

Report of the Biological Survey of Mutsu Bay_2. Medusae of Mutsu Bay.

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Report of the Biological Survey of Mutsu Bay.

2. Medusae of Mutsu Bay.*

BY

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This is a report on medusae collected in Mutsu Bay during the three years 1924-1926. Numerous specimens examined by me include 22 species, namely, 14 belonging to the Hydromedusae, 6 to the Scyphomedusae, and 2 to the Ctenophorae. Of these, one medusa is uncertain and two others have been newly recorded from the country; one is *Melicertum*, which is common on the northern Atlantic coast of America and the other is a new variety of *Rhopilema esculenta*.

The medusae found in the bay are as follows.

Hydromedusae.

Ord. Anthomedusae.

- 1) *Euphysa* sp.
- 2) *Hybocodon prolifer* L. AGASSIZ.
- 3) *Cladonema radiatum* var. *mayeri* PERKINS.
- 4) *Urashimea globosa* KISHINOUE.
- 5) *Turritopsis nutricula* McCRADY.
- 6) *Rathkea blumenbachii* (RATHKE).
- 7) *Spirocodon saltatrix* (TILESUS).

Ord. Leptomedusae.

- 8) *Melicertum campanula* L. AGASSIZ.
- 9) *Obelia* sp.
- 10) *Phialidium discoida* (MAYER).
- 11) *Aequorea coerulescens* (BRANDT).
- 12) *Gonionema murbachi* var. *oshoro* UCHIDA.

Ord. Trachomedusae.

* A contribution from the Marine Biological Station, Asamushi, Aomori-Ken.

- 13) *Aglantha digitale* HAECKEL.
 14) *Liriope tetraphylla* (CHAMISSE et EYSENHARDT).

Scyphomedusae.

Ord. Cubomedusae.

- 15) *Charybdea rastonii* HAACKE.

Ord. Stauromedusae.

- 16) *Haliclystus auricula* CLARK.
 17) *Sasakiella cruciformis* OKUBO.

Ord. Saemostomae.

- 18) *Dactylometra pacifica* GOETTE.
 19) *Cyanea capillata* ESCHSCHOLTZ.

Ord. Rhizostomae.

- 20) *Rhopilema esculenta* var. *asamushi*, n. var.

Ctenophorae.

- 21) *Hormiphora palmata* CHUN.
 22) *Beroë ramosa* KOMAI.

From the viewpoint of oceanographical distribution, the fauna in Mutsu Bay is very interesting. There are found many arctic species, such as *Hybocodon prolifer*, *Urashimea globosa*, *Rathkea blumenbachii*, *Melicertum campanula*, *Gonionema murbachi* var. *oshoro*, *Aglantha digitale*, *Haliclystus auricula*, *Sasakiella cruciformis*, *Cyanea capillata*, and *Beroë ramosa*. These medusae, except *Urashimea globosa*, *Rathkea blumenbachii*, and *Haliclystus auricula*, have never been found on the Pacific coast of Honshu except in Mutsu Bay. Therefore, the fauna is, as a whole, similar to that of Oshoro, Hokkaido. On the other hand, the following three medusae, viz. *Spirocodon saltatrix*, *Aequorea coerulea*, and *Dactylometra pacifica*, which are very common in the water of Honshu and Kiushu, have never been recorded from Hokkaido, as far as I know. Pelagic medusae, which are occasionally found swarming in the bay, are *Hybocodon prolifer*, *Rathkea blumenbachii*, *Aequorea coerulea*, and *Aglantha digitale*, but large medusae, such as *Spirocodon saltatrix* and Scyphomedusae seem to be found only in small numbers. On *Sargassum*, there are commonly found four me-

dusae, such as *Cladonema radiatum* var. *mayeri*, *Gonionema murbachi* var. *oshoro*, *Haliclystus auricula*, and *Sasakiella cruciformis* during July and August, but they disappear when the sea-weeds die.

Finally, I should like to express here warm thanks to Prof. S. HATAI and Prof. S. HOZAWA, who were so kind in helping my study in various ways, and also to Assist. Prof. S. KOKUBO and Mr. S. TAKATSUKI for collecting materials.

Hydromedusae.

ORD. ANTHOMEDUSAE.

1) *Euphysa* sp.

The bell is 1 mm. high and 0.8 mm. wide. The gelatinous substance is uniformly thin. Four radial canals, straight and equal in length. A ring canal rather broad. Tentacle bulbs four in number and very large. An ocellus on the protruded outer side of the bulb. Tentacles four in number and filamentar, all provided with many ring-like nematocyst clusters. Of the four tentacles, one is by far the longest, the two adjacent to it, intermediate, and the one opposite it, the smallest. They are all hollow. Velum well-developed. Manubrium somewhat cone-like. Gonads are not ripe in the specimen.

Colour. Ocelli light red. Other parts colourless in the preserved specimen.

Loc. Asamushi, March 14, 1926.

Remarks. The medusa must be referable to a new species because of the presence of ocelli and the structure of tentacles, but as there is only one specimen the specific name will be reserved for further study.

2) *Hybocodon prolifer* L. AGASSIZ.

Hybocodon prolifer: AGASSIZ, L., 1862, Cont. Nat. Hist. U. S., vol. 4, p. 243 et 243, pl. 23a, fig. 10, 11, pl. 25, fig. 1-19. UCHIDA, 1925, Jap. Jour. Zool., vol. 1, p. 78, fig. 1.

A large number of the medusa were collected by Assist. Prof. S. KOKUBO and Mr. TAKATSUKI by a surface tow in the spring. In most

of the specimens, both sexual and asexual reproduction occur simultaneously, as described in the American medusa. The species is very common in the arctic region of both the Atlantic and the Pacific.

Loc. Asamushi, March 14, 1926.

3) *Cladonema radiatum* var. *mayeri* PERKINS.

Cladonema mayeri; PERKINS, 1906, Year Book of the Carnegie Inst. of Washington, no. 4, p. 118.

Cladonema radiatum var. *mayeri*; UCHIDA, 1925, Jap. Jour. Zool., vol. 1, p. 81, fig. 7.

