THE CARLSBERG FOUNDATION'S
OCEANOGRAPHICAL EXPEDITION ROUND THE WORLD 1928—30
AND PREVIOUS "DANA"-EXPEDITIONS
UNDER THE LEADERSHIP OF THE LATE PROFESSOR JOHANNES SCHMIDT

DANA-REPORT No. 46.

THE HYDROMEDUSAE OF THE ATLANTIC OCEAN AND ADJACENT WATERS

BY

P. L. KRAMP
ZOOLOGICAL MUSEUM, COPENHAGEN

WITH 2 PLATES AND 335 FIGURES IN THE TEXT

PUBLISHED BY THE CARLSBERG FOUNDATION

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INTRODUCTION

The present paper is divided into three sections: *A*, Systematic account of the collected species, *B*, a survey of the hydromedusae occurring in the Atlantic Ocean and adjacent waters, *C*, Zoogeography.

Section *A* is an account of the species which have been collected during the expeditions in the Atlantic by the "Dana" and other vessels, from which collecting was carried out by request of the "Dana" Committee, in so far as they have not been published before. For each species are given: the most important references to previous literature, a list of the new localities with numbers of specimens collected, morphological and systematical remarks, and geographical distribution. The following new species are described: *Pennaria pauper*, *Gotoea similis* and *Toxorchis polynema*; moreover a new subspecies, *Sibogita geometrica* Maas, subsp. *occidentalis*.

The collections are deposited in the Zoological Museum, Copenhagen.

Section *B* is a survey of all the hydromedusae which up to now have been found in the Atlantic Ocean and adjacent waters, with diagnoses of the orders, families, genera and species, and with keys for identification. As far as possible the diagnosis of each species is accompanied by a figure derived from the available literature, many of them redrawn from the original figures by Mr. Poul H.Winther. Systematic discussions are occasionally added. Various doubtful species are mentioned in the text but omitted from the keys. Species from the Black Sea are included in this section. Further remarks are given in the introduction to the section.

In section *C* I have tried to describe the composition of the fauna of hydromedusae within each of the zoogeographical regions into which the Atlantic area may be divided, to connect the faunas with the hydrographical conditions, and to compare the faunas of the different regions with each other and with the faunas in other oceans. The Black Sea is omitted from this discussion because its fauna is insufficiently known. The species will be divided into four ecological groups: neritic species, slope species, epipelagic-oceanic species, and bathypelagic-oceanic species, and each of these groups will be treated separately to be followed by some concluding remarks. I have previously, from 1913 onwards, dealt with the faunas of medusae in several different areas, and the results are published in a number of papers to which I refer for details. I am quite aware that every zoogeographical discussion must be provisional, because several geographical areas are insuffiently investigated, and new information may lead to alterations of the views derived from our present knowledge. The extensive collections dealt with in the present paper, however, have provided us with great and important additions to our previous knowledge, so much so that I have dared to deliver a general account of the Atlantic fauna of hydromedusae from zoogeographical points of view, an account which I hope may direct the attention of other marine biologists towards these interesting and important problems.

P. L. Kramp,
Zoological Museum, Copenhagen.

A. SYSTEMATIC ACCOUNT OF THE COLLECTED SPECIES

Anthomedusae.

Fam. **Pennariidae.**

Pennaria pauper n. sp.

Pl. I fig. 1.

Material:

St. 4005. 12.III.1930. 13°31′ N. 18°03′ W. S 150, 1000 m wire. 1 specimen.

Description: Umbrella almost cylindrical, 7.2 mm. high, 3.7 mm. in diameter, with fairly thin lateral walls and a small conical apical projection. Velum narrow. Manubrium very large, almost completely filling the spacious subumbrellar cavity, gonad ring-shaped, covering the entire surface of the manubrium. A narrow apical canal issues from the stomach reaching to the top of the umbrella. Four radial canals and ring canal very narrow. No traces of marginal bulbs, and no ocelli.

This species is considerably larger than any other species of *Pennaria* described up to now, and it is further distinguished by the complete absence of marginal bulbs and by the possession of a well-developed apical canal.

The locality is near Cape Verde.

Fam. **Tubulariidae.**

Euphysora furcata Kramp.

Euphysora furcata Kramp 1948 b p. 19. Pl. figs. 7, 8.
Euphysora furcata Kramp 1955 p. 247.
Euphysora furcata Kramp 1957 p. 5. Pl. 1 fig. 2.

Material:[1]

St. 844 24.IV.20
25°49′ N. 51°55′ W.
P 150 100 m. w. **1**

St. 849 3.VI.20
19°00′ N. 63°53′ W.
300 m. w. **1**

St. 850 4.VI.20
20°39′ N. 61°48′ W. **1**

St. 1294 18.IV.22
17°43′ N. 64°56′ W.
S 200 100 m. w. **1**

St. 3975 31.I.30
35°42′ S. 18°37′ E.
S 150 2500 m. w. **1**

St. 3978 13.II.30
30°15′ S. 13°15′ E.
S 200 600 m. w. **2**

St. 3980 17.II.30
23°26′ S. 3°56′ E.
S 150 3000 m. w. **1**

St. 3998 1.III.30
7°34′ S. 8°48′ W.
S 200 100 m. w. **4**
S 150 2000 m. w. **4**
S 150 4000 m. w. **2**

St. 4000 4.III.30
0°31′ S. 11°02′ W.
E 300 1000 m. w. **1**
S 150 1000 m. w. **1**
S 150 2000 m. w. **24**
S 150 5000 m. w. **1**

St. 4003 9.III.30
8°26′ N. 15′11′ W.
S 150 4000 m. w. **1**

St. 4005 12.III.30
13°31′ N. 18°03′ W.
S 150 2500 m. w. **3**
S 150 3500 m. w. **1**

St. 4007 15.III.30
18°22′ N. 18°14′ W.
S 200 300 m. w. **1**

St. 4009 18.III.30
24°36.5′ N. 17°27′ W.
S 150 3000 m. w. **1**

For discriptions of nets (P 150, S 150, S 200 etc.) cf. Dana-Report no. 1 pag. 18. All gears have been towed horizontally. The depth where the nets have fished has been estimated at about 1/3 of the length of wire out (m.w.) when this did not exceed 1.000 metres and one half of the wire length in deeper hauls.

[1]) In this and following lists of material heavy figures denote numbers of specimens.

Distribution: This remarkable little medusa, which is characterized by the double bifurcation of its main tentacle, was first described from the northern Atlantic, south of the Newfoundland Bank, and recently recorded from two localities off the west coast of Africa, one near Tristan da Cunha, and one in the Indian Ocean off Somaliland. The "Dana" has taken it both in the West-Indian waters, and in several localities off the west coast of Africa from the Cape of Good Hope almost to the Canary Islands.

Some of the specimens were taken in the upper strata, but at most of the stations the medusa was taken in the deep hauls, whereas it was missing in the hauls made in the upper layers at the same stations. Though we must consider the possibility that specimens may have been captured during the hauling in of the open nets, this seems to indicate that the species really lives in the deep as well as in the upper strata and accordingly has a very considerable vertical distribution. See particularly St. 4000, where 24 specimens were taken with 2000 m. wire, one with 5000, two with 1000 m., and none in the surface-water hauls. On the other hand, almost all the localities are fairly near the coastal areas. Presumably, therefore, it has a fixed hydroid stage attached to objects on the bottom in fairly deep water, probably on the continental slopes. This is confirmed by measurements of the specimens; in the deep hauls specimens of all sizes were found, from 2 mm. upwards in height of the umbrella, whereas all the specimens from the upper strata are 4—6 mm. high.

Gotoea similis n. sp.

Pl. II fig. 1.

Material:

St. 3996. 25.II.30. 15°41′ S. 5°50′ W. S 150, 1500 m wire. 1 specimen.

Description: Umbrella 3.5 mm. high, 3 mm. wide, with flat top and almost perpendicular sides, gelatinous substance very thin; exumbrella with scattered nematocysts. Manubrium with a broad base, tapering downwards, somewhat longer than the bell cavity, mouth with an indication of four broad and very short lips, oral margin with nematocysts. Gonad with four large, pendent, interradial sacs hanging downwards from the upper part of the manubrium, of unequal size, the largest reaching as far down as to the level of the bell opening, the others decreasing in size in an anti-clockwise direction. Four radial canals and ring canal narrow. Four large marginal bulbs, one of them bearing a long, stiff tentacle, almost twice as long as the height of the umbrella. The tentacle is hollow and terminates in a large spherical knob of nematocysts. The marginal bulbs are large, somewhat elongated swollen pads, covered with nematocysts, prolonged downwards beyond the margin of the umbrella and upwards on the exumbrella; they are of unequal size, the smallest being the one bearing the tentacle; the bulb opposite the tentacular bulb is more than twice as large, the two others of intermediate size and both alike. No ocelli.

It is only provisionally that I describe this medusa as a new species. It is very similar to *Gotoea typica* which was described by Uchida (1927 p. 195, fig. 31) from two specimens taken at the Seto Marine Biological Station, Japan. It is of about the same size as the one described above, its marginal bulbs are much smaller, the tentacle short and thick, which may be due to contraction. Future studies may show that the two species are identical, but owing to the great geographical distance I think we had better keep them separate until more specimens have been found.

The specimen described above was taken near St. Helena.

Paragotoea bathybia Kramp.

Paragotoea bathybia Kramp 1942 p. 26, fig. 7.

Material:

St. 3975. 31.I.30. 35°42′ S. 18°37′ E. S 150, 2000 m. w. 1 specimen.

The specimen is 2 mm. high, 3 mm. wide, somewhat crumpled, but details of the structure are well preserved and agree in every respect with the original specimen, which was taken in deep water in Davis

Strait west of Greenland. I compared the type specimen with *Gotoea typica* Uchida and stated as follows: "the manubrium is somewhat damaged and irregularly crumpled; it is evidently completely surrounded by the gonad which forms some broad dilatations, but a regular arrangement of four interradial processes cannot be discerned". In the present specimen the manubrium is in a better state, and I can state with certainty that it has no traces of interradial, pendent sacs like those of *Gotoea*. As mentioned above the single tentacle of *Gotoea* is hollow; in *Paragotoea* it is solid, with the endoderm forming a single core of disk-shaped cells. Moreover the structure of the marginal bulbs is entirely different in the two genera. We may state, accordingly, that *Gotoea* and *Paragotoea* are two distinct genera.

In the present specimen the tentacle is slightly longer and somewhat more slender than in the type specimen, and the umbrella has a slightly elevated conical apex, which may be due to the state of contraction. The agreement between the two specimens is, however, so complete that in spite of the great geographical distance I refer them without any doubt to the same species. In both localities it was taken in deep water, and there is every reason to believe that the species is evenly distributed in the deep strata of the Atlantic Ocean, where this tiny medusa may easily have escaped attention.

Distribution: Originally described from deep water in Davis Strait west of the southern part of Greenland; the present specimen was taken near the Cape of Good Hope.

? **Steenstrupia** sp.

Pl. I fig. 2.

Material:

St. 4158. 18.VI.30. 46°28′ N. 8°01′ W. S 150, 2000 m. w. 1 specimen.

Description: Umbrella (without the apical projection) 1.5 mm. high, 0.9 mm. wide, with almost perpendicular sides, gelatinous substance thin. With a very long and slender, pointed apical projection as long as the height of the umbrella, containing a narrow central core of vacuolated endoderm cells from the stomach almost to the top of the gelatinous projection. Manubrium consisting of two parts separated by a slight constriction: a cylindrical stomach, somewhat shorter than the height of the subumbrellar cavity, and a "mouth tube" of about the same length as the stomach, tapering in thickness and terminating in a blunt point without any mouth opening. Some remnants of sexual tissue indicate that the stomach has been completely surrounded by a thick, ring-shaped gonad from its base to the annular constriction between the stomach proper and the "mouth tube".

There are four very narrow radial canals and four very small, quite rudimentary, perradial marginal bulbs without pigmentation. A narrow ring canal seems to be present. No velum. Some small groups of nematocysts are scattered over the exumbrella.

Since the remnants of gonads are mature this specimen cannot be a young stage, but owing to the complete absence of tentacles and mouth opening it must be designated as an abortive medusa. It bears some resemblance to the medusa from North Carolina figured by Mayer (1910 Pl. I fig. 7) under the name of "*Steenstrupia rubra*" which, however, is provided with a mouth opening and one very long tentacle. I provisionally refer the present specimen to *Steenstrupia*, leaving the final determination to future studies of more specimens.

Distribution: Deep water in the Bay of Biscay.

Fam. **Zancleidae.**

Zanclea costata Gegenbaur 1856.

Syn.: *Z. implexa* (Alder 1857), *gemmosa* McCrady 1857, *cladophora* (A. Agassiz 1865), ? *orientalis* Browne 1916.

Material:

St. 4003. 9.III.30. 8°26′ N. 15°11′ W. S 200, 50 m. w. 1 specimen.

A single specimen was taken off Sierra Leone on the west coast of Africa.

Distribution: Coastal waters of north-western Europe; Mediterranean; Red Sea; Nicobars, Malayan Archipelago; western tropical Pacific; Pacific coast of Mexico; West Indies; Florida; New England. Now for the first time taken off the west coast of Africa.

Fam. **Cytaeidae.**

Cytaeis tetrastyla Eschscholtz 1829.

Pl. I figs. 3—6.

Material:

"Ingolf"
St. 257 9.III.11
30°05′ N. 52°58′ W.
S 150 25 m. w. **7**
S 100 47 m. w. **3**

St. 258 11.III.11
32°54′ N. 46°44′ W.
S 150 25 m. w. **22**
S 100 47 m. w. **1**

St. 259 12.III.11
33°55′ N. 43°40′ W.
S 150 25 m. w. **3**

St. 260 13.III.11
34°39′ N. 40°54′ W.
S 150 25 m. w. **2**

St. 261 14.III.11
35°27′ N. 37°18′ W.
S 100 47 m. w. **2**

"St. Croix"
St. 272 22.II.11
30°30′ N. 49°57′ W.
S 150 116 m. w. **1**

St. 290 12.V.11
37°31′ N. 35°24′ W.
S 200 28 m. w. **2**
S 150 56 m. w. **1**

St. 293 18.VI.11
26°35′ N. 53°59′ W.
S 150 66 m. w. **10**

"Agent Petersen"
St. 299 13.VI.11
37°05′ N. 54°34′ W.
S 100 34 m. w. **4**

St. 303 16.VI.11
39°31′ N. 49°39′ W.
S 100 38 m. w. **1**

"St. Thomas"
St. 334 8.VII.11
38°10′ N. 40°50′ W.
S 200 16 m. w. **2**

"Ingolf"
St. 403 3.XI.11
27°10′ N. 21°53′ W.
S 200 surface **6**
S 150 56 m. w. **1**

St. 405 5.XI.11
24°42′ N. 24°50′ W.
S 200 surface **4**

"Dana"
St. 839 26.IV.20
24°31′ N. 46°46′ W.
P 150 surface **6**

St. 845 30.IV.20
24°46′ N. 54°08′ W.
P 150 50 m. w. **1**

St. 847 2.V.20
22°34′ N. 57°07′ W.
P 150 150 m. w. **1**

St. 848 2.VI.20
18°00′ N. 64°41′ W.
P 150 50 m. w. **1**

St. 849 3.VI.20
19°00′ N. 63°53′ W.
P 150 200 m. w. **2**

St. 850 4.VI.20
20°39′ N. 61°48′ W.
P 150 50 m. w. **8**
P 150 100 m. w. **30**

St. 855 9.VI.20
29°15′ N. 59°45′ W.
S 200 24 m. w. **1**

St. 882 13.VII.20
33°00′ N. 54°02′ W.
S 200 50 m. w. **1**
S 200 100 m. w. **1**

St. 894 31.VII.20
37°32′ N. 74°15′ W.
S 200 100 m. w. **1**

St. 1165 9.XI.21
12°11′ N. 35°49′ W.
E 300 1000 m. w. **1**

St. 1216 28.I.22
18°22′ N. 78°38′ W.
E 300 1000 m. w. **1**

St. 1320 27.IV.22
23°18′ N. 56°58′ W.
S 200 100 m. w. **1**

St. 3998 1.III.30
7°34′ S. 8°48′ W.
S 200 50 m. w. **1**

St. 4005 12.III.30
13°31′ N. 18°03′ W.
S 50 surface **2**
S 200 50 m. w. **2**
S 200 600 m. w. **2**
S 150 3500 m. w. **2**

St. 4007 15.III.30
18°22′ N. 18°14′ W.
S 200 50 m. w. **49**
S 200 100 m. w. **2**
S 200 300 m. w. **4**
S 200 600 m. w. **2**
S 150 1000 m. w. **1**
S 150 2000 m. w. **1**
S 150 2500 m. w. **1**
S 150 3000 m. w. **1**

St. 4009 18.III.30
24°36.5′ N. 17°27′ W.
S 50 surface **1**

St. 4195 22.VI.31
41°55′ N. 32°22′ W.
S 200 100 m. w. **1**

St. 257—334 and 839—882 are between the Azores and the West-Indian Islands, St. 894 near Cape Hatteras on the east coast of North America, St. 1216 and 1320 in the West-Indian waters, St. 4195 N.W. of the Azores; the others are off the west coast of Africa.

On a previous occasion (Kramp 1953 p. 263) I have maintained the view that the original specimens of *Cytaeis vulgaris* from the Fiji Islands (Agassiz & Mayer 1899) may provisionally be retained as a distinct species, whereas all other specimens from the Pacific previously referred to that species probably belong to *C. tetrastyla*.

Asexual propagation.

In my recent paper in the Discovery Reports (KRAMP 1957 p. 12) I have described the peculiar asexual propagation in *Bougainvillia platygaster*, in which polypoid hydranths may be produced by budding from the corners of the stomach of the medusa (see also below, p. 11). Asexual production of polypoid structures from the tissues of a medusa was previously known in only two other species, the Leptomedusa *Phialidium mccradyi* (BROOKS) and the Limnomedusa *Proboscidactyla ornata* (MCCRADY). In the "Dana" collection of *Cytaeis tetrastyla* I have found a fourth instance of this peculiar form of asexual propagation which, accordingly, is not so unique among the hydromedusae as formerly supposed.

Some of the specimens of *Cytaeis tetrastyla* from "Dana" Stat. 1216, 4005, 4007 and 4009 have medusa buds developing on the stomach wall in the usual and well-known way. But in some of these specimens a number of small polyps were also observed, likewise situated on the stomach wall between the medusa buds. They were found in specimens from St. 4005 (surface and with 50 m. wire out) and St. 4007 (50 and 600 m. wire). When I made this surprising discovery I examined the whole extensive collection of *Cytaeis* in our museum looking for other specimens with polypoid buds which might have been overlooked, but I only found them in a few specimens from the "Atlantide" expedition, St. 33, 17°11′ N. 24°52′ W., north of the Cape Verde Islands, 7.XII.1945.

When polypoid buds are present in *Cytaeis tetrastyla* they are always situated on the proximal portion of the stomach wall, usually surrounded by numerous medusa buds as seen in Pl. I fig. 3. The polyps are somewhat larger than the medusa buds, cylindrical, with a broad proboscis and with a whorl of 5—7 short tentacles. They resemble the hydranths of *Cytaeis "japonica"* as described and figured by KOMAI (1931 pp. 255—258) who was the first to discover the hydroid stage of *Cytaeis*. It formed creeping colonies on the shells of living gastropods, *Nassarius livescens*, near Misaki in Japan. The hydranths were more elongated and had some more tentacles, up to 10, than seen in the polypoid buds observed by me in the medusae from West Africa. None of these polypoid buds are, however, fully developed, the tentacles are fairly short, and the mouth opening has not yet broken through; Pl. I fig. 4 shows a longitudinal section of a specimen in which the mouth is on the point of penetrating the terminal end of the proboscis. Pl. I fig. 5 shows a transverse section of a hydranth; it will be observed that the uniserial core of endoderm cells in the tentacles is separated from the endoderm of the gastral cavity by a distinct lamella of mesosarc as in other hydroid polyps of Anthomedusae.

The longitudinal section (Pl. I fig. 6) clearly shows that the polyps are developed as direct outgrowths from the stomach wall, their cellular tissues as well as their supporting lamella being confluent with the corresponding tissues of the medusa. Accordingly they are neither parasites nor actinulae, but asexual, polypoid offspring of the medusa produced by budding from the external wall of the stomach.

Thus a medusa of *Cytaeis tetrastyla* is able to produce polypoid as well as medusoid offspring by asexual propagation. Owing to the ability to produce medusa buds, the occurrence of this species is not limited to the coastal waters, but the fate of the polypoid buds during their further development remains a riddle.

Distribution: Widely distributed in the warm parts of all the oceans, including the Mediterranean. The corresponding hydroid, which has been described from Japan (KOMAI 1931 p. 255, as *C. japonica*) probably lives in shallow water, but the ability of the medusa to propagate asexually by budding enables it to obtain an oceanic distribution. It belongs to the surface water, and specimens taken in the deep hauls may have been captured during the hauling in of the nets (see above, St. 4007).

Fam. **Clavidae.**

Oceania armata KÖLLIKER.

Oceania armata KÖLLIKER 1853 p. 323.
Turritopsis armata HAECKEL 1879 p. 65.
Callitiara polyophthalma HAECKEL 1879 p. 67, Pl. 3 fig. 1—5.
Oceania armata MAYER 1910 p. 147, fig. 81.

