

Bulletin of the Museum of Comparative Zoölogy

AT HARVARD COLLEGE.

VOL. XXXIX. No. 9.

MEDUSAE FROM THE MALDIVE ISLANDS.

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WITH NINE PLATES.

CAMBRIDGE, MASS., U. S. A. :
PRINTED FOR THE MUSEUM.

APRIL, 1904.

No.9.—*Medusae from the Maldive Islands.* By HENRY B. BIGELOW.

THE Medusae described in the following pages were taken during the exploring trip of the steamer "Amra" to the Maldive islands, carried out by Mr. Alexander Agassiz during the months of December, 1901, and January, 1902. I accompanied the expedition as assistant to Mr. Agassiz, and during the cruise the capture and preservation of the Medusae fell to my special care. The original drawings for the figures accompanying this article were made on the spot, from life.

I wish to express my gratitude to Mr. Agassiz for his kindness in giving me the opportunity to visit the islands; and also for his assistance in the preparation of the manuscript and illustrations for this paper.

The Maldive islands, which comprise thirteen main atolls and several smaller ones, occupy the greater part of a submarine plateau the area of which is about thirty-five thousand square miles. The islands themselves extend from 8° north to 1° south latitude; and the long axis of the group nearly coincides with the 73d meridian of east longitude. The peculiarly open condition of the larger atolls, especially of the more northern ones, which has already been described by Mr. Agassiz (*Amer. Journ. Science*, March, 1901), allows free access to the water on all sides, and strong currents sweep through the passages and lagoons in all directions. This, as is noted later, has had a considerable influence on the distribution of the Medusae. During our visit, which lasted from December 25, 1901, until January 22, 1902, we made surface hauls at seventeen stations, in eleven atolls, and intermediate hauls at three stations, off the easterly faces of Kolumadulu, Haddummati, and Suvadiva atolls. The surface towing was done with a small net, at our nightly anchorages within the lagoons. The strong currents, which ran almost continuously, made it possible for us to tow when the ship was at anchor, by merely lowering the net overboard and letting the water run through it.

The intermediate hauls were all made with large open nets, at depths from near the surface to one hundred fathoms. We took Medusae at

every station, and in every haul; but the inside hauls were uniformly much more productive than those made at sea. This is probably in large measure due to the fact that the former were always made at about nine o'clock in the evening, an hour which seems particularly favorable for Medusae to come to the surface, and when the water was always very calm. The surface of the ocean itself was usually rather barren during the daytime; but on one occasion, on January 19, while we were sounding to the eastward of Guradu island, we found it very rich, taking *Physalia*, *Porpita*, *Cestus*, *Aurelia*, *Oceania*, *Aglaura*, and swarms of Copepods, Amphipods, Pteropods, and Heteropods.

The small number of our outside hauls makes it impossible to draw any comparison, between the Medusa fauna of the lagoons and of the open sea, more comprehensive than the following correlation between the open character of the atolls, with their free circulation of water, and the fact that there was no Trachomedusa which we took outside, and did not take commonly inside as well. Of the nineteen species of Hydromedusae which we collected, eleven were Leptolinae, and eight Trachylinae, a proportion of Trachylinae forms which at first sight seems large, considering that by far the greater number of hauls were made in shallow, enclosed waters within the lagoons. The explanation for this condition again is found in the free circulation through the atolls, which is constantly sweeping the adjacent surface water of the ocean through them to an unusual degree.

We took in all sixteen genera of Hydromedusae, two of Scyphomedusae, three of Siphonophorae and four of Ctenophorae, making a total of twenty-five genera, represented by twenty-nine species: of these one genus and fifteen species are new: nine species are already known, while four, represented each by a single specimen, were too fragmentary for determination. The number of Siphonophores, when compared with similar collections from other tropical waters, is surprisingly small. That so few of the species known to occur off the coast of Ceylon (*Haeckel*, Siphonophorae of the "Challenger" Expedition) exist also in the Maldives is very improbable, and the smallness of our catch must be attributed to some other cause.

The distribution of the fifteen new species is as follows: of the eleven Leptolinae, all, with one possible exception (*Dipurena*), are new; of the eight Trachylinae four are new; of the two Discomedusae, one; and of the four Ctenophorae, all, with one possible exception, are new. All of the Siphonophores belong to well-known and widely distributed species. The geographical occurrence of the nine known species is

dissonema Haeckel, Aglaura prismatica Maas, Nausithoe punctata Kölliker, and Diphyopsis appendiculata Agassiz and Mayer. These are all forms of very general distribution, and all either occur in the Atlantic or are represented there by exceedingly close allies. Of the thirteen genera common to both regions, not one is peculiarly Pacific; and the most characteristic Pacific forms, the Rhizostomae, were not found at all in the Maldives. This is of interest in view of their common occurrence in the Red Sea and the Persian Gulf, and off Zanzibar. (Vanhöffen, E. Untersuch. über Semaestome und Rhizostome Medusen. Bibl. Zoöl., bd. 1, heft 3, 51; and Chun, Beitrag. Zum. Kenntniss öst. Afric. Medusen, etc., Mittheil. Nat. Mus. Hamburg, jahrg. 13, p. 5, 1896.)

If we turn now to the Tortugas in the tropical Atlantic (Mayer, A. G., Bull. Mus. Comp. Zoöl., vol. 37, no. 2), we find they have in common with the Maldives the following fifteen genera: Aeginella, Aglaura, Bougainvillia, Dipurena, Gonionemus, Liriope, Oceania, Aurelia, Nausithoe, Diphyopsis, Physalia, Porpita, Beroë, Bolina, and Ocyroe. Of these, however, four only are represented by identical or even by exceedingly closely allied forms; these are Dipurena fragilis, Aeginella dissonema Haeckel, Aglaura hemistoma Haeckel, and Nausithoe punctata Kölliker.

A similar comparison with the Mediterranean shows twenty-one genera in common, but only two species, Aeginella dissonema Haeckel and Nausithoe punctata Kölliker; with two more, Rhopalonema typicum Maas and Aglaura prismatica Maas, represented by very closely allied forms. With the exception of the new genus Timoides, every genus found in the Maldives is well known in the Atlantic, and the following typically Atlantic genera, not recorded from the Pacific, were taken in the Maldives. **These are Berenice, Turritopsis, and Ocyroe.**

General Conclusions.

The Medusa fauna of the Maldives shows a very general resemblance to that of the Tortugas in the Atlantic and Fiji in the Pacific, as shown by the large number of genera which they possess in common. But the fact that very few of these genera are represented by identical species, and, still more important, that all such identical species are forms well known to be of very wide distribution throughout the tropical waters of the globe, is good evidence that this Maldivian fauna has no recent relationship to either of the other areas. The general resemblance of the

three is to be explained on the ground that they all belong to the characteristic "coral reef" type. Evidence that this cannot be considered a truly representative tropical type is found in the fact that the Canaries in the tropical Atlantic, whose physical characteristics, apart from the temperature of the water, are very different from those of any of the three other areas already considered, possess a Medusa fauna of markedly different characters.

As I have already stated, all of the Leptoline Hydromedusae from the Maldives, with one possible exception, are new. At the same time all of the Trachylinae which belong to the families Geryonidae and Peganthidae, whose members are well known to be local in their distribution, are also new. In other words, all the "local" forms, with one possible exception, are new, and the only species of Hydromedusae already known are those distributed, or at least represented, by exceedingly close allies throughout the tropical oceans of the globe. This same rule holds good for the Discomedusae, Aurelia, and Nausithoe, the Siphonophores and Ctenophores. We reasonably expect to find traces of such a condition in almost any region. The striking thing in the Maldives is the extent to which it is seen; for not only do we find nearly all the local forms new, but we find them separated from their nearest allies by very considerable divergences which amount often nearly to generic importance. The frequent occurrence in the Maldives of very aberrant species in genera which until now have been very homogeneous is a striking feature. The main conclusions which I wish to draw from these facts are two:—first, the very large proportion of new forms among those groups whose members are known to be of somewhat local distribution, particularly the Leptolina, and the fact that none of the typical Atlantic or Pacific Leptolina were found, points to the conclusion that, so far as the Medusa fauna is concerned, the Maldives are an area of geographic isolation. The very considerable degree of divergence from their near allies shown by the new species, and the frequent occurrence of aberrant members in otherwise very homogeneous genera, points to the second important conclusion, that this condition of isolation has lasted for a considerable period.

The fact that all but one of the genera of Acalephs found in the Maldives occur in the Atlantic, while only about two thirds of them are known to occur in the Pacific; and that while we found no typically Pacific genus, we did take five genera not previously recorded, except from the Atlantic, — seems to point to a closer connection with the Atlantic than with the Pacific. This connection, if it exists, is of very great

DESCRIPTION OF THE SPECIES.

I. HYDROMEDUSAE.

Dipurena fragilis.

Dipurena fragilis Mayer, A. G., 1900. Bull. Mus. Comp. Zoöl., vol. 37, p. 28, plate 17.

This Medusa, if not identical with *Dipurena fragilis* Mayer, from the Tortugas, is very closely allied to it. It appears to differ from it in being colorless, and in having the swollen regions on the proboscis much less prominent. The fact that only one specimen was taken makes me hesitate to separate it specifically.

January 2. Suvadiva atoll, near Dandu island; surface.

The occurrence of *Dipurena* in the Indian Ocean is of interest, since this genus has never been taken in the tropical Pacific, though in the tropical Atlantic and Mediterranean it is represented by numerous species.

Euphysa tetrabrachia, sp. nov.

Plate 1, Fig. 1.

I have rather doubtfully referred the present species to *Euphysa*, to which genus it shows more resemblance than to *Corymorpha*. The bell is four mm. high by two and one half broad; pear-shaped, with a low and broad apical projection, and it is perfectly symmetrical. The single long tentacle is well developed, and is about four times as long as the bell is high. The other three, instead of being mere rudiments, are of considerable size, about one third as long as the bell height, and are equally developed. All four are ringed with nettle cells, about three rings on each of the short, and six or eight on the long, tentacle.

There is an ocellar bulb borne at the base of each tentacle. The proboscis is flask-shaped, its upper portion distended by the swollen half-spherical masses of gonads, arranged in eight fairly distinct rows. The mouth hangs below the bell opening, and bears no lips.

The bell is colorless and very transparent, the gonads brownish yellow, the proboscis slightly pinkish, and the ocellar bulbs and rings of nettle cells rose pink.