The medusa is commonly found attached on *Sargassum* in the bay during July and August. All specimens examined by me agree with the species formerly recorded (1925) in the presence of the regular number of tentacles (9), gonads (6), and oval tentacles (6). The small tentacles, which were described as suckers, are undoubtedly young filamentar ones, as suggested in my last paper. For the first time, the tip of the short, young tentacles is covered with nematocysts and subsequently the dorsal side is gradually bordered by several series of nematocyst batteries, regularly arranged and developed from the terminal to the basal portion, so nematocyst batteries are always more prominent on the dorsal side of tentacles than on the ventral side. Out of the specimens obtained in the bay, the largest one is 3.5 mm. high and 3 mm. wide.

Loc. Yunoshima, July 13, 1926. Namiuchi, Hirauchimura, July 17, 1926. Tsuchiya, July 14, August 5, 1925 and July 2, 1926.

4) *Urashimea globosa* KISHINOUE.

Urashimea globosa; KISHINOUE, 1910, Jour. Coll. Sci. Imp. Univ. Tokyo, vol. 27, art. 9, p. 28, pl. 5, fig. 27-29. MAYER, 1910, Medusae of the world, vol. 3, p. 722. HARTLAUB, 1913, Nordisches Plankton, Bd. 12, p. 344, Fig. 290-292.

Urashimea macrotentaculata; KISHINOUE, 1910, Jour. Coll. Sci. Imp. Univ. Tokyo, vol. 27, art. 9, p. 29, pl. 5, fig. 30.

Zanclaea maasi; UCHIDA, 1925, Jap. Jour. Zool. vol. 1, p. 80, fig. 2-5.

Zanclaea sp.; MAAS, 1909, Abhandl. K. Bayer. Akad. Wiss. Suppl. Bd. 1, Abhandl. 8, p. 8, Taf. 1, Fig. 2. HARTLAUB, 1914, Nordisches Plankton, Bd. 12, p. 400.

Several specimens of this interesting medusa were caught by Prof. S. HOZAWA and Mr. TAKATSUKI. Out of specimens examined by me, the largest one is 11 mm. high.

Recently several specimens of the medusa were sent through the kindness of Prof. A. OKA. They are in different stages and represent the structures of *Zanclaea maasi*, *Urashimea globosa*, and *Urashimea macrotentaculata* respectively, so I wish to condense these specific names into one. The metamorphosis of the species will be given in another paper.

Loc. Okunai, July 8, 1926.

5) *Turritopsis nutricula* McCRADY.

Turritopsis nutricula; McCRADY, 1857, Gymn. Charleston Harbor, p. 25, pl. 8, fig. 1. UCHIDA, 1925, Jap. Jour. Zool., vol. 1, p. 84, fig. 8-9.

Four young specimens belonging to the common species were obtained. They are about 1 mm. high, and are provided with 24 tentacles and four simple lips. Gonads are not yet developed.

Loc. Asamushi, March 14, 1924.

6) *Rathkea blumenbachi* (RATHKE).

Rathkea blumenbachi; UCHIDA, 1925, Jap. Jour. Zool., vol. 1, p. 86.

Rathkea octopunctata var. *grata*; MAYER, 1910, Medusae of the World, vol. 1, p. 179, pl. 18, fig. 5.

Lizzia shinako; KISHINOUE, 1910, Jour. Coll. Sci., Imp. Univ. Tokyo, vol. 27, art. 9, p. 25, pl. 5, fig. 24.

Oceania blumenbachii; RATHKE, 1835, Mém. Acad. Imp. Sci. St. Pétersbourg, tome 2, p. 321, pl. 1, fig. 1-4.

A great number of the common medusa were obtained by Assist. Prof. S. KOKUBO at Asamushi. They are in different stages of development and give rise to medusa buds on their manubrium. As the species has been described several times, the specific diagnosis is omitted here.

Loc. Asamushi, March 14, 1926.

7) *Spirocodon saltatrix* (TILESUS).

Spirocodon saltatrix; MAAS, 1909, Abhandl. K. Bayer. Akad. Wiss. Suppl.-Bd. 1, Abhandl. 8, p. 18, Pl. 2, Fig. 10-13. MAYER, 1910, Medusae of the world, vol. 1, p. 220, fig. 112, —, 1910, ditto, vol. 3, p. 724. OKADA, 1926, Ann. Zool. Jap., vol. 11, p. 76-79 et 81-85, fig. 1-4, pl. 1, fig. 1-2.

Spirocodon brevitentacularis (moribund medusa); OKADA, 1926, Ann. Zool. Jap., vol. 11, p. 80-81, pl. 1, fig. 3-4.

Goneomeandrus chrysostephanus; KIRKPATRICK, 1903, Ann. Mag. Nat. Hist., vol. 12, p. 616, pl. 33, fig. 1-4.

Medusa saltatrix; TILESIIUS, 1818, Mém. Acad. St. Pétersbourg, tome 6, p. 554, pl. 18.

Several specimens were obtained in the neighbourhood of the Asamushi Marine Biological Station. All specimens examined by me were by far larger than those ever caught in other localities. They were about 70 mm. high and 65 mm. wide and were provided with about 60 hollow tentacles in each octant. As far as my observations go, the medusa seems to be referred to the Anthomedusae. The discussion on the systematic position of the species will be given in another paper.

Loc. Namiuchi, Moura, and Shimanai, March 10 and May 5, 1925.

ORD. LEPTOMEDUSAE.

8) *Melicertum campanula* L. AGASSIZ.

Melicertum campanula; AGASSIZ, L., 1862, Cont. Nat. Hist. U. S., vol. 4, p. 349 et 352. MAYER, 1910, Medusae of the world, vol. 1, p. 207, pl. 23, fig. 4-5, pl. 24, fig. 5.

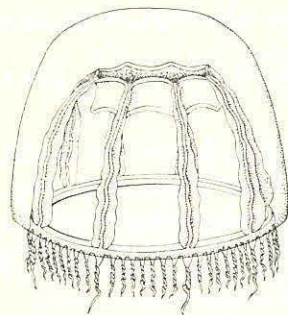


Fig. 1. *Melicertum campanula*.
7 mm. high.

