536-539 meters; bottom temperature 6.83° C.; fine coral sand with black specks; March 31, 1902 (1, USNM, E.7125).

Albatross station 3865; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing S. 79° W., 6.9 miles distant; 468-517 meters; bottom temperature 7.11° C. to 7.22° C.; volcanic sand and rock; April 10, 1902 (19, USNM, E.7127).

Albatross station 4096; northeast approach to the Pailolo Channel; Mokuhooniki Islet bearing S. 77° 30′ W., 7.0 miles distant; 497-523 meters; bottom temperature 7.39° C.; fine gray sand; July 22, 1902 (70, USNM, E.7124, E.7126).

This new species is most closely related to *O. impotens* Koehler from Celebes, from which it differs in its smaller size, in the short proximal arm plates which are not in contact, in the fewer arm spines basally (four instead of seven or six as in *O. impotens*), in the less numerous mouth papillae (five instead of six or seven), in the more strongly projecting side arm plates, and in the shorter genital slits.

It is less closely related to *O. diomedeae* Lütken and Mortensen from the Galapagos Islands which is considerably larger with ovoid radial shields, large proximal upper arm plates, more (seven or eight) mouth papillae, and more numerous (four to six) spines on the proximal side arm plates.

Ophiomusium relictum Koehler, Siboga Exped. **45a** (15): 61, pl. 10, figs. 5-7, 1904 (*Siboga* station 156; west of Waigeu, lat. 0° 29.2′ S., long. 130° 05.3′ E., 469 meters).—Koehler, U. S. Nat. Mus., Bull. **100** (5): 416, pl. 91, figs. 6-8, 1922 (*Albatross* station 5651; Gulf of Boni, Celebes; 1,280 meters).

Albatross station 3996; in the vicinity of Kauai; Kapuai Point bearing S. 23° 15′ W., 15.5 miles distant; 1,866-2,157 meters; bottom temperature 2.29° C.; gray sand and rock; June 13, 1902 (1, USNM, E.7128).

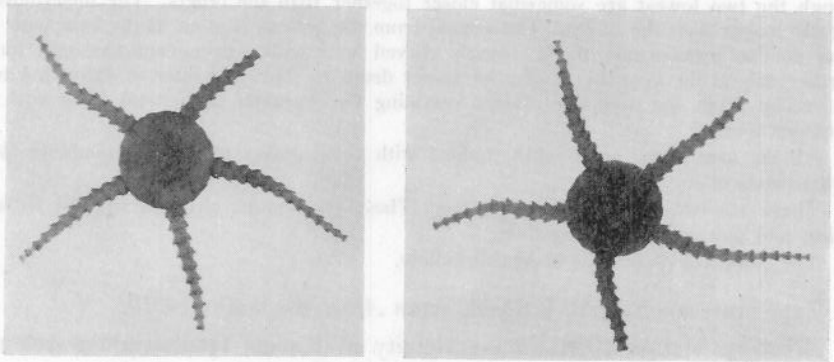
Except in its larger size (disk 19 mm. in diameter), this specimen does not seem to differ in any significant degree from *O. relictum* which was dredged

by the *Siboga* at station 156, west of Waigeu (lat. 0° 29′ 12″ S., long. 130° 05′ 18″ E.), in 469 meters, and later by the *Albatross* at station 5651, in the Gulf of Boni, Celebes (lat. 4° 43′ 50″ S., long. 121° 23′ 24″ E.), in 1,280 meters. The plates in the central portion of the disk are more numerous, as would be expected from the larger size, and are less regularly arranged. The tubercles on the plates are not so prominent as in the specimen from Celebes.

Ophiomusium zela, new species (fig. 22, *a, b*).

The disk is 5.5 mm. in diameter, circular, and the arms are 10 mm. long, narrow, 1.3 mm. wide at the base, and tapering evenly to a sharp point.

On the aboral surface a large circular central plate is surrounded by five radially arranged plates of about the same size, which are almost circular but have the outer border subangulate, between the bases of which are five small triangular plates. The radial shields are slightly larger than the plates of the central rosette and are a little longer than broad. They are in contact for almost their entire length. Their inner ends abut against the outer edge of the radial plates of the central rosette, diverging at an angle of about 90 degrees; a small triangular first brachial is wedged between their outer ends. In two radii a very small plate is wedged between their inner ends following the radial plate of the central rosette. The interradial margin of the disk is occupied by a broad plate raised considerably above the general surface that overlaps the outer half of the radial shields on either side. Between the middle of this and the central rosette are two long and narrow plates, half as broad as the radial shields or even narrower, that connect the marginal plate with the interradial angles of the central rosette at the suture between the large radial plates. In one interradius there is an additional small triangular plate that connects the inner of these two plates with the small triangular interradial plate on the border of the central plate. The surface of all the plates is swollen, and they are separated by rather deep and abrupt grooves. The surface is evenly studded with approximately uniform, small, rounded, glassy tubercles looking like rounded sand grains which are separated from each other by somewhat more than their own diameter.



a *b*

FIGURE 22.—*Ophiomusium zela,* type specimen: **a,** aboral view, × 2; **b,** oral view, × 2.

The lateral interradial areas are almost completely filled by a large, swollen, six-sided plate, half again as broad as high, aborally adjoining the radial shields and orally separated from the first side arm plates by the very acute distal angles of the genital plates.

In the interradial areas on the oral surface the margin is occupied by the large interradial plate just described. This is separated from the arm bases by the outer angles of the very large subtriangular genital plates, which are about three times as long as broad. Between the genital plates is an oblong plate, somewhat longer than broad, and narrower than the genital plate on either side. Just proximal to this is the fan-shaped oral shield, in size intermediate between it and the genital plates, on each side of which are the swollen adoral shields, rounded triangular and about the size of the genital plates, which meet rather broadly below the oral shields. The jaw plates are sharply triangular, about three times as long as broad. They are bordered by three to five (usually three or four) very narrow mouth papillae the outer edges of which form a straight line and the adjoining ends are so closely appressed that they appear to be soldered together. When three papillae are present the middle one is much the longest, the outermost about two-thirds its length, and the innermost small and about half the length of the outermost. At the tip of the jaw there is a minute, triangular, terminal unpaired papilla.

The plates on the oral surface are somewhat swollen, especially the adoral shields and the first side arm plates, and are separated by rather deep grooves; they are thickly studded with small rounded glassy tubercles like the plates of the aboral surface.

The first under arm plate is very small, and ordinarily is not distinguishable. The second is fan-shaped, small, separated from the first by about half the length of the first side arm plates. The third is similar and of about the same size. There are none beyond the third.

The first upper arm plate is very small, wedged between the outer ends of the radial shields. The second, slightly smaller and widely separated from the first, occupies a notch between the ends of the side arm plates of the first pair. Those following decrease slowly in size, but persist until the end of the arm.

The first side arm plates are large and somewhat swollen, especially at the distal end; they are nearly as large as the genital plates. They bear two short and slender arm spines on the distal end. The following side arm plates are long with the outer half swollen so that the distal border extends for some distance beyond the base of the pair following, giving the arm a knotted appearance. At the base of the arms they bear five short spines almost equally spaced from the aboral to the oral end of the plate, though the two lowest are somewhat closer together than the others. The uppermost is slightly longer than the others. The second from the bottom is stout at the base with the outer portion transformed into a strongly curved hook with a prominent accessory tooth. Farther out on the arm the number of spines drops to four, and later to three and two, the second from the oral side always retaining its character as a stout hook with an accessory tooth.

All the arm plates are thickly studded with small glassy tubercles resembling those on the plates of the disk.

There are two pairs of tentacle pores. These are minute, circular, without tentacle scales, and unusually close together.

The color (dry) is light brownish yellow.

Type: cat. no. E.7129, USNM, from *Albatross* station 4018.

Albatross station 4018; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 57° W., 7.4 miles distant; 1,469-1,342 meters; bottom temperature 2.94° C.; Foraminifera, sand, and manganese fragments; June 21, 1902 (3, USNM, E.7129, E.7130).

The largest specimen, with the disk 6.5 mm. in diameter and the arms 12 mm. long, has the plates in the central portion of the disk irregular, probably due to some pathological condition.

This new species is related to *O. granosum* Lyman from off southern Japan in 1,875 fathoms, which has the same coarse tuberculation, essentially the same arrangement of the plates, five arm spines, and two pairs of tentacle pores without tentacle scales. In *O. granosum* the interradial plates about the central aboral plate, instead of being very small, are as large as the central plate itself, six-sided, and form a closed ring about the central plate. Beyond this closed ring of interradial plates are the five equally large radial plates; beyond each radial plate is a triangular plate that separates the inner ends of the radial shields for nearly half their length. In *O. granosum* the marginal interradial plate is smaller than in *O. zela,* the oral shield and the plate between it and the marginal plate are larger, and the adradial shields and first side arm plates are smaller. In *O. granosum* the tubercles near the edge of the disk rise into small points, and the second arm spine from the oral side is not transformed into a hook.

This species is perhaps most closely related to *O. canaliculatum* H. L. Clark from *Albatross* station 4732, eastern tropical Pacific, in 2,012 fathoms. It has the same median groove on the oral and aboral surfaces of the arms. Though smaller, it presents somewhat more mature features. On the aboral surface of the disk the radial shields are somewhat larger and are separated interradially by two much narrower plates in addition to the broad one on the margin. The arm segments (pairs of side arm plates) are shorter, basally broader than long, and at the base of the arms there are five arm spines instead of three or four.

Ophiomusium lymani Wyville Thomson, Depths of the Sea, 172-174, figs. 32, 33, 1873 (warm area, Faeroe Channel; also off coast of Ireland, 600-700 fathoms).—Koehler, Échinodèrmes provenant des campagnes du yacht Princesse-Alice (Astéries, Ophiures, Echinides et Crinoïdes), 161, 1909 (*Princesse-Alice* stations 486, 515, 624, 663, 673, 698, 719, 724, 738, 847, 858, 1209, 1331, 1334), pl. 3, fig. 4 (colored), pl. 4, fig. 1 (colored).

Albatross station 3891; north coast of Molokai; Mokapu Islet bearing S. 30° W., 4.1 miles distant; 852-1,172 meters; bottom temperature 4.50° C.; volcanic sand, broken shells, and lava; April 18, 1902 (82, USNM, E.7134, E.7135).

Albatross station 3892; north coast of Molokai; Mokapu Islet bearing S. 66° 15′ E., 9.8 miles distant; 600-757 meters; bottom temperature 5.83° C.; fine gray sand; April 18, 1902 (100, USNM, E.7131, E.7132).

Albatross station 4123; southwest coast of Oahu; Barbers Point Light bearing S. 78° E., 3.2 miles distant; bottom temperature 5.72° C.; fine gray sand and mud; July 26, 1902 (2, USNM, E.1902).

Fisher recorded the color of the specimens from station 4123 as "Dorsal surface: arms very pale buff with grayish tinge; disk same, greenish. Under side pale sepia on arms, disk rather deep sepia, except at edge of disk."

Ophiozonella depressa Lyman, Mus. Comp. Zoöl., Bull. **5** (7) : 128, pl. 6, figs. 155-157, 1878 (*Challenger* station 214; 500 fathoms).—Lyman, Challenger Reports, Zoology **5** (14) : 24, pl. 11, figs. 16-18, 1882 (*Challenger* station 214; near the Philippines, lat. 4° 33′ N., long. 127° 06′ E.; 500 fathoms).

Albatross station 3891; north coast of Molokai; Mokapu Islet bearing S. 30° W., 4.1 miles distant; 852-1,172 meters; bottom temperature 4.50° C.; volcanic sand, broken shells, and lava; April 18, 1902 (2, USNM, E.7136).

These two specimens seem to agree in all essentials with *O. depressa* as described and figured by Lyman. Both of them have a few more plates on the aboral surface than is shown in Lyman's figure, and the plates are rather less regularly arranged. The disk is low with rather sharp edges and the plates, except for the slightly convex radial shields, are flat and imbricate slightly outward.

In one specimen, with the disk 11 mm. in diameter, the central plate is pentagonal with slightly truncated angles, each of the five sides bearing a trapezoidal plate tapering outward which is about as long as the radius of the central plate. These trapezoidal plates separate five large radial plates which are nearly as large as the central plate and are broadly rounded outwardly as shown in Lyman's figure. On one of the two arms preserved the upper arm plates beyond the second are not in contact as shown in Lyman's figure; on the other arm the first four upper arm plates are in contact. There are two subequal, or usually subequal, arm spines which are about two-thirds the length of a segment.

The other specimen has the disk 10 mm. in diameter. The large pentagonal central plate on the aboral surface is surrounded by five large radially situated plates nearly as large as itself. The trapezoidal interradial plates are absent, although in one interradius a small triangular plate separates the bases of two of the large radial plates. The second upper arm plate is not quite in contact with the first, and those following are widely separated. The arm spines are slightly shorter than those of the other specimen, and the upper is slightly longer and stouter than the lower.

Ophioplocus imbricatus (Müller and Troschel).

Ophiolepis imbricata Müller and Troschel, System der Asteriden, 93, 1842 (Isle de France = Mauritius; Timor).

Ophioplocus imbricatus H. L. Clark, B. P. Bishop Mus., Bull. **27** : 94, 1925 (Wake Island).

Wake Island (H. L. Clark, 1925).

Ophioderma panamense Lütken, Additamenta ad historiam Ophiuridarum (2) : 91, 1859 (Panama).

Ophioderma panamensis Koehler, Bull. scient. de la France et de la Belgique **41** : 282, 1907 (Isles Sandwich).

In his "Revision de la collection des ophiures du Muséum d'Histoire Naturelle de Paris" (*27*) Professor Koehler lists an alcoholic specimen of *Ophioderma panamensis* from Panama and a dry specimen from the Hawaiian Islands.

In his original description of *Astriclypeus manni* (39, p. 311) Verrill writes "The single specimen of this curious species was presented by Mr. Horace Mann, of Cambridge, Mass., in honor of whom I have named it. It was obtained by him, with several other West Coast echinoderms from Mr. Pease of the Sandwich Islands. Its origin is therefore entirely doubtful." In a footnote (p. 312) he says "The species received in this collection are as follows: *Linckia unifascialis* Gray, *Nidorellia armata* Gray, *Oraster occidentalis* Verrill, *Heliaster kubiniji* Xantus, *Culcita,* sp., *Dendraster excentricus* Ag., *Encope grandis* Ag., *E. occidentalis*? V., *Astriclypeus manni* V."

APPENDIX

THE HAWAIIAN ECHINODERM FAUNA

Introduction

At present we do not have sufficiently detailed information regarding the echinoderms of the Pacific as a whole, particularly of the deeper water, to make more than rather general statements concerning the relationships of the Hawaiian fauna.

As we know it today, the center of abundance and of intensity of the Indo-Pacific fauna is in the Malayan region, from the north coast of the Sunda Islands to the Philippines, and this has apparently been true for a very long time. From this center the number of representative types diminishes in all directions until on the periphery of the Indo-Pacific region the fauna has become much attenuated, this attenuation being in part compensated by the occurrence of local endemic types, some of which are modifications, usually slight, of widely spread types arising through isolation, while others are quite different from anything now living in any other portion of the Indo-Pacific region and presumably represent ancient types which have died out elsewhere.

A fauna is essentially a living thing, in a continuous state of flux, certain elements gradually disappearing, their place being taken by the intrusion of new elements, by the extension of the ecological range of other local elements, sometimes accompanied by the appearance of new species, or animals of another phylum. This process has been going on from the earliest geologic time, so that the present fauna of any area includes types that have arisen at various epochs in the past, some of them as early as the Cambrian.

The Hawaiian fauna is an attenuated peripheral Indo-Pacific fauna in which a number of the component types have become locally modified so as to form endemic species. Some of these supposedly endemic species may occur elsewhere in the relatively less known regions farther south, but most of them are probably confined to the Hawaiian group. Professor Fisher has noted a Japanese element among the Hawaiian starfishes. This Japanese element is more strongly emphasized among the sea urchins, brittle stars and crinoids. He has also noted an Australian element among the starfishes.

It might be expected that the peripheral fauna of the Hawaiian Islands would be most closely parallel to the peripheral fauna of southern Japan, and would include elements occurring in other peripheral faunas such as that of Australia and of the western Indian Ocean. There is no reason for assuming any direct past faunal connection between Hawaii and southern Japan. The species common to the two regions probably reached them from the Indo-Pacific center by quite different paths and simply have died out elsewhere.

To understand how this might come about it is instructive to consider the present distribution of certain large and conspicuous sea urchins, easily preserved littoral types of which we know the details of distribution with a fair degree of completeness.

The genus *Heterocentrotus*—the well-known slate-pencil urchins—contains two wide-ranging species, *H. mammillatus* and *H. trigonarius*. These two species are so much alike as to be almost impossible to distinguish without detailed examination. Since, for this reason, many of the records are dubious, the following notes are based upon specimens identified by Agassiz and H. L. Clark, H. L. Clark, de Meijere, Mortensen, and me.

Both *Heterocentrotus mammillatus* and *H. trigonarius* occur at Madagascar, Reunion (Bourbon), Mauritius, Rodriguez, Salibabu, the Philippines, New Guinea, Fiji, and Johnston Island.

Heterocentrotus mammillatus alone is known from the Red Sea, Tanganyika, Binongka, Karakelong, Rotti [Roti], Timor, the Lucipara Islands, Amboina, Cape Jaubert, Western Australia, Biak Island (north of Geelvink Bay, New Guinea), the Murray Islands in Torres Strait, Darnley Island, Lord Howe Island, the Loyalty Islands, the Hawaiian Islands, the Bonin Islands, and the Ryukyu Islands.

Heterocentrotus trigonarius alone is known from Zanzibar, Natal, the Sunda Strait, Java, the Solomon Islands, the Tonga Islands, Samoa, the Society Islands, the Tuamotus, the Marquesas, the Phoenix Islands (Baker Island), the Ellice Islands (Funafuti), Palmyra Island, the Gilbert Islands, Wake Island, the Marshalls, and the Carolines.

In the Pacific area *H. mammillatus* and *H. trigonarius*—except in the Philippines, New Guinea, Fiji, and Johnston Island—inhabit different regions. Throughout the entire central region *H. trigonarius* alone is found; *H. mam-*

millatus alone occurs in the extreme north and south, about the periphery of the region where *H. trigonarius* lives.

Much the same type of discontinuous distribution is illustrated by the related genus *Colobocentrotus,* the limpet urchins. *Colobocentrotus* includes three species. One of these, *C. atratus,* occurs at Zanzibar, Natal, Madagascar, Mauritius, the Seychelles, Ceylon, the Andaman Islands, Java, Christmas Island (Indian Ocean), Timor, Amboina, and the Hawaiian Islands. It is not known from any locality between Timor and the Moluccas and the Hawaiian Islands. In the Bonin Islands and on Guam[5] it is replaced by the quite different *C. mertensii,* while in the Tuamotus it is represented by *C. pedifer.* A related genus, *Zenocentrotus,* with two species, occurs in the Tongan and Samoan Islands.

The genus *Ophiocomella* includes five small but common species. *Ophiocomella clippertoni* occurs throughout the Hawaiian group and has been recorded from Wake and Palmyra Islands. It was originally described from Clipperton Island south of the Gulf of California in about lat. 10° N., long. 110° W. It is quite possibly conspecific with *O. parva* described from the Murray Islands in Torres Strait. On Canton in the Phoenix Islands it is replaced by *O. schultzi.* Of the other two species, one occurs in the Galapagos Islands, the other in the Caribbean. The species of *Ophiocomella* are so small as to be easily overlooked, but they are no smaller than *Ophiactis savignyi,* which has been recorded from a great number of localities throughout the tropics. If the genus *Ophiocomella* were represented in the Malayan region it would almost certainly have been found by the zoologists of the *Challenger, Gazelle, Siboga, Albatross, Investigator,* or *Willibrord Snellius,* or by such thorough collectors as Mortensen, Brock, Strubell, Von Martens, and others who have visited the region.

Heretofore, only *Heterocentrotus mammillatus* has been known from Johnston Island. Fredrick M. Bayer recently made a short visit to Johnston Island and brought back a number of specimens of *H. mammillatus* together with several large typical specimens of *H. trigonarius.* His specimens are now in the U. S. National Museum. Incidentally, Mr. Bayer's specimens of *H. trigonarius* from Johnston Island are the largest known. In one of them the longer diameter is 123 mm., the shorter diameter 100 mm., the height 68 mm., and the longest spines are 150 mm. long. In another, possibly larger, the longest spines are 165 mm. long. In all, the spines are rather slender, evenly tapering, and sharply triangular in cross section.

In the following lists, the *Albatross* stations are given in numerical sequence, and the other localities are arranged alphabetically. The strictly Hawaiian localities, from northwest to southeast, are: Kure, Midway Island,

[5] Specimens in the U. S. National Museum (cat. no. E.6934) collected by Lieut.-Comdr. David H. Johnson, U.S.N.R., in May 1945.

Pearl and Hermes Reef, Lisiansky Island, Laysan Island, Gardner Island, French Frigate Shoal, Necker Island, Moku Manu, Nihoa, Niihau, Kauai, Oahu, Penguin Bank, Molokai, Lanai, Maui, and Hawaii.

Wake Island is situated on the same submarine elevation as the Marshalls, though some distance from them. Johnston Island is on an isolated submarine elevation. Palmyra and Fanning Islands are on a submarine bank directly south of Oahu and Hawaii.

The species marked with an asterisk (*) are not known from the Hawaiian group.

Records from Hawaiian Islands and Vicinity

HOLOTHUROIDEA

HOLOTHURIIDAE

Actinopyga parvula (Selenka): Fanning; Hawaiian Is., without definite locality; Johnston; ?Necker; Oahu; Palmyra; Wake.

Actinopyga nobilis (Selenka): Hawaiian Is., without definite locality; Laysan; Oahu; Palmyra.

Actinopyga obesa (Selenka): Hawaiian Is., without definite locality; Johnston; Laysan; Oahu.

Actinopyga mauritiana (Quoy and Gaimard): Fanning; Hawaii; Johnston; Maui; Necker; Niihau; Oahu; Palmyra; Wake.

Holothuria paradoxa (Selenka): *Albatross* station 3847; Pearl and Hermes reef.

Holothuria kapiolaniae (Bell): Hawaiian Is., without definite locality.

Holothuria cinerascens (Brandt): Hawaii; Hawaiian Is., without definite locality; Honolulu, reef; Laysan; Necker; Oahu.

Holothuria pervicax (Selenka): Fanning; Hawaii; Hawaiian Is., without definite locality; Honolulu, reef; Laysan; Oahu; Pearl and Hermes Reef.

Holothuria atra Jaeger: Fanning; Hawaii; Hawaiian Is., without definite locality; Honolulu, reef; Johnston; Laysan; Maui; Oahu; Pearl and Hermes Reef; Wake.

Holothuria monacaria (Lesson): Fanning; French Frigate Shoal; Hawaiian Is., without definite locality; Johnston; Lisiansky; Palmyra; Pearl and Hermes Reef; Wake.

Holothuria vagabunda Selenka: Hawaiian Is., without definite locality.

Holothuria humilis Selenka: Hawaiian Is., without definite locality.

Holothuria fuscorubra Théel: French Frigate Shoal; Hawaiian Is., without definite locality; Kauai; Laysan; Necker; Oahu; Pearl and Hermes Reef.

Holothuria arenicola Semper: Fanning; Hawaiian Is., without definite locality; Laysan; Oahu; Palmyra; Wake.

Holothuria pardalis Selenka: Fanning; Hawaii; Hawaiian Is., without definite locality; Honolulu, reef; Johnston; Laysan; Oahu; Palmyra; Pearl and Hermes Reef; Wake.

Holothuria inhabilis Selenka: Hawaiian Is., without definite locality.

Holothuria impatiens (Forskål): *Albatross* station 3834; Hawaiian Is., without definite locality; Honolulu, reef; Johnston; Laysan; Molokai; Necker; Oahu; Pearl and Hermes Reef.

Holothuria edulis Lesson: Hawaiian Is., without definite locality; Wake.

Holothuria verrucosa Selenka: Hawaiian Is., without definite locality.

**Holothuria lineata* Ludwig (= *pardalis* Selenka): Johnston.

Holothuria hawaiiensis Fisher: *Albatross* stations 3872, 3876; ?Necker.

Holothuria anulifera Fisher: *Albatross* stations 3872, 3876.

Holothuria fusco-olivacea Fisher: *Albatross* station 3834.

**Holothuria rugosa* Ludwig: Fanning.

Holothuria, sp.: Oahu.

Labidodemas semperianum Selenka: Hawaiian Is., without definite locality.

Stichopus chloronotos Brandt: Fanning; Hawaiian Is., without definite locality; Palmyra; Wake.

**Stichopus variegatus* Semper: Wake.

Stichopus tropicalis Fisher: Hawaii; Honolulu, reef; Oahu.

Mesothuria carnosa Fisher: *Albatross* stations 3988, 3997, 4021, 4041, 4130, 4131, 4132, 4134, 4136, 4139.

Mesothuria murrayi (Théel): *Albatross* stations 3472, 3813, 3866, 3883, 4088, 4096.

Mesothuria parva (Théel): *Albatross* stations 3895, 3919, 3998, 4081, 4115, 4122.

Bathyplotes patagiatus Fisher: *Albatross* stations 3824, 3988, 3994, 4021, 4041, 4134, 4140.

Pseudostichopus propinquus Fisher: *Albatross* station 3866.

Paelopatides retifer Fisher: *Albatross* stations 3887, 3979, 3995, 4019, 4022, 4028, 4038, 4039, 4110, 4141, 4150, 4176, 4187.

