

PROCEEDINGS
OF THE
ROYAL IRISH ACADEMY.

Third Series.

VOLUME V.



DUBLIN :
PUBLISHED AT THE ACADEMY HOUSE, 19, DAWSON-STREET.

SOLD ALSO

By HODGES, FIGGIS. & CO. (LTD.), GRAFTON-ST.:

By WILLIAMS & NORGATE,

LONDON : 14, HENRIETTA-STREET, COVENT GARDEN.

EDINBURGH : 20, SOUTH FREDERICK-ST. OXFORD : 7, BROAD-ST.

1898-1900.

XXXI.

THE FAUNA AND FLORA OF VALENCIA HARBOUR
ON THE WEST COAST OF IRELAND.

(PLATES XIX. TO XXI.)

[COMMUNICATED BY DR. R. F. SCHARFF, JUNE 26TH, 1899.]

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PREFACE.

THE west coast of Ireland has for a long time been the hunting ground of marine naturalists. Its extreme western position, with a fine indented coast-line broken up into numerous sheltered bays, has induced many to investigate its own peculiar fauna and to search after rare Atlantic species.

In the spring of 1895, Mr. W. I. Beaumont, Mr. F. W. Gamble, and I agreed to form a party for investigating those groups of animals in which we were particularly interested, and it so happened that these groups—Medusæ, Turbellaria, Nemertea, and Nudibranchiata—had received very little attention from previous workers on the west coast.

On the strong recommendation of Prof. A. C. Haddon we decided to make Valencia Harbour our headquarters, as that locality appeared to be the most suitable for our requirements—a well sheltered harbour with dredging grounds and a good tide from the ocean. We arrived there at the beginning of April, and were so fortunate as to obtain the use of an empty house close to the shore. This we converted into a temporary laboratory for two months.

The successful results of this visit led us to organize another expedition to the same place for the summer of 1896. The Royal Society gave us a grant for the hire of a trawler for exploring the ground outside the harbour; and the trustees of the Fishermen's Hall at Valencia kindly allowed us the use of the building. This large hall was most suitable for our requirements, possessing many windows and an ample supply of large tables. Two anterooms were also available, one we used for sorting over and keeping in dishes the material collected, and the other for photographic purposes.

On this occasion the party consisted of six naturalists, the new members being Prof. F. E. Weiss, Mr. A. O. Walker, and Mr. M. D. Hill. It was necessary to organize more definitely our work and duties. Mr. Gamble took charge of the dredging operations, and his colleagues were Mr. Beaumont and Mr. Hill. Prof. Weiss devoted his attention to the collecting of marine algae, and Mr. Walker dredged specially for crustacea. The whole of the tow-netting, as on the first visit, fell to my share.

During our visits we enjoyed the kind hospitality of the Knight of Kerry and Lady Fitz Gerald.

The Rev. A. Delap and Mrs. Delap gave us all a hearty welcome, and a great part of our success is due to their advice and kindness. The Misses Delap, who had for some years taken a great interest in the marine fauna of the harbour, gave us invaluable assistance, and their work is recorded in most of the reports.

To all who so kindly received us and made our visits so pleasant, and to those who helped us in our work, we desire to express our sincere thanks.—E. T. BROWNE.

PART I.—*The Pelagic Fauna.*

I.—NOTES ON THE PELAGIC FAUNA (1895–98). BY E. T. BROWNE,
B.A., University College, London.

The energies of the marine zoologists who have worked on the west coast of Ireland have chiefly been devoted to the sedentary animals obtained by dredging and shore-searching, but the pelagic forms collected by tow-netting have been rather neglected. It was the scarcity of records relating to the medusæ that led to my visit, but although the tow-nettings were usually taken for medusæ, and most of my time occupied in examining them whilst alive, still I noted the occurrence of animals belonging to other groups which were identifiable, and when possible preserved a few specimens.

The Misses Delap most willingly continued the tow-nettings after our departure in 1896, and sent me the material, preserved in formalin, for examination. They also frequently recorded the temperature of the sea, and kept notes on the changes in the pelagic fauna. Their tow-nettings extended from October, 1896, to December, 1898. Over a hundred bottles of general tow-net material have been sent to me, in addition to numerous bottles containing delicate animals, like Medusæ, specially preserved. This material has formed the main foundation of the various reports on the pelagic fauna.

It was not my intention, nor that of the Misses Delap, to investigate thoroughly the whole pelagic fauna of Valencia Harbour. Such an undertaking can only be successfully carried out by many specialists at a properly equipped Biological Station. Certain groups have received more attention than others, and an attempt has been made to record the principal and characteristic inhabitants of the harbour taken with the tow-net.

It was a great pleasure to find friends who were willing to help in the examination of the material.

Professor W. A. Herdman received the pelagic Tunicates, and has kindly written a report upon them (page 748).

Mr. I. C. Thompson most generously undertook to examine all the

Copepoda—a laborious undertaking, especially as the Copepoda usually formed the chief bulk of the tow-nettings (page 737).

Mr. J. T. Cunningham has written a report upon the few larval fishes taken during my first visit in 1895 (page 752).

Mr. F. W. Gamble has identified the various Chætogonatha (p. 745).

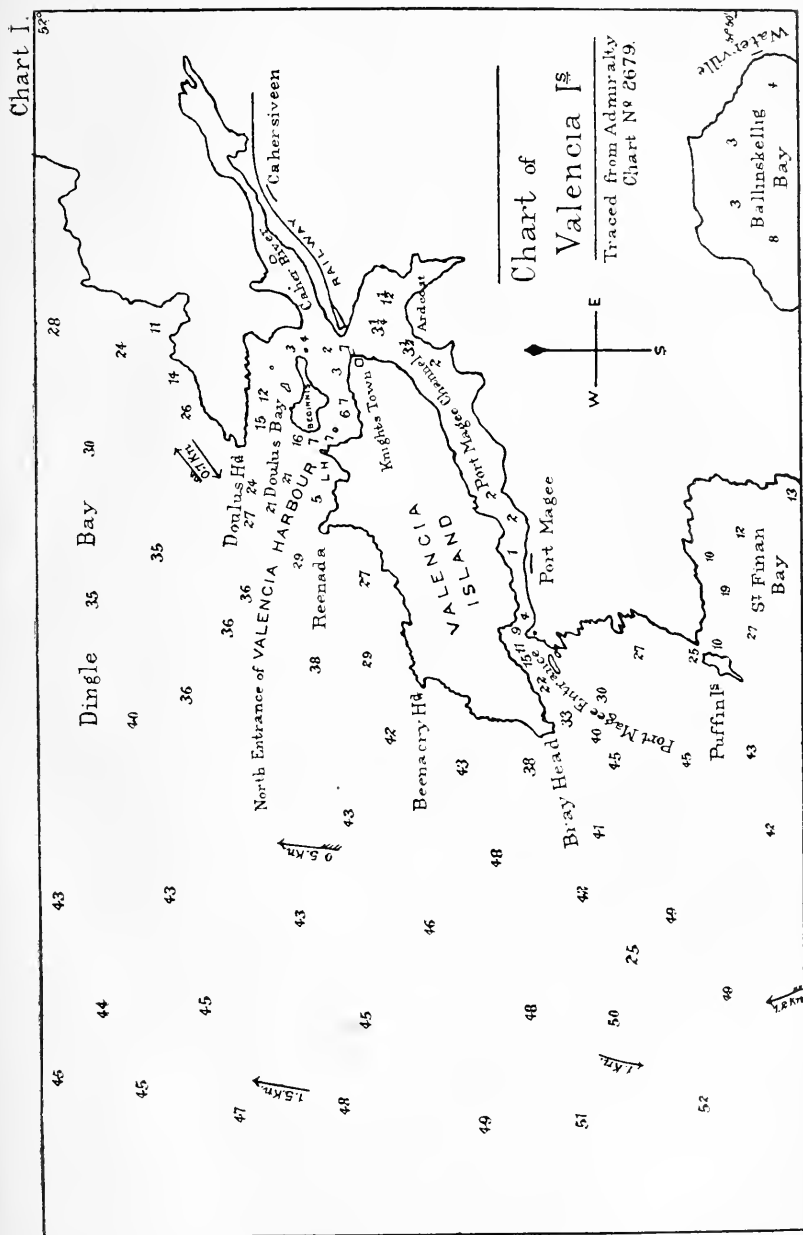
The four reports mentioned above are treated as separate publications, each complete in itself; and I have added one on the Medusæ, on account of its disproportionate length. The remaining pelagic animals belonging to various groups, for the identification of which I am mainly responsible, are placed together in this part under Faunistic Notes (page 676).

Valencia Harbour, and its Surroundings.

(See CHART I., p. 671, and CHART II., p. 754.)

The harbour occupies the unique position of being the most westerly port in Europe, the lighthouse at its entrance standing in longitude $10^{\circ} 19' 16''$ W., and latitude $51^{\circ} 56' 0''$ N. It is situated at the northern end of Valencia Island, which is separated from the mainland by a narrow channel like a tidal river in general appearance. This channel, with 1 to 4 fms. of water at low tide, is about six miles in length, extending from Valencia Harbour to Port Magee, situated at its southern entrance. The tide does not enter at one end of the channel and pass out at the other, but comes in at both ends: the two tides meeting in the channel about midway, so that the action of the tide in Valencia Harbour is just like that in a tidal river.

Most of the tow-nettings were taken in Valencia Harbour Channel, between the lighthouse at the entrance and the ferry pier at Knightstown. This channel is about two miles in length, 5–7 fms. deep at low water, and does not exceed half a mile in width. It has a narrow entrance from the ocean, facing the north-west, and not quite a quarter mile across. A little way inside is an isolated reef of rocks lying in mid-channel, and just uncovered at low tide, round which the tide flows at a good pace. In this locality the tide is strong enough to keep afloat and to extend fully a large tow-net fastened to a boat at anchor, the ideal method of tow-netting. The flow of the flood-tide is marked one and a half knots on the Admiralty Chart, and the ebb-tide two knots. The narrow entrance with the rocky reef just inside, followed by a curving of the channel to eastwards, affords an excellent



natural protection from the swell of the Atlantic. The part of the channel which forms the anchorage grounds is completely sheltered. It is a splendid place for tow-netting, and easily reached in ten minutes from the ferry pier. The tow-nettings were usually taken during the flood tide, as the water was then quite clean and the fauna less scattered.

When the sea permitted, tow-nettings were occasionally taken outside the harbour entrance (14–18 fms.), and in Doulus Bay (12–20 fms.) on the north side of Beginnis Island. There is a second entrance to the harbour through Doulus Bay and round the north side of Beginnis Island, but a sand-bar and shallow water render it less favourable for tow-netting, besides which the main harbour channel has to be crossed to get to it.

A very small river, the Cahir, empties itself into Valencia Harbour. The great bulk of its water passes out into Doulus Bay, and only after very heavy rains is its water, brownish from the peat bogs, visible in the Harbour Channel. At other times the amount of fresh water in the harbour is insignificant. During heavy gales, which are particularly severe on this exposed coast in winter time, the harbour is completely churned up, and the destruction of the pelagic animals is very great.

The main flood-tide runs northwards along the coast of Kerry. Off Valencia Island the stream is about seven miles away, running direct from the Skelligs to the Blasket Islands. A branch of the main stream, of considerable size and strength, passes along the shores of Valencia Island and round Doulus Head into Dingle Bay. It is from this stream that the harbour is supplied.

Sea Temperatures and Climate.

Sea Temperatures.—During my visits the surface temperature of the sea was taken on every occasion on which the tow-net was used. The Misses Delap have also recorded a large number of readings from February, 1896 to December, 1898. As a rule the temperatures were taken from a boat, but during stormy weather from the rocky shore near Reenagiveen Point. Although the readings are not sufficiently accurate for physical observations, yet they are quite near enough for biological purposes. The following table shows the temperatures for each month of the year:—

THE SURFACE TEMPERATURE OF THE SEA IN VALENCIA
HARBOUR.

	VALENCIA HARBOUR.				DINGLE. Mean. (1879-82).	BEREHAVEN. Mean. (1879-82).
	1895.	1896.	1897.	1898.		
Jan. 1-7	F.° °	° °	47-48	49 °	°	°
8-14			46·5-48	50	44	45
15-22			45·5-46	50·5		
23-31		48	44·5-45			
Feb. 1-7		49	46-46·5	49		
8-14		49		49	46	46
15-22			48	49·5		
23-28		49	48·5			
Mar. 1-7			46	46-49		
8-14		50-51	46-48	49	49	48
15-22		50				
23-31		51	50	48		
Apr. 1-7	49		48			
8-14	49-50	52	51		51	49
15-22	50-51	53		50		
23-30	51-52	53	50	50·5		
May 1-7	51	54				
8-14	52-53		50-51	52·5-54	56	54
15-22	52-53		52-54	52		
23-31	54	54	53	52		
June 1-7		56-57	53-56			
8-14		58	56	58	58	56
15-22		60-60·5				
23-30		59·5	56-57	57·5-58		

Dingle and Berehaven.—The Mean Surface Temperature of the Sea for the Month (1879-82).—From the *Meteorological Atlas*, 1883.

THE SURFACE TEMPERATURE OF THE SEA IN VALENCIA
HARBOUR—continued.

	VALENCIA HARBOUR.				DINGLE. Mean. (1879-82).	BEREHAVEN. Mean. (1879-82).
	1895.	1896.	1897.	1898.		
July 1-7	F.° °	56-57	56.5 °	56 °	°	°
8-14		58	56.59		59	57
15-22		60-60.5	58	58		
23-31		59.5	59.5-60.5			
Aug. 1-7		57-60.5	58	59.5		
8-14		56.5-59		60	60	59
15-22		58-58.5		59.5		
23-31		59	58	59-60		
Sept. 1-7		58	57	59		
8-14		57	55.5	61	58	57
15-22		57	57	59.5		
23-30		56-57		59.5		
Oct. 1-7		54-58	55			
8-14		50-52	55		52	53
15-22		50-52	55.5	57		
23-31		50	50	57-58		
Nov. 1-7		49-50	54	54		
8-14		50	55-55.5	56.5	49	50
15-22				54		
23-30		49-50	54			
Dec. 1-7		48-49	47.5-54	52		
8-14				50-52	45	47
15-22		45.5	50	50		
23-31		48	49	48		

Dingle and Berehaven—The Mean Surface Temperature of the Sea for the Month (1879-82).—From the *Meteorological Atlas*, 1883.

The maximum summer temperature has not exceeded 61° F. The minimum winter reading was 44°·5 F. in the winter of 1896–7, but in the following winter 47°·5 was the lowest reading.

Climate.—From 1867 to 1892 Valencia Island was honoured with a first-class Meteorological Station, which now stands on the adjacent mainland. Mr. J. E. Cullum has been the Director of this important Observatory almost since its foundation, and has recently published a useful paper on the “Climatology of Valencia Island, County Kerry” (Quart. Journ. Roy. Meteor. Soc., vol. xxii., 1896), from which I take a few abstracts.

Air-Temperature.—The island enjoys a very equable climate, suffering neither from frosty winters nor hot summers. Mr. Cullum, in his remarks on a table showing the mean monthly air-temperatures for a period of twenty-three years (1869–91), states:—“The first three months (of the year) exhibit a striking uniformity in the mean temperature (Jan. 45°·2, Feb. 45°·3 Mar. 45°·4), a feature which extends back to December. A rise of 2°·7 occurs between March and April, and the curve continues to ascend briskly for the next two months (May. 52°·1, June, 56°·6). The rise then slackens, and the actual maximum of the monthly mean temperatures, 59·2, appears in August. The descent is more uniform, and more rapid than the ascent has been, as in the space of four months the lowest point is again reached, in December, with a mean temperature of 45°.”

“It is somewhat remarkable that there are no clearly marked periods of either spring or autumn. Throughout the four months of winter the total change of mean monthly temperature does not exceed 0·6, while no approach to such uniformity is noticeable at any other season. The maximum in August coincides with the known maximum in sea-surface temperature of the same month; but there is no corresponding coincidence of a minimum of air-temperature in February, when the sea-surface is at its coldest.”

Sunshine.—“The mean annual amount (1881–1890) is 33·8 per cent., corresponding to 1486·5 hours of sunshine. The year commenced with a percentage of 21·9 in January, rising to a maximum of 43·3 in May. The figure then sinks to 31·7 in July, but rises to a second maximum of 35·9 in August; when this is past, the figures show a gradual decrease, until the minimum of 19·3 appears in December.”

“In considering the individual months, we find that there is but little difference between April, May, and June, the respective numbers being 40·9, 43·3, 39·9.”

Rainfall.—"The average yearly amount for the four lustra (1871-1890) is 58·26 inches, and the number of rain-days is 248."

"The curve for the twenty years is a very simple one, with a maximum of 6·45 inches in January, and a minimum of 3·29 inches in May. There is a decided indication of a second minimum in September; but the figures suffice to show that, without controversy, Valencia belongs to the region of winter rains."

FAUNISTIC NOTES.

(TABLES I. and II. on pages 692, 693).

It is somewhat disappointing to find that oceanic animals are not so numerous at Valencia as the geographical position of the place would lead one to suppose. To bring the Atlantic forms within the range of the coast tides a good surface drift towards land, such as is produced by moderate winds blowing in one direction for a few weeks, is required.