Material:

St. 1192	15.XII.21	St. 4009	18.III.30	St. 4017	27.III.30
17°43.4′ N.	64°54.3′ W.	24°36.5′ N.	17°27′ W.	29°11′ N.	14°14′ W.
S 200	300 m. w. **2**	S 150	2500 m. w. **1**	S 200	50 m. w. **1**
S 200	600 m. w. **1**			S 200	100 m. w. **1**
				S 200	300 m. w. **5**

Distribution: Common in the Mediterranean and adjacent parts of the Atlantic: Portugal, the Canary Islands, and S.W. of the Azores. Also recorded from southern Japan (Uchida 1927 p. 219). The present specimens were taken south and north of the Canary Islands. The species belongs to the upper strata, and the specimen taken in a deep haul at St. 4009 has probably been captured during the hauling in of the net.

Turritopsis nutricula McCrady.

Oceania (*Turritopsis*) *nutricula* McCrady 1856 pp. 1—36, Pl. 4 fig. 1—10.
Oceania polycirrha Keferstein 1862 p. 26, Pl. 2 fig. 11—13.
Turritopsis nutricula var. *pacifica* Maas 1909 p. 14, Pl. 1 fig. 6—8, Pl. 2 fig. 9.
Turritopsis nutricula Mayer 1910 p. 143, Pl. 14 fig. 10—13, Pl. 15 fig. 10—13; text-fig. 77—79.
Turritopsis pacifica Mayer 1910 p. 722.
Turritopsis nutricula Russell 1953 p. 115. Pl. 5 fig. 1—5, Pl. 29 fig. 1—3; text-fig. 54 A—C, 55, 56.
Turritopsis nutricula Kramp 1955 p. 248.

Material:

St. 4003	9.III.30	St. 4005	12.III.30	St. 1360	4.VI.22
8°26′ N.	15°11′ W.	13°31′ N.	18°03′ W.	26°56′ N.	53°09′ W.
S 200	50 m. w. **2**	S 200	600 m. w. **1**	E 300	1000 m. w.
S 200	300 m. w. **1**	S 150	2500 m. w. **1**	1 specimen, determination uncertain.	
S 150	1000 m. w. **1**				
S 150	2000 m. w. **1**				

We may now state with certainty that all species of *Turritopsis* described belong to one species, except *T. lata* v. Lendenfeld which is a distinct species; I have seen the type specimen from Australia.

Distribution: East coast of North America from northern parts of New England to the West Indies; southern parts of the North Sea and the British coasts; tropical west coast of Africa; Mediterranean; Red Sea; Indian Ocean; western Pacific from Japan to New Zealand. It belongs to the upper strata.

Fam. **Bougainvilliidae.**

Bougainvillia platygaster (Haeckel).

Hippocrene platygaster Haeckel 1879 p. 91.
Bougainvillia platygaster Mayer 1910 p. 165.
Bougainvillia niobe Vanhöffen 1912 *a* p. 359.
Bougainvillia platygaster Thiel 1938 p. 299.
Bougainvillia niobe Kramp 1948 *a* p. 4.
Bougainvillia platygaster Kramp 1957 p. 9, Pl. 3 fig. 1—6.

Material:

"Ingolf" St. 252	4.III.11	St. 254	6.III.11	St. 255	7.III.11	St. 256	8.III.11
23°53′ N.	61°36′ W.	26°45′ N.	59°35′ W.	27°42′ N.	58°00′ W.	28°55′ N.	55°25′ W.
S 150	25 m. w. **14**	S 150	25 m. w. **6**	S 100	47 m. w. **4**	S 150	25 m. w. **27**
S 100	47 m. w. **3**	S 100	47 m. w. **5**			S 100	47 m. w. **7**

St. 257 9.III.11
30°05′ N. 52°58′ W.
S 150 25 m. w. **1**

St. 260 13.III.11
34°39′ N. 40°54′ W.
S 100 47 m. w. **1**

"St. Croix"
St. 272 22.II.11
30°30′ N. 49°57′ W.
S 150 116 m. w. **1**

St. 292 17.V.11
25°00′ N. 55°59′ W.
S 200 47 m. w. **17**
S 150 66 m. w. **1**

"St. Jan"
St. 329 20.VII.11
25°32′ N. 52°08′ W.
S 200 35 m. w. **1**

"St. Thomas"
St. 334 8.VII.11
38°10′ N. 40°50′ W.
S 200 16 m. w. **1**

St. 336 9.VIII.11
22°40′ N. 60°00′ W.
S 200 16 m. w. **1**

"St. Croix"
St. 346 11.IX.11
38°22′ N. 35°50′ W.
S 150 48 m. w. **1**

"St. Thomas"
St. 390 5.XI.11
26°09′ N. 55°15′ W.
S 200 28 m. w. **2**

"Ingolf"
St. 405 5.XI.11
24°42′ N. 24°50′ W.
S 200 surface **1**

"Dana"
St. 839 6.IV.20
24°31′ N. 46°46′ W.
P 150 surface **4**
P 150 50 m. w. **4**
P 150 100 m. w. **2**

St. 840 27.IV.20
25°16′ N. 48°05′ W.
P 150 surface **4**
P 150 100 m. w. **8**

St. 841 27.IV.20
25°42′ N. 48°59′ W.
P 150 50 m. w. **1**
P 150 100 m. w. **11**

St. 842 28.IV.20
25°48′ N. 49°22′ W.
P 150 100 m. w. **4**
P 150 200 m. w. **2**
P 150 300 m. w. **3**

St. 844 29.IV.20
25°49′ N. 51°55′ W.
P 150 150 m. w. **1**

St. 845 30.IV.20
24°46′ N. 54°08′ W.
P 100 surface **1**
P 150 50 m. w. **7**
P 150 100 m. w. **4**
P 150 150 m. w. **7**
P 150 200 m. w. **1**
P 150 300 m. w. **1**

St. 846 1.V.20
23°40′ N. 55°22′ W.
P 150 150 m. w. **3**

St. 847 2.V.20
22°34′ N. 57°07′ W.
P 150 100 m. w. **1**
P 150 150 m. w. **2**

St. 848 2.VI.20
18°00′ N. 64°41′ W.
S 200 300 m. w. **1**

St. 849 3.VI.20
19°00′ N. 63°53′ W.
P 150 surface **1**
P 150 100 m. w. **2**

St. 850 4.VI.20
20°39′ N. 61°48′ W.
P 150 50 m. w. **35**
P 150 100 m. w. **3**
S 200 150 m. w. **4**
S 200 300 m. w. **1**

St. 851 5.VI.20
22°23′ N. 60°46′ W.
P 150 50 m. w. **11**

St. 853 7.VI.20
25°52′ N. 59°25′ W.
P 150 100 m. w. **2**

St. 854 8.VI.20
27°53′ N. 59°23′ W.
S 200 150 m. w. **7**

St. 855 9.VI.20
29°15′ N. 59°45′ W.
S 200 24 m. w. **10**
P 150 300 m. w. **1**
S 200 300 m. w. **1**

St. 866 23.VI.20
28°32′ N. 56°38′ W.
S 200 50 m. w. **12**
S 200 100 m. w. **1**
P 150 150 m. w. **1**

St. 867 24.VI.20
28°15′ N. 56°29′ W.
P 150 100 m. w. **1**

St. 868 24.VI.20
27°10′ N. 55°52′ W.
S 150 125 m. w. **2**

St. 869 25.VI.20
27°54′ N. 55°50′ W.
P 150 200 m. w. **2**

St. 870 26.VI.20
27°29′ N. 59°20′ W.
S 150 50 m. w. **4**
S 150 100 m. w. **7**
S 200 100 m. w. **1**

St. 875 1.VII.20
28°58′ N. 67°09′ W.
S 150 100 m. w. **6**
S 150 150 m. w. **2**

St. 883 14.VII.20
30°53′ N. 54°07′ W.
S 200 50 m. w. **2**

St. 884 15.VII.20
28°49′ N. 54°10′ W.
S 200 100 m. w. **9**

St. 885 16.VII.20
26°46′ N. 54°14′ W.
S 200 3 m. w. **1**
S 200 50 m. w. **18**

St. 886 17.VII.20
24°40′ N. 54°19′ W.
P 150 25 m. w. **4**
S 150 50 m. w. **20**
P 150 150 m. w. **2**

St. 891 24.VII.20
29°28′ N. 69°25′ W.
S 150 50 m. w. **5**
S 200 100 m. w. **6**

St. 892 25.VII.20
30°49′ N. 73°30′ W.
S 150 100 m. w. **3**

St. 1223 1.II.22
22°06′ N. 84°58′ W.
E 300 1000 m. w. **2**

St. 1238 11.II.22
26°13′ N. 78°48′ W.
E 300 800 m. w. **3**

St. 1240 13.II.22
25°35′ N. 74°45′ W.
E 300 1000 m. w. **1**

St. 1242 14.II.22
24°05′ N. 74°36′ W.
E 300 1000 m. w. **1**
E 300 4000 m. w. **1**

St. 1243 16.II.22
21°04′ N. 73°48′ W.
E 300 1000 m. w. **2**

St. 1245 17.II.22
19°35′ N. 73°27′ W.
E 300 1000 m. w. **1**

St. 1250 26.II.22
17°54′ N. 67°30′ W.
E 300 1000 m. w. **1**

St. 1261 9.III.22
19°04′ N. 65°43′ W.
E 300 4500 m. w. **1**

St. 1266 13.III.22
17°45′ N. 64°55,5′ W.
E 300 1000 m. w. **1**

St. 1273 25.III.22
17°43′ N. 64°56′ W.
E 300 1000 m. w. **1**

St. 1294 18.IV.22
17°43′ N. 64°56′ W.
S 200 300 m. w. **1**
S 200 600 m. w. **2**

St. 1334 7.V.22
27°28′ N. 59°29′ W.
E 300 1000 m. w. **1**

The affinities of this medusa have recently been discussed by me in a paper on the Hydromedusae of the "Discovery" expeditions (Kramp 1957) in which I compared *B. platygaster* with *B. carolinensis* (McCrady), *B. niobe* Mayer and *B. fulva* Agassiz & Mayer. I came to the conclusion that they are four distinct species, and this is confirmed by the examination of the present collections.

In the same paper I described the very peculiar asexual propagation of *B. platygaster*. In several specimens I found that medusa buds are developed on the pedicels of typical hydranths produced by asexual budding from the corners of the stomach of the parent medusa; these hydranths are provided with a mouth opening surrounded by tentacles, and they are even able to catch food like the hydranths of an ordinary, fixed hydroid colony. Numerous budding specimens are observed in the present collection; moreover larvae of Narcomedusae are found in specimens from St. 256, 845, 846, 849, 850, 885, 886, 1223, and 1294; they will be described further below.

Most of the specimens in the present collection are 7—9 mm. in diameter, but some few smaller individuals, 4—5 mm. wide, were found at St. 1243 (1000 m. wire), St. 1261 (4500 m. wire) and St. 1294 (300 and 600 m. wire). The collections were made between 1st February and 7th May, but the medusa may also be taken at other seasons, e. g. in October (by the "Discovery").

All previous records of *B. platygaster* are from the upper strata; it is peculiar, therefore, that some of the specimens in the "Dana" collection were taken in hauls with 1000 m. wire out, or more. They may either have been captured at higher levels during the hauling in of the nets, or they may really occur in deeper water layers.

Distribution: (see the map, fig. 327): Previously recorded from the Canary Islands and at considerable distances west and north-west of the Cape Verde Islands; off the east coast of Brazil; off the east coast of Africa between Port Elisabeth and Zanzibar. Now taken in several localities in West-Indian waters.

Bougainvillia niobe Mayer.

Bougainvillia niobe Mayer 1894 p. 236, Pl. 1 fig. 2.
Bougainvillia niobe Mayer 1910 p. 166, Pl. 18 fig. 1—3; text-fig. 90.
Bougainvillia niobe Bigelow 1918 p. 368.
Bougainvillia niobe Bigelow 1938 p. 104.
Bougainvillia niobe Moore 1949 p. 6.

Material:

St. 1188 7.XII.21
17°43.7′ N. 64°57′ W.
S 200 300 m. w. **3**

St. 1190 12.XII.21
17°58.5′ N. 64°45′ W.
S 200 50 m. w. **1**
S 200 100 m. w. **3**

St. 1192 15.XII.21
17°43.4′ N. 64°54.3′ W.
S 200 50 m. w. **9**
S 200 100 m. w. **5**
S 200 300 m. w. **140**
S 200 600 m. w. **3**

St. 1241 13.II.22
25°18′ N. 74°00′ W.
S 150 50 m. w. **1**

St. 1243 16.II.22
21°04′ N. 73°48′ W.
S 200 50 m. w. **4**

St. 1272 23.II.22
17°43′ N. 64°56′ W.
S 200 100 m. w. **2**

St. 1294 18.IV.22
17°43′ N. 64°56′ W.
S 200 100 m. w. **150**

St. 1321 28.IV.22
24°13′ N. 54°36′ W.
S 200 500 m. w. **1**

St. 1352 21.V.22
35°42′ N. 73°43′ W.
S 200 200 m. w. **1**

St. 1360 4.VI.22
26°56′ N. 53°09′ W.
S 200 100 m. w. **2**
E 300 1000 m. w. **1**

St. 1361 4.VI.22
27°07′ N. 51°10′ W.
E 300 1000 m. w. **1**

In this species medusa buds are developed directly on the lateral sides of the stomach of the medusa, not in clusters as in *B. platygaster*. Sexually mature specimens of *B. niobe* have eight adradial gonads, whereas in *B. platygaster* the gonads are interradial. Moreover the oral tentacles of *B. niobe* have a fairly long unbranched basal trunk before the first bifurcation, in contradistinction to *B. platygaster* where they bifurcate immediately at their points of issue from the mouth tube. The extensive material of both species in the present collection has enabled me to state with certainty that the two species are distinct. In *B. carolinensis*, which is a small medusa, well described by MAYER (1910 p. 165, Pl. 16 fig. 7—9, Pl. 17 fig. 7) the gonads are interradial as in *B. platygaster*, but the manubrium is long and narrow, and the oral tentacles have a long, undivided trunk as in *B. niobe*. *B. carolinensis* partly occurs in the same area as *B. niobe*. *B. fulva*, which occurs in the Indian and Pacific Oceans, is very similar to *B. platygaster* in size and general appearance, but its gonads are distinctly adradial, widely separated in the interradii.

The specimens of *B. niobe* collected by the "Dana" are 2—7 mm. in diameter. Medusa buds are present in specimens from St. 1188 (300 m. w.), 1192 (50, 100 and 300 m. w.), 1243 (50 m. w.), 1272 (100 m. w.), 1352 (200 m. w.), and 1361 (1000 m. w., probably captured during the hauling in of the net). Two of the specimens from St. 1192 (600 m. w.) have gonads with large, ripe eggs. Some of the other specimens may also have had mature gonads, but owing to the state of preservation this cannot be stated with certainty.

Distribution (see the map, fig. 326). Previously recorded from Chesapeake Bay, Bermuda, Bahamas, and Florida. The "Dana" found this species among the Bahamas, near the Virgin Islands (in great abundance), and far at sea S.E. of Bermuda (St. 1360 and 1361); St. 1352 is outside Chesapeake Bay.

Fam. **Pandeidae.**

Paratiara digitalis KRAMP & DAMAS.

Paratiara digitalis KRAMP & DAMAS 1925 p. 273, fig. 18—20.
Paratiara digitalis KRAMP 1926 p. 66.

Material:

St. 851. 5.VI.20. 22°23′ N. 60°46′ W. P 150, 50 m. w. 1 specimen.
St. 891. 24.VII.20. 29°28′ N. 69°26′ W. S 150, 50 m. w. 1 specimen.

These localities, north-east of the Bahamas and the West-Indian Islands, are far away from the waters where this species has previously been observed. A direct comparison with specimens from Norway and Iceland show, however, that the present specimens agree with the others in every regard, except that the manubrium is not so distinctly twisted. The specimen from St. 851 is 4.5 mm. high and 4 mm. wide, with large, mature eggs; the specimen from St. 891 is 6 mm. high and 4 mm. in diameter.

Distribution: Northern Norway; east of the Shetland Islands; south of Iceland. Now found to occur in warm water in the western Atlantic.

Cnidotiara gotoi UCHIDA.

Pl. I fig. 7—8.

Cnidotiara gotoi UCHIDA 1927 p. 204, fig. 33.

Material:

St. 303. 16.VI.11. 39°31′ N. 49°39′ W. S 100, 38 m. w. 4 specimens.

It was a great surprise to find this Japanese species in the Atlantic Ocean. The diameters of the specimens are 3, 4, 5 and 7 mm, the two largest specimens are considerably crumpled, especially the apical gelatinous projection is much shrunk. The two smaller specimens are in good condition, twice as high as wide, with a pointed-conical apical projection which makes up about two-fifths of the total height of the umbrella. The lateral walls of the umbrella are fairly thin. The stomach has a broad, quadratic or slightly cruciform base

and is attached to the subumbrella by a slight indication of a peduncle; mesenteries are entirely absent. The stomach is barrel-shaped, the mouth tube slightly constricted, prismatic, the mouth-rim slightly thickened and everted, entire and simple, without indications of lips. In the largest specimen the manubrium extends to the level of the velum, in the others it is one-half to two-thirds the length of the bell cavity. The eight adradial gonads have a smooth surface without folds or pits, but in female gonads the large eggs may be somewhat protruding; the gonads are distinctly separated perradially as well as interradially. Radial canals and ring canal narrow and straight, except in the two crumpled specimens, where the radial canals are sinuated. There are four perradial tentacles which in the best preserved specimens are about half as long as the height of the umbrella, evenly tapering from their base outwards. In one of the large specimens some of the tentacles are broken and have attained an appearance very similar to that in UCHIDA's figure. The tentacle bulbs are fairly narrow, each with an abaxial spur partly grasping over the umbrella margin and with an abaxial ocellus, and each with a large, spherical, adaxial knob of nematocysts, which is the most characteristic feature of this species. There are no indications of any more tentacles developing on the umbrella margin. Velum narrow.

Distribution: UCHIDA found a single specimen of this characteristic medusa at Seto Marine Biological Station in Japan; the present four specimens were taken in the North Atlantic about midway between the Azores and the east coast of North America.

Amphinema rugosum (MAYER).

Stomotoca rugosa MAYER 1900 *a* p. 4, Pl. 2 fig. 5.
Stomotoca rugosa MAYER 1910 p. 112, Pl. 10 fig. 5—6, Pl. 11 fig. 1—2.
Amphinema rugosum RUSSELL 1953 p. 183, Pl. 10 fig. 3, Pl. 11 fig. 2, 4; text-fig. 90 A, B.

Material:

St. 1214. 26.I.22. 14°21′ N. 76°50′ W. S 150, 50 m. w. 1 specimen.

The specimen is 3 mm. high and wide, badly preserved in alcohol. The rudimentary tentacles, 4—5 in each quadrant between the radial canals, are very small and slender. Nevertheless it undoubtedly belongs to *A. rugosum*.

Distribution: North-western Europa; east coast of North America from Florida to Newport, Rhode Island; Japan. The present specimen was taken in the Caribbean Sea.

? **Amphinema** sp.

Pl. I fig. 9.

Material:

St. 1323. 1.V.22. 27°17′ N. 54°35′ W. S 200, 100 m. w. 1 specimen.

The umbrella is 1 mm. high and wide, the gelatinous substance extremely thin, which may be due to the preservation in alcohol; there is no trace of an apical projection. The manubrium is large, longer than the height of the umbrella; the base of the stomach is broad, cruciform, but there are no mesenteries connecting the radial canals with the corners of the stomach. The gonads are interradial, smooth and thick, covering the stomach from its base to somewhat beyond the level of the umbrella margin; they contain large eggs; the specimen is accordingly not a young stage. The mouth is broadly dilatated, about quadrangular, with smooth edges. There are four narrow radial canals and two opposite tentacles with very large, elongated, conical bulbs, each with a small but distinct abaxial spur; no ocelli. The filiform part of the tentacles is moniliform, provided with six ring-shaped clusters of nematocysts. There are no rudimentary tentacles, neither opposite the two radial canals nor in the spaces between the radial canals.

I cannot refer this specimen with certainty to any known genus or species, but owing to the state of preservation I hesitate to describe it as a new species.

It was taken in the open ocean far south-east of Bermuda.

Annatiara affinis (Hartlaub).

Tiaranna affinis Hartlaub 1913 p. 269, fig. 220, 221.
Tiaranna affinis Kramp 1920 p. 6, Pl. 1 fig. 1.
Tiaranna affinis Kramp 1926 p. 68, Pl. 1 fig. 15—17.
Tiaranna affinis Ranson 1934 *b* p. 436.
Annatiara affinis Russell 1940 p. 518.
Annatiara affinis Russell 1953 p. 200, fig. 101—103.
Annatiara affinis Kramp 1955 p. 251, fig. 3.
Annatiara affinis Kramp 1957 p. 15.

Material:

St. 178 2.IX.06
48°04′ N. 12°40′ W.
Y 330 1000 m. w. **2**

St. 855 9.VI.20
29°15′ N. 59°45′ W.
S 200 500 m. w. **2**

St. 1165 9.XI.21
12°11′ N. 35°49′ W.
E 300 1000 m. w. **1**

St. 1363 7.VI.22
30°25′ N. 44°46′ W.
E 300 1000 m. w. **1**

St. 4000 4.III.30
0°31′ S. 11°02′ W.
S 200 300 m. w. **1**
S 200 600 m. w. **2**
S 150 1000 m. w. **2**
E 300 1000 m. w. **4**

St. 4005 12.III.30
13°31′ N. 18°03′ W.
S 200 600 m. w. **2**
S 150 1000 m. w. **1**

St. 4007 15.III.30
18°22′ N. 18°14′ W.
S 200 300 m. w. **11**
S 200 600 m. w. **5**

St. 4009 18.III.30
24°36.5′ N. 17°27′ W.
S 150 2000 m. w. **1**
S 150 2500 m. w. **1**

St. 4158 17.VI.30
46°28′ N. 8°01′ W.
S 150 1500 m. w. **1**

St. 4192 19.VI.31
39°57′ N. 24°59′ W.
S 200 600 m. w. **1**

The only specimen which is in a tolerable condition is the one from St. 4192; it is 18 mm. in diameter and has about 48 tentacles; the gonads are well developed and complexly folded. The other specimens are about 10—15 mm. in diameter.