ELPIDIIDAE

Scotodeima vitreum Fisher: *Albatross* station 3979.

Orphnurgus insignis Fisher: *Albatross* stations 3475, 3836, 3839, 3883, 3979, 3988, 3994, 3997, 4015, 4021, 4025, 4041, 4083, 4084, 4085, 4086, 4096, 4123, 4134, 4140.

Laetmogone biserialis Fisher: *Albatross* stations 3988, 4141.

Laetmogone, sp.: *Albatross* station 4043.

Pannychia pallida Fisher: *Albatross* stations 3994, 4041.

CUCUMARIIDAE

Thyonidium hawaiiense Fisher: *Albatross* station 4101.

Thyonidium alexandri Fisher: *Albatross* station 4044.

Psolus macrolepis Fisher: *Albatross* station 3863.

SYNAPTIDAE

**Synapta maculata* (Chamisso and Eysenhardt): Palmyra.

**Leptosynapta oöplax* (Von Marenzeller): Fanning.

Polyplectana kefersteinii (Selenka): *Albatross* stations 3876, 4031; Johnston; Oahu.

Euapta godeffroyi (Semper): *Albatross* stations 3872, 3976; Hawaii; Palmyra; Wake.

Opheodesoma spectabilis Fisher: Oahu; Pearl and Hermes Reef.

Protankyra albatrossi Fisher: *Albatross* stations 3835, 3836, 3839, 3840, 3895, 3984, 3998, 4043, 4044, 4079, 4082, 4083, 4132, 4139, 4140, 4141, 4142.

Anapta inermis Fisher: *Albatross* stations 3839, 3916, 3919, 3997, 4088, 4089.

Chiridota hawaiiensis Fisher: Honolulu, reef.

Chiridota rigida Semper: Hawaiian Is., without definite locality; Johnston; Palmyra; Wake.

Chiridota uniserialis Fisher: *Albatross* station 3892.

Taeniogyrus, sp.: *Albatross* station 3919.

CRINOIDEA

COMASTERIDAE

Pentacrinoid young, probably of a species of Comactiniinae; *Albatross* station 3809.

MARIAMETRIDAE

Lamprometra palmata palmata (J. Müller): Oahu.

THALASSOMETRIDAE

Thalassometra hawaiiensis (A. H. Clark): *Albatross* stations 3475, 3476.

Oceanometra gigantea (A. H. Clark): *Albatross* station 3985.

Parametra fisheri (A. H. Clark): *Albatross* station 4122.

Cosmiometra crassicirra (A. H. Clark): *Albatross* station 3882.

Cosmiometra delicata (A. H. Clark): *Albatross* station 3963.

Stiremetra decora A. H. Clark: *Albatross* station 4107.

CHARITOMETRIDAE

Glyptometra lateralis (A. H. Clark): *Albatross* stations 4177, 4179, 4180.

ANTEDONIDAE

Argyrometra crispa (A. H. Clark): *Albatross* station 3938.
Sarametra triserialis (A. H. Clark): *Albatross* station 4122.
Psathrometra congesta A. H. Clark: *Albatross* station 3992.
Trichometra vexator A. H. Clark: *Albatross* stations 3859, 3865, 3883, 3910, 3925, 4105.

PENTAMETROCRINIDAE

Thaumatocrinus rugosus (A. H. Clark): *Albatross* station 4157.

ATELECRINIDAE

Atelecrinus conifer A. H. Clark: *Albatross* station 3887.

PHRYNOCRINIDAE

Naumachocrinus hawaiiensis A. H. Clark: *Albatross* station 4187.

ECHINOIDEA

CIDARIDAE

Histocidaris variabilis (A. Agassiz and H. L. Clark): *Albatross* stations 3865, 3866, 3883, 3893, 3918, 4081, 4083, 4085, 4090, 4096, 4097, 4116, 4117.
Stereocidaris grandis (Döderlein): *Albatross* stations 3831, 3919, 4044, 4096.
Stereocidaris leucacantha A. Agassiz and H. L. Clark: *Albatross* stations 3828, 3835, 3839, 3865, 3866, 3867, 3893, 3909, 3912, 3917, 3918, 3992, 4096, 4097, 4116, 4117.
Acanthocidaris hastigera A. Agassiz and H. L. Clark: *Albatross* stations 3823, 3838, 3845, 3846, 3847, 3848, 3861, 3906, 4061, 4062, 4064, 4066, 4077.
Stylocidaris calacantha (A. Agassiz and H. L. Clark): *Albatross* stations 3859, 3863, 3882, 3885, 3886, 4045, 4100.
Eucidaris metularia (Lamarck): *Albatross* stations 3838, 3847, 3849, 3861, 3871, 3872, 3874, 3876, 3955, 3962, 3968, 3970, 3971, 3978, 4027, 4032, 4033, 4034, 4046, 4146, 4147, 4148, 4149, 4150, 4158, 4159, 4160, 4161, 4162, 4167, 4169; French Frigate Shoal; Kure; Laysan; Oahu; Palmyra; Pearl and Hermes Reef.
Actinocidaris thomasii (A. Agassiz and H. L. Clark): *Albatross* stations 3823, 3838, 3863, 4046, 4062, 4096.
Prionocidaris hawaiiensis (A. Agassiz and H. L. Clark): *Albatross* stations 3845, 3846, 3849, 3861, 3863, 3872, 3876, 3906, 3936, 3955, 3987, 3991, 4027, 4046, 4054, 4057, 4064, 4066, 4073, 4077, 4128, 4160, 4161.

Chondrocidaris gigantea (A. Agassiz): *Albatross* station 4050; off Honolulu reefs.

ECHINOTHURIIDAE

Phormosoma bursarium A. Agassiz: *Albatross* stations 3884, 3892, 3904, 3957, 3988, 3994, 3997, 4019, 4022, 4025, 4087, 4089, 4091, 4110, 4112, 4113, 4141.

Sperosoma obscurum A. Agassiz and H. L. Clark: *Albatross* stations 3824, 3865, 3979, 3988, 4015, 4021, 4025, 4036, 4089, 4096, 4112, 4117, 4130, 4131, 4134, 4136 4137.

SALENIIDAE

Salenocidaris miliaris (A. Agassiz): *Albatross* stations 4125, 4181.

Salenocidaris crassispina (A. Agassiz and H. L. Clark): *Albatross* station 4045.

ARBACIIDAE

Habrocidaris argentea A. Agassiz and H. L. Clark: *Albatross* station 3973.

Podocidaris ornata H. L. Clark: *Albatross* station 3919.

ASPIDODIADEMATIDAE

Aspidodiadema meijerei Döderlein: *Albatross* stations 3817, 3818, 3836, 3839, 3865, 3914, 3918, 3920, 4096, 4097, 4105, 4107, 4116, 4122, 4178.

Aspidodiadema nicobaricum Döderlein: *Albatross* stations 3892, 3981, 3988, 3989, 3994, 4013, 4014, 4021, 4022, 4025, 4030, 4107, 4110, 4112, 4131, 4137, 4140, 4141, 4166, 4177, 4180.

PEDINIDAE

Caenopedina hawaiiensis H. L. Clark: *Albatross* stations 3865, 3879, 4178, 4179.

Caenopedina pulchella (A. Agassiz and H. L. Clark): *Albatross* station 3991.

DIADEMATIDAE

Astropyga radiata (Leske): *Albatross* station 3875; off Honolulu, 18 fathoms.

Chaetodiadema pallidum (A. Agassiz and H. L. Clark): *Albatross* stations 3856, 3857, 3957, 4103, 4104.

Diadema[6] *paucispinum* A. Agassiz: *Albatross* stations 3968, 4169; Hawaii; Honolulu, reef; Laysan; Oahu; Pearl and Hermes Reef.

[6] *Diadema* Gray, 1825, is preoccupied by *Diadema* Schumacher, 1817, for a crustacean, and also by Ranzani 1817 for a crustacean. In 1912 the name *Centrechinus* Jackson (Boston Soc. Nat. Hist., Mem. 7: 28, 1912) was suggested to replace it. But the name *Centrechinus* has not been generally adopted, and at present the International Commission on Zoological Nomenclature is considering placing *Diadema* Gray on the list of *nomina conservanda*.

Echinothrix calamaris (Pallas): *Albatross* station 4033; Hawaii; Hawaiian Is., without definite locality; Palmyra.

Echinothrix diadema (Linné): Hawaii; Honolulu, reef; Johnston; Palmyra; Pearl and Hermes Reef; Wake.

Centrostephanus asteriscus A. Agassiz and H. L. Clark: *Albatross* stations 4034, 4066, 4128, 4161, 4163.

Leptodiadema purpureum A. Agassiz and H. L. Clark: *Albatross* station 3847.

TEMNOPLEURIDAE

Temnotrema hawaiiensis (A. Agassiz and H. L. Clark): *Albatross* stations 3823, 3847, 3871, 3872, 3876, 3962, 3978, 4148, 4150.

Prionechinus sculptus A. Agassiz and H. L. Clark (including *P. depressus*): *Albatross* stations 3818, 4028, 4039, 4083, 4086, 4087, 4088, 4115.

Prionechinus agassizi Wood-Mason and Alcock: *Albatross* station 4126.

Trigonocidaris albida A. Agassiz: *Albatross* stations 3859, 3863, 3892, 4045.

Orechinus monolini (A. Agassiz): *Albatross* stations 3839, 3865, 3914, 3918, 4085, 4117, 4125, 4126, 4131; Hawaiian Is., without definite locality.

TOXOPNEUSTIDAE

Cyrtechinus verruculatus (Lütken): *Albatross* stations 3847, 3871, 3872, 3955, 3970, 4031, 4032, 4162, 4168; Oahu.

**Toxopneustes maculatus* (Lamarck): Palmyra.

Tripneustes gratilla (Linné): *Albatross* station 3876; French Frigate Shoal; Hawaii; Hawaiian Is., without definite locality; Honolulu, reef; Johnston; Laysan; Oahu; Palmyra.

Pseudoboletia indiana (Michelin): *Albatross* stations 3872, 3876, 4033, 4164; French Frigate Shoal; Kure; Midway; Pearl and Hermes Reef.

PARASALENIIDAE

**Parasalenia gratiosa* A. Agassiz: Palmyra.

ECHINOMETRIDAE

Echinostrephus aciculatus A. Agassiz: *Albatross* stations 3959, 3960, 3968, 3969, 3970, 3975, 4147; Hawaiian Is., without definite locality; Johnston; Kure; Laysan; Midway; Pearl and Hermes Reef; Wake.

Echinostrephus molaris (de Blainville): Johnson; Kure; Laysan; Midway; Pearl and Hermes Reef; Wake.

Echinometra mathaei (de Blainville) (including *E. picta*): *Albatross* stations 3881, 3959, 3975; French Frigate Shoal; Gardner; Hawaii; Honolulu, reef; Johnston; Kure; Laysan; Midway; Necker; Nihoa; Niihau; Oahu; Palmyra; Pearl and Hermes Reef; Wake.

Echinometra oblonga (de Blainville): French Frigate Shoal; Gardner; Hawaii; Honolulu, reef; Johnston; Kauai; Lanai; Laysan; Necker; Nihoa; Niihau; Oahu; Wake.

Heterocentrotus mammillatus (Linné): French Frigate Shoal; Hawaii; Johnston; Kure; Laysan; Midway; Necker; Oahu; Palmyra; Pearl and Hermes Reef.

**Heterocentrotus trigonarius* (Lamarck): Johnston; Wake.

Colobocentrotus atratus (Linné): *Albatross* station 3881; French Frigate Shoal; Gardner; Hawaii; Lanai; Maui; Necker; Nihoa; Niihau; Oahu.

CLYPEASTRIDAE

Clypeaster lytopetalus (A. Agassiz and H. L. Clark): *Albatross* stations 3936, 3962; Pearl and Hermes Reef.

Clypeaster reticulatus (Linné): *Albatross* stations 3846, 3847, 3848, 3849, 3850, 3863, 3871, 3872, 3874, 3876, 3962, 3982, 3987, 4031, 4032, 4033, 4034, 4061, 4128, 4146, 4148, 4150, 4158, 4164; Midway.

Clypeaster leptostracon A. Agassiz and H. L. Clark: *Albatross* stations 3823, 3987, 4046, 4064, 4066.

Clypeaster eurypetalus H. L. Clark: Pearl and Hermes Reef.

LAGANIDAE

Laganum fudsiyama Döderlein: *Albatross* stations 3811, 3814, 3838, 3859, 3863, 3876, 3984, 4079, 4080, 4081, 4099, 4101, 4115, 4122, 4132.

Peronella strigata (A. Agassiz and H. L. Clark): *Albatross* station 3859.

FIBULARIIDAE

Fibularia australis (Desmoulins): Midway; Hawaiian Is., without definite locality; off Honolulu, 2-5 fathoms.

Echinocyamus elongatus H. L. Clark: *Albatross* stations 3856, 4064, 4148.

Echinocyamus scaber de Meijere: *Albatross* stations 3839, 3908, 3914.

Echinocyamus incertus H. L. Clark: *Albatross* station 4045.

ECHINONEIDAE

Echinoneus cyclostomus Leske: Fanning; Hawaiian Is., without definite locality; Kure; Laysan; Midway; Palmyra; Pearl and Hermes Reef; Wake.

Echinoneus abnormalis de Loriol: Hawaii; Hawaiian Is., without definite locality.

Micropetalon purpureum A. Agassiz and H. L. Clark: *Albatross* station 3847.

AEROPSIDAE

Aceste ovata A. Agassiz and H. L. Clark: *Albatross* stations 3836, 3839, 3898, 4041.

PALEOPNEUSTIDAE

Phryssocystis multispina A. Agassiz and H. L. Clark: Hawaiian Is., without definite locality.

?*Phryssocystis aculeata* A. Agassiz: Hawaiian Is., without definite locality.

Argopatagus vitreus A. Agassiz: *Albatross* station 4039.

Pycnolampas oviformis A. Agassiz and H. L. Clark: *Albatross* stations 3838, 3890, 4144.

HEMIASTERIDAE

Hypselaster maximus (A. Agassiz and H. L. Clark): *Albatross* station 4130.

SPATANGIDAE

Brissopsis luzonica (Gray): *Albatross* stations 3824, 3826, 3836, 3839, 3842, 3863, 3892, 3908, 3912, 3916, 3917, 3918, 3992, 3997, 4028, 4044, 4070, 4083, 4131, 4132.

Metalia sternalis (Lamarck): Hawaiian Is. without definite locality.

Metalia spatagus (Linné): Oahu.

Rhynobrissus placopetalus A. Agassiz and H. L. Clark: *Albatross* stations 4146, 4160.

Brissus latecarinatus (Leske): Hawaiian Is., without definite locality; Johnston; Kure; Laysan; Moku Manu; Pearl and Hermes Reef.

Gymnopatagus pulchellus A. Agassiz and H. L. Clark: *Albatross* stations 3810, 3811, 4045.

Gymnopatagus obscurus A. Agassiz and H. L. Clark: *Albatross* stations 3912, 4081.

Spatangus paucituberculatus A. Agassiz and H. L. Clark: *Albatross* stations 3863, 3865, 4096, 4097, 4116.

?*Breynia australasiae* (Leach): Hawaiian Is., without definite locality.

Lovenia grisea A. Agassiz and H. L. Clark: *Albatross* station 4080.

?*Lovenia subcarinata* (Gray): Hawaiian Is., without definite locality.

Pseudolovenia hirsuta A. Agassiz and H. L. Clark: *Albatross* stations 3836, 3839, 3865, 3920, 4028, 4036, 4083, 4122.

ASTEROIDEA

ASTROPECTINIDAE

Astropecten polyacanthus Müller and Troschel: *Albatross* station 4168; French Frigate Shoal.

Astropecten triseriatus myobrachius Fisher: Pearl and Hermes Reef.

Astropecten hawaiiensis Döderlein: *Albatross* stations 3849, 4031, 4055.

Astropecten ctenophorus Fisher: *Albatross* station 3937.

Astropecten callistus Fisher: *Albatross* stations 3810, 3835, 3957, 4044, 4055, 4079, 4080, 4114.
Astropecten pusillulus Fisher: *Albatross* stations 3472, 3865, 3918, 4044, 4045, 4048, 4082, 4083, 4084, 4085, 4096, 4116, ?4181.
Astropecten productus Fisher: *Albatross* stations 4101, 4102.
Ctenophoraster hawaiiensis Fisher: *Albatross* station 3935.
Tritonaster craspedotus Fisher: *Albatross* stations 3473, 3914, 3918, 3919.
Psilaster attenuatus Fisher: *Albatross* stations 3470, 3471, 3474, 3475, 3476, 3865, 3866, 3867, 3883, 3884, 3887, 3908, 3909, 3910, 3911, 3916, 3917, 3918, 4086, 4087, 4088, 4089, 4090, 4091, 4095, 4096.
Persephonaster cingulatus (Fisher): *Albatross* stations 3824, 3887, 3995, 3997, 4028, 4123.
Dipsacaster nesiotes Fisher: *Albatross* stations 3866, 3867, 3884, 3908, 3910, 3915.
Patagiaster nuttingi Fisher: *Albatross* stations 3472, 3836, 3919, 4044, 4081, 4082, 4083, 4115, 4116.

LUIDIIDAE

Luidia hystrix Fisher: *Albatross* stations 3861, 3876, 3987, 4031, 4032, 4034, 4168; Oahu.
Luidia magnifica Fisher: *Albatross* station 3849; Pearl and Hermes Reef.
Luidia brevispina Lütken: Hawaiian Is., without definite locality.
Luidia, sp.: ?Penguin Bank, about 25 fathoms.

BENTHOPECTINIDAE

Cheiraster inops Fisher: *Albatross* stations 3474, 3865, 3868.
Cheiraster snyderi Fisher: *Albatross* stations 3981, 3997, 3998, 4007.
Luidiaster horridus (Fisher): *Albatross* station 4079.

ARCHASTERIDAE

Archaster typicus Müller and Troschel: Hawaiian Is., without definite locality.

GONIASTERIDAE

Pseudarchaster jordani Fisher: *Albatross* station 3474.
Pseudarchaster myobrachius Fisher: *Albatross* stations 3995, 4028.
Mediaster ornatus Fisher: *Albatross* stations 3474, 3475, 3476, 3997, 4019, 4021, 4022, 4028, 4123, 4141.
Ceramaster bowersi (Fisher): *Albatross* stations 4132, 4134.
Ceramaster micropeltus (Fisher): *Albatross* station 4151.
Sphaeriodiscus ammophilus (Fisher): *Albatross* stations 3919, 4081, 4082, 4083.

Plinthaster ceramoideus Fisher: *Albatross* stations 3865, 3883, 4082, 4096.
Astroceramus callimorphus Fisher: *Albatross* station 3857.
Calliderma spectabilis Fisher: *Albatross* stations 3838, 3938, 4074, 4077, 4079, 4098, 4102.
Calliaster pedicellaris Fisher: *Albatross* station 4100.
Gilbertaster anacanthus Fisher: *Albatross* station 4041.
Evoplosoma forcipifera Fisher: *Albatross* station 4186.
Anthenoides epixanthus (Fisher): *Albatross* stations 3813, 4080, 4081, 4082, 4084, 4115.

OREASTERIDAE

Pentaceraster hawaiiensis (Fisher): *Albatross* stations 3849, 3850, 3872, 4072, 4075.
Asterodiscus tuberculosus Fisher: *Albatross* stations 3940, 4128.
**Culcita novaeguineae* forma *novaeguineae* Müller and Troschel: Johnston.
Culcita novaeguineae forma *arenosa* Perrier: Hawaii; Hawaiian Is., without definite locality; Oahu.
Culcita novaeguineae forma *nesiotis* Fisher: Oahu.
Culcita novaeguineae ?forma (*Goniodiscides sebae*): Hilo, Hawaii.
Culcita novaeguineae ?forma: Hawaiian Is., without definite locality.

LINCKIIDAE

Ophidiaster lorioli Fisher: *Albatross* station 3834; Molokai; Wake.
Ophidiaster squameus Fisher: *Albatross* stations 4023, 4100; Oahu; Pearl and Hermes Reef.
Ophidiaster rhabdotus Fisher: *Albatross* station 3982.
Tamaria triseriatus (Fisher): *Albatross* station 4128.
Tamaria scleroderma (Fisher): *Albatross* station 4077.
Tamaria tenella (Fisher): *Albatross* station 4100.
?*Tamaria pusilla* (Müller and Troschel): Oahu.
Leiaster brevispina H. L. Clark: Hawaiian Is., without definite locality.
Leiaster leachii hawaiiensis Fisher: Kauai.
Leiaster callipeplus Fisher: *Albatross* stations 3872, 3875, 4128, 4149, 4164.
Linckia guildingii Gray: *Albatross* stations 3848, 3872; Laysan; Oahu.
Linckia multifora (Lamarck): Hawaiian Is., without definite locality; Johnston; Oahu; Palmyra; Pearl and Hermes Reef; Wake.
?*Linckia laevigata* (Linné): Hawaii; Hawaiian Is., without definite locality.
?*Gomophia aegyptica* Gray: Hawaiian Is., without definite locality.
Dactylosaster cylindricus pacificus Fisher: Hawaii; Kure; Laysan; Oahu.
Fromia pacifica H. L. Clark: Hawaiian Is., without definite locality.
**Ferdina cancellata tylota* Fisher: Wake.

ASTEROPIDAE

Asterope carinifera (Lamarck): Hawaii; Hawaiian Is., without definite locality.

GANERIIDAE

Hyalinothrix millespina Fisher: *Albatross* station 3863.

ASTERINIDAE

**Asterina coronata cristata* Fisher: Palmyra.
**Asterina cepheus* (Müller and Troschel): Wake.
Asterina anomala H. L. Clark: Oahu.
Asterina granulosa Perrier: Hawaii; Hawaiian Is., without definite locality; Oahu.
Asterina, sp.: Hawaii; Oahu.
Nepanthia, sp.: Hawaii; Maui; Oahu.

ANSEROPODIDAE

Anseropoda insignis Fisher: *Albatross* stations 3835, 4101.

ECHINASTERIDAE

Henricia robusta Fisher: *Albatross* station 4115.
Henricia pauperrima Fisher: *Albatross* stations 4044, 4166.
**Othilia luzonica* Gray: Palmyra.
Echinaster, sp.: *Albatross* stations 3872, 4046, 4162.

ACANTHASTERIDAE

Acanthaster planci (Linné): Hawaiian Is., without definite locality; Johnston; Oahu; Pearl and Hermes Reef.

VALVASTERIDAE

Valvaster striatus (Lamarck): *Albatross* station 3469.

MITHRODIIDAE

Mithrodia fisheri Holly: *Albatross* stations 3847, 3871, 3872, 3876, 3960, 3975, 3978, 4024, 4034, 4046, 4062, 4146, 4159, 4160, 4162, 4163, 4164, 4169, 4170; French Frigate Shoal; Hawaiian Is., without definite locality; Johnston; Laysan; Pearl and Hermes Reef.
Mithrodia, sp.: *Albatross* station 4147.

MYXASTERIDAE

Asthenactis papyraceus Fisher: *Albatross* station 4157.

PTERASTERIDAE

Pteraster reticulatus Fisher: *Albatross* stations 3472, 3476, 3867.
Hymenaster pentagonalis Fisher: *Albatross* stations 3911, 3914, 4090.
Benthaster eritimus Fisher: *Albatross* station 3824.

ZOROASTERIDAE

Zoroaster spinulosus Fisher: *Albatross* stations 3892, 4007, 4112, 4139.

ASTERIIDAE

Coscinasterias acutispina (Stimpson): Hawaiian Is., without definite locality; Kure; Maui; Oahu; Pearl and Hermes Reef.
Sclerasterias euplecta (Fisher): *Albatross* stations 3835, 3859, 3885, 4045, 4062, 4064, 4066, 4079, 4100, 4101.
Tarsastrocles verrilli (Fisher): *Albatross* station 3867.

PEDICELLASTERIDAE

Coronaster eclipes Fisher: *Albatross* station 4031.

BRISINGIDAE

Odinia pacifica Fisher: *Albatross* stations 3828, 3992.
Craterobrisinga panopla (Fisher): *Albatross* stations 3828, 3992, 4177, 4178.
Craterobrisinga alberti (Fisher): *Albatross* stations 3992, 4177.
Craterobrisinga evermanni (Fisher): *Albatross* station 3992.
Brisingella fragilis (Fisher): *Albatross* stations 3817, 3824, 3865, 3892, 3910, 3914, 3920, 4041, 4090, 4091, 4096, 4131, 4166.

OPHIUROIDEA

OPHIOMYXIDAE

Ophiomyxa fisheri A. H. Clark: *Albatross* stations 4096, 4100, 4101.

TRICHASTERIDAE

Asteroschema tubiferum Matsumoto: *Albatross* stations 4125, 4185, 4186.
Asteroschema caudatum var. *granulosum* A. H. Clark: *Albatross* stations 4018, 4136, 4178.
Asteroschema caudatum var. *obscurum* A. H. Clark: *Albatross* stations 3992,

4080, 4107, 4108, 4137, 4171; Hawaiian Is., without definite locality.

Asteroschema edmondsoni A. H. Clark: *Albatross* stations 3981, 3989, 4019, 4037, 4134, 4171, 4172, 4182.

Asteroschema ajax A. H. Clark: *Albatross* stations 3992, 4107, 4139, 4171.

GORGONOCEPHALIDAE

Gorgonocephalus dolichodactylus Döderlein: Hawaiian Is., without definite locality.

HEMIEURYALIDAE

Ophioleila elegans A. H. Clark: *Albatross* station 4019.

Ophiomoeris inflata A. H. Clark: *Albatross* station 3973.