I have drawn up a table (I.) to show the occurrence of the principal members of the fauna of the harbour from July, 1896, to December, 1898. Special tables for the Medusæ and Copepoda will be found at the end of their respective reports.

Another table (II.) is constructed to show the months in which certain pelagic animals either appeared in shoals from the ocean, or, as members of the littoral fauna, occurred in such abundance that a considerable number of specimens could be taken in a short haul with the tow-net. On certain occasions a particular animal occurred in such vast quantities that tow-netting for anything else was almost useless. For instance:—*Cupulita* on October 8th and 9th, 1897; *Pleurobrachia* on May 13th, 1897, and at times in June, July, and August, 1898; *Oikopleura* on June 11th, 1898; *Thalia* on September 5th, 1896; and *Limacina* in July, 1897.

RADIOLARIA.

Radiolarians, belonging to the genus *Acanthometron*, were at times very abundant in the harbour, and usually came in shoals.

1896. Shoals in August and September.

1897. Shoals in August, September, and October.

1898. Shoal in August.

SIPHONOPHORA.

Verella spirans (Forskål).

This beautiful Siphonophore occasionally drifts into the harbour, and has been taken by the Misses Delap in the following months:—

1895. June. Two specimens.

1896. (None seen).

1897. July to September. Common in July.

1898. June, July, October, and November. A few specimens taken in each month.

The smallest specimen measured 23 mm. in length, and the largest 40 mm.

The margin of the disc is nearly smooth and not deeply notched. The tentacles are usually in a single row, but in places two rows are present. A few specimens taken with Medusa-buds upon the gonostyles.

Verella has been frequently recorded from the west coast of Ireland, and is often found stranded on sandy beaches after westerly gales.

It is very rare on the south coast of England; Cocks (1849), however, recorded a shoal at Falmouth in 1848, when hundreds were found on the beach after a south-westerly gale.

Muggiæa atlantica, Cunningham.

Muggiæa atlantica, Cunningham, 1892, Journ. Mar. Biol. Assoc., vol. ii., p. 212.

Although this species has but recently received a name, it is by no means a recent addition to the British Fauna. It was first briefly described by Peach in 1849 from specimens found in Fowey Harbour, Cornwall. It has also been confused with *M. Kochii*, which is very much like it in general appearance.

At Valencia this little Siphonophore occurs during the summer and autumn.

1896. From July to November 13th. Usually a few specimens taken on each occasion the tow-net was used. Some of the specimens were infested with a minute Cercaria, which lived in the mesogloea of the nectocalyx.

1897. Only two specimens taken in July. One seen in October and a few in November.

1898. It was taken from September 3rd to November 19th, and was very abundant during October. The nectocalyx of the largest specimens measured about 7 mm. in length. Medusoid gonophores bearing either ova or spermatozoa were common in October.

There is not sufficient evidence at present to show that this Siphonophore is a regular member of our southern fauna; it may be only a frequent visitor. Since it was first described by Cunningham, in 1892, it has been recorded almost yearly for the Plymouth district, where it has at times occurred in shoals. During the same period it has been frequently found in Falmouth Harbour by Vallentin.

Bourne (1890) probably took this species off the south-west coast of Ireland in 1889, but has recorded it under the name of *M. Kochii*.

Cupulita Sarsii, Haeckel.

Agalmopsis elegans, Sars (*partim*), 1846, "Fauna Littoralis Norvegiae," Part I., p. 32, pl. vi.

Cupulita sarsii, Haeckel, 1888, Siphonophora, "Challenger" Report, p. 234.

Haeckel, in the Report on the Siphonophora of the "Challenger" Expedition, has separated the original *Agalmopsis elegans* of Sars into two species. One form has retained its original name; the other has been transferred to the genus *Cupulita*, and given the new specific name of *sarsii*.

There are three genera very closely related, and distinguished principally by the shape of the tentilla.

Halistemma. Tentilla with a naked cnidoband and a simple terminal filament.

Cupulita. Tentilla with an involucrate cnidoband and a simple terminal filament.

Agalmopsis. Tentilla tricornuate, with a terminal ampulla and two-paired horns.

Sars has figured three kinds of tentilla for *Agalmopsis elegans*:—tricornuate (Plate v., figs. 7, 8); involucrate (Plate v., figs. 5, 6); and an oval form without a spiral cnidoband (Plate vi., fig. 10).

The drawings of the Valencia specimens made by the Misses Delap clearly show that a colony has two forms of tentilla. An involucrate form (like Sars, Plate v., fig. 6) and an oval form without a spiral euidoband (Plate vi., fig. 10). In some colonies the latter form is only present; in others both forms are present—the involucrate form occupying the central portion of the siphosome.

The tricornuate form has not yet been seen in any of the Valencia specimens.

1895. Small colonies about an inch in length were not uncommon during April and May. The largest was taken on April 18th, and measured 5 inches. The colonies were of a brilliant red colour, and the tentilla were of a simple oval shape.

The Misses Delap found colonies in July, and several on September 28th; the largest was 14 inches in length when fully extended.

1896. It was scarce during my visit in the summer, and only four small colonies, less than an inch in length, were found. A few nectocalyces were taken in the tow-net on November 6th.

1897. It occurred from March to November. Abundant about the middle of April, in May, and July. A specimen taken in April measured 10 inches in length, and had fourteen pairs of nectocalyces. Very abundant during September and October; some seen with sixteen pairs of nectocalyces.

1898. It was taken from March to December. Fairly common in August. Very abundant in October.

This Siphonophore is one of the animals which suffers badly from the destructive power of gales. In October, 1897 and 1898, *Cupulita* was very abundant, but almost disappeared after the first heavy gale. The Misses Delap informed me that after a very rough sea, early in November, 1898, the tow-net was full of isolated pneumatophores.

It belongs to the fauna of the Atlantic. Sars found his specimens on the coast of Norway. Greene (1857) has recorded *Agalmopsis elegans*, Sars, for Kingstown Harbour. At Port Erin, in April, 1894, I found several small specimens of a Siphonophore about an inch in length, and recorded its

occurrence under the name of *Halistemma*, Sp.? (Fauna of Liverpool Bay, vol. iv., p. 279.) Subsequently I changed the name to *Agalmopsis elegans*, Sars. (10th Ann. Report L.M.B.C., p. 30.) I have again examined these specimens in my collection, and find that they are similar to the small specimens of *Cupulita sarsii* taken in Valencia Harbour. The Port Erin specimens have all the tentilla of the simple oval form without a spiral cnidoband. Until a spiral cnidoband had been actually seen it was easy to go astray over the small oval tentilla, and I considered them to be tentilla in the process of development. It has not yet been found on the south coast of England.

ANTHOZOA.

Arachnactis albida, Sars.

Arachnactis albida, Fowler, 1897, P. Z. S., p. 803.

Only a few specimens of this floating Actinian have been taken in the harbour. They were found during May, 1895 and 1897, and belonged to early stages.

This species has been recorded from Norway, the Faeröe Channel, and the Hebrides. It is apparently new to the west coast of Ireland, and Valencia Harbour at present is its southernmost record.

Arachnactis bournei, Fowler.

Arachnactis bournei, Fowler, 1897, P. Z. S., p. 805.

This little brownish anemone, a floating larval form not yet traced to any known adult, was at times not uncommon in the harbour.

1895. April 5th to 18th, a few seen on every occasion on which the net was used. Absent in May. A single specimen taken on July 8th.

1896. Not uncommon during April.

1897. Taken from March to June.

It has been recorded from St. Andrews, Plymouth, Falmouth, and the Isle of Man.

CTENOPHORA.

Three species belonging to three different families are found in the harbour. Their size and beauty make them conspicuous objects at the surface of the sea on a calm day; their abundance is a marked feature in the pelagic fauna of the harbour.

A note of warning may prevent disappointment, and perhaps the loss of valuable specimens, by stating that formalin is a bad preservative for Ctenophores.

I have preserved a good many specimens of *Pleurobrachia* and *Beroë* in formalin of various percentages up to 10 per cent., and have used sea-water as well as fresh-water for the solutions. At first the specimens look splendid, and keep so for several months; but within a year a great change takes place. They gradually become opaque and flabby, and shrink up until the ciliated bands almost touch one another. Formalin is quite useless for *Bolina*, the specimens break up at once and simply melt away.

Formalin 5 per cent. solution is an excellent killing re-agent for *Beroë* and *Pleurobrachia*; but when the specimens are fixed, I advise the gradual introduction of alcohol until a 70 per cent. strength is reached.

***Pleurobrachia pileus*, Modeer.**

This is the commonest species in the harbour, and occurs almost all the year round. It is widely distributed throughout the British area.

1895. During April and the early part of May, a few specimens were taken on every occasion on which the tow-net was used. Towards the end of May it became more abundant. (Notes were only kept during April and May.)

1896. On my arrival in July *Pleurobrachia* was present in the harbour, and remained until November. It was very abundant at the end of July, swimming in shoals near the surface. On several days in August it was just as numerous. Large specimens up to 25 mm. in length were common during August. From September to November small forms, 2-4 mm. in length, were common and occasionally abundant, even in November.

1897. It was taken from January to November. Very scarce during the early part of the year. Small specimens abundant from May to July. Large specimens, 15-20 mm., were abundant during August and September, but scarce in October. Young stages, 2-4 mm. in length, were taken during October to the end of November; at times they were very abundant.

1898. It occurred from March to November. During May young stages, 2-3 mm., were common. Early in July specimens, 3-5 mm., and at the end of the month, 6-12 mm., were abundant. During August and September both early stages, 2-4 mm., and large adults, 15-25 mm., were abundant.

I am inclined to believe that there are two generations in a year. The larval forms, so numerous in the autumn, which survive the winter storms by remaining near the bottom in fairly deep water, reach the adult condition early in the following year, and produce the spring generation which is found during April and May. This generation growing rapidly during the warm summer months produces the autumn generation, which is more numerous, having been reared under more favourable circumstances.

M'Intosh (1889) gives an excellent account of the distribution of this species at St. Andrews for the year 1888.

***Bolina norvegica* (Sars). Sp.?**

The identification of this common but beautiful lobate *Ctenophore* has yet to be verified. When I was at Valencia I had no means of identifying the species, owing to the absence of the necessary books, and the numerous attempts to preserve specimens by different methods all terminated in absolute failure. The early larval stages killed in Flemming's solution and transferred to alcohol were passable, but the large specimens contracted almost beyond recognition.

1895. Only three specimens taken in April, and a few occasionally during May. Most were young stages. The largest specimen measured 32 mm. in length.

1896. From July to the end of September there was a mixture of early stages and large adults. During July young forms, 1-10 mm. in length were common, but adults over two inches were scarce. August was the principal month for large specimens. They were abundant on August 1st, 4th, 10th, and 24th; and very abundant (in shoals) on August 12th, 15th, and 22nd. The adult specimens ranged from 60 to 80 mm. in length, and 30 to 40 mm. in width. There was a considerable decrease in numbers after the first week of September. The last specimen was seen on September 24th, two days after a heavy gale.

1897. It was taken from May to October. Abundant in June. Very large specimens common during September and early in October.

1898. It occurred from May to November. Fairly common in the summer. A specimen taken early in September measured 85 mm. in length and 50 mm. in width.

Lobate Ctenophores have on several occasions been recorded in British seas. As a rule on each occasion a fresh name has been used, and no attempt has been made to give a full and careful description with good figures. Whether there are really several genera and species, or only a solitary species, is a subject for future investigation.

The following references may be of use to future workers on the lobate forms :—

Bolina hibernica, n.s., Patterson, 1838, Trans. Roy. Irish Acad., vol. xix., p. 96. 1839, p. 154. Lough Larne. Dublin Bay. June, 1838.

= *Alcinoe hibernica*, Thompson, 1856, Nat. Hist. Ireland, vol. iv., p. 447.

Alcinoe rotunda, n.s., Forbes and Goodsir, 1839, Rep. Brit. Assoc., p. 856. Kirkwall Bay.

Alcinoe smithii, n.s., Forbes and Goodsir. Ailsa Craig. Irish coast.

Mnemia norvegica of Sars. Greene, 1857, Nat. Hist. Review, vol. iv., p. 175.

"I have frequently obtained specimens of it, which were fully two inches in length; it is, however, a very fragile animal. Kingstown Harbour. 1856."

Mnemia norvegica, Haddon, 1886, Proc. Roy. Irish Acad., vol. iv., p. 615.

Numerous specimens on the south-west coast of Ireland.

= *Bolina hibernica*, Patterson.

Lesueuria vitrea of Milne Edward. M'Intosh, 1888, Ann. Nat. Hist., ser. 6, vol. ii.

St. Andrews. Very abundant. The largest measured $3\frac{1}{2}$ inches in length.

M'Intosh, 1890, Ann. Nat. Hist., ser. 6, vol. v., p. 40.

Young *Lesueuria* occur in April, and are abundant in May and June. Occasionally captured in November and December, about $\frac{5}{8}$ – $1\frac{1}{2}$ inches long. The adults appear to spawn in

July and gradually die off, leaving the young to develop during winter.

M'Intosh, 1889, Report, Fishery Board for Scotland, Part iii., pp. 259-300.

A full account of its occurrence at St. Andrews in 1888.

Bolina hydatina of Chun. Garstang, 1894, Journ. Mar. Biol. Assoc., vol. iii.

Found at Plymouth in May, 1892, and 1894.

Bolina hydatina, Vallentin, 1893, Journ. R. Instit., Cornwall, vol. xi.; 1896, vol. xiii., p. 45; 1897, vol. xiii., p. 254.

Falmouth Harbour, June, 1892. Abundant in June, 1894; May, 1895; May, 1897. Some measured 5.4 cm. in length.

Mnemia norvegica, n.s., Sars, 1835, Beskrivelser og Tagtagelser, &c. Norway.

Beroe bilobata, Dalyell, 1848, Rare and Remarkable Animals of Scotland, vol. ii., p. 254, plate liv.

Bolina norvegica (?) Hartlaub, 1894, Arbeiten Biol. Anstalt, Helgoland, Bd. i. Heligoland.

***Beroe ovata*, Eschscholtz.**

1896. *Beroe* was not seen in July, but on August 1st a specimen, about 10 mm. in length, was taken. From the middle of August to the middle of September it was a common object in the harbour, and at times quite abundant. Most of the specimens were large, 50-75 mm. in length. Early stages, 2-3 mm., were common on September 14th, and again in November.

1897. During January and February a few young stages, 2-4 mm. in length, were taken. It was not seen during March and April; and only one specimen of a young stage was captured in May. From June to November this Ctenophore was nearly always present in the harbour. It was very abundant during July and October. The largest specimens were taken in September and October.

1898. It was first seen in July, and remained until November. Very abundant during August and September. In the autumn very large specimens, up to 90 mm. in length and 50 mm. in breadth, were common. Small specimens, 4-6 mm. in length, were taken about the middle of August and during October.

The quick disappearance of the large Ctenophores in the autumn is, I believe, mainly due to gales and rough seas in shallow water. The flimsy construction of *Bolina* renders it specially liable to destruction by rough seas, but *Beroe* is less so. *Pleurobrachia* is the least liable to destruction owing to its shape, comparative smallness, and the firmer consistency of its mesoglæa.

Beroe apparently has only one generation in the year. Its breeding season is during the summer months, when the adults are so plentiful. The larval forms which survive the winter probably live in deep water. They seek the surface early in the summer, and are carried by surface currents towards the shore and by the tide into the harbour.

Beroe ovata has a wide distribution. Large specimens swarm off the Shetlands and the Hebrides, and also at times at St. Andrews, during the summer. Haddon (1886) found it exceedingly abundant off the west coast of Ireland. It is apparently rather rare on the south coast of England. I have only seen a few small specimens at Plymouth.

ECHINODERMATA.

Larval forms, known as *Pluteus*, *Bipinnaria*, and *Auricularia*, were not uncommon during the spring and autumn, and at times were quite abundant.

Bipinnaria asterigera, Sars.

Bipinnaria asterigera, M'Intosh, 1898, Ann. Nat. Hist. Ser. 7. vol. ii., p. 105, pl. ii.

A single specimen of this fine *Bipinnaria* was taken on November 25th, 1895. It measured about 6 mm. in length, and had twelve arms with corrugated margins. The *Bipinnaria* carried a well-developed little starfish, which belongs to the genus *Luidia*.

NEMERTEA.

Pilidium.

Two specimens of this larval form were taken in April, 1895. Its occurrence may have been more frequent, as it is not very likely that such a small and delicate form would be in a recognisable condition in unassorted tow-net material sent a long distance by post.

POLYCHÆTA.

No special records were kept of the numerous larval forms except a few, which I happen to know by name; only two are recorded here.

Magelona.

The free-swimming larval form was found on the following dates:—

1895. In May; abundant on the 24th. Specimens measured 1 to 2 mm. in length. July 5th, one specimen, 3 mm. in length.
1896. March 16th. A few specimens about 2 mm. in length. August 28th and September 1st, a solitary specimen on each date.
1897. July 19th, 29th, and August 5th, a solitary specimen on each date.
1898. March 30th and April 24th, a solitary specimen on each date.

Mitraria.

This rare larval form was only seen in 1895. A sudden swarm entered the harbour on April 10th, and disappeared on April 22nd. A few specimens were also taken between May 13th and 27th.

