PROCEEDINGS

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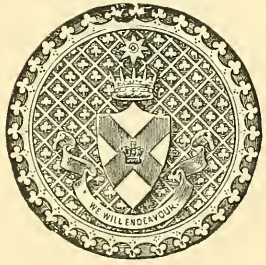

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1898–1900.

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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Part I.—*The Pelagic Fauna.*

Part II.—*The Benthos (Dredging and Shore Collecting).*

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 Chætognatha (p. 745).

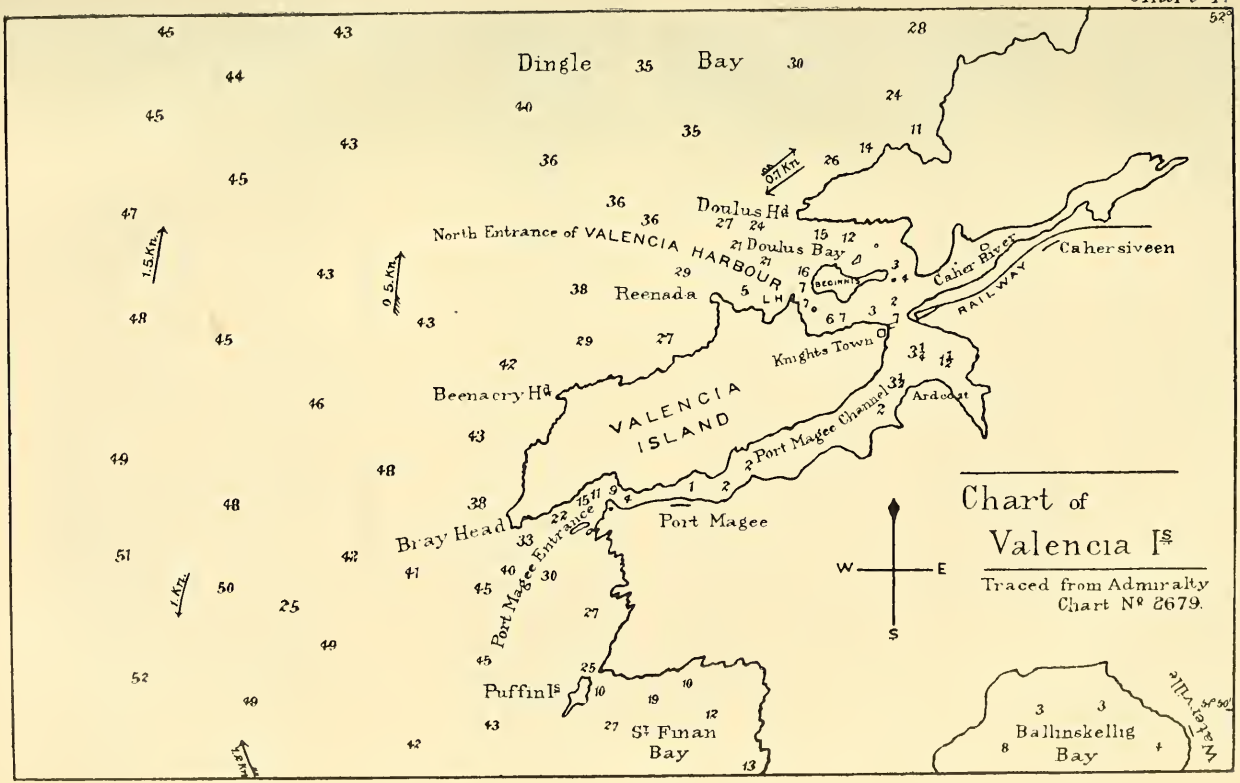
The four reports mentioned above are treated as separate publications, each complete in itself; and I have added one on the Medusæ, on account of its disproportionate length. The remaining pelagic animals belonging to various groups, for the identification of which I am mainly responsible, are placed 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° 19′ 16″ W., and latitude 51° 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


Dingle Bay
Doulus Hd
North Entrance of VALENCIA HARBOUR
Doulus Bay
Reenada
Beenacry Hd
VALENCIA ISLAND
Knights Town
Cahersiveen
Caher River
RAILWAY
Ardcost
Port Magee Channel
Port Magee
Bray Head
Port Magee Entrance
Puffin Is
St Finan Bay
Ballinskellig Bay
Waterville
0.7 Kn.
1.5 Kn.
0.5 Kn.
1 Kn.
BEGINNIS
LH
W
E
S
Chart of Valencia Is
Traced from Admiralty Chart No 2679.

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.		
	F.°	°	°	°	°	°
July 1–7		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.

Velella 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.

Velella 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 mesoglœa 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 Norvegiæ," 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 cuidoband (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 *Beroe* 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 *Beroe* 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 Tagttagelser, &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, Lamarck.