OPHIACANTHIDAE

Ophiacantha bisquamata Matsumoto: *Albatross* station 4100.

Ophiacantha prionota H. L. Clark: *Albatross* stations 3865, 4147.

Ophiacantha dumosa A. H. Clark: *Albatross* station 3865.

Ophiothamnus otho A. H. Clark: *Albatross* station 4096.

Ophiomitra semele A. H. Clark: *Albatross* stations 3868, 3986, 3992, 4016, 4107, 4136.

Ophioplinthaca athena A. H. Clark: *Albatross* station 3996.

Ophioplinthaca clothilde A. H. Clark: *Albatross* stations 3981, 4019; Hawaiian Is., without definite locality.

Ophiologimus quadrispinus H. L. Clark: *Albatross* stations 4096, 4100; *Tanager* station 4, Laysan, 366 meters.

AMPHIURIDAE

Amphiura dino A. H. Clark: *Albatross* station 4021; Hawaiian Is., without definite locality.

Amphiura immira Ely: *Albatross* station 3984; Black Point, Oahu.

Amphipholis squamata (Delle Chiaje): Hawaii; Laysan; Oahu; Wake.

Amphioplus cythera A. H. Clark: *Albatross* station 4066; Hawaiian Is., without definite locality.

Amphioplus caelatus Ely: Oahu, Black Point.

?*Amphiodia*, sp.: Oahu.

Amphiurid: Laysan, 200 fathoms.

OPHIACTIDAE

Ophiactis savignyi (Müller and Troschel): *Albatross* stations 3872, 3876; Hawaii; Hawaiian Is., without definite locality; Johnston; Oahu; Wake.

Ophiactis dyscrita H. L. Clark: *Albatross* stations 4070, 4096; Oahu.

Ophiactis modesta Brock: *Albatross* stations 3823, 3876, 4066, 4070, 4076; Oahu.

Ophiactis lethe A. H. Clark: *Albatross* stations 3849, 3850, 3875, 4066, 4070, 4071, 4072; Hawaiian Is., without definite locality.

?*Ophiactis kröyeri* Lütken: Hawaiian Is., without definite locality; Oahu.

Amphiactis lycidas A. H. Clark: *Albatross* stations 3981, 4108.

Amphiactis astarte A. H. Clark: *Albatross* station 4100.

OPHIOTRICHIDAE

Ophiothrix demessa Lyman: *Albatross* stations 3873, 3962, 3968, 3969, 4032, 4033, 4034, 4146, 4147, 4160, 4161, 4167; French Frigate Shoal; Hawaii; Hawaiian Is., without definite locality; Laysan; Maui; Molokai; Oahu; Pearl and Hermes Reef.

Ophiothrix lepidus hawaiiensis A. H. Clark: *Albatross* stations 3845, 3846, 3939, 4046, 4072, 4076.

OPHIOCHITONIDAE

Ophioplax melite A. H. Clark: *Albatross* stations 3982, 4066, 4100.

Ophionereis porrecta Lyman: *Albatross* stations 3969, 4031, 4032, 4033, 4034, 4146, 4147, 4160, 4167; Hawaii; Hawaiian Is., without definite locality; Kure; Maui; Oahu.

Ophionereis dubia (Müller and Troschel): Hawaiian Is., without definite locality; Oahu.

Ophiodesmus degeneri A. H. Clark: *Albatross* stations 3969, 4033, 4160; Oahu.

OPHIOCOMIDAE

Ophiomastix asperula Lütken: Hawaii.

Ophiocoma erinaceus Müller and Troschel: *Albatross* stations 3834, 4044, 4146, 4167, 4168, 4169; Hawaii; Hawaiian Is., without definite locality; Laysan; Kure; Johnston; Necker; Oahu; Palmyra; Wake.

Ophiocoma insularia Lyman: Hawaii; Hawaiian Is., without definite locality; Maui; Oahu; Pearl and Hermes Reef.

Ophiocoma insularia var. *variegata* E. A. Smith: Hawaiian Is., without definite locality; Kure; Laysan; Necker; Oahu; Pearl and Hermes Reef.

Ophiocoma pica Müller and Troschel: *Albatross* stations 3834, 3968, 4031, 4033, 4044; Hawaii; Hawaiian Is., without definite locality; Johnston; Kure; Laysan; Maui; Oahu; Pearl and Hermes Reef; Wake.

Ophiocoma scolopendrina (Lamarck): *Albatross* stations 3828, 3861, 3872, 3876, 3968, 3969, 3982, 4146, 4147, 4160, 4167; Hawaiian Is., without definite locality; Laysan; Maui; Oahu; Palmyra.

Ophiocoma brevipes Peters: *Albatross* station 4167; Hawaii; Hawaiian Is., without definite locality; Kure; Laysan; Midway; Pearl and Hermes Reef.
Ophiocomella clippertoni A. H. Clark (= *Ophiocoma parva* H. L. Clark): Laysan; Lisiansky; Oahu; Palmyra; Pearl and Hermes Reef; Wake.

OPHIODERMATIDAE

Distichophis clarki Ely: *Albatross* station 3969; Oahu.
**Ophiarachnella parvispina* H. L. Clark; Wake.
Ophiopezella spinosa (Ljungman): Oahu.

OPHIOLEPIDIDAE

Ophiura kinbergi Ljungman: *Albatross* stations 3876, 3939, 3962.
Ophiura monaria A. H. Clark: *Albatross* stations 3474, 3995, 4028, 4041, 4091, 4123, 4139, 4140.
Ophiura ursula A. H. Clark: *Albatross* stations 4101, 4102.
Ophiura fisheri A. H. Clark: *Albatross* stations 3818, 3836, 3865, 3916, 4084, 4085; Hawaiian Is., without definite locality.
Ophiura ponderosa (Lyman): *Albatross* station 4044.
Ophiomusium elii A. H. Clark: *Albatross* stations 3818, 3865, 4096.
Ophiomusium relictum Koehler: *Albatross* station 3996.
Ophiomusium zela A. H. Clark: *Albatross* station 4018.
Ophiomusium lymani Wyville Thomson: *Albatross* stations 3891, 3892, 4123.
Ophiozonella depressa (Lyman): *Albatross* station 3891.
**Ophioplocus imbricatus* (Müller and Troschel): Wake.

Hawaiian Localities from which Echinoderms are Recorded, with Species Found in Each

ALBATROSS STATIONS

Station 3469; south of eastern Oahu (lat. 21° 14′ 15″ N., long. 157° 43′ 30″ W.); 26 meters; sand and coral; December 3, 1891.

Asteroidea: *Valvaster striatus.*

Station 3470; south of eastern Oahu (lat. 21° 08′ 30″ N., long. 157° 49′ 00″ W.); 627 meters; bottom temperature 6.27° C.; white sand; December 4, 1891.

Asteroidea: *Psilaster attenuatus.*

Station 3471; south of eastern Oahu (lat. 21° 10′ 30″ N., long. 157° 48′ 30″ W.); 616 meters; fine white sand; December 4, 1891.

Asteroidea: *Psilaster attenuatus.*

Station 3472; south of eastern Oahu (lat. 21° 12′ 00″ N., long. 157° 49′ 00″ W.); 539 meters; fine white sand; December 4, 1891.

Holothuroidea: *Mesothuria murrayi.*

Asteroidea: *Astropecten pusillulus, Patagiaster nuttingi, Pteraster reticulatus.*

Station 3473; Kaiwi Channel, between Oahu and Molokai (lat. 21° 15′ 00″ N., long. 157° 30′ 00″ W.; 572 meters; bottom temperature 6.55° C.; fine gray sand; December 6, 1891.

Asteroidea: *Tritonaster craspedotus.*

Station 3474; south of eastern Oahu (lat. 21° 12′ 00″ N., long. 157° 38′ 30″ W.); 685 meters; fine white sand; December 6, 1891.

Asteroidea: *Psilaster attenuatus, Pseudarchaster jordani, Cheiraster inops, Mediaster ornatus.*

Ophiuroidea: *Ophiura monaria.*

Station 3475; south of eastern Oahu (lat. 21° 08′ 00″ N., long. 157° 43′ 00″ W.); 642 meters; fine white sand; December 6, 1891.

Holothuroidea: *Orphnurgus insignis.*

Crinoidea: *Thalassometra hawaiiensis.*

Asteroidea: *Psilaster attenuatus, Mediaster ornatus.*

Station 3476; south of eastern Oahu (lat. 21° 09′ 00″ N., long. 157° 53′ 00″ W.); 545 meters; fine white sand; December 6, 1891.

Crinoidea: *Thalassometra hawaiiensis.*

Asteroidea: *Psilaster attenuatus, Mediaster ornatus, Pteraster reticulatus.*

Station 3809; south coast of Oahu; Honolulu Light bearing N. 28° E., 2 miles distant; 228-93 meters; fine coral sand with black specks; March 27, 1902.

Crinoidea: Pentacrinoid larvae of Comasteridae, attached to a cirrus probably of a species of Comactiniinae.

Station 3810; south coast of Oahu; Honolulu Light bearing N. 2° E., 2.4 miles distant; 386-97 meters; bottom temperature 8.72° C.; fine coral sand; March 27, 1902.

Echinoidea: *Gymnopatagus pulchellus.*

Asteroidea: *Astropecten callistus.*

Station 3811; south coast of Oahu; Honolulu Light bearing N. 4° W., 3.9 miles distant; 435-95 meters; bottom temperature 21.39° C.; coral sand and rock; March 27, 1902.

Echinoidea: *Laganum fudsiyama, Gymnopatagus pulchellus.*

Station 3813; south coast of Oahu; Diamond Head Light bearing N. 76° E., 2.2 miles distant; 483-335 meters; bottom temperature 5.28° C.; coral sand, lava specks, and shells; March 28, 1902.

Holothuroidea: *Mesothuria murrayi.*

Asteroidea: *Anthenoides epixanthus.*

Station 3814; south coast of Oahu; Diamond Head Light bearing NE., 1.7 miles distant; 519-77 meters; bottom temperature 7.77° C.; coral sand, shells, and stones; March 28, 1902.

Echinoidea: *Laganum fudsiyama.*

Station 3817; south coast of Oahu; Diamond Head Light bearing N. 77° W., 8.4 miles distant; 585 meters; bottom temperature given as 23.05° C. (evidently an error); coarse lava, coral sand, and shells; March 28, 1902.

Echinoidea: *Aspidodiadema meijerei.*

Asteroidea: *Brisingella fragilis.*

Station 3818; south coast of Oahu; Diamond Head Light bearing N. 59° E., 4.3 miles distant; 536-539 meters; bottom temperature 6.83° C.; fine coral sand with black specks; March 31, 1902.

Echinoidea: *Aspidodiadema meijerei, Prionechinus sculptus.*

Ophiuroidea: *Ophiura fisheri, Ophiomusium elii.*

Station 3823; south coast of Molokai; Lae o Ka Laau Light bearing N. 34° W., 5.1 miles distant; 146-406 meters; bottom temperature 20.55° C.; fine sand and pebbles; April 1, 1902.

Echinoidea: *Actinocidaris thomasi, Acanthocidaris hastigera, Temnotrema hawaiiensis, Clypeaster leptostracon.*

Ophiuroidea: *Ophiactis modesta.*

Station 3824; south coast of Molokai; Lae o Ka Laau Light bearing N. 35° W., 6.1 miles distant; 406-910 meters; bottom temperature 9.73° C.; coral, rocks, and broken shells; April 1, 1902.

Holothuroidea: *Bathyplotes patagiatus.*

Echinoidea: *Sperosoma obscurum, Brissopsis luzonica.*

Asteroidea: *Persephonaster cingulatus, Benthaster eritimus, Brisingella fragilis.*

Station 3826; south coast of Molokai; Lae o Ka Laau Light bearing N. 46° W., 9.2 miles distant; 786-678 meters; bottom temperature 5.28° C.; gray mud, coral, and rock; April 1, 1902.

Echinoidea: *Brissopsis luzonica.*

Station 3828; south coast of Molokai; Lae o Ka Laau Light bearing N. 46° W., 11 miles distant; 583-514 meters; bottom temperature 6.55° C.; broken shells and gravel; April 1, 1902.

Echinoidea: *Stereocidaris leucacantha.*

Asteroidea: *Odinia pacifica, Craterobrisinga panopla.*

Ophiuroidea: *Ophiocoma scolopendrina.*

Station 3831; south coast of Molokai; Lae o Ka Laau Light bearing N. 46° W., 13.6 miles distant; 477-325 meters; brown mud, coral sand, rocks, and coral; April 2, 1902.

Echinoidea: *Stereocidaris grandis.*

Station 3834; south coast of Molokai; Kaunakakai landing bearing N. 22° E., ⅜ mile distant; 15 meters; coral, rock, sand, and shells; April 2-3, 1902.

Holothuroidea: *Holothuria impatiens, H. fusco-olivacea.*

Asteroidea: *Ophidiaster lorioli.*

Ophiuroidea: *Ophiocoma erinaceus, O. pica.*

Station 3835; south coast of Molokai; Lae o Ka Laau Light bearing N. 64° W., 13.7 miles distant; 309-333 meters; bottom temperature 12.77° C.; fine brown sand and mud; April 3, 1902.

Holothuroidea: *Protankyra albatrossi.*

Echinoidea: *Stereocidaris leucacantha.*

Asteroidea: *Astropecten callistus, Anseropoda insignis, Sclerasterias euplecta.*

Station 3836; south coast of Molokai; Lae o Ka Laau Light bearing N. 58° 30′ W., 11.8 miles distant; 435-466 meters; bottom temperature 8.88° C.; brown and gray mud and sand; April 3, 1902.

Holothuroidea: *Orphnurgus insignis, Protankyra albatrossi.*

Echinoidea: *Aspidodiadema meijerei, Aceste ovata, Brissopsis luzonica, Pseudolovenia hirsuta.*

Asteroidea: *Patagiaster nuttingi.*

Ophiuroidea: *Ophiura fisheri.*

Station 3838; south coast of Molokai; Lae o Ka Laau Light bearing N. 74° 30′ W., 8.1 miles distant; 168-388 meters; bottom temperature 19.44° C.; fine gray and brown sand; April 4, 1902.

Echinoidea: *Eucidaris metularia, Actinocidaris thomasii, Acanthocidaris hastigera, Laganum fudsiyama, Pycnolampas oviformis.*

Asteroidea: *Calliderma spectabilis.*

Station 3839; south coast of Molokai; Lae o Ka Laau Light bearing N. 64° W., 9.7 miles distant; 473-486 meters; bottom temperature 7.94° C.; light brown mud and sand; April 4, 1902.

Holothuroidea: *Orphnurgus insignis, Protankyra albatrossi, Anapta inermis.*

Echinoidea: *Stereocidaris leucacantha, Aspidodiadema meijerei, Orechinus monolini, Echinocyamus scaber, Aceste ovata, Brissopsis luzonica, Pseodolovenia hirsuta.*

Station 3840; south coast of Molokai; Lae o Ka Laau Light bearing N. 60° W., 10 miles distant; 486-574 meters; bottom temperature 7.77° C.; light brown mud, sand, and rock; April 4, 1902.

Holothuroidea: *Protankyra albatrossi.*

Station 3842; south coast of Molokai; Lae o Ka Laau Light bearing N. 40° W., 8.5 miles distant; 905-925 meters; bottom temperature 4.72° C.; fine brown sand, mud, and rock; April 4, 1902.

Echinoidea: *Brissopsis luzonica.*

Station 3845; south coast of Molokai; Lae o Ka Laau Light bearing N. 69° 30′ W., 18.1 miles distant; 110-117 meters; bottom temperature 21.66° C.; coarse sand, pebbles, and shells; April 8, 1902.

Echinoidea: *Acanthocidaris hastigera, Prionocidaris hawaiiensis.*
Ophiuroidea: *Ophiothrix lepidus hawaiiensis.*

Station 3846; south coast of Molokai; Lae o Ka Laau Light bearing N. 69° 45′ W., 19.1 miles distant; 117-110 meters; bottom temperature 21.94° C.; coarse brown sand, shells, and gravel; April 8, 1902.

Echinoidea: *Prionocidaris hawaiiensis, Acanthocidaris hastigera, Clypeaster reticulatus, Echinocyamus elongatus.*
Ophiuroidea: *Ophiothrix lepidus hawaiiensis.*

Station 3847; south coast of Molokai; Lae o Ka Laau Light bearing N. 64° 30′ W., 23 miles distant; 42-44 meters; sand and stones; April 8, 1902.

Holothuroidea: *Holothuria paradoxa.*
Echinoidea: *Eucidaris metularia, Acanthocidaris hastigera, Leptodiadema purpureum, Cyrtechinus verruculatus, Temnotrema hawaiiensis, Clypeaster reticulatus, Micropetalon purpureum.*
Asteroidea: *Mithrodia fisheri.*

Station 3848; south coast of Molokai; Lae o Ka Laau Light bearing N. 68° 15′ W., 22.4 miles distant; 80-133 meters; bottom temperature 21.61° C.; sand and gravel; April 8, 1902.

Echinoidea: *Acanthocidaris hastigera, Clypeaster reticulatus.*
Asteroidea: *Linckia guildingii.*

Station 3849; south coast of Molokai; Lae o Ka Laau Light bearing N. 71° W., 21.9 miles distant; 133-79 meters; bottom temperature 19.77° C.; coarse sand, broken shells, and coral; April 8, 1902.

Echinoidea: *Eucidaris metularia, Prionocidaris hawaiiensis, Clypeaster reticulatus.*
Asteroidea: *Astropecten hawaiiensis, Luidia magnifica, Pentaceraster hawaiiensis.*
Ophiuroidea: *Ophiactis lethe.*

Station 3850; south coast of Molokai; Lae o Ka Laau Light bearing N. 74° 15′ W., 22.2 miles distant; 79-121 meters; bottom temperature 22.05° C.; coarse sand, broken shells, and coral; April 8, 1902.

Echinoidea: *Clypeaster reticulatus.*
Asteroidea: *Pentaceraster hawaiiensis.*
Ophiuroidea: *Ophiactis lethe.*

Station 3856; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing N. 42° 45′ E., 10 miles distant; 239 meters; bottom temperature 19.17° C.; fine sand and yellow mud; April 9, 1902.

Echinoidea: *Chaetodiadema pallidum.*

Station 3857; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing N. 38° E., 9 miles distant; 239-240 meters; bottom temperature 16.94° C.; fine sand and yellow mud; April 9, 1902.

Echinoidea: *Chaetodiadema pallidum.*
Asteroidea: *Astroceramus callimorphus.*

Station 3859; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing N. 18° E., 5.6 miles distant; 252-256 meters; bottom temperature 15.66° to 15.83° C.; fine sand and mud; April 9, 1902.

Crinoidea: *Trichometra vexator.*
Echinoidea: *Stylocidaris calacantha, Trigonocidaris albida, Laganum fudsiyama, Peronella strigata.*
Asteroidea: *Sclerasterias euplecta.*

Station 3861; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing N. 13° 5′ W., 7.4 miles distant; 55-95 meters; fine sand, small pebbles, and coral; April 10, 1902.

Echinoidea: *Eucidaris metularia, Prionocidaris hawaiiensis, Acanthocidaris hastigera.*
Asteroidea: *Luidia hystrix.*
Ophiuroidea: *Ophiocoma scolopendrina.*

Station 3863; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing N. 31° W., 2.7 miles distant; 232-281 meters; bottom temperature 15.55° to 16.11° C.; broken coral, coarse gravel, and rock; April 10, 1902.

Holothuroidea: *Psolus macrolepis.*
Echinoidea: *Stylocidaris calacantha, Actinocidaris thomasi, Prionocidaris hawaiiensis, Trigonocidaris albida, Clypeaster reticulatus, Laganum fudsiyama, Brissopsis luzonica, Spatangus paucituberculatus.*
Asteroidea: *Hyalinothrix millespina.*

Station 3865; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing S. 79° W., 6.9 miles distant; 468-517 meters; bottom temperature 7.11° to 7.22° C.; volcanic sand and rock; April 10, 1902.

Crinoidea: *Trichometra vexator.*
Echinoidea: *Stereocidaris leucacantha, Histocidaris variabilis, Aspidodiadema meijerei, Sperosoma obscurum, Caenopedina hawaiiensis, Orechinus monolini, Spatangus paucituberculatus, Pseudolovenia hirsuta.*
Asteroidea: *Astropecten pusillulus, Psilaster attenuatus, Cheiraster inops, Plinthaster ceramoideus, Brisingella fragilis.*
Ophiuroidea: *Ophiacantha dumosa, O. prionota, Ophiura fisheri, Ophiomusium elii.*

Station 3866; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing S. 70° 15′ W., 7.6 miles distant; 517-519 meters; bottom temperature 6.55° C.; gray mud and fine sand; April 10, 1902.

Holothuroidea: *Mesothuria murrayi, Pseudostichopus propinquus.*
Echinoidea: *Stereocidaris leucacantha, Histocidaris variabilis.*
Asteroidea: *Psilaster attenuatus, Dipsacaster nesiotes.*

Station 3867; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing S. 64° 30′ W., 9.1 miles distant; 519-530 meters; bottom temperature 6.55° to 6.66° C.; fine sand and mud; April 10, 1902.

Echinoidea: *Stereocidaris leucacantha.*

Asteroidea: *Psilaster attenuatus, Dipsacaster nesiotes, Pteraster reticulatus, Tarsastrocles verrilli.*

Station 3868; Pailolo Channel, between Molokai and Maui; Mokuhooniki Islet bearing S. 57° W., 14.3 miles distant; 537-1,250 meters; bottom temperature 6.44° to 6.95° C.; fine gray sand and rock; April 11, 1902.

Asteroidea: *Cheiraster inops.*

Ophiuroidea: *Ophiomitra semele.*

Station 3871; Auau Channel, between Maui and Lanai; Mokuhooniki Islet bearing N. 3° W., 15.9 miles distant; 24-79 meters; fine white sand; April 12, 1902.

Echinoidea: *Eucidaris metularia, Cyrtechinus verruculatus, Temnotrema hawaiiensis, Clypeaster reticulatus.*

Asteroidea: *Mithrodia fisheri.*

Station 3872; Auau Channel, between Maui and Lanai; Mokuhooniki Islet bearing N. 3° E., 16.6 miles distant; 79-58 meters; bottom temperature 23.66° C.; yellow sand, pebbles, and coral; April 12, 1902.

Holothuroidea: *Holothuria hawaiiensis, H. anulifera, Euapta godeffroyi.*

Echinoidea: *Eucidaris metularia, Prionocidaris hawaiiensis, Cyrtechinus verruculatus, Temnotrema hawaiiensis, Pseudoboletia indiana, Clypeaster reticulatus.*

Asteroidea: *Pentaceraster hawaiiensis, Leiaster callipeplus, Linckia guildingii, Echinaster,* sp., *Mithrodia fisheri.*

Ophiuroidea: *Ophiactis savignyi, Ophiocoma scolopendrina.*

Station 3873; Auau Channel, between Maui and Lanai; Mokuhooniki Islet bearing N. 5° E., 17.3 miles distant; 58-66 meters; bottom temperature 23.66° C.; coral and pebbles; April 12, 1902.

Ophiuroidea: *Ophiothrix demessa.*

Station 3874; Auau Channel, between Maui and Lanai; Mokuhooniki Islet bearing N. 19° 45′ E., 18.2 miles distant; 38-51 meters; bottom temperature 24.05° C.; sand, pebbles, and shells; April 12, 1902.

Echinoidea: *Eucidaris metularia, Clypeaster reticulatus.*

Station 3875; Auau Channel, between Maui and Lanai; Mokuhooniki Islet bearing N. 14° 30′ E., 13.7 miles distant; 119-62 meters; bottom temperature 21.55° C.; fine gray sand; April 12, 1902.

Echinoidea: *Astropyga radiata.*

Asteroidea: *Leiaster callipeplus.*

Ophiuroidea: *Ophiactis lethe.*

Station 3876; Auau Channel, between Maui and Lanai; Lahaina Light, Maui, bearing N. 60° 45′ E., 1.6 miles distant; 51-79 meters; bottom temperature 23.33° C.; sand and gravel; April 14, 1902.

Holothuroidea: *Holothuria hawaiiensis, H. anulifera, Polyplectana kefersteinii, Euapta godeffroyi.*

Echinoidea: *Eucidaris metularia, Prionocidaris hawaiiensis, Tripneustes gratilla, Temnotrema hawaiiensis, Pseudoboletia indiana, Clypeaster reticulatus, Laganum fudsiyama.*

Asteroidea: *Luidia hystrix, Mithrodia fisheri.*

Ophiuroidea: *Ophiactis savignyi, O. modesta, Ophiura kinbergi, Ophiocoma scolopendrina.*

Station 3879; south of Lanai; Molokini Islet bearing N. 75° E., 42.6 miles distant; 1,687-1,976 meters; bottom temperature 2.83° C.; Globigerina ooze and rock; April 15, 1902.

Echinoidea: *Caenopedina hawaiiensis.*

Station 3881; Pailolo Channel, between Maui and Molokai; Napili Harbor, Maui; shore collecting; April 16, 1902.

Echinoidea: *Echinometra mathaei, Colobocentrotus atratus.*

Station 3882; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing N. 30° W., 3.1 miles distant; 249 meters; bottom temperature 17.50° C.; sand, coral, and rock; April 16, 1902.

Crinoidea: *Cosmiometra crassicirra.*

Echinoidea: *Stylocidaris calacantha.*

Station 3883; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 80° 30′ W., 7.8 miles distant; 506-519 meters; bottom temperature 7.33° C.; Globigerina ooze; April 16, 1902.

