FIFTEENTH

ANNUAL REPORT

OF THE

FISHERY BOARD FOR SCOTLAND,

Being for the Year 1896.

IN THREE PARTS.

PART I.—GENERAL REPORT.
PART II.—REPORT ON SALMON FISHERIES.
PART III.—SCIENTIFIC INVESTIGATIONS.

PART II.—REPORT ON SALMON FISHERIES.

Presented to Parliament by Command of Her Majesty.

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TABLE OF CONTENTS.

APPENDIX.

* A full Table of Contents will be found prefixed to this Report, page 3.

FIFTEENTH ANNUAL REPORT.

TO THE RIGHT HONOURABLE

LORD BALFOUR OF BURLEIGH,

Her Majesty's Secretary for Scotland.

OFFICE OF THE FISHERY BOARD
FOR SCOTLAND,
EDINBURGH, 1*st April* 1897.

MY LORD,

In continuation of our Fifteenth Annual Report, we have the honour to submit—

PART II.—REPORT ON SALMON FISHERIES.

The fishing season of 1896, judged by the number of boxes of salmon sent to Billingsgate, was up to the average of recent years. The number sent to Billingsgate was 22,435, or about 4 per cent. lower than the average of the previous sixty-two years, and over $1\frac{1}{2}$ per cent. higher than the average of the previous ten years. In the following Table will be found the numbers sent in each year since 1834—each box weighing about 1 cwt.:—

Table of Boxes of Scotch Salmon sent to Billingsgate from 1834 to 1896 inclusive.

Year.	Boxes of Salmon.	Year.	Boxes of Salmon.
1834	30,650	1866	21,725
1835	42,330	1867	23,006
1836	24,570	1868	28,020
1837	32,300	1869	20,474
1838	21,400	1870	20,648
1839	16,340	1871	23,390
1840	15,160	1872	24,404
1841	28,500	1873	30,181
1842	39,417	1874	32,180
1843	30,300	1875	20,375
1844	28,178	1876	34,655
1845	31,062	1877	28,189
1846	25,510	1878	26,465
1847	20,112	1879	13,929
1848	22,525	1880	17,457
1849	23,690	1881	23,905
1850	13,940	1882	22,968
1851	11,593	1883	35,506
1852	13,044	1884	27,219
1853	19,485	1885	30,362
1854	23,194	1886	23,407
1855	18,197	1887	26,907
1856	15,438	1888	22,857
1857	18,654	1889	21,101
1858	21,564	1890	18,931
1859	15,823	1891	25,889
1860	15,870	1892	21,919
1861	12,337	1893	18,903
1862	22,796	1894	15,489
1863	24,297	1895	25,364
1864	22,603	1896	22,435
1865	19,009		

Table of Boxes of Salmon sent to Billingsgate in each month from 1884 to 1896 inclusive.

The Fishmongers' Company have been kind enough, as heretofore, to furnish information for each month from February to September inclusive regarding the number of boxes of salmon received at Billingsgate and the average price per lb. obtained. From this information the following Table has been compiled :—

Month.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	Average of 10 years 1884–93.	Average Monthly Price p. lb. during 1895.	Average Monthly Price p. lb. during 1896.
															s. d.	*s. d.*
February, .	1,335	879	841	717	535	691	612	934	1,078	557	327	400	822	*818*	2 0½	1 7
March . .	1,402	1,116	1,008	797	899	1,006	902	1,116	1,688	773	692	1,207	1,385	*1,071*	1 6	1 7
April, . .	1,973	1,886	1,744	1,456	1,096	1,152	952	1,403	1,657	845	887	1,160	1,580	*1,416*	1 11¾	1 7½
May . .	3,162	2,257	2,485	2,432	2,603	1,859	1,844	2,591	2,125	1,997	1,745	2,567	2,376	*2,335*	1 8	1 7
June, . .	3,821	3,863	2,896	3,531	3,953	3,827	3,127	4,140	2,438	3,802	3,078	4.611	3,595	*3,540*	1 2¾	1 4½
July . .	8,765	10,582	8,045	9,544	7,943	7,414	7,148	8,007	6,259	5,786	4,464	9,066	7,450	*7,949*	0 10	0 11
August, .	6,070	9,151	5,777	7,794	5,474	4,826	4,035	7,028	6,064	4,722	3,968	5,694	4,477	*6,094*	0 11½	1 0½
September,	691	628	611	636	356	326	311	670	610	421	328	659	750	*526*	2 0	2 0
Total, .	27,219	30,362	23,407	26,907	22,859	21,101	18,931	25,889	21,919	18,903	15,489	25,364	22,435	*23,749*	...	...

It will be observed from this Table that the only month in which the quantity of fish sent to Billingsgate was materially below the corresponding monthly average of the years 1884–93 was the month of August. If it is estimated that each box contains 1 cwt. of salmon, the value of the Scottish salmon delivered at Billingsgate in 1896 was £155,454, 12s., or on an average £6, 18s. 7d. per cwt. The value of that delivered in 1895 was £163,513, 2s. 4d., or on an average £6 8s. 11¼d. per cwt.

Boxes of Scottish Salmon forwarded from various Stations, Ports, &c.

We are indebted to the Scottish railway companies and steamship owners for information regarding the weight of the boxes of salmon forwarded by them during 1894, 1895, and 1896 from the various stations, ports, &c. This information has been embodied in the following Table:—

District.	1894. Weight.				1895. Weight.				1896. Weight.			
	Tons.	Cwt.	Qrs.	Lbs.	Tons.	Cwt.	Qrs.	Lbs.	Tons.	Cwt.	Qrs.	Lbs.
Berwick to Cairnbulg Point, .	963	8	2	23	1,834	1	3	24	1,583	6	1	26
Cairnbulg Point to Cape Wrath,	729	2	3	17	1,492	12	..	7	987	13	1	8
Cape Wrath to Glasgow, . .	471	13	3	4	576	7	..	10	414	2	3	5
Glasgow to the Border, . . .	273	6	..	..	326	..	1	17	293	3	..	1
Total, . . .	2,437	11	1	16	4,229	1	2	2	3,278	5	2	12

The slight difference between the figures given above for the years 1894 and 1895 and those given in our previous Reports is due to a few additional returns having been received for those years.

Replies to Printed Queries regarding the yield of the Salmon Fisheries in 1896.

Page 12 *et seq.*

The answers which have been received to the usual circular of printed queries sent to the Clerks of District Boards at the close of the salmon fishing season of 1896 indicate that in most districts salmon were plentiful but grilse scarce. The replies are given in Note I. of the Appendices to this Report. From twelve of them it seems that the take of fish generally was above the average, from seven that it was about the average, and from five that it was below the average. In the district of the river Alness it was above the average in tidal waters, but below it in fresh waters; and in that of the river Nith it was better than last year. The Clerks of the District Boards of the rivers Awe and Torridon have sent no replies to the circular.

The districts in which the fishing season is reported as being above the average are as follows:—

Forth.
Tay.
North Esk.
Dee (Aberdeenshire).
Ythan.
Deveron.
Conon.

The Rivers of the East and West Coast of Sutherland.
Kennart.
Girvan.
Cree.
Annan.

It is from the districts of the rivers Ugie, Spey, Findhorn, Ness, Kyle of Sutherland, Stinchar, and Dee (Kirkcudbrightshire) that an average fishing season is reported; and from those of the South Esk, Don, Nairn, the rivers of the north coast of Sutherlandshire, and the Lochy that the fishing season is reported as being below the average.

Receipts and Expenditure of District Boards, with rateable value of Salmon Fishings, from 1881 to 1894 inclusive.

The receipts and expenditure of District Fishery Boards, and the rateable value of the salmon fishings in their districts, in the years 1881 to 1894 inclusive, are as follows:—

Year.	Rateable Value of Fisheries.	Receipts (Exclusive of Balances).	Expenditure (Exclusive of Balances).	Outstanding Loans.
	£	£	£	£
1881	90,226	9,961	9,611	184
1882	86,654	9,299	9,258	191
1883	85,776	10,170	9,937	156
1884	85,311	9,654	9,775	135
1885	88,218	10,322	10,154	...
1886	91,407	10,848	11,116	...
1887	94,644	11,298	11,172	...
1888	96,312	11,224	11,445	282
1889	93,667	11,673	11,647	141
1890	97,593	11,741	11,557	...
1891	97,548	11,798	11,700	110
1892	97,523	11,787	11,605	...
1893	100,459	11,606	11,627	...
1894	106,099	12,393	11,698	...

A more detailed account, showing the sums raised and expended by each District Board, will be found in Note II. of the Appendices, Page 46 *et seq.* from which it will be seen that in the years 1881 to 1889 inclusive returns are comprised in the above statement from the districts of the rivers Annan, Cree, Dee (Solway), Dee (Aberdeen), Deveron, Don, Esk (North), Esk (South), Findhorn, Forth, Girvan, Kyle of Sutherland, Lochy, Ness, Nith, Spey, Tay, Ugie, Ythan, and Tweed, and that in the five subsequent years returns from seven, and in one case six, additional districts are included. If the returns from the latter districts are eliminated those from the former are as follows in the under-mentioned years:—

Year.	Rateable Value of Fisheries.	Receipts (Exclusive of Balances).	Expenditure (Exclusive of Balances).	Outstanding Loans.
	£	£	£	£
1890	92,101	11,296	11,073	...
1891	90,763	11,144	11,114	110
1892	90,725	11,114	11,016	...
1893	94,752	11,158	11,171	...
1894	99,894	11,739	10,985	...

The following is the rental of the Tay fishings since 1828:—

Rental of Tay Salmon Fishings.