Distribution: This species belongs to the deep and intermediate strata. It has an extensive distribution from north to south in the eastern parts of the Atlantic Ocean, from north-west of Scotland to the Cape of Good Hope, 60° N. to 34° S. The above-mentioned stations 855, 1165 and 1363 are considerably farther west than known before.

Eutiara mayeri Bigelow.

Eutiara mayeri Bigelow 1918 p. 374, Pl. 1 fig. 1—5, Pl. 3 fig. 6.
Neoturris mayeri Ranson 1936 pp. 40, 74—75.

Material:

St. 1294. 18.IV.22. 17°43′ N. 64°56′ W. S 200, 300 m. w. 1 specimen.

The specimen is somewhat crumpled, but otherwise quite typical in every respect; in its present condition it is 10 mm. high and 7 mm. in diameter. I have nothing to add to the original description.

Distribution: This is the first time the species has been found since it was described from near Chesapeake Bay on the Atlantic coast of North America. The present specimen was taken in the Caribbean Sea near the Virgin Islands.

Leuckartiara octona (Fleming 1823).

Leuckartiara octona Hartlaub 1913 p. 285, fig. 239—253.
Leuckartiara octona Russell 1953 p. 188, Pl. 11 fig. 5, 6, Pl. 12 fig. 3, Pl. 31; text-fig. 91, 92, 93 A, B, 94, 95, 96.

Material:

St. 4007. 15.III.30. 18°22′ N. 18°14′ W. S 200, 600 m. w. 1 specimen.

Distribution: This species has its principal occurrence in the coastal waters of the boreal parts of Europe and North America; it is also common in the Mediterranean, and it is recorded from several scattered localities in the Pacific and Indian Oceans. It has previously been found in some localities on the tropical west coast of Africa, and the specimen taken by the "Dana" was found near Cape Verde.

Neoturris pileata (Forskål 1775).

Neoturris pileata Hartlaub 1913 p. 326, fig. 270—281.
Neoturris pileata Russell 1953 p. 203, Pl. 12 fig. 1; text-fig. 104—106.

Material:

St. 3988 23.II.30
5°52′ S. 6°02′ W.
S 200 50 m. w. **1**

St. 3998 1.III.30
7°34′ S. 8°48′ W.
S 200 50 m. w. **3**
S 200 100 m. w. **6**

St. 4007 15.III.30
18°22′ N. 18°14′ W.
S 200 50 m. w. **10**
S 200 100 m. w. **7**
S 200 300 m. w. **5**
S 200 600 m. w. **14**
E 300 1000 m. w. **1**
S 150 1000 m. w. **1**
S 150 2000 m. w. **2**
S 150 2500 m. w. **3**
S 150 3000 m. w. **10**
S 150 3500 m. w. **5**
E 300 4000 m. w. **4**

St. 4009 18.III.30
24°36.5′ N. 17°27′ W.
S 200 100 m. w. **2**
S 200 300 m. w. **1**

St. 4019 30.III.30
33°08′ N. 10°22′ W.
S 200 50 m. w. **1**
S 200 100 m. w. **2**
S 200 300 m. w. **1**
S 200 600 m. w. **3**
S 150 2000 m. w. **1**
S 150 3000 m. w. **2**

Specimens of very different sizes were found, varying from 1.5 to 30 mm. in height of bell, apparently without relation to geographical latitude or depth of the hauls. All the localities are off the west coast of Africa, the two southernmost very far from the coast; nevertheless the specimens taken at these two stations are comparatively small; they were taken in the upper water layers. The number and size of specimens taken in hauls with different length of wire may be summarized as follows:

Length of wire m	Number of specimens	Height of bell mm
50	15	3—27
100	17	$1^1/_2$—22
300	7	4—30
600	17	7—29
1000	2	10—27
2000	3	9—12
2500	3	13
3000	12	4—14
3500	5	10
4000	4	6—24

This complete lack of regularity confirms the supposition that all the specimens taken in the deep-sea hauls were captured during the setting out and hauling in of the nets through the upper strata, in which this species generally occurs.

Distribution: *Neoturris pileata* is a common medusa in the north-eastern Atlantic until as far north as Iceland and in the Mediterranean. One very large specimen is recorded from off the southern part of the west coast of Africa (Kramp 1957, p. 17); the five stations, where the species was taken by the "Dana", bridge the gap between that isolated locality and the areas of common occurrence. It has never been observed in the western parts of the Atlantic, and a record from the Philippine Islands may provisionally be regarded as doubtful.

Pandea conica (Quoy & Gaimard).

Dianaea conica Quoy & Gaimard 1827 p. 182, Pl. 6 fig. 3, 4.
Pandea conica Lesson 1843 p. 288.
Pandea conica Mayer 1910 p. 118, fig. 63.
Pandea conica Hartlaub 1913 p. 338, fig. 286, 287.
Pandea conica Picard 1956 pp. 1—11, fig. 1—3.

Material:

St. 845 30.IV.20
24°46′ N. 54°08′ W.
P 150 200 m. w., **5** young stages

St. 850 4.VI.20
20°39′ N. 61°48′ W.
S 200 150 m. w., **1** young stage

St. 851 5.VI.20
22°23′ N. 60°46′ W.
P 150 50 m. w. **1**

St. 855 9.VI.20
29°15′ N. 59°45′ W.
S 200 24 m. w. **5**

St. 882 15.VII.20
33°00′ N. 54°02′ W.
S 200 50 m. w. **2**

St. 891 24.VII.20
27°28′ N. 69°26′ W.
S 200 100 m. w. **1**

St. 1336 9.V.22
28°15′ N. 63°40′ W.
P 150 500 m. w. **1**

St. 4050 2—3.V.30
38°48′ N. 12°06′ W.
S 200 150 m. w. **3**
S 200 150 m. w. **2**
S 200 200 m. w. **1**
S 200 250 m. w. **3**

St. 4192 19.VI.31
39°57′ N. 24°59′ W.
S 200 50 m. w. **1**
S 200 500 m. w. **1**

St. 4197 25.VI.31
43°39′ N. 24°04′ W.
S 200 50 m. w. **2**

St. 845—1336 are in the western Atlantic north and north-east of the West Indies, St. 4050 is west of the coast of Spain, St. 4192 and 4197 east of the Azores.

The specimens from St. 845 and 850 are young stages, 1.5—2.0 mm. in height and width, strongly spherically contracted, exumbrella with about 16 or more meridional ridges. They have about 16 tentacle bulbs which, owing to the almost complete constriction of the umbrella margin, are pressed firmly together, so that each of them has attained a trapezoid shape, each with a tentacle which is short (? broken) in five of the specimens, whereas long and filiform tentacles are present in one of the largest specimens. The stomach is large and broad, with irregular gonadial folds and pits; mouth with folded lips.

Distribution (see the map, fig. 328 p. 249): This is a very common medusa in the Mediterranean, and it has also been found in several localities in the Atlantic Ocean between about 45° S. and 40° N., mainly in the eastern parts of the ocean, but also in some parts of the western Atlantic. Its partly oceanic distribution is due to its hydroid being attached to shells of the Pteropod *Cleodora cuspidata*, as recently discovered by Picard (1956). The hydroid was described by Gegenbaur (1854) as *Campaniclava cleodorae*. The medusa is also recorded from the Philippines and southern Japan. It mainly occurs in the upper strata.

Pandeid, gen. et sp. indeterm.

Material:

St. 4000. 4.III.30. 0°31′ S. 11°02′ W. S 150, 5000 m. w. 1 specimen.

The umbrella is barrel-shaped, with thin walls, 3 mm. high and 2.5 mm. wide; the manubrium is much mutilated, but seems to have been very large, connected with the four radial canals by very long mesenteries. Traces of several tentacles can be seen.

Fam. **Calycopsidae.**

Heterotiara anonyma Maas.

Pl. I fig. 10.

Heterotiara anonyma Maas 1905 p. 19, Pl. 3 fig. 19—21.
Heterotiara anonyma Bigelow 1909 *a* p. 216, Pl. 41 fig. 12, 13.
Heterotiara anonyma Vanhöffen 1911 p. 211, Pl. 22 fig. 3, 4.
Heterotiara anonyma Bigelow 1913 p. 25.
Heterotiara anonyma Bigelow 1918 p. 382.
Heterotiara anonyma Bigelow 1938 p. 108.
Heterotiara anonyma Kramp 1948 *b* p. 21.
Heterotiara anonyma Moore 1949 p. 6.

Material:

St. 303 16.VI.11
39°31′ N. 49°39′ W.
S 100 38 m. w. **3**

St. 842 28.IV.20
25°48′ N. 49°22′ W.
P 150 200 m. w. **1**

St. 892 25.VII.20
30°49′ N. 73°30′ W.
S 150 100 m. w. **4**

St. 1190 12.XII.21
17°58.5′ N. 64°45′ W.
S 200 50 m. w. **2**

St. 1192 15.XII.21
17°43.4′ N. 64°54.3′ W.
S 200 50 m. w. **25**
S 200 100 m. w. **31**
S 200 600 m. w. **1**

St. 1269 15.III.22
17°13′ N. 64°58′ W.
E 300 4500 m. w. **1**

St. 1294 18.IV.22
17°43′ N. 64°56′ W.
S 200 100 m. w. **8**
S 200 300 m. w. **2**
S 200 600 m. w. **3**

St. 3978 13.II.30
30°15′ S. 13°15′ E.
S 150 4000 m. w. **1**

? St. 4009 18.III.30
24°36.5′ N. 17°27′ W.
S 200 600 m. w.
1 juvenile specimen.

St. 303 and 842 are in the central part of the Atlantic between the Azores and North America, St. 892 north of the Bahamas, St. 1190—1294 near the Virgin Islands in the West Indies; most of the specimens taken in this region are 3—7 mm. in height of bell; one is 10 mm. high (St. 303); another is 8 mm. high; it was taken at St. 1269 in a haul with 4500 m. wire out, but has undoubtedly been captured at some higher level during the hauling in of the net. The same applies to the specimen from St. 3978 which is off the southern part of the west coast of Africa, thus in quite another geographical area, where this species has never been observed before. The specimen is fairly large, 8.5 mm. high, and its number of tentacles does not exceed 12. There can be no doubt, therefore, that it belongs to *H. anonyma* and not to *H. minor* which has a greater number of tentacles, usually 16—24.

A very small medusa taken at St. 4009, south of the Canary Islands, may possibly be a young stage of *Heterotiara anonyma*, but it cannot be identified with certainty before a series of older stages are found to connect it with well-developed specimens. It is 2.5 mm. high, 1.5 mm. wide, somewhat conical, with a small, hollow apical projection. The manubrium is half as long as the height of the umbrella cavity, broad and apparently with a smooth surface. The four radial canals are fairly broad and are not connected with the stomach by mesenteries. There are four rather thick and stiff, hollow tentacles with a thick mesogloea, each terminating in a knob of nematocysts; the tentacles are of unequal length, their basal part is not adnate to the exumbrella but is provided with a small basal bulb with nematocysts. The shape of the umbrella and its apical projection may be due to shrinkage by the preservation in alcohol. In the hope that future investigations may lead to an identification of this specimen, I give a drawing of it in Pl. I fig. 10.

Distribution: *Heterotiara anonyma* has a rather peculiar distribution. It is recorded from the Malayan Archipelago west of New Guinea (Maas) and the west coast of Sumatra (Vanhöffen); from the coast of Peru (Bigelow 1909 *a*) and from six localities in the northern Pacific between the Queen Charlotte Islands in British Columbia and Kamchatka (Bigelow 1913). Moreover it has been found in the western Atlantic: Florida, Bahamas and Bermuda (Bigelow 1918 and 1938, Moore 1949) and between Newfoundland and the Azores (Kramp 1948 *b*). It is no wonder, therefore, that numerous specimens were taken near the Virgin Islands and in other localities in the western Atlantic by the "Dana", whereas it was more surprising to find it off the South-African coast. It is mainly found in the upper water layers.

Bythotiara murrayi Günther.

Bythotiara murrayi Günther 1903 p. 424, Pl. 10 fig. 4, 5.
Bythotiara murrayi Maas 1910 p. 2.
Bythotiara murrayi Kramp 1924 p. 12, fig. 8—11.
Bythotiara murrayi Ranson 1936 p. 93, Pl. 1 fig. 12.

Material:

St. 1157	27.X.21		St. 4007	15.III.30		St. 4158	17.VI.30	
21°57′ N.	22° 58′ W.		18°22′ N.	18°14′ W.		46°28′ N.	8°01′ W.	
E 300	1000 m. w.	**1**	S 150	1000 m. w.	**2**	S 200	950 m. w.	**1**
			E 300	4000 m. w.	**1**	S 150	2000 m. w.	**1**
St. 3996	25.II.30		St. 4050	2—3.V.30		S 150	4500 m. w.	**1**
15°41′ S.	5°50′ W.		38°48′ N.	12°06′ E.		S 150	5000 m. w.	**2**
S 200	600 m. w.	**1**	S 150	2000 m. w.	**1**			

St. 4050 is in the Mediterranean N.W. of Sicily, St. 1157, 3996 and 4007 west of Africa, St. 4158 in the Bay of Biscay.

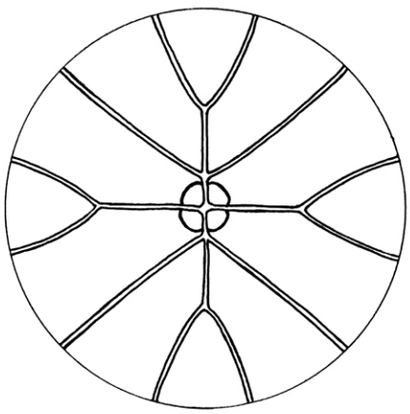

Fig. 1. *Bythotiara murrayi*. Schematic representation of abnormal branching of radial canals in a specimen from "Dana" St. 1157.

Abnormalities in the course of the radial canals are frequently seen in this species, also in some of the present specimens. Normally each of the four primary radial canals is bifurcated once near its origin from the stomach so that eight canals open into the ring canal. Among the specimens from St. 4007 one has 13 terminal branches of the canals, another has 14. A special and rather uncommon abnormality is seen in the specimen from St. 1157 (text-fig. 1); in this specimen the canals are branched in such a way that two crosswise planes of bilateral symmetry are formed. Most of the specimens are in too bad a condition to allow a description of the course of their radial canals.

Distribution: The occurrence of this species seems to be restricted to the Mediterranean and the eastern parts of the Atlantic from 32°45′ S. (north-east of Tristan da Cunha) to 60°35′ N. on the west coast of Norway. The westernmost locality in the Atlantic is west of the Azores, about 40° W. An isolated record from Nias Island in the Indian Ocean west of Sumatra (Vanhöffen 1911) may be regarded as doubtful.

Genus **Calycopsis** Fewkes.

The revision of the genus *Calycopsis* carried out by H. B. Bigelow in a series of papers and summarized in 1940 (pp. 290 ff.) affords a great help in our attempts to identify the species of this difficult genus. The present collection, however, gives occasion to some additions and corrections.

Calycopsis is a genus which by geographical speciation has been divided into a considerable number of species. As emphasized by Bigelow (1940 p. 292) each species has a somewhat restricted area of distribution. When a *Calycopsis* was found in a new geographical area, it was frequently necessary to describe it as a new species, or it might with some doubt be referred to a species already described but differing from the typical form in certain respects. Most of the species have been found only on one or a few occasions, and some of them present a considerable range of variation, especially in number of canals and tentacles. In the following pages I shall describe some specimens, the affinities of which have cost me a lot of consideration.

Among the genera of the family Calycopsidae, *Calycopsis* is characterized by the possession of four primarily undivided radial canals and a varying number of centripetal canals issuing from the ring canal; they may or may not come to fuse either with the cruciform base of the manubrium or with the radial canals, and then always close to the base of the stomach. The gonads are interradial and transversely folded, usually

forming a double series of regular transverse folds. The four oral lips may be small and simple or large and complexly folded. The basal part of the tentacles is adnate to the wall of the exumbrella until some distance above the ring canal and may be deeply sunk into the gelatinous substance of the umbrella margin. Fully developed tentacles are long, destitute of nematocysts except in a bulbous swelling at their terminal end. The gelatinous substance of the umbrella is usually very firm and rigid, but sometimes rather soft and limp which, however, in certain cases seems to be due to preservation. The umbrella is frequently somewhat laterally compressed, so that one diameter is much larger than the other, and the flattening is sometimes perradial, sometimes interradial. BIGELOW has discussed this peculiarity and concluded that it is the result of temporary contraction or of preservation. It may, however, occur in living specimens. While on board the "Discovery II" in the autumn of 1955 I found a specimen resembling *C. geometrica*; though evidently moribund, its umbrella still made slight rythmical pulsations, and already in this condition it showed a lateral compression, which became still more pronounced after preservation in formalin.

The species of *Calycopsis* may be arranged in an approximately progressive series from the simplest to the most complicated structure. Ten species were recognized by BIGELOW (1940) and well characterized by him, but it may be useful to recapitulate their diagnostic features, to which a few supplementary remarks may be added, and at the same time the identifications of the specimens collected by the "Dana" will be discussed.

Calycopsis simplex KRAMP & DAMAS.

Calycopsis simplex KRAMP & DAMAS 1925 p. 282, fig. 23—25.

Umbrella globular, 8 mm. high and wide. Gonads in few transverse folds. Four blind, interradial centripetal canals. Eight tentacles all alike. — Norway, in deep water.

Calycopsis borchgrevinki (BROWNE).

Sibogita borchgrevinki BROWNE 1910 p. 17, Pl. 2 fig. 1—5.
Calycopsis borchgrevinki VANHÖFFEN 1911 p. 215, Pl. 22 fig. 7, text-fig. 10 a, b.
Calycopsis borchgrevinki VANHÖFFEN 1912 *a* p. 364.
Calycopsis borchgrevinki KRAMP 1957 p. 20.

Umbrella about 20 mm. high, slightly higher than wide, jelly very thick and firm. Four interradial centripetal canals, blind or joining base of manubrium. 8—16 tentacles. The most characteristic feature of this species is that the gonads are not in exterior folds, but in pockets and embedded in the wall of the stomach, with definite openings to the exterior. Such gonads are not found in any other species of the genus. — Antarctic and subantarctic, circumpolar.

Calycopsis bigelowi VANHÖFFEN.

Calycopsis bigelowi VANHÖFFEN 1911 p. 218, fig. 12.
Calycopsis bigelowi KRAMP 1957 p. 21.

Umbrella almost globular, up to 16 mm. high and wide, jelly very thick; gonads with about 10 transverse folds in each row. Four blind, interradial centripetal canals. Eight large tentacles opposite the canals and numerous, up to 40, small tentacles, but of the same structure as the large ones. Originally described from deep water in the Gulf of Aden (VANHÖFFEN), later on recorded from two localities west of the Cape of Good Hope, likewise in deep water (KRAMP), collected by the "Discovery". According to VANHÖFFEN the stomach is red, but in the specimens from South Africa the gonads have a characteristic yellow-green colour; moreover their gelatinous substance is remarkably soft.

Calycopsis simulans (Bigelow).

Sibogita simulans Bigelow 1909 *a* p. 213, Pl. 5 fig. 4, 5; Pl. 41 fig. 8, 9; Pl. 43 fig. 1, 2; text-fig. 2.
Calycopsis typa var. *simulans* Bigelow 1919 p. 292, Pl. 40 fig. 8; Pl. 41 fig. 1.
Calycopsis simulans Bigelow 1940 p. 293.

Umbrella dome-shaped, up to 30 mm. high and 25 mm. wide, jelly thick. Gonads with about 15 transverse folds in each row. Eight adradial centripetal canals, blind or joining base of manubrium. Twelve large tentacles opposite the twelve canals and occasionally some small tentacles between the canals. Recorded by Bigelow from three localities: Gulf of Panama at the surface of the water (1909), Sulu Sea (1919) and off the Pacific coast of Colombia (1940). Besides some variation in the colour of the gonads, which are described as reddish-brown (Panama), pale brownish-yellow (Sulu Sea) and pale ochre (Colombia), there is a remarkable difference between the South-American specimens, in which all the centripetal canals are blind, and the number of tentacles does not exceed twelve, and the Philippine specimen which, in spite of its smaller size (16 mm. wide) had eight small supplementary tentacles and in which seven of the eight centripetal canals joined the base of the manubrium.

Calycopsis papillata Bigelow.

Calycopsis typa Vanhöffen 1912*a* p. 364.
Calycopsis papillata Bigelow 1918 p. 378, Pl. 2 fig. 1—7; Pl. 3 fig. 1.
Calycopsis papillata Kramp 1955 p. 252, Pl. 1 fig. 2, 3.

This species was collected by the "Dana" in the following localities:

Material:

St. 1192. 15.XII.21. 17°43.4′ N. 64°54.3′ W. S 200, 300 m. w. 1 specimen.
St. 1261. 9.III.22. 19°04′ N. 65°43′ W. E 300, 4500 m. w. 1 specimen.