One specimen, January 7, in Suvadiva atoll. Surface.

The generic position of this very distinct species seems doubtful. It agrees with *Euphysa* in the symmetry of the bell, and in the arrangement of the gonads, which correspond very well to the figures of *Euphysa virgulata*, given by Alexander Agassiz (North American Acalephae, 1865, p. 190, fig. 317).

It differs, however, from both *Euphysa* and *Corymorpha* in the considerable and equal development of the three short tentacles, and further study may prove it to be representative of a new genus.

Turritopsis, sp.

A single young specimen of *Turritopsis* was taken in the tow on January 10, in Felidu atoll. Species undetermined.

Bougainvillia, sp.

A single specimen of *Bougainvillia*, in a very fragmentary condition, was taken in the tow on December 30, off the east face of Kolumadulu atoll, in an open net at one hundred fathoms.

Berenice, sp.

A single specimen of *Berenice* was taken in the tow on the night of January 8, in Haddummati atoll. It was too fragmentary for description.

Oceania virens, sp. nov.

Plate 1, Figs. 3, 4.

The bell is lenticular, with rather thin but firm gelatinous substance, about twelve mm. in diameter and one third as high. There are between sixteen and twenty tentacles, the exact number being variable, irregularly arranged. Each tentacle is thick, swollen at the base, only slightly contractile, and about one half as long as the bell-height. Besides the tentacles there are from thirty to forty rudimentary tentacular bulbs borne on the bell margin, two or three between each two tentacles. These knobs, however, are irregularly arranged, and vary greatly in number in different specimens. They appear never to be developed into anything more than the mere rudiments of tentacles or cirri. The proboscis is short, flask-shaped, very distensible, and bears four simple pointed lips. The gonads are long for this genus, occupying the distal half of the radial canals.

There are thirty-two otocysts, two or three between each pair of tentacles, but rather irregularly distributed. Each contains one or two spherical otoliths.

The bell is colorless. The gonads, proboscis, and tentacles are light yellowish green.

Several specimens, December 26, Male atoll, near Male island, and January 2 in Suvadiva atoll, near Dandu island, surface.

In form, arrangement of the gonads and otoliths, and in general appearance,

this species much resembles *Oceania pacifica* Agassiz and Mayer (Bull. Mus. Comp. Zool., vol. 32, no. 9), from Fiji. It differs from it strikingly, however, in the possession of rudimentary tentacular bulbs on the bell margin, in which respect it resembles *Oceania carolinae* Mayer, from the western Atlantic, from which species it is clearly distinguished by the shape of the bell and the size and position of the gonads.

Oceania brunescens, sp. nov.

Plate 1, Fig 2.

The bell is low and flat, about two mm. in diameter and one third as high. There are about thirty short thick tentacles, much swollen at the base. The bell margin does not bear tentacular bulbs. The proboscis is very short and broad, and the mouth bears four simple lips. The most distinctive feature of this Medusa are the gonads, which are exceedingly thick and prominent, and nearly hemispherical (Plate 1, Fig. 2). They occupy the proximal third of the radial canals.

There are from thirty-two to forty small otocysts, each with one or two otoliths, scattered irregularly along the bell margin.

The bell is colorless and very transparent. The canals and gonads are greenish yellow. The tentacles are colorless, but at the base of each there is a prominent brown pigment spot.

Two specimens, January 15, near the southern end of Malosmadulu atoll. The very large, hemispherical gonads and prominent brown pigment spots clearly distinguish this Medusa from all described species of *Oceania*.

Eutimeta lactea, sp. nov.

Plate 2, Figs. 7, 8.

The bell is thin, slightly conical, nine mm. in diameter, and about one half as high. There are eight permanent and well-developed tentacles, of which the four opposite the radial canals are about as long as the diameter of the bell, and the other four slightly shorter. Small lateral spurs are borne at the bases of the tentacles, and there are in addition about twenty-four papillae on the bell margin. None of these bear lateral cirri. There are eight otocysts, each of which contains four or five otoliths. The peduncle of the proboscis is slender and slightly shorter than the bell diameter. The proboscis is cylindrical and as long as $\frac{2}{3}$ of the bell height. The mouth bears four slightly foliated lips. The position of the gonads is somewhat distinctive. They are borne on the radial canals, and occupy the central two thirds of the peduncle, as figured by Haeckel for *Eutimeta gentiana* (System der Medusen, 1880, plate 12, fig. 7). In *Eutimeta levuka* Agassiz and Mayer, from Fiji, they are found near the circular canal. The gonads are of considerable size, and form four swollen ridges.

This species is nearly colorless : the tentacles and manubrium are of a very faint bluish tinge, and the gonads are opaque milky white.

Several specimens, Male atoll, near Male island, December 26, surface.

This species is most closely allied to *Eutimeta gentiana* Haeckel, from the Canaries, but differs from it in the form of the bell, and in having much smaller marginal cirri. The gonads are more prominent, but occupy a shorter portion of the peduncle. In the form of the bell it resembles *Eutimeta levuka* Agassiz and Mayer, but the peripheral position of the gonads in the latter is an important point of difference.

***Eirene danduensis*, sp. nov.**

Plate 1, Fig. 5. Plate 2, Fig. 6.

The bell is flatter than a hemisphere, somewhat conical in outline, with rather thin gelatinous substance : it is twenty-five mm. in diameter and about one third as high. There are thirty-two tentacles, of which the four opposite the radial canals are at least one fourth longer than the others. Each tentacle bears two lateral cirri at its base, and there are also about seventy small papillae scattered irregularly along the bell margin. There are thirty-two otocysts, eight to each quadrant, and each contains about five spherical otoliths. The peduncle, the most distinctive feature of this form, is long for the genus, reaching well below the bell opening, and is conical in outline. The proboscis is about one half as long as the peduncle. It may be extended to nearly double this length, but cannot be retracted within the bell opening. The mouth bears four simple lips.

The spindle-shaped gonads occupy the distal two thirds of the radial canals. The bell is colorless. The gonads are bluish green.

A single specimen was taken on January 8, off the east face of Haddummati atoll, in an open net, at two hundred fathoms.

This Medusa is distinguished from all described species of *Eirene* by the very considerable length of the peduncle and proboscis.

***Timoides agassizii*, gen. et sp. nov.**

Plate 3, Figs. 10, 11.

Timoides forms a new genus of Eucopidae, belonging to that division of the family characterized by possessing numerous otocysts and tentacles, and numerous cirri on the bell margin. The gonads are borne on the radial canals, but are wholly restricted to the peduncle, which is very long. The lips are large and form an important feature. By far the most characteristic feature of this genus, which in the main resembles *Tima*, is the presence, between the radial canals, of blind centripetal canals arising from the ring canal.

The Medusa is bell-shaped, of much the same outline as *Tima formosa* Agassiz. The gelatinous substance of the bell is very thick. The extreme diameter is

twenty mm.; and the bell is two thirds as high as broad. The tentacles may be extended to nearly a foot in length, and are exceedingly flexible and contractile. When retracted they are usually coiled spirally, and this coiling may take place at any point in their length without affecting the rest of the tentacle. In life they stream out far behind the bell. They are thirty-two in number, arranged in four series. First, four, opposite the radial canals; second, four alternating with these; third, eight, alternating with the eight already mentioned. Every tentacle of these three series is opposite a canal, blind or radial; but the sixteen of the fourth series alternate with the canals. The bell margin also bears numerous cirri (Plate 4, Fig. 11), which, as well as the tentacles, are spirally coiled when retracted. Neither cirri nor tentacles bear lateral spurs.

The blind canals, which are the most important structural features of the Medusa, are arranged in two series, the first of four, alternating with the radial canals, and reaching up for two thirds the height of the bell; the second of eight, about one half as long, and alternating with the radials and blind canals of the first series. They are all in free communication with the ring canal, and each is opposite a tentacle.

The peduncle hangs below the bell opening for a distance at least equal to the height of the bell cavity. Throughout most of its length it is nearly cylindrical, but at its base it is somewhat funnel-shaped. At its distal end it passes, without any external separation, into the stomach, which is barrel-shaped in outline, and bears four prominent lips. These lips are, in life, the most striking feature of the Medusa. They are very long, and so extensible that they may reach a length considerably greater than that of peduncle and stomach combined. They are rather narrow, and their edges are thrown into innumerable constantly changing folds.

The gonads consist of a great number of simple and branched papilliform processes so closely crowded on the alternate sides of the radial canals that they form four prominent double ridges. They occupy slightly more than the distal half of the peduncle, and their relative extension seems, in adult specimens, to be practically invariable.

The coloring of this Medusa is exceedingly brilliant. The gelatinous substance of the bell is faintly tinged with blue: the gonads are rich Indian yellow, changing in certain lights to ruddy orange. In sharp contrast to them, the stomach and mouth arms are pink-violet; the radial canals and tentacles are rose pink, and there is a pink pigment spot at the base of every tentacle.

Abundant in Haddummati atoll, near Gadu island, on January 8. It appeared on the surface in great numbers at about four o'clock in the afternoon, when the bright colors and long streaming tentacles of the animals made them very conspicuous objects.

The fact that blind canals have never before been detected in the adult of any species of Eucopidae is at once sufficient to separate *Timoides* generically. The number of these canals and the relative extension of the gonads will probably prove to be of specific importance.

Gonionemus pelagicus, sp. nov.

Plate 4, Figs. 12, 13, 14.

The bell is rounded, but low and thin. It is about twenty mm. in diameter, and one third as high as broad. There are about fifty long, straight, flexible tentacles, each of which forms a slight elbow near the tip, in the manner characteristic of the genus. These elbows, however, are so inconspicuous in life that the tentacles resemble *Melicertum* rather than *Gonionemus*. At the elbow each tentacle bears a small almost rudimentary sucking disc, and they are ringed throughout their whole length. At the base of each there is a cluster of brown pigment spots. **There are sixteen otocysts.**

The proboscis is flask-shaped, nearly as broad as long. It is exceedingly flexible, but cannot be retracted. **The mouth bears four fimbriated lips.** The gonads, which occupy the distal third of the radial canals, consist of simple papilliform processes closely crowded together, as in *Gonionemus murbachi*, from Woods Holl, Mass.

The bell is colorless: the proboscis and tentacles are yellowish green, the pigment spots at the bases of the tentacles vandyke brown, and the gonads rose pink.