Year.	Rental.			Year.	Rental.		
1828	£14,574	10	0	1863	£14,232	16	6
1829	14,529	10	0	1864	16,742	5	2
1830	13,747	8	0	1865	17,618	0	7
1831	13,874	0	0	1866	17,465	3	4
1832	11,629	0	0	1867	16,852	18	4
1833	11,577	0	0	1868	16,965	15	10
1834	10,907	10	0	1869	17,444	15	0
1835	10,856	10	0	1870	17,044	8	4
1836	10,211	10	0	1871	16,382	8	4
1837	10,150	6	0	1872	15,162	15	0
1838	10,285	0	0	1873	17,519	14	0
1839	10,498	0	0	1874	18,941	13	8
1840	11,058	0	0	1875	21,634	4	4
1841	10,846	5	0	1876	19,930	18	4
1842	10,235	15	0	1877	21,126	14	0
1843	10,512	5	0	1878	21,187	1	0
1844	10,386	10	0	1879	21,697	14	0
1845	10,751	15	0	1880	22,518	8	7
1846	10,099	15	0	1881	19,579	11	5
1847	11,421	10	0	1882	19,221	11	7
1848	12,057	10	0	1883	17,773	3	0
1849	10,729	16	0	1884	19,655	14	5
1850	9,491	11	0	1885	20,417	0	2
1851	9,530	0	0	1886	22,542	2	8
1852	7,973	5	0	1887	22,143	16	7
1853	8,715	17	6	1888	19,655	0	0
1854	9,269	6	5	1889	17,731	2	0
1855	9,977	13	5	1890	17,819	10	0
1856	10,199	10	4	1891	17,237	6	8
1857	10,772	0	5	1892	19,018	0	0
1858	11,487	2	5	1893	21,762	14	3
1859	11,884	14	0	1894	19,578	7	5
1860	13,827	10	7	1895	17,090	15	4
1861	14,009	15	7	1896	17,180	17	9
1862	14,080	12	0				

It will be observed that the rental for 1896 is but £90 higher than that for 1895, which was the lowest rental in any year since 1872.

Return of the Fish caught at the Salmon Fishings belonging to the Aberdeen Harbour Commissioners.

The Aberdeen Harbour Commissioners have kindly furnished a return of the number and weight of fish caught at their fishings on the river Dee and the sea coast adjoining during 1896. This return, together with similar returns for each year since 1871, are embodied in a statement on p. x. It will be observed from this statement that the total weight of fish taken in 1896 is greater, with the exception of the year 1891, than in any previous year for which statistics are given. An account of the steps which were taken in 1872 to improve the fishings in the district of the river Dee, together with statistics showing the state of the fisheries in each year since that date, was given in Mr Archer's report to the Board for 1895, which forms part of the Appendices to the Board's Fourteenth Annual Report. Those statistics seem to show that the steps taken on the Dee afford a striking example of the improvement which can be effected in the salmon fisheries of a district by those interested, in the upper and in the lower waters respectively, acting in concert for the common weal.

Fourteenth Annual Report, pp. 7–8.

STATEMENT OF NUMBER AND WEIGHT OF FISH CAUGHT AT SALMON FISHINGS BELONGING TO THE ABERDEEN HARBOUR COMMISSIONERS.

Season.	Salmon.				Grilse.				Sea-Trout.				Total.			
	No.	Weight in lbs.	Total Weight for each period of 7 Years.	* Percent-age.	No.	Weight in lbs.	Total Weight for each period of 7 Years.	* Percent-age.	No.	Weight in lbs.	Total Weight for each period of 7 Years.	* Percent-age.	No.	Weight in lbs.	Total Weight for each period of 7 Years.	* Percent-age.
1872	3,981	59,303	.		5,923	27,338	.	.	2,512	5,041	.	.	12,416	91,682	.	.
1873	4,200	48,895	.	.	7,239	34,598	.	.	2,518	4,755	.	.	13,957	88,248	.	.
1874	8,100	88,398	.	.	6,187	27,219	.	.	1,671	3,307	.	.	15,958	118,924	.	.
1875	5,961	63,987	.	.	4,714	20,501	.	.	1,163	1,922	.	.	11,838	86,410	.	.
1876	2,873	33,788	.		9,184	39,297	.	.	2,710	5,058	.	.	14,767	78,143	.	.
1877	4,811	55,086	.	.	7,737	37,556	.		1,320	2,540	.	.	13,868	95,182	.	.
1878	8,918	116,308	465,765	.	3,350	14,446	200,955	.	3,524	6,553	29,176	.	15,792	137,307	695,896	.
1879	1,897	22,964	.	.	7,284	31,141	.	.	1,606	2,785	.	.	10,787	56,890	.	.
1880	4,178	43,587	.	.	5,410	23,720	.	.	2,160	4,123	.	.	11,748	71,430	.	.
1881	4,873	47,191	.	.	11,400	49,349	.	.	3,518	6,627	.	.	19,791	103,167	.	.
1882	6,530	62,717	.	.	7,415	32,413	.	.	2,815	5,644	.	.	16,760	100,774	.	.
1883	6,886	70,384	.	.	13,852	70,555	.	.	4,330	7,969	.	.	25,068	148,908	.	.
1884	5,424	64,866	.	.	6,129	27,817	.	.	3,164	5,646	.	.	14,717	98,329	.	.
1885	4,597	53,989	365,698	78·5	15,129	73,958	308,953	153·7	5,424	9,529	42,323	145·1	25,150	137,476	716,974	103
1886	6,370	68,536	.	.	9,583	39,502	.	.	2,321	4,218	.	.	18,274	112,256	.	.
1887	5,052	55,535	.	.	14,847	60,644	.	.	3,341	5,498	.	.	23,240	121,677	.	.
1888	7,843	83,292	.	.	12,905	58,653	.	.	2,235	3,825	.	.	22,983	145,770	.	.
1889	5,623	60,573	.	.	9,336	38,379	.	.	1,282	2,199	.	.	16,241	101,151	.	.
1890	7,085	66,114	.	.	9,220	43,140	.	.	4,570	8,717	.	.	20,875	117,971	.	.
1891	9,477	107,566	.	.	11,775	58,318	.	.	2,702	4,531	.	.	23,954	170,415	.	.
1892	8,594	88,932	530,548	113·9	11,329	48,620	347,256	172·8	1,329	2,115	31,103	106·6	21,252	139,667	908,907	130·6
1893	6,795	71,185	.	.	5,068	18,131	.	.	3,513	5,294	.	.	15,376	94,610	.	.
1894	4,581	45,932	.	.	6,277	28,020	.	.	4,196	7,166	.	.	15,054	81,118	.	
1895	7,002	75,603	.	.	14,938	76,836	.	.	2,566	4,497	.	.	24,506	156,936	.	
1896	10,790	122,746	.	.	9,766	41,426	.	.	2,851	4,771	.	.	23,407	168,943	.	.

* The weight for the first septennial period is taken at 100, and for the later periods as proportional parts of the first.

With regard to salmon disease in 1896 it is reported from the Forth that 1033 fish succumbed as against 857 in the previous year; from the Tay, that it was not so bad as formerly; from the South Esk, that 279 fish were taken out of the river, or an increase of 95 on the previous year; from the North Esk, that the number was 175 as against 700 in 1895; that 700 were taken out of the Dee, and 38 out of the Don, whereas no diseased fish were taken in these rivers in 1895; that there were removed from the Ythan, 467 fish, from the Ugie, 42, and from the Deveron, 340 The disease showed itself slightly in the Helmsdale, Brora, and Nith; while from the Annan, 264 diseased fish were removed. Salmon Disease in 1896.

During 1896, by the direction of the Board, Mr Archer inspected the river and sea-coast salmon fisheries of Ayrshire and Wigtownshire. He visited the rivers Endrick and Luss, which flow into Loch Lomond, and the river Cassley in Sutherlandshire, for the purpose of recommending how the waters above the obstructions on those rivers might be made accessible to salmon. He further visited the river Spey in November last for the purpose of assisting in marking salmon with the view of gaining more accurate knowledge as to their habits. In his Report to the Board, which is given on p. 1 of the Appendices to this Report, he describes his inspections, and indicates by means of red lines on a map, appended to this Report, the approximate number and position of the fixed nets on the west coast of Ayrshire and Wigtownshire. By his inspection of the fishings on this coast he has completed a survey of the sea-coast salmon fishings of Scotland between Berwick-on-Tweed and the Mull of Galloway in Wigtownshire. Those on the west and east coasts were described in his Reports to the Board for the years 1894 and 1895 respectively. Inspections during 1896.

The Royal Commission on the Tweed and Solway issued their Report last year. The Report is in two parts. The first relates to the Tweed, the second to the Solway. This Commission was appointed in 1895 'to inquire into the salmon and fresh water fisheries of 'the mouth and entrance of the Tweed, including the tributaries of 'that river, and all the portion of the sea comprised within the 'area of the present Tweed Acts, and the method of fishing therein 'used, the rights affecting the said fisheries, and the laws applying 'thereto, and the operation of such laws; and also into the fisheries 'of the Solway Firth, with the rights affecting the same, the 'methods of fishing there used, together with the laws applying to 'the said fisheries, and also the operation of the Solway Act and 'other statutes relating to the fisheries of the Solway, and to report 'thereon and make such recommendations relating thereto as they 'may think fit.' Royal Commission on Tweed and Solway.

Page 74. In Note III. of the Appendices a list is given of the dates of the commencement and termination of the annual close time for net and rod fishings respectively, applicable to the salmon rivers in Scotland. Annual Close Time.

Page 77. In Note IV. of the Appendices will be found a list of Chairmen and Clerks of Salmon Fishery District Boards in Scotland with their addresses. It is satisfactory to note that during 1896 a List of Chairmen and Clerks of District Boards.

Board has been formed for the district of the river Ayr, where none previously existed, and that the Boards for the districts in the Island of Mull, which had been allowed to lapse, have been resuscitated.

We have the honour to be,

Your Lordship's most obedient servants.

ANGUS SUTHERLAND, *Chairman.*
D. CRAWFORD, *Deputy Chairman.*
JOHN MURRAY.
J. RITCHIG WELCH.
W. R. DUGUID.
ARCHIBALD JAMESON.

WM. C. ROBERTSON, *Secretary.*

APPENDIX.

FIFTEENTH ANNUAL REPORT TO THE FISHERY BOARD FOR SCOTLAND

ON THE

SCOTTISH SALMON FISHERIES IN 1896

BY

WALTER E. ARCHER, F.R.S.E.,
Inspector of Salmon Fisheries for Scotland.

TABLE OF CONTENTS.

NOTES TO SALMON FISHERY REPORT.

MAP

SHOWING THE POSITION OF THE

Sea Salmon Fishings on the South-West Coast of Scotland,

BETWEEN ARDLAMONT POINT AND THE MULL OF GALLOWAY.

NOTE.

The Red lines denote the number of fixed nets to every 5 miles of Coast line between Ardlamont Point and the Mull of Galloway; 1 Red line denotes less than 5 nets, and every additional line denotes 5 or part of 5 additional nets.

thus:

- *under* 5
- 5 *to* 10
- 10 *to* 15
- 15 *to* 20
- 20 *to* 25
- 25 *to* 30
- 30 *to* 35

Black lines denote the Boundaries of the different Fishery Districts.

The portions marked in the darker shade of blue represent the waters within the estuary lines, as fixed by the Bye-laws of the Salmon Commissioners.

REPORT.

I have the honour to submit my Annual Report to the Fishery Board for Scotland for the year 1896.

Inspections of Sea Coast Salmon Fishings.