Bell higher than a hemisphere and flat-topped, 7 mm. high and 8 mm. wide. The gelatinous substance is fairly thick, especially at the aboral pole. There are eight simple, broad radial canals, which are equally developed and which become wider at the basal portion. They are somewhat undulating, probably on account of shrinkage. Tentacles 64 in number, 8 in each octant. These tentacles, arise from the bell margin, and each has a large bulb at its base. They are tapering and coiling, hollow and short. The ocelli could not be seen in preserved specimens. There are no sensory clubs or statocysts between the tentacles. The velum is stout but narrow. The manubrium is wide, shallow, and provided with eight recurved lips, which correspond to the eight radial canals. There are eight gonads, which

cover the entire length of the eight radial canals. They are especially developed in the lower portion, showing several foldings, as seen in gonads of *Ptychogena*.

Colour. According to Mr. TAKATSUKI, who obtained two specimens of the species, radial canals and manubrium were white when living. In the preserved specimens, gonads and lips are slightly brown.

Loc. Tsuchiya, June 5, 1926.

Remarks. There are known two certain species in the genus: *Melicertum campanula* and *M. octocostatum*, both occurring in the Atlantic. The two species above mentioned are pyriform in shape and are provided with a well-developed apical solid gelatinous substance, while the Japanese specimens are flat-topped in shape. According to MAYER's figures (1910), however, the young medusa of *M. campanula* has no apical jelly mass, so our specimens, of smaller size than the former, may be referable to *Melicertum campanula*. On the other hand, any indication of the several longitudinal lines of nematocyst-like cells, which are present on the subumbrella of *Melicertum octocostatum*, could not be found in the Japanese medusae.

9) *Obelia* sp.

Several specimens were obtained by a surface tow on August 25, 1926. The medusa is 1.5 mm. in diameter and is provided with 18 tentacles in each quadrant, arranged younger and older alternating. Gonads are situated on the radial canals, a little nearer the marginal portion. The species is absolutely colourless. It is difficult for us to identify medusae belonging to the genus without any knowledge of their hydroid.

10) *Phialidium discoida* (MAYER).

Phialidium discoida; BIGELOW, 1909, Mem. Mus. Comp. Zool., Harvard coll., vol. 37, p. 155, pl. 6, fig. 8, pl. 38, fig. 6-7. MAAS, 1909, Abhandl. d. math.-phys. Klass. d. K. Bayer. Akad. d. Wissen., Suppl.-Bd. 1, Abhandl. 8, p. 25. MAYER, 1910, Medusae of the World, vol. 2, p. 272. UCHIDA, 1925, Jap. Jour. Zool., vol. 1, p. 90, fig. 14.

Oceania discoida; MAYER, 1900, Bull. Mus. Comp. Zool. at Harvard coll., vol. 37, p. 51, pl. 20, fig. 53-55.

Several young specimens belonging to the species were obtained

in the bay on Sept. 16, 1923. The youngest medusa, with a diameter of 2 mm., has four perradial tentacles and the same number of interradial ones, the latter being smaller than the former. The tentacles consist of a prominent tentacle bulb and a narrow filamentous portion which is tightly coiled. Besides these eight tentacles, the medusa has five tentacle-bulbs, each being situated in one octant between the perradial and the interradial tentacles, while in three octants no indication of them could be found. Four gonads, round in shape, at the basal portion of the four radial canals. Statocysts alternate with tentacles in position. Manubrium short.

A larger medusa, with a diameter of 4 mm., has three short tentacles between the perradial ones. Two statocysts are present between two tentacles. Short manubrium squarish and brown gonads well-developed, situated close to the ring canal. The velum is narrow.

Loc. Asamushi, Sept. 16, 1924.

Remarks. The species was at first recorded by MAAS (1909) from Japan and recently by me (1925) from Oshoro.

11) *Aequorea coerulescens* (BRANDT).

Aequorea coerulescens; TORREY, 1909, Univ. California Publ. Zool., vol. 6, No. 2, p. 28. BIGELOW, 1909, Mem. Mus. Comp. Zool., Harvard Coll., vol. 37, p. 177, pl. 4, fig. 4 and pl. 35, fig. 3-8.

Aequorea forskalea (in part); MAYER, 1910, Medusae of the World, vol. 2, p. 325.

Mesonema (Zygodactyla) coerulescens; BRANDT, 1838, Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. et Nat., tome 4, p. 360, pl. 5.

Mesonema pensile; MAAS, 1909, Abhandl. math.-phys. d. Klass. d. K. Bayer. Akad. d. wissen., Suppl.-Bd. 1, Abhandl. 8, p. 26.

Zygodactyla coerulescens; BRANDT, 1838, Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, tome 4, p. 360, pl. 5.

The bell is very flat and discoid, 134 mm. in diameter. The gelatinous substance is soft and massive, as in the saemostome medusa *Aurelia*, but especially thick in the aboral portion of the stomach, measuring 20 mm. and gradually becoming thinner towards the peripheral margin. The margin is recurved inwards, as in *Aurelia*. The recurved portion is 11 mm. in width and becomes wider as the medusa grows.

The diameter of the stomach and mouth (without lips) is 65 mm. and 42 mm. respectively. Numerous radial canals, having almost equal

intervals, arise separately from the edge of the stomach and extend straight out to the ring canal. The radial canals, 85 in number, are straight and are arranged so that a young and narrow one comes between older and wider ones. The tentacles are numerous and are equally developed, arranged in two rows, the younger on the inner side. In the swimming medusa they become filamentar, and are very long, but in preserved specimens, they are short, tapering, and coiled. The tentacles are hollow and are covered with ring-like nematocyst clusters. The excretory papillae are present

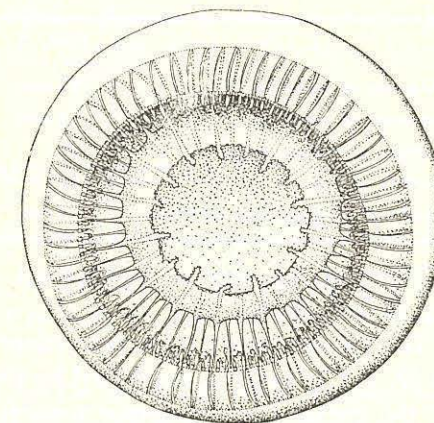


Fig. 2. *Aequorea coerulescens*.