In life this Medusa bears little resemblance to other species of *Gonionemus*. It swims freely by frequent contractions of the bell, the tentacles streaming behind at full length. The flexible tentacles are continually contracting and expanding and swaying to and fro in the water. The Medusa showed no inclination to attach itself, nor did it swim to the surface, sink, and then swim up again in the manner so characteristic of the genus. The anatomical structure of the tentacles also points to this habit of life, which has led me to give it the name "pelagicus." It differs from all other species of *Gonionemus*, to which genus it certainly belongs, in the rudimentary condition of the sucking discs. One specimen, January 7, near Gadu island, Suvadiva atoll, surface.

Messonema coerulescens BRANDT.

Brandt, 1838, Mem. Acad. Imp. St. Pétersbourg, ser. 6, vol. 4.

A single specimen of *Messonema* was taken on January 8, in Haddummati atoll. It probably belongs to this species, but was too fragmentary for accurate determination.

Rhopalonema typicum MAAS.

Homoeonema typicum Maas, 1897, Mem. Mus. Comp. Zoöl., vol 22, p. 22, taf. 3.

Two specimens of this species were taken on January 8, in Haddummati atoll.

Aglaura prismatica MAAS.

Aglaura prismatica Maas, 1897, Mem. Mus. Comp. Zoöl., vol. 12, p. 24, taf. 3.
Lessonia radiata? Eydoux et Souleyet, 1841-52, Voyage de la Bonité, vol. 2, Zoöphytes, plate 2.

A species of *Aglaura* apparently identical with the *Aglaura prismatica* of Maas was one of the most abundant Medusae in the tow. We took it at almost every station, both inside and outside the atolls, often in large numbers. All our specimens were quite colorless and transparent, a condition similar to that observed by Agassiz and Mayer in several specimens from Fiji (Bull. Mus. Comp. Zoöl., vol. 32, p. 165, plate 4, fig. 13).

Aglaura octagona, sp. nov.

Plate 2, Fig. 9.

The bell is distinctly octagonal, lantern-shaped, and flattened at the top; it is three mm. high, and about one half as broad. The walls, although exceedingly thin, are very rigid, and the vellum is provided with a series of circular muscles. There are about thirty-two tentacles, which in our specimens were all broken short off, leaving stumps behind. The peduncle is three fourths as long as the bell is high and cannot be retracted within the bell cavity. The stomach is short and globular, and the mouth bears four simple lips, which hang nearly on a level with the bell opening. The gonads are egg-shaped, and are borne at the junction of the radial canals with the stomach. There are eight interradial otocysts. **The whole Medusa is perfectly colorless.**

Two specimens, December 30, off the east face of Kolumadulu atoll, in an open net at about one hundred fathoms. *Aglaura octagona* is very closely allied to *Aglaura laterna* Haeckel, from the Canary Islands. It differs, however, in the following particulars: The peduncle is longer, the gonads are egg-shaped instead of spherical, and the tentacles seem rather more numerous. (*Aglaura laterna* has usually from sixteen to twenty-four.) The form of the bell in both species is identical, and in other general proportions they are very similar. The genus *Aglaura* falls into two well-marked divisions, one represented by *Aglaura hemistoma*, with the closely allied varieties, *prismatica* Maas, from the Pacific, *nausicaa* Haeckel and *vitrea* Fewkes, from the Atlantic, characterized by the short peduncle; and the other represented by *Aglaura laterna* Haeckel, from the Canaries, and *Aglaura octagona*, sharply distinguished by the long peduncle and lantern-shaped bell. I think it is probable that these may all prove to be merely geographical races of two well-defined species.

Liriope LESSON, 1843.

In the "Craspedoten Medusen der Deutschen Tiefsee-expedition," p. 79, Dr. Ernst Vanhöffen has given an able analysis of this genus which he, follow-

ing Maas and Metschnikoff (Arb. Zoöl. Inst., Vienna, vol. 6), widens to include all Geryonidae with four radial canals. He thus includes Haeckel's genera *Glossocodon* and *Glossoconus* (Haeckel, System der Medusen, 1879), of which the distinctive character, the presence in the adult state of blind centripetal canals, has been shown by Maas to be a developmental feature of little systematic importance. Although knowledge of the young stages of most species of *Liriope* is entirely lacking, or very fragmentary, Maas, writing of the collections of the Plankton Expedition (Craspedoten Medusen der Plankton Ex. 18), was able to say: "Of all the material of the expedition, no single species of the Geryonidae can be named, of which it can safely be said that it has no centripetal canals."

Our catch included two species of *Liriope*, both of which appear to be new.

Liriope indica, sp. nov.

Plate 5, Figs. 17, 18.

This species is one of the medium-sized members of the genus, measuring in diameter fourteen mm., and in height about nine. The outline of the bell is almost an exact segment of a circle (Plate 5, Fig. 17), and the gelatinous substance is of medium thickness, thus agreeing well with Vanhöffen's statement that the thickness of the gelatinous walls of members of this genus correspond in general to their size. The eight permanent tentacles are very unequal; the four opposite the radial canals are hollow, flexible, ringed with nettle cells, about as long as the bell diameter. Although they are moved actively, they seem only very slightly contractile, so that their length varies but little. Alternating with them are four others, only about one fourth as long, which are solid, stiff, and curved outwards. Their centripetal surfaces are set with ridges of nettle cells, which extend around about one half the circumference of the tentacle. The ring canal does not give rise to any blind canals, but opposite each of the short tentacles it becomes abruptly broader, forming a triangular spur (Plate 5, Fig. 18). The peduncle is nearly cylindrical, about as long as the bell is high, and hangs far below the bell opening. The stomach is one third as long as the peduncle, and does not bear a stomatostyle. The mouth is a simple, square opening, without lips. The gonads, which occupy nearly the whole length of the radial canals, are shield-shaped, and so broad that they occupy one third of the surface of the subumbrella. The eight otocysts are borne one at the base of each tentacle. Their position, however, differs: the ones corresponding to the short tentacles occurring directly above them, while the four connected with the long tentacles are at one side (Plate 5, Fig. 17). The Medusa is perfectly transparent and colorless, except that the gonads are opaque yellowish, and the nettle knots on the short tentacles reddish brown.

Four specimens, January 2, in Suvadiva atoll, near Dandu island, surface. This Medusa in several respects resembles the *Liriope hyalina* of Agassiz and

Mayer (Bull. Mus. Comp. Zoöl., vol. 30, p. 166, plate 9). Mayer's figure appears to be taken from an immature individual, and in his description he makes no mention of the form of the gonads, so it is possible that the two species may prove to be identical. Both are closely allied to *Liriope scutigera* McCrady (Proc. Elliott Soc. Nat. Hist., vol. 1, p. 208, 1859), from Charleston Harbor, South Carolina.

Liriope hemisphericus, sp. nov.

Plate 4, Figs. 15, 16.

The bell is nearly hemispherical, with rather thick walls. It is eight mm. in diameter and slightly more than half as high as broad. The bell cavity is flatter than a hemisphere. There are two kinds of chymiferous tubes. There are four radial canals, and alternating with these are four broad, arrow-shaped canals which arise from the ring canal and end blindly in the bell wall at about one half the height of the cavity. Corresponding to these two kinds of canals are two kinds of tentacles. The four opposite the radial canals are hollow, flexible, about as long as the bell is high, and ringed with nettle cells throughout their length. Alternating with these, and opposite the blind canals, are four others which are only slightly shorter, but are solid, stiff, and carried curved sharply outward. Instead of being ringed, they bear a series of clusters of nettle cells on their centripetal surfaces (Plate 4, Fig. 16). The cylindrical peduncle, which is very flexible, is nearly as long as the diameter of the bell, and so hangs far below the opening. Its distal end is prolonged into a pointed stomatostyle. The stomach is nearly cylindrical and the mouth bears four simple lanceolate lips which are usually recurved. The gonads are heart-shaped, rather narrow, and occupy the proximal half of the radial canals. They occupy hardly more than one eighth of the surface of the subumbrella. The eight otocysts, which are all similar, are arranged radially and interradially, the radials being at one side of the tentacles, the interradials directly above their bases (Plate 4, Fig. 16). This Medusa is colorless, except that the gonads are opaque whitish, and the nettle cells on the short tentacles Vandyke brown.

Three specimens, December 26, Male atoll, near Male island, surface. This species differs in important particulars from all known members of that division of the genus *Liriope* whose adult members normally possess centripetal canals, in having only one of the latter to each quadrant, — a condition characteristic of the young of other species. In general appearance it most resembles *Liriope tenuirostris* Agassiz, from the Atlantic coast of North America. A striking characteristic of the species is the large size of the interradial canals.

Although our specimens were sexually mature, it is by no means certain that the number of blind canals had reached its maximum. Studies on a species of *Olindias* from Bermuda have shown a condition in which the number of these canals and of the tentacles nearly doubles with the increase in size of the Me-

dusa after sexual maturity is reached; and it is by no means improbable that the same may be true here. As in the case of the velar canals of *Charybdea*, so here the number and even form of the blind centripetal canals are probably chiefly dependent upon age, and cannot be considered of much systematic importance.

Pegantha simplex, sp. nov.

Plate 5, Figs. 19, 20.

This Medusa has the form characteristic of the genus. The bell consists of a thick, lenticular central portion, surrounded by a dependent ring or collar, from which it is divided by a shallow furrow. The margin of the collar is divided into eight lappets, each of which is in turn subdivided into two by a shallow groove. The lappets are very flexible, and can be curved inward, so that they nearly close the bell opening. The bell is about three mm. in diameter, and one half as high as broad. There are only eight tentacles, a much smaller number than has been reported for any other species of the genus; and this number seems to be constant. They arise from the periphery of the central disc, alternating with the eight marginal lappets, and corresponding to the grooves between them. They are broadly conical at the base, solid, carried curved stiffly outward, and are slightly longer than the bell is high. They taper very rapidly, and toward the tips are very delicate. A characteristic feature of this Medusa, in which there are no radial canals, is the large size of the stomach. This organ, which is lenticular in cross-section and provided with a broad, simple mouth without lips, extends to the periphery of the central disc. In outline it is somewhat octagonal, the angles being opposite the tentacles, and from the middle of each side (alternating with the tentacles) it throws out a narrow canal running to the corresponding gonad, one of which lies at about the middle of each marginal lappet. The gonads are sac-shaped bodies, of considerable size, suspended from the surface of the subumbrella. In this Medusa they are simple, although in most other species of the genus they are subdivided into three or more secondary lobes. There are about two hundred otocysts, situated on the edges of the marginal lappets, about twenty-five to each lappet. Each otocyst arises from a low and broad "auditory papilla," which is thickly set with short stiff ciliae. The otocysts themselves are oval, and contain three rather long prismatic otoliths. At their bases they bear club-shaped processes, about twice as long as the otocyst, which extend up into the substance of the bell. When the lappets are retracted over the bell opening, these processes alone are visible.