C. papillata differs from all other species of *Calycopsis* by the presence of a group of well-marked, prominent gelatinous papillae on the lobes of the umbrella margin between the deep furrows in which the basal parts of the tentacles are imbedded. The type specimen, which was described from the Straits of Florida by Bigelow (1918) was 27 mm. high and 26 mm. wide; two somewhat smaller specimens were taken among the Bahamas. The gelatinous substance of the medusa is very thick and rigid, the manubrium small with small, simple lips, about 14—15 folds of gonads in each row. There are eight centripetal canals adradially placed, blind in the younger specimens, partly joining the base of the manubrium in the largest, and twelve tentacles. Three specimens, recorded by Vanhöffen (1912*a*) as *C. typa* were supposed by Hartlaub (1913 p. 360) to belong to *C. valdiviae* Hartlaub, but they undoubtedly belong to *C. papillata*. They were not thoroughly described, but two of them differ from the original specimens in having only 9 tentacles and 9 or 10 canals. They were collected in the following localities: Indian Ocean, 26° S. 58° E., central Atlantic, 0° N. 16° W., and near Cape Verde Islands, 14° N. 28° W. (see Kramp 1955 p. 253). Moreover a large specimen, 33 mm. high and 21 mm. wide, was recently described by me (Kramp 1955 p. 252) from the west coast of Africa off Angola. It differs from the other specimens in the position of the centripetal canals; in each of the four quadrants there is one interradial and one adradial canal, all of them blind but extending almost to the base of the manubrium, and it has only eight tentacles, four perradial and four interradial, whereas there are no tentacles opposite the adradial canals. All the specimens were taken near the surface of the water. The two specimens collected by the "Dana" were taken in the West Indies, near the Virgin Islands; they are 10—13 mm. high and agree in every respect with Bigelow's original specimens, having 12 tentacles and 12 canals; the centripetal canals are adradial and terminate blindly at a short distance from the manubrium. One of them was taken in a deep haul with 4500 m. wire out, but may have been captured during the hauling in of the net. *C. papillata* apparently has a very extensive geographical distribution, occurring in the western as well as the eastern parts of the tropical Atlantic and also in the western part of the Indian

Ocean. We cannot exclude the possibility, however, that VANHÖFFEN's remark on the warts on the lobes of the umbrella between the tentacle bases does not apply to the specimen from the Indian Ocean, so that this specimen may have belonged to another species.

Calycopsis nematophora BIGELOW.

Calycopsis nematophora BIGELOW 1913 p. 23. Pl. 2 fig. 8, Pl. 3 fig. 1—3.
Calycopsis nematophora BIGELOW 1918 p. 377.
Calycopsis nematophora BIGELOW 1940 pp. 290—293.

This species differs from all the other species of *Calycopsis* by the possession of stalked nematocyst knobs on the edges of the complexly folded oral lips. Moreover the gonads have a peculiar structure, in so far as the two series of folds are less precise and less crowded than in most other species and are supplemented by a number of intervening folds. The umbrella may attain a height of 31 mm. and a diameter of 30 mm.; the gelatinous substance is thick. There are usually three centripetal canals in each quadrant, and as a rule all of them join the cruciform base of the stomach, but occasionally some of them are blind. The number of tentacles is somewhat variable, 8—16 large tentacles being associated with canals and in addition a number of small tentacles in the spaces between the canals. The total number of tentacles is usually 32—48, but in the largest specimen as many as 57 were counted.

Several specimens were found in seven localities in the Bering Sea, among the Aleutian Islands, off Kamchatka, and in the Sea of Okhotsk, mainly in the upper water layers, and the species has not been found since it was described from this area.

Calycopsis typa FEWKES.

Calycopsis typa FEWKES 1882 p. 304, Pl. 1 fig. 34.
Sibogita nuarchus BIGELOW 1909 *c* p. 206, Pl. fig. 1—8.
Calycopsis typa BIGELOW 1913 p. 21.
Calycopsis typa BIGELOW 1915 p. 316.
Calycopsis typa BIGELOW 1922 p. 159.
Calycopsis typa BIGELOW 1940 pp. 290—293.

None of the specimens identified as *C. typa* by VANHÖFFEN (1911 and 1912*a*) belong to this species.

Three specimens were collected by the "Dana" in the following locality, near Cape Verde, very far from the area, from which this species was previously known:

Material:

St. 4007. 15.III.30. 18°22′ N. 18°14′ W. S 200, 600 m. w. 1 specimen. E 300, 4000 m. w. 2 specimens.

Moreover two doubtful specimens, which will be described below, were taken in the West Indies:

St. 1250. 26.II.22. 17°54′ N. 67°30′ W. E 300, 1000 m. w. 2 specimens.

Calycopsis typa, the type species of the genus, had been described by FEWKES from the Gulf Stream off the New England coast; it was found again in the same area by BIGELOW (1909*c*) who described his specimens as a new species, *nuarchus*, but later on (1913) he realized that they belonged to *C. typa*. It was recorded again by BIGELOW (1915 and 1922), and up to now the species has been found only within a restricted area along the continental slope off the New England coast, taken in open nets hauled from between 500 and 300 metres to the surface.

According to BIGELOW's description (1909) and later notes this species is first of all characterized by the presence of a deep funnel-shaped depression in the apical jelly, not seen in any other species of the genus. The largest specimen observed was 37 mm. in height and 40 mm. in diameter, with a pronounced disposition to lateral compression. The gelatinous substance of the bell is firm, but not very thick. There are usually three

or four blind centripetal canals in each quadrant, the greatest total number of canals observed by BIGELOW being 21. The total number of tentacles varies from 16 to 30. It is also characteristic that the manubrium is comparatively large and broad with fairly large, folded oral lips. There are numerous transverse gonadial folds, and in addition, irregular projecting lobes of gonads may be developed. The colour of the gonads is described as deep brownish-red, and the basal bulbs and terminal knobs of the tentacles are pale yellowish.

The specimens taken by the "Dana" at St. 4007 near Cape Verde on the west coast of Africa differ from the American specimens in one respect only, their jelly is remarkably soft and limp, which may be the result of bad preservation. The apical depression characteristic of the species is very pronounced, deep. The height of the umbrella is 19—21 mm., the width cannot be measured with any accuracy. Besides the four radial canals there are 12 centripetal canals, apparently all blind. Corresponding to the 16 canals there are 16 large tentacles and moreover about 16 very small tentacles between the large ones, but no indication of a further increase of the number of tentacles. These three specimens seem to me to agree so well with the descriptions of the American form that I am sure they belong to the same species; the geographical distance is no objection to this supposition, since many other American species of medusae have been recorded from the African coast (see KRAMP 1955).

On the other hand, I am much in doubt of the identification of the two specimens collected by the "Dana" at St. 1250, near Porto Rico. They are about 14—16 mm. high in their present crumpled condition, the jelly is fairly rigid, but owing to a considerable shrinkage it is thin and flexible. There is no trace of an apical depression! The manubrium is broad as in *C. typa*, in the largest specimen 6 mm. long and 7 mm. broad, the mouth is large with broad, complexly folded lips with smooth edges, no trace of nematocyst knobs like those of *C. nematophora*. The rows of gonads are widely separated in the perradii, in the largest specimen there are about 18 gonadial folds in each row, and there are some instances of egg-shaped projecting lobes of gonads like those described in *C. typa*. One of the specimens has about 30, the other 34, canals; the centripetal canals extend to the base of the stomach, but I am not sure whether they join the stomach, apparently they do not. There is one tentacle opposite each canal, most of them large and of equal size, but some few tentacles, placed off particularly narrow (young) canals are small. Moreover there is one very small, hook-shaped tentacle in each space between the canals. The gonads are bright orange-red, and there is a group of orange pigment spots inside the base of each of the larger tentacles.

In several respects these specimens resemble *C. typa* and, at any rate, they cannot be referred to any other species of *Calycopsis* described up to now. The greater number of tentacles and canals as compared with *C. typa* of even larger size might be due to geographical variation. What makes me hesitate to refer the specimens with certainty to *C. typa* is the absence of a funnel-shaped depression in the apex of the umbrella.

Calycopsis valdiviae HARTLAUB.

Calycopsis typa VANHÖFFEN 1911 p. 214, Pl. 22 fig. 6.
Calycopsis valdiviae HARTLAUB 1913 p. 360.

A single specimen of a large and beautiful medusa was taken in the Agulhas Current off the south coast of Africa, 34°31′ S. 26°00′ E. VANHÖFFEN referred it to *Calycopsis typa*, but HARTLAUB realized that it could not belong to that species, and he established a new species, *C. valdiviae*, for this specimen; he was mistaken, however, in referring some specimens taken by the German South Polar Expedition in the tropical Atlantic and Indian Oceans, and likewise identified by VANHÖFFEN (1912*a*) as *C. typa*, to the same species; they belong most probably to *C. papillata* (see above).

According to VANHÖFFEN's description and coloured drawing *C. valdiviae* may be characterized as follows: Umbrella 38 mm. high and 30 mm. wide, somewhat oblique, jelly thick and rigid. Manubrium fairly large, 14 mm. long, with gonads in 19—22 regular transverse folds in each row, mouth with folded lips. About 60 canals of somewhat different width, 24 of them designated as main canals ("Hauptkanäle") joining the base of the manubrium, and between them are about 36 canals which are narrower ("Zwischenkanäle"), some of

which terminate blindly near the base of the stomach. There are 24 large tentacles opposite the 24 main canals and occasionally small rudiments of tentacles opposite the narrow canals. The gonads are red, oral lips, canals and tentacles colourless.

The affinity of this medusa will be discussed below.

Calycopsis chuni VANHÖFFEN.

Calycopsis chuni VANHÖFFEN 1911 p. 217, Pl. 22 fig. 8.

Two specimens were collected by the "Valdivia" Expedition, one near Cape Guardafui, 9°06′ N. 53°41′ E., another in the Gulf of Aden, 13°03′ N. 46°42′ E. The former was 28 mm. high and 25 mm. wide, the latter was 26 mm. high and wide. In general shape they resemble *C. valdiviae*, though the umbrella is not oblique. According to the coloured figure, the base of the stomach is more pronouncedly cruciform than in *C. valdiviae*. The smaller specimen has 27 canals, usually one narrow "centripetal" canal (blind?) between two successive "main canals", and 16 tentacles. In the larger specimen there are 36 canals, somewhat irregularly distributed, and 17 tentacles. VANHÖFFEN lays much stress on the different colouration in the two species; in *C. chuni* the entire manubrium is brownish-red, and in the specimen from Cape Guardafui the canals and the tentacles are red, whereas they are colourless in the specimen from Aden. Evidently, therefore, the colour is not such a relevant specific character as emphasized by VANHÖFFEN.

The specimens collected by the "Dana" may serve to elucidate the relation between *C. valdiviae* and *chuni*; if they are identical, which I think they are, *chuni* takes priority over *valdiviae*.

Calycopsis chuni VANHÖFFEN.

Syn. *Calycopsis valdiviae* HARTLAUB (see above).

Material:

St. 1283	5.IV.22	St. 3998	1.III.30	St. 4017	27.III.30	St. 4019	30.III.30
14°38′ N.	61°16′ W.	7°34′ S.	8°48′ W.	29°11′ N.	14°14′ W.	33°08′ N.	10°22′ W.
E 300	1000 m. w. 1	S 200	300 m. w. 1	S 200	600 m. w. 1	E 300	4000 m. w. 1

Though the first of these localities is in the West Indies and the others off the west coast of Africa, the specimens are remarkably alike. All of them have a rigid and fairly thick, though somewhat shrunken jelly, and in their present condition they are strongly laterally compressed, the one from St. 1283 according to an interradial plane, the others perradially. Their sizes are as follows:

Station no.	1283	3998	4017	4019
Height of bell, mm	31	33	25	22
Greatest diameter, mm	25	34	24	21

In the two largest specimens (St. 1283 and 3998) the manubrium is about 15 mm. long, and in all the specimens the gonads are in about 25 transverse folds in each row; the oral lips are short and simple, and the base of the stomach is distinctly cruciform. In all the specimens there are 32 canals, all of which communicate with the stomach, usually directly joining the cruciform base of the stomach, but sometimes fused with a neighbouring canal close by the manubrium. Some irregular anastomoses are seen in the specimen from St. 3998. The number of tentacles is likewise the same in all the four specimens; there are 16 large tentacles and 16 very small, hook-shaped, all the 32 tentacles placed opposite the canals. There are no indications of a further number of tentacles being developed. The canals terminating at the small tentacles are usually slightly narrower than the others.

Stomach and gonads are light yellowish in all the specimens, and inside the base of the large tentacles of the specimen from St. 3998 there is a group of bright orange-red pigment spots, whereas the tentacle bases of the three other specimens are yellow.

We cannot ascribe much importance to the colours of the various organs of preserved medusae for distinction between species. In morphological and numerical respects the present specimens differ from *Calycopsis chuni* only in the presence of 16 small tentacles between the 16 large ones, which may be the outcome of further development. BIGELOW has shown that in certain species of *Calycopsis* the tentacles develop before the corresponding canals appear, but in other species the opposite sequence may occur. The absence of young tentacles corresponding to the last series of 16 canals in VANHÖFFEN's specimens of *C. chuni*, therefore, presents no severe obstacle against the supposition that the Atlantic specimens described above belong to that species. The fact that all the centripetal canals join the base of the stomach in the Atlantic specimens, whereas some of them are blind in VANHÖFFEN's specimens, is likewise only a developmental feature. In other species with more than four centripetal canals (*simulans, papillata, nematophora,* see above) they are blind in some specimens, preferably young, fused with the manubrium in others.

In accordance with these statement I see no reason to retain *C. valdiviae* as a distinct species. It has about the same total number of tentacles as the Atlantic specimens of *C. chuni* (24 large and some small), and it has almost twice as many canals, somewhat more than half of them being narrower (younger) that the others. It seems to me that *C. valdiviae* must be regarded as a far advanced stage of development of *C. chuni*. Through the Atlantic specimens we have a progressive series of stages: In VANHÖFFEN's specimens of *C. chuni* from East Africa the number of canals has increased to about 32, whereas the number of tentacles is still only about 16; in the Atlantic specimens 16 new small tentacles have appeared, and in the particularly large specimen from South Africa some of these tentacles have grown to full size, and a new series of centripetal canals have been developed.

Calycopsis chuni thus has an extensive, though continuous geographical distribution, occurring in the West Indies and off the western, southern and eastern coasts of Africa. The bathymetrical distribution of the species is somewhat uncertain. VANHÖFFEN's specimens were taken in vertical hauls from 2000, 1800 and 1200 metres to the surface; some of the Atlantic specimens were taken in deep hauls, 1000 m. wire (St. 1283 in the West Indies), 4000 m. wire (St. 4019 off Morocco) and 600 m. wire (St. 4017 near the Canary Islands); but the specimen from St. 3998, near the island Ascension, was taken in the upper strata in a haul with only 300 m. wire out. Upwelling of deep-sea water cannot be expected to occur in this locality, so evidently the medusa is able to live in the upper water layers; but apparently it has its principal occurrence in the deep and intermediate layers. All the localities where the medusa has been found are near the coasts; presumably, therefore, the corresponding hydroid is an inhabitant of the deeper parts of the continental slopes.

Speciation of Calycopsis.

The following discussion is given with due reservation, because most species of *Calycopsis* are known from only few localities, and future investigations may alter our present conception of their geographical distribution. On the other hand, the distribution of the various species as known up to now is so characteristic that it must invoke our attention (see the maps, figs. 2—3).

The genus has a very extensive distribution in the oceans, but it has been divided into several species, most of which occur within restricted and widely separated areas. In each of these areas the population has developed into a separate species with its own characteristic features, not merely in numerical respect but frequently also showing structural peculiarities.

C. simplex is a small species with a very simple structure; it is known only from one of the fjords on the west coast of Norway, where it was found in deep water.

C. borchgrevinki, like *C. simplex,* has only one centripetal canal in each quadrant; its distribution is circumpolar in antarctic and subantarctic waters, where no other species of *Calycopsis* are found, and it has acquired a special structure of the gonads, not seen in any other species (see above, p. 19).

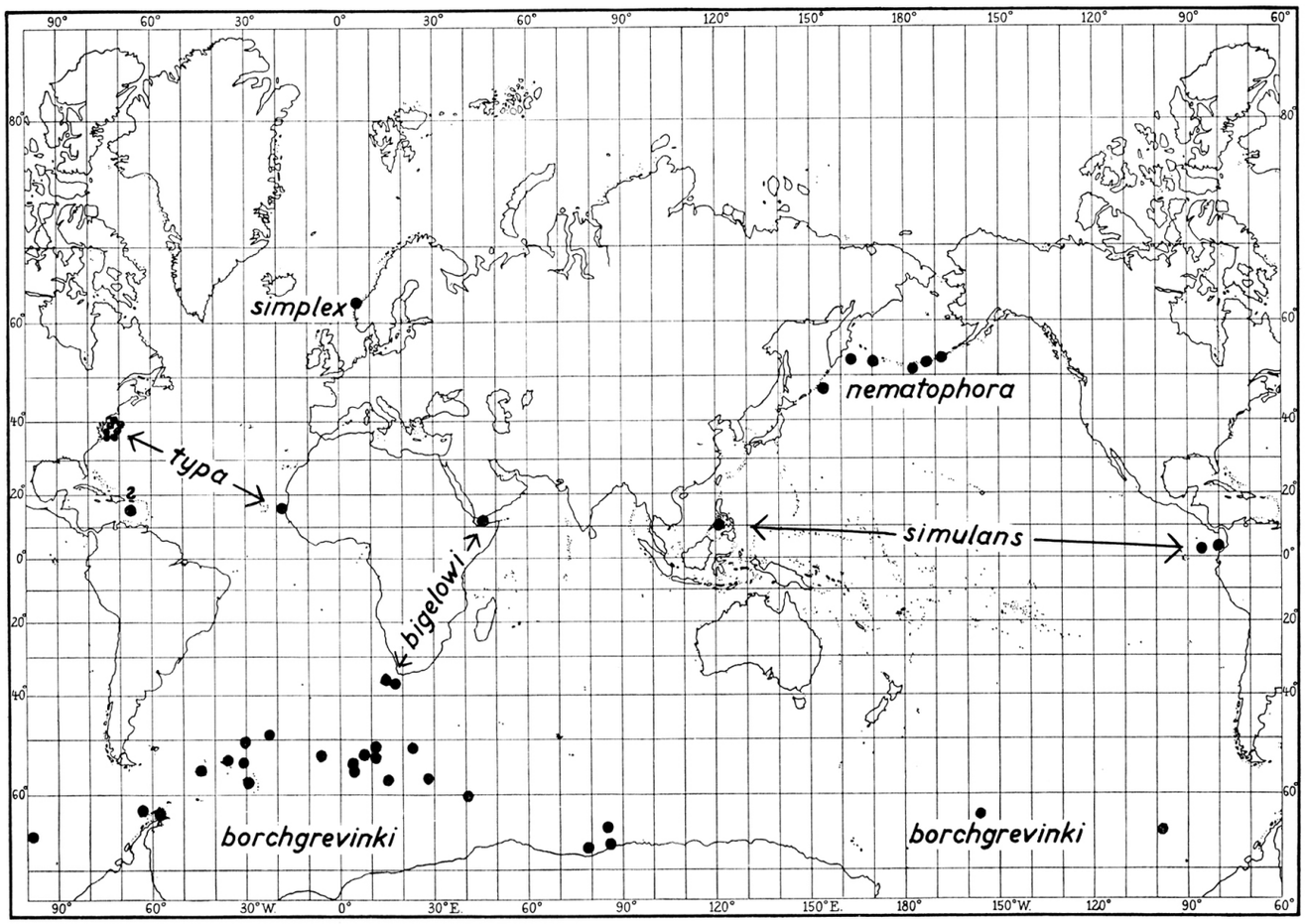

Fig. 2. Geographical distribution of six species of *Calycopsis*.

C. simulans, with two centripetal canals in each quadrant, is the only species which occurs in the tropical Pacific, in the eastern as well as in the western parts, and apparently certain differences have arisen in the two widely separated populations (see above, p. 20).

C. nematophora, which has three centripetal canals in each quadrant, has an isolated occurrence in the northernmost parts of the Pacific, and it differs from all the other species in the presence of stalked nematocyst knobs on the oral lips.

C. bigelowi occurs off East and South Africa; it is one of the species with only one centripetal canal in each quadrant, but it is characterized by the development of several small tentacles between the eight large tentacles corresponding to the eight canals.

C. typa has a greater number of tentacles and canals than the preceding five species; it occurs off the coast of New England and near Cape Verde in West Africa, perhaps also in the West Indies, where an aberrant form has been found. This species also has acquired a structural character unknown in any other species of the genus, *viz.* a deep funnel-shaped depression in the apical jelly.

These six species, which occur in as many widely separated areas, seem to be typical examples of geographical speciation. This impression is, however, complicated by the distribution of two other species, *papillata* and *chuni*, which occur partially within the same areas as *typa* and *bigelowi*. *C. papillata* differs from all the other species by its gelatinous papillae on the lobes of the umbrella margin, and *C. chuni* is a large species characterized by its great number of canals and tentacles. Both of them have a rather extensive distribution; *C. papillata* occurs in the tropical Atlantic from Florida and the West Indies to the west coast of Africa, probably also in the western part of the Indian Ocean; the distribution of *C. chuni* comprises the coasts of Africa

from the Gulf of Aden around South Africa to Morocco, and it has also been found in the West Indies. Both species are subject to some variation which, however, does not seem to be geographically determined.