This larval form has been very rarely found in British seas. It has been recorded from Plymouth (Bourne, 1889) and Falmouth (Vallentin, 1891).

Watson (1898, 12th Ann. Rep., Liverpool Biol. Soc., p. 16) has succeeded in connecting Mitraria with a Polychæte called *Owenia filiformis*.

Autolytus, Sp. ?

A few females, carrying eggs, were taken during the spring, in the years 1895–98. It was twice seen in July, 1897, and once early in November, 1896 and 1897. The male, known as *Polybostrichus*, was only seen twice, on April 10th, 1897, and March 8th, 1898.

Tomopteris onisciformis, Eschscholtz.

This beautiful, transparent, free-swimming Polychæte is a regular inhabitant of Valencia Harbour. During the early

part of the year, from January to April, it is rather scarce, and only a few specimens are occasionally taken. Up to the end of March most of the specimens are about 6 mm. in length; but a few are larger, ranging up to 10 mm. In April fine adult specimens are taken, 25–30 mm. in length. In May large specimens are occasionally taken, and young ones, about 2–3 mm. in length, make their first appearance. During May and June the adult specimens gradually disappear, and their place is taken by their more numerous offspring. In July *Tomopteris* becomes fairly common, and at times even abundant. Most of the specimens are about 6 mm. in length, but some are quite young stages, about 2–3 mm., and a few belong to later stages, 10–13 mm. The association of early and intermediate stages tends to show that the breeding time of the adults extends over several months. The early stages taken in May probably come from eggs liberated in April, and are represented by the larger specimens taken in July; and the early stages taken in July come from eggs liberated at the beginning of June. During August most of the specimens are 5–12 mm. in length; but a few up to 30 mm. are taken. From the middle of September until late in October is the breeding season of this summer generation; and early in October young stages, 2–4 mm. in length, make their appearance, and soon become abundant. At the end of October there is again a mixture of different stages, just as in May, consisting of young and intermediate forms 2–12 mm. in length, and a few adults over 20 mm. About the middle of November a rapid decrease in numbers takes place, and by the end of the month *Tomopteris* becomes quite scarce. What becomes of all the numerous stages is a problem yet to be solved. Probably the winter storms may account for the destruction of a good many.

It is clear from the sudden appearance of numerous young specimens that there are two distinct generations in a year, one in the spring and the other in the autumn. The intermediate and adult specimens taken in the spring are, I believe, the survivors of the autumn generation. These have passed safely through the winter with a considerable loss in numbers; but their offspring, reared under more favourable circumstances, apparently do not suffer such a loss in numbers, and produce a larger generation in the autumn.

In the autumn of 1897 the young individuals formed a large shoal in the harbour. They were also very abundant in the same season of 1898.

The largest specimen of *Tomopteris* was taken on May 1st, 1895. It measured, when alive, 55 mm. in length, with sixteen pairs of parapodia, and about six rudimentary pairs on the tail. The body contained a large number of ova.

AMPHIPODA.

Parathemisto oblivia, Kroyer.

This little Amphipod, kindly identified for me by Mr. A. O. Walker, was taken often in the summer and autumn. At times it became quite abundant, especially in August, 1896, and September, 1897. All the specimens were very small, and belonged to young stages.

MOLLUSCA.

Ianthina communis, Lamarek.

A solitary specimen was found stranded on the shore in the harbour by the Misses Delap, on August 31st, 1896, and was brought to the Laboratory. When placed in sea-water it soon became active, and lived for three days. I found several clusters of eggs, some of which had reached the veliger stage, with a dark brownish spiral shell.

Ianthina always remained fully expanded when the sun was shining upon it, but a shadow suddenly thrown across the aquarium would immediately cause the animal to contract.

This Mollusc has often been recorded from the west coast of Ireland.

Atlanta, sp. ?

Atlanta, M'Intosh, 1890, Ann. Nat. Hist., ser. 6, vol. v., p. 47, pl. viii., figs. 3, 4.

A single specimen taken on August 7th, 1896. The shell agreed in general appearance with the figures given by M'Intosh, who found his specimens at St. Andrews in September, 1888.

PTEROPODA.

***Limacina retroversa* (Fleming).**

Limacina retroversa, Pelseneer (1887).

This species may be regarded as a regular inhabitant of the harbour. It often occurred in dense shoals, and formed a layer of considerable thickness at the bottom of the tow-net can.

1895. A few specimens were taken once in April. On May 6th a shoal entered the harbour and remained until the 17th, when a sudden decrease took place.

1896. It was very abundant during May, June, and July. Early in August it suddenly became very scarce, and finally disappeared at the beginning of October.

1897. It was taken from June to December. Very abundant in July and at the end of October.

1898. It was seen from July to October, and again in December. Abundant at the end of July and during the early part of October.

***Clione limacina* (Phipps).**

Clione limacina, Boas (1886); Pelseneer (1887); M'Intosh (1898).

Clione borealis, Pallas.

A few specimens of this Pteropod were occasionally taken in the harbour, 1896. It occurred from the end of July to September 10th. Larval stages were found about $1\frac{1}{2}$ mm. in length, with median and posterior ciliated bands, as figured by M'Intosh (1898; pl. ii., fig. 6), and also younger stages with three ciliated bands.

The adult stage was taken in August; the largest specimen measured 17 mm. in length. This is small as compared with Arctic specimens, 35–40 mm.

1897. A few specimens were taken from July 19th to October 8th. Some were larval stages and others adults.

1898. A few specimens seen in August; one in October; and one on December 26th.

The home of this species is in the Arctic Ocean. It is not uncommon in the northern part of the British area, but rarely taken in the south. A solitary specimen was found by Leach at Falmouth, which is its southernmost record.

Dexiobranchæa ciliata (Gegenbaur), Sp. ?

Dexiobranchæa ciliata, Boas (1886); Pelseneer (1887); Gegenbaur (1855).

Only a few larval stages with ciliated bands were taken in the harbour in 1896, on August 4th and 8th, and September 2nd.

All the specimens were of about the same age, and agreed in general appearance with a figure given by Gegenbaur (1855, Taf. iv., fig. 11).

This species has been recorded from the Faerøe Channel and other parts of the North Atlantic, and also from the Mediterranean.

PHORONIDEA.

Phoronis hippocrepia, Wright.*Actinotrocha*.

The larval stage commonly called *Actinotrocha* was only taken during the spring.

1895. It was not uncommon during April and May. A stage, 5 mm. in length, about ready to start its sedentary life, was taken on May 13th.

1897. A single specimen was seen on March 23rd.

The larval form has been recorded for Scotland and the south coast of England, but I have not met with any records of it for the west coast of Ireland. August and September appear to be the principal months for its occurrence at Plymouth and Falmouth.

HEMICHORDATA.

Balanoglossus.

Tornaria krohnii, Bourne, 1889, Journ. Mar. Biol. Assoc., voi. i., n.s., pp. 63-68, pl. vii.

The larval form commonly called *Tornaria* was taken only on two occasions.

1897. July 3rd, four specimens.

1898. July 22nd, two specimens.

These specimens agreed in general appearance with the species which is at times not uncommon at Plymouth in August and September.

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TABLE I.

Monthly Distribution of certain Pelagic Animals

	1896. Summer.		1896. Autumn.			1896-1897. Winter.			1897. Spring.		
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
<i>Muggiaea atlantica</i> ,	×	×	×	×	×	×	×	×
<i>Cupulita sarsii</i> ,	×	×	×	×	×	×	×	×
<i>Velella spirans</i> ,	×	×
<i>Bolina norvegica</i> ,	×	×	×	×
<i>Pleurobrachia pileus</i> ,	×	×	×	×	×	..	×	×	×	×	×
<i>Beroe ovata</i> ,	×	×	×	×	..	×	×	×	..	×
<i>Tomopteris onisciformis</i> ,	×	×	×	×	×	×	×	×	×	..	×
<i>Sagitta bipunctata</i> ,	×	×	×	×	×	×	×	×	×	×	×
<i>Parathemisto obliqua</i> ,	×	..	×	×
<i>Clione limacina</i> ,	×	×	×	×
<i>Limacina retroversa</i> ,	×	×	×	×
<i>Thalia democratica-mucronata</i> ,	×	×	×
<i>Doliolum tritonis</i> (sp. ?),	×	×	×	×	×	×	×	×	×
<i>Oikopleura flabellum</i> (sp. ?),	×	×	×	×	×	×	×	×	×

TABLE II.

Table showing the Months in which Pelagic Animals

	1896. Summer.		1896. Autumn.			1896-1897. Winter.			1897. Spring.		
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
<i>Corymorpha nutans</i> ,	×
<i>Sarsia prolifera</i> ,	×
<i>Dipleurosoma typicum</i> ,
<i>Euchilota pilosella</i> ,
<i>Laodice calcarata</i> ,	×
<i>Obelia nigra</i> ,	×
<i>Phialidium cymbaloideum</i> ,	×	..	×
<i>Phialidium temporarium</i> ,	×
<i>Solmaris corona</i> ,	×
<i>Pelagia perla</i> ,	×	×
<i>Cupulita sarsii</i> ,	×
<i>Pleurobrachia pileus</i> ,	×	×	×	×	×	×
<i>Bolina norvegica</i> ,	×	×	×
<i>Beroe ovata</i> ,	×
<i>Tomopteris onisciformis</i> ,
<i>Sagitta bipunctata</i> ,	×	×
<i>Limacina retroversa</i> ,	×
<i>Thalia democratica-mucronata</i> ,	×	×
<i>Oikopleura flabellum</i> (sp. ?),	×

II.—REPORT ON THE MEDUSÆ (1895-98). BY E. T. BROWNE, B.A.,
University College, London.

INTRODUCTION.

PREFATORY REMARKS.

VERY few species of Medusæ have been recorded for the west coast of Ireland; and, owing to the vagueness of the descriptions originally given to these forms, the records are now in most cases of little value. Consequently it was impossible to form an idea as to whether the Medusoid fauna was similar to that of the English coasts or totally different from it; and it was equally impossible to determine what share the true Atlantic Medusæ took in adding to the richness of the littoral fauna.

Though the Medusæ of the west have remained in a neglected condition, there have been periods of great activity on the eastern coast, more especially in the Dublin Bay district, where the labours of Ray Greene (1857) and Haddon (1885) have produced valuable contributions to our knowledge of the British Medusæ.

The northern shores of Ireland and the Belfast district claim the early work of Templeton (1836), Patterson (1859), Forbes, and Thompson; and the southern shores that of Allman.

It was necessary for the progress of my research on the British Medusæ that I should investigate the fauna of the west coast of Ireland. The first visit to Valencia Harbour, on the coast of Kerry, was made in 1895, during April and May, with my friends Mr. W. I. Beaumont and Mr. F. W. Gamble, to both of whom I am indebted for much kindness and help. The second visit to the same locality was made during the summer (July to September) of 1896, when I was a member of a small expedition to investigate more thoroughly the fauna of the harbour.

This Report, however, is mainly based upon a series of tow-nettings taken by the Misses Delap, of Valencia Island, to whom I am greatly indebted, not only for specimens, but also for valuable notes and drawings. I must take the responsibility for the contents of this Report and the identification of the species; but it is chiefly owing to the Misses Delap that the Medusoid fauna of Valencia Harbour is now better known than that of any other locality within the British area.

It will be seen from the list of species that most of the Medusæ belong to one or other of the two orders—Anthomedusæ and Leptomedusæ. These orders contain nearly all the species usually found in our seas. Though only a few Medusæ have been connected with Hydroids, yet probably an alternation of generations will be ultimately proved to exist in all the species belonging to the two orders. Up to the present time no evidence has been found of the direct development of a Medusa from a Medusa in either the Anthomedusæ or Leptomedusæ.

The Medusæ belonging to the other orders, the Trachomedusæ and the Narcomedusæ, may be regarded as visitors to our shores. Their natural habitat is the open ocean, and their development is probably direct, as we have no evidence of the existence of any Hydroid form belonging to them.

Our Medusæ may, therefore, be divided into two groups:—(a) Littoral (Anthomedusæ and Leptomedusæ; (b) Oceanic (Trachomedusæ and Narcomedusæ). Certain species of the Leptomedusæ may be regarded as visitors to British waters, as they have been very rarely recorded (such an one is *Octorchis*); but they may be common elsewhere, and probably belong to Hydroids inhabiting grounds far away from our shores.

The geographical position of Valencia Harbour makes it difficult there to distinguish the regular inhabitants of the coast from the oceanic species and the casual visitors; but, by comparing them with Medusæ found at places further from the Atlantic, an approximately correct estimate can be obtained. For this comparison I select two places:—Plymouth, and Port Erin, in the Isle of Man, where the Medusoid fauna is fairly well known to me.

THE VALENCIA MEDUSÆ COMPARED WITH SPECIES FOUND AT PLYMOUTH AND PORT ERIN.

All the Anthomedusæ found at Valencia have, with one exception, been taken at or near Plymouth. This exception is *Margelis pyramidata*, which has only been recorded from the west coast of Scotland. Since this species almost certainly comes from a Hydroid belonging to the genus *Bougainvillia*, or a closely allied genus, its distribution must mainly depend upon the distribution of that Hydroid, which may live in fairly deep water off the Atlantic coasts of Ireland and Scotland.

I have taken at Port Erin nearly all the Valencia Anthomedusæ; and, from the known distribution of the missing species, they, with

all probability, will eventually be found there, except, perhaps, *Margelis pyramidata*.

My visits to Port Erin have been principally during April and May, and not during the summer months: consequently my knowledge is somewhat limited to the spring forms.

The Leptomedusæ of Valencia do not show so close an agreement with those of Plymouth as the Anthomedusæ, but the difference is not great. There are only three species which I have not taken at Plymouth:—*Dipleurosoma typicum*, *Meliceritidium octocostatum*, and *Laodice calcarata*.

Dipleurosoma typicum is a remarkable Medusa; and until more is known about its distribution, and especially its life-history, my remarks must be of a speculative nature. There ought now to be no difficulty in tracing its life-history, as the ova remain attached to the Medusa until the planula stage is reached,¹ and the planulæ could be reared in a "Plunger" aquarium, such as is used in the Plymouth laboratory. This Medusa was very scarce during my visit in 1896; but the Misses Delap reported shoals in 1897 and 1898. It has not often been recorded, but its distribution is wide:—Newfoundland, Norway, south coast of Ireland, Kingstown Harbour, and Brighton. Its occurrence at Brighton (1879) tends to show that the Medusa passed up Channel on that occasion.

The second species, not taken at Plymouth, *Meliceritidium octocostatum*, is a member of our northern fauna. It is common in Scotland, but rarely taken in the southern part of the British area. It was only taken once at Valencia in 1897, and has only been once recorded for the English Channel—at Falmouth, by Cocks, when it was abundant in the summer (1849). This species has such well-marked characters (eight radial canals and eight large gonads) that there should not be the slightest difficulty in determining the sole member of the genus. It is not likely, then, that this species would have escaped observation at Plymouth if taken in the tow-net.

The third species, *Laodice calcarata*, has a wide distribution; but its exact range cannot be decided until the "good species" of the

¹ *Dipleurosoma typicum*.—Last summer the Misses Delap successfully reared several dozen planulæ up to a hydroid form. The hydroids are still alive in an aquarium, but have remained stationary in growth throughout the winter. From the description and drawings kindly sent to me by the Misses Delap I am inclined to think that the hydroids have not developed very far. It will be best to wait for further development before publishing a description of the hydroid, which, at its present stage, appears to belong to the genus *Cuspidella* (March, 1900).

genus have been finally determined. There may be only one species, or several. According to Agassiz it has a Hydroid form (*Lafoëa calcarata*, of Agassiz), found in Buzzards Bay, on the Atlantic coast of North America. The Hydroid has yet to be found on this side of the Atlantic. The Medusa may be easily recognized by its sensory clubs (cordyli) on the margin of the umbrella. It has been rarely recorded in British seas. Forbes and Goodsir, I believe, found specimens in 1851 on the west coast of Scotland; a solitary specimen was taken by me at Port Erin in May, 1894;¹ and one specimen was found in my examination of Dr. Fowler's collection from Kirkwall Bay in 1896. These are the only British records that I know of, and up to the present time it has not been taken in the English Channel.² This species has occurred every year (1895–98) at Valencia. It appears to be an inhabitant of the Atlantic coast of Ireland and Scotland. The Port Erin specimen probably drifted down through the North Channel.

I am inclined to add *Polycanna forskalea* as a fourth species, found at Valencia, and not at Plymouth. It has occurred regularly at Valencia, 1896–98, whereas I have only seen a single specimen of the *Æquoridæ* at Plymouth (June, 1898). It was a few millimetres in diameter, and too young for the determination of the species. At present there is the usual difficulty about determining the different species of the genus; and, until this is done, a distribution list is useless. Forbes certainly found this species in the outer Hebrides (1851); and young stages of *Æquorea* have been recorded by Greene for the south-west coast of Ireland. According to Goodsir, this large Leptomedusa has a hydroid stage.

At Port Erin the following Leptomedusæ have not been recorded, but some of them ought to be found there in the summer:—*Agastra caliculata* (the Hydroid *Campanularia caliculata* of Hincks is recorded for the Isle of Man by Miss Thornely), *Dipleurosoma typicum*, *Euchilota pilosella* (probably occurs in the summer),³ *Octorchis gegenbauri*, and *Polycanna forskalea*.