The Medusa is altogether colorless. An abundant species: numerous specimens, December 26, Male atoll, near Male island; January 2, off the east face of Kolumadulu atoll, in an open net at fifty and one hundred fathoms; January 15, Malosmadulu atoll, surface. One of the few species which appeared to be equally common inside and outside the atolls.

This form seems quite distinct from all other species of *Pegantha*, to which genus it undoubtedly belongs. Its two striking peculiarities are the small number of tentacles, and the fact that the gonads are not subdivided. The smallest number of tentacles described from any species of the genus is fourteen, in *Pegantha martagon* (Haeckel, System, 1879).

Aeginella dissonema HÆCKEL.

Haeckel, 1879, Syst. der Medusen, p. 340, taf. 20, fig. 16.

We took one specimen of this Medusa in South Malosmadulu atoll, January 15, surface. Drawings made from life agree perfectly with the figures given by Haeckel (System, taf. 20), and by Mayer (Bull. Mus. Comp. Zoöl., vol. 37, plate 14, fig. 30), except that our specimen was altogether colorless, instead of having green pigment spots on the stomach. The only other described species, *Aeginella bitentaculata* Quoy et Gaimard, seems to differ very slightly from *Aeginella dissonema* Haeckel.

II. SCYPHOMEDUSAE.

Aurelia maldivensis, sp. nov.

Plates 6 and 8, Figs. 22, 23, 27.

This Medusa is by far the most aberrant species of *Aurelia*, to which genus I rather doubtfully refer it. The bell is disc-shaped, of very solid consistency, and rather thick; it is about two hundred and fifty mm. in diameter, and slightly more than one third as high as broad. Its outline is broken by eight deep indentations, forming eight marginal lappets, each of which bears a slight central depression at its margin. At the base of each of the eight indentations lies a prominent sense organ (Plate 6, Fig. 23). In their proportions these sense organs differ considerably from those of *Aurelia flavidula* Pér. et Less., although they agree with them in general structure. They differ, however, in their connection with the stomach, which here consists of a single straight radial canal, which instead of opening into a broad circular cavity, connecting on either side of the sense organ with the ring canal, spreads but slightly, forming only a small cavity, which sends out two narrow branches, one on either side of the sense organ, to the ring canal. No other chymiferous vessels open into this enlarged cavity, except that it usually anastomoses with the neighboring radial canal on either side. This condition is, however, not constant. There are three short canals which arise from under the floor of the expanded cavity. One of these is broad, short, and runs to the otocyst; the other two form a horseshoe, embracing the otocyst, and run into the two

marginal papillae, near the outer edges. These papillae are large and prominent, but extend only slightly, if at all, beyond the margin of the bell. The oocyst itself, containing a number of minute spherical otoliths, is covered over by a curtain-like structure (Plate 6, Fig. 23).

The tentacles, borne on the exumbrella, some distance from the bell margin, are short, very numerous, about five hundred in number, and alternate with as many small dorsal lappets. There are about forty-eight chymiferous tubes in the region of the stomach, but they branch frequently, and occasionally anastomose, so that at the bell margin there are about one hundred and seventy to one hundred and seventy-five. The eight canals running to the sense organs do not branch, nor do the eight which run to the middle of the marginal lappets. The mouth arms are long and broad, fringed with innumerable minute tentacles, and in life they hang slightly below the bell opening, but do not extend outward beyond its margin. The structure of the mouth parts, and their complexity, separates this Medusa from every other member of the genus. The mouth itself is a simple cruciform opening, but it is surrounded by elongated lips, which hang far below the bell opening, suggesting in appearance a small or immature Cyanea. These lips, which are undivided, and form an extremely sensitive and mobile curtain completely surrounding the mouth, are thrown into four main folds, rendering them cruciform in cross-section, and alternating in position with the gonads. They bear in addition numerous complex lesser folds, increasing in number toward the free margins. The living Medusa constantly contracts and expands the mouth parts with every motion of the bell, and a photograph taken at the time shows them much further extended than I have figured them. The four gonads are of the horseshoe form typical of Aurelia, and are rather small. But owing to their bright color they are very conspicuous. The subgenital pits are widely opened.

This Medusa is extremely brilliant and striking in the water. The entire bell is of a delicate lilac tinge; the canals and tentacles are pinkish violet, and the gonads, and in mature specimens the edges of the mouth arms and lips are bright violet. The color varies much, — some specimens showing more pink, others more violet or blue.

Abundant on the surface on several occasions. We found it first on January 1, off the east face of Suvadiva atoll, and inside the atoll, when it was so abundant that it filled regular lanes in the water, and the tow brought in nothing else. **After that we found it in nearly every other atoll.**

Aurelia maldivensis bears little resemblance in appearance to any other Aurelia, and this is especially important in a genus where all the other species are extremely closely allied. **The most striking feature of this Medusa is, of course, the great development of the mouth parts, which, as I have noted, suggest in their structure the young of Cyanea; but the arrangement of the chymiferous tubes and the structure of the sense organs are also both distinctive.**

Nausithoe punctata KÖLLIKER.

Kölliker, 1853, *Zeit. für Wiss. Zoologie*, bd. IV.

Nausithoe punctata, var. *Pacifica*, Agassiz & Mayer, 1902, *Mem. Mus. Comp. Zoöl.*, vol. 26.

Plate 6, Fig. 21.

In the descriptions and figures of this genus, given by Kölliker, Agassiz and Mayer, Mayer, Haeckel, and Gegenbauer, there has been a great deal of confusion as to the relative radial positions of the marginal tentacles, gonads, and groups of gastric cirri. Kölliker, who established the genus, figures *Nausithoe punctata* with the gastric cirri and gonads in the tentacular radii (*Zeit. für Wiss. Zool.*, bd. 4, p. 323). Gegenbauer, who has given the best figures of this species, followed his example (*Arch. Anat. and Phys.*, 1853, p. 239). Haeckel (*System*, part 2, 1879) says that the gastric cirri are in the radii of the sense organs (gonads and tentacles adradial); while Mayer says of *Nausithoe punctata* that the gastric cirri lie in the radii of the marginal sense organs, but in his figures they are in the tentacular radii! (*Bull. Mus. Comp. Zoöl.*, vol. 37, no. 2.) Finally, Agassiz and Mayer (*Mem. M. C. Z.*, vol. 26, no. 3, 1902) figure *Nausithoe punctata* var. *pacifica* and *Nausithoe picta* with them in the tentacular radii.

In our specimens the arrangement was as follows. The four angles of the mouth, and the four groups of gastric cirri which alternate with them, are in the radii of the eight marginal sense organs. The eight gonads lie in the radii of the eight tentacles. There are thus sixteen distinct radii, eight tentacular, in which lie the eight gonads, and eight ocellar, corresponding to the four groups of gastric cirri, and the four arms of the cruciform mouth. This agrees with Haeckel's statement and Mayer's description.

The bell is flat, of the Ephyra-like outline typical of the genus, seven to nine mm. in diameter. There are eight stiff, solid tentacles arising from the clefts between the eight marginal lobes. Each marginal lobe is subdivided into two lappets, and between each two lappets there is a sense organ. Each sense organ contains a spherical otocyst and a proximal dark-brown ocellus, provided with two nerve fibres and a lens. The mouth is cruciform, and alternating with the arms of the cross there are four groups of gastric cirri, from two to five in each group. The eight gonads are pale reddish-brown. There is a ring of circular muscle fibres, occupying most of the subumbrella between the bases of the tentacles and the periphery of the stomach, and a strand of radial fibres runs from near the stomach out into each of the sixteen marginal lappets.

Seven specimens of different ages. December 26, Male atoll, near Male island, surface. January 2, Suvadiva atoll, near Dandu island, surface.

This form is very close to *Nausithoe punctata*, from which it differs only in the brighter color of the gonads, and the rarity of yellow pigment spots on the exumbrella, features of which the systematic importance is too slight to warrant the establishment of a new variety.

III. SIPHONOPHORAE.

Porpita lutkeana BRANDT.

Brandt, 1825, Mem. Acad. Imp. St. Petersbourg Sci. nat. ser. 6, tome IV.

Plate 7, Figs. 24, 25, 26.

It is with considerable hesitation that I refer our specimens of this genus to the *Porpita lutkeana* of Brandt, which seems, however, to fit them better than any other described species of *Porpita*. The Pacific and Indian forms of the genus have always been in confusion, owing to the fact that most of the early descriptions are altogether insufficient for identification. Haeckel (Siphonophorae of the "Challenger" Expedition) recognizes, besides the well-known Atlantic forms, *Porpita lutkeana* Brandt, to which he gives the synonym, *Porpita indica* (see *ibid.*); *Porpita pacifica* Lesson = *Porpita gigantea* Péron et Lesueur; *Porpita australis* Haeckel (System der Siphonophoren); and *Porpita fungia* Haeckel (Siphonophorae of the "Challenger" Exped.).

Porpita lutkeana agrees in general with our specimens, although Brandt's description is so meagre that an accurate determination is very difficult.

The disc, in the largest specimen, measured forty-five mm. in diameter and five mm. in thickness. The upper, external surface of the exumbrella bears a series of minute knobs and corrugations, making it rough to the touch. The central chamber and the eight primary radial chambers are large, and communicate with the exterior by prominent stigmata. Over the rest of the exumbrella the stigmata are very irregularly arranged. There are thirty-two circular partitions, at nearly equal distances, dividing the pneumatocyst into as many circular chambers, which are in communication with each other through openings in the circular partitions. The floor of the float cavity is thrown into a series of deep radial furrows and ridges, which interlock with the underlying ridges and furrows of the liver. These corrugations arise at the centre as eight folds, which by branching come to number about sixty. In addition to these and alternating with them, a series of shorter folds, arising at the periphery, runs centripetal for a short distance between the original centrifugal ridges, making the total number at the margin about one hundred and twenty.