The development of the six first-mentioned species has proceeded under different environmental conditions within six areas which are widely separated geographically but are in open connection with each other, and they have been so since the cretaceous period; these species are typically allopatric. In addition two other species, *papillata* and *chuni*, have arisen in the tropical Atlantic. They have attained a high degree of development and a wide distribution ranging from the western Atlantic to the western part of the Indian Ocean. From the beginning the four species now occurring in the Atlantic may have arisen in separate areas, their populations later on having extended their distribution. *C. typa* seems to have its principal occurrence off New England spreading eastwards to West Africa. *C. papillata* may likewise have originated in the western Atlantic, but in the Caribbean region, whence it has extended its distribution eastwards to West Africa and somewhat

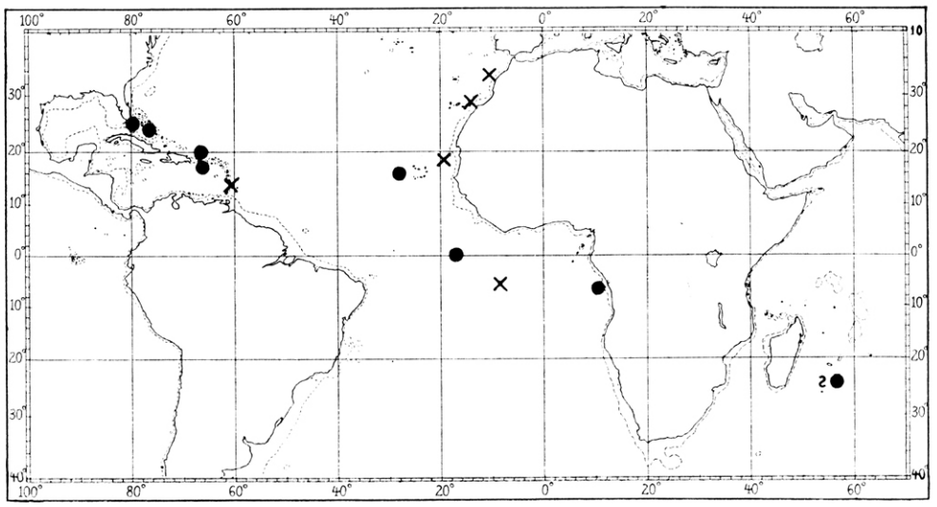

Fig. 3. Geographical distribution of *Calycopsis papillata* (●) and *C. chuni* (✕).

into the Indian Ocean. *C. chuni* apparently belongs to the African coasts, being recorded only once from the western Atlantic; and as far as we know the distribution of *C. bigelowi* is still restricted to East and South Africa.

It seems probable, therefore, that the present condition, where the areas of distribution of *papillata* and *chuni* partially coincide with the distribution of *typa* and *bigelowi*, is secondary. If this be true, the eight existing species of *Calycopsis* all have arisen in separate geographical areas, and the division of the genus into different species is a typical geographical speciation.[1])

Genus **Sibogita** Maas.

The genus *Sibogita* was established by Maas (1905 p. 16) for the species *S. geometrica* which was taken by the Siboga Expedition in the Malayan Archipelago. The generic name was adopted by Bigelow (1909*a*) for *S. nuarchus* (which later on was found to be identical with *Calycopsis typa* Fewkes) and for *S. simulans* (1909*a*), and also by Browne (1910) for *S. borchgrevinki*. Vanhöffen (1911 p. 214 and 1912 p. 364) retained the name *Sibogita* for *S. geometrica*, but referred *borchgrevinki* and his own two new species *chuni* and *bigelowi* to the genus *Calycopsis* Fewkes together with the specimens which he erroneously identified as *Calycopsis typa* Fewkes. He based the distinction between the two genera on the conformation of the centripetal canals which in *Calycopsis* are simple and partly terminating blindly, whereas in *Sibogita* they join the "main-canals". In later papers by Bigelow the two genera are united; he found that the new species *Calycopsis papillata* bridges the gap; in one of the specimens some of the centripetal canals join the radials, some the manubrium

[1]) After the above was written two more species, *C. gara* and *C. krampi* have been described from the northern Atlantic. They will be briefly mentioned in Section B.

so that "some of its quadrants would belong to one genus, others to the other, were both to be recognized" (BIGELOW 1918 p. 377).

This view is fully justified under the assumption that the canals between the four primary radial canals really are centripetal, proceeding upwards from the ring canal, in *geometrica* as well as in the other species. But I am not convinced of the correctness of this statement. Two specimens of *Sibogita geometrica* are described, one by MAAS (1905), one by BIGELOW (1919); and three specimens from the Atlantic Ocean will be described below. None of the canals are blind in any of these specimens; accordingly their "branches" may as well have been developed from above as from below. If some time in the future a specimen is found, in which some of the canals have not finished their development one way or the other, we may state whether they issue from the ring canal growing upwards to join one of the preceding canals at some higher level on the subumbrella, or whether they issue from the canals already present growing downwards towards the ring

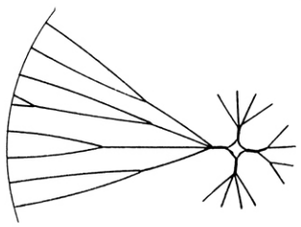

Fig. 4. *Sibogita geometrica occidentalis.* Schematic representation of branching of radial canals, "Dana" St. 1380.

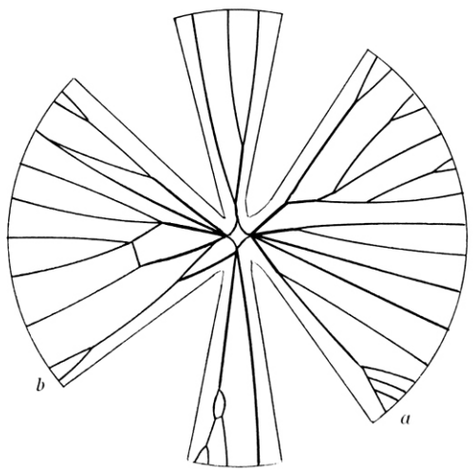

Fig. 5. *Sibogita geometrica occidentalis.* Schematic representation of branching of radial canals, "Dana" St. 1371. Umbrella radially incised.

canal. I cannot answer the question with certainty, but since I have seen the three Atlantic specimens I am much inclined to think that the development of the canals has proceeded in the latter way.

The appearance of the canals in *Sibogita* seems to me to contradict the supposition that all of them, except four primary radial canals, are developed centripetally from the ring canal; several points in their conformation cannot be explained under that supposition. Even a superficial view of the canals in the three Atlantic specimens (Pl. I fig. 11—12, Pl. II fig. 2—3, and text-fig. 4—5) and gives the impression that the branching is the result of repeated bifurcation during the growth of the canals from the central part of the umbrella towards the margin. In none of these specimens can any of the canals be pointed out as primary radial canals; this is especially evident in the specimen from "Dana" St. 1380 (text-fig. 4), in which four groups of canals issue from the corners of the stomach, each group consisting of four canals diverging from each other immediately outside the base of the stomach, each of them to be bifurcated further down. In the two other specimens the course of the canals is more irregular, but also here they diverge from each other immediately outside the stomach, and at acute angles. In the specimen from "Dana" St. 1371 (text-fig. 5) one of the canals (marked *a*) proceeds straight to the margin, but at a short distance from the ring canal it sends off three lateral branches, all to the same side, which join the ring canal very near each other; I can hardly believe that these have been emitted from the ring canal, and the canal marked *b* has undoubtedly issued from a corner of the stomach and come to join the adjacent canal during its outward growth. In all the specimens some of the canals are bifurcated immediately before reaching the ring canal, which is easily understood from the point of view that the development has taken place downwards towards the umbrella margin.

Another point of some importance is that the canals and their branches, though narrow throughout their

length, are slightly wider in their proximal parts than further below. This likewise indicates that the development takes place in a downward direction.

Notwithstanding the direction of the development of the canals *Sibogita geometrica* and the Atlantic form described below differ in one remarkable way from all species of *Calycopsis*. The centripetal canals in *Calycopsis* are either permanently blind or they join the cruciform base of the stomach or the radial canals in close vicinity to the manubrium; in *Sibogita* the canals join each other at various levels. This seems to be a difference of so much importance that it justifies a distinction into two genera (abnormalities in the form of anastomoses and other irregularities may occur in both genera but are of no taxonomic value). I therefore revive the old genus *Sibogita* with the following diagnosis:

Genus *Sibogita* Maas: Calycopsidae with radial canals which branch repeatedly at various levels; gonads transversely folded. Type species *S. geometrica* Maas.

Sibogita geometrica Maas.

Sibogita geometrica Maas 1905 p. 17, Pl. 3 fig. 16—18.
Sibogita geometrica Mayer 1910 p. 186, fig. 99.
Sibogita geometrica Vanhöffen 1911 p. 214.
Calycopsis geometrica Bigelow 1918 p. 377.
Calycopsis geometrica Bigelow 1919 p. 290, Pl. 40 fig. 5—7, Pl. 41 fig. 2.
Calycopsis geometrica Bigelow 1940 p. 293.

The original specimen, described by Maas, was found north-east of Celebes. The umbrella is 38 mm. high, laterally compressed, average diameter 20 mm., gelatinous substance thick and rigid. Manubrium slender, somewhat less than half as long as the depth of the subumbrella cavity, mouth with four folded lips; gonads in about 13 transverse folds in each of the eight rows. Four distinct radial canals which give off lateral branches at various levels, the branches being further divided, so that altogether 32 canals open into the ring canal. 16 long tentacles corresponding to as many canals. No ocelli.

Another specimen was described by Bigelow (1919) and referred with some doubt to the same species. It was found in the Sulu Sea. The umbrella is 20 mm. wide. The canals are branched in a way similar to Maas's specimen, 22 extending to the margin. Corresponding to the canals there are 22 tentacles, five of which are small and spur-like, and, moreover, there are three small tentacles unconnected with any canals. At the base of every large tentacle there is a dense group of red pigment granules.

The presence of three small tentacles unconnected with canals in Bigelow's specimen is of some interest for a comparison with the Atlantic specimens which will be described below and which have given me occasion for much consideration and some doubt.

Sibogita geometrica Maas, occidentalis nov. subsp.

Plate I fig. 11—12, Pl. II fig. 2—3.

Material:

St. 1371. 13.VI.22. 36°41′ N. 26°21′ W. E 300, 1000 m. w. 1 specimen.
St. 1380. 19.VI.22. 39°26′ N. 21°51′ W. S 150, 600 m. w. 1 specimen.

Moreover a beautiful specimen was taken in the Bay of Biscay while I was on board the English research ship "Discovery II" in the autumn of 1955:[1])

"Discovery II" St. 3332. 47°04′ N. 7°08′ W. 1.X.55. 2 m. ringtrawl, 600 m. wire, oblique haul from about 300 m. to the surface.

[1]) I am greatly indebted to Dr. N. A. Mackintosh for permission to publish the description of this specimen in the present paper.

Description of the specimens. All the specimens have lost the distal portions of the tentacles which presumably have had a terminal knob of nematocysts. The specimens collected by the "Dana" are somewhat crumpled and mutilated, but details are sufficiently well preserved to allow an examination. The Discovery-specimen was still alive when it was brought into the laboratory of the ship; the umbrella made faint rhythmical pulsations, and after careful preservation in formalin it retained its original shape almost unaltered.

"Dana" St. 1371. Height of bell about 32 mm., the greatest diameter of the umbrella, which is somewhat laterally compressed, is about 26 mm. The manubrium (Pl. I fig. 11) is 5 mm. long, with a distinctly cruciform base, mouth with four short, crenulated lips. The gonads are of the Calycopsis-type, with about six transverse folds in each row. The canals (text-fig. 5) are somewhat irregularly branched; as seen from the figure they arise from the corners of the stomach in four unequal groups. In each group 2—5 canals diverge from each other immediately outside the corner of the stomach, a few of them proceed undivided to the ring canal, most of them bifurcate one or several times, some of them immediately before reaching the ring canal; occasional anastomoses occur. Altogether 34 canals open into the ring canal, including the small peripheral bifurcations. The bell margin is somewhat mutilated; as a rule there is one large tentacle opposite each terminal end of the canals, and in tolerably well preserved parts of the margin there is one very small tentacle and two minute, wart-like protuberances between two successive fully developed tentacles. The total number of tentacles cannot be stated.

"Dana" St. 1380. Height of bell about 26 mm., greatest diameter about 28 mm. The manubrium is lost, its basal attachment to the subumbrella is discerned as a regular cross of narrow lines (text-fig. 4), which alone represent the four primary radial canals. Each of them gives rise to four diverging canals, each of which is bifurcated about midway between its point of origin and the bell margin and sometimes once again before reaching the ring canal. Apart from one or two anastomoses the branching of the canals is very regular in this specimen. Altogether 35 canals join the ring canal. The marginal organs are as in the specimen described above.

"Discovery II" St. 3332 (Pl. I fig. 12, Pl. II fig. 2—3). Umbrella 30 mm. in height, somewhat laterally compressed, the degree of compression being only slightly more pronounced after preservation, greatest diameter 40 mm. The gelatinous substance firm and rigid, 6 mm. thick at the apex, 5 mm. in the lateral sides. The manubrium is remarkably small, 4 mm. long, slender, mouth with four small and simple lips; gonads are not developed. Though the stomach is distinctly square in cross section, its base is somewhat irregular, giving rise to 12 canals which diverge from each other immediately outside the base of the stomach, most of them bifurcated once or twice, some of them three or four times before reaching out to the ring canal; in two instances two neighbouring canals run together and become united immediately above the ring canal. Altogether 43 canals join the ring canal; about midway between the apex and the margin of the umbrella 30 canals may be counted. The proximal parts of the canals, nearest to the manubrium, are slightly broader than the distal parts, which are particularly narrow after repeated bifurcation. There are 27 fully developed tentacles, all of them broken at a short distance from their base (Pl. I fig. 12); their basal portion is deeply sunk into a narrow furrow in the umbrella margin; the tentacles have no basal swellings, and no accumulations of pigment granules are seen. Everyone of the large tentacles is placed opposite a radiating canal, and between each pair of successive large tentacles there is one very small tentacle (rarely two) and two tiny wart-like protuberances, presumably vestiges of a third series of tentacles. The small tentacles and warts are placed independently of radiating canals. The arrangement of the tentacles in this well-preserved specimen is thus in accordance with that observed in the parts of the margins of the two other specimens in which an examination was possible. The velum is narrow. The living specimen was completely colourless, except the manubrium which was faintly yellow.

I have been much in doubt of the specific identification of these three specimens. We have seen above some examples of variation in number and arrangement of canals and tentacles and the relation between tentacles and canals in various species of *Calycopsis* (*simulans, papillata, typa, chuni*), in some cases due to different stages of development, in other cases mere individual variations; some of the variations may perhaps be designated as geographical variations. All these variations, however, are so slight that they do not justify a

distinction between different species or subspecies. On the other hand, the specimens of *Sibogita* collected in the Atlantic by the "Dana" and the "Discovery II" differ from the Malayan specimens described by MAAS and BIGELOW in certain characteristic ways which render it necessary to provide them with a proper name. Their manubrium is remarkably small with only some few gonadial folds. In the Malayan specimens the four primary radial canals run straight from the manubrium to the umbrella margin sending out lateral branches towards both sides, the branches giving rise to other lateral branches of second and third order; in the Atlantic specimens the four primary radial canals are much reduced, and immediately outside the corners of the stomach they are divided into diverging branches which further down are dichotomously branched. Moreover the Atlantic specimens have a second series of small tentacles almost regularly alternating with the first series of large tentacles and in addition a third series of minute marginal warts. In the type specimen described by MAAS no small tentacles were observed, and the large tentacles were only half as numerous as the terminal ends of the radiating canals. In the specimen described by BIGELOW, however, there was a tentacle opposite every one of the canals, and moreover some few small tentacles were present between the others and unconnected with canals. To some degree, therefore, BIGELOW's specimen bridges the gap between the type specimen and the Atlantic specimens. This makes me hesitate to describe the Atlantic form as a new species, but it differs so much from the typical, Malayan form that it may be regarded as a distinct geographic race or subspecies of *Sibogita geometrica*. In spite of the much better state of preservation of the "Discovery" specimen I designate the specimen from "Dana" St. 1371 as the type specimen of this new subspecies, because it has a manubrium with well-developed gonads, whereas the "Discovery" specimen is immature.

Fam. **Russelliidae.**

Russellia mirabilis KRAMP.

Russellia mirabilis KRAMP 1957 p. 24, Pl. 4 fig. 1—6.

Material:

St. 1245. 17.II.22. 19°35′ N. 73°27′ W. E 300, 1000 m. w. 3 specimens.

This species was recently described by me in the Discovery Reports; four specimens were found in antarctic waters, and the species was so peculiar that it had to be described not merely as a new genus and species but as representative of a new family, probably related to the Calycopsidae but differing from that family in several important characters.

The present specimens are 13, 16 and 16 mm. high, and they agree with the original specimens in every structural detail, so I have nothing to add to the description. Unfortunately the "Dana" specimens as well as the "Discovery" specimens have lost the distal portions of all the tentacles, so we do not know whether they have had a terminal nematocyst knob, which might have given a clue to the determination of the systematical position of the family.

Distribution: The original specimens were taken in four localities in antarctic waters, west of Graham Land, near the South Shetlands, and east of South Georgia. It was a surprise, therefore, to find the same species in West-Indian waters, between Haïti and Cuba. Most of the antarctic specimens were taken in the upper strata, thus at very low temperatures. It is quite resonable, therefore, that the species avoids the high temperature of the surface layers in the West-Indian waters, where it was taken in a haul with 1000 m. wire out.

Fam. **Tiarannidae.**

Tiaranna rotunda (Quoy & Gaimard).

Tiara rotunda Mayer 1910 p. 124.
Tiaranna rotunda Hartlaub 1913 p. 266, fig. 218, 219.
Tiaranna rotunda Kramp 1920 p. 6, Pl. 1 fig. 2—4.

Material:

St. 4025. 9.IV.30. 35°57′ N. 5°30′ W. S 200, 50 m. w. 2 specimens. S 200, 100 m. w. 4 specimens.

This locality is in the Straits of Gibraltar, the classical locality of the species, whence it was described by Quoy and Gaimard in 1827. All the specimens taken by the "Dana" are young, 3—11 mm. in diameter; their state of preservation is not sufficiently good for a description of these developmental stages.

Distribution: Recorded from several localities in the northern Atlantic: Davis Strait, Irminger Sea, the North Sea, and the west coast of Norway; Straits of Gibraltar and adjacent parts of the Mediterranean and Atlantic; recently (Kramp 1957) also recorded from the Gulf of Guinea, off Patagonia, and from two localities in the warm deep water of the Antarctic south of Australia. It mainly belongs to the deep and intermediate strata, but in the Straits of Gibraltar it may evidently ascend into the surface layers of the water.

Chromatonema rubrum Fewkes.

Chromatonema rubrum Fewkes 1882 p. 305, Pl. 1 fig. 41.
Thaumantias rubrum Mayer 1910 p. 199.
Chromatonema rubrum Kramp 1919 p. 7, Pl. 1 fig. 1—8, text-fig. 3, 4 a.
Chromatonema rubrum Kramp 1947 p. 52, Pl. 6 fig. 7.
Chromatonema rubrum Kramp 1957 p. 25.

Material:

St. 1209. 17.I.22. 7°15′ N. 78°54′ W. E 300, 3500 m. w. 1 specimen.

The specimen is about 18 mm. in diameter; it is somewhat mutilated, but the determination is doubtless. It is the first time that this species has been found in the Pacific, *viz.* in the Gulf of Panama, and it confirms the supposition that *C. erythrogonon* (Bigelow), which is recorded from the Gulf of California to Peru, belongs to the same species.

Distribution: Generally distributed in the deep parts of the northern Atlantic from the Bermudas and the Azores northwards to Iceland and the Davis Strait; recently (Kramp 1957) recorded from South Africa and from several localities in the Atlantic and Indian sectors of the Antarctic Ocean. It is a bathypelagic species.

Leptomedusae.

Fam. **Dipleurosomidae.**

Dichotomia cannoides Brooks.

Dichotomia cannoides Brooks 1903 p. 11, Pl. 1 fig. 1—3.
Dichotomia cannoides Mayer 1910 p. 223, fig. 116.
Dichotomia cannoides Moore 1949 p. 6.

Material:

"Pennsylvania"
St. 355 9.X.11
38°45′ N. 69°56′ W.
S 200 32 m. w. **2**

"Dana"
St. 845 30.IV.20
24°46′ N. 54°08′ W.
P 150 150 m. w. **2**

St. 848 2.VI.20
18°00′ N. 64°41′ W.
S 200 300 m. w. **6**

St. 850 4.VI.20
20°39′ N. 61°48′ W.
S 200 150 m. w. **1**

St. 867 24.VI.20
28°15′ N. 56°29′ W.
S 200 150 m. w. **1**

St. 875. 1.VII.20
28°58′ N. 67°09′ W.
S 150 150 m. w. **1**

St. 1294 18.VI.22
17°43′ N. 64°56′ W.
S 200 300 m. w. **1**

St. 848 and 1294 are near the Virgin Islands in the West Indies, the other localities are north and north-east of the West-Indian islands as far north as off Delaware Bay. Previously recorded from the Bahamas (Brooks) and the Bermudas (Moore).