In my Reports to the Board for the years 1894 and 1895 I described the salmon fishing industry on the east, north, and west coasts of Scotland, and indicated graphically on maps appended to those Reports the approximate number and position of the fixed nets in use. During 1896, by the direction of the Board, I completed my inspection of the salmon fishing stations on the sea coast by visiting those situated between Ardlamont Point in Argyllshire and the Mull of Galloway in Wigtownshire.

Map of South-West Coast, showing approximate Number of Nets in use.

Following the method adopted last year for giving a general idea of the extent of this industry, I have divided the coast line from Ardlamont Point to the Mull of Galloway, in the map accompanying this Report, into 5-mile sections by means of black lines, and have indicated by red lines drawn parallel with the coast the approximate number of fixed nets in each section. One red line denotes less than five nets, and every additional red line five or part of five additional nets.

Number of Nets and Cost of Fishing.

The conditions under which the bag-nets are used on this part of the coast resemble more nearly those prevailing on the east coast in respect of the number of men required to work a given number of nets, and those obtaining on the west coast in respect of the length of time during which the full staff of fishermen is employed. Subject to the qualifications mentioned in my previous Reports, referred to above, the following estimate as to the cost of fishing and the number of persons employed may be made:—A pair of bag-nets—that is, one in use and one on the shore to change from time to time—cost, on an average, £33; one-third as much again is spent annually to keep them in fishing order; and four men at an average weekly wage of 22s., together with a boat costing £17, 6s. 6d., are required to work every seven nets. If this estimate is correct, and if the 97 bag-nets erected on the west coasts of Ayrshire and Wigtownshire in the month of July are fished on an average during four and a half months of the year, the capital invested in these fishings would be, in round numbers, £3500, the annual expenditure £2500, and the number of fishermen employed about 60.

Nets in Solway.

In the Solway Firth, eastward of the Mull of Galloway, no fixed nets are allowed, except such as were granted certificates of privilege by the Special Commissioners appointed in 1877 to carry out the Act 40 & 41 Vict. cap. 240. Seeing that the number of these engines is scheduled, and the position where they may be used laid down, I have not thought it necessary to indicate their approximate number and position on the map accompanying this Report. It may, however, be mentioned that about 53 fixed nets and eight ranges of poke-nets have been fished during recent years on these shores.

Besides inspecting the sea coast fishings, I visited the rivers of Ayrshire and Wigtownshire.

River Irvine. There may be said to be practically no salmon fishings in the district of the river Irvine. The pollutions poured into it and its tributary, the Garnock, from Kilmarnock, Dalry, and other towns through which they flow, seem completely to have destroyed their salmon-producing capabilities. There are now, so far as I was able to ascertain, no fishing stations in the river, in the estuary, or on the sea coast within 6 miles of the mouth of the river. An occasional migratory fish is said to ascend it during a flood, but to die as soon as the flood subsides and the water resumes its ordinary condition. It appears, however, that the Ayr County Council are taking steps to enforce the provisions of the Rivers Pollution Prevention Act. Should their action ultimately result in the waters being purified, there seems nothing to prevent these rivers again producing salmon in the same abundance as in former years, and if such a fortunate result were attained, the proprietors of the salmon fishings would do well to adopt a scheme for the proper distribution and regulation of the nets throughout the district while there were still no existing fishing interests to be considered.

River Ayr. Mr Young, my predecessor, writing of the river Ayr in 1883, states that the following description given by Mr Buckland and himself in their Report of 1871 was still true of this naturally fine stream :—'The Ayr, as ' a salmon river, is in a very bad state. No weekly close time is observed. ' There are no gratings to mill lades. Fry are killed by anglers, colliers ' destroy the breeding fish at the top of the river, stake-nets destroy the ' ascending fish at the bottom, and pollutions destroy them in the middle. ' If it were the object to extirpate, instead of to preserve and increase, ' that object could hardly be more effectually carried out than by the ' system now adopted. If these evils could be remedied, and the ' proprietors would co-operate in protecting the salmon interests, the Ayr ' might, as in former years, produce tons of salmon annually, as the Ayr ' and Lugar still continue to possess good spawning grounds.'

I regret to say that I did not find matters much improved at the time of my visit. Hecks, or gratings, had been placed on some of the mill lades, but they had in most cases been allowed to fall into disrepair. No district board had been formed, nor was anything being done to enforce the Salmon Fishery Acts, and relative bye-laws. It was complained that the salmon were gaffed as they attempted to ascend the mill dams in the town of Ayr ; that the smolts were destroyed as they came down the river; and that the parent salmon were not protected at spawning time, nor the young of salmon after they were hatched. Under these circumstances, it can hardly be a matter of surprise that the salmon fishings are almost entirely destroyed. But, although I found this very undesirable state of affairs existing at the time of my inspection, it is satisfactory to state that, as a result of my visit, a Board has been formed, and a clerk has been appointed. I have been in communication with this gentleman, and understand from him that steps are being taken to enforce the provisions of the Salmon Fishery Acts and relative bye-laws.

River Doon. The river Doon, if properly looked after, should be one of the best salmon-fishing rivers in the south-west of Scotland. There is, however, no district board,* the association of heritors which formerly existed has been allowed to lapse, and there is at present no authority representing the fishing interests to enforce the Salmon Fishery Acts, or to take advantage of the exceptional capabilities which this stream possesses for the production of fish.

The salmon fishings have often suffered severely from poisonous discharges from coal-pits and iron-works. My predecessor mentions that

* Since writing the above a Board has been formed and a clerk appointed.

on one occasion, when he visited the river many years ago, all the fish —even eels—between the pits and the sea were destroyed by a discharge from the Carnaham coal-pits. Again, in 1889, he mentions that about 150 fish were destroyed by pollution discharged from one of the pits of the Dalmellington Iron Company. Lastly, in 1893, an escape of pollution occurred on two separate occasions, and upwards of 500 fish were taken out of the river in a dead or dying condition. Matters, it is stated, are now much improved, although they are not yet all that can be desired. The liquid which escapes into the river from the settling-tank at Skeldon where there are mills for the manufacture of blankets, is still much complained of. It is not supposed actually to poison the fish, but to sicken them so that they will not rise to the fly, and the rod fishing is said to have fallen off very much in consequence. An engineer is being consulted as to the best means of dealing with this pollution.

There are seven mill dams on the river, but, with one exception, they are not regulated in accordance with the bye-law Schedule G., 31 & 32 Vict. cap. 123.

It also appears that full advantage is not taken of the exceptional opportunities which Loch Doon affords for the storage of a large quantity of compensation water. The area of Loch Doon is fully 1240 acres, and at its outlet channels have been cut through the rock and sluices constructed, whereby the outflow can be controlled and regulated. The depth of the channels allows of 16 feet of water being drawn off the surface of the loch. This gives a storage of over 864¼ million cubic feet or a flow of 6600 cubic feet a minute for three months in the year, in addition to the natural flow of the river. The advantage to the fisheries of paying careful attention to the proper management of these sluices cannot be too strongly impressed on the proprietors. The sluices should be so regulated as to maintain an equable flow of water in dry weather, and thus lessen the injurious effects arising from the quick discharge of surface-water under the present system of land drainage.

River Girvan.

In the Girvan district but little interest seems to be taken in the salmon fishings. A Board has been formed, but it holds no meetings, employs no staff, and raises no funds for the purpose of enforcing the Salmon Fishery Acts. The protection of the river fishings is left to the keepers on the different estates. This arrangement, however, is said not to work satisfactorily, as, at the time when salmon are in the river, the keepers are fully occupied with their duties in connection with the shootings, and consequently illegal fishing is prevalent. In addition to illegal fishing during the annual close season, it is complained that the district is overfished during the open season. At present fixed nets on the sea coast are permitted, and placed within 300 yards of the mouth of the river, and draft-nets are used in the river itself. I was informed by a tacksman of some of the fixed net fishings on the coast that, some years ago, when, by agreement among the proprietors, fixed nets were placed at a distance of 600 yards from the mouth of the river, and netting in the river discontinued, there were many more salmon caught on the coast than there have been since these restrictions were given up. This evidence as to the effect of prohibiting netting in confined waters agrees with that given on page 83 of the Thirteenth, and pages 7 and 8 of the Fourteenth, Annual Reports, of the Board. The fishings in this district merit more attention than they are at present receiving.

River Stinchar.

The Stinchar is an ideal small salmon river. Its bed is of fine gravel, most suitable for spawning, while pool and rapid stream follow one another in close succession. It is about 29 miles long, drains an area of 133 square miles, is noted for its large salmon, and is, for its size, productive, it being not uncommon, I am informed, for an angler to take four or five in the day when the river is in suitable order for angling. A Board has been formed for the district, but no assessment is levied, nor are any regular water-bailiffs employed. Lord Stair, the principal proprietor, however, employs a watcher solely to look after his fishings and to see that his tenants observe the weekly close time; with this exception the watching is done by the keepers on the several estates. The limits of the district are from Benane Head on the north to the lighthouse on the Mull of Galloway on the south. In the roll of the proprietors, however, shown me by Mr Greig, Clerk to the Board, only the proprietors of the fishings in the river and of those on the sea coast in its immediate neighbourhood are included. The District Board should have this error rectified, as, in the event of their imposing an assessment, under the Salmon Fishery Acts, that assessment should be levied on all the proprietors of fisheries in the district, and not alone on those in the river and its immediate neighbourhood.

River Luce.

The Luce is a late river. Salmon are said not to ascend it until September, although sea trout do so in June and July. There is neither a district board, nor a regular staff of water-bailiffs. The proprietors employ their own watchers, each on his own water. The bye-law for the regulation and use of mill dams is not observed. In the mill dam immediately above the bridge at Glenluce, a stone had become fixed across the head of the fish-pass, thereby rendering the pass useless. This was not of much consequence at the time, as a breach had been made by a recent flood in the centre of the dam, through which the fish could easily ascend. It may be pointed out, however, with regard to this matter, that section 15 of the Salmon Fisheries (Scotland) Act of 1868 provides that any person who does any act for the purpose of preventing salmon from passing through any fish-pass, shall, for every such offence, be liable to a penalty not exceeding £5, and, in addition to such penalty, to the costs and expenses of prosecution and conviction. A strong complaint was made in this district that those fishing for salmon under licences from the Crown did not conform to the regulations made by the Office of Woods. It was urged that that Department should take steps to enforce their regulations.

River Bladenoch.