The liver is of considerable thickness, completely filling the space between the bottom of the float cavity and the lower surface of the disk, where it communicates with the bases of the reproductive polypites.

There are about two hundred tentacles, arranged in about four or five concentric rows, instead of the nine rows described by Brandt. When fully extended they are about as long as the diameter of the disc. Each tentacle bears three distinct rows of knobs, in the manner typical of the genus. At the tip of the tentacle there is a cluster of four, and this number appears invariable. **In each row there are about ten knobs.**

The central sterile polypite is large, with smooth walls, and very distensible.

The remainder of the lower surface of the disc, between the central polypite and the tentacular zone, is completely covered by the long, slender feeding and reproductive polypites, bearing at their bases clusters of Medusae in all stages of development. These Medusae agree very well with the figures given by Alexander Agassiz for *Porpita linneana*. (Mem. Mus. Comp. Zoöl., vol. 8, no. 3.) Scattered among the reproductive polypites are a few of larger size, which seem to be sterile. Their heads are rounded and surrounded by four clusters of nettle cells. Our preserved specimens are unfortunately too imperfect to allow of histological investigation, so I have been unable to trace the number or position of the tracheae.

The characteristic external features of this species are: first, its intense Prussian blue color; second, the large size and extreme flatness of the disc; third, the shortness of the tentacles, and fourth, the great length of the feeding and reproductive polypites.

Diphyopsis appendiculata AGASSIZ and MAYER.

Diphyes appendiculata Eschscholtz, 1829, Syst. der Acalephs, p. 138, taf. 12, fig. 7.

Diphyes appendiculata Huxley, 1859, Oceanic Hydrozoa, p. 34, plate 1, figs. 2-2c.

Diphyopsis appendiculata Agassiz, A., and Mayer, A. G., 1899, Mem. Mus. Comp. Zoöl., vol. 26, no. 3, p. 160, plate 9.

A species of *Diphyopsis*, apparently identical with the *Diphyopsis appendiculata* of Agassiz and Mayer, was one of the most abundant Acalephs in the tow, and was taken at almost every station. The only distinction between it and the Pacific variety is that all our specimens were colorless, instead of having the polypites and nematocyst batteries yellowish or pinkish.

Physalia megalista PÉRON ET LESUEUR.

Physalia megalista Péron, F., et Lesueur, C. A., 1807, Voyage aux terres Australes, Mollusques et Zoophytes, plate 29, fig. 1.

Physalia megalista Haeckel, E., 1888, "Challenger" Report, Zoöl., vol. 28.

One specimen of *Physalia* belonging to this species was taken on January 19, off Tiladummati atoll. The pneumatocyst measured twenty-five mm. in length and was deep Prussian blue in color.

III. CTENOPHORAE.

Bolina ovalis, sp. nov.

Plate 8, Fig. 28.

This species appears closely allied to *Bolina microptera* A. Agassiz (N. Amer. Acalephs, 1865), and may prove to be identical with it. But the

absence of figures of *B. microptera* leaves me in doubt. The animal is about fifty mm. in length, and in the broad diameter nearly half as wide. In general outline it resembles *Bolina vitrea* rather than *Bolina septentrionalis* Mertens. The lobes are, however, at least one third shorter than in *Bolina vitrea*, and the digestive cavity is proportionately longer, one third longer than the lobes. The auricles are similar in shape to those of *Bolina vitrea*. The apical sense organ is situated at the bottom of a deep cleft, and is provided with a series of radiating muscle fibres. There are from fifteen to eighteen vibratile combs in each of the short, and thirty to thirty-five in each of the long ciliary bands. Unfortunately in our single specimen the lobes were so damaged that the course of the chymiferous tubes could not be traced with accuracy. Enough, however, remained to show that they were no more complicated than in *Bolina vitrea*. This is the only point in which it disagrees with A. Agassiz's description of *Bolina microptera*.

Bolina, sp. ?

On January 19, near Guradu Island, we took a single immature Ctenophore, which is probably a young *Bolina*. It is in the *Pleurobrachia* stage, figured by Chun (Mon. Ctenophoren), but the lateral lobes have already begun to appear, and the tentacles are short. The rows of vibratile combs extend nearly to the bases of the lobes. The mouth is a simple slit.

Ocyroe pteroessa, sp. nov.

Plate 8, Fig. 29.

The polar diameter of the animal is about twenty-five mm. The body is so much flattened that the narrow diameter is only one half the broad. The lateral lobes form large wing-like structures, one third longer than the polar diameter. The movements of the animal are effected by their vigorous flappings. The ciliated bands are short, containing but few combs. The auricles are short, being only one half as long as the polar diameter, and are always pointed upward. Their edges are lined with a series of stout cilia, set at considerable intervals. The digestive cavity is large, variable in form, but is not normally lobed. The windings of the chymiferous tubes are simple, much more so than in *Ocyroe crystallina*. The "spots" so characteristic of the lobes of *Ocyroe maculata* are wanting, but most of the substance of the lobes is occupied by stout muscle fibres which radiate to the periphery.

Ocyroe pteroessa is most closely allied to *Ocyroe crystallina* Rang, of which Fewkes and Mayer both give good figures (Bull. Mus. Comp. Zoöl., vol. 9, plate 1, and Bull. Mus. Comp. Zoöl., vol. 38, plate 31), but differs from it in several important particulars. The lobes are proportionately larger, the body narrower, the auricles very much shorter, about one half as long. The outline of the stomach is simple instead of lobed, and it is much shorter. The

windings of the chymiferous tubes are much less complex, and the muscle fibres occupy more nearly the whole substance of the lobes.

Beroë, sp.

One young specimen of this genus was taken on January 19, near Guradu island, on the surface. It had arrived at nearly mature form, except that the rows of vibratile combs extended only about halfway from the apical pole to the mouth. The chymiferous tubes were put into communication by an extremely simple network similar to that described by Agassiz and Mayer for *Beroë australis* (Bull. Mus. Comp. Zoöl., vol. 32, p. 177, plate 16). It may be the young of that species.

Cestus pectenalis, sp. nov.

Plate 8, Fig. 30.

A species of *Cestus* was exceedingly abundant on January 19, on the surface near Guradu island, and on examination proved to be a wholly distinct species. In general form, as well as in its movements, it closely resembles *Cestus veneris*, but differs from it in the possession of a large and prominent orange spot at either end, and in the extent and structure of the ciliary bands. These extend from near the apical sense organ along the aboral edge of the band, following the chymiferous tube to the extremity of the lobe. They do not extend along the oral edge of the lobe, but come to an end at its extremity. The vibratile combs are comparatively few in number, and set at considerable distances from one another. The cilia are very long and rigid, presenting a comb-like appearance. The lateral flattening of the animal is excessive. The digestive cavity is broad, but short. The longest specimen captured measured one metre, by forty mm. in breadth; but the size was very variable. No *Cestus* with pigment patches has ever been described, and the comb-like structure of the ciliary bands, and their restriction to the aboral edge of the animal, are of even greater importance. It seems probable that further investigation may prove them to be of generic significance. Like *Cestus veneris*, this species is extremely graceful in the water, moving in slow, ribbon-like undulations, and shining with brilliant violet iridescence.

EXPLANATION OF PLATES.

oc., otocyst; *m. s.*, marginal sense organ.

PLATE 1.

- Fig. 1. *Euphysa tetrabrachia*.
 Fig. 2. *Oceania brunescens*.
 Fig. 3. " *virens*.
 Fig. 4. " " bell margin.
 Fig. 5. *Eirene danduensis*, bell margin.

PLATE 2.

- Fig. 6. *Eirene danduensis*.
 Fig. 7. *Eutimeta lactea*.
 Fig. 8. " " bell margin.
 Fig. 9. *Aglaura octagona*.

PLATE 3.

- Fig. 10. *Timoides agassizii*.
 Fig. 11. " " bell margin.

PLATE 4.

- Fig. 12. *Gonionemus pelagicus*.
 Fig. 13. " " bell margin.
 Fig. 14. " " tip of tentacle.
 Fig. 15. *Liriopie hemisphericus*.
 Fig. 16. " " bell margin.

PLATE 5.

- Fig. 17. *Liriopie indica*.
 Fig. 18. " " bell margin.
 Fig. 19. *Pegantha simplex*.
 Fig. 20. " " oral view.

PLATE 6.

- Fig. 21. *Nausithoe punctata*.
Fig. 22. *Aurelia maldivensis*, radial canals, showing one octant of subumbrella.
Fig. 23. " " marginal sense organ.

PLATE 7.