All the Trachomedusæ may be regarded as true Atlantic forms;

¹ *Laodice calcarata*, taken at Port Erin in May, 1899. Chadwick, H. C. 13th Ann. Rep. L. M. B. C., p. 35.

² *Laodice calcarata*. Intermediate stages were common in the Scilly Islands. July, 1899.—E. T. B.

³ *Euchilota pilosella*, taken at Port Erin, from June to August, 1899. Chadwick, H. C. 13th Ann. Rep. Liverpool Mar. Biol. Com., p. 35.

and of the three Valencia species—*Aglantha rosea*, *Gossea circinata*, and *Liriantha appendiculata*—only the latter has occurred at Plymouth; it was very abundant there in 1893, and a few in 1897. Until I found this species at Valencia, the English Channel, where it was first found by Forbes in 1846, was its only known habitat. Only a few specimens were taken at Valencia in 1896 and 1897. Apparently it is an occasional visitor to our shores. *Aglantha* is a typical Atlantic Medusa. It was taken at Valencia in 1895 and 1896, and has been recorded from the Shetlands, St. Andrews, and Heligoland. *Gossea circinata*, the rarest of the Valencia Medusæ, has only been taken at Croisic, on the coast of Normandy, unless it be ultimately proved that *Gossea corynetes* of Gosse, taken at Ilfracombe in 1852, and not since recorded, be a younger stage. Both species of this genus may be regarded as typical visitors to the British shores.

Solmaris corona was the only species of the Narcomedusæ which was taken at Valencia; it was very scarce in 1895–96, but abundant in 1897–98. At Plymouth, in September, 1895, I found two young stages of a *Solmaris*, which may belong to this species.

Amongst the Scyphomedusæ, *Pelagia perla* may be regarded as an Atlantic species, which arrives at times in shoals on the west coast of Ireland and Scotland. It has never been recorded for Plymouth. Forbes, however, found specimens off the coast of Cornwall in 1846.

None of the Trachomedusæ or Narcomedusæ, nor *Pelagia*,¹ have been recorded for the Isle of Man. It will be seen that the majority of the species found in Valencia Harbour occur at Plymouth and Port Erin, and the remainder mark the character of an Atlantic port, viz.: *Dipleurosoma*, *Laodice*, *Polycanna*, *Aglantha*, *Solmaris*, and *Pelagia*. With tow-netting carried on almost continuously for three years, I expected to find more Atlantic Medusæ than have been met with.

NOTES ON THE TABLES.

(Tables facing p. 736.)

The Valencia Medusæ are conveniently divided into three series, corresponding to the three tables placed at end of this Report.

Table I.—The first series is quite distinct, and contains only those Medusæ taken by me during April and May, 1895.

Table II.—The second series contains the results of my tow-nettings during the summer (July to September), 1896.

¹ *Pelagia perla*. A shoal at Port Erin early in October, 1899. Chadwick, H. C. 13th Ann. Rep. L. M. B. C., p. 34.

In Tables I. and II. the Medusæ are recorded for each day on which the tow-net was used. The species are arranged according to the dates of capture; and by the use of figures and symbols an attempt has been made to convey an idea of their abundance.

Table III.—This series contains the results of the tow-nettings and the observations of the Misses Delap, extending from October, 1896, to December, 1898. To make this table more useful for the comparison of one year with another, I have added to it my own records for July, August, and September, 1896, so that the Medusæ of three summers are shown. The table is arranged on a different plan from the first two; it is simply a monthly record of the species present in the harbour, and the quantity is mentioned in the notes on the different species.

The order of the species is arranged on nearly the same plan as in the previous tables. The species which usually make their first appearance early in the year and during the spring are placed at the top of the table, followed by the regular summer forms, the rarer species being placed towards the bottom. The Medusæ on the upper half of the table may be regarded as the common annual inhabitants of the harbour.

There is a conspicuous blank for the winter months of 1897–8, owing to the scarcity of tow-nettings, mainly due to the bad weather so common on that coast in winter time. A special effort was made for December, 1898, as I particularly wanted to find out more about the occurrence of Medusæ during the winter months. I received eight tow-nettings taken on eight different days in the month by the local ferryman, James Higgins, under the directions of the Misses Delap, but found only one Medusa. The month was notorious for gales, and the contents of the tow-net chiefly consisted of broken algæ and Copepods.

The great decrease of Medusæ during October, and especially in November is, I am inclined to think, chiefly due to the heavy seas off that coast during the autumn gales. The first gale in the autumn plays great havoc with the pelagic fauna. I noticed this myself after a gale with a heavy sea at the end of September in 1896; and a tow-netting taken after the first gale in October, 1898, was full of the remains of *Solmaris* and other delicate animals.

The tow-nettings taken in the autumn contain young and immature stages of several species of Medusæ, including *Lar sabellarum*, *Phialidium cymbaloideum*, *Tiara pileata*, which one would expect to be found during the winter months, but these forms either completely

disappear or become very scarce. I do not think their disappearance is due to the decrease of temperature, for the usual winter surface temperature of the sea at Valencia is about 48°F. , and the maximum in the summer does not exceed 61°F. ; so that the difference between winter and summer is only about 13°F. Occasionally in winter the sea is below 48°F. , but never for any length of time, and the extreme minimum for the three years (1896–98) was $44^{\circ}\cdot 5\text{F.}$ Copepods form the principal food supply of the Medusæ, and they are fairly plentiful throughout the winter, therefore the decrease can hardly be due to starvation. I am inclined to think that it is the rough seas which play havoc with the delicate littoral animals; and those which escape and turn up early in the spring as mature forms, have passed the winter in deep water far away from the coast. These small Medusæ are quite at the mercy of the tides and currents; they certainly have the power of increasing or decreasing their depth in the water, but not of swimming against the stream, like the large *Rhizostoma*. It seems to be a matter of chance whether they reach deep water or get smashed on the coasts in winter.

Two papers on British Medusæ, written by myself, and published in the "Proceedings of the Zoological Society of London," contain descriptions and figures of some of the Medusæ taken at Valencia in 1895 and 1896.

In reports of a faunistic nature I do not think it is necessary to give the full lists of synonyms and references relating to the commoner species, and the few references which are given have been selected for their usefulness. The geographical distribution is only given for the rarer and more interesting species, and when omitted it may be understood that the species is widely distributed throughout the British area.

CRASPEDOTA.

Order.—ANTHOMEDUSÆ.

Amphinema dinema (Peron et Lesueur).

Saphenia dinema, Forbes, 1848, p. 25, pl. ii.

Amphinema titania, Haeckel, 1879, p. 50, Taf. iv.

Amphinema dinema, Browne, 1896, P. Z. S., p. 475.

In 1896–98 this Medusa made its first appearance in July and disappeared in September, except in 1898, when it remained until October. A few specimens taken occasionally during each month. The largest measured 6 mm. in length.

The top of the umbrella is ornamented with a cone-shaped process, which is very long and pointed in the Valencia specimens, and about the same length as the umbrella.

This species has only been twice recorded outside the English Channel; by Gosse from Ilfracombe, and by Forbes from the Shetlands.

It may be easily recognised by its two fine crimson or purplish tentacles.

***Cladonema radiatum*, Dujardin.**

Cladonema radiatum, Hincks, 1868, p. 68, pl. xi.; Allman, 1872, p. 357, pl. xvii.

In October, 1898, Miss M. Delap found the Hydroid in an aquarium which had been used for keeping alive various animals taken from the harbour. The Hydroid, owing to its minuteness, was not discovered until it had produced a considerable network of stolons. It was probably introduced into the aquarium at the planula stage in the process of adding a fresh supply of sea-water.

Early in April Medusa-buds were first noticed upon the hydranths, and at the end of the month a young Medusa was seen swimming in the aquarium.

The Hydroid, I believe, has not yet been found in its natural habitat, but has always mysteriously appeared in marine aquaria.

While I was occupying a table at the Plymouth Marine Laboratory in the autumn of 1897, I received from Mr. Rupert Vallentin some adult Medusæ of *Cladonema radiatum* taken in Falmouth Harbour. Two specimens were placed in an aquarium, but soon disappeared. On my arrival at Plymouth, in the following April, I found in the aquarium several Hydroid colonies of *Cladonema*, which evidently had developed from the eggs liberated from one of the Medusæ. The colonies budded off Medusæ during May and June.

The Medusa is a remarkable creature, for it is able to attach itself by means of special suckers upon its tentacles to any fixed object, such as a rock, a piece of sea-weed, or the glass sides of an aquarium. I often watched the little Medusæ in the aquarium at Plymouth, and never saw them use their tentacles for crawling, but only for attachment. They remain at rest for long periods, with their tentacles expanded on the

wait for prey, generally a Copepod. Directly a Copepod is caught by a tentacle the Medusa starts swimming, and with great skill conveys the unfortunate Copepod into its mouth.

In the sea the Medusa probably lives amongst sea-weed. I have never taken a specimen in a tow-net, but Mr. Vallentin has seen a few specimens swimming at the surface of the sea in Falmouth Harbour.

There are very few records either for the Hydroid or its free-swimming Medusa. It has been found on the coast of Belgium; at St. Malo, in France; Messina; and in England, on the coasts of Kent, Devon, and Cornwall.

***Clavatella prolifera*, Hincks.**

Clavatella prolifera, Hincks, 1868, p. 73, pl. xii; Allman, 1872, p. 384, pl. xviii.

In April, 1895, Mr. Gamble found several specimens of the Medusa crawling over seaweeds taken from a rock pool, near high tide-mark. The specimens were of a brilliant orange colour.

In September, 1896, the Misses Delap also found a few specimens on seaweeds from a rock pool.

The Hydroid form has not yet been found in the harbour, but it is very minute, and scarcely visible to the naked eye.

***Corymorpha nutans*, Sars.**

Corymorpha nutans, Allman, 1872, p. 388, pl. xix.; Browne, 1896, P. Z. S., p. 463, pl. xvi.

Steenstrupia rubra et flaveola, Forbes, 1848, p. 73, pl. xiii.

Steenstrupia galanthus, Haeckel, 1879.

In 1895-98, the Medusa occurred in vast quantities. It appears about the end of March, or early in April, reaches maturity early in May, and disappears during the summer. It becomes very abundant towards the end of April, and dies off rapidly in June; stray specimens may be taken in July and August, and probably come from Medusa-buds which have developed unusually late in the spring. A young specimen was taken on July 27th, 1896; it measured about $1\frac{1}{2}$ mm. in length.

The Medusæ on liberation from the Hydroid are about 1 mm. in length and width; they grow to about 5 mm. in length, and

3 mm. in width. A few of the Valencia specimens measured 6 mm. in length.

The abundance of the Medusæ clearly shows that the Hydroid must be very abundant somewhere in the neighbourhood of Valencia Island, but it has yet to be found. This Hydroid is a difficult object to dredge, as it usually lives rooted in sand.

***Cytæandra areolata* (Alder).**

Cytæandra areolata, Haeckel, 1879; Browne, 1897, P. Z. S., p. 817, pl. xlviii.

A very scarce Medusa, occurring at irregular intervals from April to November. Solitary specimens were taken on the following dates :—

1895, April 12th and 29th, May 14th, July 8th.

1896, July 18th, Nov. 2nd.

1897, September 8th.

1898, July 27th (two specimens).

An adult with ripe ova was taken in April, 1895.

This Medusa is probably liberated from one of the species belonging to the Hydroid genus *Podocoryne*.

***Dipurena ophiogaster*, Haeckel.**

Sarsia strangulata, Allman, 1871, p. 46, fig. 17.

Dipurena ophiogaster, Haeckel, 1879, p. 29.

In 1896, only a few specimens were taken during the summer.

In 1897, it first appeared in May and disappeared in September; fairly common during June.

In 1898, it was very scarce, only seen in May and September.

The largest specimen measured 5 mm. in length and width. The manubrium, when fully expanded, was 40 mm. in length, and carried four oval masses of generative cells, in addition to a large mass of cells adjacent to the stomach.

This species was first taken by Allman on the south-west coast of Ireland, and figured in his monograph under the name of *Sarsia strangulata*. I have retained Haeckel's specific name, as there is an American species called *Dipurena strangulata* (MacCraday, 1857).

Haeckel records *D. ophiogaster* from Granville in Normandy, and from Jersey. I have also taken it at Jersey and Plymouth.

Dipurena halterata (Forbes).

Slabberia halterata, Forbes, 1848, p. 53, pl. vi.

Slabberia catenata, Forbes and Goodsir, 1851, p. 311, pl. x.

Dipurena halterata, Haeckel, 1879; Browne, 1897, P. Z. S., p. 816, pl. xlix.

This is a scarce Medusa at Valencia, but it has not often been recorded from other localities, though its distribution extends from Mull to Jersey.

In 1895, taken once in April, July, and September.

In 1896, once in July and September.

In 1897, once in August and September.

In 1898, once in April, twice in June, once in July and November.

Solitary specimens were usually taken; but on July 21st, 1898, the Misses Delap had the good fortune to capture fourteen adults, and kindly sent them to me for examination. The umbrella of the smallest measured 5 mm. in length and width, and that of the largest 8 mm. in length and 6½ mm. in width. This Medusa is remarkable for having very large clusters of nematocysts, forming conspicuous rings at the ends of the four tentacles. By these rings the species may be easily distinguished from *D. ophiogaster*. The number of rings of nematocysts upon the tentacles of the specimens taken in July varies from one to five, as the following list shows:—

Umbrella-length, mm.	Number of rings on each of the four tentacles.				Remarks.
5.	1,	2,	2,	3.	The large terminal bullet-shaped cluster of nematocysts is not counted in with rings.
5.	2,	2,	2,	2.	
5.	4,	4,	4,	4.	
6.	3,	3,	3,	3.	
7.	3,	4,	3,	5.	
8.	1,	3,	3,	4.	

In the earliest stage, about 1 mm. in length, there is only a terminal cluster of nematocysts; the rings appear later, and the uppermost one of the series is the youngest.

Forbes first found *Slabberia halterata* in Mounts Bay, Cornwall, in 1836, and described the species with one large terminal cluster of nematocysts on each tentacle. Off Mull, in 1851, Forbes found some specimens of the same genus having, in addition to the terminal cluster, five to six rings of the nematocysts on the lower half of each tentacle. He regarded the presence of the rings as a specific character, and described a second species under the name of *S. catenata*. In other details the Mull specimens agree fairly well with the first-named species. The specimens taken at Valencia show the connexion between the two species of Forbes; and I consider *S. catenata* to be the fully developed adult stage of *S. halterata*.

All the Valencia specimens have the peculiar linear swellings upon the four radial canals; they have the appearance of immature gonads. In the adult the generative cells are arranged in large clusters upon the manubrium.

Abnormal specimen.—One specimen, taken in July, 1898, had an interesting abnormality, which I have not seen before among the Sarsiadæ.

There was an extra tentacle attached to one of the four normal tentacles. It was like its companion in size; but its basal bulb was smaller, and joined to its neighbour. The ocellus was very small, faintly coloured, and only just visible.

Ectopleura dumortierii (van Beneden).

Ectopleura dumortierii, Hincks, 1868, p. 124, pl. xxi.

In 1895-96, not a single specimen was taken.

In 1897, the Medusa appeared at the end of April and disappeared early in October. Usually one or two specimens were taken on each day of tow-netting. On April 27th, nine specimens were taken; the smallest about 1 mm. in diameter, and the largest 4 mm. in length and $2\frac{1}{2}$ mm. in width. Specimens with ova were taken in May.

In 1898, it was found from March to June; usually very scarce.

This Medusa is liberated from the rare Hydroid *Ectopleura dumortierii*, which has only been twice recorded: by Van Beneden at Ostend; and by Hincks, who found it on driftwood cast ashore at Point of Ayr, Isle of Man. The free-swimming Medusa has been taken at Heligoland (Hartlaub); St. Andrews (Crawford); Plymouth (E. T. B.).

Euphysa aurata, Forbes.

Euphysa aurata, Forbes, 1848, p. 71, pl. xiii.; Haeckel, 1879; Browne, 1896, P. Z. S., p. 474.

In 1895, during my visit in the spring, this Medusa was usually present in the tow-net. The smallest specimen measured $\frac{3}{4}$ mm. in length, and the largest about 3 mm.

In 1896, only two specimens were taken in August; one was quite an early stage, about 1 mm. in length, and the other an adult with ova. The Misses Delap sent me two immature specimens taken early in November.

In 1897-98, it appeared in April and disappeared in June. A solitary specimen was taken in September, 1897.

This Medusa never became abundant; usually only a few were specimens taken at one time.

It reaches maturity in May. The life-history of the species is still unknown.

Euphysa aurata may be distinguished from *Corymorpha nutans* by not possessing a pointed, cone-shaped process on the top of the umbrella; and from *Hybocodon prolifer* by not having the tentacular side of the umbrella longer than the opposite side, and by not possessing Medusa-buds.

Hybocodon prolifer, L. Agassiz.

Hybocodon prolifer, Agassiz, 1862; Allman, 1872; Browne, 1896, P. Z. S., p. 466.

Amphicodon amphipleurus, Haeckel, 1879, p. 37, Taf. i.

Amphicodon fritillaria et globosus, Haeckel, 1879.