The 14 specimens in the present collection are 3—8 mm. in diameter, most of them 4—5 mm., usually slightly higher than wide. They agree quite well with the original description of the species, except that the branching of the radial canals is not always as regular as described by Brooks. In most of the specimens the four main radial canals arise in pairs from the ends of a short transverse canal (as in the type), and in some of them they are regularly dichotomously branched two or three times, so that 28—32 terminal branches open into the ring canal. In others the branching is more or less irregular, as seen in the figures (text-figs. 6*a*—*b*). In the specimen from St. 1294 (fig. 6*a*) each of the four canals is divided into two widely diverging

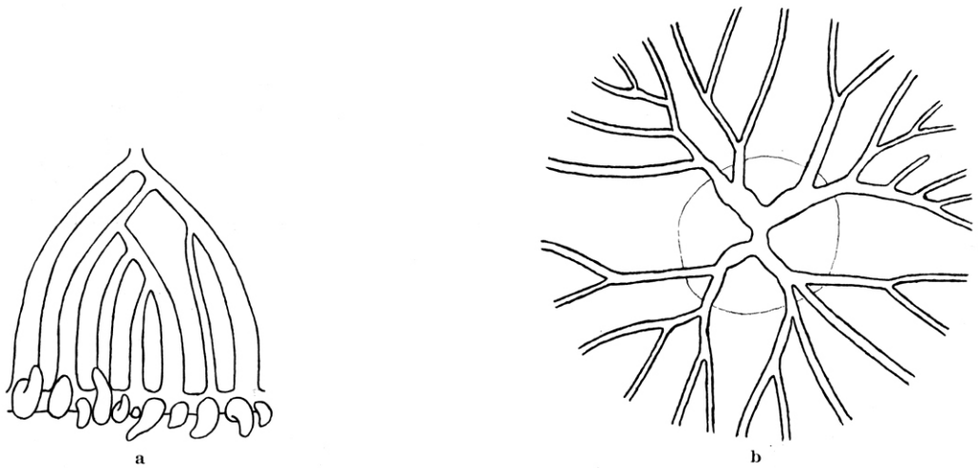

Fig. 6. *Dichotoma cannoides*. Branching of radial canals. *a*, one quadranth, with bell margin ("Dana" St. 1294); *b*, aboral view of central part of umbrella with four groups of radial canals, outline of stomach faintly indicated ("Dana" St. 850).

branches immediately outside the base of the stomach, but the further branching takes place by emission of lateral branches of first, second and third order, all the branches being collected inside the space between the two original diverging canals; in this specimen altogether 29 canals open into the ring canal. In the specimen from St. 850 the branching is somewhat more irregular (fig. 6*b*). In all the specimens which are so well preserved that it has been possible to follow the course of the canals, the terminal ends of the canals join

the ring canal at almost equal distances. Most of the canals are fairly broad, but some are quite narrow; their attachment to the subumbrella is as described and figured by BROOKS. The ring canal is also fairly broad. The manubrium is broad and about half as long as the height of the umbrella cavity.

Where it has been possible to count the tentacles, their number is usually 50—60, in the largest specimen, 8 mm. wide, as many as 70; most of them are broken at a short distance from their base. The basal bulbs are elongated pear-shaped and of very different sizes, but large and small are not regularly alternating, and their position is not always in correspondence with the canals. The tentacles are so densely crowded that they are more or less displaced up- and downwards on the umbrella margin, without regularity. According to the original description there are two kinds of tentacles in this species, 16—32 long hollow tentacles alternating with as many short, stiff, solid tentacles which are directed upwards. In the present specimens large and small tentacles differ from each other only in size; their basal bulbs are hollow, the young tentacles, some of which are fully retained, are not "solid" in the sense that their endoderm consists of a single core of cylindrical cells, but there are several rows of endoderm cells, so that even if no central cavity is present, the structure is essentially the same as in the fully developed tentacles. It is true that the small tentacles are kept in an upright position, but so are the basal bulbs of many of the large tentacles.

The numbers of terminal branches of the radial canals in proportion to the approximate numbers of tentacles in eight specimens are as follows: 25/50, 28/50, 29/50, 30/60, 30/65, 32/50, 32/55, 32/70.

Distribution: West Indies and the waters north of these islands up to about 39° N.

Fam. **Laodiceidae.**

Laodicea undulata (FORBES & GOODSIR).

Thaumantias undulata FORBES & GOODSIR 1853 p. 313, Pl. 10 fig. 7.
Laodicea cruciata MAYER 1910 p. 201.
Laodicea undulata KRAMP 1919 p. 16, Pl. 2 fig. 1—8.
Laodicea undulata RUSSELL 1953 p. 230, Pl. 14 fig. 1—3, text-fig. 123—131.

Material:

St. 850	4.VI.20	St. 4003	9.III.30	St. 4007	15.III.30	St. 4050	2—3.V.30
20°39′ N.	61°48′ W.	8°26′ N.	15°11′ W.	18°22′ N.	18°14′ W.	38°48′ N.	12°06′ E.
P 150	50 m. w. 1	S 150	3000 m. w. 1	S 200	50 m. w. 1	S 200	100 m. w. 2
				S 200	100 m. w. 1	S 200	150 m. w. 1
St. 1294	18.IV.22	St. 4005	12.III.30	S 150	2000 m. w. 1	S 200	200 m. w. 1
17°43′ N.	64°56′ W.	13°31′ N.	18°03′ W.			S 200	250 m. w. 2
S 200	100 m. w. 11	S 200	100 m. w. 6			S 200	300 m. w. 1
S 200	600 m. w. 1	S 150	1000 m. w. 1				
		S 150	2000 m. w. 1				
		S 150	2500 m. w. 1				

All specimens taken in deep hauls were probably captured in the upper strata during the hauling in or setting out of the nets.

The West-Indian specimens (St. 1294) are small, 3—4 mm. in diameter; the specimens from West Africa (St. 4003, 4005 and 4007) are 4—11 mm. wide; the specimens from the Mediterranean, near the west point of Sicily (St. 4050), are somewhat larger, 7—13 mm. in diameter. Most of the specimens are badly preserved; only in the specimens from the West Indies have I been able to state that there is an ocellus on about every third tentacle bulb.

Distribution: Common in the Mediterranean and the north-eastern Atlantic as far north as Iceland and Lofoten in Norway; also recorded from a number of localities along the west coast of Africa southwards to the Cape of Good Hope. In the western Atlantic it ranges from the Gulf of Maine to the West Indies, and it has also been found near the coast of Brazil, about 10° S., and on the Patagonian Bank.

Orchistoma pileus (LESSON).

Mesonema pileus LESSON 1843 p. 317. Pl. 6 fig. 1.
Orchistoma pileus MAYER 1910 p. 211. Pl. 25 fig. 1—4.

Material:

St. 1294. 18.IV.22. 17°43′ N. 64°56′ W. S 200, 300 m. w. 9 specimens.

The specimens are badly preserved, but I have no doubt of the correctness of the determination.

Distribution: ? West Africa (LESSON); Florida, Bahamas, and south of Cuba. Now found near the Virgin Islands.

"Orchistoma" tentaculata MAYER.

Orchistoma tentaculata MAYER 1900 *a* p. 8, Pl. 5 fig. 19.
Orchistoma tentaculata MAYER 1910 p. 212, Pl. 24 fig. 1.

Material:

"Agent Petersen" St. 301. 16.VI.11. 38°50′ N. 50°50′ W. S 100, 19 m. w., 1 specimen.

The locality is north-east of the Bermuda Islands. The specimen is somewhat mutilated, 5.5 mm. wide and about 4 mm. high, with dome-shaped apical jelly. The stomach is torn but has been broad. There are 22 unbranched radial canals issuing from the periphery of the stomach, all extending to the ring canal; the radial canals are ribbon-like, the ring canal narrow. Altogether 59 tentacles, 8 of which are distinctly larger than all the others. The large tentacles have a broadly conical or somewhat pear-shaped basal bulb, flattened on the abaxial side, without ocelli and without an adaxial papilla; these tentacles have apparently been long, one of them is spirally coiled at the tip. The small tentacles are densely crowded; they have no basal swellings, and most of them are directed outwards from the umbrella margin. Cordyli have not been observed in this species, but in the present specimen a few minute appendages may possibly be mutilated cordyli. The velum is lost.

I have no doubt but that this specimen belongs to the same species which was described by MAYER from a single specimen taken at Newport, Rhode Island. Since, however, the presence of cordyli has not been stated with certainty, its systematic position remains doubtful.

Distribution: Off the Atlantic coast of North America.

Toxorchis polynema n. sp.

Pl. I fig. 13, Pl. II fig. 4.

Material:

St. 3988. 23.II.30. 15°52′ S. 6°02′ W. S 200, 50 m. w. 1 specimen, which is the **type specimen.**

Description: Umbrella flat and thin, 17 mm. in diameter. Manubrium broad and flat, mouth with broad crenulated lips; the aboral surface of the stomach is attached to the subumbrella along the margins of a perradial cross consisting of two pairs of diverging branches united by a short bridge. Near the margin of the stomach each of the cross-arms is divided into two diverging furrows, each of which gives rise to two radial canals running to the umbrella margin. The result of this branching process is the formation of four groups of radial canals, each consisting of four canals arranged in two pairs. The branching is thus typically dichotomous, but it takes place inside the cruciform base of the stomach. The terminal ends of the radial canals, where they join the ring canal, are not equidistant, but the number of tentacles between two successive canals varies from 5 to about 40. There are 16 elongated gonads (female) along the proximal 3/5 or 2/3 of the radial canals, so that also the gonads are arranged in four groups with two pairs of gonads in

each group. The proximal ends of the gonads in each pair are very close together, but they are not confluent. The gonads are somewhat sinuous, broader in their proximal than in their distal ends; they are divided by a median line along their ventral edge. The distal portions of the radial canals free of gonads are very narrow, and the ring canal is also narrow.

The marginal tentacles (Pl. I fig. 13) are very numerous and all alike; parts of the umbrella margin are somewhat mutilated, but the greater part is retained, and the number of tentacles may be estimated at about 320. The basal bulbs of the tentacles are broadly pear-shaped, most of the tentacles are broken near their base, but some of them have retained their filiform part, which is either densely spirally coiled or extended to a length of $3^1/_2$—4 mm. and very thin. The cordyli are slightly club-shaped, somewhat shorter than the broad parts of the tentacle bulbs, each mounted on a minute marginal protuberance, and they have no nematocysts. Most of the cordyli are lost, but apparently there has been one between every successive pair of tentacles. Velum very narrow.

MAYER (1910 p. 228) gives the following diagnosis of the genus *Toxorchis*: "Thaumantiadae with 4, 6, or more main radial canals which branch regularly and dichotomously one or more times. The gonads are upon the outermost branches of the radial canals, near the ring-canal. Numerous tentacles, cirri, and marginal clubs". (The term "near the ring canal" must, however, be excluded from the diagnosis, since in all the species the radial canals have a considerable distal part free of gonads). The type species is *Toxorchis arcuatus* HAECKEL from the Canary Islands, which has six radial canals bifurcated once, and 24 tentacles; cordyli and spiral cirri are present. *T. kellneri* MAYER (1910), which occurs off the American coast from Cape Cod to Florida, has 8 radial canals bifurtated once, about 32 tentacles and about 50 cordyli. *Dipleurosoma brooksi* MAYER (1910) may probably also be referred to *Toxorchis*; it was found at the Bahamas, and it has 8 principal radial canals, four of which have two lateral branches opposite each other, whereas the four other radial canals are unbranched, and 16 tentacles (+ two small ones); cordyli are not mentioned in the description, which is based on a drawing made by the late W. K. BROOKS, but the figure distinctly shows a club-shaped marginal body between each successive pair of tentacles. The new species described above agrees with the diagnosis of the genus, except that no cirri are observed, but it cannot be confounded with any of the three species mentioned above.

MAYER (1910 p. 228) also refers *Berenix thalassina* PÉRON & LESUEUR (1809) to *Toxorchis*; it was found in northern Australia, and it was 50 mm. in diameter with about 70—100 tentacles; it had six primary radial canals, dichotomously branched several times, each with about 16 terminal branches. Cordyli were not seen by PÉRON, but MAYER may be right that *Cladocanna polyclada* HAECKEL, from New Guinea, belongs to the same species; it has a similar number of canals and tentacles, and it has marginal clubs and cirri; unfortunately it was not figured. According to the pretty figure given by PÉRON & LESUEUR the mode of branching of the radial canals in *T. thalassina* is very similar to that in the new species *T. polynema*, but it has six principal radial canals, and they are much more branched.

Toxorchis polynema n. sp. is well characterized by having four principal radial canals twice dichotomously branched, and very numerous tentacles.

Fam. **Mitrocomidae.**

Tiaropsis multicirrata (M. SARS).

Thaumantias multicirrata M. SARS 1835 p. 26. Pl. 5 fig. 12 *a—c*.
Tiaropsis diademata L. AGASSIZ 1849 p. 289. Pl. 6 fig. 1—18, Pl. 8 fig. 11.
Thaumantias eschscholtzii HAECKEL 1879, p. 129. Pl. 8 fig. 4.
Tiaropsis multicirrata KRAMP 1932 p. 364. Fig. 14, 15, 20, 35, 48 (full synonymy).
Tiaropsis multicirrata RUSSELL 1953 p. 278. Pl. 17 fig. 1, text-fig. 167—171.

Material:

St. 4019. 30.III.30. 33°08′ N. 10°22′ W. S 200, 50 m. w. 1 specimen.

The specimen is 5 mm. in diameter, somewhat mutilated, but there is no doubt of the identification. The locality, which is in the mouth of the Bay of Cadiz, is considerably farther south than the previously known area of distribution of this species.

Distribution: Common in the coastal waters of the northern Atlantic and adjacent waters; it occurs from Woods Hole on the American coast northwards to about 70° N. on the coasts of Baffin Land and Greenland; its occurrence in north-western Europe ranges from the English Channel to the north coast of Iceland and along the Norwegian coast to the Barents Sea. Also recorded from the Tschukotski Sea north of Siberia and from the Bering Sea.

Fam. **Phialuciidae.**

Octophialucium funerarium (Quoy & Gaimard).

Dianaea funeraria Quoy & Gaimard 1827 p. 184. Pl. 6 fig. 10—15.
Octocanna funeraria Maas 1911 p. 3.
Octocanna funeraria Kramp & Damas 1925 p. 306, fig. 27—33.
Octophialucium funerarium Kramp 1955 p. 260.

Material:

St. 4025. 9.IV.30. 35°57′ N. 5°30′ W. S 200, 50 m. w. 7 specimens. S 200, 100 m. w. 8 specimens. S 200, 300 m. w. 8 specimens. S 200, 600 m. w. 12 specimens.
St. 4158. 17.VI.30. 46°28′ N. 8°01′ W. S 200, 950 m. w. 1 specimen.

In a recent paper (Kramp 1955) I have given reasons for the view that the generic name *Octocanna* Haeckel (1879) must be cancelled, because the two species, for which Haeckel erected this genus, are unrecognizable. For the other species, which later on had been referred to *Octocanna*, I introduced the new name *Octophialucium*. I also demonstrated the near relation between these species and the species of the genus *Phialucium* Maas and united the two genera into the new family Phialuciidae.

The specimen from St. 4158 in the Bay of Biscay is much damaged; it has probably been about 30 mm. in diameter. The other specimens, which were taken in the Straits of Gibraltar, the classical locality of the species, are likewise rather badly preserved, the tentacles cannot be counted in any of them, but most of them could be measured. They vary in size between 7 and 19 mm. in diameter, without relation to the depth in which they were captured; among 31 specimens 21 are between 10 and 13 mm. wide, 4 are less than 10 mm., 6 are more than 13 mm. Three specimens have only 7 radial canals, all the others have the normal number of eight.

Distribution: Fairly common in the Mediterranean and in some of the deep Norwegian fjords, once recorded from west of Scotland; St. 4158 in the Bay of Biscay connects these two areas of distribution. It is a medusa belonging to the deep and intermediate strata, and it is very interesting that at St. 4025 in the Straits of Gibraltar it was collected in the upper water layers.

Octophialucium sp.

Material:

St. 1294. 18.IV.22. 17°43′ N. 64°56′ W. S 200, 100 m. w. 2 specimens.

The specimens are about 18 mm. in diameter, one with eight, the other probably with nine radial canals; both specimens are very badly preserved, and their tentacles cannot be counted. It is deplorable that the species cannot be identified, since this is the first time that an *Octophialucium* has been found in the western Atlantic.

Fam. **Eirenidae.**

Philopsis diegensis Torrey.

Phialopsis diegensis Torrey 1909 p. 23. Fig. 9.
Eirene diegensis Ranson 1934 *a* p. 275.
Phialopsis diegensis Russell 1953 p. 333. Pl. 20 fig. 5; text-fig. 213, 214.
Phialopsis diegensis Kramp 1957 p. 35.

Material:

St. 3996 25.II.30
15°41′ S. 5°50′ W.
S 150 1000 m. w. **2**

St. 3998 1.III.30
7°34′ S. 8°48′ W.
S 150 2000 m. w. **2**
S 150 3000 m. w. **1**

St. 4000 4.III.30
0°31′ S. 11°02′ W.
S 200 600 m. w. **1**

St. 4003 9.III.30
8°26′ N. 15°11′ W.
S 200 100 m. w. **2**
S 200 300 m. w. **10**
S 150 1000 m. w. **1**
S 150 2000 m. w. **1**
S 150 3000 m. w. **2**
S 150 5000 m. w. **1**

St. 4005 12.III.30
13°31′ N. 18°03′ W.
S 200 50 m. w. **11**
S 200 100 m. w. **5**
S 200 300 m. w. **2**
S 200 600 m. w. **1**
S 150 1000 m. w. **3**
S 150 2500 m. w. **1**

St. 4007 15.III.30
18°22′ N. 18°14′ W.
S 200 300 m. w. **1**
S 150 2000 m. w. **2**

St. 4009 18.III.30
24°36.5′ N. 17°27′ W.
S 200 300 m. w. **1**
S 150 3500 m. w. **1**

St. 4017 27.III.30
29°11′ N. 14°14′ W.
S 200 50 m. w. **1**
S 200 100 m. w. **1**
S 150 1500 m. w. **1**

St. 4019 30.III.30
33°08′ N. 10°22′ W.
S 200 300 m. w. **2**

All the specimens are in a very bad condition, but by comparison with other specimens from neighbouring localities they could be identified.

Distribution: Though this is a Leptomedusa, it has a predominantly oceanic distribution. All the stations mentioned above are off the west coast of Africa, where the species has previously been found in several localities. It is also recorded from off the coast of Uruguay in South America, from South Africa and from Somaliland on the east coast of Africa. In the northern Atlantic it has been found south-west of Ireland, east of Newfoundland, and in the Irminger Sea. In the eastern Pacific it is recorded from a locality south-west of the Galapagos Islands and from San Diego in California, whence it was first described by Torrey.

Fam. **Aequoreidae.**

Aequorea aequorea (Forskål).

Medusa aequorea Forskål 1775 p. 110, 1776 Pl. 32.
Aequorea forskalea Péron & Lesueur 1809 p. 336.
Aequorea forskalea Russell 1953 p. 342. Pl. 21 fig. 3, Pl. 32 fig. 1—2, text-fig. 220—221.

Material:

St. 299. 13.VI.11. 37°05′ N. 54°34′ W. S 100, 34 m. w., 1 specimen.
St. 4195. 22.VI.31. 41°55′ N. 32°22′ W. S 200, 50 m. w., 1 specimen.

The specimen from St. 299 is 58 mm. in diameter, that from St. 4195 is young specimen, 18 mm. wide, with about 72 radial canals; number of tentacles estimated at about 20.

Distribution: European coasts from Portugal to about 66° N. off the west coast of Norway; Mediterranean Sea; Atlantic coast of North America from Florida to Cape Cod; recorded from scattered localities on the west coast of Africa between Cape Verde and the Cape of Good Hope; Patagonian coast of South America. The locality mentioned above is near the Azores. Records from the Pacific coast of North America are doubtful.

Aequorea macrodactyla (Brandt).

Mesonema macrodactylum Brandt 1838 p. 359. Pl. 5.
Aequorea maldivensis Browne 1905 p. 732. Pl. 56 fig. 4—12.
Aequorea macrodactylum Bigelow 1909 *a* p. 174. Pl. 36 fig. 5—10.
Aequorea macrodactyla Mayer 1910 p. 333.
Aequorea macrodactyla Kramp 1953 p. 294.
Aequorea pensilis Russell 1953 p. 355. Pl. 33 fig. 1—5; text-fig. 220 C, D, 225.

Material:

St. 1192 15.XII.21
17°43.4′ N. 64°43.3′ W.
S 200 100 m. w. **1**

St. 1208 16.I.22
6°48′ N. 80°33′ W.
E 300 1000 m. w. **7**

St. 1225 2.II.22
23°58′ N. 83°22′ W.
E 300 1000 m. w. **1**

St. 3975 31.I.30
35°42′ S. 18°37′ E.
S 150 1500 m. w. **4**
S 150 2000 m. w. **3**
S 150 2500 m. w. **3**

St. 3980 17.II.30
23°26′ S. 3°56′ E.
S 150 2000 m. w. **1**

St. 3988 23.II.30
15°52′ S. 6°02′ W.
S 200 50 m. w. **4**

St. 3996 25.II.30
15°41′ S. 5°50′ W.
S 200 50 m. w. **10**
S 200 100 m. w. **6**
S 200 300 m. w. **9**
E 300 1000 m. w. **8**
S 150 1000 m. w. **3**
S 150 1500 m. w. **6**
S 150 2000 m. w. **19**
S 150 3000 m. w. **47**
E 300 4000 m. w. **3**

St. 3998 1.III.30
7°34′ S. 8°48′ W.
S 200 600 m. w. **1**

As previously stated by me (Kramp 1953) *A. pensilis* (Haeckel) and *A. macrodactyla* (Brandt) are two distinct species, distinguished from each other mainly by the structure of the tentacle bulbs, which in *A. macrodactyla* are provided with an abaxial longitudinal keel and spur and a prominent adaxial excretory papilla, whereas in *A. pensilis* the bulbs have long lateral extensions and no keel, and the excretory pore is not mounted on a papilla. As a rule *A. pensilis* has many more radial canals than *A. macrodactyla* of corresponding size, but in numerical respect both species are very variable and overlap each other. Both are widely distributed in the Pacific and Indian Oceans, but *A. pensilis* does not seem to occur in the Atlantic, whence *A. macrodactyla* is recorded several times.