only on the axial base of well developed tentacles. There are numerous statocysts between the tentacles. They can not be seen without difficulty on account of the latter. The velum is narrow but stout. The manubrium is very flat, its ventral wall has numerous meridional ridges which almost correspond to the number of the radial canals, but which are, strictly speaking, a little fewer. The ridges lead to the terminal end of each lip, interfering with the lines of the ring muscles, which are arranged concentrically on the wall of the manubrium. The peripheral wall of the stomach is somewhat folded and bulges out. The lips are 60 in number and are tapering, with folded margins showing the same structure as the oral arms in *Aurelia*. The narrow linear gonads are developed upon these canals and cover the whole length of the radial canals except the terminal portion close to the ring canal. They are at first linear but gradually become folded, and the middle portion is the widest.

Colour. Tentacles deep blue. Radial canals and lips blue. Gelatinous substance bluish.

Loc. Off Yunoshima, May 1926.

Remarks. Several specimens were caught in the bay by Mr.

TAKATSUKI. In the medusae, the number of radial canals and lips do not correspond with the diameter of the umbrella as shown in the following table.

	Spec. A	Spec. B	Spec. C	Spec. D
Diameter of umbrella.	25 mm.	31 mm.	132 mm.	134 mm.
Diameter of stomach.	14 mm.	16 mm.	73 mm.	68 mm.
Number of radial canals.	60	61	108	85
Number of lips.	16	29	57	66
Thickness of gelatinous substance.	8 mm.	10 mm.	20 mm.	20 mm.

Moreover, the time of development of the gonads is variable according to individuals.

The medusa bears some resemblance to *Aequorea forskali* and *A. pensile*, but is easily distinguished by the fewer number of radial canals and the considerably numerous tentacles, which are several times as many as the radial canals. MAAS (1909) recorded as *M. pensile* a medusa, from Sagami Bay, belonging to the genus. His specimens were broken and had no marginal tentacles, so the identification was based upon the number of radial canals, and the diameters of the umbrella and the stomach. But the relative number of these organs can not be utilized in specific identification, as mentioned above. Though the specimens in question are provided with more radial canals, they are probably the same as my species, as I have examined several specimens of *A. coerulescens* collected at Misaki.

12) *Gonionema murbachi* var. *oshoro* UCHIDA.

Gonionema murbachi var. *oshoro*; UCHIDA, 1925, Jap. Jour. Zool., vol. 1, p. 84, fig. 18-19.

A great number of living or preserved medusa belonging to the species were examined by me. The well-developed medusa is very flat in shape as described in my last paper, but the youngest medusa among them is 3 mm. wide and 2 mm. high and is provided with six tentacles in each quadrant. Gonads make their appearances on the uppermost portion of four radial canals in the medusa. As the medusa grows, the bell becomes gradually flatter and finally takes a quite different shape in a later stage. It is also noticeable that the medusa

is liable to have a higher bell in a preservative than in the living state. The species is very common and attaches on *Sargassum* at Asamushi as well as in Oshoro.

Loc. Yunoshima, July 13, 1926. Namiuchi, Hirauchimura, July 17, 1926. Moura, Hirauchimura, July 20, 1926. Tsuchiya, July 3, 1926.

ORD. TRACHOMEDUSAE.

13) *Aglantha digitale* HAECKEL.

Aglantha digitalis; HAECKEL, 1879, Syst. der Medusen, p. 272, Tab. 16, Fig. 5, 6.

Aglantha digitale; BIGELOW, 1913, Proc. U. S. Nat. Mus., vol. 44, p. 43. UCHIDA, 1925, Jap. Jour. Zool., vol. 1, p. 97.

Several medusae belonging to the common arctic species were collected among innumerable diatoms. Out of specimens examined by me, the smallest one is 5 mm. high and 3.2 mm. wide. Eight gonads make their appearances as a round sac on the uppermost part of eight radial canals. The largest specimen is 12 mm. high and 7 mm. wide. Gonads develop as eight sausage-like masses, hanging down from the upper part of radial canals into the bell cavity. The medusa is occasionally tinted pinkish.

A young medusa was already from Oshoro in 1925.

Loc. Asamushi, March 10, 1925.

14) *Liriope tetraphylla* (CHAMISSO et EYSENHARDT).

Liriope tetraphylla; BIGELOW, 1913, Proc. U. S. Nat. Mus., vol. 44, p. 55.

Liriope rosacea; MAAS, 1909, Abhandl. d. math.-phys. Klass. d. K. Bayer. Akad. d. Wissen. Suppl.-Bd. 1, Abhandl. 8, p. 31.

Geryonia tetraphylla; CHAMISSO et EYSENHARDT, 1821, Nova Acta Phys. Med. Acad. Leop. Carot., tome 10, p. 357, pl. 27, fig. 2.

Several young specimen were examined. As they were all in a young stage, definite identification could not be made, but they are probably to be referred to the species, which is very common in any Japanese water.

Loc. Asamushi, Sept. 16, 1924. Yunoshima, Sept. 30, 1926. Hadakaiwa, Oct. 16, 1926.

Scyphomedusae.

ORD. CUBOMEDUSAE.

15) *Charybdea rastonii* HAACKE.

Charybdea rastonii; HAACKE, 1887, Jen. Zeit. f. Naturw., Bd. 20, p. 591, Pl. 35, Fig. 1-15. MAYER, 1906, Bull. U. S. Fish. Commission, vol. 23, pt. 3, p. 1134, pl. 1, fig. 1-1 c. BIGELOW, H. B., 1909, Mem. Mus. Comp. Zool. at Harvard Coll., vol. 37, p. 17, pl. 1, 10. MAAS, 1909, Abhandl. d. math.-phys. Klas. d. K. Bayer. Akad. d. Wissen. Suppl.-Bd. 1, Abhandl. 8, p. 41. MAYER, 1910, Medusae of the world, vol. 3, p. 508, 726. —, 1913, Pub. Carnegie Inst. Wash., no. 214, p. 170. YATSU, 1913, Journ. Coll. Sci., Tokyo, vol. 40, art. 3, p. 1. —, Dobutsugaku Zassi, vol. 30, p. 24. MAYER, 1917, Smithsonian Inst. Nat. Mus., Bull. 100, vol. 1, pt. 3, p. 187. STIASNY, 1912, Vid. Medd. f. Dansk naturh. Foren Bd. 73, p. 515.