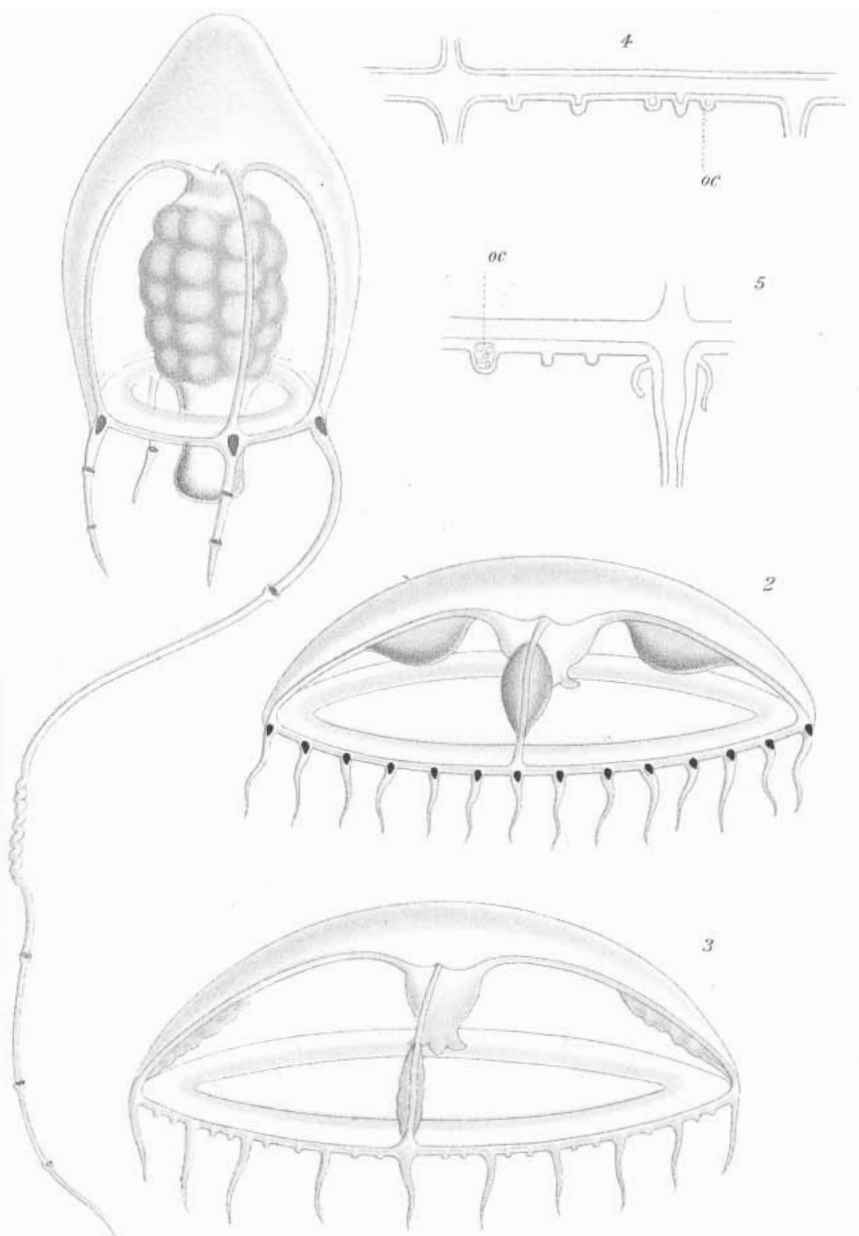
- Fig. 24. *Porpita lutkeana*.
Fig. 25. " " vertical section of disk; *s*, central stigmata; *cav.*, central chamber; *c.*, circular partition; *R.*, white tubules; *H.*, brown hepatic tubules.
Fig. 26. *Porpita lutkeana*, reproductive polypite with budding Medusae.

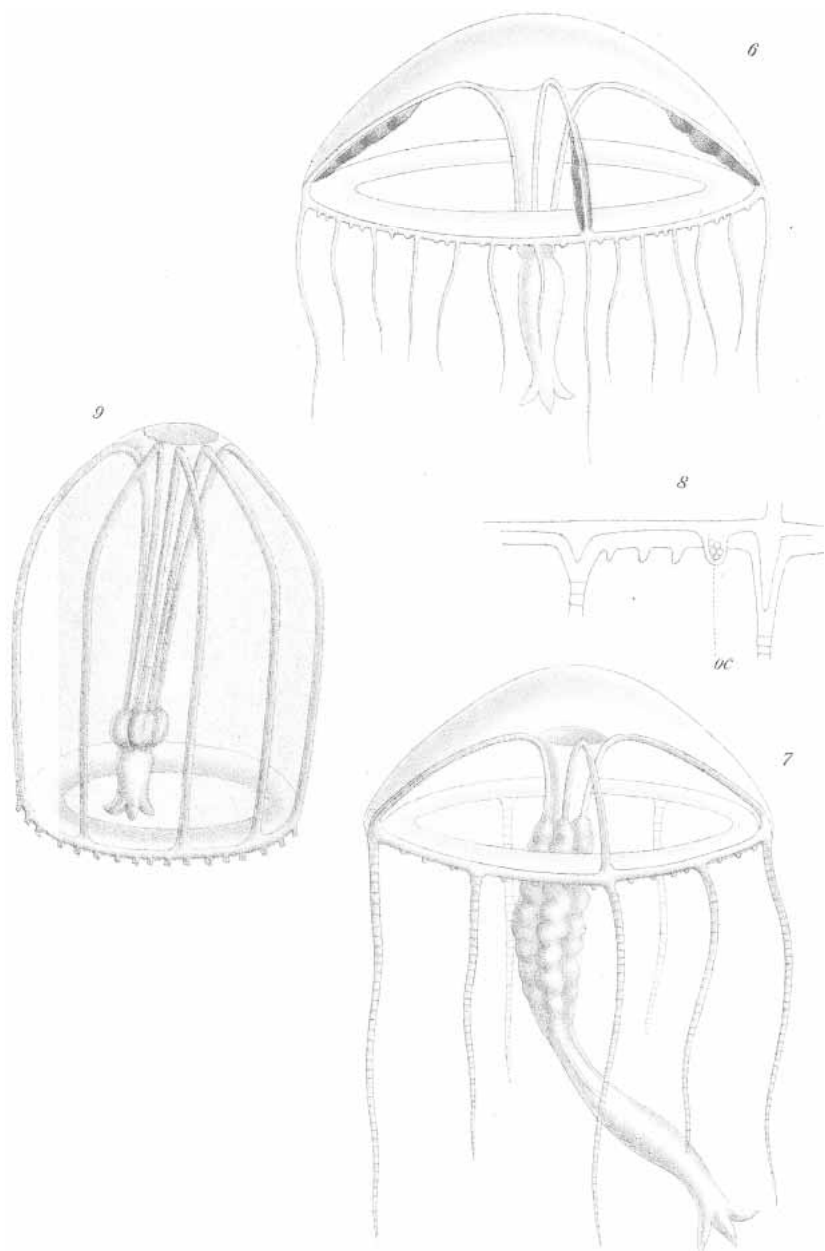
PLATE 8.

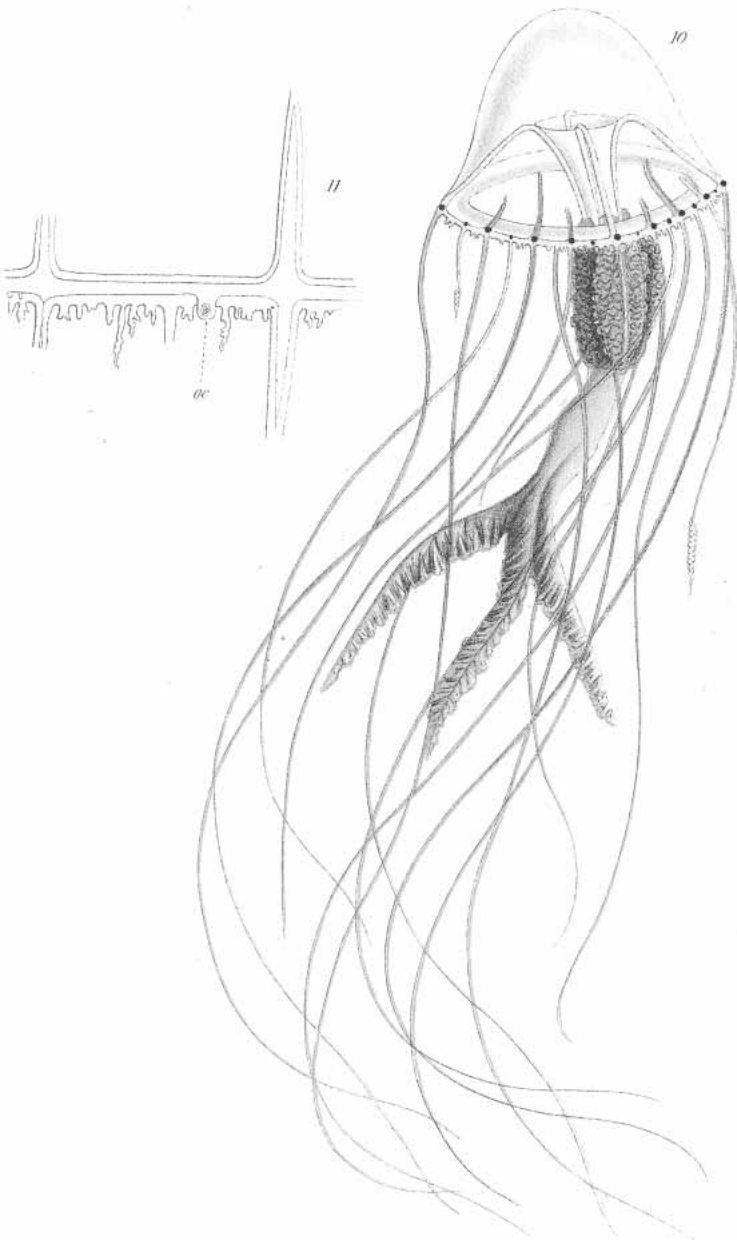
- Fig. 27. *Aurelia maldivensis*.
Fig. 28. *Bolina ovalis*.
Fig. 29. *Ocyroe pteroessa*.
Fig. 30. *Cestus pectenalis*.

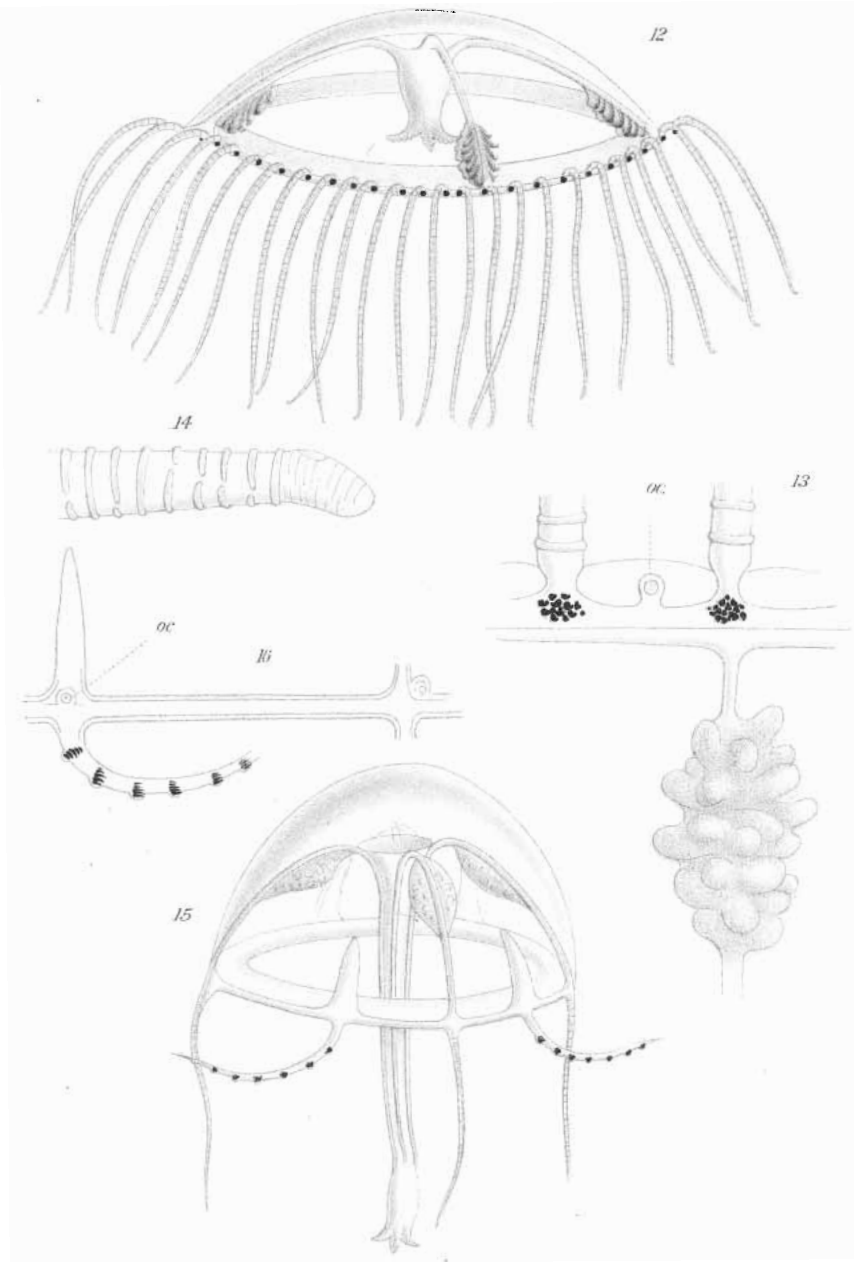
PLATE 9.