In most of the specimens collected by the "Dana" counting of radial canals and tentacles was impossible, but I shall give the available data.

The specimen from St. 1192, near the Virgin Islands in the West Indies, is about 25 mm. wide; the specimen from St. 1225, between Cuba and Florida, is 70 mm. wide with 83 radial canals and probably about 17 tentacles. St. 1208 is in the Gulf of Panama; the seven specimens taken here are small and have the following numbers of radial canals:

Diameter, mm	5	8	9—10	12
Radial canals	26	?	29—31	27—34

All the other stations are off the west coast of Africa, and their dimensions may be treated collectively.

Diameter mm.	Radial canals	Tentacles	Diameter mm.	Radial canals	Tentacles
5	26	6	12	34	?
6	36	4	13	32	?
8	34	7	14	28	?
8	39	?	14	32	7
9	31	?	15	32	7
12	33	6	15	35	11
12	33	?	17	28	7
12	34	5			

The variation in number of radial canals and tentacles is thus not very great in this collection.

It is rather peculiar that *A. macrodactyla*, which usually occurs in the upper strata, was taken by the "Dana" in hauls with very different lengths of wire out. It seems to me most probable that all of them were actually captured in the surface water, where this, as well as other species of *Aequorea*, may sometimes be

seen in dense shoals. This impression is confirmed by the following measurements of the specimens taken in hauls with different lengths of wire; if the specimens had really been captured at so many different levels down to about 2000 metres below the surface, one should expect to find a certain characteristic vertical dispersion of the various size-groups. The figures show, however, that the specimens vary within very nearly the same limits at all "depths":

Length of wire m.	Number of specimens	Diameter mm.	Length of wire m.	Number of specimens	Diameter mm.
50	13	8—17	1500	10	5—14
100	6	13—16	2000	23	5—12
300	9	5—13	2500	3	6—12
600	1	9	3000	47	5—17
1000	11	5—13	4000	3	8—10

No adult specimens were taken in the series of stations off the African coast. This may possibly be due to the season (February).

Distribution: Widely distributed in the warm parts of the Indian and Pacific Oceans from Africa to America. Also recorded from Great Fishbay (THIEL 1938 p. 332) and several other localities off the southern part of the west coast of Africa and from the Patagonian coast of South America (KRAMP 1957). According to RUSSELL (1953) it may occur in the English Channel. Now also found in the West Indies, whence it has not previously been recorded.

Aequorea sp.

Material:

St. 1192. 15.XII.21. 17°43.4′ N. 64°54.3′ W. S 200, 300 m. w., 1 specimen.
St. 1294. 18.IV.22. 17°43′ N. 64°56′ W. S 200, 100 m. w., 1 specimen.
St. 1314. 22.IV.22. 17°43′ N. 64°56′ W. E 300, 1000 m. w., 1 specimen.

Fragmentary specimens which may possibly belong to *A. macrodactyla*. The localities are near the Virgin Islands in the West Indies.

Zygocanna vagans BIGELOW.

Zygocanna vagans BIGELOW 1912 p. 255.
Zygocanna vagans BIGELOW 1919 p. 315. Pl. 42 fig. 5—7, Pl. 43 fig. 6.
Zygocanna vagans BIGELOW 1940 p. 299. Fig. 14.
Zygocanna vagans KRAMP 1957 p. 40.

Material:

St. 4195. 22.VI.31. 41°55′ N. 32°22′ W. S 200, 300 m. w., 1 specimen.

The specimen is in a fairly good condition, 50 mm. in diameter, flat and rigid. It agrees perfectly with BIGELOW's descriptions. The variability and irregularities of the branching of the radial canals are pointed out by BIGELOW; the way of branching in the present specimen is illustrated in text-fig. 7. The thoroughly dichotomous branching takes place entirely inside the periphery of the stomach, which is about 17 mm. in diameter measured between its outermost lobes. As a matter of fact, therefore, it is not the canals themselves which are branched, but "rather the lines on the roof of the manubrium, which represent their location at early stages" (BIGELOW). The branching originates from three diverging central trunks, each of which soon bifurcates, and the repeated bifurcation results in 41 canals leaving the periphery of the stomach; one, and only one, of the canals, is further bifurcated twice before reaching the umbrella margin. The "canals" inside the periphery of the stomach may approximately be divided into six groups consisting of 8, 7, 5, 6, 6 and 9 terminal branches. The numbers of marginal tentacles corresponding to the six groups of canals are respectively: 6, 5, 5, 6, 6 and 6; the total number of tentacles thus is 34. Between successive tentacles

there are sometimes two, but usually 3—4 rudimentary marginal knobs. There is a radiating row of prominent gelatinous papillae on the subumbrella between each successive pair of radial canals, exactly as in the specimens described by BIGELOW.

BIGELOW is inclined to think that the two medusae from the Malayan Archipelago, described by MAAS (1905 p. 44), belong to *Zygocanna vagans*. They are young specimens, 20—22 mm. wide, and the branching of the radial canals mainly takes place outside the periphery of the stomach. There is the possibility that by further development the stomach may grow outwards beyond the basal parts of the canals with the result that their branching portions will be situated inside the periphery of the stomach as in *Z. vagans*. According to the figure of the marginal organs (MAAS Pl. 8 fig. 53) the basal bulbs of the tentacles in his specimens are

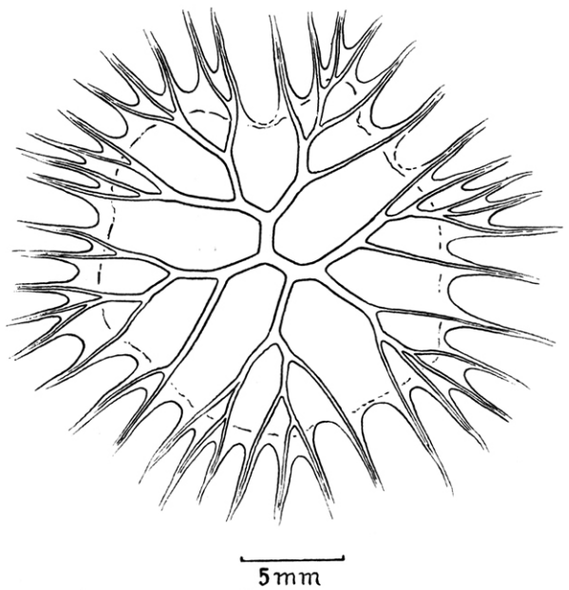

Fig. 7. *Zygocanna vagans*. aboral view of stomach, showing branching of radial canals (P. WINTHER del.).

considerably broader and shorter than in *Z. vagans*, and excretory papillae seem to be absent, whereas in *Z. vagans* the tentacle bulbs as well as the rudimentary marginal knobs are provided with particularly long and prominent excretory papillae. BIGELOW may be right in his assumption, but some doubt of the identity seems to me to remain.

Distribution: The specimens described by BIGELOW were collected in two widely separated parts of the Pacific, the Philippines and the Gulf of Panama. A specimen was taken by the "Discovery" near the Cape of Good Hope in South Africa (KRAMP 1957) and the locality where it was found by the "Dana" is near the Azores. It is very interesting that, apart from minor individual variations in numerical respects, the specimens found in these four widely separated areas agree so perfectly in all structural details; in this species no indication of geographical variation may be pointed out.

Trachymedusae.

Fam. **Halicreidae.**

Halicreas minimum Fewkes.

Halicreas minimum Fewkes 1882 p. 306.
Halicreas papillosum Vanhöffen 1902 p. 68. Pl. 9 fig. 7, 8, Pl. 11 fig. 30.
Halicreas papillosum Bigelow 1909 *a* p. 138. Pl. 3 fig. 3, Pl. 33 fig. 8, 9, Pl. 34 fig. 1—3, 5, 8, 10, 11.
Halicreas minimum Bigelow 1938 p. 122.
Halicreas minimum Kramp 1947 p. 7. Pl. 6 fig. 3.
Halicreas minimum Kramp 1957 p. 47.

Material:

St. 1156 25.X.21
25°11′ N. 20°57′ W.
6000 m. w. **1**

St. 1185 27.XI.21
17°41′ N. 60°50′ W.
E 300 6000 m. w. **2**

St. 1203 11.I.22
7°30′ N. 79°19′ W.
E 300 2500 m. w. **1**
E 300 3500 m. w. **6**

St. 1206 14.I.22
6°40′ N. 80°47′ W.
E 300 4500 m. w. **30**

St. 1208 16.I.22
6°48′ N. 80°33′ W.
E 300 3500 m. w. **30**
E 300 3600 m. w. **30**

St. 1209 17.I.22
7°15′ N. 78°54′ W.
E 300 3500 m. w. **15**

St. 1217 29.I.22
18°50′ N. 79°07′ W.
E 300 4000 m. w. **1**

St. 1228 3.II.22
23°35′ N. 81°54′ W.
E 300 1000 m. w. **1**

St. 1239 12.II.22
25°50′ N. 76°55′ W.
S 150 3000 m. w. **1**
S 150 4000 m. w. **5**
E 300 4500 m. w. **4**

St. 1242 14.II.22
24°05′ N. 74°36′ W.
E 300 4000 m. w. **2**

St. 1247 20.II.22
17°57′ N. 72°51′ W.
E 300 1000 m. w. **1**

St. 1261 9.III.22
19°04′ N. 65°43′ W.
S 150 4000 m. w. **3**

St. 1267 14.III.22
17°56′ N. 64°50′ W.
E 300 4500 m. w. **2**

St. 1269 15.III.22
17°13′ N. 64°58′ W.
E 300 4500 m. w. **2**

St. 1288 10.IV.22
16°04′ N. 61°52′ W.
E 300 1500 m. w. **1**

St. 1342 15.V.22
34°00′ N. 70°01′ W.
E 300 4500 m. w. **2**

St. 1387 25.VI.22
46°28′ N. 8°01′ W.
E 300 5000 m. w. **6**

St. 3975 31.I.30
35°42′ S. 18°37′ E.
E 300 1000 m. w. **13**
S 150 1000 m. w. **12**
S 150 2500 m. w. **2**
E 300 3000 m. w. **30**

St. 3978 13.II.30
30°15′ S. 13°15′ E.
S 150 2000 m. w. **7**
S 150 3000 m. w. **27**
S 150 4000 m. w. **15**
E 300 5000 m. w. **9**

St. 3980 17.II.30
23°26′ S. 3°56′ E.
S 150 2000 m. w. **3**
S 150 3000 m. w. **11**
S 150 4000 m. w. **2**
S 150 5000 m. w. **2**
E 300 6000 m. w. **1**

St. 3996 25.II.30
15°41′ S. 5°50′ W.
S 150 2000 m. w. **10**
S 150 3000 m. w. **11**
E 300 4000 m. w. **8**

St. 3998 1.III.30
7°34′ S. 8°48′ W.
S 150 2000 m. w. **17**
S 150 3000 m. w. **5**
S 150 4000 m. w. **5**
S 150 5000 m. w. **3**
E 300 6000 m. w. **11**

St. 4000 4.III.30
0°31′ S. 11°02′ W.
E 300 1000 m. w. **14**
S 150 2000 m. w. **1**
S 150 3000 m. w. **12**
S 150 4000 m. w. **12**
S 150 5000 m. w. **12**
E 300 6000 m. w. **25**

St. 4003 9.III.30
8°26′ N. 15°11′ W.
E 300 1000 m. w. **3**
S 150 2000 m. w. **11**
S 150 3000 m. w. **2**
S 150 4000 m. w. **3**
S 150 5000 m. w. **3**
E 300 6000 m. w. **12**

St. 4005 12.III.30
13°31′ N. 18°03′ W.
S 200 600 m. w. **2**
E 300 1000 m. w. **80**
S 150 1000 m. w. **10**
S 150 2500 m. w. **8**
S 150 3500 m. w. **14**
E 300 4000 m. w. **14**

St. 4007 15.III.30
18°22′ N. 18°14′ W.
E 300 1000 m. w. **72**
S 150 1000 m. w. **16**
S 150 2000 m. w. **13**
S 150 2500 m. w. **29**
S 150 3000 m. w. **19**
S 150 3500 m. w. **27**
E 300 4000 m. w. **115**

St. 4009 18.III.30
24°36.5′ N. 17°27′ W.
S 150 2500 m. w. **12**
S 150 3000 m. w. **18**
S 150 3500 m. w. **8**
E 300 4000 m. w. **17**

St. 4017 27.III.30
29°11′ N. 14°14′ W.
S 150 3000 m. w. **2**
S 150 4000 m. w. **2**
E 300 5000 m. w. **2**

St. 4019 30.III.30
33°08′ N. 10°22′ W.
S 150 3000 m. w. **1**
E 300 4000 m. w. **1**

St. 4158 17.VI.30
46°28′ N. 8°01′ W.
S 150 4000 m. w. **1**
S 150 4500 m. w. **1**
E 300 5000 m. w. **7**
S 150 5500 m. w. **1**

Almost all the specimens are badly preserved, as a rule only the gelatinous disk is left, but even so the species may be determined with security by means of the gelatinous marginal warts. The diameter has been measured, when it was possible, in order to see, whether any correlation between the size of the specimens and their bathymetrical occurrence might be pointed out. The number of specimens found in different parts of the areas investigated presents some points of interest.

Very few specimens were taken at St. 1156 south-west of the Canary Islands, St. 1342 north-west of the Bermudas, and St. 1387 and 4158 in the Bay of Biscay. The species likewise seems to be scarce in West-Indian waters, St. 1185 and 1217—1288; it has not previously been recorded from this area. At St. 1203—1209 in the Gulf of Panama it was rather abundant.

St. 3975—4019 is an interesting series off the west coast of Africa from near the Cape of Good Hope to Morocco. The number of specimens taken at each of the eleven stations of this series is very variable and may roughly be illustrated by the following figures:

Station number	Average number of specimens per one haul	Maximal number of specimens in one haul
3975	19	30
3978	14.5	27
3980	4	3
3996	10	11
3998	8	17
4000	13	25
4003	11	12
4005	21	80
4007	42	115
4009	14	18
4017	2	2
4019	1	1

Though these figures do not give an exact impression of the quantity of the medusa in the various parts of this tract, they clearly show that it was particularly abundant at St. 3975 and 3978 near the southernmost part of the African coast, and at St. 4005 and 4007, which are near the coast between Cape Verde and Cape Blanco, whereas it was less common in the off-shore area between the Cape of Good Hope and Cape Verde and again decreasing remarkably in number in the coastal waters off Rio de Oro and Morocco. Considering that this species is a distinctly oceanic, bathypelagic medusa, it seems peculiar that it was less abundant in the off-shore areas than in the neighbourhood of the coasts. It should be remembered, however, that upwelling of cold deep water towards the coast is particularly pronounced just off the two parts of the African coast, where *Halicreas* was so very abundant. The upwelling does not directly concern the deep strata inhabited by this medusa, but the upwelling brings about an increased production of nutritive matters in the upper strata, resulting in the development of a dense population of pelagic animals, and this effect is transmitted downwards to the inhabitants of the psychrosphere and improve their conditions of life. The abundance of *Halicreas* near the coasts of South-West Africa and the Cape Verde region is most probably due to particularly favourable food conditions in these tracts. Upwelling also takes place further north off the Mauretanian coast; nevertheless *Halicreas* was scarce in this tract, decreasing remarkably in number from St. 4009 to 4017 and 4019. This is most probably due to the outflow of water from the Mediterranean causing a comparatively high temperature of the lower strata, as seen from the following examples of the hydrographical observations:

Station number	Temperatures[1]) at: 600 m.	1000 m.	2000 m.
4005	8.0°	5.6°	3.4°
4007	8.7°	6.3°	3.5°
4009	9.75°	7.15°	3.7°
4017	11.1°	8.3°	4.4°
4019	10.6°	9.8°	4.3°

The medusa was still moderately common at St. 4009 in hauls with 2500 to 4000 m. wire, but very rare at the two northernmost stations, where it was entirely lacking in hauls with less than 3000 m. wire, a few

[1]) All temperatures in the present paper are given in centigrades.

specimens being found in the deepest strata, where the increase in temperature was not so remarkable. This is in good accordance with the general occurrence of this bathypelagic medusa.

Owing to the use of open nets, the depths in which the specimens have actually been captured cannot be stated with certainty. The maximal depth may, however, be determined, and measurements of the specimens give some idea of the bathymetrical distribution of the different stages of development, as seen from the following measurements of specimens found off the west coast of Africa:

Length of wire m.	Size-limits of the specimens mm.
600	8—14
1000	8—18 (27)
2000	8—34
3000	6—37
4000	10—38
5000	10—38
6000	8—35

During the investigations by the "Dana" *Halicreas* was taken with 600 m. wire out on only one occasion, at St. 4005, near Cape Verde, when two specimens were found at this comparatively high level, both of them small. With the exception of one specimen, 27 mm. wide, which was found at St. 3975 near the Cape of Good Hope, all the specimens taken in hauls with 1000 m. wire were less than 18 mm. in diameter. At greater depths all sizes were represented, varying from 6 to 38 mm. in diameter. Some of the specimens taken in the deep hauls may have been captured at higher levels, but the figures clearly show that adult specimens were found only in hauls with 2000 m. wire or more, whereas young individuals may ascend into somewhat higher levels. Measurements of the specimens from the Gulf of Panama give similar results; in the hauls with 3500 and 4500 m. wire the umbrella of the medusae varied in size between 14 and 41 mm.; the only specimen taken with 2500 m. wire was only 23 mm. wide. The few specimens from the West Indies were all fairly small, 18—26 mm. wide.

Distribution: *Halicreas minimum* is a bathypelagic medusa, probably generally distributed in the deep parts of all the oceans except the Mediterranean and the arctic basins. In the Atlantic it occurs as far north as off the south coast of Iceland and into the southern part of Davis Strait. It was not previously known from the West-Indian waters, where the "Dana" found it in several localities. Its southward distribution extends almost to the slope of the Antarctic Continent, in the Atlantic as well as in the Indian sector. It is abundant in the eastern tropical Pacific and also recorded from the Bering Sea, the Sea of Ochotsk, Japan, the Philippines, the Malayan Archipelago and off North-East and South-East Australia, whereas it has not yet been recorded from the central and southern parts of the Pacific.

Haliscera bigelowi Kramp.

Homoeonema alba Bigelow 1909 *a* p. 142. Pl. 3 fig. 1, 2, Pl. 33 fig. 6, 11, Pl. 34 fig. 9.
Haliscera bigelowi Kramp 1947 p. 8. Pl. 1 fig. 5—8, Pl. 2 fig. 1, 2.
Haliscera bigelowi Kramp 1948 *b* p. 6.
Haliscera bigelowi Russell 1953 p. 456. Pl. 27 fig. 2; text-fig. 301, 302.

Material:

St. 4003 9.III.30 8°26′ N. 15°11′ W. S 150, 3000 m. w. 15 specimens.
St. 4017 27.III.30 29°11′ N. 14°14′ W. S 150, 4000 m. w. 1 specimen.
St. 4158 18.VI.30 46°28′ N. 8°01′ W. S 150, 1500 m. w., 50 specimens, S 150, 2000 m. w., 5 specimens, S 150, 3000 m. w., 6 specimens, S 150, 4000 m. w., 1 specimen, E 300, 5000 m. w., 6 specimens, S 150, 5500 m. w., 3 specimens.

This species is quite different from *Haliscera alba* which has never been found again since it was insufficiently described by Vanhöffen (1902) from a locality south-west of Africa.

Distribution: The previous records of *Haliscera bigelowi* are partly from the eastern tropical Pacific (BIGELOW), partly from the northern Atlantic ranging from about 45° N. towards the south coast of Iceland. It is interesting that it has now been found off the northern part of the west coast of Africa. It is a predominantly bathypelagic species.

Botrynema brucei BROWNE.

Halicreas glabrum VANHÖFFEN 1902 p. 70. Pl. 9 fig. 3.
Botrynema brucei BROWNE 1908 p. 239. Pl. 1 fig. 8, 9, Pl. 2 fig. 1.
Botrynema brucei VANHÖFFEN 1912 *a* p. 382. Pl. 25 fig. 5; text-fig. 18, 19.
Botrynema brucei KRAMP 1942 p. 77.
Botrynema brucei KRAMP 1947 p. 11. Pl. 1 fig. 9, Pl. 2 fig. 3, Pl. 6 fig. 4.
Botrynema brucei KRAMP 1948 *b* p. 6.
Botrynema brucei RUSSELL 1953 p. 459. Pl. 27 fig. 1; text-fig. 303, 304.