Holothuroidea: *Mesothuria murrayi, Orphnurgus insignis.*

Crinoidea: *Trichometra vexator.*

Echinoidea: *Histocidaris variabilis.*

Asteroidea: *Psilaster attenuatus, Plinthaster ceramoideus.*

Station 3884; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 75° W., 9.2 miles; 519-530 meters; bottom temperature 6.66° C.; Globigerinae and mud; April 16, 1902.

Echinoidea: *Phormosoma bursarium.*

Asteroidea: *Psilaster attenuatus, Dipsacaster nesiotes.*

Station 3885; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing N. 27° W., 3.3 miles distant; 249-271 meters; bottom temperature 18.22° C.; sand and pebbles; April 17, 1902.

Echinoidea: *Stylocidaris calacantha.*

Asteroidea: *Sclerasterias euplecta.*

Station 3886; Pailolo Channel, between Maui and Molokai; Mokuhooniki

Islet bearing N. 47° W., 3.4 miles distant; 271 meters; bottom temperature 18.33° C.; pebbles and rock; April 17, 1902.

Echinoidea: *Stylocidaris calacantha.*

Station 3887; north coast of Molokai; Mokuhooniki Islet bearing S. 15° W., 8.8 miles distant; 1,009-1,479 meters; bottom temperature 4.17° C.; Globigerinae and mud; April 17, 1902.

Holothuroidea: *Paelopatides retifer.*

Crinoidea: *Atelecrinus conifer.*

Asteroidea: *Persephonaster cingulatus.*

Station 3890; north coast of Molokai; Mokapu Islet bearing S. 77° 30′ W., 2.8 miles distant; 130-517 meters; bottom temperature 21.77° C.; black sand; April 18, 1902.

Echinoidea: *Pycnolampas oviformis.*

Station 3891; north coast of Molokai; Mokapu Islet bearing S. 30° W., 4.1 miles distant; 852-1,172 meters; bottom temperature 4.50° C.; volcanic sand, broken shells, and lava; April 18, 1902.

Ophiuroidea: *Ophiomusium lymani, Ophiozonella depressa.*

Station 3892; north coast of Molokai; Mokapu Islet bearing S. 66° 15′ E., 9.8 miles distant; 600-757 meters; bottom temperature 5.83° C.; fine gray sand; April 18, 1902.

Holothuroidea: *Chiridota uniserialis.*

Echinoidea: *Aspidodiadema nicobaricum, Phormosoma bursarium, Trigonocidaris albida, Brissopsis luzonica.*

Asteroidea: *Zoroaster spinulosus, Brisingella fragilis.*

Ophiuroidea: *Ophiomusium lymani.*

Station 3893; Kaiwi Channel, between Molokai and Oahu; Lae o Ka Laau Light bearing S. 34° E., 7.1 miles distant; 402-632 meters; bottom temperature 8.33° C.; fine white sand and rock; April 19, 1902.

Echinoidea: *Stereocidaris leucacantha, Histocidaris variabilis.*

Station 3895; south of Molokai and west of Lanai; Lae o Ka Laau Light bearing N. 3° 30′ E., 6.5 miles distant; 461-784 meters; bottom temperature 8.33° C.; coral and rock; April 28, 1902.

Holothuroidea: *Protankyra albatrossi, Mesothuria parva.*

Station 3898; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 81° 45′ W., 9.5 miles distant; 472-517 meters; bottom temperature 6.72° C.; brown Globigerina mud and fine sand; April 29, 1902.

Echinoidea: *Aceste ovata.*

Station 3904; north coast of Molokai; Mokapu Islet bearing S. 76° W., 13 miles distant; 539 meters; bottom temperature 6.61° C.; brown mud, sand, and rock; April 30, 1902.

Echinoidea: *Phormosoma bursarium.*

Station 3906; north coast of Molokai; Mokapu Islet bearing S. 74° E., 12.8 miles distant; 121-175 meters; bottom temperature 22.22° C.; gray sand, shells, and pebbles; May 1, 1902.

Echinoidea: *Prionocidaris hawaiiensis, Acanthocidaris hastigera.*

Station 3908; south coast of Oahu; Diamond Head Light bearing N. 21° E., 6.9 miles distant; 556-563 meters; bottom temperature 6.55° C.; fine white sand and mud; May 5, 1902.

Echinoidea: *Echinocyamus scaber, Brissopsis luzonica.*

Asteroidea: *Psilaster attenuatus, Dipsacaster nesiotes.*

Station 3909; south coast of Oahu; Diamond Head Light bearing N. 31° E., 5.3 miles distant; 563-589 meters; bottom temperature 6.39° C.; fine white sand and mud; May 5, 1902.

Echinoidea: *Stereocidaris leucacantha.*

Asteroidea: *Psilaster attenuatus.*

Station 3910; south coast of Oahu; Diamond Head Light bearing N. 7° E., 12.5 miles distant; 568-616 meters; bottom temperature 6.50° C.; fine gray sand and mud; May 5, 1902.

Holothuroidea: *Anapta inermis.*

Crinoidea: *Trichometra vexator.*

Asteroidea: *Psilaster attenuatus, Dipsacaster nesiotes, Brisingella fragilis.*

Station 3911; south coast of Oahu; Diamond Head Light bearing N. 10° E., 11 miles distant; 616-611 meters; bottom temperature 6.22° C.; fine gray sand and mud; May 5, 1902.

Asteroidea: *Psilaster attenuatus, Hymenaster pentagonalis.*

Station 3912; south coast of Oahu; Diamond Head Light bearing N. 20° E., 10.2 miles distant; 611-567 meters; bottom temperature 6.11° C.; fine gray sand and mud; May 5, 1902.

Echinoidea: *Stereocidaris leucacantha, Brissopsis luzonica, Gymnopatagus obscurus.*

Station 3914; south coast of Oahu; Diamond Head Light bearing N. 23° 10′ E., 16.4 miles distant; 528-534 meters; gray sand and mud; May 6, 1902.

Echinoidea: *Aspidodiadema meijerei, Orechinus monolini, Echinocyamus scaber.*

Asteroidea: *Tritonaster craspedotus, Hymenaster pentagonalis, Brisingella fragilis.*

Station 3916; south coast of Oahu; Diamond Head Light bearing N. 40° E., 9.7 miles distant; 547-603 meters; bottom temperature 6.66° C.; gray sand and mud; May 6, 1902.

Holothuroidea: *Anapta inermis.*

Echinoidea: *Brissopsis luzonica.*

Asteroidea: *Psilaster attenuatus, Dipsacaster nesiotes.*

Ophiuroidea: *Ophiura fisheri.*

Station 3917; south coast of Oahu; Diamond Head Light bearing N. 50° 20′ E., 10.3 miles distant; 603-537 meters; bottom temperature 6.66° C.; gray sand and mud; May 6, 1902.

Echinoidea: *Stereocidaris leucacantha, Brissopsis luzonica.*

Asteroidea: *Psilaster attenuatus.*

Station 3918; south coast of Oahu; Diamond Head Light bearing N. 63° E., 8 miles distant; 537-470 meters; bottom temperature 6.94° C.; white sand and mud; May 6, 1902.

Echinoidea: *Stereocidaris leucacantha, Histocidaris variabilis, Aspidodiadema meijerei, Orechinus monolini, Brissopsis luzonica.*

Asteroidea: *Astropecten pusillulus, Tritonaster craspedotus, Psilaster attenuatus.*

Station 3919; south coast of Oahu; Diamond Head Light bearing N. 84° E., 7.9 miles distant; 470-402 meters; bottom temperature 7.55° C.; gray sand; May 6, 1902.

Holothuroidea: *Mesothuria parva, Anapta inermis, Taeniogyrus,* sp.

Echinoidea: *Stereocidaris grandis, Podocidaris ornata.*

Asteroidea: *Tritonaster craspedotus, Patagiaster nuttingi, Sphaeriodiscus ammophilus.*

Station 3920; south coast of Oahu; Diamond Head Light bearing N. 74° E., 8.9 miles distant; 512-484 meters; bottom temperature 7.00° C.; gray sand and broken shells; May 6, 1902.

Echinoidea: *Aspidodiadema meijerei, Pseudolovenia hirsuta.*

Asteroidea: *Brisingella fragilis.*

Station 3925; south coast of Oahu; Diamond Head Light bearing N. 29° 30′ E., 10.2 miles distant; 590-547 meters; bottom temperature 6.50° C.; fine gray sand, mud, and rock; May 7, 1902.

Crinoidea: *Trichometra vexator.*

Station 3935; in the vicinity of Laysan Island; Laysan Island Light bearing S. 79° E., 7.3 miles distant; 104-144 meters; bottom temperature, 21.72° C.; white sand, broken shells, and corallines; May 16, 1902.

Asteroidea: *Ctenophoraster hawaiiensis.*

Station 3936; in the vicinity of Laysan Island; Laysan Island Light bearing S. 84° E., 7.5 miles distant; 144-238 meters; bottom temperature 20.00° C.; small broken shells and corallines; May 16, 1902.

Echinoidea: *Prionocidaris hawaiiensis, Clypeaster lytopetalus.*

Station 3937; in the vicinity of Laysan Island; Laysan Island Light bearing S. 87° E., 7.2 miles distant; 238-271 meters; bottom temperature 17.22° C.; white sand and small shells; May 16, 1902.

Asteroidea: *Astropecten ctenophorus.*

Station 3938; in the vicinity of Laysan Island; Laysan Island Light bearing S. 88° 30′ E., 7.8 miles distant; 271-298 meters; bottom temperature 15.72° C.; white sand and broken shells; May 16, 1902.

Crinoidea: *Argyrometra crispa.*

Asteroidea: *Calliderma spectabilis.*

Station 3939; in the vicinity of Laysan Island; Laysan Island Light bearing S. 89° 30′ E., 8.1 miles distant; 298-108 meters; bottom temperature 14.17° C.; white sand, broken shells, and rock; May 16, 1902.

Ophiuroidea: *Ophiothrix lepidus hawaiiensis, Ophiura kinbergi.*

Station 3940; in the vicinity of Laysan Island; Laysan Island Light bearing S. 84° E., 7.0 miles distant; 108-128 meters; bottom temperature 21.11° C.; white sand and broken shells; May 16, 1902.

Asteroidea: *Asterodiscus tuberculosus.*

Station 3955; in the vicinity of Laysan Island; Laysan Island Light bearing S. 12° 30′ W., 6.1 miles distant; 37-55 meters; bottom temperature 23.33° C.; coral rock and algae; May 21, 1902.

Echinoidea: *Eucidaris metularia, Prionocidaris hawaiiensis, Cyrtechinus verruculatus.*

Station 3957; in the vicinity of Laysan Island; Laysan Island Light bearing S. 87° E., 8.2 miles distant; 402-316 meters; bottom temperature 11.94° C.; fine white sand; May 22, 1902.

Echinoidea: *Chaetodiadema pallidum, Phormosoma bursarium.*

Asteroidea: *Astropecten callistus.*

Station 3959; in the vicinity of Laysan Island; Laysan Island Light bearing N. 75° E., 1.3 miles distant; 18 meters; white sand and coral; May 22, 1902.

Echinoidea: *Echinostrephus aciculatus, Echinometra mathaei.*

Station 3960; in the vicinity of Laysan Island; Laysan Island Light bearing N. 67° E., 1.5 miles distant; 18-35 meters; sand, shells, and coral; May 22, 1902.

Echinoidea: *Echinostrephus aciculatus.*

Asteroidea: *Mithrodia fisheri.*

Station 3962; in the vicinity of Laysan Island; Laysan Island Light bearing N. 56° E., 5.2 miles distant; 29 meters; white sand and coral; May 22, 1902.

Echinoidea: *Eucidaris metularia, Temnotrema hawaiiensis, Clypeaster lytopetalus, C. reticulatus.*

Ophiuroidea: *Ophiothrix demessa, Ophiura kinbergi.*

Station 3963; in the vicinity of Laysan Island; Laysan Island Light bearing N. 56° 30′ E., 6.6 miles distant; 583 meters; bottom temperature 23.17° C.; white sand and broken shells; May 22, 1902.

Crinoidea: *Cosmiometra delicata.*

Station 3968; off French Frigate Shoal (lat. 23° 46′ 00″ N., long. 166° 18′ 55″ W.); 26-30 meters; coarse sand and coral; May 29, 1902.

Echinoidea: *Eucidaris metularia, Diadema paucispina, Echinostrephus aciculatus.*

Ophiuroidea: *Ophiothrix demessa, Ophiocoma scolopendrina, O. pica.*

Station 3969; off French Frigate Shoal (lat. 23° 45′ 50″ N., long. 166° 20′ 15″ W.); 27-29 meters; coarse sand, shells, and coral; May 29, 1902.

Echinoidea: *Echinostrephus aciculatus.*

Ophiuroidea: *Ophiothrix demessa, Distichophis clarki, Ophionereis porrecta, Ophiodesmus degeneri, Ophiocoma scolopendrina.*

Station 3970; off French Frigate Shoal (lat. 23° 45′ 50″ N., long. 166° 20′ 50″ W.); 31-32 meters; coarse sand, shells, and coral; May 29, 1902.

Echinoidea: *Eucidaris metularia, Cyrtechinus verruculatus, Echinostrephus aciculatus.*

Station 3971; off French Frigate Shoal (lat. 23° 46′ 05″ N., long. 166° 21′ 45″ W.); 31 meters; coarse sand, shells, and coral; May 29, 1902.

Echinoidea: *Eucidaris metularia.*

Station 3973; off French Frigate Shoal (lat. 23° 47′ 10″ N., long. 166° 24′ 55″ W.); 722-726 meters; bottom temperature 5.00° C.; coarse coral sand and shells; May 29, 1902.

Echinoidea: *Habrocidaris argentea.*

Ophiuroidea: *Ophiomoeris inflata.*

Station 3975; Necker Island shoal (lat. 23° 30′ 00″ N., long. 164° 41′ 00″ W.); 29-313 meters; coarse sand, coral, and shells; May 31, 1902.

Echinoidea: *Echinostrephus aciculatus, Echinometra mathaei.*

Asteroidea: *Mithrodia fisheri.*

Station 3978; in the vicinity of Moku Manu, or Bird Island; center of island bearing N. 14° E., 2.2 miles distant; 58-84 meters; coarse sand, Foraminifera, and rock; June 3, 1902.

Echinoidea: *Eucidaris metularia, Temnotrema hawaiiensis.*

Asteroidea: *Mithrodia fisheri.*

Station 3979; in the vicinity of Moku Manu; center of island bearing N. 64° 30′ E., 11.0 miles distant; 406-707 meters; bottom temperature 12.22° C.; fine white sand, Foraminifera, and rock; June 3, 1902.

Holothuroidea: *Paelopatides retifer, Scotodeima vitreum, Orphnurgus insignis.*

Echinoidea: *Sperosoma obscurum.*

Station 3981; in the vicinity of Kauai; Nawiliwili Light bearing N. 82° W., 4.2 miles distant; 1,163-757 meters; Globigerina ooze; June 10, 1902.

Echinoidea: *Aspidodiadema nicobaricum.*

Asteroidea: *Cheiraster snyderi.*

Ophiuroidea: *Asteroschema edmondsoni, Ophioplinthaca clothilde, Amphiactis lycidas.*

Station 3982; in the vicinity of Kauai; Nawiliwili Light bearing N. 68° W., 1.6 miles distant; 426-73 meters; bottom temperature 9.17° C.; coarse brown coral sand and shells; June 10, 1902.

Echinoidea: *Clypeaster reticulatus.*

Asteroidea: *Ophidiaster rhabdotus.*

Ophiuroidea: *Ophioplax melite, Ophiocoma scolopendrina.*

Station 3984; in the vicinity of Kauai; Nawiliwili Light bearing N. 30° 30′ W., 3.5 miles distant; 433-300 meters; bottom temperature 8.44° C.; fine coral sand; June 10, 1902.

Holothuroidea: *Protankyra albatrossi.*

Echinoidea: *Laganum fudsiyama.*

Ophiuroidea: *Amphiura immira.*

Station 3985; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 53° 30′ W., 6.0 miles distant; 872-786 meters; bottom temperature 4.44° C.; gray sand, Foraminifera, and shore deposits; June 10, 1902.

Crinoidea: *Oceanometra gigantea.*

Station 3986; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 37° 30′ W., 6.5 miles distant; 662-100 meters; bottom temperature 5.44° C.; gray sand, Foraminifera, and shore deposits; June 11, 1902.

Ophiuroidea: *Ophiomitra semele.*

Station 3987; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 29° W., 6.8 miles distant; 100-91 meters; bottom temperature 22.77° C.; coarse coral sand and coral fragments; June 11, 1902.

Echinoidea: *Prionocidaris hawaiiensis, Clypeaster reticulatus, C. leptostracon.*

Asteroidea: *Luidia hystrix.*

Station 3988; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 21° W., 12.6 miles distant; 857-302 meters; bottom temperature 4.44° C.; gray Foraminifera, sand, and pebbles; June 11, 1902.

Holothuroidea: *Mesothuria carnosa, Bathyplotes patagiatus, Orphnurgus insignis, Laetmogone biserialis.*

Echinoidea: *Aspidodiadema nicobaricum, Phormosoma bursarium, Sperosoma obscurum.*

Station 3989; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 33° W., 9.5 miles distant; 914-704 meters; bottom temperature 3.05° C.; coral sand and rock; June 11, 1902.

Echinoidea: *Aspidodiadema nicobaricum.*

Ophiuroidea: *Asteroschema edmondsoni.*

Station 3991; in the vicinity of Kauai; Mokuaeae Islet bearing S. 78° W., 5.2 miles distant; 595-538 meters; bottom temperature 5.61° C.; gray sand, Foraminifera, and rock; June 12, 1902.

Echinoidea: *Prionocidaris hawaiiensis, Caenopedina pulchella.*

Station 3992; in the vicinity of Kauai; Mokuaeae Islet bearing S. 54° E., 3.5 miles distant; 965 meters; bottom temperature 4.22° C.; fine gray sand and mud; June 12, 1902.

Crinoidea: *Psathyrometra congesta.*

Echinoidea: *Stereocidaris leucacantha, Brissopsis luzonica.*

Asteroidea: *Odinia pacifica, Craterobrisinga panopla, C. alberti, C. evermanni.*

Ophiuroidea: *Asteroschema caudatum* var. *obscurum, A. ajax, Ophiomitra semele.*

Station 3994; in the vicinity of Kauai; Mokuaeae Islet bearing S. 63° E., 10.2 miles distant; 603-698 meters; bottom temperature 6.06° C.; fine gray sand and Foraminifera; June 12, 1902.

Holothuroidea: *Bathyplotes patagiatus, Orphnurgus insignis, Pannychia pallida.*

Echinoidea: *Aspidodiadema nicobaricum, Phormosoma bursarium.*

Station 3995; in the vicinity of Kauai; Mokuaeae Islet bearing S. 69° 30′ E., 11.5 miles distant; 780-1,236 meters; bottom temperature 4.77° C.; fine gray sand and rock; June 13, 1902.

Holothuroidea: *Paelopatides retifer.*

Asteroidea: *Persephonaster cingulatus, Pseudarchaster myobrachius.*

Ophiuroidea: *Ophiura monaria.*

Station 3996; in the vicinity of Kauai; Kapuai Point bearing S. 23° 15′ W., 15.5 miles distant; 1,866-2,157 meters; bottom temperature 2.29° C.; gray sand and rock; June 13, 1902.

Ophiuroidea: *Ophioplinthaca athena, Ophiomusium relictum.*

Station 3997; in the vicinity of Kauai; Ukula Point bearing S. 79° 15′ E., 7.0 miles distant; 766-784 meters; bottom temperature 5.00° C.; fine gray sand and brown mud; June 14, 1902.

Holothuroidea: *Mesothuria carnosa, Orphnurgus insignis, Anapta inermis.*

Echinoidea: *Phormosoma bursarium, Brissopsis luzonica.*

Asteroidea: *Persephonaster cingulatus, Cheiraster snyderi, Mediaster ornatus.*

Station 3998; in the vicinity of Kauai; Ukula Point bearing S. 71° E., 9.7 miles distant; 429-417 meters; bottom temperature 8.33° C.; coarse broken coral, sand, shells, and rock; June 14, 1902.

Holothuroidea: *Mesothuria parva, Protankyra albatrossi.*

Asteroidea: *Cheiraster snyderi.*

Station 4007; between Honolulu and Kauai; Ukula Point bearing N. 65° 30′ W., 7.4 miles distant; 929-1,018 meters; bottom temperature 4.44° C.; gray sand and Foraminifera; June 17, 1902.

Asteroidea: *Cheiraster snyderi, Zoroaster spinulosus.*

Station 4013; in the vicinity of Kauai; Hanamaulu warehouse bearing N. 85° W., 3.4 miles distant; 729-698 meters; bottom temperature 5.00° C.; fine gray sand and Foraminifera; June 20, 1902.

Echinoidea: *Aspidodiadema nicobaricum.*

Station 4014; in the vicinity of Kauai; Hanamaulu warehouse bearing N. 85° W., 3.4 miles distant; 729-698 meters; bottom temperature 4.88° C.; sand and Foraminifera; June 20, 1902.

Echinoidea: *Aspidodiadema nicobaricum.*

Station 4015; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 82° W., 2.6 miles distant; 662-581 meters; bottom temperature 5.11° C.; gray sand and rock; June 20, 1902.

Holothuroidea: *Orphnurgus insignis.*

Echinoidea: *Sperosoma obscurum.*

Station 4016; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 62° W., 2.2 miles distant; 581-558 meters; bottom temperature 6.05° C.; black sand; June 20, 1902.

Ophiuroidea: *Ophiomitra semele.*

Station 4018; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 57° W., 7.4 miles distant; 1,469-1,342 meters; bottom temperature 2.94° C.; Foraminifera, sand, and manganese fragments; June 21, 1902.

Ophiuroidea: *Asteroschema caudatum* var. *granulosum, Ophiomusium zela.*

Station 4019; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 43° W., 8.1 miles distant; 1,342-748 meters; bottom temperature 3.22° C.; gray sand, Foraminifera, and rock; June 21, 1902.

Holothuroidea: *Paelopatides retifer.*

Echinoidea: *Phormosoma bursarium.*

Asteroidea: *Mediaster ornatus.*

Ophiuroidea: *Asteroschema edmondsoni, Ophioplinthaca clothilde, Ophioleila elegans.*

Station 4021; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 28° 30′ W., 9.5 miles distant; 523-729 meters; bottom temperature 6.66° C.; coral sand and Foraminifera; June 21, 1902.

Holothuroidea: *Mesothuria carnosa, Bathyplotes patagiatus, Orphnurgus insignis.*

Echinoidea: *Aspidodiadema nicobaricum, Sperosoma obscurum.*

Asteroidea: *Mediaster ornatus.*

Ophiuroidea: *Amphiura dino.*

Station 4022; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 30° W., 10.2 miles distant; 729-684 meters; bottom temperature 5.00° C.; coral sand, Foraminifera, and rock; June 21, 1902.

Holothuroidea: *Paelopatides retifer.*

Echinoidea: *Aspidodiadema nicobaricum, Phormosoma bursarium.*

Asteroidea: *Mediaster ornatus.*

Station 4023; in the vicinity of Kauai; Mokuaeae Islet bearing N. 85° 30′ E., 6.2 miles distant; 33-75 meters; gray sand, Foraminifera, coral, and rock; June 23, 1902.

Asteroidea: *Ophidiaster squameus.*

Station 4024; in the vicinity of Kauai; Mokuaeae Islet bearing S. 83° E., 7.6 miles distant; 44-79 meters; bottom temperature 23.17° C.; coarse coral sand and Foraminifera; June 23, 1902.

Asteroidea: *Mithrodia fisheri.*

Station 4025; in the vicinity of Kauai; Mokuaeae Islet bearing S. 66° E., 10.4 miles distant; 503-673 meters; bottom temperature 7.17° C.; fine gray sand, broken shells, and Foraminifera; June 23, 1902.

Holothuroidea: *Orphnurgus insignis.*

Echinoidea: *Aspidodiadema nicobaricum, Phormosoma bursarium, Sperosoma obscurum.*

Station 4027; in the vicinity of Kauai; Ukula Point bearing S. 74° E., 6.0 miles distant; 583 meters; bottom temperature 6.00° C.; fine gray sand and rock; June 24, 1902.

Echinoidea: *Eucidaris metularia, Prionocidaris hawaiiensis.*

Station 4028; in the vicinity of Kauai; Ukula Point bearing S. 82° 30′ E., 10.2 miles distant; 812-874 meters; bottom temperature 4.44° C.; gray sand and Globigerinae; June 24, 1902.

Holothuroidea: *Paelopatides retifer.*

Echinoidea: *Prionechinus sculptus, Brissopsis luzonica, Pseudolovenia hirsuta.*

Asteroidea: *Persephonaster cingulatus, Pseudarchaster myobrachius, Mediaster ornatus.*

Ophiuroidea: *Ophiura monaria.*

Station 4030; in the vicinity of Kauai; Ukula Point bearing S. 82° 30′ E., 13.1 miles distant; 773-801 meters; bottom temperature 5.00° C.; fine coral sand, Foraminifera, and rock; June 24, 1902.

Echinoidea: *Aspidodiadema nicobaricum.*

Station 4031; Penguin Bank, south coast of Oahu; Diamond Head Light bearing N. 20° W., 18 miles distant; 49-51 meters; fine coral sand, Foraminifera, and coral; July 9, 1902.