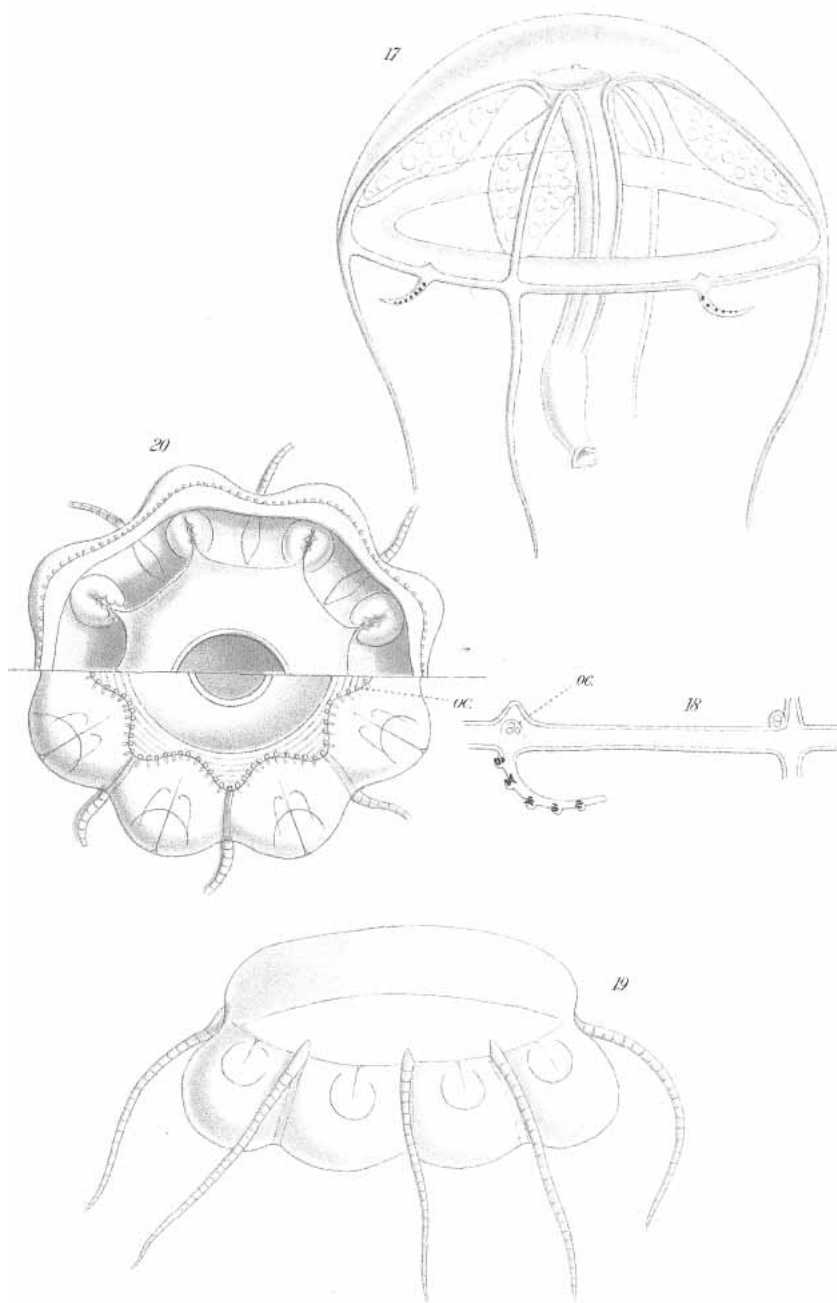
Chart of the Maldive Archipelago, showing the track of the "Amra."
Reduced from Admiralty Charts 66 *a*, 66 *b*, 66 *c*; Sheets 1-3; Scale, 3.5" = sixty miles corrected to May, 1903. Northern, Central, and Southern Maldives.

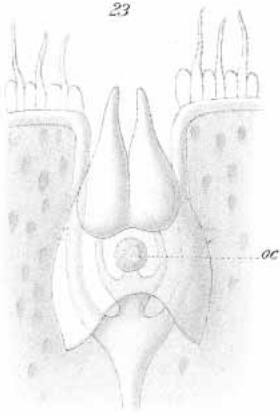
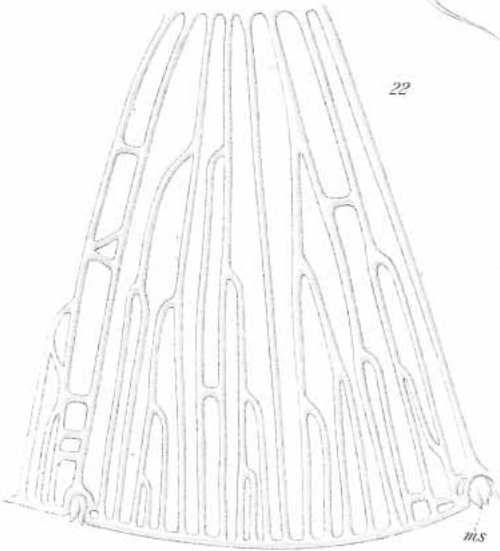
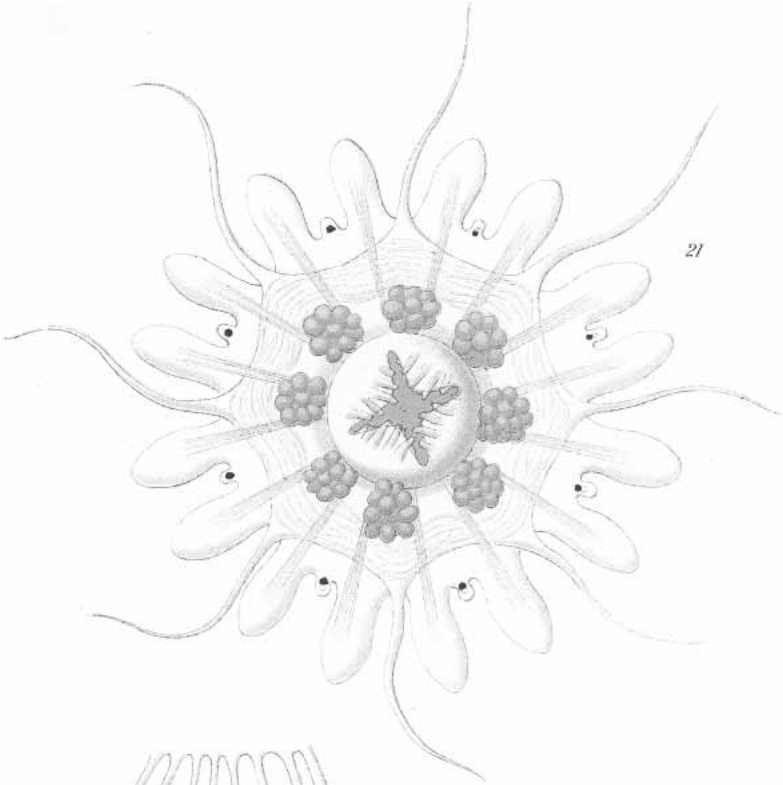


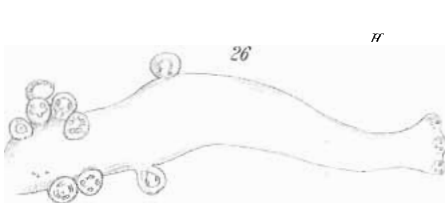
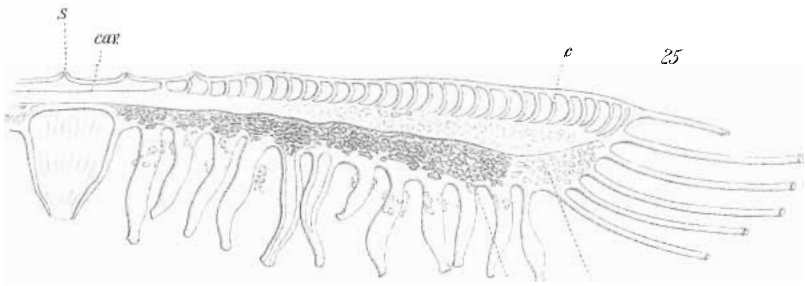
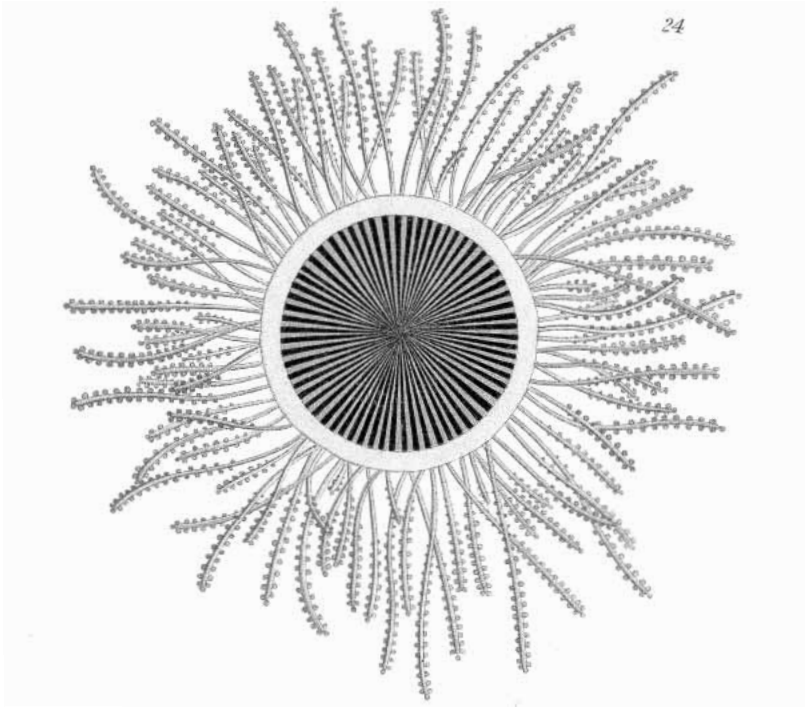