In 1895, I arrived at Valencia about the time the Medusa was disappearing, and only a few specimens were taken during the first fortnight in April. All the specimens had reached maturity; some with ova upon the wall of the stomach, others with free Actinulæ inside the umbrella-cavity.

In 1897, a solitary specimen was taken on February 15th, with eight Medusa-buds upon the base of the large tentacle. Another specimen was taken on June 1st.

In 1898, none were seen.

The Medusa is liberated from the Hydroid *Hybocodon prolifer*, which has not yet been recorded in British seas. The Medusa, at first, has only one solitary tentacle, but later on develops two more, one on each side of the first tentacle.

The Medusa usually occurs in the spring, reaches maturity in April, and disappears early in the summer. Apparently it is not a common species at Valencia.

Lar sabellarum, Gosse.

Lar sabellarum, Allman, 1872; Hincks, 1872, p. 313, pl. xix.; Browne, 1896, P. Z. S., p. 468, pl. xvi., and 1897, p. 818, Woodcuts, 1-9.

Willisia stellata, Forbes, 1848, p. 19, pl. i.

This Medusa is liberated from the Hydroid *Lar sabellarum*, which has been recorded from only two localities—Ifracombe (Hincks) and Plymouth (E. T. B.). The Hydroid colony forms a fringe round the tube of a Sabella; it is very minute, and, unless specially searched for, may be easily overlooked. The Medusa has been frequently recorded from several British localities, and is not uncommon in the summer.

At Valencia the Medusa was one of the common objects in the tow-net; it was nearly always present, but never in any great numbers. The youngest stage (with six tentacles, 1 mm. in diameter) was the most plentiful, only occasionally absent. It was taken every month, from July, 1896, to November, 1897, but was very scarce during the winter. Its presence in winter time is not conclusive evidence that the Hydroid liberates Medusæ all the year round. They may have been budded off late in the autumn, and remained at the first stage until the following spring.

The second stage (with twelve tentacles, umbrella about 2 mm. in diameter) has not been seen in the winter; it first appears in April.

The third stage (with eighteen tentacles, about 3 mm. in diameter) comes on in May.

The adult stage (with twenty-four tentacles, about 4-5 mm. in diameter) appears in July and remains until November.

To judge from the number of early stages taken, the principal period for the liberation of the Medusæ from the Hydroid is during the spring and summer.

Lizzia blondina, Forbes.

Lizzia blondina, Forbes, 1848, p. 67, pl. xii.; Browne, 1896, P. Z. S., p. 475.

In 1895, six specimens were taken at the end of May.

In 1897, two specimens found on June 9th.

I cannot account for the extreme scarceness of this Medusa at Valencia, and speculation is somewhat useless until its life-history is known. Its distribution extends from the Shetlands to Cornwall; it was very abundant off the Eddystone in September, 1897, and May, 1898.

This species may be distinguished from *Margellium octopunctatum* by the constant presence of four simple unbranched oral tentacles, each terminating in a single cluster of nematocysts. In *Margellium* the oral tentacles have at least two terminal and two lateral clusters of nematocysts.

Margelis autumnalis (Hartlaub).

Bougainvillia autumnalis, Hartlaub, 1897, p. 465. Taf. xv.

In 1896, six specimens were taken early in August. It was the only species of *Margelis* seen during my visit in the summer.

In the tow-nettings sent to me by the Misses Delap eight specimens were found early in November.

Margelis bella (Hartlaub),

Bougainvillia bella, Hartlaub, 1897, p. 470, Taf. xv.-xvi.

A solitary specimen taken in May, 1895, and two during August, 1897.

Margelis principis, Steenstrup.

Margelis principis, Haeckel, 1879, p. 88, Taf. vi.

Margelis britannica, Browne, 1896, Irish Naturalist, p. 180.

In 1895, this Medusa was not uncommon during April and May.

In 1897, only a few specimens taken during April and May.

The smallest specimen measured $1\frac{1}{2}$ mm. in length. Oral tentacles twice branched. Four tentacles in each of the marginal groups.

The largest specimen measured 7 mm. in length and $8\frac{1}{2}$ mm. in width. Oral tentacles five times dichotomously branched. 24-26 tentacles in each of the four marginal groups.

In large specimens the umbrella is globular, and about as long as wide. The stomach is on a broad but short peduncle; it has four large perradial lobes, which in some specimens reach over the top of the umbrella-cavity. Upon the sides of these lobes the gonads develop, and, when viewed from the top of the umbrella, they represent a short, thick, perradial cross.

The large compound tentacular bulbs are either epaulette-shaped or well curved; but in the intermediate stages the bulbs are only slightly curved. In these specimens the tentacular bulbs are not so large and not so much curved as in specimens taken at Plymouth and Port Erin.

The tentacular bulbs are of a dark brown colour, with longitudinal rows of pigment corresponding to the tentacles in position. The ocelli are large and black.

Dr. Hartlaub has recently published a revision of the genus *Bougainvillia* in his Report on the Hydromedusæ of Heligoland. I have here used Haeckel's generic name *Margelis* in place of *Bougainvillia*, as I prefer the latter name for those Medusæ which have been traced to Hydroids belonging to the genus *Bougainvillia*. Up to the present none of the Valencia species have been traced to Hydroid forms.

I believe the Valencia specimens belong to the species which I have called *Margelis principis* in my Report on the Medusæ of the Isle of Man (1895). But Hartlaub's revision causes me to reconsider the correctness of the former identification. If the exact position of the gonads is to be taken as one of the characteristic features in determining the species of this genus, then my specimens certainly do not agree with Haeckel's figures of the specimens in the Copenhagen Museum, collected by Streenstrup. It was the very large epaulette-shaped or crescent-shaped tentacular bulbs in the Port Erin specimens which led me to adopt the name of *M. principis*, for they corresponded with the figures given by Haeckel. As I have already used the name *M. principis* for these Medusæ with large epaulette-shaped bulbs, it will be best to continue the use of the name until the correct determination of the species has been made.

I have rarely seen specimens with the large epaulette-shaped tentacular bulbs, and it is probable that they represent this species, at its maximum growth, with the greatest number of tentacles.

***Margelis pyramidata* (Forbes and Goodsir).**

Hippocrene pyramidata, Forbes and Goodsir, 1851, p. 312, pl. x.; Haeckel, 1879, p. 635.

In 1897, about twenty specimens were found in the tow-nettings taken during June and July.

The smallest specimen measured 2 mm. in length and $1\frac{1}{2}$ mm. in width. Six tentacles on each of marginal bulbs. Oral tentacles twice dichotomously branched.

The largest specimen was 4 mm. in length and 5 mm. in width. Eight tentacles on each marginal bulb. Oral tentacles 3-4 times dichotomously branched. The umbrella is globular in shape. The stomach is situated upon a broad inverted cone-shaped peduncle. The gonads form narrow bands extending from the stomach, along the radial canals, up to the base of the peduncle. The compound tentacular bulbs are small and roundish; of a reddish orange colour in formalin. Ocelli black. In the early stages the peduncle is very small. This Medusa was first found by Forbes and Goodsir at Mull, and later by Haeckel off Handa Island, west coast of Scotland.

Margellium octopunctatum (Sars).

Lizzia octopunctata, Forbes, 1848, p. 64, pl. xii.

Rathkea octopunctata, Haeckel, 1879, p. 97.

Margellium octopunctatum, Haeckel, 1879, p. 95; Browne, 1896, P. Z. S., p. 479.

Margellium gratum, Haeckel, 1879, p. 95.

In 1895, during April and May this Medusa was often a common object in the tow-net; it was very abundant about the middle of April. I was able to collect a large number of specimens, and to form a series, showing the development of the Medusa from its earliest free-swimming stage to its maximum growth. The Medusa at its maximum growth has not been previously found in Europe, but only is known from North America, where it has been found and described by Agassiz under the name of *Lizzia grata*.

In 1896, during my visit in the summer, the Medusa was not seen. I was surprised to see specimens in the tow-nettings sent to me by the Misses Delap, taken between October 23rd and November 6th. These specimens all belonged to the earliest stage, with Medusa-buds upon the stomach in different stages of development. There appears to have been a sudden swarm, which lasted about a fortnight. I have never taken this species in the autumn, nor do I know of any autumn records. It is common in the spring, and has a very wide distribution.

In 1897, it first appeared in January and disappeared in May; it was very scarce early in the year, but common in

March and April. A solitary specimen, with Medusa-buds, was taken on July 29th.

In 1898, it was taken in March; abundant in April, and finally disappeared in June.

Podocoryne carnea, Sars.

Podocoryne carnea, Hincks, 1868, p. 29, pl. v.; Allman, 1872, p. 349, pl. xvi.; Browne, 1896, P. Z. S., p. 463.

This Medusa is liberated from the Hydroid *Podocoryne carnea*, which is commonly found on shells of *Nassa*. The Hydroid was not taken at Valencia.

The Medusa was rarely found in the tow-net, and only on the following dates:—

1895. April 10th. A solitary specimen, with 8 tentacles.

1896. September 1st. A solitary specimen, with 8 tentacles.

1897. January 15th. A solitary specimen, with 7 tentacles.

February 15th. Two specimens.

All the specimens belonged to the earliest free-swimming stage.

Sarsia gemmifera, Forbes.

Sarsia gemmifera, Forbes, 1848, p. 57, pl. vii.

Codonium gemmiferum, Haeckel, 1879, p. 15.

A rather scarce Medusa at Valencia, and only taken on the following dates:—

1896. A few specimens in July and August; the largest 2–3 mm. in length. All had Medusa-buds upon the manubrium.

1898. A single specimen taken in June, and a few in July.

The distribution of this species ranges from the Shetlands to the English Channel, but it has not often been recorded.

Sarsia prolifera, Forbes.

Sarsia prolifera, Forbes, 1848, p. 59, pl. vii.; Haeckel, 1879, p. 18.

Syneoryne prolifera, Allman, 1871, p. 83, fig. 38.

In 1896, on July 18th, the first day of my using the tow-net, a few specimens were taken. The Medusa was present in the harbour until August 1st, but not abundant. On August 3rd and 4th not a specimen was seen; but on August 7th a great shoal arrived. Within half an hour I obtained over 300 specimens. By August 10th, the Medusa had again become scarce, and was last seen on August 15th.

The great shoal on August 7th was probably due to the accumulation of specimens produced by rapid gemmation for the increase of the number of sexual individuals. The shoal was probably formed off the coast early in August, and was carried into the harbour by the tide. The rapid decrease is remarkable; for within a week there was a complete disappearance.

The specimens taken in July were budding off Medusæ from the basal bulbs of the tentacles, and the generative cells were only just visible on the stomach of a few individuals. Nearly all the specimens taken on August 7th possessed generative cells, and the Medusa-buds were either very small or absent.

In 1897, it appeared in June and disappeared in August; very abundant in July.

In 1898, it appeared in May and remained until September.

The distribution of this species is somewhat noteworthy. Forbes first found it in Penzance Bay in 1846; and since then it has been recorded for Falmouth, Fowey, Plymouth, Jersey, and the Orkney Islands. The latter is a genuine record by Busch (1851), with a figure of the Medusa.

***Sarsia tubulosa* (Sars).**

Sarsia tubulosa, Forbes, 1848, p. 55, pl. vi.; Haeckel, 1879, p. 16.

In 1895, a few specimens occasionally taken during April and May.

In 1896, not present during my visit from July to September.

In 1897, it first appeared in February and disappeared in August. On April 24th, four specimens were taken, with umbrella 9–10 mm. in length. On April 27th, a specimen captured, which measured $8\frac{1}{2}$ mm. in length and 8 mm. in width.

In 1898, it was taken from April to July. A fine specimen was captured on May 23rd; the umbrella measured 9 mm. in length and width.

This species is well distributed throughout the British seas. It reaches maturity about April or May.

***Tiara pileata* (Forskål).**

Tiara pileata, Haeckel, 1879, p. 58, Taf. iii.

Oceania episcopalis, Forbes, 1848, p. 27, pl. ii.

In 1895, during my visit in April and May, a few young and

intermediate stages (smallest 5 mm. in length) were taken in the tow-net, and many fine large specimens caught swimming at the surface in a cove close to Doulus Head on May 21st. These large specimens showed considerable variation in the shape of the umbrella and in coloration. The apex or crown of the umbrella had five distinct shapes, ranging from a long narrow-pointed process, like a spike on the top of a helmet, to a large globe-shaped mass of jelly; the intermediate forms making connecting links between the extremes.

The colour of the stomach and tentacular bulbs in most of the specimens was reddish brown, in a few bright crimson, and in others a pale translucent brown, which is the usual colour of the younger stages. The largest specimens measured 20–28 mm. in length; one possessed 38 tentacles.

In 1896, during my visit in the summer, a few specimens were taken in August. All belonged to the intermediate stages; the largest measured 10 mm. in length, and had 8 tentacles and 8 adradial bulbs.

In 1897, it first appeared in April and disappeared in October; abundant throughout the summer. The earliest stage, with two tentacles, was taken in April and October. Early in October some large specimens were taken, and measured 35–45 mm. in length and 20 mm. in width; also young stages about 5 mm. in length, and intermediate stages up to 20 mm.

In 1898, it appeared in March and disappeared early in November. It was not nearly so abundant as in 1897. Large specimens were again taken in October and early in November.

Hartlaub (1895) succeeded in rearing in an aquarium the Medusæ liberated from the Hydroid *Perigonimus repens* (in a later publication, 1897, the Hydroid name is changed to *P. vestitus*, Allman) to a stage sufficiently advanced to show its connection with the early free-swimming stages of *Tiara pileata*. Since then I also have reared Medusæ liberated from *Perigonimus* at the Plymouth Laboratory, and am able to confirm Hartlaub's observations.

There is a difference of opinion with regard to the names to be used for Medusæ liberated from Hydroids. At present there are two distinct systems of classification in use, one for the Hydroid forms, the other for the Medusæ. So long as the Medusa remains attached to its Hydroid it receives the Hydroid name; but directly it swims away on its own career it usually

changes its name. This double system is useful in cases where the Medusa has not yet been traced to its Hydroid; but when once the connection has been firmly established, in my opinion, the Medusa ought to be called by its Hydroid name, if the latter has priority. My reason for not using the Hydroid name in this case is due to some doubt which I have with regard to the right specific name to be given to the Hydroid.

It does not come within the scope of the present Report to enter into details concerning the different species of *Perigonimus*; but a revision of the genus is needed.

Order.—LEPTOMEDUSÆ.

Agastra caliculata (Hincks).

Hydroid form.

Campanularia caliculata, Hincks, 1868, p. 164, pl. xxxi.; Giard, 1898.

Medusoid form.

Agastra mira, Hartlaub, 1897, p. 504, Taf. xxii.

Leptomedusa. Gen.? Sp.? Browne, 1897, P. Z. S., p. 832, pl. xlix.

Hartlaub first described the free-swimming Medusa under the name of *Agastra mira*, and his specimens were obtained off Heligoland in 1895 and 1896, in the autumn.

At Valencia, in May, 1895, I found a single specimen of the Medusa, and in August, 1896, three more specimens. These I described and figured in the "Proceedings of the Zoological Society" without giving a name, as I felt almost certain that these peculiar little Medusæ, without a stomach or tentacles, must have been recently liberated from a Hydroid colony. For this reason I preferred to wait for the discovery of its Hydroid.

Fortunately there has not been a long delay, as Giard has found the Hydroid *Campanularia caliculata* of Hincks abundant at Wimereux, and has been able to find Medusæ in the gonothecæ which agree with the description given by Hartlaub of *Agastra mira*. As Giard points out, the genus *Campanularia* is confined to certain Hydroids which do not possess Medusæ, but have simple sporosacs. He has suggested the removal of this species from the genus *Campanularia* to a new genus, which he proposes to call *Agastra*, after the generic name given by Hartlaub to the Medusa. Now I see no reason

for there being two specific names, one for the Hydroid and another for the Medusa, and according to the rules of nomenclature Hincks's name has priority.

Hincks states that the Hydroid is not common. It is recorded for Pegwell Bay, near Ramsgate; Dorsetshire; Ilfracombe; Kinsale, Co. Cork; Courtmasherry Harbour, Cork; and Jersey.

***Dipleurosoma typicum* (Boeck).**

Dipleurosoma typica, Axel Boeck, 1866.

Dipleurosoma stuwitzii, Axel Boeck, 1866.

Ametrangia hemispharica, Allman, 1873, "Nature," vol. ix., p. 73.

Dipleurosoma irregulare, Haeckel, 1879, p. 636.

Dipleurosoma typicum, Haeckel, 1879, p. 155.

Dipleurosoma hemispharica, Haddon, 1885; Browne, 1897, P.Z.S., p. 826, pl. xlviii.

In 1895, a solitary specimen was taken in April, and a few in May.

In 1896, only three specimens were taken during August.

In 1897, a single specimen was taken on June 30th, and on July 19th a great shoal appeared, and remained in the harbour until the middle of August. A great decrease took place early in September, and the final disappearance on October 9th. The smallest specimens were about 3 mm. in diameter, and the largest did not exceed 8 mm.

In 1898, it first appeared in May and disappeared in October. Abundant during June and July.