Charybdea brevipedalia; KISHINOUE, 1891, Dobutsugaku Zassi, vol. 3, p. 437, fig. 1-3.

Charybdea (young); UCHIDA, 1926, Proc. Imp. Acad., vol. 2, p. 295, fig. 1.

Two fine specimens of the species were examined by me. The larger one is 35 mm. high and 32 mm. wide. The medusa is common during August and September in Japanese waters. It is not unworthy of mention that those found in the Japan Sea and in Hokkaido are generally larger than those in the Pacific but no other remarkable difference could be seen. Recently a young medusa with a height of 1.2 mm. was recorded.

Loc. Hadakaiwa, Oct. 5, 1926.

ORD. STAUROMEDUSAE.

16) *Haliclystus auricula* CLARK.

Haliclystus auricula; CLARK, H. J., 1863, Jour. Boston Soc. Nat. Hist., vol. 7, p. 559. MAYER, 1910, Medusae of the World, vol. 3, p. 532.

Haliclystus tenuis; KISHINOUE, 1910, Jour. Coll. Sci., Imp. Univ., Tokyo, vol. 27, art. 9, p. 4, pl. 1, fig. 3.

The bell, without the peduncle, is octangular-pyramidal, gradually expanding towards the bell margin, 9 mm. high and 10 mm. wide. The peduncle is quadrate and with four interradial furrows, about 6 mm. long and 1.7 mm. in diameter, and gradually widening towards the basal disc. The whole surface of the animal is finely granulated with nematocysts. The gelatinous substance is thin and rigid. The

marginal portion of the bell is divided into 8 parts, making eight arms, one in each adradius. Each arm is provided with a tentacle cluster. The four perradial clefts between the tentacle clusters are deeper than the four interradial ones. Each tentacle cluster consists of about 30-40 knobbed tentacles, which are hollow, and are provided with globular knobs, which are covered with nematocysts, at their terminal ends. They are about 0.8 mm. in length. The eight marginal anchors, which are situated in each perradius and interradius, are kidney-shaped and are mounted upon a short cylindrical peduncle, the perradial four among them being situated at a higher level than the interradial four. Their diameter is about half that of the peduncle. The manubrium is short and four sided, and liable to be folded on account of its thinness. The gastric filaments are numerous in each perradius, arranged along about the lower half part of the gastric cavity. There are eight adradial gonads, making four pairs in each perradius. These gonads are narrow, extending to the ends of the eight arms from the aboral end of the umbrella, each consisting of about forty or more out-folded vecicles, arranged in about two rows. These vecicles are various in size according to the stage. The peduncle has four interradial tracts of longitudinal muscle-fibers and four perradial canals, which communicate with the central stomach cavity of the umbrella.

Colour. Colour very variable; umbrella brown or green with scattered white spots, which are especially conspicuous on the bell margin. The peduncle is generally light brown or green. The knobs of the marginal tentacle are brown, and the stem is green. The adradial parts of the medusa are brown. The marginal anchors are bright brown and the gonads brown or deep port wine coloured.

Loc. Tsuchiya, July 27, 1926. Zizo, July 2, 1926.

Remarks. The medusa is very common on *Sargassum* from the

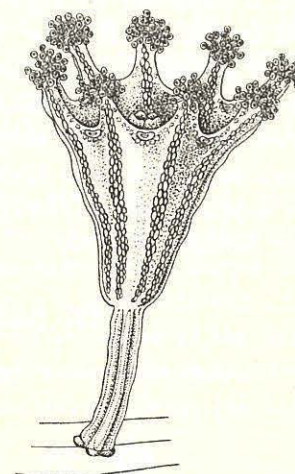


Fig. 3. *Haliclystus auricula*.
17 mm. high.

beginning of July to the end of August. A young medusa was recorded from Oshoro by KISHINOUE (1910) as *Haliclystus tenuis*. According to his description, this medusa has eight genital glands, each consisting of many round sacs arranged in two longitudinal rows and a comparatively higher bell than that of medusae formerly recorded. Of course, the Japanese medusa is somewhat smaller in size and has fewer gonads, but I examined several specimens which were collected at Oshoro and the genital vesicles in each gonad are arranged in four rows. Moreover, the shape of the preserved medusa is more or less variable according to shrinkage, so the medusa in question seems to be a young one of *Haliclystus auricula*, which is commonly found in the northern Atlantic.

17) *Sasakiella cruciformis* OKUBO.

Sasakiella cruciformis; OKUBO, 1917, Dobutsugaku Zassi, vol. 29, p. 317, fig. 1-2.

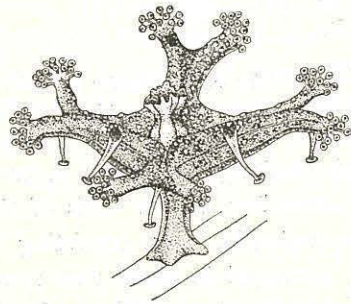


Fig. 4. *Sasakiella cruciformis*.
10 mm. in diameter.

Bell provided with four interradial arms, which are divided into two short, paired arms, therefore giving a nearly cruciform shape. Bell 10 mm. in diameter and 2.5 mm. in thickness, when expanded. Peduncle 3 mm. in length, becoming wider towards the basal end, which represents a adhesive disc. The gelatinous substance is transparent, with numerous small white spots, which are especially abundant in the perradial part of the subumbrella. The exumbrella is generally smooth, while the subumbrella has four interradial furrows, which begin at the base of the manubrium, leading to the marginal portion of the subumbrella. The primary tentacles are hollow and are eight in number, four in each perradius and another four in each interradius. These tentacles are tapering and each is provided with an adhesive disc at its terminal end and a white spot at the middle length. The perradial four are about 3 mm. long, while the interradial four 2 mm. The interradial arms become generally narrow towards

the distal end, and are consequently divided into two short arms about 1 mm. long and which are provided with 10 hollow secondary tentacles at their ends. These tentacles are capped and are arranged in three radial rows, the outer three tentacles, which are older, being furnished with a white spot on their abaxial side. The manubrium has four thin lips, its perradial ridges each connecting with a perradial portion of the subumbrella, which is elevated. Gastral filaments make groups in each interradial part, close to the mouth. Gonads represent eight adradial rows of 9 succules, which extend from the base of the manubrium to the tip of the arms.