Holothuroidea: *Polyplectana kefersteinii.*

Echinoidea: *Cyrtechinus verruculatus, Clypeaster reticulatus.*

Asteroidea: *Astropecten hawaiiensis, Luidia hystrix, Coronaster eclipes.*

Ophiuroidea: *Ophionereis porrecta, Ophiocoma pica.*

Station 4032; Penguin Bank, south coast of Oahu; Diamond Head Light bearing N. 19° W., 20.0 miles distant; 49-53 meters; fine coral sand and Foraminifera; July 9, 1902.

Echinoidea: *Eucidaris metularia, Cyrtechinus verruculatus, Clypeaster reticulatus.*

Asteroidea: *Luidia hystrix.*

Ophiuroidea: *Ophiothrix demessa, Ophionereis porrecta.*

Station 4033; Penguin Bank, south coast of Oahu; Diamond Head Light bearing N. 19° W., 20.8 miles distant; 53-51 meters; fine coral sand and Foraminifera; July 9, 1902.

Echinoidea: *Eucidaris metularia, Echinothrix calamaris, Pseudoboletia indiana, Clypeaster reticulatus.*

Ophiuroidea: *Ophiothrix demessa, Ophionereis porrecta, Ophiodesmus degeneri, Ophiocoma pica.*

Station 4034; Penguin Bank, south coast of Oahu; Diamond Head Light bearing N. 19° W., 21.5 miles distant; 51-26 meters; fine coral sand and Foraminifera; July 9, 1902.

Echinoidea: *Eucidaris metularia, Centrostephanus asteriscus, Clypeaster reticulatus.*

Asteroidea: *Luidia hystrix, Mithrodia fisheri.*

Ophiuroidea: *Ophiothrix demessa, Ophionereis porrecta.*

Station 4036; west coast of Hawaii; Kawaihae Light bearing S. 80° E., 24.2 miles distant; 1,256-1,265 meters; bottom temperature 3.44° C.; fine dark gray sand and Foraminifera; July 10, 1902.

Echinoidea: *Sperosoma obscurum, Pseudolovenia hirsuta.*

Station 4037; west coast of Hawaii; Kawaihae Light bearing S. 78° E., 23.0 miles distant; 1,265-1,259 meters; bottom temperature 3.39° C.; gray mud, Foraminifera, and rock; July 10, 1902.

Ophiuroidea: *Asteroschema edmondsoni.*

Station 4038; west coast of Hawaii; Kawaihae Light bearing S. 75° 30′ E., 23.0 miles distant; 1,259-1,225 meters; bottom temperature 3.61° C.; gray mud and Foraminifera; July 10, 1902.

Holothuroidea: *Paelopatides retifer.*

Station 4039; west coast of Hawaii; Kawaihae Light bearing S. 75° 30′ E., 24.9 miles distant; 1,225-1,274 meters; gray mud and Foraminifera; July 10-11, 1902.

Holothuroidea: *Paelopatides retifer.*

Echinoidea: *Prionechinus sculptus, Argopatagus vitreus.*

Station 4041; west coast of Hawaii; Kawaihae Light bearing S. 67° 30′ E.,

10.0 miles distant; 698-462 meters; bottom temperature 5.33° C.; gray mud and Foraminifera; July 11, 1902.

Holothuroidea: *Mesothuria carnosa, Orphnurgus insignis, Bathyplotes patagiatus, Pannychia pallida.*

Echinoidea: *Aceste ovata.*

Asteroidea: *Gilbertaster anacanthus, Brisingella fragilis.*

Ophiuroidea: *Ophiura monaria.*

Station 4043; west coast of Hawaii; Kawaihae Light bearing S. 74° 31′ E., 5.9 miles distant; 431-426 meters; bottom temperature 8.28° C.; gray sand, broken shells, and rock; July 11, 1902.

Holothuroidea: *Laetmogone,* sp., *Protankyra albatrossi.*

Station 4044; west coast of Hawaii; Kawaihae Light bearing S. 80° 30′ E., 5.2 miles distant; 426-362 meters; bottom temperature 8.33° C.; fine gray sand; July 11, 1902.

Holothuroidea: *Thyonidium alexandri, Protankyra albatrossi.*

Echinoidea: *Stereocidaris grandis, Brissopsis luzonica, Pycnolampas oviformis.*

Asteroidea: *Astropecten callistus, A. pusillulus, Patagiaster nuttingi, Henricia ?pauperrima.*

Ophiuroidea: *Ophiura ponderosa, Ophiocoma erinaceus, O. pica.*[7]

Station 4045; west coast of Hawaii; Kawaihae Light bearing N. 82° 30′ E., 4.1 miles distant; 362-269 meters; bottom temperature 9.44° C.; coral sand and Foraminifera; July 11, 1902.

Echinoidea: *Stylocidaris calacantha, Salenocidaris crassispina, Trigonocidaris albida, Echinocyamus incertus, Gymnopatagus pulchellus.*

Asteroidea: *Astropecten pusillulus, A. callistus, Sclerasterias euplecta.*

Station 4046; west coast of Hawaii; Kawaihae Light bearing N. 52° E., 3.4 miles distant; 269-130 meters; bottom temperature 15.00° C.; coral sand and Foraminfera; July 11, 1902.

Echinoidea: *Eucidaris metularia, Actinocidaris thomasii, Prionocidaris hawaiiensis, Clypeaster leptostracon.*

Asteroidea: *Echinaster,* sp., *Mithrodia fisheri.*

Ophiuroidea: *Ophiothrix lepidus hawaiiensis.*

Station 4048; west coast of Hawaii; Kawaihae Light bearing S. 71° 30′ E., 9.5 miles distant; 501 meters; bottom temperature 5.11° C.; fine gray sand and rock; July 11, 1902.

Asteroidea: *Astropecten pusillulus.*

Station 4050; west coast of Hawaii; Kawaihae Light bearing N. 10° W., 0.5 mile distant; 26-393 meters; fragments of coral and rock; July 14, 1902.

Echinoidea: *Chondrocidaris gigantea.*

[7] The two species of *Ophiocoma* were probably wrongly labeled.

Station 4054; northeast coast of Hawaii; Alia Point Light (Hilo Bay) bearing N. 8° 30′ W., 48-91 meters; coarse coral sand and corallines; July 16, 1902.

Echinoidea: *Prionocidaris hawaiiensis.*

Station 4055; northeast coast of Hawaii; Alia Point Light (Hilo Bay) bearing N. 20° W., 3.5 miles distant; 91-113 meters; fine gray sand and Foraminifera; July 16, 1902.

Asteroidea: *Astropecten hawaiiensis.*

Station 4057; northeast coast of Hawaii; Alia Point Light (Hilo Bay) bearing N. 43° 45′ W., 2 miles distant; 141-137 meters; fine gray sand and shells; July 16, 1902.

Echinoidea: *Prinocidaris hawaiiensis.*

Station 4061; northeast coast of Hawaii; Kauhola Light bearing S. 79° E., 6.7 miles distant; 44-152 meters; coral sand, corallines, nodules, and Foraminifera; July 18, 1902.

Echinoidea: *Acanthocidaris hastigera, Clypeaster reticulatus.*

Station 4062; northeast coast of Hawaii; Kauhola Light bearing S. 69° 15′ E., 152-207 meters; coral, volcanic sand, shells, and Foraminifera; July 18, 1902.

Echinoidea: *Actinocidaris thomasii, Acanthocidaris hastigera.*

Asteroidea: *Mithrodia fisheri, Sclerasterias euplecta.*

Station 4064; northeast coast of Hawaii; Kauhola Light bearing S. 71° E., 6.7 miles distant; 115-196 meters; bottom temperature 20.55° C.; volcanic sand, Foraminifera, and coral; July 18, 1902.

Echinoidea: *Prionocidaris hawaiiensis, Acanthocidaris hastigera, Clypeaster leptostracon, Echinocyamus elongatus.*

Asteroidea: *Sclerasterias euplecta.*

Station 4066; Alenuihaha Channel, between Hawaii and Maui; Ka Lae o Ka Ilio Point, Maui, bearing N. 79° 30′ W., 3.5 miles distant; 322-90 meters; bottom temperature 11.39° C.; rocky bottom; July 18, 1902.

Echinoidea: *Prionocidaris hawaiiensis, Acanthocidaris hastigera, Centrostephanus asteriscus, Clypeaster leptostracon.*

Asteroidea: *Sclerasterias euplecta.*

Ophiuroidea: *Ophiactis modesta, O. lethe, Amphioplus cythera, Ophioplax melite.*

Station 4070; northeast coast of Maui; Puniawa Point bearing S. 81° 30′ E., 6.4 miles distant; 82-95 meters; bottom temperature 21.55° C.; fine gray sand; July 19, 1902.

Echinoidea: *Brissopsis luzonica.*

Ophiuroidea: *Ophiactis dyscrita, O. modesta, O. lethe.*

Station 4071; northeast coast of Maui; Puniawa Point bearing S. 78° 30′ E., 6.8 miles distant; 95-102 meters; bottom temperature 22.73° C.; fine coral and volcanic sand; July 19, 1902.

Ophiuroidea: *Ophiactis lethe.*

Station 4072; northeast coast of Maui; Puniawa Point bearing S. 74° 30′ E., 7.1 miles distant; 102-108 meters; bottom temperature 23.00° C.; coarse coral sand and Foraminifera; July 19, 1902.

Asteroidea: *Pentaceraster hawaiiensis.*

Ophiuroidea: *Ophiactis lethe, Ophiothrix lepidus hawaiiensis.*

Station 4073; northeast coast of Maui; Puniawa Point bearing S. 72° E., 7.8 miles distant; 126-143 meters; bottom temperature 22.17° C.; coarse coral sand and Foraminifera; July 19, 1902.

Echinoidea: *Prionocidaris hawaiiensis.*

Station 4074; northeast coast of Maui; Puniawa Point bearing S. 70° E., 8.5 miles distant; 143-155 meters; bottom temperature 21.55° C.; coarse sand and Foraminifera; July 19, 1902.

Asteroidea: *Calliderma spectabilis.*

Station 4075; northeast coast of Maui; Puniawa Point bearing S. 79° 30′ E., 6 miles distant; 90-104 meters; bottom temperature 23.11° C.; fine gray sand and Foraminifera; July 21, 1902.

Asteroidea: *Pentaceraster hawaiiensis.*

Station 4076; northeast coast of Maui; Puniawa Point bearing S. 72° 30′ E., 6.7 miles distant; 104-124 meters; bottom temperature 21.22° C.; coarse sand, shells, and Foraminifera; July 21, 1902.

Ophiuroidea: *Ophiactis modesta, Ophiothrix lepidus hawaiiensis.*

Station 4077; northeast coast of Maui; Puniawa Point bearing S. 45° 45′ E., 6.1 miles distant; 181-194 meters; bottom temperature 21.11° C.; fine coral sand and Foraminifera; July 21, 1902.

Echinoidea: *Prionocidaris hawaiiensis, Acanthocidaris hastigera.*

Asteroidea: *Calliderma spectabilis, Tamaria scleroderma.*

Station 4079; northeast coast of Maui; Puniawa Point bearing S. 31° 30′ E., 6 miles distant; 261-325 meters; bottom temperature 16.00° C.; gray sand and Foraminifera; July 21, 1902.

Holothuroidea: *Protankyra albatrossi.*

Echinoidea: *Laganum fudsiyama.*

Asteroidea: *Astropecten callistus, Luidiaster horridus, Calliderma spectabilis, Sclerasterias euplecta.*

Station 4080; north coast of Maui; Puniawa Point bearing S. 23° E., 6.6 miles distant; 325-369 meters; bottom temperature 13.55° C.; gray sand and Foraminifera; July 21, 1902.

Echinoidea: *Laganum fudsiyama, Lovenia grisea.*

Asteroidea: *Astropecten callistus, Anthenoides epixanthus.*

Ophiuroidea: *Asteroschema caudatum* var. *obscurum.*

Station 4081; north coast of Maui; Puniawa Point bearing S. 17° 45′ E., 7.6 miles distant; 369-402 meters; bottom temperature 10.94° C.; gray sand and Foraminifera; July 21, 1902.

Holothuroidea: *Mesothuria parva.*

Echinoidea: *Histocidaris variabilis, Laganum fudsiyama, Gymnopatagus obscurus.*

Asteroidea: *Patagiaster nuttingi, Sphaeriodiscus ammophilus, Anthenoides epixanthus.*

Station 4082; north coast of Maui; Puniawa Point bearing S. 11° 30′ E., 8.1 miles distant; 402-435 meters; bottom temperature 9.44° C.; gray sand; July 21, 1902.

Holothuroidea: *Protankyra albatrossi.*

Asteroidea: *Astropecten pusillulus, Patagiaster nuttingi, Sphaeriodiscus ammophilus, Plinthaster ceramoideus, Anthenoides epixanthus.*

Station 4083; north coast of Maui; Puniawa Point bearing S. 4° 15′ E., 8.8 miles distant; 435-462 meters; gray sand; July 21, 1902.

Holothuroidea: *Orphnurgus insignis, Protankyra albatrossi.*

Echinoidea: *Histocidaris variabilis, Prionechinus sculptus, Brissopsis luzonica, Pseudolovenia hirsuta.*

Asteroidea: *Astropecten pusillulus, Patagiaster nuttingi.*

Station 4084; north coast of Maui; Puniawa Point bearing S. 3° 15′ E., 10.1 miles distant; 462-488 meters; bottom temperature 6.17° C.; fine gray sand; July 21, 1902.

Holothuroidea: *Orphnurgus insignis.*

Asteroidea: *Astropecten pusillulus, Anthenoides epixanthus.*

Ophiuroidea: *Ophiura fisheri.*

Station 4085; north coast of Maui; Puniawa Point bearing S. 2° E., 10.9 miles distant; 488-517 meters; sand and shells; July 21, 1902.

Holothuroidea: *Orphnurgus insignis.*

Echinoidea: *Histocidaris variabilis, Orechinus monolini.*

Asteroidea: *Astropecten pusillulus.*

Ophiuroidea: *Ophiura fisheri.*

Station 4086; north coast of Maui; Puniawa Point bearing S., 11.8 miles distant; 517-563 meters; bottom temperature 7.00° C.; sand and shells; July 21, 1902.

Holothuroidea: *Orphnurgus insignis.*

Echinoidea: *Prionechinus sculptus.*

Asteroidea: *Psilaster attenuatus.*

Station 4087; northeast approach to the Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 85° 45′ W., 21.2 miles distant; 563-559 meters; bottom temperature 6.44° C.; fine gray sand; July 21, 1902.

Echinoidea: *Phormosoma bursarium, Prionechinus sculptus.*

Asteroidea: *Psilaster attenuatus.*

Station 4088; northeast approach to the Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 81° 30′ W., 20.1 miles distant; 559-543 meters; bottom temperature 6.55° C.; fine gray sand; July 21, 1902.

Holothuroidea: *Mesothuria murrayi, Anapta inermis.*

Echinoidea: *Prionechinus sculptus.*

Asteroidea: *Psilaster attenuatus.*

Station 4089; northeast approach to the Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 76° W., 20.3 miles distant; 543-556 meters; bottom temperature 6.55° C.; fine gray sand; July 21-22, 1902.

Holothuroidea: *Anapta inermis.*

Echinoidea: *Phormosoma bursarium, Sperosoma obscurum.*

Asteroidea: *Psilaster attenuatus.*

Station 4090; northeast approach to the Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 71° 15′ W., 20.7 miles distant; 556-563 meters; bottom temperature 6.55° C.; fine gray sand; July 22, 1902.

Echinoidea: *Histocidaris variabilis.*

Asteroidea: *Psilaster attenuatus, Hymenaster pentagonalis, Brisingella fragilis.*

Station 4091; northeast approach to the Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 66° 15′ W., 21.3 miles distant; 563-559 meters; bottom temperature 6.55° C.; fine gray sand; July 22, 1902.

Echinoidea: *Phormosoma bursarium.*

Asteroidea: *Psilaster attenuatus, Brisingella fragilis.*

Ophiuroidea: *Ophiura monaria.*

Station 4095; northeast approach to the Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 61° W., 10.6 miles distant; 530-523 meters; bottom temperature 6.61° C.; brown mud, fine sand, and Globigerinae; July 22, 1902.

Asteroidea: *Psilaster attenuatus.*

Station 4096; northeast approach to the Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing S. 77° 30′ W., 7.0 miles distant; 497-523 meters; bottom temperature 7.39° C.; fine gray sand; July 22, 1902.

Holothuroidea: *Mesothuria murrayi, Orphnurgus insignis.*

Echinoidea: *Actinocidaris thomasii, Stereocidaris grandis, S. leucacantha, Histocidaris variabilis, Aspidodiadema meijerei, Sperosoma obscurum, Spatangus paucituberculatus.*

Asteroidea: *Astropecten pusillulus, Psilaster attenuatus, Plinthaster ceramoideus, Brisingella fragilis.*

Ophiuroidea: *Ophiomyxa fisheri, Ophiologimus quadrispinus, Ophiothamnus otho, Ophiomusium elii.*

Station 4097; northeast approach to the Pailolo Channel; Mokuhooniki Islet bearing S. 67° 16′ W., 8.0 miles distant; 523 meters; bottom temperature 6.77° C.; fine gray sand; July 22, 1902.

Echinoidea: *Stereocidaris leucacantha, Histocidaris variabilis, Aspidodiadema meijerei, Spatangus paucituberculatus.*

Station 4098; north coast of Maui; Puniawa Point bearing S. 52° 30′ E., 6.5 miles distant; 174-278 meters; bottom temperature 18.3° C.; coral sand, Foraminifera, and rock; July 23, 1902.

Asteroidea: *Calliderma spectabilis.*

Station 4099; north coast of Maui; Puniawa Point bearing SE., 8.3 miles distant; 278-280 meters; bottom temperature 15.94° C.; fine sand, Foraminifera, and shells; July 23, 1902.

Echinoidea: *Laganum fudsiyama.*

Station 4100; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing N. 35° W., 3.1 miles distant; 238-276 meters; bottom temperature 16.11° C.; coral sand, shells, and Foraminifera; July 23, 1902.

Echinoidea: *Stylocidaris calacantha.*

Asteroidea: *Calliaster pedicellaris, Ophidiaster squameus, Tamaria tenella, Sclerasterias euplecta.*

Ophiuroidea: *Ophiomyxa fisheri, Ophiologimus quadrispinus, Ophiacantha bisquamata, Amphiactis astarte, Ophioplax melite.*

Station 4101; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing N. 8° 30′ E., 4.8 miles distant; 261-223 meters; bottom temperature 15.39° C.; coral sand, shells, and Foraminifera; July 23, 1902.

Holothuroidea: *Thyonidium hawaiiense.*

Echinoidea: *Laganum fudsiyama.*

Asteroidea: *Astropecten productus, Anseropoda insignis, Sclerasterias euplecta.*

Ophiuroidea: *Ophiomyxa fisheri, Ophiura ursula.*

Station 4102; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing N. 29° E., 5.6 miles distant; 223-241 meters; fine gray sand and Foraminifera; July 23, 1902.

Asteroidea: *Astropecten productus, Calliderma spectabilis.*

Ophiuroidea: *Ophiura ursula.*

Station 4103; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing N. 32° 45′ E., 6.7 miles distant; 241-258 meters; bottom temperature 16.50° C.; fine gray sand; July 23, 1902.

Echinoidea: *Chaetodiadema pallidum.*

Station 4104; Pailolo Channel, between Maui and Molokai; Mokuhooniki Islet bearing N. 38° 15′ E., 8.1 miles distant; 258-225 meters; bottom temperature 16.00° C.; fine gray sand and Foraminifera; July 23, 1902.

Echinoidea: *Chaetodiadema pallidum.*

Station 4105; Kaiwi Channel, between Molokai and Oahu; Lae o Ka Laau Light, Molokai, bearing S. 45° 30′ E., 10.6 miles distant; 574-612 meters; bottom temperature 6.55° C.; fine coral sand and Foraminifera; July 24, 1902.

Crinoidea: *Trichometra vexator.*

Echinoidea: *Aspidodiadema meijerei.*

Station 4107; Kaiwi Channel, between Molokai and Oahu; Lae o Ka Laau Light, Molokai, bearing S. 34° 30′ E., 12.3 miles distant; 640-649 meters; bottom temperature 5.33° C.; coral sand and Foraminifera; July 24, 1902.

Crinoidea: *Stiremetra decora.*

Echinoidea: *Aspidodiadema nicobaricum, A. meijerei.*

Ophiuroidea: *Asteroschema caudatum* var. *obscurum, A. ajax, Ophiomitra semele.*

Station 4108; Kaiwi Channel, between Molokai and Oahu; Lae o Ka Laau Light, Molokai, bearing S. 21° E., 15.5 miles distant; 751-808 meters; bottom temperature 4.66° C.; coral sand and Foraminifera; July 24, 1902.

Ophiuroidea: *Asteroschema caudatum* var. *obscurum, Amphiactis lycidas.*

Station 4110; Kaiwi Channel, between Molokai and Oahu; Lae o Ka Laau Light, Molokai, bearing S. 24° E., 18.7 miles distant; 821-841 meters; bottom temperature 4.61° C.; gray sand; July 24, 1902.

Holothuroidea: *Paelopatides retifer.*

Echinoidea: *Aspidodiadema nicobaricum, Phormosoma bursarium.*

Station 4112; Kaiwi Channel, between Molokai and Oahu; Lae o Ka Laau Light bearing S. 19° 30′ E., 17.5 miles distant; 447-433 meters; bottom temperature 4.73° C.; fine sand; July 24, 1902.

Echinoidea: *Aspidodiadema nicobaricum, Phormosoma bursarium, Sperosoma obscurum.*

Asteroidea: *Zoroaster spinulosus.*

Station 4113; Kaiwi Channel, between Molokai and Oahu; Lae o Ka Laau Light, Molokai, bearing S. 26° E., 16.4 miles distant; 433-395 meters; bottom temperature 4.77° C.; coral, Foraminifera, and sand; July 24, 1902.

Echinoidea: *Phormosoma bursarium.*

Station 4114; northwest coast of Oahu; Kahuku Point bearing N. 72° 30′ E., 9.3 miles distant; 282-357 meters; bottom temperature 15.94° C.; coral sand and Foraminifera; July 25, 1902.

Asteroidea: *Astropecten callistus.*

Station 4115; northwest coast of Oahu; Kahuku Point bearing N. 83° E., 9.0 miles distant; 356-441 meters; bottom temperature 12.83° C.; coral sand and Foraminifera; July 25, 1902.

Holothuroidea: *Mesothuria parva.*

Echinoidea: *Prionechinus sculptus, Laganum fudsiyama.*

Asteroidea: *Patagiaster nuttingi, Anthenoides epixanthus, Henricia robusta.*

Station 4116; northwest coast of Oahu; Kahuku Point bearing N. 86° 30′ E., 9.1 miles distant; 441-516 meters; bottom temperature 9.33° C.; coral sand and Foraminifera; July 25, 1902.

Echinoidea: *Stereocidaris leucacantha, Histocidaris variabilis, Aspidodiadema meijerei, Spatangus paucituberculatus.*

Asteroidea: *Astropecten pusillulus, Patagiaster nuttingi.*

Station 4117; northwest coast of Oahu; Kahuku Point bearing S. 69° 30′ E., 9.0 miles distant; 516-462 meters; bottom temperature 7.55° C.; coral sand and Foraminifera; July 25, 1902.

Echinoidea: *Stereocidaris leucacantha, Histocidaris variabilis, Sperosoma obscurum, Orechinus monolini.*

Station 4122; southwest coast of Oahu; Barbers Point Light bearing N. 82° E., 2.2 miles distant; 351-643 meters; bottom temperature 18.11° C.; coarse coral sand and shells; July 26, 1902.

Holothuroidea: *Mesothuria parva.*

Crinoidea: *Sarametra triserialis, Parametra fisheri.*

Echinoidea: *Aspidodiadema meijerei, Laganum fudsiyama, Pseudolovenia hirsuta.*

Station 4123; southwest coast of Oahu; Barbers Point Light bearing S. 78° E., 3.2 miles distant; 643-653 meters; bottom temperature 5.72° C.; fine gray sand and mud; July 26, 1902.

Holothuroidea: *Orphnurgus insignis.*

Asteroidea: *Persephonaster cingulatus, Mediaster ornatus.*

Ophiuroidea: *Ophiura monaria, Ophiomusium lymani.*

Station 4125; Kaieie Waho Channel between Oahu and Kauai; Kahuku Point, Oahu, bearing S. 77° E., 12.0 miles distant; 1,760-2,055 meters; bottom temperature 2.44° C.; brown mud, Foraminifera, and rock; July 31, 1902.

Echinoidea: *Salenocidaris miliaris, Orechinus monolini.*

Ophiuroidea: *Asteroschema tubiferum.*

Station 4126; Kaieie Waho Channel between Oahu and Kauai; Kahuku Point, Oahu, bearing S. 72° E., 25.0 miles distant; 2,336-1,358 meters; bottom temperature 1.9° C.; gray sand and Foraminifera; July 31, 1902.

Echinoidea: *Orechinus monolini, Prionechinus chuni.*

Station 4128; in the vicinity of Kauai; Hanamaulu warehouse bearing N. 44° 30′ W., 2.6 miles distant; 462-124-327 meters; bottom temperature 8.77° C.; coarse brown coral sand and Foraminifera; August 1, 1902.

Echinoidea: *Prionocidaris hawaiiensis, Centrostephanus asteriscus, Clypeaster reticulatus.*

Asteroidea: *Asterodiscus tuberculosus, Tamaria triseriatus, Leiaster callipeplus.*

Station 4130; in the vicinity of Kauai; Hanamaulu warehouse bearing N. 61° W., 2.2 miles distant; 517-565 meters; bottom temperature 7.83° C.; fine gray sand; August 1, 1902.