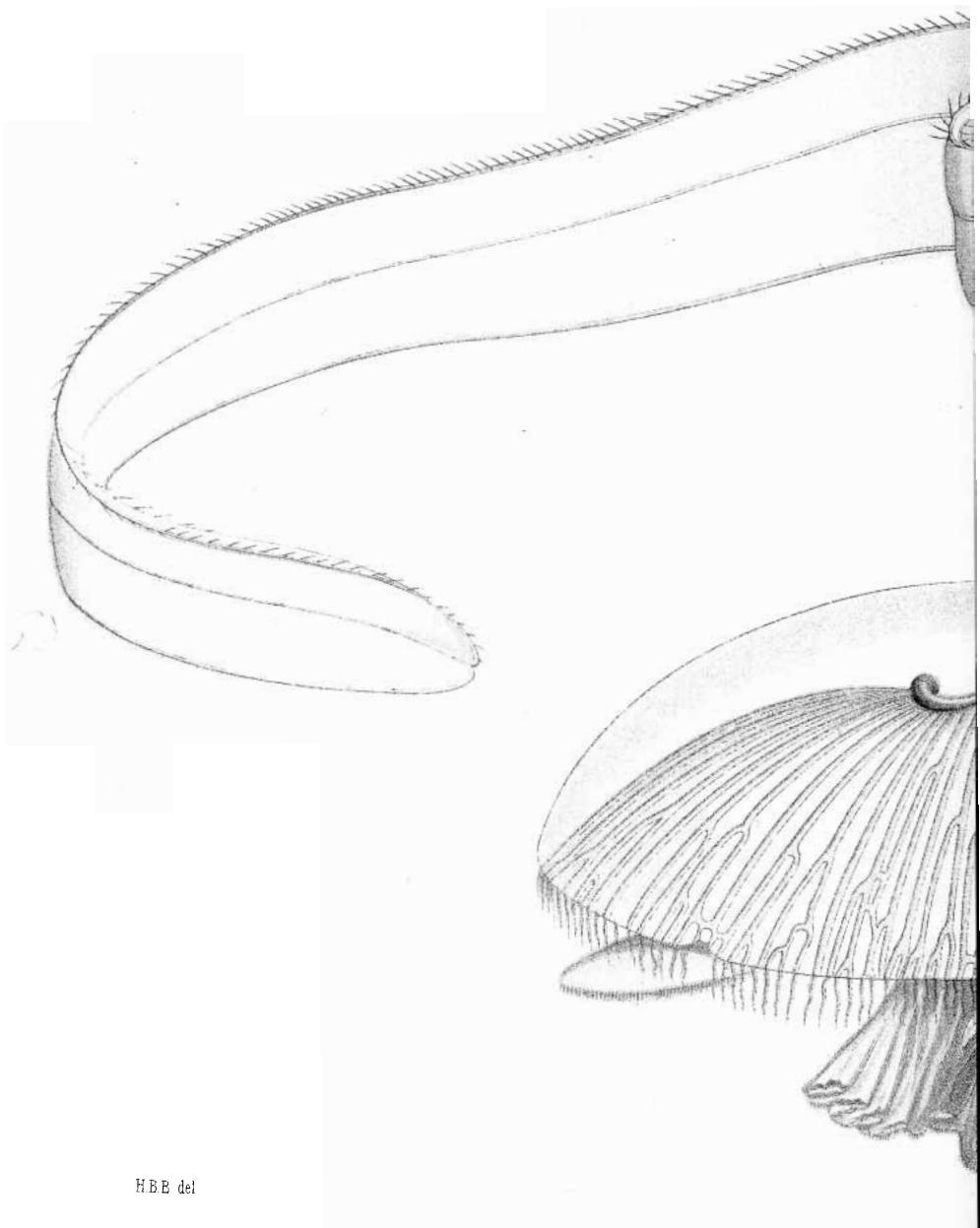




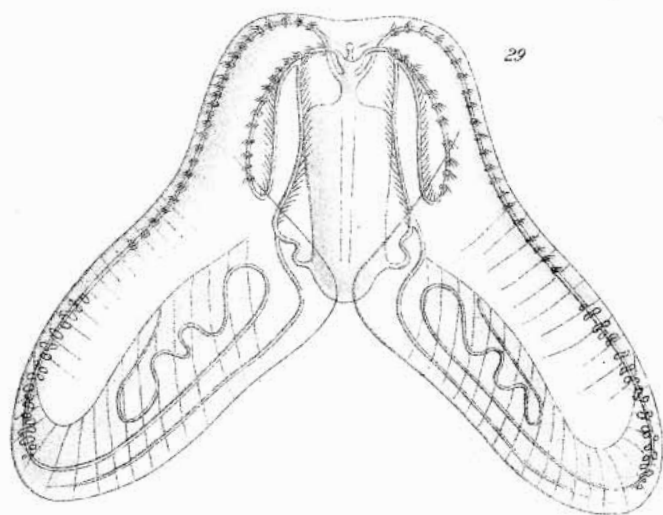
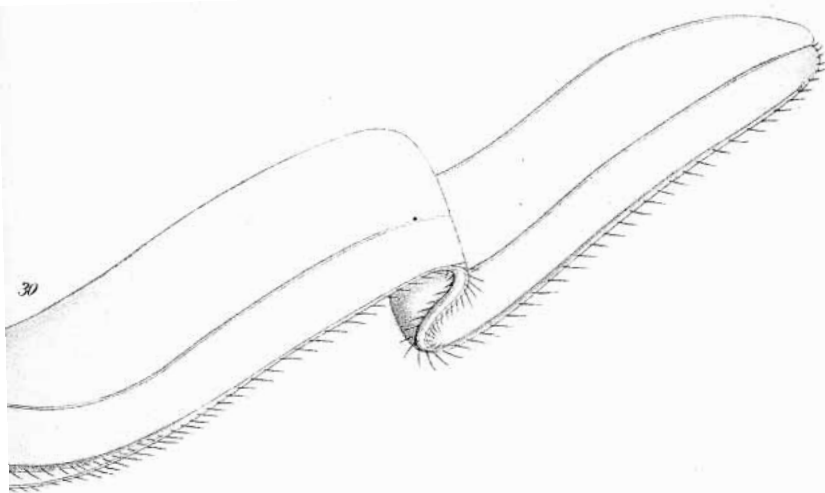




BIGELOW-MALDIVE MEDUSAE



H.B.E. del



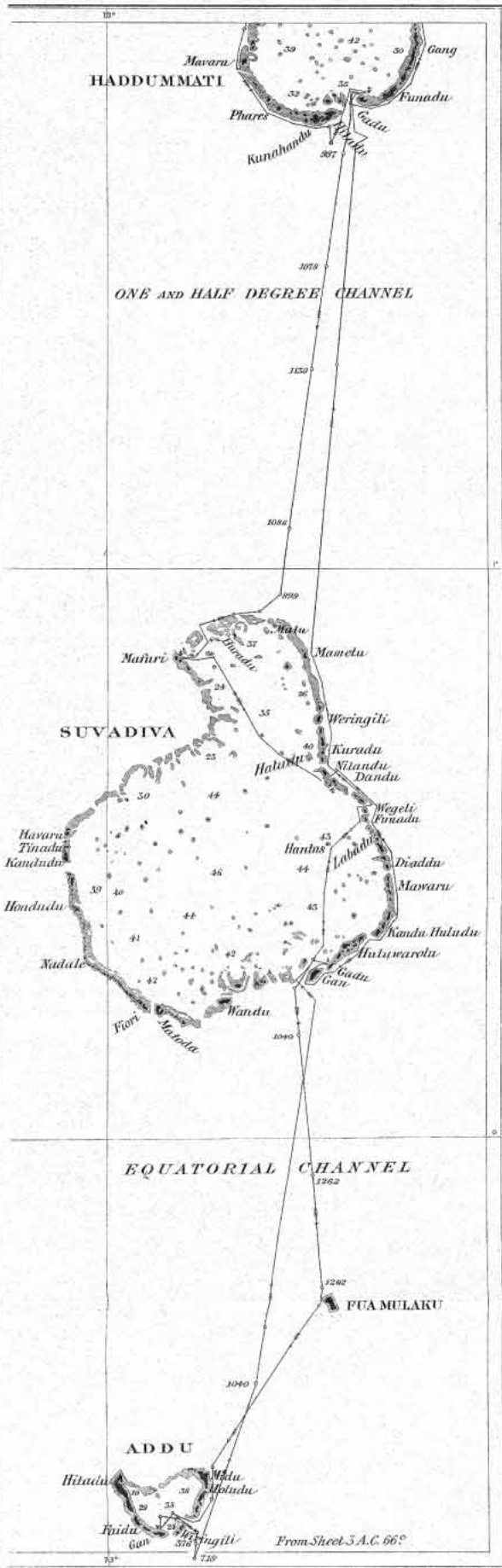
NORTHERN PART OF MALDIVES



From Sheet No. 1 Admiralty Chart 66°

From

SOUTHERN MALDIVES



From Sheet 5 A.C. 66°