Colour. Exumbrella generally transparent, with small white spots, the entoderm brown and especially deeper brown along the marginal portion. Subumbrella also brown with white spots on the margin and the perradial parts. Stem, gelatinous substance, transparent, with some small white spots, its entoderm brown, especially deeper at the base. Manubrium light brown. The primary tentacles are white in the stem, slightly brown in the adhesive disc, and brownish purple at the base. Secondary tentacles brown.

Loc. Tsuchiya, Sept. 27, 1926.

Remarks. This interesting species was first recorded by OKUBO (1917) from Oshoro, Hokkaido. From the result of my investigation on the medusa at Oshoro last year and at Asamushi this year, those at Oshoro were blacker than those at Asamushi. However, as far as my observations go, medusae belonging to the order are generally considerably variable in colour. The remarkable characteristics in the genus lie in the primary tentacles, which are not metamorphosed into anchors.

The medusa is commonly found attached on *Sargassum*.

ORD. SAEMOSTOMAE.

18) *Dactylometra pacifica* GOETTE.

Dactylometra pacifica; BIGELOW, 1913, Proc. U. S. Nat. Mus., vol. 44, p. 92.

Dactylometra quinquecirrha var. *pacifica*; GOETTE, 1886, Sitz. d. könig. preuss. Akad. d. Wiss. z. Berlin, Bd. 39, p. 4.

Dactylometra pacifica var. *ferruginaster*; MAAS, 1909, Abhandl. d. math.-phys. Klass. d. K. Bayer. Akad. d. Wissen., Suppl.-Bd. 1, Abhandl. 1, p. 44, Taf. 2, Fig. 14.

Dactylometra longicirra; KISHINOUE, 1892, Dobutsugaku Zassi, vol. 4, p. 261, pl. 2.
Dactylometra ferruginaster; KISHINOUE, 1892, Dobutsugaku Zassi, vol. 4, p. 263, pl. 3.

According to Mr. S. KOKUBO, the medusa is commonly found at Asamushi from spring to winter. I have examined numerous specimens from various localities of the country, such as Aomori, Misaki, Kanazawa, Seto, the Inland Sea, Kagoshima, and Toyama and have come to the conclusion to reduce several synonyms given above into one, viz. *Dactylometra pacifica*, concurring with BIGELOW (1913). However, *Kuragea depressa*, which was referred to the above species by him seems to me to be a quite different species. The original describer of the species was GOETTE, who gave it a brief description in 1886, based on a preserved specimen obtained at Nagasaki, but KISHINOUE (1892), who examined specimens from the Inland Sea, described the species in detail.

19) *Cyanea capillata* ESCHSCHOLTZ.

Cyanea capillata: ESCHSCHOLTZ, 1829, Syst. der Acalephen, p. 68.

Cyanea capillata (in part); MAYER, 1910, Medusae of the World, vol. 3, p. 596.

Cyanea capillata var. *capillata*: BIGELOW, 1913, Proc. U. S. Nat. Mus., vol. 44, p. 93, pl. 4, fig. 8, 9.

Cyanea ferruginea: ESCHSCHOLTZ, 1899, System der Acalephen, p. 70, Taf. 5, Fig. 1.

Cyanea citrea: KISHINOUE, 1910, Jour. Coll. Sci., Imp. Univ. Tokyo, vol. 27, art. 9, p. 16, pl. 4, fig. 16, 17.

The umbrella is quite flat and discoidal, high in the central and the marginal (especially the adradial) parts, making a shallow groove on the exumbrella. It measures 350 mm. in diameter. The umbrella margin is divided into 16 lobes by deeper adradial clefts and shorter perradial and interradial sensory ones. The adradial clefts measure 45 mm., while the sensory ones 30 mm. These lobes are again divided into two, the one nearer to the sensory organ being smaller than the other.

The exumbrella is generally smooth, but the subumbrella is very complicated, as follows. The eight sensory organs are found deep at the bottom of a groove formed by two ephyral lobes and an exumbrella roof. The gastrovascular system in a lobe is characteristic in the species; it consists of a broad canal adjacent to the sense organ and about ten radial canals in a group. The broad canal sends out several canals on both sides, among them, those nearer to the sensory

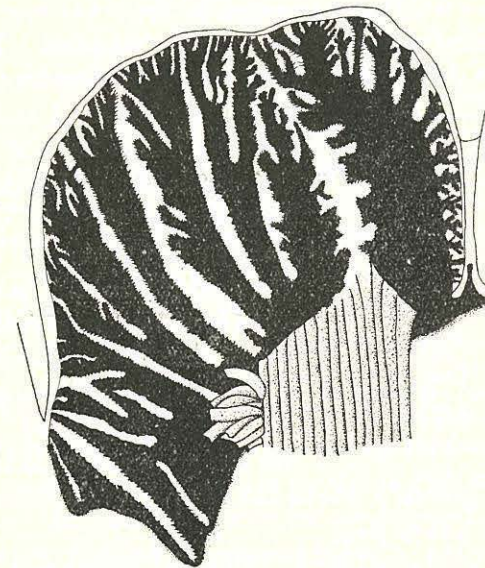


Fig. 5. *Cyanea capillata*. Canal system of an ephyral lappet.