Holothuroidea: *Mesothuria carnosa.*

Echinoidea: *Sperosoma obscurum, Hypselaster maximus.*

Station 4131; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 81° 30′ W., 2.2 miles distant; 565-470 meters; bottom temperature 6.5° C.; fine gray sand; August 1, 1902.

Holothuroidea: *Mesothuria carnosa.*

Echinoidea: *Aspidodiadema nicobaricum, Sperosoma obscurum, Orechinus monolini, Brissopsis luzonica.*

Asteroidea: *Brisingella fragilis.*

Station 4132; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 37° W., 27 miles distant; 470-570 meters; bottom temperature 6.22° C.; fine gray sand and mud; August 1, 1902.

Holothuroidea: *Mesothuria carnosa, Protankyra albatrossi.*

Echinoidea: *Laganum fudsiyama, Brissopsis luzonica.*

Asteroidea: *Ceramaster bowersi.*

Station 4134; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 35° 30′ W., 5.2 miles distant; 592-411 meters; bottom temperature 6.11° C.; coral and volcanic sand; August 1, 1902.

Holothuroidea: *Mesothuria carnosa, Bathyplotes patagiatus, Orphnurgus insignis.*

Echinoidea: *Sperosoma obscurum.*

Asteroidea: *Ceramaster bowersi.*

Ophiuroidea: *Asteroschema edmondsoni.*

Station 4136; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 31° 45′ W., 6.9 miles distant; 539-643 meters; bottom temperature 6.77° C.; fine coral sand; August 1, 1902.

Holothuroidea: *Mesothuria carnosa.*

Echinoidea: *Sperosoma obscurum.*

Ophiuroidea: *Asteroschema caudatum* var. *granulosum, Ophiomitra semele.*

Station 4137; in the vicinity of Kauai; Hanamaulu warehouse bearing N. 65° 15′ W., 4 miles distant; 751-870 meters; bottom temperature 5.0° C.; coral and volcanic sand, Foraminifera, and rocks; August 1, 1902.

Echinoidea: *Aspidodiadema nicobaricum, Sperosoma obscurum.*

Ophiuroidea: *Asteroschema caudatum* var. *obscurum.*

Station 4139; in the vicinity of Kauai; Hanamaulu warehouse bearing S.

57° W., 5.2 miles distant; 936-620 meters; bottom temperature 4.61° C.; August 2, 1902.

Holothuroidea: *Mesothuria carnosa, Protankyra albatrossi.*

Asteroidea: *Zoroaster spinulosus.*

Ophiuroidea: *Asteroschema ajax, Ophiura monaria.*

Station 4140; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 39° W., 4.9 miles distant; 620-799 meters; bottom temperature 6.33° C.; fine gray sand; August 2, 1902.

Holothuroidea: *Bathyplotes patagiatus, Orphnurgus insignis, Protankyra albatrossi.*

Echinoidea: *Aspidodiadema nicobaricum.*

Ophiuroidea: *Ophiura monaria.*

Station 4141; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 46° W., 6.2 miles distant; 799-1,155 meters; bottom temperature 5.0° C.; volcanic sand and Foraminifera; August 2, 1902.

Holothuroidea: *Paelopatides retifer, Laetmogone biserialis, Protankyra albatrossi.*

Echinoidea: *Aspidodiadema nicobaricum, Phormosoma bursarium.*

Asteroidea: *Mediaster ornatus.*

Station 4142; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 43° 15′ W., 7.3 miles distant; 1,155-1,610 meters; bottom temperature 3.66° C.; coarse manganese nodules, sand, and rock; August 2, 1902.

Holothuroidea: *Protankyra albatrossi.*

Station 4146; in the vicinity of Moku Manu; center of island bearing S. 62° W., 0.5 mile distant; 42-47 meters; bottom temperature 25.94° C.; coralline, coarse sand, and Foraminifera; August 5, 1902.

Echinoidea: *Eucidaris metularia, Clypeaster reticulatus, Rhynobrissus placopetalus.*

Asteroidea: *Mithrodia fisheri.*

Ophiuroidea: *Ophiothrix demessa, Ophionereis porrecta, Ophiocoma erinacea, O. scolopendrina.*

Station 4147; in the vicinity of Moku Manu; center of island bearing S. 21° W., 2.0 miles distant; 47 meters; bottom temperature 23.28° C.; coral and corallines; August 5, 1902.

Echinoidea: *Eucidaris metularia, Echinostrephus aciculatus.*

Asteroidea: *Mithrodia,* sp.

Ophiuroidea: *Ophiacantha prionota, Ophiothrix demessa, Ophionereis porrecta, Ophiocoma scolopendrina.*

Station 4148; in the vicinity of Moku Manu; center of island bearing S. 10° W., 3.2 miles distant; 47-60 meters; bottom temperature 23.28° C.; coral sand and Foraminifera; August 5, 1902.

Echinoidea: *Eucidaris metularia, Temnotrema hawaiiensis, Clypeaster reticulatus, Echinocyamus elongatus.*

Station 4149; in the vicinity of Moku Manu; center of island bearing S. 7° 30′ W., 4.3 miles distant; 60-130 meters; bottom temperature 25.39° C.; coral and coralline; August 5, 1902.

Echinoidea: *Eucidaris metularia, Cyrtechinus verruculatus.*

Asteroidea: *Leiaster callipeplus.*

Station 4150; in the vicinity of Moku Manu; center of island bearing S. 6° W., 5.5 miles distant; 130-183 meters; bottom temperature 23.33° C.; coral; August 5, 1902.

Echinoidea: *Eucidaris metularia, Temnotrema hawaiiensis, Clypeaster reticulatus.*

Station 4151; in the vicinity of Moku Manu; center of island bearing S. 32° W., 12.8 miles distant; 1,463-572 meters; bottom temperature 3.22° C.; fine coral sand, Foraminifera, and stones; August 5, 1902.

Holothuroidea: *Paelopatides retifer.*

Asteroidea: *Ceramaster micropeltus.*

Station 4157; in the vicinity of Moku Manu; center of island bearing S. 77° 30′ E., 11.1 miles distant; 1,393-1,828 meters; bottom temperature 3.33° C.; white mud, Foraminifera, and rock; August 6-7, 1902.

Crinoidea: *Thaumatocrinus rugosus.*

Asteroidea: *Asthenactis papyraceus.*

Station 4158; in the vicinity of Moku Manu; center of island bearing N. 1.0 mile distant; 37-55 meters; bottom temperature 25.88° C.; coral and corallines; August 7, 1902.

Echinoidea: *Eucidaris metularia, Clypeaster reticulatus.*

Station 4159; in the vicinity of Moku Manu; center of island bearing N. 81° E., 2.0 miles distant; 55-57 meters; bottom temperature 25.72° C.; coarse coral sand, broken shells, and Foraminifera; August 7, 1902.

Echinoidea: *Eucidaris metularia.*

Asteroidea: *Mithrodia fisheri.*

Station 4160; in the vicinity of Moku Manu; center of island bearing S. 83° E., 3.8 miles distant; 57-71 meters; bottom temperature 25.55° C.; coral and coralline; August 7, 1902.

Echinoidea: *Eucidaris metularia, Prionocidaris hawaiiensis, Rhynobrissus placopetalus.*

Asteroidea: *Mithrodia fisheri.*

Ophiuroidea: *Ophiothrix demessa, Ophionereis porrecta, Ophiodesmus degeneri, Ophiocoma scolopendrina.*

Station 4161; in the vicinity of Moku Manu; center of island bearing S. 75° E., 5.0 miles distant; 71-334 meters; bottom temperature 23.28° C.; coral and coralline; August 7, 1902.

Echinoidea: *Eucidaris metularia, Prionocidaris hawaiiensis, Centrostephanus asteriscus.*

Ophiuroidea: *Ophiothrix demessa.*

Station 4162; in the vicinity of Moku Manu; center of island bearing N. 75° E., 21.3 miles distant; 38-44 meters; coral; August 8, 1902.

Echinoidea: *Eucidaris metularia, Cyrtechinus verruculatus.*

Asteroidea: *Echinaster,* sp., *Mithrodia fisheri.*

Station 4163; in the vicinity of Moku Manu; center of island bearing N. 79° 30′ E., 20.0 miles distant; 44-73 meters; bottom temperature 25.61° C.; coral; August 8, 1902.

Echinoidea: *Centrostephanus asteriscus.*

Asteroidea: *Mithrodia fisheri.*

Station 4164; in the vicinity of Moku Manu; center of island bearing N. 84° E., 18.5 miles distant; 73-102 meters; bottom temperature 25.61° C.; coral sand, pebbles, and shells; August 8, 1902.

Echinoidea: *Pseudoboletia indiana, Clypeaster reticulatus.*

Asteroidea: *Leiaster callipeplus, Mithrodia fisheri.*

Station 4166; in the vicinity of Moku Manu; center of island bearing S. 86° E., 16.2 miles distant; 536-1,464 meters; bottom temperature 7.55° C.; coral sand, Foraminifera, and rock; August 8, 1902.

Echinoidea: *Aspidodiadema nicobaricum.*

Asteroidea: *Henricia pauperrima, Brisingella fragilis.*

Station 4167; in the vicinity of Moku Manu; center of island bearing N. 78° 30′ E., 11.6 miles distant; 33-37 meters; coral sand; August 8, 1902.

Echinoidea: *Eucidaris metularia.*

Ophiuroidea: *Ophiothrix demessa, Ophionereis porrecta, Ophiocoma erinaceus, O. scolopendrina, O. brevipes.*

Station 4168; in the vicinity of Moku Manu; center of island bearing N. 80° E., 13.0 miles distant; 37-38 meters; bottom temperature 25.72° C.; coral sand and Foraminifera; August 8, 1902.

Echinoidea: *Cyrtechinus verruculatus.*

Asteroidea: *Astropecten polyacanthus, Luidia hystrix.*

Ophiuroidea: *Ophiocoma erinaceus.*

Station 4169; in the vicinity of Moku Manu; center of island bearing N. 81° E., 14.3 miles distant; 38-40 meters; bottom temperature 25.88° C.; coral; August 8, 1902.

Echinoidea: *Eucidaris metularia, Diadema paucispinum.*

Asteroidea: *Mithrodia fisheri.*

Ophiuroidea: *Ophiocoma erinaceus.*

Station 4170; in the vicinity of Moku Manu; center of island bearing N. 72° E., 16.3 miles distant; 47-49 meters; bottom temperature 25.11° C.; coral sand and Foraminifera; August 8, 1902.

Asteroidea: *Mithrodia fisheri.*

Station 4171; in the vicinity of Moku Manu; center of island bearing N. 75° 15′ E., 17.2 miles distant; 49-57 meters; bottom temperature 25.55° C.; coral; August 8, 1902.

Ophiuroidea: *Asteroschema caudatum* var. *obscurum, A. edmondsoni, A. ajax.*

Station 4172; in the vicinity of Moku Manu; center of island bearing N. 68° E., 21.0 miles distant; 1,373-632 meters; bottom temperature 3.33° C.; coarse coral sand, Foraminifera, and rock; August 8, 1902.

Ophiuroidea: *Asteroschema edmondsoni.*

Station 4176; in the vicinity of Niihau; Kawaihoa Point bearing N. 73° 30′ W., 8.6 miles distant; 1,228-982 meters; bottom temperature 3.5° C.; gray sand and mud with Foraminifera; August 12, 1902.

Holothuroidea: *Paelopatides retifer.*

Station 4177; in the vicinity of Niihau; Kawaihoa Point bearing S. 54° W., 17.5 miles distant; 824-583 meters; bottom temperature 5.0° C.; gray sand and Globigerinae; August 12, 1902.

Crinoidea: *Glyptometra lateralis.*

Echinoidea: *Aspidodiadema nicobaricum.*

Asteroidea: *Craterobrisinga panopla, C. alberti.*

Station 4178; in the vicinity of Niihau; Kawaihoa Point bearing S. 61° 30′ W., 17.6 miles distant; 583-691 meters; coral sand, rock, and pebbles; August 12, 1902.

Echinoidea: *Aspidodiadema meijerei, Caenopedina hawaiiensis.*

Asteroidea: *Craterobrisinga panopla.*

Ophiuroidea: *Asteroschema caudatum* var. *granulosum.*

Station 4179; in the vicinity of Niihau; Kawaihoa Point bearing S. 60° 45′ W., 19.2 miles distant; 691-779 meters; bottom temperature 5.55° C.; coral sand, rock, and pebbles; August 12, 1902.

Crinoidea: *Glyptometra lateralis.*

Echinoidea: *Caenopedina hawaiiensis.*

Station 4180; in the vicinity of Niihau; Kawaihoa Point bearing S. 58° W., 19.5 miles distant; 779-762 meters; bottom temperature 5.05° C.; pebbles, Globigerinae, and rock; August 12, 1902.

Crinoidea: *Glyptometra lateralis.*

Echinoidea: *Aspidodiadema nicobaricum.*

Station 4182; in the vicinity of Kauai; Hanamaulu warehouse bearing N. 74° 30′ W., 5.6 miles distant; 1,227-1,749 meters; bottom temperature 3.55° C.; manganese nodules, stones, Globigerinae, and rock; August 13, 1902.

Ophiuroidea: *Asteroschema edmondsoni.*

Station 4181; in the vicinity of Kauai; Hanamaulu warehouse bearing N. 56° W., 6.6 miles distant; 1,482-1,227 meters; bottom temperature 3.39° C.; manganese nodules, stones, and Globigerinae; August 13, 1902.

Echinoidea: *Salenocidaris miliaris.*

Asteroidea: *?Astropecten pusillulus.*

Station 4185; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 49° 30′ W., 8.4 miles distant; 1,828-2,462 meters; bottom temperature 2.55° C.; gray sand, mud, and Foraminifera; August 13, 1902.

Ophiuroidea: *Asteroschema tubiferum.*

Station 4186; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 48° 15′ W., 7.1 miles distant; 1,247-929 meters; bottom temperature 3.39° C.; gray sand and Foraminifera; August 13, 1902.

Asteroidea: *Evoplosoma forcipiferum.*

Ophiuroidea: *Asteroschema tubiferum.*

Station 4187; in the vicinity of Kauai; Hanamaulu warehouse bearing S. 38° 45′ W., 8.1 miles distant; bottom temperature 4.44° C.; gray sand and Foraminifera; August 13, 1902.

Holothuroidea: *Paelopatides retifer.*

Crinoidea: *Naumachocrinus hawaiiensis.*

Species Taken in Shore Collecting

FANNING ISLAND

Holothuroidea: *Holothuria arenicola, H. atra, H. monocaria, H. pardalis, H. pervicax, H. rugosa, Stichopus variegatus, Actinopyga mauritiana, A. parvula, Leptosynapta oöplax.*

Echinoidea: *Echinoneus cyclostomus.*

FRENCH FRIGATE SHOAL

Holothuroidea: *Holothuria fuscorubra, H. monocaria.*

Echinoidea: *Eucidaris metularia, Pseudoboletia indiana, Tripneustes gratilla, Echinometra mathaei, E. oblonga, Colobocentrotus atratus, Heterocentrotus mammillatus.*

Asteroidea: *Astropecten polyacanthus, Mithrodia fisheri.*

GARDNER ISLAND

Echinoidea: *Echinometra mathaei, E. oblonga, Colobocentrotus atratus.*

HAWAII (HILO, HONAUNAU, KONA COAST, PUAKO BAY)

Holothuroidea: *Holothuria cinerascens, H. pervicax, H. atra, H. pardalis, Stichopus tropicalis, Actinopyga mauritiana, Euapta godeffroyi.*

Echinoidea: *Diadema paucispinum, Echinothrix diadema, E. calamaris, Tripneustes gratilla, Echinometra mathaei, E. oblonga, Colobocentrotus atratus, Heterocentrotus mammillatus, Echinoneus abnormalis.*

Asteroidea: *Asterina granulosa, A.* sp., *?Linckia laevigata, Dactylosaster cylindricus pacificus, Culcita novaeguineae* forma *arenosa* [*Goniodiscides sebae = Culcita novaeguineae*], *Asterope carinifera,*[8] *Nepanthia,* sp.

Ophiuroidea: *Ophiomastix asperula, Ophiactis savignyi, Amphipholis squamata, Ophiothrix demessa, Ophionereis porrecta, Ophiocoma erinaceus, O. pica, O. brevipes, O. insularia.*

HAWAIIAN ISLANDS, WITHOUT DEFINITE LOCALITY

Holothuroidea: *Holothuria cinerascens, H. pervicax, H. atra, H. fuscorubra, H. arenicola, H. pardalis, H. impatiens, H. edulis, H. kapiolaniae, H. monocaria, H. vagabunda, H. humilis, H. inhabilis, H. verrucosa, Labidodemas semperianus, Stichopus chloronotos, Actinopyga parvula, A. nobilis, Chiridota rigida.*

Echinoidea: *Echinothrix calamaris, Orechinus monolini, Tripneustes gratilla, Echinostrephus aciculatus, Echinoneus abnormalis, E. cyclostomus, Fibularia australis, Phryssocystis multispina, ?Phryssocystis aculeata, Brissus latecarinatus.*

Asteroidea: *Luidia brevispina, Archaster typicus, Culcita novaeguineae* forma *arenosa, ?Linckia laevigata, L. multifora, Fromia pacifica, Gomophia aegyptica, ?Tamaria pusilla, Leiaster brevispinus, Acanthaster planci, Asterope carinifera, Asterina granulosa, A. anomala, Mithrodia fisheri, Coscinasterias acutispina.*

Ophiuroidea: *Gorgonocephalus dolichodactylus, Ophioplinthaca clothilde, Ophiactis savignyi, O. lethe, Amphioplus cythera, Amphiura dino, Ophiothrix demessa, Ophionereis porrecta, Ophiocoma erinaceus, O. scolopendrina, O. pica, O. brevipes, O. insularia* var. *variegata, Ophiura fisheri.*

HONOLULU, REEF

Holothuroidea: *Holothuria cinerascens, H. pervicax, H. atra, H. arenicola, H. pardalis, H. impatiens, Stichopus tropicalis, Actinopyga parvula, Chiridota hawaiiensis.*

Echinoidea: *Chondrocidaris gigantea, Astropyga radiata* (18 fathoms), *Diadema paucispinum, Echinothrix diadema, Tripneustes gratilla, Echinometra mathaei, E. oblonga.*

[8] There are specimens in the U. S. National Museum from Honaunau, Kona District, collected by John B. Henderson in 1920 (cat. no. E.556), and from five miles southwest of Kapoho collected by Otto Degener on September 25, 1929 (cat. no. E.1509).

JOHNSTON ISLAND

Holothuroidea: *Holothuria atra, H. impatiens, H. lineata, H. monocaria, H. pardalis, Actinopyga mauritiana, A. obesa, A. parvula, Polyplectana kefersteinii, Chiridota rigida.*

Echinoidea: *Echinothrix diadema, Tripneustes gratilla, Echinostrephus aciculatus, E. molaris, Echinometra mathaei, E. oblonga, Heterocentrotus mammillatus, H. trigonarius, Brissus latecarinatus.*

Asteroidea: *Culcita novaeguineae* forma *novaeguineae, Linckia multifora, Acanthaster planci, Mithrodia fisheri.*

Ophiuroidea: *Ophiactis savignyi, Ophiocoma erinaceus, O. pica.*

KAUAI (KOLOA)

Holothuroidea: *Holothuria cinerascens, H. fuscorubra.*

Echinoidea: *Echinometra oblonga.*

Asteroidea: *Leiaster leachii hawaiiensis.*

KURE (OCEAN) ISLAND

Echinoidea: *Eucidaris metularia, Pseudoboletia indiana, Echinostrephus aciculatus, E. molaris, Echinometra mathaei, Heterocentrotus mammillatus, Echinoneus cyclostomus, Brissus latecarinatus.*

Asteroidea: *Dactylosaster cylindricus pacificus, Coscinasterias acutispina.*

Ophiuroidea: *Ophionereis porrecta, Ophiocoma brevipes, O. insularia* var. *variegata, O. erinaceus, O. pica.*

LANAI

Echinoidea: *Echinometra oblonga, Colobocentrotus atratus.*

LAYSAN ISLAND

Holothuroidea: *Holothuria arenicola, H. atra, H. cinerascens, H. impatiens, H. pardalis, H. pervicax, H. fuscorubra, Actinopyga parvula, A. obesa, A. nobilis.*

Echinoidea: *Eucidaris metularia, Diadema paucispinum, Tripneustes gratilla, Echinostrephus aciculatus, E. molaris, Echinometra mathaei, E. oblonga, Heterocentrotus mammillatus, Echinoneus cyclostomus, Brissus latecarinatus.*

Asteroidea: *Dactylosaster cylindricus pacificus, Linckia guildingii, Mithrodia fisheri.*

Ophiuroidea: *Ophiologimus quadrispinus, Amphipholis squamata, Ophiothrix demessa, Ophiocoma brevipes, O. insularia* var. *variegata, O. erinaceus, O. pica, Ophiocomella clippertoni.*

LISIANSKY ISLAND

Holothuroidea: *Holothuria monocaria.*

Ophiuroidea: *Ophiocomella clippertoni.*

MAUI (MAALAEA BAY)

Holothuroidea: *Holothuria atra, Actinopyga mauritiana, A. parvula.*
Echinoidea: *Colobocentrotus atratus.*
Asteroidea: *Nepanthia,* sp., *Coscinasterias acutispina.*
Ophiuroidea: *Ophiothrix demessa, Ophionereis porrecta, Ophiocoma scolopendrina, O. pica, O. insularia.*

MIDWAY ISLAND

Echinoidea: *Pseudoboletia indiana, Echinostrephus aciculatus, E. molare, Echinometra mathaei, Heterocentrotus mammillatus, Clypeaster reticulatus, Fibularia australis, Echinoneus cyclostomus.*
Ophiuroidea: *Ophiocoma brevipes.*

MOKU MANU (BIRD ISLAND)

Echinoidea: *Brissus latecarinatus* (in 26 fathoms).

MOLOKAI

Holothuroidea: *Holothuria impatiens.*
Asteroidea: *Ophidiaster lorioli.*
Ophiuroidea: *Ophiothrix demessa.*

NECKER ISLAND

Holothuroidea: *Holothuria fuscorubra, H. impatiens, ?H. hawaiiensis, H. cinerascens, Actinopyga mauritiana, ?A. parvula.*
Echinoidea: *Echinometra mathaei, E. oblonga, Heterocentrotus mammillatus, Colobocentrotus atratus.*
Ophiuroidea: *Ophiocoma insularia* var. *variegata, O. erinaceus.*

NIHOA

Echinoidea: *Echinometra mathaei, E. oblonga, Colobocentrotus atratus.*

NIIHAU

Holothuroidea: *Holothuria atra, Actinopyga mauritiana.*
Echinoidea: *Echinometra mathaei, E. oblonga, Colobocentrotus atratus.*

OAHU (BLACK POINT, FORT ARMSTRONG, HALEIWA, KAHANA BAY, KAHALA, KAHUKU, KANEOHE BAY, KAWELA BAY, KUALOA, MAILE POINT, PEARL HARBOR, PUNALUU, WAIKIKI)

Holothuroidea: *Holothuria arenicola, H. atra, H. cinerascens, H. fuscorubra, H. impatiens, H. pardalis, H. pervicax, H.* sp., *Polyplectana kefersteinii, Ophiodesoma spectabilis, Actinopyga mauritiana, A. parvula, A. obesa, A. nobilis.*

Crinoidea: *Lamprometra palmata palmata.*

Echinoidea: *Eucidaris metularia, Diadema paucispinum, Cyrtechinus verruculatus, Tripneustes gratilla, Echinometra mathaei, E. oblonga, Colobocentrotus atratus, Heterocentrotus mammillatus, Clypeaster reticulatus, Metalia spatagus.*

Asteroidea: *Luidia hystrix, Culcita novaeguineae* forma *arenosa, C. novaeguineae* forma *nesiotis, Dactylosaster cylindrica pacifica, Linckia multifora, L. guildingii, Ophidiaster squameus, Acanthaster planci, Asterina anomala, A. granulosa, Nepanthia* sp., *Coscinasterias acutispina.*

Ophiuroidea: *Amphioplus caelatus, Amphiura immira, Amphipholis squamata, Ophiactis savignyi, O. modesta, Ophiothrix demessa, Distichophis clarki, Ophionereis porrecta, Ophiodesmus degeneri, Ophiocoma insularia* var. *variegata, O. erinaceus, O. insularia, O. pica, Ophiocomella clippertoni.*

PALMYRA ISLAND

Holothuroidea: *Holothuria arenicola, H. monocaria, H. pardalis, Stichopus chloronotus, S. variegatus, Actinopyga mauritiana, A. nobilis, A. parvula, Euapta godeffroyi, Synapta maculata, Chiridota rigida.*

Echinoidea: *Eucidaris metularia, Echinothrix calamaris, E. diadema, Toxopneustes maculatus, Tripneustes gratilla, Parasalenia gratiosa, Echinometra mathaei, Heterocentrotus mammillatus, Echinoneus cyclostomus.*

Asteroidea: *Linckia multifora, Asterina coronata cristata, Othilia luzonica.*

Ophiuroidea: *Ophiocoma erinaceus, O. scolopendrina, Ophiocomella clippertoni.*

PEARL AND HERMES REEF

Holothuroidea: *Holothuria pardalis, H. atra, H. difficilis, H. paradoxa, H. pervicax, H. fuscorubra, H. monocaria, H. impatiens, Opheodesoma spectabilis.*

Echinoidea: *Eucidaris metularia, Diadema paucispinum, Echinothrix diadema, Pseudoboletia indiana, Echinostrephus aciculatus, E. molaris, Echinometra mathaei, Heterocentrotus mammillatus, Clypeaster eurypetalus, C. lytopetalus, Echinoneus cyclostomus, Brissus latecarinatus.*

Asteroidea: *Astropecten triseriatus myobrachius, Luidia magnifica, Linckia multifora, Ophidiaster squameus, Acanthaster planci, Mithrodia fisheri, Coscinasterias acutispina.*

Ophiuroidea: *Ophiothrix demessa, Ophiocoma brevipes, O. insularia* var. *variegata, O. pica, O. insularia, Ophiocomella clippertoni.*

?PENGUIN BANK (ABOUT 25 FATHOMS)

Asteroidea: *Luidia* sp.