The few specimens taken in 1895 and 1896 showed that this Medusa had a very irregular radial canal system. Though I was able to identify the specimens as *Ametrangia hemispharica* of Allman, yet I felt sure that the species had not been correctly described. Fortunately the Medusa was abundant in 1897 and 1898, so that the Misses Delap were able to send me a large number of specimens, which have enabled me to give a better description of the radial canal system, and to connect Allman's species with *Dipleurosoma typicum* of Boeck. Allman's specimens were taken on the south coast of Ireland, and the following is his description (from "Nature," 1873):—

"Umbrella hemispherical, about half an inch across the umbrella-margin. Tentacles more than a hundred, very exten-

sile, three to four inches long when fully expanded, spiral when contracted. Each tentacle has a bulbous base, with a distinct ocellus. No marginal vesicles. Velum of moderate width. Manubrium forms a small projection from the summit of the umbrella, and terminates in four rather indistinct lips. From the base of the manubrium three wide canals are sent off, at equal distances; these gradually contract in diameter, and finally enter the ring canal. The symmetry of the radiating canals is confined to these three primary trunks. From their wide proximal ends each sends off branches, some of which may be traced to the margin, where they join the ring canal, while others end blindly in the substance of the umbrella. The branches are very irregular in number, length, and direction.

The generative elements are formed in oval sporsacs, developed one on each of the three primary canals at the spot where the wider base passes into the narrow continuation. The ova remain in the sac until the planula stage is reached. The planula breaks out of the sac and remains attached to the outer wall for some time. Nearly spherical in shape, it never acquires cilia, and possesses little or no power of locomotion. The gastric cavity is fully formed. Further development unknown. Very abundant. South coast of Ireland."

Haeckel, in 1879, found a few specimens at Brighton, and noticed the variability of the canal system. In his "*System der Medusen*" he has placed the species in the genus *Dipleurosoma*, under the name of *D. irregulare*, and gives Allman's *A. hemisphaerica* as a doubtful synonym. The genus contains two other species, *D. typicum*, Boeck, and *D. amphithecium*, Haeckel.

Haeckel's definition of the genus *Dipleurosoma* is as follows:—

"Canotidæ, with six branched radial canals leaving a bilateral stomach in two opposite groups, three canals in each group, with irregular branches. The main canals and their branches generally enter the ring canal. Six gonads on the undivided part of the main canals near the stomach."

This description is based on *D. amphithecium*, and not on *D. typicum* or *A. hemisphaerica*.

D. amphithecium has a bilateral stomach with six main canals. The gonads are on these canals close to the stomach, and the lateral branches of the main canals are between the gonads and the ring canal.

I have made rough diagrams of the canal systems of 200 specimens taken in Valencia Harbour in 1897, and have selected twelve diagrams (figs. 1–12) to illustrate the irregular arrangement of the radial canals. These specimens clearly show that this species does not agree with Haeckel's definition of the genus *Dipleurosoma*. I do not wish to make a new genus for this species, especially as Boeck originally founded the genus *Dipleurosoma*; but Haeckel's definition must be ultimately altered and *D. amphithecum* removed to another genus.

NOTES ON THE VALENCIA SPECIMENS. (Plates xx., xxi.)

Stomach.—In the majority of the specimens the stomach is longer than it is wide, and the usual type is shown in fig. 3; but it may be triangular (fig. 4), or nearly round (fig. 5), or very irregular (fig. 11). In all the figures only the base of the stomach is drawn, so as not to make the diagrams too complicated. The walls of the stomach meet about the centre, and terminate in a mouth with four lips. Nearly all the specimens preserved in formalin have the mouth fully expanded, forming a simple ring.

I believe that the irregularly shaped stomach is due to the outgrowth of the radial canals, and to a subsequent outgrowth of the stomach itself. The base of the stomach has the appearance of ground glass, divided by a number of clear lines which meet about the centre. These transparent lines correspond in position with some of the large canals (figs. 8 and 11), and, I believe, mark the original position of the radial canals. The stomach has grown outwards and taken in a part of the radial canals. The enlargement, also, of the radial canals at their exit from the stomach is a process connected with the growth of the stomach, converting a portion of the canals into lobes of the stomach. Upon this outgrowth I base my views that all the radial canals leave either the stomach itself or a lobe of the stomach, and that the primary canals, in the young Medusa, are not subsequently branched, as in the figure given by Haeckel of *D. amphithecum*.

Radial Canal System.—At present I have no clue to the number and the position of radial canals in the earliest free-swimming stage. All the specimens belonged either to intermediate stages or to the adult form, mostly to the latter. The radial canal system may conveniently be divided into three types, which are not absolutely distinct, as a blending of the types occurs in some specimens.

(a) A roundish stomach, with four or more canals about equal distances apart.

- (b) A triangular stomach, with three primary canals, one from each corner of the stomach, and the usual accessory canals, in different stages of development. (Allman's type.)
- (c) An elongated stomach, with a canal at each end and two canals on each side; also with accessory canals. (Boeck and Haeckel's type.)

The number of radial canals leaving the stomach (including those which had not reached the ring canal) were counted in 217 specimens taken in 1897; the result is given in the following table:—

The number of Canals leaving the Stomach.	The number of Specimens.
5.	3.
6.	8.
7.	18.
8.	31.
9.	43.
10.	32.
11.	31.
12.	25.
13.	11.
14.	5.
15.	6.
16.	2.
17.	1.
18.	1.

I do not think that there is any tendency on the part of the Medusa to produce permanent blind canals, but that the aim of every canal on leaving the stomach is to unite with the ring canal. In two specimens I noticed a short canal running out from the ring canal and directed towards the stomach. As the radial canals are so irregular in number and position it is not possible, until the earliest stages have been seen, to express a definite opinion as to the normal type. Scarcely two specimens have the canals in exactly the same position, and they apparently develop in no definite order.

Generative Organs.—According to Haeckel's definition of the genus there ought to be six gonads; Allman gives only three. The Valencia specimens used in the above table show that the gonads may be upon all the canals, or only on a few; the number of gonads ranges from

one to twelve, and five is the most frequent number. The females were in excess of the males in the proportion of about four to three. The ova remain attached to the ovary until the planula stage is reached.¹

Distribution.—South-east coast of Norway (Boeck). Newfoundland (Stuwitz). South coast of Ireland (Allman); Kingstown Harbour (Haddon). Brighton (Haeckel).

***Euchilota pilosella* (Forbes).**

Thaumantias pilosella, Forbes, 1848, p. 42, pl. viii.; Gosse, 1853. p. 334.

Euchilota pilosella, Browne, 1896, P. Z. S., p. 484.

In 1895, during April and May, three specimens were taken; one was an early stage, about 2 mm. in length; the others were adults, the largest 20 mm. in diameter.

In 1896, only a very early stage was taken in August.

In 1897, it first appeared in April and disappeared in October; abundant throughout the summer.

In 1898, it first appeared in July and disappeared in October; abundant during July and August. The largest specimen measured 22 mm. in diameter.

This Medusa is not uncommon on the British coasts during the summer.

***Eutima insignis* (Keferstein).**

Eutima insignis, Haeckel, 1879, p. 192; Browne, 1896, P. Z. S., p. 492.

In 1896, it was only taken on three occasions during my visit in the summer; a single specimen on July 22nd and August 19th; and it was common just outside the harbour on August 10th.

In 1897, it was not seen by the Misses Delap.

In 1898, it only occurred in July. Four large specimens taken with ova along the whole length of the peduncle. Diameter of the umbrella 10–12 mm.

Under *Saphenia mirabilis* I have commented on the probable relationship of that Medusa with this species.

¹ See footnote on page 696.

***Laodice calcarata*, Agassiz.**

- *Laodice calcarata*, Haeckel, 1879, p. 134; Browne, 1897, P. Z. S., p. 823, pl. xlix.

In 1895, three specimens were taken in April and three in July.

In 1896, five specimens were taken in July and August. On September 3rd we visited Puffin Island (a few miles south of Valencia), and there Mr. Gamble found a few specimens close to the rocks. On the two following days a small shoal entered Valencia Harbour, but soon disappeared. It consisted almost entirely of fine adult specimens, 20–27 mm. in diameter.

In 1897, it first appeared in May and disappeared in November. It was fairly common in August and September and again in November.

In 1898, it first appeared in June and disappeared in November; very abundant during July and August.

The specimens taken in 1896 were nearly colourless, but the largest specimens taken in 1897–98 had pinkish gonads. This species has not often been recorded in British seas.

***Meliceritidium octocostatum* (Sars).**

Stromobrachium octocostatum, Forbes, 1848, p. 30, pl. iv.

Meliceritidium octocostatum, Haeckel, 1879, p. 136.

A solitary specimen was taken in the harbour by the Misses Delap on July 19th, 1898, and sent to me for identification. It measured 6 mm. in length and 4 mm. in width; the gonads were fairly well developed.

This species, I believe, belongs to our northern fauna, and occasionally drifts southwards. It was first taken by Sars off the Norwegian coast, and has been several times recorded off the Scottish coasts:—Bute (Forbes), Arran (Landsborough), St. Andrew's (McIntosh), Cromarty Firth (Romanes). It was abundant in Lamlash Bay, in Arran, during August, 1897, when Messrs. Jenkinson and Montagu, of University College, London, found some fine specimens.

Greene (1857) has recorded it for Dublin Bay, and two specimens were taken by me at Port Erin in 1893. Forbes found it common in the bays on the north-west coast of Ireland in 1839. It has only once been recorded for the English Channel, at Falmouth, by Cocks (1849), when it was abundant in the summer.

Obelia nigra, sp. nov.

I have found this Medusa common at Valencia, Plymouth, and Port Erin, in the Isle of Man, but have not been able to trace it to any described species that I know of. For the time being, until its Hydroid has been traced, I propose to call it *Obelia nigra*, taking the black colour of certain basal bulbs of the tentacles as a specific character, by which it may be distinguished from the other species of the genus.

Description of an adult specimen:—

Umbrella slightly curved; stomach short, with a quadrangular base, and with a small cone-shaped (apical) process in the substance of the umbrella; mouth with four lips; eight marginal sense-organs, with a single otolith in each. Tentacles, 150–200. The basal bulbs of the tentacles are of two kinds; the majority are colourless, but others, varying in number and position, contain a dark brown or black pigment. There are usually six coloured basal bulbs in each quadrant; they are about twice the size of the colourless bulbs, and are situated on the inner side of the tentacles. The total number varies between 22 and 27. In some specimens, in addition to the completely coloured bulbs, there are bulbs only partly coloured, with just one or two small patches of colour. In one specimen 30 such bulbs were counted, but usually only two or three are present. They have the appearance of bulbs developing pigment. The gonads are globular in shape, and situated at about two-thirds the length of the radial canals from the stomach, but never on the inner half of the canal. Diameter of the umbrella, 4–5½ mm.

In 1895, at Valencia, this species was taken from April 15th till the termination of my visit at the end of May. It became very abundant after May 14th. In a tow-netting made on July 8th by the Misses Delap many specimens were found.

In 1896, it was present nearly throughout my visit in the summer. Up to August 24th it was by no means common, often very scarce. On August 28th, a great shoal entered the harbour, and over 500 specimens were preserved. They were mostly young specimens, but many adults were present. The shoal, decreasing in size, remained until September 14th, when the Medusa completely disappeared. In the tow-nettings sent by the Misses Delap I found the species again on September

30th, during October, and until November 13th; only a few specimens in each tow-netting.

In 1897, the Misses Delap record the species in their notes from February to November. It was very abundant in July and September.

In 1898, it appeared in March and disappeared in November; very abundant in July and August.

A variation in the number of radial canals occurred in only seven of the 450 specimens (taken on August 28th, 1898):—

One specimen with one canal and one radial gonad upon it.

Five specimens with three canals and three gonads.

One specimen with five canals and five gonads.

Other species of *Obelia* were taken; but as the specimens were in formalin they were not identified.

***Octorchis gegenbauri*, Haeckel.**

Octorchis gegenbauri, Haeckel, 1879, p. 171, Taf. xiii.; Browne, 1896, P. Z. S., p. 494.

This Medusa has only been recently added to the British Fauna. A solitary specimen was taken at Plymouth in 1895, and previous to that date it was only known in the Mediterranean.

In September, 1896, I took a young stage in Valencia Harbour, and the Misses Delap fortunately captured two fine specimens in 1897, and sent them to me, along with good sketches from life for identification. As very little is known about this species, a description of the Valencia specimens may be of use.

September 21st, 1896. This specimen was not in good condition when captured, so that full details cannot be given. Umbrella about 6 mm. in diameter; manubrium about 6 mm. in length. Four perradial tentacles and four interradial bulbs, from which tentacles probably develop later on. Many tubercles on the margin of the umbrella, and probably each one with a lateral cirrus. Eight marginal sense-organs, each with about 10–12 otoliths, arranged in a semicircle. Gonads present along the outer third of the radial canals on the sub-umbrella, and also on the radial canals along the peduncle of the stomach, but quite immature. The Medusa was perfectly colourless, just like clear glass in water.

July 30th, 1897. An intermediate stage, with umbrella about 10 mm. in width and 7 mm. in length. Manubrium about 25 mm. in length. Mouth and stomach 2 mm. in length; mouth with four lips having a folded margin. Four very long perradial tentacles, but no traces of interr radial tentacles. Marginal tubercles, 87, nearly every one with a single cirrus. Eight marginal sense-organs (otoliths not visible owing to the specimen being in formalin). Gonads present, about 4 mm. in length, on the outer half of the four radial canals on the sub-umbrella, but not extending to the margin. Gonads also present on the peduncle, about half-way down, about 5 mm. in length; one on each radial canal, side by side, forming an oval mass. The gonads on the sub-umbrella and on the peduncle of the stomach both contained immature ova.

September 11th, 1897. A fine adult specimen. Umbrella about 17 mm. in width and 11 mm. in length. Velum about $1\frac{1}{2}$ mm. in width. Manubrium, contracted, 22 mm. in length; the base of the manubrium about 10 mm. in diameter, and having the appearance of a long funnel. Stomach and mouth about $3\frac{1}{2}$ mm. in length. Mouth with four lips, which have a closely folded margin. Eight long tentacles of about equal size. About eighty marginal tubercles, nearly every one with a cirrus. Eight marginal sense organs (otoliths not visible). The gonads on the sub-umbrella start near the margin, extend over the top of the sub-umbrella cavity, and terminate a little way down the peduncle. Gonads are also present in the centre of the peduncle. Both sets contain ova; the ova on the sub-umbrella were less advanced than on the peduncle.

In my description of the species taken at Plymouth, in 1895 (P. Z. S., 1896), I stated—"On each of the four radial canals, about the middle of the peduncle, there is an oval mass of ova, and also a genital band probably containing spermatozoa, extending along the radial canals from the base of the peduncle nearly to the margin of umbrella." It appears from the Valencia specimens that the sexes are separate, but I have not yet seen the male. In the Plymouth specimen I recognised ova upon the peduncle, but could not find any on the sub-umbrella, where there was simply a homogeneous mass of cells resembling an immature mass of spermatozoa; but I am inclined now to regard it as an immature ovary.

The Valencia specimens show that the Medusa has at first four perradial tentacles, and that the four interradial tentacles are of later growth.

Phialidium cymbaloideum (van Beneden).

Phialidium cymbaloideum, Browne, 1896, P. Z. S., p. 491, pl. xvii.

In 1895, during April and May, a large number of specimens were collected, and a series formed to show the development of the Medusa from the earliest stage to the adult form.

In 1896, from July to September, the Medusa was very scarce. Nearly all the specimens belonged to intermediate stages; a specimen of the earliest stage was taken on August 28th. Early in November the intermediate stages were abundant, but the Medusa was not taken in December. The appearance of the young and intermediate stages in the autumn shows that the Hydroid liberates Medusæ in the autumn as well as in the spring.

In 1897, it first appeared in January and disappeared in October.

On January 27th early stages were taken, and on February 2nd a large specimen, 7 mm. in diameter, which probably came from the autumn stock of the previous year. Early in March the earliest and intermediate stages were abundant; a slight decrease occurred in April, but during May and June the number again increased, so that in July the Medusa became very abundant, both intermediate and adult specimens being present. After a rapid decrease in September the Medusa finally disappeared in October. Apparently there was no autumn brood as in the previous year.

In 1898, the Medusa first appeared in March and disappeared in October. It never became abundant at any time during the summer.

This Medusa is probably liberated from a Hydroid belonging to the genus *Campanulina*, so that the abundance of the Medusa and its first appearance depend upon the breeding activity of the Hydroid. It is a very common British species, and may be distinguished by its thick umbrella, and by the presence of only eight marginal sense organs which have more than one otolith in each. The youngest stage has four tentacles and four marginal sense organs; but the presence of at least two otoliths in each sense organ distinguishes this species from the young

stages of other species. Another point, which may often help to determine the species (especially when the specimens are in alcohol or formalin and the sense organs are not visible), is the presence of four interradian black pigment spots at the base of the stomach, visible when looking down upon the top of the umbrella. These black spots are occasionally not present, and sometimes very faint, so that they cannot be relied upon as a specific character.

***Phialidium temporarium*, Browne.**

Phialidium temporarium, Browne, 1896, P. Z. S., p. 489, pl. xvii.