organs are larger and more numerous than those on the other side. The other radial canals are mostly dendritic, especially in the terminal portion, and sometimes are anastomosed. The peripheral margin of these canals are also provided with numerous minute canals. There are sixteen bundles of radial muscular ridges in the subumbrella between the per- (or inter-) radial and the adradius. A bundle is 60 mm. long and 30 mm. wide, consisting of 15 muscular ridges. These muscular ridges are provided with several simple transverse canals. Outside of the stomach there are parallel, concentric muscular ridges, among them, 15 peripheral are conspicuous and 5 proximal are faint. The zone of the muscular ridges is 40 mm. wide and is divided into 16 groups; eight in each per- (or inter-) radius and another eight in each adradius. Those in the perradius and the interradius are longer, 60 mm. in length, while those in the adradius are shorter, 30 mm. These concentric muscle ridges also have several transverse canals which are wider than those in the radial ridges and are somewhat arboraceous in their terminal portion. There are

numerous tentacles which are arranged in about five rows along these radial and concentric muscle zones in each adradius. The tentacles are hollow and very contractile. The

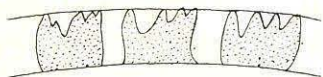
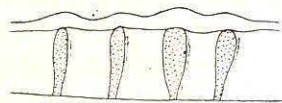


Fig. 6. *Cyanea capillata*. a. Canals of a radial muscular ridge; b. Canals of a concentric muscular ridge.

mouth is four-sided and is provided with four perradial oral arms, which are curtain-like and complexly folded, especially at the free margin. The stomach is 130 mm. in diameter and gives rise to 16 radial pouches, which again send out several radial canals into the lobes. The genital porticuses are somewhat isosceles triangular, though the periphery is round. The gonads are linear, imbedded in the gelatinous substance, which generally swells out from the four interradial genital porticuses, like a hollow bag.

Colour. Tentacle brick brown. Muscular system and gonad yellow in preserved specimens.

Loc. Tsubakiyama, May 11, 1926.

Remarks. Medusae belonging to the genus were described as several different species from several localities. MAYER (1910) reduced these species into two: *Cyanea capillata* and *Cyanea annaskala*. BIGELOW (1913) followed him and described the Japanese species in the Inland Sea as *Cyanea capillata* var. *nozakii*. STIASNY (1921) tried another revision of the genus but used the name for the medusa. However, I am of the opinion that two medusa, namely *C. capillata* and *C. nozakii*, must be separated, because they are distinguishable in the radial canals, the radial muscle system, and the colour.

The identification of species belonging to the genus has formerly been made based on their colour, or size, and the shape of the marginal lobes, but these factors are highly variable in one species, so special observations must be made on the canal systems and the muscular system, as they are stable in a preservative. With regard to the radial canals of *Cyanea capillata*, there are some differences in former figures, but those made by KISHINOUE (1910) and BIGELOW (1913) almost agree with the canals in my specimens.

ORD. RHIZOSTOMAE.

20) *Rhopilema esculenta* var. *asamushi*, n. var.

The umbrella is higher than a hemisphere, 100–200 mm. in diameter. The gelatinous substance is rigid, and thick at the center, becoming gradually thin towards the margin. The margin of the umbrella is divided into 64 or more velar lappets, which are often cut again. They are highly variable, not only in individuals but even in octants in a specimen. These velar lappets are oval, while the eight ocular lappets are smaller in size and more or less lanceolate. The thin marginal portion, which is turned inside and is velum-like, is 32 mm. wide in a medusa with a diameter of 180 mm. The subgenital porticus in each interradius is large and somewhat kidney-shaped. There is a wart-like protuberance, a papilla, in each interradial margin of the porticus. Its outer surface is concave inwards. The oral pillar in each perradius is almost an isosceles-triangle in cross section, having one outer surface and two inner ones. The upper portion of the oral

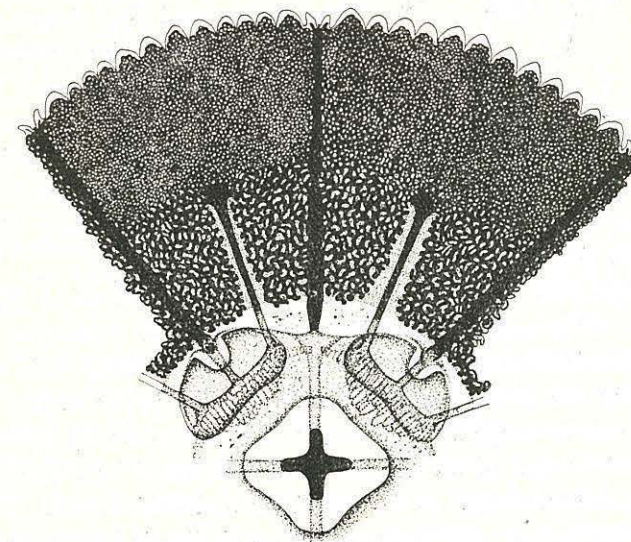


Fig. 7. *Rhopilema esculenta* var. *asamushi*, n. var. Ventral view of a quadrant of the umbrella. $\times \frac{2}{3}$

part is 100 mm. in diameter and is connected with the quadrate prismatic part downwards. The prismatic part is 40 mm. in diameter and has a canal in the central portion. The canal is cruciform in section and sends off 8 pairs of canals, one into each scapulet, which is furnished with complicated sucking frills and numerous hollow filamentous appendages. Each scapulet is divided into two pairs at the distal end. The cruciform canal above mentioned is divided into 12 canals, three in each perradius. Out of these canals, a middle one leads downwards, while two paired ones run in a scapulet respectively, being divided again into two canals at its distal end. The un-paired middle canal is divided again in a lower portion into three canals:

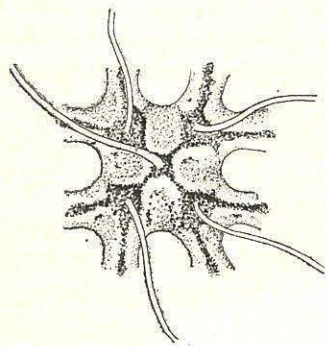


Fig. 8. *Rhopilema esculenta* var. *asamushi*, n. var. Ventral view of oral part.

one middle and two paired. The former leads to the underside of the oral part, while the latter ones run into the oral arm, which hangs below. The ventral side of the oral arm is very similar to *Rhopilema esculenta*. There are five separate groups of sucking frills,—one smaller one in the center and four larger ones in each perradius, each provided with a long filamentar appendage. The central frill is connected by four narrow arms with the four perradial ones, which are again connected by two arms with those of the eight arms. Among the five filamentar appendages, the central one is the largest and longest.