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 1½ 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 Faeröe 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., vol. 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
Muggiæa atlantica,	×	×	×	×	×	..	..	..	..	×	..
Cupulita sarsii,	×	×	×	×	×	..	..	..	×	×	×
Velella spirans,	..	..	..	..	..	..	..	..	..	..	..
Bolina norvegica,	×	×	×	..	..	..	..	..	..	..	×
Pleurobrachia pileus,	×	×	×	×	×	..	×	×	×	×	×
Beroe ovata,	..	×	×	..	×	..	×	×	..	..	×
Tomopteris onisciformis,	×	×	×	×	×	×	×	×	×	..	..
Sagitta bipunctata,	×	×	×	×	×	×	×	×	×	×	×
Parathemisto oblivia,	..	×	..	×	×	..	..	..	..	..	..
Clione limacina,	×	×	×	×	..	..	..	..	..	..	..
Limacina retroversa,	×	×	×	×	..	..	..	..	..	..	..
Thalia democratica-mucronata,	..	×	×	..	..	..	..	..	..	..	..
Doliolum tritonis (sp. ?),	×	×	×	×	..	..	..	..	..	..	..
Oikopleura flabellum (sp. ?),	×	×	×	×	..	..	×	×	×	×	×

TABLE II.

Table showing the Months in which Pelagic Animal

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

VALENCIA HARBOUR.

From July, 1896, to December, 1898.

1897. Summer.			1897. Autumn.			1897–1898. Winter.			1898. Spring.			1898. Summer.			1898. Autumn.			'98 W.
June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
:	×	:	·	×	×	:	:	:	:	×	:	×	:	×	×	×	×	×
×	×	×	×	×	:	:	:	:	×	:	×	×	×	×	×	×	×	:
×	×	×	×	×	:	:	:	:	:	:	:	×	×	×	×	×	×	:
×	×	×	×	×	×	:	×	:	×	×	×	×	×	×	×	×	×	×
:	×	×	×	×	×	×	:	:	:	:	:	:	:	:	:	:	×	×
:	×	×	×	×	×	:	:	:	:	:	:	×	×	×	:	:	:	:
:	×	:	×	×	:	×	:	:	:	:	:	:	:	×	:	:	:	×
:	:	:	×	:	:	:	:	:	:	:	:	×	:	:	:	:	:	:

VALENCIA HARBOUR.

Occurred in Shoals, or in Great Abundance (1896–1898).

1897. Summer.			1897. Autumn.			1897–1898. Winter.			1898. Spring.			1898. Summer.			1898. Autumn.			'98 W.
June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
×	:	:	:	:	:	:	:	:	:	×	×	:	:	:	:	:	:	:
:	×	:	:	:	:	:	:	:	:	:	:	×	×	:	:	:	:	:
×	×	×	:	:	:	:	:	:	:	:	:	:	×	×	:	:	:	:
×	×	:	×	×	:	:	:	:	:	:	:	:	×	×	:	:	:	:
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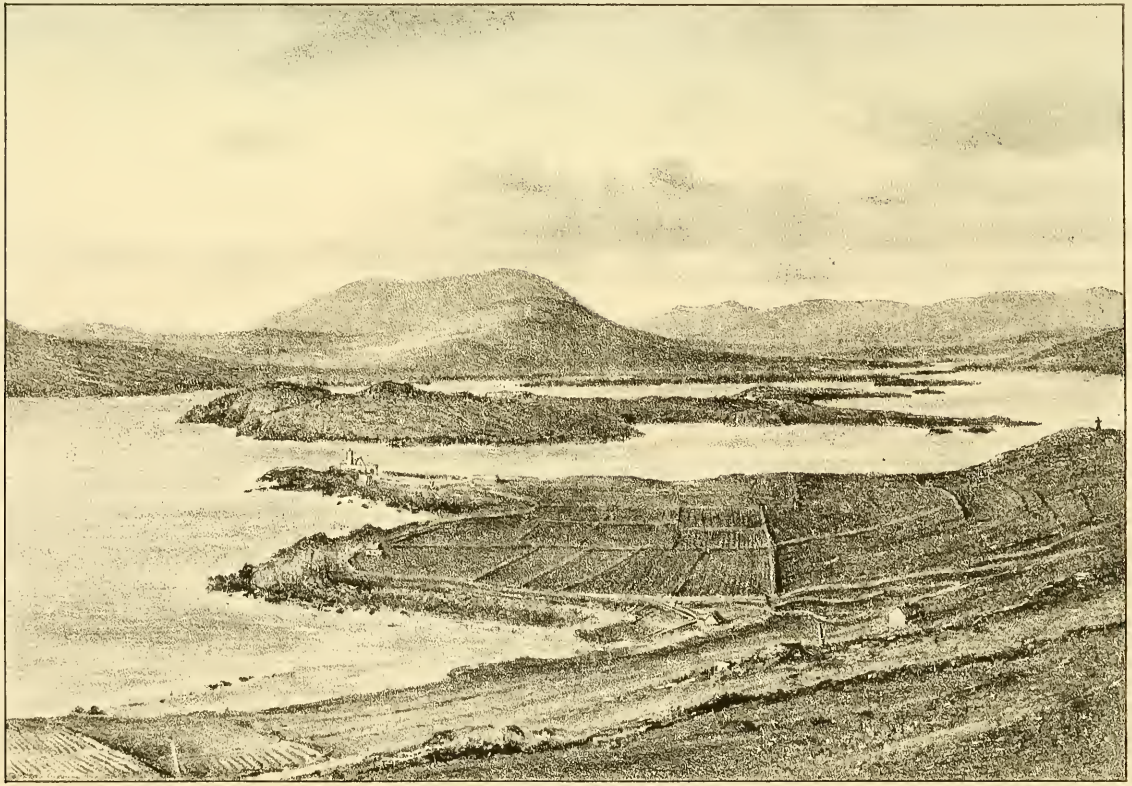

Geo. Ward. & Sons. lith.