In the district of the river Bladenoch, where no Board has been formed, and where there is consequently no authority to enforce the Commissioners' bye-laws, it was complained that the dam dyke at New Mills had been altered so as to form a greater obstruction to the free passage of fish than formerly existed. The alteration complained of was the placing of a beam or plank, some 4 or 5 inches in height, along the crest of the dam. The miller pleaded in justification of this alteration that the dam, which was carried away in the winter of 1894–1895, when rebuilt, was not restored to its original height, and that the beam was only added temporarily until the level of the water would permit of the stone-work being raised to its former level. An obstruction of even greater importance than the beam just referred to was a wooden dam or sluice fixed across the head of the fish-pass in such a manner as to form a complete barrier to the passage of salmon. Such an obstruction appeared to be a contravention of the 15th section of the Salmon Fisheries (Scotland) Act, 1868. It will be remembered that I reported specially on this matter on my return to Edinburgh, and that steps were taken by the Board to have the obstruction removed.

River Leven (Dumbartonshire).

In the district of the river Leven (Dumbartonshire) an active interest is being taken by the new Loch Lomond Angling Improvement Association in opening up the various spawning streams connected with the loch. By the direction of the Board, and at the request of Colonel Blackburn of Killearn, and of Mr Alfred Brown, secretary of the Association, I visited the fall at Gartness on the river Endrick, and a mill dam on the river Luss, for the purpose of advising them as to the construction of fish-passes. The fall at Gartness is said to exclude salmon from 12 miles of good spawning grounds, while the mill dam on the Luss, which is situated within a short distance of Loch Lomond, practically shuts them off entirely from the spawning grounds in the latter stream. It would undoubtedly tend greatly to the increase of salmon and sea trout in Loch Lomond if these obstructions were opened up. Hitherto, however, it has not been found possible to raise sufficient funds to carry out the plans I suggested for the purpose.

I am informed by Mr Alfred Brown that the Association has leased the salmon fishings on the river Leven and on Loch Lomond (so far as possessed on the loch by the Colquhoun Trustees), and has abolished netting in these waters. Arrangements have also been entered into with the lessees of the salmon fishings on the Clyde between Dumbarton, Cardross, and Ardmore, to limit netting to four and a half days a week, and to maintain an efficient superintendence during the weekly and annual close times. The Association has further appointed a staff of water-bailiffs to put down illegal fishing during the open season, and to assist in protecting the spawning fish in the tributary streams during the close season, and has thrown open to the public, free of charge, the whole of the waters over which it has acquired the right of salmon fishing, under certain conditions as to fair fishing.

Kyle of Sutherland.

In my Report last year, I mentioned that the Kyle of Sutherland Board had made an unsuccessful attempt to open up fresh spawning grounds in their district by blasting the Glenmuick Falls on the river Cassley, and had asked me to advise them in the matter. By the direction of the Fishery Board, I inspected these falls during last summer, and subsequently forwarded drawings to the Clerk of the District Board, showing how they might be made accessible to salmon.

River Deveron.

The case as to the cruive dyke on the river Deveron, referred to in my last year's Report, was decided by the Court of Session on the 23rd February last. It had reference to the powers of the Commissioners appointed under the Act of 1862 to make regulations with respect to the construction and use of cruives held under Royal Grant or Charter. By the 6th section of the Salmon Fisheries (Scotland) Act, 1862, power was given to the Commissioners appointed under that Act "to make general 'regulations" with respect "to the construction and use of cruives," but this power is subject to the important qualification "that such 'regulations shall not interfere with any rights held, at the time of 'the passing of this Act, under Royal Grant or Charter, or possessed for 'time immemorial." The principal questions in this case were whether the proprietor, who held his right to the cruive dyke under Royal Charter, was entitled to maintain and to continue to use the cruives at a width of not more than an ell or 37 inches each, as fixed by previous decrees of the Court, or whether he was bound, in conformity with the Commissioners' bye-law (Schedule F., 31 & 32 Vict. cap. 123), to increase the width to not less than four feet. The Court decided that the cruives should be widened to four feet, and gave judgment in favour of the District Board, with expenses.

River Spey.

In November last I visited the district of the river Spey, where the marking of salmon is being continued with much interest, with the view of recommending an improved system of weighing and measuring the marked fish. It is satisfactory to learn from Mr Wedderspoon, Commissioner to the Duke of Richmond, that the men now show much greater aptitude in carrying out the work, and that the statistics regarding the weight and length of the fish which are marked are now recorded with the strictest accuracy.

Bye-law with respect to construction of Mill Dams.

I have drawn attention in the foregoing remarks to the non-observance of the bye-law made by the Commissioners with regard to the construction and use of mill dams or lades, or water wheels. The provisions of this bye-law are habitually infringed in many mills, not only in Ayrshire and Wigtownshire, but in other parts of Scotland. In many cases ignorance is pleaded as an excuse; I have thought it, therefore, worth while to print the bye-law, with a view of dispelling, to some extent, this ignorance, and of calling attention to some of the most frequent ways in which its provisions are contravened.

SCHEDULE (G).

Bye-law.

25th and 26th Vict. cap. 97.
26th and 27th Vict. cap. 50.
27th and 28th Vict. cap. 118.

"Acts to regulate and amend the Law respecting the Salmon Fisheries 'of Scotland."

We, the Commissioners appointed under the said Acts, and empowered thereby "to make general regulations with respect to the construction 'and alteration of mill dams or lades, or water wheels, so as to afford a 'reasonable means for the passage of salmon," do hereby make the following general regulations with respect to the construction and use of mill dams or lades, or water wheels :—

1. Every new dam, and every portion of any dam that may require to be renewed or repaired after this time, shall be made and maintained water-tight, or as nearly so as possible, so that no water that can reasonably be prevented, shall run through the dam; but all water not taken into the lade for the use of the mills or other lawful purpose shall be made to flow over the dam as fully as may be practicable.

2. There shall be a sluice or sluices at the intake of every mill lade. No water shall, with the exception herein-after stated, be allowed to enter any mill lade beyond the quantity required for the use of the water wheel or wheels of any one fall on that lade, or for other lawful purpose in the lade; that is to say, no water shall be allowed to escape from any lade into the river by means of any bye-wash or overflow, but all water not required for the uses aforesaid shall be made to flow over the dam into the river as far as may be practicable.

At the option of the millers or manufacturers, this provision may be carried out either by shutting the sluice or sluices at the intake of the lade, or by raising the banks of the lade to a height that will prevent an overflow of water from the lade when the sluice at the wheel and the bye-wash sluice herein-after mentioned are both kept shut. Provided always, that the said bye-law shall not apply to millers or manufacturers when taking measures necessary for the protection of their premises during heavy floods, or when rivers are cumbered with ice, or while necessary repairs are being executed on any emergency; provided that nothing be omitted, or done unnecessarily to defeat the objects of this bye-law. Furthermore, in all cases when the intake sluice is more than 300 yards from the water wheel, it shall not be imperative to shut the intake sluice, or to keep the bye-wash sluice shut, during ordinary meal hours, or during any stoppage of the wheel not exceeding an hour at a time.

3. At the intake of every lade there shall be placed and constantly kept a heck or grating for each opening, or one embracing the whole openings, the bars to be not more than three inches apart, if horizontal and not more than two inches if vertical.

4. A similar heck or grating shall be placed and constantly kept across the lade or troughs immediately above the entrance to each mill wheel.

5. A similar heck or grating shall be placed and constantly kept across the lower end of each tail lade at its entrance into the main river.

Note.—To prevent any obstruction to the flow of the water by the hecks or gratings in the lades, it is recommended that the lade should be increased in width where the hecks are placed, and that the heck, instead of being in a straight line across, should be curved or pointed up or down stream, and thereby increased in length, so that the aggregate of the openings between the bars shall exceed the sectional area (or waterway) of the lade, and thus compensate for the space occupied by the bars.

6. There shall be a bye-wash sluice placed as near as practicable above each water wheel in the embankment of the lade of not less than three feet in width, with its sill as low as the bottom of the lade, and the said sluice shall be raised to a height sufficient to allow the smolts to descend for at least five but not exceeding eight hours each week from the 15th March to the 1st July, not more than six days intervening between each time of opening.

There shall be a salmon pass or ladder on the down stream face of very dam, weir, or cauld, capable of affording a free passage for the ascending fish at all times when there is water enough in the river to supply the ladder. The width shall not be less than four feet in the clear in rivers of less than 100 feet in breadth at the site of the dam, nor less than five feet in breadth in rivers of less than 200 feet and more than 100 feet in breadth as aforesaid, nor less than six feet in breadth in rivers of more than 200 feet in breadth as aforesaid; the upper sill shall be not less than six inches below the lowest part of the crest of the dam for the whole width of the ladder; the inclination shall in no case be steeper than five horizontal to one perpendicular, but, wherever practicable, shall be seven or eight horizontal to one perpendicular, and in all cases shall be provided with breaks or stops placed at suitable intervals, so as to lessen the velocity of the current sufficiently to allow the fish to ascend without difficulty.

The foot of the ladder shall be placed where there is most running water, and with the best lead for the fish to approach it; and if the ladder should project beyond the toe of the dam, there shall be an apron of stone formed to the dam, extending as far down the river as the entrance to the pass or ladder, and extending throughout the whole length of the dam at either side of the ladder, and on a high enough level to prevent there being any pool in the river, or sufficient depth of water farther up than the entrance to the said pass or ladder, by which the fish might be induced to remain there obstructed in their ascent, and not be led to the ladder.

Note.—The Commissioners would recommend the following details to be adopted in the construction of salmon ladders, in addition to those given in the foregoing bye-law, but do not insist on them, provided some other perfectly efficient arrangement be substituted,—viz., the side walls to be not less than twenty-two inches in height; the breaks to be not less than eighteen inches in height, with openings of ten inches in breadth at the alternate ends of each break, and five feet apart in cases where the gradient of the ladder is one in five and of a greater distance, but the same proportions being maintained where the gradient is easier than one in five.

7. No dam shall be so altered as to create a greater obstruction to the free passage of fish than at present exists.

Wm. J. Ffennell,
Fred. Eden, Commissioners.
James Leslie,

Fisheries Department, Home Office,
29th day of April 1865.

Approved,
G. Grey.

Whitehall, 19th July 1865.
(This bye-law to take effect from the 28th July 1865.)

It will be observed that the object aimed at, in sections 1 and 2, is to provide that all water not required for milling purposes shall be made to flow down the fish-pass and over the mill dam, instead of being allowed to run to waste. There is no more important provision in the whole bye-law, as the larger the volume of water flowing from a fish-pass, the more will fish be tempted to ascend it. There is, however, none which is more systematically contravened.