WAKE ISLAND

Holothuroidea: *Holothuria atra, H. arenicola, H. edulis, H. monocaria, H. pardalis, Stichopus chloronotus, S. variegatus, Actinopyga mauritiana, A. parvula, Euapta godeffroyi, Chiridota rigida.*

Echinoidea: *Echinothrix diadema, Echinostrephus aciculatus, E. molaris, Echinometra mathaei, E. oblonga, Heterocentrotus trigonarius, Echinoneus cyclostomus.*

Asteroidea: *Ferdina cancellata tylota, Ophidiaster lorioli, Linckia multifora, Asterina cephea.*

Ophiuroidea: *Amphipholis squamata, Ophiactis savignyi, Ophiocoma erinaceus, O. pica, Ophiocomella clippertoni, Ophiarachnella parvispina, Ophioplocus imbricatus.*

BIBLIOGRAPHY

1. Agassiz, Alexander, and Clark, H. L., Hawaiian and other Pacific Echini, Mus. Comp. Zoöl., Mem. **34** (1) : 1-42, pls. 1-42, 1907; (2) : 43-132, pls. 43-59, 1908; (3) : 133-203, pls. 60-89, 1909; (4) : 205-383, pls. 90-121, 1912.
2. Bell, F. J., Report on the zoological collections made in the Indo-Pacific Ocean during the Voyage of H.M.S. Alert, in 1881-82, Echinodermata, 134-146, 1884.
3. Clark, A. H., Descriptions of new species of crinoids, chiefly from the collections made by the U. S. Fisheries Steamer Albatross at the Hawaiian Islands in 1902, with remarks on the classification of the Comatulida, U. S. Nat. Mus., Proc. **34** (1608) : 209-239, 1908.
4. Clark, A. H., The crinoids of the Indian Ocean, Echinoderma of the Indian Museum (7) Crinoidea : 1-325, 61 text figs., Calcutta, 1912 [includes a complete bibliography].
5. Clark, A. H., Naumachocrinus, a new genus belonging to the family Phrynocrinidae, U. S. Nat. Mus., Proc. **42** : 195-197, 1912 [Naumachocrinus hawaiiensis figured in U. S. Nat. Mus., Bull. 82, **1** (1) : 201-203, figs. 129, 130, 1915].
6. Clark, A. H., The unstalked crinoids of the Siboga Expedition, Siboga Exped., Monogr. **42b** : i-ix, 1-300, pls. 1-28, 1918.
7. Clark, A. H., A monograph of the existing crinoids, U. S. Nat. Mus., Bull. 82, **1** (1) : i-vi, 1-406, pls. 1-17, figs. 1-602, 1915; (2) : i-xxv, 1-795, pls. 1-57, figs. 1-1364, 1921; (3) : i-vii, 1-816, pls. 1-82, figs. 1-227, 1931; (4a) : i-vii, 1-603, pls. 1-61, figs. 1-283, 1941; (4b) : i-vii, 1-473, pls. 1-43, figs. 1-220, 1947.
8. Clark, H. L., Catalogue of recent ophiurans, Mus. Comp. Zoöl., Mem. **25** (4) : 165-376, pls. 1-20, 1915.
9. Clark, H. L., Hawaiian and other Pacific Echini, Mus. Comp. Zoöl., Mem. **46** (1) : 1-78, pls. 122-143, 1914; (2) : 79-283, pls. 144-161, 1917.
10. Clark, H. L., Brittle-stars, old and new, Mus. Comp. Zoöl., Bull. **62** (6) : 265-338, pls. 1-8, 1918.
11. Clark, H. L., The echinoderm fauna of Torres Strait: Its composition and its origin, Dept. Marine Biol. Carnegie Inst. Washington **10** (214) : i-viii, 1-223, pls. 1-38, 1921.
12. Clark, H. L., Echinoderms other than sea stars of the tropical central Pacific, B. P. Bishop Mus., Bull. **27** : 89-111, pls. 9-11, 1925.
13. Clark, H. L., Echinoderms from Australia, Mus. Comp. Zoöl., Mem. **55** : i-viii, 1-596, pls. 1-28, 1938.
14. Clark, H. L., The echinoderm fauna of Australia: its composition and its origin, Carnegie Inst. Washington, Pub. **566** : i-iv, 1-567, 1946.
15. Dujardin, M. F., and Hupé, M. H., Histoire naturelle des zoophytes Échinodèrmes, 1-627, pls. 1-10, Paris, 1862.
16. Edmondson, C. H., Reef and shore fauna of Hawaii, B. P. Bishop Mus., Special Pub. **22** :1-295, figs. 1-163, 1933 (revised edition 1946).
17. Ely, C. A., Shallow water Asteroidea and Ophiuroidea of Hawaii, B. P. Bishop Mus., Bull. **176** : 1-63, pls. 1-13, text figs. 1-18, 1942.
18. Fisher, W K., The starfishes of the Hawaiian Islands, U. S. Fish Comm., Bull. **23** (3) : 987-1130, pls. 1-49, 1906.
19. Fisher, W. K., The holothurians of the Hawaiian Islands, U. S. Nat. Mus., Proc. **32** (1555) : 637-744, pls. 66-82, 1907.

20. FISHER, W. K., Hyalinothrix, a new genus of starfishes from the Hawaiian Islands, U. S. Nat. Mus., Proc. 39 (1807) : 659-664, pls. 69-71, 1911.

21. FISHER, W. K., Starfishes of the Philippine seas and adjacent waters, U. S. Nat. Mus., Bull. 100, 3 : i-xi, 1-712, pls. 1-156, 1919.

22. FISHER, W. K., Sea stars of tropical central Pacific, B. P. Bishop Mus., Bull. 27 : 63-87, pls. 5-8, 1925.

23. GALTSOFF, P. S., Pearl and Hermes Reef, Hawaii, hydrographical and biological observations, B. P. Bishop Mus., Bull. 107 : i-ii, 3-49, pls. 1-5, 1933.

24. GRUBE, A. E., Diagnosen einiger neuen Echinodermen, Archiv. für Naturgesch., Jahrg. 23, 1 : 340-344, 1857.

25. HARTLAUB, CLEMENS, Die Comatuliden [of the Blake Expeditions, 1877-80], Mus. Comp. Zoöl., Mem. 27 (4) : 277-491, pls. 1-18, 1912 [record of *Antedon similis* = *Lamprometra palmata palmata* from Oahu, p. 410].

26. HOLLY, MAXIMILIAN, Echinodermata from Pearl and Hermes Reef, B. P. Bishop Mus., Occ. Papers 10 (1) : 1-9, 1932.

27. KOEHLER, RENÉ, Revision de la collection des ophiures du muséum d'histoire naturelle de Paris, Bull. scient. de la France et de la Belgique 41 : 279-351, pls. 10-14, 1907.

28. LJUNGMAN, AXEL, Om nägra nya arter af Ophiurider, Öfv. K. Vet.-Akad. Förh. 23 (6) : 163-166, 1866.

29. LJUNGMAN, AXEL, Ophiuroidea viventia huc usque cognita, Öfv. K. Vet.-Akad., Förh. 23 (9) : 303-336, 1866.

30. LYMAN, THEODORE, Descriptions of new Ophiuridae belonging to the Smithsonian Institution and to the Museum of Comparative Zoölogy, at Cambridge, Boston Soc. Nat. Hist., Proc. 7 : 252-262, 1860.

31. LYMAN, THEODORE, Descriptions of new Ophiuridae, Boston Soc. Nat. Hist., Proc. 8 : 75-86, 1861.

32. LYMAN, THEODORE, Ophiuridae and Astrophytidae, Illus. Cat. Mus. Comp. Zoöl. 1 : i-viii, 1-200, pls. 1-2, 19 text figures, 1865.

33. LYMAN, THEODORE, Preliminary report on the Ophiuridae and Astrophytidae dredged in deep water between Cuba and the Florida reef, by L. F. de Pourtalès, Asst., U. S. Coast Survey, Mus. Comp. Zoöl., Bull. 1 (10) : 309-354, 1869.

34. LYMAN, THEODORE, Supplement to the Ophiuridae and Astrophytidae, Illus. Cat. Mus. Comp. Zoöl. 6 : 1-17, pls. 1-2, 1871.

35. LYMAN, THEODORE, Ophiuridae and Astrophytidae, old and new, Mus. Comp. Zoöl., Bull. 3 (10) : 221-272, 1874.

36. LYMAN, THEODORE, Report on the Ophiuroidea dredged by H. M. S. Challenger 1873-76, Challenger Reports, Zoology, 5 (14) : 1-386, pls. 1-48, 1882.

37. MORTENSEN, THEODOR, A Monograph of the Echinoidea 1 : 1–551, pls. 1–88, 173 text figures, Copenhagen, London, 1928 ; 2 : 1-647, pls. 1-89, 377 text figures, Copenhagen, 1935 ; 3 (1) : 1-370, pls. 1-77, 197 text figures, Copenhagen, 1940 ; 3 (2) : 1-553, pls. 1-56, 321 text figures, Copenhagen, 1943 ; 3 (3) : 1-446, pls. 1-66, 215 text figures, Copenhagen, 1943.

38. VERRILL, A. E., Notes on the Radiata in the Museum of Yale College . . . : Notes on the echinoderms of Panama and west coast of America, with descriptions of new genera and species, Conn. Acad. Arts and Sci., Trans. 1 (2) : 251-322, 1867. [Reprint includes material not in original publication.]

39. VERRILL, A. E., On new and imperfectly known echinoderms and corals, Boston Soc. Nat. Hist., Proc. 12 : 381-396, 1869.

INDEX

Abnormalis, Echinoneus 78, 118
Acanthaster planci 82, **118**, 119, 121
Acanthasteridae 82
Aceste ovata 78, 89, 94, 104
aciculatus, Echinostrephus 77, 97, 98, 113, 118, 119, 120, 121, 122
Actinocidaris thomasii 75, 88, 89, 91, 104, 105, 108
Actinopyga mauritiana 72, 117, 119, 120, 121, 122
  nobilis 72, 118, 119, 120, 121
  obesa 72, 119, 120
  parvula 72, 117, 118, 119, 120, 121, 122
aculeata, Phryssocystis 79, 118
acutispina, Coscinasterias 83, 118, 119, 120, 121
adiaphora, Ophiacantha 18, 19
aegyptica, Gomophia 81, 118
Aeropsidae 78
agassizi, Prionechinus 77
ajax, Asteroschema 11, 84, 100, 110, 113, 116, fig. 3, *b*, p. 11
albatrossi, Protankyra 74, 89, 94, 99, 100, 104, 106, 107, 112, 113
alberti, Craterobrisinga 83, 100, 116
albida, Trigonocidaris 77, 91, 94, 104
alexandri, Thynodium 74, 104
ammophilus, Sphaeriodiscus 80, 96, 107
Amphiactis astarte 38, 85, 109, fig. 14, *c*, *d*, p. 37
  lycidas 36, 85, 99, 110, fig. 14, *a*, *b*, p. 37
amphilogus, Ophiodesmus 47, 48
Amphiodia, sp. 31, 84
Amphioplus ancistrota 30
  caelatus 31, 84, 121
  cythera 29, 84, 105, 118, fig. 12, *a*, *b*, p. 30
Amphipholis squamata 29, 84, 118, 119, 121, 122
Amphiura dino 27, 84, 101, 118, fig. 11, *a*, *b*, p. 28
  immira 28, 31, 84, 99, 121
  iris 28
amphiurid 31, 84
Amphiuridae 27, 84
anacanthus, Gilbertaster 81, 104
Anapta inermis 74, 89, 95, 96, 100, 108
ancistrota, Amphioplus 30
anisacantha, Ophiomyxa 6
anomala, Asterina 82, 118, 121
Anseropoda insignis 82, 89, 109
Anseropodidae 82
Antedonidae 73, 92, 93
Anthenoides epixanthus 81, 87, 107, 111
anulifera, Holothuria 73, 92, 93
Arbaciidae 76
Archaster typicus 80, 118
Archasteridae 80
arenicola, Holothuria 72, 117, 118, 119, 120, 121, 122
arenosa, Culcita novaeguineae forma 81, 118, 121
argentea, Habrocidaris 76, 98
Argopatagus vitreus 79, 103
Argyrometra crispa 75, 97
armata, Nidorellia 69
asperula, Ophiomastix 4, 48, 85, 118
Aspidodiadema meijerei 76, 88, 89, 91, 95, 96, 108, 109, 110, 111, 116
  nicobaricum 76, 94, 98, 99, 100, 101, 102, 110, 112, 113, 115, 116
Aspidodiadematidae 76
astarte, Amphiactis 38, 85, 109, fig. 14, *c*, *d*, p. 37
Asterias squamata 29
Asteriidae 83
Asterina anomala 82, 118, 121
  cephea 82, 122
  coronata cristata 82, 121
  granulosa 82, 118, 121
  sp. 82, 118
Asterinidae 82
asteriscus, Centrostephanus 77, 103, 105, 111, 115
Asterodiscus tuberculosus 81, 97, 112
Asterope carinifera 82, 118
Asteropidae 82
Asteroschema ajax 11, 84, 100, 110, 113, 116, fig. 3, *b*, p. 11
  caudatum 7
  caudatum caudatum 9
  caudatum granulosum 9
  caudatum var. granulosum 7, 9, 83, 101, 112, 116, fig. 2, *a*, p. 8
  caudatum var. obscurum 9, 83, 100, 107, 110, 112, 116, fig. 2, *b*, p. 8
  edmondsoni 10, 84, 99, 101, 103, 112, 116, fig. 3, *a*, p. 11
  fastosum 12
  ferox 11
  horridum 11
  migrator 12
  mindorense 9, 10
  oedipus 12
  tubiferum 7, 83, 111, 117
  (Ophiocreas) caudatum 7, 9
Asthenactis papyraceus 83, 114
Astriclypeus manni 69
Astroceramus callimorphus 81, 91
Astropecten callistus 80, 87, 89, 97, 104, 106, 107, 110
  ctenophorus 79, 96
  hawaiiensis 79, 90, 103, 105
  polyacanthus 79, 115, 117
  productus 80, 109
  pusillulus 80, 87, 91, 96, 104, 107, 109, 111, 117
  triseriatus myobrachius 79, 121
Astropectinidae 79
Astropyga radiata 76, 92, 118
Atelecrinidae 75
Atelecrinus conifer 75, 94
athena, Ophioplinthaca 23, 84, 100, fig. 9, p. 24

atra, Holothuria, 72, 117, 118, 119, 120, 121, 122
atratus, Colobocentrotus 71, 78, 93, 117, 118, 119, 120, 121
attenuatus, Psilaster, 80, 86, 87, 91, 92, 93, 95, 96, 107, 108, 109
australasiae, Breynia 79
australis, Fibularia 78, 118, 120
australis, Ophiomyxa 5

Bathyplotes patagiatus 73, 88, 99, 100, 101, 104, 112, 113
Benthaster eritimus 83, 88
Benthopectinidae 80
biserialis, Laetmogone 73, 99, 113
bisquamata, Ophiacantha 17, 84, 109
bowersi, Ceramaster 80, 112
brevipes, Ophiocoma 86, 115, 118, 119, 120, 121
  var. insularia, Ophiocoma 50, 118
  var. variegata, Ophiocoma 50
brevispina, Leiaster 81, 118
brevispina, Luidia 80, 118
Breynia australasiae 79
Brisingella fragilis 83, 88, 91, 94, 95, 96, 104, 108, 109, 112, 115
Brisingidae 83
Brissopsis luzonica 79, 88, 89, 91, 94, 95, 96, 100, 102, 104, 105, 107, 112
Brissus latecarinatus 79, 118, 119, 120, 121
bursarium, Phormosoma 78, 93, 94, 97, 99, 100, 101, 102, 108, 110, 113

Caelatus, Amphioplus 31, 84, 121
Caenopedina hawaiiensis 76, 91, 93, 116
  pulchella 76, 100
calacantha, Stylocidaris 75, 91, 93, 94, 104, 109
calamaris, Echinothrix 77, 103, 118, 121
Calliaster pedicellaris 81, 109
Calliderma spectabilis 81, 89, 97, 106, 109
callimorphus, Astroceramus 81, 91
callipeplus, Leiaster 81, 92, 112, 114, 115
callistus, Astropecten 80, 87, 89, 97, 104, 106, 107, 110
canaliculatum, Ophiomusium 67
cancellata tylota, Ferdina 81, 122
carinifera, Asterope 82, 118
carnosa, Mesothuria 73, 99, 100, 101, 104, 112, 113
caudatum, Asteroschema 7
  caudatum, Asteroschema 9
  granulosum, Asteroschema 9
  var. granulosum, Asteroschema 7, 9, 83, 101, 112, 116, fig. 2, *a*, p. 8
  var. obscurum, Asteroschema 9, 83, 100, 107, 110, 112, 116, fig. 2, *b*, p. 8
(Ophiocreas) 7, 9
caudatus, Ophiocreas 7
Centrechinus 76
Centrostephanus asteriscus 77, 103, 105, 111, 115
cephea, Asterina 82, 122
Ceramaster bowersi 80, 112
micropeltus 80, 114
ceramoideus, Plinthaster 81, 91, 93, 107, 109
Chaetodiadema pallidum 76, 90, 91, 97, 109, 110
Charitometridae 75
Cheiraster inops 80, 87, 91, 92
snyderi 80, 99, 100, 101
Chiridota hawaiiensis 74, 118
rigida 74, 118, 119, 121, 122
uniserialis 74, 94
chloronotos, Stichopus 73, 118, 121, 122
Chondrocidaris gigantea 75, 104, 118
chuni, Prionechnus 111
Cidaridae 75
cinerascens, Holothuria 72, 117, 118, 119, 120
cingulatus, Persephonaster 80, 88, 94, 100, 102, 111
clarki, Distichophis 29, 31, 54, 86, 121
clarkii, Distichophis 54, 98
clippertoni, Ophiocomella 4, 54, 71, 86, 119, 121, 122
clothilde, Ophioplinthaca 24, 84, 99, 101, 118, fig. 10, *a*, *b*, p. 25
Clypeaster eurypetalus 78, 121
  leptostracon 78, 88, 99, 104, 105
  lytopetalus 78, 96, 97, 121
  reticulatus 78, 90, 91, 92, 93, 97, 99, 102, 103, 105, 111, 113, 114, 115, 120, 121
Clypeastridae 78
Colobocentrotus 71
  atratus 71, 78, 93, 117, 118, 119, 120, 121
  mertensii 71
  pedifer 71
Comactiniinae 74, 87
Comasteridae 74, 87
congesta, Psathyrometra 75, 100
conifer, Atelecrinus 75, 94
Coronaster eclipes 3, 83, 103
coronata, Ophiura 59, 60
coronata cristata, Asterina 82, 121
Coscinasterias acutispina 83, 118, 119, 120, 121
Cosmiometra crassicirra 74, 93
  delicata 74, 97
craspedotus, Tritonaster 80, 87, 95, 96
crassicirra, Cosmiometra 74, 93
crassispina, Ophionereis 46
crassispina, Salenocidaris 76, 104
Craterobrisinga alberti 83, 100, 116
  evermanni 83, 100
  panopla 83, 88, 100, 116
crispa, Argyrometra 75, 97
cristata, Asterina coronata 82, 121
Ctenophoraster hawaiiensis 80, 96
ctenophorus, Astropecten 79, 96
Cucumariidae 74
Culcita novaeguineae 81, 118

novaeguineae forma arenosa 81, 118, 121
novaeguineae forma nesiotis 81, 121
novaeguineae forma novaeguineae 81, 119
sp. 69
cyclostomus, Echinoneus 78, 117, 118, 119, 120, 121, 122
cylindricus pacificus, Dactylosaster 81, 118, 119, 121
Cyrtechinus verruculatus 77, 90, 92, 97, 98, 102, 103, 114, 115, 121
cythera, Amphioplus 29, 84, 105, 118, fig. 12, *a, b,* p. 30

Dactylosaster cylindricus pacificus 81, 118, 119, 121
decora, Stiremetra 74, 110
degeneri, Ophiodesmus 46, 48, 85, 98, 103, 114, 121, fig. 17, *a, b,* p. 47
delicata, Cosmiometra 74, 97
demessa, Ophiothrix 39, 85, 92, 97, 98, 103, 113, 114, 115, 118, 119, 120, 121
Dendraster excentricus 69
depressa, Ophiozonella 68, 86, 94
depressus, Prionechinus 77
Diadema 76
paucispinum 76, 98, 115, 118, 119, 121
diadema, Echinothrix 77, 118, 119, 121, 122
Diadematidae 76
difficilis, Holothuria 121
dino, Amphiura 27, 84, 101, 118, fig. 11, *a, b,* p. 28
diomedeae, Ophiomusium 64
Dipsacaster nesiotes 80, 91, 92, 93, 95
Distichophis clarki 29, 31, 54, 86, 121
clarkii 54, 98
dolichodactylus, Gorgonocephalus 13, 84, 118
dubia, Ophiolepis 46, 85
dumosa, Ophiacantha 18, 84, 91, fig. 6, *a, b,* p. 18
dyscrita, Ophiactis 32, 84, 105
Echinaster, sp. 82, 92, 104, 115
Echinasteridae 82
Echinocyamus elongatus 78, 90, 105, 114
incertus 78, 104
scaber 78, 89, 95
Echinometra mathaei 77, 93, 97, 98, 117, 118, 119, 120, 121, 122
oblonga 78, 117, 118, 119, 120, 121, 122
picta 77
Echinometridae 77
Echinoneidae 78
Echinoneus abnormalis 78, 118
cyclostomus 78, 117, 118, 119, 120, 121, 122
Echinostrephus aciculatus 77, 97, 98, 113, 118, 119, 120, 121, 122
molaris 77, 119, 120, 121, 122
Echinothrix calamaris 77, 103, 118, 121
diadema 77, 118, 119, 121, 122
Echinothuriidae 76
eclipes, Coronaster 3, 83, 103
edmondsoni, Asteroschema 10, 84, 99, 101, 103, 112, 116, fig. 3, *a,* p. 11
edulis, Holothuria 73, 118, 122
elegans, Ophioleila 13, 14, 84, 101, fig. 4, *a, b,* p. 14
elii, Ophiomusium 62, 86, 88, 91, 109, fig. 21, *a, b,* p. 63
elongatus, Echinocyamus 78, 90, 105, 114
Elpidiidae 73
Encope grandis 69
occidentalis 69
epixanthus, Anthenoides 81, 87, 107, 111
erinacea, Ophiocoma 49, 113
erinaceus, Ophiocoma 48, 51, 52, 85, 89, 104, 115, 118, 119, 120, 121, 122
eritimus, Benthaster 83, 88
Euapta godeffroyi 74, 92, 93, 117, 121
Eucidaris metularia 75, 89, 90, 91, 92, 93, 97, 98, 102, 103, 104, 113, 114, 115, 117, 119, 121
euplecta, Sclerasterias 83, 89, 91, 93, 104, 105, 106, 109
eurypatalus, Clypeaster 78, 121
evermanni, Craterobrisinga 83, 100
Evoplosoma forcipifera 81, 117
excentricus, Dendraster 69

Fastosum, Asteroschema 12
Ferdina cancellata tylota 81, 122
ferox, Asteroschema 11
Fibularia australis 78, 118, 120
Fibulariidae 78
fisheri, Mithrodia 82, 90, 92, 93, 97, 98, 102, 103, 104, 105, 113, 114, 115, 116, 117, 118, 119, 121
fisheri, Ophiomyxa 5, 83, 109, fig. 1, *a, b,* p. 6
fisheri, Ophiura 59, 86, 88, 89, 91, 96, 107, 118, fig. 20, *a, b,* p. 59
fisheri, Parametra 74, 111
forcipifera, Evoplosoma 81, 117
fragilis, Brisingella 83, 88, 91, 94, 95, 96, 104, 108, 109, 112, 115
fragilis, Ophiactis 36
Fromia pacifica 81, 118
fudsiyama, Laganum 78, 87, 88, 89, 91, 93, 99, 106, 107, 109, 111, 112
fusco-olivacea, Holothuria 73, 88
fuscorubra, Holothuria 72, 117, 118, 119, 120, 121

Ganeriidae 3, 82
gigantea, Chondrocidaris 75, 104, 118
gigantea, Oceanometra 74, 99
Gilbertaster anacanthus 81, 104
Glyptometra lateralis 75, 116
godeffroyi, Euapta 74, 92, 93, 117, 121
Gomophia aegyptica 81, 118
Goniasteridae 80

Goniodiscides sebae 81, 118
Gorgonocephalidae 13, 84
Gorgonocephalus dolichodactylus 13, 84, 118
grandis, Encope 69
grandis, Stereocidaris 75, 88, 96, 104, 108
granosum, Ophiomusium 67
granulosa, Asterina 82, 118, 121
granulosum, Asteroschema caudatum 7, 9, 83, 101, 112, 116, fig. 2, *a*, p. 8
gratilla, Tripneustes 77, 93, 117, 118, 119, 121
gratiosa, Parasalenia 77, 121
grisea, Lovenia 79, 106
guildingii, Linckia 81, 90, 92, 119, 121
Gymnopatagus obscurus 79, 95, 107
pulchellus 79, 87, 104