In 1895, during April and May this species was present in nearly every tow-netting, especially the young stages; but it never became really abundant. The adult form was taken in May; the largest specimen measured 20 mm. in width and 11 mm. in height, with 38 tentacles and 1-3 marginal sense-organs between every two tentacles. The average size of the adult is 10-15 mm. in width, with about 32 tentacles and 1-2 sense-organs between the tentacles. In this species there is one otolith in each sense-organ; two otoliths sometimes occur as a variation, but are never present in all the sense-organs.

In 1896, it was a common object in the tow-net during my visit in the summer. Most of the specimens were adults; the early stages were not taken. The specimens of *P. temporarium* taken in 1895 were of the usual yellowish brown colour, and a few were reddish brown. In 1896 I found brilliantly coloured specimens more numerous than those of the normal colour. The basal bulbs of the tentacles were of a bright orange colour; the gonads and the lips of the mouth faintly coloured with purple, and the stomach of the usual yellowish brown colour. A single specimen was taken with the basal bulbs of the tentacles and the gonads of a brilliant reddish purple.

In 1897, the Medusa first appeared in February and disappeared in November. It was common throughout the summer and abundant in September and October. Young stages were plentiful in the spring, and the purplish-coloured specimens in May.

In 1898, it first occurred in March and disappeared in October. Common throughout the summer; abundant in August.

This is one of the commonest of the British Medusæ, and is probably liberated from the Hydroid *Clytia johnstoni*. I have

found it necessary to give a new specific name to this species, so as to make sure of its identity and to save further trouble, as the literature connected with the two genera *Thaumantias* and *Phialidium* is in a hopeless state of confusion, mainly brought about by the early observers not recording the marginal sense organs. The same set of Medusæ are described in two distinct families by Haeckel—*Thaumantidæ* (sense organs without otoliths) and *Eucopidæ* (sense organs with otoliths). The early and the intermediate stages have also been classified into distinct genera and species, which are divided between the two families.

***Polycanna forskalea* (Forbes).**

Æquorea forskalea, Forbes, 1851, P. Z. S., p. 272, pl. iv.

Polycanna forskalea, Browne, 1897, P. Z. S., p. 828.

In 1896, a single specimen was found on September 4th, and on the following day five specimens were taken in a hand-net, and others seen swimming too deep down to be captured. On September 7th another specimen was taken. These specimens have been fully described in the P. Z. S., 1897.

In 1897, eighteen specimens were taken by the Misses Delap on July 26th; the largest about 40 mm. in diameter. Two specimens were taken on July 30th and one on August 7th.

In 1898, specimens were taken on the following dates:—

July 25th. Two specimens; largest about 65 mm.

July 30th. Three specimens.

August 23rd. Two specimens; largest about 130 mm.

October 11th. Two damaged specimens.

November 5th. One large specimen of a bright pink colour.

The specimens taken in 1896 agreed with the description given by Forbes for a Medusa which he called *Æquorea forskalea* (Peron), and found by him in the Outer Hebrides. I think that the descriptions given by the writers previous to Forbes are rather incomplete, and for the present I prefer to call this species *P. forskalea* (Forbes), and to leave the question of priority for further investigation.

Greene (1858) has recorded an *Æquorea* (sp.?) for Dublin Bay, and for several places on the south-west coast of Ireland where it occurred in considerable numbers. From the description given it appears to be a young stage (umbrella not exceeding an inch in diameter) of an *Æquorea* or a *Polycanna*.

Medusæ belonging to the Polycannidæ have rarely been taken in British seas.

***Saphenia mirabilis* (Wright).**

Saphenia mirabilis, Haeckel, p. 192; Browne, 1896, P. Z. S., p. 493, pl. xvii.

In 1895, two specimens taken at the end of May; one 4 mm. in diameter, the other 9 mm.

In 1896, from July to September, only a few specimens taken. The smallest 3 mm. in length and width; the largest 10 mm. in width and 8 mm. in length.

In 1897, none seen.

In 1898, six specimens taken in July. The smallest 7 mm. in width; the largest 13 mm. in width and 9 mm. in length.

Some of the specimens had generative cells along the whole length of the peduncle.

One specimen with ten marginal sense-organs instead of the normal eight. Two specimens with marginal bulbs containing black pigment in the centre; usually the bulbs are colourless.

In three hauls with the tow-net, taken on August 10th, 1896, just outside Valencia Harbour, I found four specimens of *Saphenia mirabilis* and seven specimens of *Eutima insignis*. These two genera agree in every important detail, with the exception of the number of tentacles. *Saphenia* has two (opposite) tentacles and *Eutima* has four tentacles. Among these specimens some were of the *Saphenia* type, and some of the *Eutima* type; but others showed a difference in the size of the four tentacles. They had two long opposite tentacles and two tentacles much smaller, varying in length in the different individuals. I have two series of specimens taken at Plymouth, and another series taken at Valencia, in 1898, which show the same thing. In some of the specimens one pair of tentacles is just developing, whilst the opposite pair are very long. This leads me to believe that *Eutima insignis* is really the adult form (showing the maximum growth) of *Saphenia mirabilis*, though the latter may have ripe gonads.

This species is not uncommon in the British seas, and usually occurs in the summer months.

Tiaropsis multicirrata (Sars).

Tiaropsis multicirrata, Haeckel, 1879, p. 179.

In 1895, two specimens taken in April; both very early stages, about 1 mm. in diameter.

In 1897, a solitary young stage taken in April.

This Medusa appears to be very rare at Valencia; but it is not uncommon in other parts of the British area.

Greene (1857) has recorded it for Belfast under the name of *Thaumantias pattersoni*.

It is not uncommon at Port Erin, Isle of Man, in the spring.

Vallentin (1897) found this species very abundant in Falmouth Harbour during May and June, 1895. "The sea, in certain protected places in the harbour, was almost solid with examples."

Order.—TRACHOMEDUSÆ.

Aglantha rosea (Forbes).

Circe rosea, Forbes, 1848, p. 34, pl. i.

Aglantha rosea, Browne, 1897, P. Z. S., p. 833, pl. xlix.

In 1895, only a few specimens were taken during April and May. The Misses Delap sent me a specimen in July, and informed me that it was abundant during September.

In 1896, a solitary specimen was taken on January 8th. During my visit in the summer it was by no means common.

In 1897 and 1898, not a single specimen was seen.

Aglantha rosea has eight marginal sense-organs, which distinguish it from *A. digitalis*, with only four sense-organs.

This species has been recorded from Shetland Islands, St. Andrew's, and Heligoland. It is an inhabitant of the Atlantic Ocean, and an occasional visitor to our shores.

Liriantha appendiculata (Forbes).

Geryonia appendiculata, Forbes, 1848, p. 36, pl. 5.

Liriantha appendiculata, Haeckel, 1879; Browne, 1896, P. Z. S., p. 495.

Only a few young stages were taken in August and November, 1896, and in November, 1897.

It is an Atlantic Medusa which occasionally visits the British coasts. It was first taken by Forbes in the English Channel in 1846. I found it very abundant at Plymouth in 1893, but scarce in 1897.

Gossea circinata, Haeckel.

Gossea circinata, Haeckel, 1879, p. 252, pl. xviii.

To the numerous tow-nettings taken by the Misses Delap we are indebted for the addition of this very rare Medusa to the Valencia fauna. It was first taken on October 24th, 1898, when two specimens were secured and sent to me for identification. On October 29th nine, and on November 9th twelve specimens were taken, and many seen too deep down to be captured. All these specimens, well preserved in formalin, were sent to me for examination; but before giving an account of them, it will be well to state briefly what has already been published on the genus.

According to Haeckel, the genus *Gossea* contains only two species—*G. corynetes* of Gosse, and *G. circinata* of Haeckel—and neither of these species has been recorded since its first discovery. Gosse found his specimens at Ilfracombe (Devonshire) in September and October, 1852. He has given a good description of the species, with coloured figures, in his well-known book, “A Naturalist’s Rambles on the Devonshire Coast.” Gosse placed his new species temporarily in the genus *Thaumantias*, which in those days contained a miscellaneous group of species now dispersed among many genera.

Louis Agassiz (1862), having recognised its true position, made for it a new genus, *Gossea*, named after its discoverer. I have two reasons for writing on Gosse’s species; first, because it may ultimately be proved to be an early stage of *G. circinata*; and, secondly, because Haeckel has changed Gosse’s description of the species to such an extent that he makes really another species of it.

Gosse described the Medusa with twenty-four tentacles, “arranged in eight bundles of *three* each, at the points of junction of the four radiating vessels, and midway between them. One in each group is minute and rudimentary.” In notes on some more specimens, taken a few weeks later, Gosse states:—“The subsidiary tentacle in each group of three was less disproportionately small in these specimens.” With the exception of the grouping of the tentacles *G. corynetes* agrees fairly well with the description of *G. circinata*, so that there is need to give a further account from Gosse.

Haeckel, in his "System der Medusen," has altered Gosse's description in the following manner:—Sixteen large club-shaped tentacles, in eight groups of *two* each. Between them twenty-four sense-organs (eight adradial groups of three each) and eight short and delicate spiral tentacles. It will be seen that Haeckel has removed the smallest tentacle from each group and placed it alone by itself. Gosse clearly states that the three tentacles are close together, and his excellent illustrations fully bear out his description.

The examination of the Valencia specimens throws light upon the subject, and shows that the position of the tentacles is regulated by the order of their development.

Gossea circinata is distinguished from *G. corynetes* by Haeckel by possessing eight groups of three tentacles in each, and short spiral tentacles, one about midway between every two groups. If Haeckel had kept strictly to Gosse's description of *G. corynetes*, then both species would have been alike in the number of tentacles in each group, and the difference would have been in the additional eight single solitary tentacles found in *G. circinata*.

The following is an abstract of Haeckel's description of *Gossea circinata*:—Umbrella semicircular, a little broader than high. Stomach one-third as long as the length of the umbrella; mouth with four crenated lips. Gonads club-shaped swellings occupying about two-thirds of the radial canals, and leaving both ends free. Twenty-four large club-shaped tentacles, in eight groups of three each; between them twenty-four marginal sense-organs (eight adradial groups of three each). Eight short and small spiral tentacles.

Some of the Valencia specimens agree fairly well with Haeckel's description, but others show that more short tentacles are developed upon the margin of the umbrella. None, however, correspond to the specimens taken by Gosse; and for this reason I have kept the two species apart for the present, though I am strongly of opinion that Gosse's specimens are a stage younger than those described by Haeckel. Some of the Valencia specimens are a stage older than Haeckel's specimens. If the size of a tentacle is regulated by its age, then the order of the growth of the tentacles can be demonstrated. In each group the tentacles are of different sizes—large, medium, and small; the same order existing in all the groups. The eight large tentacles

represent the primary series, and tend to show that the Medusa at a very early stage has only eight simple tentacles (four perradial and four interradial); then the second series develops, forming eight groups of two tentacles each; and a little later, a third series appears, forming three tentacles in each group (Gosse's *G. corynetes*). The next series consists of eight isolated adradial tentacles, separated from the groups by sense-organs, and about midway between the groups (Haeckel's *G. circinata*). Some of the Valencia specimens, as already stated, have other very minute tentacles, which are irregular in position, and usually separated by sense-organs from the other tentacles. One specimen had as many as ten just budding out, without bands of nematocysts. All the tentacles are built on the same principle, differing only in size and in the number of rings of nematocysts upon them. In the largest tentacles about fifty conspicuous circular bands of nematocysts are present, and a large terminal cluster; in the smaller tentacles only one or two bands are usually present. The tentacles, when partly contracted, have the appearance of clubs, as figured by Gosse; hence his specific name.

The sense-organs are not very regular in position. There are either two or three together in a group; but the groups become separated in some of the specimens by the development of the tiny tentacles. The number of sense-organs is not quite constant. I counted twenty-nine in one specimen, and they were divided into the following groups by the tentacles:—3, 4, 4, 4, 2, 4, 4, 4. In another specimen, with twenty-four sense-organs, the numbers ran thus:—3, 3, 3, 4, 3, 3, 2, 3. Each sense-organ contained a single otolith.

The smallest specimen measured 5 mm. in length and 7 mm. in width; the largest 8 mm. by 12 mm.

The Misses Delap inform me that this Medusa is a strong and rapid swimmer. The colour of the stomach is greenish; the mouth, gonads, and tentacles pinkish.

Haeckel found his specimens at Croisic, near St. Nazaire, South Brittany.

NARCOMEDUSÆ.

Solmaris corona (Keferstein and Ehlers).

Ægineta corona, Keferstein und Ehlers, 1861, p. 94, Taf. xiv., figs. 7-9.

Solmaris corona, Haeckel, 1879, p. 358.

In 1895, three specimens were taken in July by the Misses Delap.

In 1896, only a solitary specimen in a damaged condition was taken on July 17th.

In 1897, it first appeared in July, and disappeared in November; very abundant from July to the middle of September.

In 1898, it first appeared in July and disappeared in November; abundant during July and September.

Although the Valencia specimens do not agree in every detail with the description given of *Solmaris corona*, yet the resemblance is so close that I do not feel justified in adding a new species to the genus.

The specific characters are mainly based upon the number of sense-organs upon each lobe on the margin of the umbrella; upon the shape of the lobe; and upon the number of tentacles. All of these organs increase in number with the growth of the Medusa.

The following are the principal characters of *S. corona* taken from Haeckel's monograph:—

Umbrella three to four times as broad as high (14 mm. broad, 4 mm. high). 27-30 lobes on the margin of the umbrella; nearly rectangular, twice as long as broad. Genital band, simple, smooth; in the outer half of the lower wall of the stomach. 27-30 tentacles, twice as long as the diameter of the umbrella. 60-80 sense organs (2-3 on each lobe).

The specimens sent to me were difficult to work upon, owing to the contraction and curling up of the lobes of the umbrella and the disappearance of most of the sense-organs in the formalin; but some diagrams and sketches, made by the Misses Delap from living specimens, helped me considerably in the determination of the species.

In taking the diameter of the umbrella as a guide to the age of the specimens, the following table shows that an increase in the number of lobes, tentacles, and sense-organs takes place along with the growth of the Medusa:—

Diameter of Umbrella, mm.	Number of Tentacles and Lobes.	Number of Sense-organs on each Lobe.
2-3.	12-16.	1.
4.	15-18.	
5.	17-29.	1-2.
6.	21-29.	1-3.
7.	22-30.	
8.	30.	
10.	36.	
12.	25-35.	

A comparison of the Valencia specimens with the description given by Haeckel, shows that the umbrella is a little smaller, and that there are a few more lobes and tentacles. The lobes are not twice as long as broad, but only slightly longer. The lobes increase in number by longitudinal division, so that they are not all of the same shape, some being much broader than others. The sense-organs were of a pale yellowish colour; they varied from one to three in number on each lobe, but more than three together were never seen. The genital band agreed with Haeckel's description. In most of the specimens it was on the outer half of the stomach, but in a few it extended over the outer two-thirds. In specimens about 3 mm. in diameter the generative cells were just visible, and nearly ripe in specimens of about 6 mm. in diameter.

Solmaris corona has only been recorded from Naples.

ACRASPEDA.

Order.—DISCOMEDUSÆ.

Aurelia aurita (Linn.).

In 1895, a few adult specimens were seen during June.

In 1896, a single Ephyra was taken on February 14th. The adult form was not seen in the harbour during the year. (Miss C. Delap saw a great quantity of large adult specimens off Fenit Pier, Tralee Bay, in May.)

In 1897, six Ephyrae were taken on January 14th, and a few in February. Some adult specimens seen in the harbour during July.

In 1898, a few Ephyrae taken in February and March. Adult specimens seen from May to August; only a few at a time, and usually in a damaged condition.

The scarceness of the Ephyrae during the spring seems to indicate that the Scyphistoma stage is either absent or very scarce in the harbour.

Chrysaora isosceles (Linn.).

In 1895, very abundant in the harbour from the middle of June to the middle of July. Some about 9 inches in diameter

In 1896, none seen.

In 1897, four specimens seen on July 27th.

In 1898, a few damaged specimens seen during July and August.

Cyanea lamarekii, Peron et Lesueur.

In 1895, during the early part of August the harbour was full of large specimens.

In 1896-97, none were seen.

In 1898, about a dozen damaged specimens seen on August 23rd and 24th.

Pelagia perla (Slabber).

Pelagia cyanella, Forbes, 1847, p. 390, pl. ix.

In 1895, none seen.

In 1896, on July 23rd, August 31st, and September 4th, shoals entered the harbour; on the latter date very abundant.

In 1897, shoals arrived in July, August, and November.

In 1898, none seen.

Pelagia floats in with the tide, swimming close to the surface, as the tide recedes large numbers are usually left stranded on the shore.

The umbrella is a little broader than high, about $2\frac{1}{2}$ to 4 inches in diameter. The buccal arms about $2\frac{1}{2}$ to $4\frac{1}{2}$ inches in length. The tentacles are about 4 inches in length when contracted, but are capable of extending to several feet. Colour usually purplish, occasionally brownish purple or pale mauve.

Pilema octopus (Linn.).

Rhizostoma pulmo, Forbes, 1848.

Pilema octopus, Haeckel, 1879.

In 1895, a specimen was seen by the Misses Delap on October 10th. It was swimming fast against the tide. Umbrella

about 2 feet in diameter; the combined length of the umbrella and arms about 4 feet. The colour of the umbrella was pale green, with a deep reddish margin. Arms bright blue.