The regulations with regard to hecks in sections 3, 4, and 5 were made with a view of preventing salmon being killed in mill lades. In many cases, however, the hecks have become damaged in such a way as to serve an exactly opposite purpose than that for which they were intended, for while they do not prevent salmon entering mill lades they form an effectual barrier to their exit.

In section 6 the Commissioners seem to recognise that the chief requisite in making a fish-pass that salmon not only *can*, but *will* ascend, is to provide an attractive entrance in a proper position. It will be observed that they lay down that the entrance shall be placed where there is most running water, and that it shall not project beyond the foot of the obstruction. These provisions are, however, frequently infringed. It is not uncommon to see the entrance to the pass placed at some distance below the foot of the fall, where the fish are not the least likely to find it.

With regard to section 7, it is commonly complained when a mill dam or cruive dyke is repaired, that it has been altered in such a manner as to create a greater obstruction to the free passage of fish than formerly. Owing, however, to the want of accurate information as to the dimensions of the erection previous to its alteration, it is impossible to verify these complaints.

The importance of enforcing the first six sections of this bye-law, and of having plans made of the various dam dykes, so as to determine accurately their present dimensions, cannot be too strongly impressed on District Boards; and in districts where no Boards have been formed, it is essential that proprietors of the salmon fisheries should form such Boards, in order that they may avail themselves of the powers conferred on them by the Salmon Fishery Acts.

In the Report of the Royal Commission on Tweed and Solway fisheries, issued in 1896, the need of enforcing the present law with regard to the removal of obstructions is referred to in the following terms:—'We cannot conclude this branch of our report without saying that, 'in our view, it is a mistake to expect too much from legislation, and 'that we have a strong conviction that, even as the law stands at 'present, much more might be done than is being done to assist the '*natural* multiplication of fish in the rivers, by removing obstructions 'which prevent access being obtained to the upper waters, and by 'taking care of the young salmon during their existence in fresh 'water before going down to the sea. There is strong proof that the 'destruction of these immature fish is very great, and is one of the most 'serious losses to which a salmon river is subjected. The capture of 'such by anglers and others should be prevented by every reasonable 'means, and the law as to the protection of the intakes of mill raceways 'should be more strictly carried out, so that fish may not get into them. 'The natural enemies of the young fish, such as pike and eels, especially 'the latter, should be kept down as much as possible, but little or no 'attention appears to have been paid to this.'

Salmon Fishery Investigations.

During 1896, investigations were made to determine whether salmon do or do not feed in fresh-water; whether they cease feeding during the later stages of the development of their genitalia when in the sea; and to determine the chemical changes which take place in their organs throughout the year. For this purpose salmon were supplied from the upper and lower waters of the Helmsdale, Spey, Dee, and Annan, through the courtesy and liberality of the Duke of Richmond, the Duke of Sutherland, the Duke of Fife, Mr Mackenzie of Newbie, Mr Heywood Lonsdale, Invereshie, and the District Board of the river Dee (Aberdeenshire). The investigations were conducted under the supervision of Dr Nöel Paton, Superintendent of the Research Laboratory of the Royal College of Physicians, who, together with a number of other skilled workers, kindly undertook to conduct a series of researches provided arrangements were made for a regular supply of material being furnished them throughout the year. The completion of the work has been delayed through the illness of two of the observers, and through the Royal College of Physicians having removed their laboratory to new premises. The study of the female salmon is, however, nearly complete, and that of the males is now being pursued. I have received a letter from Dr Nöel Paton in which he states that he expects to be able to submit a detailed report in the course of the present summer. He adds that the investigations have been undertaken on the following plan by the various workers:—

First. On whether salmon feed in fresh-water, and, throughout the whole season, in the sea?

(*a*) Structural changes in the lining membrane of the stomach and intestine, and in the digestive gland. By Dr Lovell Gulland.

(*b*) Activity of digestive secretion. By Dr Gillespie.

(*c*) Bacteriology of the stomach and intestine. By Dr Gillespie.
(*d*) Changes in the weight, weight of muscle, ovary, and testes. By Drs Nöel Paton and Dunlop.

Second. Chemical changes in the organs of salmon throughout the season.

(*a*) Changes in the solids. By Dr Nöel Paton.
(*b*) Changes in the albuminous constituents. By Dr Dunlop.
(b^2) Nature of these constituents. By Drs Boyd, Nöel Paton, and Greig.
(*c*) Changes in the fats and allied bodies—
1. Chemical. By Dr Nöel Paton.
2. Microscopic. By Mr Mahalanobis.
(*d*) Changes in the phosphorus compounds. By Drs Johnston and Nöel Paton.
(*e*) Changes in the iron. By Dr Greig.
(*f*) Pigments of the salmon. By Miss Newbiggin.

These investigations, it may be mentioned, form part of a series which are being conducted with a view of ascertaining the value for breeding purposes of salmon entering the rivers at different seasons of the year. The results obtained from the completed portion of Dr Nöel Paton's investigations, some of which I have had the pleasure of discussing with him, seem to be of the greatest interest, and will throw much additional light on this important problem.

The investigations already recorded in the Appendices to Part II. of the previous Reports of the Board establish the following points:—

1st. That *some* salmon spawn annually, although there is strong negative evidence that all do not do so (*Eleventh Annual Report*, p. 68).

2nd. That the growth of the ovaries has already begun in so-called 'spring' salmon which ascend some rivers in the earliest months of the year, and that it proceeds with almost mathematical regularity until maturity is reached (*Fourteenth Annual Report*, p. 15).

3rd. That the growth of the ovaries of female grilse begins at a later date than that of female salmon, but that both arrive at the sexually ripe condition at about the same time (*Fourteenth Annual Report*, p. 21).

4th. That the weight of the genitalia bears approximately the same proportion to the weight of the body in large as in small female salmon (*Fourteenth Annual Report*, p. 11).

5th. That salmon which remain in the sea to the end of August continue to feed: this is shown by the presence of food in the stomachs of some salmon, and by an absence up to that time of any diminution in weight of the remaining organs of the body, notwithstanding the growth of the ovaries (*Fourteenth Annual Report*, p. 29).

Evidence with regard to the growth and migration of salmon is still very incomplete, but, as far as it has been collected, it shows (1) that a grilse may become a salmon of 25 to 30 lbs. in three and a half years (*Eleventh Annual Report*, p. 69); and (2) that salmon are caught on the sea coast at a considerable distance from rivers where they were marked (*Eleventh Annual Report*, p. 70).

With regard to salmon disease it has been shown that, in the earlier months of the epidemic, males succumb in greater numbers than females (*Eleventh Annual Report*, p. 74).

Royal Commission Tweed and Solway.

In 1895 a Royal Commission was appointed 'to inquire into the salmon 'and fresh water fisheries of the river and mouth or entrance of the river 'Tweed, including the tributaries of that river, and all the portion of 'the sea comprised within the area of the present Tweed Acts, and the 'method of fishing therein used, the right affecting the said fisheries and 'the laws applying thereto, and the operation of such laws; and also into 'the fisheries of the Solway Firth, with the rights affecting the same, 'the methods of fishing there used, together with the laws applying 'to the said fisheries, and also the operation of the Solway Act and 'other statutes relating to the fisheries of the Solway, and to report 'thereon and make such recommendations relating thereto as they may 'think fit.' The Commission issued their report with regard to the Tweed in June last, and that with regard to the Solway in August following.

I have the honour to be,

Your obedient Servant,

WALTER E. ARCHER.

THE FISHERY BOARD FOR SCOTLAND,
1st *April* 1897.

NOTE I.

THE FOLLOWING QUERIES HAVE BEEN SENT TO CLERKS OF DISTRICT BOARDS:—

Take of Fish—

1. Has the take of fish in your district in 1896 been above, about, or below the average.
   (*a*) In tidal waters?
   (*b*) In fresh waters?
   (*c*) In fixed engines?
   (*d*) Generally throughout the district?

2. Can you give the number of fish caught in your district, exactly or approximately?
   (*a*) By net and coble?
   (*b*) By fixed engines?
   (*c*) By rods?

3. At what period of the year in your district during 1896—
   (*a*) Were the first clean fish taken?
   (*b*) When was the main take of salmon?
   (*c*) When did the grilse and sea-trout run?

4. In order that accurate records be kept as to whether the run of salmon in your district is becoming earlier or later, it is desirable that you should, if possible, obtain and furnish me with statistics of the percentage of fish taken in each month—
   (*a*) By net and coble?
   (*b*) By fixed engines?

5. What was the weight of the heaviest salmon or trout caught in your district in 1896—
   (*a*) By net and coble?
   (*b*) By fixed engines?
   (*c*) By rods?

Protection—

1. Please state the amount of the assessable rental of your district in 1896?
2. What was the assessment levied thereon during this year?
3. State the number of water bailiffs employed in your district in 1896?
4. Were any prosecutions instituted under the Salmon Fishery Acts in 1896? If so, for what offences were they instituted, and what was the result?

Obstructions to the Passage of Fish—

1. Give full particulars of any dams destroyed or given up in your district in 1896; or any new dams built or old dams altered?
2. Have any cruives in your district not been fished during 1896?
3. Are the dams and cruives in your district worked in accordance with the provisions of the bye-laws (Schedule F and G) regulating the same?

4. Have any fish-passes been built or altered in 1896 ?
5. Do the existing fish-passes afford at all, or any, or at what times a free passage to salmon wishing to ascend ?
6. Have any natural obstructions been opened up during 1896 ?
7. Generally, have any acts been done either by new fisheries being started, old fisheries not being used, or in any other way whereby the ascent of fish has been influenced ? If so, state fully what changes have taken place.

Pollutions—
1. Were there any fresh causes of river pollution introduced in your district in 1896 ?
2. Were any steps taken in 1896 to remove causes of pollution ; and if so, were they attended with success ?

The Salmon Disease—
1. Has the salmon disease shown itself in your district this year? If so, when did it first make its appearance ? When was it at its height ? When did it disappear ?
2. What was the level of the river during the prevalence of the salmon disease ?
3. Can you state the number of diseased salmon taken from the river in each month, specifying what proportion was male and what female, what kelts, and what clean fish ?
4. Generally, have you any remarks or suggestions to make with regard to the salmon disease ?

The Spawning Season—
1. What was the earliest date, during the season of 1895–96, on which salmon were noticed spawning ?
2. Between what dates did the greatest number spawn ?
3. When did the spawning season finish ?
4. What was the level of the river during the spawning season ?
5. Were the numbers of spawning fish more or less than usual ?
6. Which are the principal spawning streams in your district ?