The eight oral arms are not so well developed as in *Mastigias*. They are three-winged and are furnished with numerous hollow appendages which are distributed among the sucking frills of each wing. They are smaller and filamentar in the upper region but are stout and spindle-shaped. The larger ones are generally present near the terminal portion of the oral arm, but none could be specially called the terminal appendage, as in *Mastigias* and *Rhizostoma*. The oral arm and the largest appendage are almost similar in length, measuring 90 mm. The central canal of the arm gives off a few broad canals on either side, which extend to the wings and are divided into

numerous minute canals which lead to a suctorial mouth.

The gastrovascular system of the medusa is characteristic. There are eight perradial and interradial canals which extend from the central

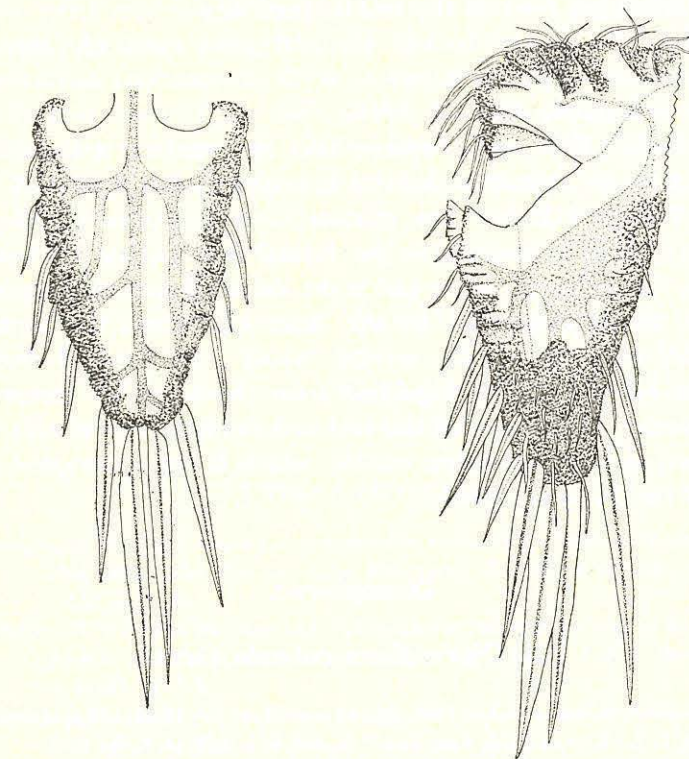


Fig. 9. *Rhopilema esculenta* var. *asamushi*, n. var. Frontal view of oral arm. $\times \frac{2}{3}$
 Fig. 10. *Rhopilema esculenta* var. *asamushi*, n. var. Lateral view of oral arm. $\times \frac{2}{3}$

stomach to the eight sense organs. Besides these eight canals, eight narrower and shorter adradial canals come off from the stomach and connect at a swollen end with the indistinct ring canal. Inside the ring canal, there are anastomosed canals, which are connected with the eight perradial and interradial canals but not with the eight adradial canals. Outside the ring canal, there are numerous narrow canals, which are more complexly anastomosed than those inside the canal.

The central stomach cavity is almost octagonal in outline and is provided with numerous gastral filaments in each interradius.

The gonads develop in each interradius, showing numerous foldings, which are larger towards the middle portion.

Colour. The umbrella and the oral arms are sandy colour and the gonads are yellowish brown.

Loc. Asamushi, Aug. 29, 1925.

Remarks. It is rather seldom that the medusa is found in the bay, but I saw numerous medusae belonging to the species at Yunohama, Yamagata Prov. The medusa is very similar to *Rhopilema esculenta*, which is common in the Inland Sea and on the coasts of Kiushu, but differs in colour and in the shape of the larger appendages of oral arms. In respect to the latter character, the medusa is somewhat common to *Rh. verrillii*, which was recorded from the Atlantic, but is easily distinguished from the latter by the presence of filamentar appendages on the oral arms and the ventral side of the oral part, and the concentric muscle, which is not interrupted in the radii of the 16 radial canals.

Ctenophorae.

21) *Hormiphora palmata* CHUN.

Hormiphora palmata; CHUN, 1898, Die Ctenophoren der Plankton-Expedition, p. 17, Pl. 3, Fig. 1, 2. KOMAI, 1918, Ann. Zool. Jap., vol. 9, p. 451, pl. 7, fig. 1.

Hormiphora japonica; MOSER, 1908, Abhandl. K. Bayer. Akad. Wiss. Suppl.-Bd. 1, Abhandl. 4, p. 10 pl. 1, fig. 6-8.

A specimen of the common species was obtained by Mr. TAKATSUKI. The medusa is 46 mm. long and 20 mm. wide. Comb plates, 75 in number. Tentacles torn off.

Colour. Tentacle bases yellowish. Comb plates white.

Remarks. The species was recorded from the Pacific coasts of Japan by MOSER (1908) and KOMAI (1918).

I examined several specimens obtained at Toyama Bay, the Japan Sea.

Loc. The quay of the Asamushi Marine Biological Station, May, 1926.

22) *Beroë ramosa* KOMAI.

Beroë ramosa; KOMAI, 1921, Ann. Zool. Jap., vol. 10, p. 17, fig. 2.

Four specimens caught by Mr. TAKATSUKI were examined by me. The largest specimen among them is 55 mm. long and 25 mm. wide. The gelatinous substance is thick at the upper portion and becomes gradually thin towards the bell margin. Comb plates so numerous and closely set that one can hardly count them. Meridional canals, as well as pharyngeal canals, giving off numerous side-branches on either side; these branches generally run horizontally into various depths of the gelatinous substance, repeatedly branching.

Colour. Slightly pinkish.

Loc. The quay of Asamushi Marine Biological Station, Sept. 5, 1926.

Remarks. The species was described in detail by KOMAI (1921) based on several specimens from Hokkaido.

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