In 1896, a specimen was captured by Mr. F. W. Gamble on September 1st, between Bray Head and Puffin Island. Mr. Gamble informs me that slightly over a hundred young Horse-Mackerel (*Caranx trachurus*) were seen sheltering under the umbrella. When first seen the little fish formed a zone as they hovered round the Medusa. On the capture being made with a bucket the fish were found hidden away in the sub-genital pouches. The size of the fish varied from 16 to 45 mm. in length; they were sent to Mr. E. W. L. Holt for identification (Holt, 1895, Journ. Mar. Biol. Assoc., p. 119 and p. 340). The association of young fish with *Rhizostoma* has been noticed by Gadeau de Kerville (1894) at Granville. The same species of fish was also found by him. Some other specimens of *Rhizostoma* were seen off the mouth of the harbour early in September by Mr. W. I. Beaumont. Some of these were also accompanied by little fish.

In 1897-98, none were seen.

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TABLE II.—VALENCIA HARBOUR.

Distribution of Medusæ, 1896, July to September.

I. Very scarce. II. Scarce. III. Few. IV. Fairly common. V. Common. VI. Abundant. VII. Very abundant. The "Arabic" figures show the actual number taken.

	JULY.							AUGUST.															SEPTEMBER.										
	18	20	21*	22	25	27	31	1	3	4	7	8*	10	12	15	18	19	22	24	28	31*	1	2	4*	5*	7	10	14	18	21			
<i>Sarsia prolifera</i> ,	III	V	..	IV	(2)	V	IV	III	..	..	VII	..	I	..	I	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Dipurena ophiogaster</i> , . . .	(1)	..	..	..	..	..	(2)	..	..	..	(6)	..	(3)	..	..	..	..	(1)	..	..	..	..	(1)	..	..	(1)	..	..	..	..	(1)
<i>Cyrtandra arcolata</i> , . . .	(1)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Solmaris corona</i> ,	(1)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Phialidium temporarium</i> , . .	III	V	..	..	..	(3)	III	III	III	III	V	..	VI	III	III	III	II	III	IV	I	..	II	III	..	..	(1)	(3)	III	..	IV	
<i>Phialidium cymbaloideum</i>, . .	..	(1)	..	..	..	..	(1)	..	..	..	(4)	..	..	..	(1)	..	..	..	..	(4)	..	..	..	..	..	..	..	..	..	..	III
<i>Obelia nigra</i>, . . . .	..	I	..	III	..	III	III	III	III	II	I	..	I	..	I	III	II	..	III	VII	..	V	VI	..	..	IV	V	IV	..	..	
<i>Laodice calcarata</i>, . . . .	..	(1)	..	(1)	..	..	..	(1)	..	..	..	..	..	(1)	..	(1)	..	..	..	..	..	..	..	VII	IV	..	..	..	..	..
<i>Pelagia perla</i>, . . . .	..	..	I	VI	..	..	III	..	..	..	..	..	..	..	..	..	..	..	(1)	..	VI	..	..	..	..	..	..	..	..	..	..
<i>Sarsia gemmifera</i>, . . . .	..	(4)	..	(1)	(1)	..	..	..	..	..	III	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Eutima insignis</i>, . . . .	..	..	..	(1)	..	..	..	..	..	..	..	..	IV	..	..	..	(1)	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Saphenia mirabilis</i>, . . . .	..	..	..	(1)	..	(2)	..	..	..	..	(1)	..	II	(1)	..	(1)	..	..	..	..	..	..	..	..	..	..	(1)	..	..	..
<i>Aglantha rosea</i>, . . . .	..	..	..	(3)	..	(6)	(1)	(1)	(1)	(1)	(4)	..	(2)	..	..	..	..	..	..	(2)	..	..	(1)	..	..	..	..	..	..	..	III
<i>Lar sabellarum</i>, . . . .	..	..	..	(2)	..	IV	I	(2)	(1)	I	II	..	(1)	(1)	(6)	II	I	(1)	(1)	V	..	IV	III	..	..	(3)	I	(1)	I	IV	
<i>Dipurena balterata</i>, . . . .	..	..	..	..	..	(1)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	(1)
<i>Corymorpha nutans</i>, . . . .	..	..	..	..	..	(1)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Amphinema dinema</i>, . . . .	..	..	..	..	..	..	(1)	..	(3)	II	I	..	(4)	..	(1)	..	..	..	..	..	..	..	(1)	..	..	..	..	..	..	..	..
<i>Margelis autumnalis</i>, . . . .	..	..	..	..	..	..	..	(1)	(1)	(2)	(1)	..	(1)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Liriantia appendiculata</i>, . .	..	..	..	..	..	..	..	..	..	..	(1)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Euchilota pilosella</i>, . . . .	..	..	..	..	..	..	..	..	..	..	(1)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Euphysa aurata</i>, . . . .	..	..	..	..	..	..	..	..	..	..	(1)	..	..	..	..	..	..	..	(1)	..	..	..	..	..	..	..	..	..	..	..	..
<i>Dipleurosoma typicum</i>, . . .	..	..	..	..	..	..	..	..	..	..	..	(2)	..	..	(1)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
<i>Tiara pileata</i>, . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	(1)	..	III	III	..	..	..	..	..	..	..	..	..	..	..	..
<i>Podocoryne carnea</i>, . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	(1)	..	..	..	..	..	..	..	..	..
<i>Polycanna forskalea</i>, . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	(1)	(5)	(1)	..	..	..	..	..
<i>Octorchis gegenbauri</i>, . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	(1)
Number of species taken, . .	5	6	..	9	2	8	9	7	6	6	14	..	10	4	7	6	4	4	6	5	..	4	6	..	..	5	3	4	1	7	

The occurrence of only two species on July 25th is probably due to a short haul of the tow-net on account of the roughness of the sea.

The occurrence of only one species on September 18th may be due to a moderate gale and a rough sea on the previous day.

* Tow-nettings not taken on these dates.

TABLE III.*—VALENCIA HARBOUR.

Monthly Distribution of Medusæ, from July, 1896, to December, 1898.

	1896. Summer.		1896. Autumn.			1896-1897. Winter.			1897. Spring.			1897. Summer.			1897. Autumn.			1897-1898. Winter.			1898. Spring.			1898. Summer.			1898. Autumn.			'98 W.
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
CRASPEDOTA.																														
Lar sahellarum,	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X
Obelia nigra,	X	X	X	X	X				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	
Phialidium cymbaloideum,	X	X	X	X	X				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	
Phialidium temporarium,	X	X	X	X	X				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	
Tiara pileata,		X																												
Murgellium octopunctatum,				X	X			X	X	X	X	X	X	X							X	X	X	X	X	X	X	X	X	
Corymorpha nutans,	X									X	X	X	X	X							X	X	X	X	X	X	X	X	X	
Ectopleura dumortieri,										X	X	X	X	X							X	X	X	X	X	X	X	X	X	
Sarsia tubulosa,								X	X	X	X	X	X	X								X	X	X	X	X	X	X	X	
Hyboeodon prolifer,									X	X	X	X	X	X								X	X	X	X	X	X	X	X	
Tiaropsis multicirrata,										X	X	X	X	X																
Euphyssa aurata,		X			X					X	X	X	X	X								X	X	X	X	X	X	X	X	
Euchilota pilosella,		X								X	X	X	X	X																
Dipurena halterata,	X	X	X								X	X	X	X								X	X	X	X	X	X	X	X	
Dipurena ophiogaster,	X	X	X								X	X	X	X									X	X	X	X	X	X	X	
Sarsia prolifera,	X	X	X									X	X	X									X	X	X	X	X	X	X	
Dipleurosoma typicum,		X	X									X	X	X									X	X	X	X	X	X	X	
Laodice calcarata,	X	X	X	X							X	X	X	X									X	X	X	X	X	X	X	
Solmaris corona,	X	X	X									X	X	X										X	X	X	X	X	X	
Amphinema dinema,	X	X	X									X	X	X										X	X	X	X	X	X	
Polyranna forskalea,			X									X	X	X										X	X	X	X	X	X	
Sarsia gemmifera,	X	X																					X	X	X	X	X	X	X	
Saphenia mirabilis,	X	X	X																					X	X	X	X	X	X	
Eutima insignis,	X	X																						X	X	X	X	X	X	
Octorchis gegenbauri,			X										X											X	X	X	X	X	X	
Cytæandra areolata,	X				X								X		X									X	X	X	X	X	X	
Margelis pyramidata,													X												X	X	X	X	X	
Margelis bella,													X												X	X	X	X	X	
Margelis autumnalis,		X			X																						X	X	X	
Margelis principis,											X												X							
Lizzia blondina,												X																		
Meliceridium octocostatum,													X																	
Liranthia appendiculata,		X			X												X													
Aglantha rosea,	X	X	X	X	X																									
Gossea circinata,																														
ACRASPEDA.																														
Aurelia aurita,							X	X					X							X	X		X	X	X	X				
Pelagia perla,	X	X											X	X											X	X	X	X	X	
Chrysaora isosceles,													X												X	X	X	X	X	
Cyanea lamarckii,																										X	X	X	X	
Pilema octopus,			X	X																										
Number of species taken,	17	19	13	7	9	1	4	8	6	12	14	15	23	17	16	10	7				10	10	15	16	23	16	13	11	9	1

* Notes on Table III., see p. 699.

TABLE I.—VALENCIA TOW-NETTINGS.

Distribution of Copepoda, 1895 (April to September).

	APRIL.										MAY.				JUNE.	JULY.	SEPTEMBER.	
	5	8	10	12	13	15	16	18	27	29	5	8	14	27	27	8	6	16
<i>Calanus finmarchicus</i> ,	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
<i>Pseudocalanus elongatus</i> ,	×	×	×	×	×	×	×	..	×	×	×	×
<i>Centropages typicus</i> ,	×	×	×	..	×	..	×	×
<i>Temora longicornis</i> ,	×	..	×	×	..	×	×	×	×	×	×	×	×
<i>Thalestris peltata</i> ,	×
<i>Centropages hamatus</i> ,	×	×	×	×	×	×	..	×
<i>Candace pectinata</i> ,	×	×	..	×	..	×
<i>Acartia clausii</i> ,	×	×	×	×	×	×	×	×	×	×	×	×	..
<i>Oithona similis</i> ,	×	×	×	×	×	×	×	×	×
<i>Thaumaleus claparedii</i> ,	×
<i>Parapontella brevicornis</i> ,	×
<i>Thalestris longimana</i> ,	×
<i>Metridia armata</i> ,	×	×	×
<i>Ectinosoma spinipes</i> ,	×	×	..
<i>Anomalocera patersonii</i> ,	×
<i>Harpacticus chelifer</i> ,	×	..	×
<i>Isias clavipes</i> ,	×
<i>Bradyidius armatus</i> ,	×
<i>Ectinosoma atlanticum</i> ,	×
<i>Laophonte curticauda</i> ,	×
<i>Corycæus speciosus</i> ,	×
<i>Onca mediterranea</i> ,	×
Number of species present,	1	3	3	1	6	6	5	4	4	5	4	4	5	7	6	9	8	15
Depth of tow-net, fms.	1½	1	1½	1½	10*	2	1	3	2	2	2	2	10*	3	..	..	..	..
Sea temperature. Surface, F.	49	50	49	49	49	49	50	50	51	51	51	52	53	54	..	..	..	..

* Doulos Bay.



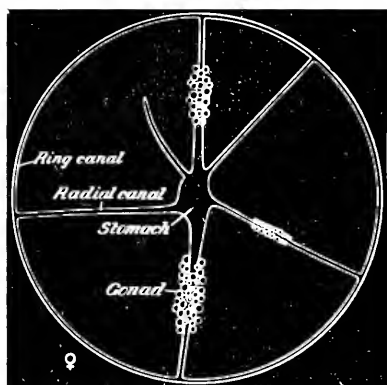


FIG. 1.

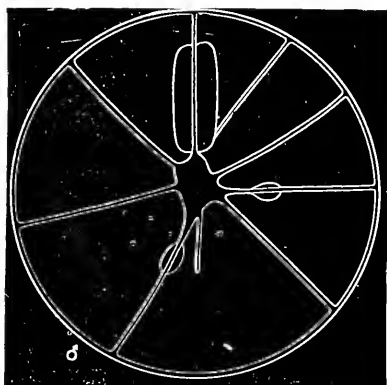


FIG. 2.

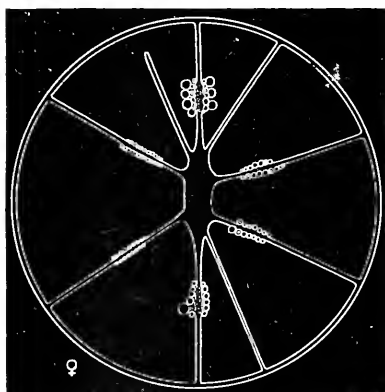


FIG. 3.

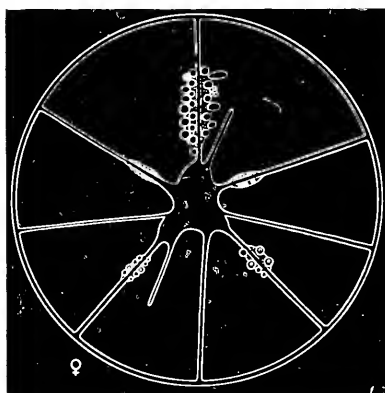


FIG. 4.

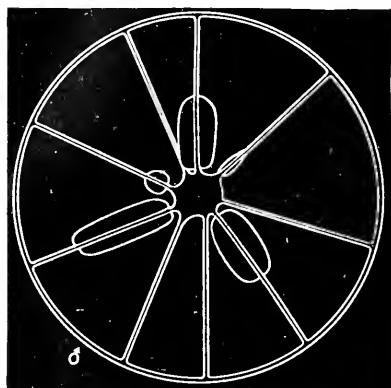


FIG. 5.

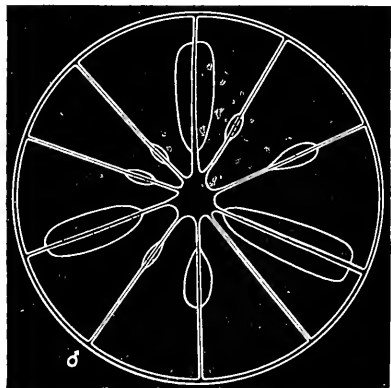


FIG. 6.

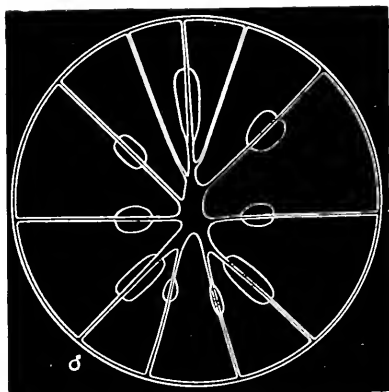


FIG. 7.

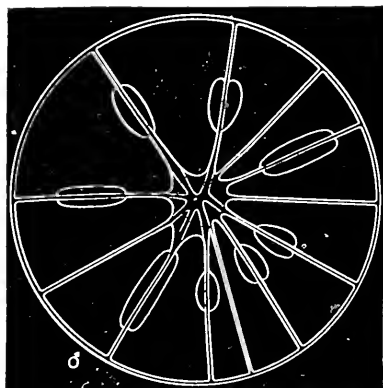


FIG. 8.

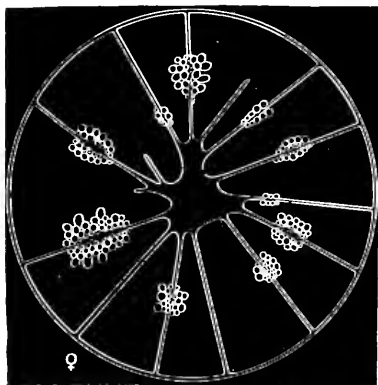


FIG. 9.

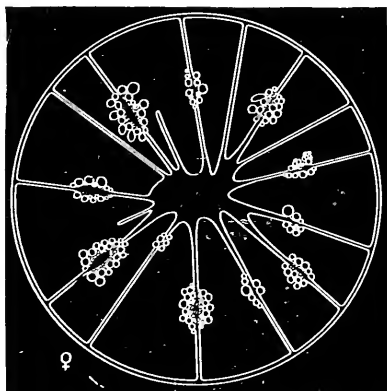


FIG. 10.

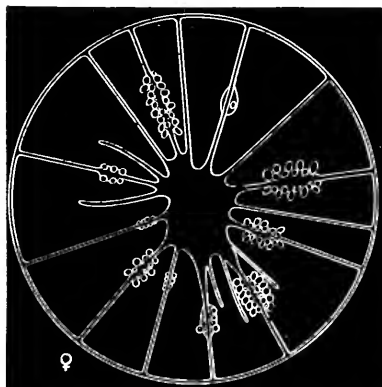


FIG. 11.

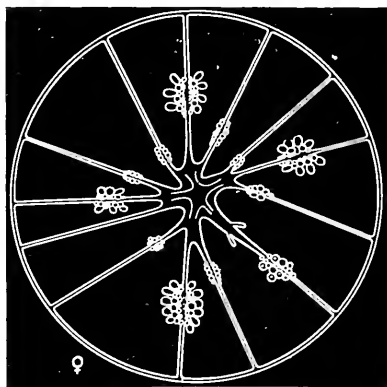


FIG. 12.