Habrocidaris argentea 76, 98
hastigera, Acanthocidaris 75, 88, 89, 90, 91, 95, 105, 106
hawaiiense, Thyonidium 74, 109
hawaiiensis, Astropecten 79, 90, 103, 105
hawaiiensis, Caenopedina 76, 91, 93, 116
hawaiiensis, Chiridota 74, 118
hawaiiensis, Ctenophoraster 80, 96
hawaiiensis, Holothuria 73, 92, 93, 120
hawaiiensis, Leiaster leachii 81, 119
hawaiiensis, Naumachocrinus 3, 75, 119
hawaiiensis, Ophiothrix lepidus 41, 85, 90, 97, 106, fig. 15, *a*, *b*, p. 41
hawaiiensis, Pentaceraster 81, 90, 92, 106
hawaiiensis, Prionocidaris 75, 90, 91, 92, 93, 95, 96, 97, 99, 100, 102, 104, 105, 106, 111, 114, 115
hawaiiensis, Temnotrema 77, 88, 90, 92, 93, 97, 98, 114
hawaiiensis, Thalassometra 74, 87
Heliaster kubiniji 69
Hemiasteridae 79
Hemieuryalidae 13, 84
hemiteles, Ophiactis 36
Henricia pauperrima 82, 104, 115
robusta 82, 111
Heterocentrotus 70
mammillatus 70, 71, 78, 117, 118, 119, 120, 121
trigonarius 70, 71, 78, 119, 122
hexactis, Ophiologimus 27
hirsuta, Pseudolovenia 79, 89, 91, 96, 102, 103, 107, 111
Histocidaris variabilis 75, 91, 93, 94, 96, 107, 108, 109, 111
Holothuria anulifera 73, 92, 93
arenicola 72, 117, 118, 119, 120, 121, 122
atra 72, 117, 118, 119, 120, 121, 122
cinerascens 72, 117, 118, 119, 120
difficilis 121
edulis 73, 118, 122
fusco-olivacea 73, 88
fuscorubra 72, 117, 118, 119, 120, 121
hawaiiensis 73, 92, 93, 120
humilis 72, 118
impatiens 73, 88, 118, 119, 120, 121
inhabilis 73, 118
kapiolaniae 72, 118
lineata 73
monocaria 72, 117, 118, 119, 121, 122
paradoxa 72, 90, 121
pardalis 73, 117, 118, 119, 120, 121, 122
pervicax 72, 117, 118, 119, 120, 121
rugosa 73, 117
vagabunda 72, 118
verrucosa 73, 118
sp. 73, 120
Holothuriidae 72
horridum, Asteroschema 11
horridus, Luidiaster 80, 106
humilis, Holothuria 72, 118
Hyalinothrix millespina 3, 82, 91
Hymenaster pentagonalis 83, 95, 108
Hypselaster maximus 79, 112
hystrix, Luidia 80, 91, 93, 99, 103, 115, 121

Imbricata, Ophiolepis 68
imbricatus, Ophioplocus 68, 86, 122
immira, Amphiura 28, 31, 84, 99, 121
impatiens, Holothuria 73, 88, 118, 119, 120, 121
impotens, Ophiomusium 64
incertus, Echinocyamus 78, 104
indiana, Pseudoboletia 77, 92, 93, 103, 115, 117, 119, 120, 121
inermis, Anapta 74, 89, 95, 96, 100, 108
inflata, Ophiomoeris 15, 84, 98, fig. 5, *a*, *b*, p. 16
inhabilis, Holothuria 73, 118
inops, Cheiraster 80, 87, 91, 92
insignis, Anseropoda 82, 89, 109
insignis, Orphnurgus 73, 87, 89, 93, 98, 99, 100, 101, 102, 104, 107, 108, 111, 112, 113
insularia, Ophiocoma 50, 85, 120, 121
Ophiocoma brevipes var. 50, 118
var. variegata, Ophiocoma 50, 85, 118, 119, 120, 121
iris, Amphiura 28

Jordani, Pseudarchaster 80, 87

Kapiolaniae, Holothuria 72, 118
kefersteini, Polyplectana 74, 93, 102, 120
kinbergi, Ophiura 55, 86, 93, 97
kröyeri, Ophiactis 36, 85
kubiniji, Heliaster 69

Labidodemas semperianus 73, 118

Laetmogone biserialis 73, 99, 113
sp. 73, 104
laevigata, Linckia 81, 118
Laganidae 78
Laganum fudsiyama 78, 87, 88, 89, 91, 93, 99, 106, 107, 109, 111, 112
lamellosa, Ophioplax 44
Lamprometra palmata palmata 74, 121
latecarinatus, Brissus 79, 118, 119, 120, 121
lateralis, Glyptometra 75, 116
leachii hawaiiensis, Leiaster 81, 119
Leiaster brevispina 81, 118
callipeplus 81, 92, 112, 114, 115
leachii hawaiiensis 81, 119
lepidus hawaiiensis, Ophiothrix 41, 85, 90, 97, 106, fig. 15, *a*, *b*, p. 41
lepidus, Ophiothrix 41
Leptodiadema purpureum 77, 90
leptostracon, Clypeaster 78, 88, 99, 104, 105
Leptosynapta oöplax 74, 117
lethe, Ophiactis 34, 85, 90, 92, 105, 106, 118, fig. 13, *a*, *b*, p. 34
leucacantha, Stereocidaris 75, 88, 89, 91, 92, 94, 95, 96, 100, 108, 109, 111
Linckia guildingii 81, 90, 92, 119, 121
laevigata 81, 118
multifora 81, 118, 119, 121, 122
unifascialis 69
Linckiidae 81
lineata, Holothuria 73
lithosora, Ophiomitra 23
lorioli, Ophidiaster 81, 88, 120, 122
Lovenia grisea 79, 106
subcarinata 79
Luidia brevispina 80, 118
hystrix 80, 91, 93, 99, 103, 115, 121
magnifica 80, 90, 121
sp. 80, 121
Luidiidae 80
Luidiaster horridus 80, 106
luzonica, Brissopsis 79, 88, 89, 91, 94, 95, 96, 100, 102, 104, 105, 107, 112
luzonica, Othilia 82, 121
lycidas, Amphiactis 36, 85, 99, 110, fig. 14, *a*, *b*, p. 37
lymani, Ophiumusium 67, 86, 94, 111
lytopetalus, Clypeaster 78, 96, 97, 121

Macrolepis, Psolus 74, 91
macroplaca, Ophiacantha 4, 48
maculata, Synapta 74, 121
maculatus, Toxopneustes 77, 121
magnifica, Luidia 80, 90, 121
mammillatus, Heterocentrotus 70, 71, 78, 117, 118, 119, 120, 121
manni, Astriclypeus 69
Mariametridae 74
mathaei, Echinometra 77, 93, 97, 98, 117, 118, 119, 120, 121, 122
mauritiana, Actinopyga 72, 117, 119, 120, 121, 122
maximus, Hypselaster 79, 112
Mediaster ornatus 80, 87, 100, 101, 102, 111, 113
meijerei, Aspidodiadema 76, 88, 89, 91, 95, 96, 108, 109, 110, 111, 116
melite, Ophioplax 42, 99, 105, 109, fig. 16, *a*, *b*, p. 43
mertensii, Colobocentrotus 71
Mesothuria carnosa 73, 99, 100, 101, 104, 112, 113
murrayi 73, 86, 87, 91, 93, 108
parva 73, 94, 96, 100, 107, 111
Metalia spatagus 79, 121
sternalis 79
metularia, Eucidaris 75, 89, 90, 91, 92, 93, 97, 98, 102, 103, 104, 113, 114, 115, 117, 119, 121
micropeltus, Ceramaster 80, 114
Micropetalon purpureum 78, 90
millespina, Hyalinothrix 3, 82, 91
migrator, Asteroschema 12
miliaris, Salenocidaris 76, 111, 117
mindorense, Asteroschema 9, 10
Mithrodia fisheri 82, 90, 92, 93, 97, 98, 102, 103, 104, 105, 113, 114, 115, 116, 117, 118, 119, 121
sp. 82, 113
Mithrodiidae 82
modesta, Ophiactis 33, 85, 88, 93, 105, 121
molaris, Echinostrephus 77, 119, 120, 121, 122
monaria, Ophiura 55, 86, 87, 100, 102, 104, 108, 111, 113, fig. 18, *a*, *b*, p. 56
monocaria, Holothuria 72, 117, 118, 119, 121, 122
monolini, Orechinus 77, 89, 91, 95, 96, 107, 111, 112, 118
multifora, Linckia 81, 118, 119, 121, 122
multispina, Phryssocystis 79, 118
murrayi, Mesothuria 73, 86, 87, 91, 93, 108
myobrachius, Pseudarchaster 80, 100, 102
Myxasteridae 83

Naumachocrinus hawaiiensis 3, 75, 117
Nepanthia, sp. 82, 118, 120, 121
nesiotes, Dipsacaster 80, 91, 92, 93, 95
nesiotis, Culcita novaeguineae forma 81, 121
nicobaricum, Aspidodiadema 76, 94, 98, 99, 100, 101, 102, 110, 112, 113, 115, 116
Nidorellia armata 69
nobilis, Actinopyga 72, 118, 119, 120, 121
novaeguineae, Culcita 81, 118
forma arenosa, Culcita 81, 118, 121
forma nesiotis, Culcita 81, 121
forma novaeguineae, Culcita 81,119

nuttingi, Patagiaster 80, 87, 89, 96, 104, 107, 111

Obesa, Actinopyga 72, 119, 120
oblonga, Echinometra 78, 117, 118, 119, 120, 121, 122
obscurum, Asteroschema caudatum var. 9, 83, 100, 107, 110, 112, 116, fig. 2, *b*, p. 8
obscurum, Sperosoma 76, 88, 91, 98, 99, 101, 102, 103, 108, 110, 111, 112
obscurus, Gymnopatagus 79, 95, 107
occidentalis, Encope 69
occidentalis, Oreaster 69
Oceanometra gigantea 74, 99
Odinia pacifica 83, 88, 100
oedipus, Asteroschema 12
oedipus, Ophiocreas 7, 9
oöplax, Leptosynapta 74, 117
Opheodesoma spectabilis 74, 120, 121
Ophiacantha adiaphora 18, 19
  bisquamata 17, 84, 109
  dumosa 18, 84, 91, fig. 6, *a*, *b*, p. 18
  macroplaca 4, 48
  prionota 17, 84, 91, 113
Ophiacanthidae 17, 84
Ophiactidae 31, 84
Ophiactis dyscrita 32, 84, 105
  fragilis 36
  hemiteles 36
  kröyeri 36, 85
  lethe 34, 85, 90, 92, 105, 106, 118, fig. 13, *a*, *b*, p. 34
  modesta 33, 85, 88, 93, 105, 121
  savignyi 31, 71, 84, 92, 93, 118, 119, 121, 122
  sexradiata 31
Ophiarachnella parvispina 54, 86, 122
Ophiaracna spinosa 55
Ophidiaster lorioli 81, 88, 120, 122
  rhabdotus 81, 99
  squameus 81, 102, 109, 121
Ophiochitonidae 42, 85
Ophiochondrinae 13
Ophiochondrus 13
Ophiocoma brevipes 86, 115, 118, 119, 120, 121
  brevipes var. variegata 50
  brevipes var. insularia 50, 118
  erinacea 49, 113
  erinaceus 48, 51, 52, 85, 89, 104, 115, 118, 119, 120, 121, 122
  insularia 50, 85, 120, 121
  insularia var. variegata 50, 85, 118, 119, 120, 121
  parva 4, 54, 86
  pica 51, 85, 89, 98, 103, 104, 118, 119, 120, 121, 122
  sannio 51
  scolopendrina 52, 85, 88, 91, 92, 93, 98, 99, 113, 114, 115, 118, 120, 121
  tartarea 48
  variabilis 48, 52
  variegata 50
Ophiocomella 71
  clippertoni 4, 54, 71, 86, 119, 121, 122
  parva 71
  schmitti 54
  schultzi 54, 71
Ophiocomidae 48, 85
Ophiocreas caudatus 7
  oedipus 7, 9
Ophioderma panamense 4, 68, 69
Ophiodermatidae 54
Ophiodesmus amphilogus 47, 48
  degeneri 46, 48, 85, 98, 103, 114, 121, fig. 17, *a*, *b*, p. 47
Ophioglypha ponderosa 60
Ophiogyptis 13
Ophioleila 13
  elegans 13, 14, 84, 101, fig. 4, *a*, *b*, p. 14
Ophiolepididae 55, 86
Ophiolepis dubia 46, 85
  imbricata 68
  savignyi 31
  sexradiata 31
Ophiologimus hexactis 27
  quadrispinus 26, 84, 109, 119
Ophiomastix 48
  asperula 4, 48, 85, 118
Ophiomitra lithosora 23
  semele 20, 23, 84, 92, 99, 100, 101, 110, 112, fig. 8, *a*, *b*, p. 21
Ophiomoeris 13
  inflata 15, 84, 98, fig. 5, *a*, *b*, p. 16
Ophiomusium canaliculatum 67
  diomedeae 64
  elii 62, 86, 88, 91, 109, fig. 21, *a*, *b*, p. 63
  granosum 67
  impotens 64
  lymani 67, 86, 94, 111
  relictum 64, 86, 100
  zela 65, 67, 86, 101, fig. 22, *a*, *b*, p. 65
Ophiomyxa anisacantha 6
  australis 5
  fisheri 5, 83, 109, fig. 1, *a*, *b*, p. 6
Ophiomyxidae 5, 83
Ophionereis crassispina 46
  porrecta 3, 45, 85, 98, 103, 113, 114, 115, 118, 119, 120, 121
Ophiopezella spinosa 55, 86
Ophioplax lamellosa 44
  melite 42, 99, 105, 109, fig. 16, *a*, *b*, p. 43
Ophioplinthaca athena 23, 84, 100, fig. 9, p. 24
  clothilde 24, 84, 99, 101, 118, fig. 10, *a*, *b*, p. 25
Ophioplocus imbricatus 68, 86, 122
Ophiothamnus otho 19, 84, 109, fig. 7, *a*, *b*, p. 19
Ophiothrix demessa 39, 85, 92, 97, 98, 103, 113, 114, 115, 118, 119, 120, 121
  lepidus hawaiiensis 41, 85, 90, 97, 106, fig. 15, *a*, *b*, p. 41
  lepidus lepidus 41
Ophiotrichidae 39, 85
Ophiozonella depressa 68, 86, 94
Ophiura coronata 59, 60
  fisheri 59, 86, 88, 89, 91, 96, 107, 118, fig. 20, *a*, *b*, p. 59
  kinbergi 55, 86, 93, 97

monaria 55, 86, 87, 100, 102, 104, 108, 111, 113, fig. 18, *a, b,* p. 56
ponderosa 60, 86, 104
robusta 62
scolopendrina 52
turgida 57, 58, 60
ursula 57, 86, 109, fig. 19, *a, b,* p. 58
Ophiure 46
Oreaster occidentalis 69
Oreasteridae 81
Orechinus monolini 77, 89, 91, 95, 96, 107, 111, 112, 118
ornata, Podocidaris 76, 96
ornatus, Mediaster 80, 87, 100, 101, 102, 111, 113
Orphnurgus insignis 73, 87, 89, 93, 98, 99, 100, 101, 102, 104, 107, 108, 111, 112, 113
Othilia luzonica 82, 121
otho, Ophiothamnus 19, 84, 109, fig. 7, *a, b,* p. 19
ovata, Aceste 78, 89, 94, 104
oviformis, Pycnolampas 79, 89, 94, 104

Pacifica, Fromia 81, 118
pacifica, Odinia 83, 88, 100
pacificus, Dactylosaster cylindricus 81, 118, 119, 121
Paelopatides retifer 73, 94, 98, 100, 101, 102, 103, 110, 113, 114, 116, 117
Paleopneustidae 79
pallida, Pannychia 73, 100, 104
pallidum, Chaetodiadema 76, 90, 91, 97, 109, 110
palmata palmata, Lamprometra 74, 121
panamense, Ophioderma 4, 68, 69
Pannychia pallida 73, 100, 104
panopla, Craterobrisinga 83, 88, 100, 116
paradoxa, Holothuria 72, 90, 121
Parametra fisheri 74, 111
Parasalenia gratiosa 77, 121
Parasaleniidae 77
pardalis, Holothuria 73, 117, 118, 119, 120, 121, 122
papyraceus, Asthenactis 83, 114
parva, Mesothuria 73, 94, 96, 100, 107, 111
parva, Ophiocoma 4, 54, 86
parva, Ophiocomella 71
parvispina, Ophiarachnella 54, 86, 122
parvula, Actinopyga 72, 117, 118, 119, 120, 121, 122
Patagiaster nuttingi 80, 87, 89, 96, 104, 107, 111
patagiatus, Bathyplotes 73, 88, 99, 100, 101, 104, 112, 113
paucispinum, Diadema 76, 98, 115, 118, 119, 121
paucituberculatus, Spatangus 79, 91, 108, 109, 111
pauperrima, Henricia 82, 104, 115
pedifer, Colobocentrotus 71
pedicellaris, Calliaster 81, 109
Pedidellasteridae 3, 83
Pedinidae 76
Pentaceraster hawaiiensis 81, 90, 92, 106
pentagonaster, Hymenaster 83, 95, 108
Pentametrocrinidae 75
Peronella strigata 78, 91
Persephonaster angulatus 80, 88, 94, 100, 102, 111
pervicax, Holothuria 72, 117, 118, 119, 120, 121
Phormosoma bursarium 76, 93, 94, 97, 99, 100, 101, 102, 108, 110, 113
Phrynocrinidae 3, 75
Phryssocystis aculeata 79, 118
multispina 79, 118
pica, Ophiocoma 51, 85, 89, 98, 103, 104, 118, 119, 120, 121, 122
picta, Echinometra 77
placopetalus, Rhynobrissus 79, 113, 114
planci, Acanthaster 82, 118, 119, 121
Plinthaster ceramoideus 81, 93, 107, 109
Podocidaris ornata 76, 96
polyacanthus, Astropecten 79, 115, 117
Polyplectana kefersteini 74, 93, 102, 119, 120
ponderosa, Ophioglypha 60
ponderosa, Ophiura 60, 86, 104
porrecta, Ophionereis 3, 45, 85, 98, 103, 113, 114, 115, 118, 119, 120, 121
Prionechinus agassizi 77
chuni 111
depressus 77
hawaiiensis 75, 90, 91, 92, 93, 95, 96, 97, 99, 100, 102, 104, 105, 106, 111, 114, 115
sculptus 77, 88, 102, 103, 107, 108, 111
prionota, Ophiacantha 17, 84, 91, 113
productus, Astropecten 80, 109
propinquus, Pseudostichopus 73, 91
Protankyra albatrossi 74, 89, 94, 99, 100, 104, 106, 107, 112, 113
Psathyrometra congesta 75, 100
Pseudarchaster jordani 80, 87
myobrachius 80, 100, 102
Pseudoboletia indiana 77, 92, 93, 103, 115, 117, 119, 120, 121
Pseudolovenia hirsuta 79, 89, 91, 96, 102, 103, 107, 111
Pseudostichopus propinquus 73, 91
Psilaster attenuatus 80, 86, 87, 91, 92, 93, 95, 96, 107, 108, 109
Psolus macrolepis 74, 91
Pteraster reticulatus 87, 92
Pterasteridae 83
pulchella, Caenopedina 76, 100
pulchella, Gymnopatagus 79, 87, 104
purpureum, Leptodiadema 77, 90
purpureum, Micropetalon 78, 90
pusilla, Tamaria 81, 118
pusillulus, Astropecten 80, 87, 91, 96, 104, 107, 109, 111, 117

Pycnolampas oviformis 79, 89, 94, 104

Quadrispinus, Ophiologimus 26, 84, 109, 119

Radiata, Astropyga 76, 92, 118
relictum, Ophiomusium 64, 86, 100
reticulatus, Clypeaster 78, 90, 91, 92, 93, 97, 99, 102, 103, 105, 111, 113, 114, 115, 120, 121
reticulatus, Pteraster 87, 92
retifer, Paelopatides 73, 94, 98, 100, 101, 102, 103, 110, 113, 114, 116, 117
Rhynobrissus placopetalus 79, 113, 114
rigida, Chiridota 74, 118, 119, 121, 122
robusta, Henricia 82, 111
robusta, Ophiura 62
rhabdotus, Ophidiaster 81, 99
rugosa, Holothuria 73, 117
rugosus, Thaumatocrinus 75, 114

Saleniidae 76
Salenocidaris crassispina 76, 104
  miliaris 76, 111, 117
Sarametra triserialis 75, 111
savignyi, Ophiactis 31, 71, 84, 92, 93, 118, 119, 121, 122
savignyi, Ophiolepis 31
scaber, Echynocyamus 78, 89, 95
schmitti, Ophiocomella 54
schultzi, Ophiocomella 54, 71
Sclerasterias euplecta 83, 89, 91, 93, 104, 105, 106, 109
scleroderma, Tamaria 81, 106
scolopendrina, Ophiocoma 52, 85, 88, 91, 92, 93, 98, 99, 113, 114, 115, 118, 120, 121
scolopendrina, Ophiura 52
Scotodeima vitreum 73, 98
sculptus, Prionechinus 77, 88, 102, 103, 107, 108, 111
sebae, Goniodiscides 81, 118
semele, Ophiomitra 20, 23, 84, 92, 99, 100, 101, 110, 112, fig. 8, *a*, *b*, p. 21
semperianus, Labidodemas 73, 118
sexradiatus, Ophiactis 31
sexradiatus, Ophiolepis 31
snyderi, Cheiraster 80, 99, 100, 101
spatagus, Metalia 79, 121
Spatangidae 79
Spatangus paucituberculatus 79, 91, 108, 109, 111
spectabilis, Calliderma 81, 89, 97, 106, 109
spectabilis, Opheodesoma 74, 120, 121
Sperosoma obscurum 76, 88, 91, 98, 99, 101, 102, 103, 108, 110, 111, 112
Sphaeriodiscus ammophilus 80, 96, 107
spinosa, Ophiaracna 55
spinosa, Ophiopezella 55, 86
spinulosus, Zoroaster 83, 94, 101, 110, 113
squamata, Amphipholis 29, 84, 118, 119, 121, 122
squamata, Asterias 29
squameus, Ophidiaster 81, 102, 109, 121
Stereocidaris grandis 75, 88, 96, 104, 108
  leucacantha 75, 88, 89, 91, 92, 94, 95, 96, 100, 108, 109, 111
sternalis, Metalia 79
Stichopus chloronotos 73, 118, 121, 122
  tropicalis 73, 117, 118
  variegatus 73, 117, 121, 122
Stiremetra decora 74, 110
striatus, Valvaster 82, 86
strigata, Peronella 78, 91
Stylocidaris calacantha 75, 91, 93, 94, 104, 109
Synapta maculata 74, 121
Synaptidae 74

Taeniogyrus, sp. 74, 96
Tamaria pusilla 81, 118
  scleroderma 81, 106
  tenella 81, 109
  triseriatus 81, 112
Tarsastrocles verrilli 83, 92
tartarea, Ophiocoma 48
Temnopleuridae 77
Temnotrema hawaiiensis 77, 88, 90, 92, 93, 97, 98, 114
tenella, Tamaria 81, 109
Thalassometra hawaiiensis 74, 87
Thalassometridae 74
Thaumatocrinus rugosus 75, 114
thomasii, Actinocidaris 75, 88, 89, 91, 104, 105, 108
Thyonidium alexandri 74, 104
  hawaiiense 74, 109
Toxopneustes maculatus 77, 121
Toxopneustidae 77
Trichasteridae 7, 83
Trichometra vexator 75, 91, 93, 95, 96, 110
trigonarius, Heterocentrotus 70, 71, 78, 119, 122
Trigonocidaris albida 77, 91, 94, 104
Tripneustes gratilla 77, 93, 117, 118, 119, 121
triserialis, Sarametra 75, 111
triseriatus myobrachius, Astropecten 79, 121
triseriatus, Tamaria 81, 112
Tritonaster craspedotus 80, 87, 95, 96
tropicalis, Stichopus 73, 117, 118
tuberculosus, Asterodiscus 81, 97, 112
tubiferum, Asteroschema 7, 83, 111, 117
turgida, Ophiura 57, 58, 60
tylota, Ferdina cancellata 81, 122
typicus, Archaster 80, 118

Unifascialis, Linckia 69
uniserialis, Chiridota 74, 94
ursula, Ophiura 57, 86, 109

Vagabunda, Holothuria 72, 118
Valvaster striatus 82, 86
Valvasteridae 82
variabilis, Histocidaris 75, 91, 93, 94, 96, 107, 108, 109, 111

variabilis, Ophiocoma 48, 52
variegata, Ophiocoma 50
Ophiocoma brevipes var. 50
Ophiocoma insularis var. 50, 85, 118, 119, 120, 121
variegatus, Stichopus 73, 117, 121, 122
verrilli, Tarsastrocles 83, 92
verrucosa, Holothuria 73, 118
verruculatus, Cyrtechinus 77, 90, 92, 97, 98, 102, 103, 114, 115, 121
vexator, Trichometra 75, 91, 93, 95, 96, 110
vitreum, Scotodeima 73, 98
vitreus, Argopatagus 79, 103

Zela, Ophiomusium 65, 67, 86, 101, fig. 22, *a*, *b*, p. 65
Zenocentrotus 71
Zoroaster spinulosus 83, 94, 101, 110, 113
Zoroasteridae 83