Kelts—
1. On what date, during last season, were kelts first noticed migrating seawards ?
2. When did the chief migration take place ?
3. When was the river free from kelts ?
4. What was the level of the river during the period kelts were migrating ?

Smolts—
1. On which dates, during the year, were smolts noticed migrating ?
2. Was it a good smolt year ?

Artificial Propagation of Salmon—

Is there any hatchery in your district for the artificial propagation of salmon and trout, either belonging to the District Board or supported by private enterprise ? If so, describe its situation, and state how many fish can be hatched out in it annually.

Proportion of Male to Female Salmon—

Can you state the proportion of the male to the female salmon in your district or river, specifying whether your return, so far as it goes, is based upon an estimate or on actual enumeration ?

General Question—

Are there any other points relating to the salmon fisheries in your district to which you would wish to direct the attention of the Board, in addition to those suggested by the preceding queries ?

ANSWERS TO THE FOREGOING QUESTIONS.

THE DISTRICT OF THE RIVER FORTH.

Take of Fish—

1. (*a*) and (*b*) Above the average in tidal and fresh waters ; (*c*) fixed engines not quite so good ; (*d*) above the average generally except (*c*).
2. (*a*), (*b*) and (*c*) No means of knowing. The tenants will give no information.
3. (*a*) 11th February ; (*b*) July and August ; (*c*) grilse in June, sea-trout all the season.
4. (*a*) and (*b*) No means of knowing. The tenants will give no information
5. (*a*) 58 lbs. ; (*b*) no information ; (*c*) 38 lbs.

Protection—

1. £3617.
2. 2s. 6d. per £.
3. Twelve.
4. Yes, 20 cases. Convictions followed in 16, and in 4 cases the accused were found not guilty. The prosecutions were instituted for fishing with nets after close time ; fishing for or taking salmon with drag-hooks, gaffs, roe, etc.

Obstructions to the Passage of Fish—

1. None.
2. None.
3. Yes.
4. Two, one on the Ardoch at Doune, and one on the Tyne at East Linton.
5. Yes.
6. No.
7. No.

Pollutions—

1. No.
2. No. No causes of pollution reported.

The Salmon Disease—

1. Yes. About 15th December 1895 ; in the end of January ; at the end of March.
2. Medium level.
3. 780 males, 253 females, from first week of December 1895 to end of March 1896. They were all kelts.
4. No.

The Spawning Season—

1. 19th November 1895 ; 15th November 1896.
2. 15th November to end of December.
3. About the end of January.
4. Medium level.
5. More.
6. Teith, Allan, and Forth.

Kelts—

1. First week of December 1895.
2. January and February 1896.
3. End of April 1896.
4. Medium level.

Smolts—
1. April and May 1896.
2. Yes.

Artificial Propagation of Salmon—
No.

Proportion of Male to Female Salmon—
No.

General Question—
The injuries to fishings by drift or hang-net fishing in the Forth between Alloa and Culross.

THE DISTRICT OF THE RIVER TAY.

Take of Fish—
1. (*a*), (*b*), (*c*) and (*d*) Best season all over since 1885.
2. (*a*), (*b*) and (*c*) No possibility of getting at anything like correct numbers.
3. (*a*) 11th February when fishing opened, clean salmon in Tay at all seasons ; (*b*) July ; (*c*) grilse latish (end of May).
4. (*a*) and (*b*) No means of getting at this except by weight of salmon sent by rail.
5. (*a*) 59½ lbs. ; (*b*) 46 lbs. ; (*c*) 43 lbs.

Protection—
1. Upper, £6934, 5s. ; Lower, £10,246, 12s. 9d. Total, £17,180, 17s. 9d.
2. £1374, 9s. 4d., being at 8 per cent. Special assessment on upper proprietors for compensation for removal of nets above Linn of Campsie at 12 per cent., £271, 1s. 11d.
3. Twenty.
4. Yes, 34, involving 57 persons, all of whom were convicted. Breaches of weekly and annual close time, fishing without leave of the proprietor, etc.

Obstructions to the Passage of Fish—
1. No change.
2. No.
3. Yes.
4. No.
5. There are no fish passes except on Ericht, and they are useless
6. No.
7. I don't think there is any change.

Pollutions—
1. No ; except perhaps that as the population is increasing that may add a little to pollution.
2. No.

The Salmon Disease—
1. About end of November (not so bad as formerly).
2. Usual winter size.
3. About 800. Chiefly spawned salmon and mostly male fish.
4. I do not think that spate or small water make any difference as to disease.

The Spawning Season—
1. First week of November.
2. From 10th November till 10th December.
3. About middle of January.
4. Average size perhaps on the heavy side.
5. Rather less.
6. A large number ; no room for names of them.

Kelts—
1. I think kelts go down in December.
2. April.
3. June.
4. Small freshets and bright weather.

Smolts—
1. Smolts were early.
2. Splendid.

Artificial Propagation of Salmon—
Hatchery at Dupplin on the Earn belonging to Fishery Board hatches 570,000.

Proportion of Male to Female Salmon—
No idea. When fishing for salmon to get ova they seem fairly level as to sex.

THE DISTRICT OF THE RIVER SOUTH ESK.

Take of Fish—
1. Below average throughout the district.
2. (*a*), (*b*) and (*c*) No.
3. (*a*) 16th February ; (*b*) July ; (*c*) July.
4. (*a*) and (*b*) Unable to furnish this information.
5. (*a*) 32 lbs. ; (*b*) 40 lbs. ; (*c*) 33 lbs.

Protection—
1. £3149.
2. Ten per cent. on rentals.
3. Nine men, including River Superintendent.
4. Five prosecutions ; chiefly for using cleeks or drags. All convicted.

Obstructions to the Passage of Fish—
1. No changes.
2. No cruives in district.
3. No cruives in district.
4. One built at New Mill, Craigessie.
5. Yes ; during average size of water.
6. No.
7. None.

Pollutions.
1. No.
2. No.

The Salmon Disease—
1. First seen December 1895 ; was at its height January 1896.
2. Twelve inches above ordinary size.
3. 279 in all taken ; all got in January and February 1896 ; 228 males and 51 female fish ; all kelts.
4. No.

The Spawning Season—
1. 14th October 1895.
2. From 26th November 1895 to 1st January 1896.
3. About 10th January 1896.
4. About 12 inches above ordinary size.
5. More.
6. Kinnaird, Brechin, Tannadice, New Mill, Shiell Hill, and most in the Stream of Prosen.

Kelts—
1. 24th February 1896.
2. During month of March.
3. About 17th June.
4. Generally when river about 12 to 24 inches above usual size.

Smolts—
1. First seen on 30th March. Continued migrating until July.
2. Yes.

Artificial Propagation of Salmon.
No hatchery in district.

Proportion of Male to Female Salmon—
Mostly males during spawning season. Return based on estimate and as shown on Fords.

General Question—
No.

THE DISTRICT OF THE RIVER NORTH ESK.

Take of Fish—
1. (*a*), (*b*), (*c*) and (*d*) Salmon about the average. Grilse very much below.
2. (*a*), (*b*) and (*c*) No.
3. (*a*) 16th February ; (*b*) and (*c*) June and July.
4. (*a*) and (*b*) Cannot give statistics of per centage.
5. (*a*) 28 lbs. ; (*b*) 40 lbs. ; (*c*) 33 lbs.

Protection—
1. £6540.
2. £359, 14s.
3. Fourteen with Superintendent.
4. No.

Obstructions to the Passage of Fish—
1. None.
2. No cruives
3. Yes.
4. No.
5. They afford a free passage for the ascending fish at all times when there is water enough in the river to supply the passes.
6. No.
7. No.

Pollutions—
1 and 2. No pollutions.

The Salmon Disease—
1. Yes. In October. There are diseased fish found throughout the season.
2. Low.
3. About 175 during the year :—

Spawned—male 112, female 14	.	126
Unspawned—Male 24, female 25	.	49
	Total,	175

4. No.

The Spawning Season—
1. Middle of November.
2. Between 15th December and 15th January.
3. About end of January.
4. About an average.

5. About an average.
6. Gannochy, King's Ford, Pert Ford, Stob Ford, Bothy Stream, Peter's Stream, Bailie Middleton's Stream, Broad Rack, and Bridge Streams.

Kelts—
1. About end of January.
2. February.
3. May.
4. Half-flood and floods.

Smolts—
1. In April.
2. Very good.

Artificial Propagation of Salmon—
No.

Proportion of Male to Female Salmon—
Estimate two-thirds males, and one-third females.

THE DISTRICT OF THE RIVER BERVIE.

Take of Fish—
1. (*a*), (*b*), (*c*) and (*d*) About an average.
2. (*a*), (*b*) and (*c*) No.
3. (*a*) At opening on 25th February 1896 ; (*b*) July and August ; (*c*) July.
4. (*a*) and (*b*) Cannot.
5. (*a*) Trout 6 to 8 lbs. ; (*b*) salmon fully 50 lbs. ; (*c*) salmon 20 lbs. ; trout 6 to 8 lbs.

Protection—
1. £1070, 13s.
2. 14 per cent.
3. Six.
4. No.

Obstructions—
1. None.
2. No cruives.

4. No.
5. When river in flood.

6 and 7. No.

Pollutions—

The Salmon Disease—
1. Yes, but very slight, only 5 fish got in January.
2. Ordinary.
3. Only 5 all the season, 2 males and 3 females.
4. Disappearing.

The Spawning Season—
1. October.
2. November to January.
3. End of January.
4. Average level to half flood
5. More.
6. Bervie Water.

Kelts—
1. End of January.
2. February.
3. March.
4. High level.

Smolts—
1. May and June.
2. Yes.

General Question—
About 3 females to 1 male—estimate.

THE DISTRICT OF THE RIVER DEE (ABERDEENSHIRE).

Take of Fish—
1. (*a*), (*b*), (*c*) and (*d*) Salmon rather above average. Grilse rather under and late.
2. (*a*), (*b*) and (*c*) No.
3. (*a*) 11th February; (*b*) in April and June; (*c*) first grilse taken on sea coasts on 28th April. In river on 15th May. Grilse most plentiful in July.
4. (*a*) and (*b*) No information on these points.
5. (*a*) 41 lbs.; (*b*) 45 lbs.; (*c*) 40 lbs.

Protection—
1. £14,592, 18s. 3d.
2. Seven per cent.
3. Twenty-three.
4. Twenty-two prosecutions, implicating 35 persons. Twenty convicted, and 2 not proven. Fines ranged from 5s. to 30s. with expenses. One offender detected despatching boxes of salmon by rail in close time; compromised the case by a payment of £60. Offences generally for taking salmon by clips and for possession of foul fish.