Material:

St. 1239 12.II.22
25°50′ N. 76°55′ W.
S 150 4000 m. w. **1**
E 300 4500 m. w. **3**

St. 1342 15.V.22
34°00′ N. 70°01′ W.
E 300 4500 m. w. **2**

St. 3978 13.II.30
30°15′ S. 13°15′ E.
S 150 4000 m. w. **2**

St. 3980 17.II.22
23°26′ S. 3°56′ E.
S 150 5000 m. w. **1**
E 300 6000 m. w. **1**

St. 3996 25.II.22
15°41′ S. 5°50′ W.
E 300 4000 m. w. **2**

St. 3998 1.III.30
7°34′ S. 8°48′ W.
S 150 2000 m. w. **1**
S 150 3000 m. w. **1**
S 150 4000 m. w. **1**

St. 4000 4.III.30
0°31′ S. 11°02′ W.
S 150 4000 m. w. **2**
S 150 5000 m. w. **2**
E 300 6000 m. w. **2**

St. 4158 18.VI.30
46°28′ N. 8°01′ W.
S 150 5500 m. w. **1**

As previously stated by me "*Halicreas glabrum*" VANHÖFFEN was not described in a recognizable way, and the accompanying figure was misleading. I therefore preferred to use the name *Botrynema brucei* BROWNE for this medusa. As a rule even badly preserved specimens may be identified with certainty by means of the characteristic shape of the umbrella and the peculiar arrangement of the traces of tentacles which are usually left on the umbrella margin.

St. 4158 is in the Bay of Biscay. St. 1239 is near the Bahamas, St. 1342 north-west of Bermuda; this is the first time the species has been found in the western part of the tropical Atlantic. The other stations are off the west coast of Africa, where the species has previously been found in several localities.

Distribution: Widely distributed in the Atlantic Ocean, where it has its northern limit of distribution south of the submarine ridge between Scotland, Iceland, Greenland and Baffin Land. Towards the south it penetrates far into the antarctic region into the Weddell Sea. It also occurs near the Indian sector of the Antarctic Continent as well as in warmer parts of the Indian Ocean. The only records from the Pacific are in two widely separated areas, the Bering Sea (BIGELOW 1913) and South-East Australia (BLACKBURN 1955). It is a decidedly bathypelagic species.

Halitrephes maasi BIGELOW.

Halitrephes maasi BIGELOW 1909 *a* p. 146. Pl. 33 fig. 1—5, 7, 10; Pl. 45 fig. 13.
Halitrephes valdiviae VANHÖFFEN 1912 *a* p. 384.
Halitrephes valdiviae BIGELOW 1938 p. 125.
Halitrephes valdiviae KRAMP 1948 *a* p. 7.
Halitrephes medius KRAMP 1948 *a* p. 7; fig. 1.
Halitrephes maasi KRAMP 1957 p. 51.

Material:

St. 1203 11.I.22
7°30′ N. 79°19′ W.
E 300 3500 m. w. **9**

St. 1206 14—15.I.22
6°40′ N. 80°47′ W.
E 300 1200 m. w. **1**
E 300 4500 m. w. **39**

St. 1208 16.I.22
6°48′ N. 80°33′ W.
E 300 3500 m. w. **2**
E 300 3600 m. w. **1**

St. 1217 29.I.22
18°50′ N. 79°07′ W.
E 300 4000 m. w. **2**

St. 1245 17.II.22
19°35′ N. 73°08′ W.
E 300 1000 m. w. **1**

St. 1261 9.III.22
19°04′ N. 65°43′ W.
S 150 3500 m. w. **1**

St. 1283 5.IV.22
14°38′ N. 61°16′ W.
E 300 4000 m. w. **2**

St. 1287 8.IV.22
16°04′ N. 61°52′ W.
E 300 1000 m. w. **1**

St. 1322 30.IV.22
27°02′ N. 53°39′ W.
E 300 2500 m. w. **1**

St. 3978 13.II.30
30°15′ S. 13°15′ E.
S 150 1000 m. w. **2**
S 150 3000 m. w. **1**

St. 3998 1.III.30
7°34′ S. 8°48′ W.
E 300 6000 m. w. **1**

St. 4005 12.III.30
13°31′ N. 18°05′ W.
E 300 4000 m. w. **2**

The relation between the three species of *Halitrephes* was recently discussed by me (Kramp 1957). I then came to the conclusion that most of Vanhöffen's specimens of *H. valdiviae* belong to *H. maasi* Bigelow, whereas the largest specimen of *H. valdiviae* might provisionally be regarded as a distinct species. Until further evidence to the contrary I also retained *H. medius* as a separate species. The "Dana" collection, however, has convinced me that all of them must be united into one species, *H. maasi*.

Unfortunately this bathypelagic medusa is very brittle and delicate; very often the gastrovascular system has entirely disappeared, so that the radial canals cannot be counted; but the basal stumps of the tentacles are usually retained and likewise some of the sensory clubs. As a rule, therefore, it is possible to determine the genus and count the tentacles. The specimens collected by the "Dana" are no exceptions from the rule, all of them are badly preserved, and in the above enumeration I have omitted several specimens of Halicreids which may have belonged to *Halitrephes* but could not be identified with certainty. In only one of the numerous specimens was it possible to count the radial canals; it is a young specimen from St. 3978, 10 mm. in diameter with 16 radial canals and about 30 tentacles.

In my recent paper in the Discovery Reports I have given a detailed account of the number of tentacles in proportion to the diameter of the umbrella in all specimens observed up to then by Bigelow, Vanhöffen and myself. In the present collection I have been able to count, or at least to estimate, the number of tentacles in 41 specimens as follows:

Diam. of umbrella mm.	Approximate number of tentacles	Number of specimens
9—10	30	2
25—30	45—50	2
30—35	60—70	2
35—40	55—70	5
40—45	50—80	8
45—50	45—80	10
50—55	70—145	2
55—60	50—90	4
60—65	145	1
65—70	170—190	1
70—75	165—180	2
75—80	190	1
80—85	205	1
130	300	1

The accompanying diagram (fig. 8) shows the number of tentacles in all specimens observed up to now in which counting was possible. The variations may be due partly to the inaccuracy of the countings, partly to the softness of the umbrella which renders an exact measurement of the diameter difficult.

It will be seen that the specimens of the various collections vary within about the same limits, and the numerous specimens from the "Discovery" and the "Dana" establish a connection of Bigelow's original specimen of *H. maasi* (55 mm. wide with about 70 tentacles) with Vanhöffen's specimens of *H. valdiviae*

less than 45 mm. in diameter. The large specimen of *H. valdiviae* (70 mm. wide with 204 tentacles) occupied an isolated position; the gap between this specimen and *H. maasi* was partly bridged by some specimens from the Bermudas (BIGELOW 1938, 45 mm. with at least 105 tentacles, 55 mm. with 102, and 60—80 mm. with at least 145—170 tentacles), and the connection is completed through a number of specimens from the "Dana", 52—83 mm. wide with 145—205 tentacles. *H. medius* KRAMP was distinguished by its large size (100 mm.) and very numerous tentacles (about 280); in both respects it is surpassed by one of the "Dana" specimens, being 130 mm. wide with about 300 tentacles.

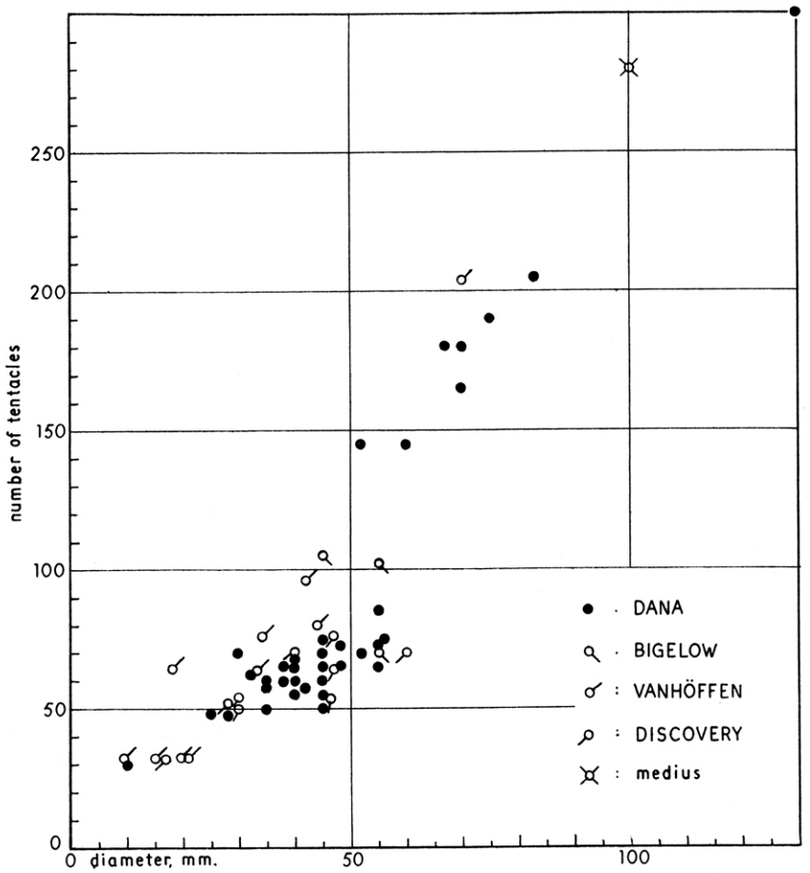

Fig. 8. *Halitrephes maasi*. Number of tentacles in proportion to diameter of umbrella.

As far as the number of tentacles in relation to size of the umbrella is concerned, there is accordingly an even transition between the three "species" of *Halitrephes*. The number of radial canals has been stated in only very few specimens. In VANHÖFFEN's specimens there were 16 canals, in so far as it was possible to count them; presumably they were not counted in the large specimen with 204 tentacles. Five specimens of the "Discovery" collection, 10—40 mm. wide, had 16—20 canals. A young specimen from South-East Australia, 18 mm. wide, recently described by BLACKBURN (1955) had 16 canals. In BIGELOW's original specimen of *H. maasi*, 55 mm. wide, 28 canals issued from the periphery of the stomach, but some of them were bifurcated, so that 33 canals reached the umbrella margin. The only specimen of *H. medius* KRAMP, 100 mm. wide, had 30 radial canals. If we presume that the radial canals were not counted in VANHÖFFEN's largest specimen, the numbers of canals do not afford any objection to the supposition that all specimens of *Halitrephes* observed up to now belong to one species, *H. maasi* BIGELOW.

Distribution: *Halitrephes maasi* is a bathypelagic medusa with a circumglobal distribution in the tropical and subtropical parts of the great oceans. It is recorded from the eastern tropical Pacific, the waters between New Zealand and southern Australia, some scattered localities in the Indian Ocean, and from several localities

in the Atlantic between about 50° S. and 32° N. (Bermudas). In the eastern Atlantic it occurs from the Cape of Good Hope to Cape Verde. It was not previously found in the West-Indian waters, where it was taken at several stations by the "Dana".

Halicreidae indeterminatae.

Undeterminable specimens of Halicreidae were collected at the following stations:

St. 1267 14.III.22
17°56′ N. 64°50′ W.
E 300 4500 m. w. **2**

St. 3975 31.I.30
35°42′ S. 18°37′ E.
S 150 1000 m. w. **3**
S 150 2000 m. w. **26**
S 150 2500 m. w. **22**

St. 3978 13.II.30
30°15′ S. 13°15′ E.
S 150 1500 m. w. **3**
S 150 2000 m. w. **7**
S 150 3000 m. w. **2**

St. 3980 17.II.30
23°26′ S. 3°56′ E.
S 200 600 m. w. **1**
S 150 2000 m. w. **10**
S 150 3000 m. w. **4**
S 150 4000 m. w. **5**
S 150 5000 m. w. **2**

St. 3996 25.II.30
15°41′ S. 5°50′ W.
S 200 600 m. w. **22**
S 150 1000 m. w. **9**
S 150 1500 m. w. **3**
S 150 2000 m. w. **14**
S 150 3000 m. w. **15**
S 150 4000 m. w. **3**

St. 3998 1.III.30
7°34′ S. 8°48′ W.
E 300 1000 m. w. **20**
S 150 1000 m. w. **3**
S 150 2000 m. w. **29**
S 150 3000 m. w. **3**
S 150 4000 m. w. **4**
S 150 5000 m. w. **1**
E 300 6000 m. w. **18**

St. 4000 4.III.30
0°31′ S. 11°02′ W.
E 300 1000 m. w. **16**
S 150 1000 m. w. **2**
S 150 2000 m. w. **10**
S 150 3000 m. w. **6**
S 150 4000 m. w. **1**
S 150 5000 m. w. **6**
E 300 6000 m. w. **2**

St. 4003 9.III.30
8°26′ N. 15°11′ W.
S 200 300 m. w. **5**
E 300 1000 m. w. **29**
S 150 1000 m. w. **4**
S 150 4000 m. w. **3**
S 150 5000 m. w. **5**
E 300 6000 m. w. **7**

St. 4005 12.III.30
13°31′ N. 18°03′ W.
S 200 300 m. w. **5**
S 200 600 m. w. **14**
S 150 1000 m. w. **22**
S 150 2000 m. w. **5**
S 150 2500 m. w. **8**
S 150 3500 m. w. **7**
E 300 4000 m. w. **15**

St. 4007 15.III.30
18°22′ N. 18°14′ W.
S 200 300 m. w. **10**
S 200 600 m. w. **25**
E 300 1000 m. w. **198**
S 150 1000 m. w. **67**
S 150 2000 m. w. **17**
S 150 2000 m. w. **17**
S 150 2500 m. w. **5**
S 150 3000 m. w. **8**
S 150 3500 m. w. **13**
E 300 4000 m. w. **23**

St. 4009 18.III.30
24°36.5′ N. 17°27′ W.
S 150 2000 m. w. **12**
S 150 2500 m. w. **3**
E 300 4000 m. w. **3**

St. 4017 27.III.30
29°11′ N. 14°14′ W.
S 150 2000 m. w. **3**
S 150 3000 m. w. **3**

St. 4019 30.III.30
33°08′ N. 10°22′ W.
S 150 1000 m. w. **3**
S 150 2000 m. w. **4**
S 150 3000 m. w. **2**
S 150 3500 m. w. **2**

St. 4158 17.VI.30
46°28′ N. 8°01′ W.
E 300 1000 m. w. **13**

Fam. **Rhopalonematidae.**

Rhopalonema velatum Gegenbaur.

Rhopalonema velatum Gegenbaur 1856 p. 251. Pl. 9 fig. 1—5.
Rhopalonema velatum Mayer 1910 p. 378. Fig. 218.
Syn.: *R. clavigerum, clavigerum* and *coeruleum* Haeckel 1879, *R. striatum* Maas 1893.

Material:

"Thor"
St. 178 2.IX.06
48°04′ N. 12°40′ W.
1000 m. w. **1**

"Ingolf"
St. 251 3.III.11
22°16′ N. 63°16′ W.
S 150 19 m. w. **1**

St. 252 4.III.11
23°53′ N. 61°36′ W.
S 150 25 m. w. **28**
S 100 47 m. w. **1**

St. 256 8.III.11
28°55′ N. 55°25′ W.
S 150 25 m. w. **12**
S 100 47 m. w. **5**

St. 259 12.III.30
33°55′ N. 43°40′ W.
S 150 25 m. w. **21**

St. 260 13.III.11
34°39′ N. 40°54′ W.
S 150 25 m. w. **5**

St. 261 14.III.11
35°27′ N. 37°18′ W.
S 100 47 m. w. **9**

St. 262 15.III.11
36°13′ N. 33°50′ W.
S 150 25 m. w. **79**
S 100 47 m. w. **60**

St. 269 4.III.11
46°44′ N. 11°20′ W.
S 100 47 m. w. **1**

"St. Croix"
St. 290 12.V.11
37°31′ N. 35°24′ W.
S 200 28 m. w. **1**

"Caroline Kock"
St. 309 6.II.11
38°06′ N. 18°24′ W.
S 100 38 m. w. **1**

"Caroline Kock"
St. 315 28.V.11
39°50′ N. 49°30′ W.
S 100 38 m. w. **21**

"Anne"
St. 374 7.X.11
42°30′ N. 32°45′ W.
S 100 48 m. w. **11**

"Ingolf"
St. 403 3.XI.11
27°10′ N. 21°53′ W.
S 200 surface **210**
S 150 56 m. w. **23**

St. 404 3.XI.11
26°12′ N. 23°02′ W.
S 200 surface **3**

St. 405 5.XI.11
24°42′ N. 24°50′ W.
S 200 surface **55**

St. 406 5.XI.11
23°49′ N. 26°25′ W.
Surface **6**
56 m. w. **20**

"Dana"
St. 842 28.IV.20
25°48′ N. 49°22′ W.
P 150 300 m. w. **4**

St. 844 29.IV.20
25°54′ N. 51°47′ W.
P 100 surface **3**

St. 845 30.IV.20
24°46′ N. 54°08′ W.
P 150 300 m. w. **1**

St. 848 2.VI.20
18°00′ N. 64°41′ W.
S 200 300 m. w. **1**

St. 849 3.VI.20
19°00′ N. 63°53′ W.
P 150 surface **1**
P 150 100 m. w. **2**
P 150 200 m. w. **3**
S 200 300 m. w. **8**

St. 850 4.VI.20
20°39′ N. 61°48′ W.
P 150 50 m. w. **8**
P 150 100 m. w. **5**
S 200 150 m. w. **14**
S 200 300 m. w. **3**

St. 851 5.VI.20
22°23′ N. 60°46′ W.
P 150 50 m. w. **36**

St. 856 11.VI.20
30°27′ N. 60°53′ W.
P 150 800 m. w. **1**

St. 868 24.VI.20
27°10′ N. 55°52′ W.
S 150 125 m. w. **1**

St. 870 26.VI.20
27°29′ N. 59°20′ W.
S 150 100 m. w. **3**
S 150 200 m. w. **5**

St. 884 15.VII.20
28°49′ N. 54°10′ W.
S 200 100 m. w. **11**

"Dana" II
St. 1107 13.IX.21
36°28′ N. 8°38′ W.
S 200 200 m. w. **2**

St. 1141 15.X.21
34°15′ N. 16°53′ W.
S 200 500 m. w. **3**

St. 1192 15.XII.21
17°43.4′ N. 64°54.3′ W.
S 200 50 m. w. **10**
S 200 100 m. w. **5**

St. 1331 5.V.22
26°37′ N. 55°50′ W.
P 150 400 m. w. **1**

St. 1353 23.V.22
33°57′ N. 66°43′ W.
E 300 1000 m. w. **1**

St. 3978 13.II.30
30°15′ S. 13°15′ E.
S 200 50 m. w. **11**
S 200 100 m. w. **1**
S 200 600 m. w. **1**
S 150 1000 m. w. **1**
S 150 1500 m. w. **1**
S 150 2000 m. w. **1**

St. 3980 17.II.30
23°26′ S. 3°56′ E.
S 200 50 m. w. **2**
S 200 100 m. w. **2**
S 200 300 m. w. **2**
S 200 600 m. w. **1**

St. 3996 25.II.30
15°41′ S. 5°50′ W.
S 200 50 m. w. **5**
S 200 300 m. w. **1**
S 150 1000 m. w. **1**
E 300 4000 m. w. **1**

St. 3998 1.III.30
7°34′ S. 8°48′ W.
S 50 surface **2**
S 200 50 m. w. **600**
S 200 100 m. w. **500**
S 200 300 m. w. **9**
S 200 600 m. w. **2**
E 300 1000 m. w. **1**
S 150 1000 m. w. **3**
S 150 2000 m. w. **2**
S 150 3000 m. w. **1**
S 150 4000 m. w. **7**
S 150 5000 m. w. **5**

St. 4000 4.III.30
0°31′ S. 11°02′ W.
S 200 50 m. w. **12**
S 200 100 m. w. **2**
S 200 300 m. w. **25**
S 200 600 m. w. **4**
E 300 1000 m. w. **1**
S 150 1000 m. w. **6**
S 150 2000 m. w. **1**
S 150 3000 m. w. **8**
S 150 4000 m. w. **9**
S 150 5000 m. w. **10**

St. 4003 9.III.30
8°26′ N. 15°11′ W.
S 200 50 m. w. **88**
S 200 100 m. w. **1**
S 200 300 m. w. **1**
S 150 3000 m. w. **1**
S 150 4000 m. w. **1**
E 300 6000 m. w. **1**

St. 4005 12.III.30
13°31′ N. 18°03′ W.
S 200 50 m. w. **24**
S 200 100 m. w. **7**
S 200 300 m. w. **4**
S 200 600 m. w. **2**
S 150 2000 m. w. **9**
S 150 2500 m. w. **2**
S 150 3500 m. w. **1**

St. 4007 15.III.30
18°22′ N. 18°14′ W.
S 200 300 m. w. **1**

St. 4009 18.III.30
24°36.5′ N. 17°27′ W.
S 200 100 m. w. **19**
S 200 300 m. w. **10**
S 200 600 m. w. **45**
S 150 1000 m. w. **150**
S 150 2000 m. w. **9**
S 150 2500 m. w. **5**
S 150 3000 m. w. **2**
S 150 3500 m. w. **1**

St. 4014 25.III.30
28°09′ N. 15°19′ W.
S 50 surface **1**
S 200 300 m. w. **12**
S 200 600 m. w. **65**
S 200 900 m. w. **62**
S 200 1200 m. w. **28**

St. 4017 27.III.30
29°11′ N. 14°14′ W.
S 200 50 m. w. **6**
S 200 100 m. w. **140**
S 200 300 m. w. **90**
S 200 600 m. w. **24**
S 150 1000 m. w. **92**
S 150 2000 m. w. **38**
S 150 3000 m. w. **9**
S 150 4000 m. w. **12**
E 300 5000 m. w. **2**

St. 4019 30.III.30
33°08′ N. 10°22′ W.
S 200 50 m. w. **13**
S 200 100 m. w. **265**
S 200 300 m. w. **38**
S 200 600 m. w. **41**
S 150 1000 m. w. **120**
S 150 2000 m. w. **5**
S 150 3000 m. w. **10**
S 150 3500 m. w. **4**