Obstructions to the Passage of Fish—
1. None.
2. No; no cruives in district.
3. Yes.
4. No.
5. No passes of an artificial kind.
6. No.
7. Nothing of this kind in 1896.

Pollutions—
1. No.
2. Unnecessary.

The Salmon Disease—
1. Yes, to a considerable extent; first observed 15th February; worst in April, and disappeared at end of May.
2. Low.
3. 700 altogether.

100 in February 250 in April 350 in May	400 males 300 females	all spent fish and diseased.
700		

4. No.

The Spawning Season—
1. 15th October.

2. In upper reaches from October to December. Lower from 1st December to middle of January.
3. Practically at end of January.
4. Very high.
5. Far more.
6. The river itself, but particularly in the tributaries of Feugh, Gavin, Muick, and Clunie.

Kelts—
1. 1st December.
2. End of April and early in May.
3. Never quite clear.
4. Average.

Smolts—
1. Early in April.
2. Yes.

Artificial Propagation of Salmon—

The Board have erected a hatchery at Drum, about 11 miles from Aberdeen, and keep it up. Ova put into it in 1896, about a million—a large percentage of which develop and are put into the river.

Proportion of Male to Female Salmon—

No information.

General Question—

None.

THE DISTRICT OF THE RIVER DON.

Take of Fish—
1. (*a*), (*b*), (*c*) and (*d*) Below the average over all.
2. (*a*), (*b*) and (*c*) No.
3. (*a*) 11th February; (*b*) end of July and first days of August; (*c*) 12th May grilse first seen; sea trout 11th February.
4. (*a*) and (*b*) No information.
5. (*a*) 30 lbs.; (*b*) 45 lbs.; (*c*) 39 lbs.

Protection—
1. £3582, 17s. 2d.
2. 18 per cent.
3. Seventeen.
4. Fourteen prosecutions, all convicted, for taking salmon with clips, etc., and for possession of unseasonable fish; fined from 10s. to 30s., with costs of about £1; few pay fines, majority go to prison.

Obstructions to the Passage of Fish—
1. None.
2. No.
3. Yes.
4. No.
5. Fish can ascend when river is at or above the ordinary level; when low, there is difficulty, and sometimes impossible.
6. No.
7. None.

Pollutions—
1. No fresh causes of pollution, but impurity increases as the population of Woodside increases.
2. Negotiations have been going on for some time between the County Council, the fishing proprietors, and the mill-owners for diminishing the evil, which, it is hoped, will end in the adoption of some scheme which will have the desired effect.

The Salmon Disease—

1. Disease has been present to some extent; appeared first on 8th January, worst in April, disappeared about middle of October.
2. Low.
3. 38 altogether :

8 in January	4 males. Others all spent female fish.
7 in February	
9 in March	
12 in April	
2 in October	
38	

4. No.

The Spawning Season—

1. 30th of October.
2. From 10th December to 10th January.
3. Practically at end of January.
4. High.
5. More.
6. Upper river about Alford and Kildrum.

Kelts—

1. Always a few.
2. Greatest number in May and June.
3. Never quite free.
4. Small.

Smolts—

1. Early in May and June.
2. A fair average.

Artificial Propagation of Salmon—

The Board contribute to a hatchery at Fish Street, Aberdeen, in which about 60,000 ova are put yearly, a large percentage of which develop and are put into the Dee and Don.

Proportion of Male to Female Salmon—

No information.

General Question—

None.

THE DISTRICT OF THE RIVER YTHAN.

Take of Fish—

1. (*a*) Above average ; (*b*) below average ; (*c*) and (*d*) above average.
2. (*a*) and (*b*) Cannot obtain this information ; (*c*) about 150 salmon.
3. (*a*) 25th February ; (*b*) August ; (*c*) August.
4. (*a*) and (*b*) Cannot obtain this information.
5. (*a*) Cannot obtain this information ; (*b*) salmon 34 lbs. ; (*c*) salmon 31 lbs., sea trout 6 lbs.

Protection—

1. £1023, 16s. 8d.
2. 2s. 9d. per £
3. One all the year round, and four additional at various dates from November to March.
4. One—for neglecting to remove leaders during the weekly close time. There was conflicting evidence as to the weather, and the charge was found 'Not proven.'

Obstructions to the Passage of Fish—
1. None.
2. No cruives in district.
3. The dams are so worked.
4. No.
5. Yes
6. There are none.
7. Nothing has been done.

Pollutions—
1. No.
2. No.

The Salmon Disease—
1. Yes, January, February, April.
2. Not observed.
3.

Month.	No. of Fish.	Male.	Female.	Diseased.	Not Diseased.
1895					
September, . .	1	...	1	...	1
December, . .	1	1	...	1	...
1896					
January, . .	33	31	2	25	8
February, . .	265	240	25	247	18
March, . . .	117	81	36	117	...
April, . . .	50	31	19	50	...
Total, . .	467	384	83	440	27

4. No.

The Spawning Season—
1. About the end of November 1895.
2. Between 1st December and 31st January.
3. February.
5. About the same as usual.
6. Ythan, Ebrie, Little Water, Bronie, Fordoun.

Kelts—
1. Not observed.
2. March.
3. May.
4. Not observed.

Smolts—
1. May.
2. Good.

Artificial Propagation of Salmon—
No.

Proportion of Male to Female Salmon—
The head water bailiff reports an estimate of 4 males to 3 females.

General Question—
No.

THE DISTRICT OF THE RIVER UGIE.

Take of Fish—
1. (*a*) Below the average; (*b*) above the average; (*c*) and (*d*) about the average.

2. (*a*) About 800 sea trout; (*b*) 5800 salmon and grilse; (*c*) 86 salmon and grilse, and 400 sea trout.
3. (*a*) February 27th; (*b*) August and September; (*c*) August, September, and October.
4. (*a*) and (*b*) The salmon fishings are in the hands of private enterprise, and the tacksmen decline to give the information or keep records.
5. (*a*) 7 lbs.; (*b*) 38 lbs.; (*c*) 30½ lbs.

Protection—
1. £503.
2. £28, 7s. 9d., at the rate of 1s. 1·55d. in the £.
3. Five.
4. One prosecution for poaching, which resulted in a conviction.

Obstructions to the Passage of Fish—
1. There have been no dams destroyed, given up, or altered in any way during the year 1896.

2 and 3. None of the dams or cruives in this district have been worked during the year 1896.

4. None.
5. The dams at Englishmill and Ravenscraig afford a free passage at all times. The dams higher up the river afford passage only when the river is at least half-flood.
6. None that I know of.
7. No.

Pollutions—
1. None so far as I am aware.
2. The pollution from a woollen manufactory referred to in last year's Report has been removed. No other steps have been taken.

The Salmon Disease—
1. Yes. The disease first appeared on the 3rd of February. It reached its height in April, and disappeared in May.
2. Low.
3. February, 3; March, 11; April, 23; May, 5. The proportion was 5 males to 3 females.
4. Disease seems to be falling off here, the affected fish being all kelts.

The Spawning Season—
1. 23rd November 1895.
2. 1st December 1895 and 16th January 1896.
3. About the end of January.
4. Half-flood.
5. Less than usual.
6. Stonemill, Bathlaw, and North Ugie.

Kelts—
1. 3rd February.
2. In March.
3. In May.
4. Mostly half-flood.

Smolts—
1. Mostly during the last week of April and the first fortnight of May
2. Yes.

Artificial Propagation of Salmon—

There is a small hatchery, but it has been abandoned, and there are no means in use for the artificial propagation of salmon and trout.

Proportion of Male to Female Salmon—

It is estimated that the proportion is about 5 males to 3 females, but there is no reliable information.

General Questions—

None.

THE DISTRICT OF THE RIVER DEVERON.

Take of Fish—
1. (*a*) Above ; (*b*) about; (*c*) above ; (*d*) above.
3. (*a*) 11th February ; (*b*) February and August ; (*c*) July.
5. (*a*) 32 lbs. ; (*b*) 41 lbs. ; (*c*) 36 lbs.

Protection—
1. £2468, 13s.
2. 2s. 9d. per £.
3. Nine watchers.
4. No.

Obstructions to the Passage of Fish—
1–7. No change since last year.

Pollutions—
1 and 2. The question of the pollution of the Isla, which is a tributary of the Deveron, is engaging the attention of the Public Health Committee of the County Council.

The Salmon Disease—
1. Yes. 2nd January. February. Disappeared in April.
2. Low.
3.

Sex.	November.	December.	January.	February.	March.	April.
Males, .	21	45	51	81	42	7
Females,	11	16	14	27	14	11
Total, .	32	61	65	108	56	18

The Spawning Season—
1. 20th October.
2. 1st November and 14th December.
3. 1st March.
4. Half-flood.
5. More.
6. Well distributed over the river.

Kelts—
1. 28th November.
2. 17th April.
3. 25th May.
4. Half-flood.

Smolts—
1. 17th April ; 4th and 25th May.
2. Yes.

Artificial Propagation of Salmon—
There is a hatchery within the policies of Duffhouse, capable of hatching 100,000.

Proportion of Male to Female Salmon—
Fish killed by net and cobble, 1 male to 4 females.

General Question—

The question of the size of the Duke of Fife's cruives has been submitted on special case between His Grace and the Board for the determination of the First Division of the Court of Session. The case is expected to be heard before the close of the year.

THE DISTRICT OF THE RIVER SPEY.

Take of Fish—

1. (*a*), (*b*), (*c*), and (*d*) About an average for salmon, but grilse scarce.
3. (*a*) 11th February ; (*b*) salmon plentiful all the season ; (*c*) grilse during July ; sea-trout May ; both very scarce this season.
5. (*a*) 44 lbs. ; (*b*) 40 lbs. ; (*c*) 37 lbs.

Protection—

1. Assessable rental, year 1896–97, £9637, 15s.
2. Assessment levied, 2s. 4d. per £=£1124, 8s. 1d.
3. One superintendent, one inspector, and forty-four bailiffs.
4. See Report.

Obstructions to the Passage of Fish—

1. One old dam dyke and fish pass overhauled and improved on the Dullan at Pittyvaich Distillery, Dufftown.
2. No cruive dyke in use in the district during the season.
3. Yes.
5. Yes generally.

Pollutions—

1. Distilleries always increasing in the district, but the pollution from these during the last year or two has been somewhat reduced by the distillers introducing filtering systems. Two or three of said filtering systems have not yet been fully finished, but it is expected they will be so before long.

The Salmon Disease—

1. See Report.
2. Normal.
3. See Report.

The Spawning Season—

1. See Report.
2. Between 15th October and end of November.
3. End of February.
4. Normal.
5. See Report.
6. See Report.

Kelts—

1. 26th November.
2. February.
3. June to August.
4. Somewhat high.

Smolts—

1. See Report.
2. See Report.

Artificial Propagation of Salmon—

Yes. See Report on Duke of Richmond and Gordon's hatchery at Fochabers.

Proportion of Male to Female Salmon—

In the upper reaches of the river the males and females may be about equal in number ; in the lower the females largely predominate.

The following is a copy of the Superintendent's Annual Report for the year ending 26th August 1896, submitted to the meeting of the Spey District Board, held at Elgin on the 23rd October 1896 :—

I.—*Salmon Spawning.*

The following Table shows the dates of the first appearance of salmon spawning beds, and the number seen by bailiffs during the last three spawning seasons on the following named streams or tributaries:—

1893.

Name of Stream.	Spawning Commenced.	No. of Beds for Season.
Fiddich	6th October 1893	566
Avon	17th ,,	957
Livet	11th ,,	619
Conglass	12th ,,	267
Lochy	12th ,,	69
Dulnain	13th ,,	616
Nethy	18th ,,	183
Druie	14th ,,	244
Feshie	14th ,,	770
Tromie	14th ,,	168
Truim	11th ,,	75
Spey (above Laggan, Badenoch)	3rd ,,	101
Total		4635 Spawning Beds

1894.

Name of Stream.	Spawning Commenced.	No. of Beds for Season
Fiddich	29th September 1894	1008
Avon	10th October	1316
Livet	12th ,,	1735
Conglass	12th ,,	445
Lochy	24th ,,	115
Dulnain	13th ,,	638
Nethy	19th ,,	435
Druie	13th ,,	430
Feshie	15th ,,	767
Tromie	18th ,,	204
Truim	15th ,,	76
Spey (above Laggan, Badenoch)	12th ,,	45
Total		7214 Spawning Beds.

1895.

Name of Stream.	Spawning Commenced.	No. of Beds for Season.
Fiddich	1st October 1895	715
Avon	15th ,,	1550
Livet	16th ,,	1300
Conglass	14th ,,	273
Lochy	14th ,,	90
Dulnain	15th ,,	420
Nethy	11th ,,	429
Druie	15th ,,	153
Feshie	14th ,,	812
Tromie	16th ,,	158
Truim	17th ,,	159
Spey (above Laggan, Badenoch)	15th ,,	144
Total		6203 Spawning Beds.

TABLE OF NINE YEARS' SPAWNING BEDS.

Total Number of Beds for Year	1887	- - -	3849
„ „	1888	- - -	5637
„ „	1889	- - -	2932
„ „	1890	- - -	2768
„ „	1891	- - -	4591
„ „	1892	- - -	5287
„ „	1893	- - -	4635
„ „	1894	- - -	7214
„ „	1895	- - -	6203

In last year's Report, under the Salmon Spawning Section, I was able to state a 'record' when giving the season's number of spawning beds counted over the tributaries, and comparing same with the numbers counted over same tributaries during any previous season. This record still stands unbroken, although the last year's spawning season was certainly a first-class one, and stands next to the highest on record. In comparing last two spawning seasons, we find a decrease of 1011 spawning beds. To find out where the decrease showed itself, we first find, comparing with the foregoing season, a deficiency of 293 beds on Fiddich; 398 beds on Avon and tributaries; 218 beds on Dulnain; and 277 beds on Druie. The most glaring of these is that of the Druie, and the cause of the falling off in this stream is accountable in a great measure to the bad order of the Dell Sawmill intake on the Doune of Rothiemurchus estate. The fish, in attempting to ascend this stream to the spawning redds above, finding the acclivity of said dam dyke to be difficult to surmount, evidently retraced their course to Spey, and thence made their way further up the river to the higher reaches, hence the possible cause of the material increase of beds upon the Truim Stream, and upon the Laggan or top reaches of Spey district. The season's spawning upon the River Spey from Speymouth up to Boat of Garten was a very heavy one. No attempt is made to count the spawning beds over this stretch, but from the appearance of fish and their work upon all the spawning fords over said district, more especially between Carron and Boat of Garten, the spawning was heavier than that of the previous year. The whole of the spawning season was all that could be wished for regarding weather. There were no high floods or spates to injure or damage the deposited ova, and severe frosts were entirely absent. In parts of the Cromdale district salmon were seen spawning as late as the first and second weeks of March.

II.—*Smolt Season.*

Descending smolts during the months of April, May, and June appeared to be numerous, and quite up to an average appearance with previous years. Eight bailiffs were on duty for six weeks—from 27th April till 6th June—protecting smolts, and were stationed as follows:—One man on the Speymouth district; one at Dundurcas, Rothes; one at Dufftown; one at Aberlour; one at Ballindalloch; one on Upper Avon and Glenlivet district; one at Grantown; and one at Duthil. From Speymouth to Laggan, Badenock, and over all the tributaries, printed notices cautioning persons against taking or killing smolts, salmon fry, or parr, were posted up as usual. The superintendent, inspector, and two constables continued salmon fry or parr protection from 6th June till 3rd August, when other four men were put on duty to continue protection of said fry during the months of August and September. Not a single person was found or detected during the whole of the season killing or being in possession of smolts, salmon fry, or parr, and all of the trout anglers come across by the watchers during the season seemed anxious to avoid catching the fry, and in almost all cases they, without being asked to, showed the contents of their baskets to the bailiffs for inspection, and in no case did anyone refuse.

III.—*Disease among Salmon.*

To give a detailed note as to the appearance of salmon fungoid disease over the Spey district during the year ending 26th August 1896, I, as in former years, confined my observations to the river Fiddich for said season's fish statistics. During last spawning season the number of salmon spawning beds counted upon Fiddich was 715, and the total number of dead or dying fish removed and buried by the bailiffs was 155. Calculating the percentage of fish dying from the disease with the number of spawning beds counted upon the stream during the last seven spawning seasons, the fish mortality from disease on Fiddich has given the following percentages :—During the season of 1889–90, 13 per cent.; 1890–91, 18 per cent.; 1891–92, 16 per cent.; 1892–93, 19 per cent.; 1893–94, 8 per cent.; 1894–95, 9 per cent.; 1895–96 (last year), 21 per cent. This shows that the death rate of last year is at least 2 per cent. higher than any of the recorded seasons—that is of season 1892–93, when the death rate was 19 per cent. The first diseased dead fish was seen on 4th December for last year (1895), giving 1 male grilse. The next return was on 24th December, giving a total of 12 fish, being 6 male and 2 female salmon, with 4 male grilses. The next was on 4th January 1896, being a total of 7, viz., 4 male salmon and 3 male grilses. On 11th January, a total of 23, viz., 15 salmon and 8 grilses, all males. On 18th January, a total of 12, being 8 salmon and 4 grilses, all males. On 25th January, a total of 20, giving 12 salmon and 8 grilses, all males. On 31st January, a total of 16, being 9 salmon and 7 grilses, all males. On 8th February, a total of 23, viz., 11 salmon and 12 grilses, all males. On 15th February, a total of 12, giving 5 male salmon and 5 male and 2 female grilses. On 22nd February, a total of 8, being 1 salmon and 7 grilses, all males. On 29th February, a total of 16, giving 2 male and 1 female salmon, and 11 male and 2 female grilses. On 7th March, a total of 3, being 2 male and 1 female salmon. On 28th March, a total of 2, viz., 2 male grilses. This gives for the season 75 male and 4 female salmon, and 72 male and 4 female grilses. All of the above were spawned fish. During the first week of May 1896, some 6 diseased dead or dying clean salmon were removed from the river Spey from the Aberlour and Wester Elchies section of fishings. During the time in question, the weather was very warm and the river exceedingly low, and the pools were well-stocked with salmon all up and down the river, so that I consider, when everything is taken into account, a few diseased clean fish in the river during a warm drought is more of a sign of abundance of fish than an indication that salmon disease is gaining or becoming more prevalent over the district.

IV.—*Poaching during the Year.*

Seven persons were brought before the Sheriff Court and convicted and fined for poaching during the season, viz.:—One case of day poaching by killing salmon with a gaff during the close time for rod and line ; one case of killing salmon on Sunday with a spear ; one case of night poaching with torch light and gaff ; one case of stoning fish on or disturbing salmon spawning beds ; and one case—during open time—of taking and killing an unclean or unseasonable salmon.

V.—*Bye-Laws.*

The Bye-Laws relating to Dam Dykes, Mill-Lades, Sluices, Hecks, &c., were generally well kept and maintained over the district during the season. Improvements, at request of Board clerks, were made upon the intake dam dyke upon the Druie at Dell Sawmill, but the improvements did not wholly remove the cause of difficulty that ascending fish encounter at said weir. Regarding the case of the tenant of the Sawmill on the Dulnain at Carr-Bridge, who failed after repeated requests through the Board clerks, &c., to put his mill dam dyke and fish pass into proper order conform with the bye-laws, and whose case was pending for prosecution at close of my last year's Report, it came up before the Sheriff Court at Inverness on 24th September 1895. Accused, instead of appearing in Court, sent a letter written by his agent at Grantown admitting the offence. Along with this admission and the evidence of the Superintendent and Inspector Brown, proving the nature of offence or breach of bye-law, accused was convicted in absence, and sentenced to pay a fine of £1, with £2, 14s. of expenses, or 14 days' imprisonment.

General Remarks.

The river and sea coast net salmon fishing opened over the Spey district upon the 11th of February. The inspection of the weekly close time during the season was attended to by myself, the Inspector, and Sergeant Alexander Mackintosh. During the whole season, as far as the weather and sea made it practicable to do so, the observance and carrying out of the weekly close time or 'slop' was strictly carried out over the whole district. The close of the net salmon fishing was carried out over the district upon the 26th of August.

The salmon hatchery at Fochabers, belonging to His Grace the Duke of Richmond and Gordon, has had another successful year's work carried out by the system of propagating and hatching salmon ova, and returning them in the stage of salmon fry into the river Spey. During the months of November and December 1895, salmon ova to the enormous number of 570,000 were secured and placed in the hatchery boxes. I visited and saw the ova during the propagating stage, and again when the hatched or life stage was reached, and, to my belief, the last 'houseful' of ova and the subsequent fry were, if possible, the finest to all appearance that I have yet seen in this hatchery. During the month of May 1896, the fry, after attaining the age of six or seven weeks, were removed from the boxes and let at large into the River Spey. Mr Thomas Rae, who had charge of the hatchery, was exceedingly well pleased with the quality of last year's ova and also with the returns of fry derived from the same, and he is quite sure that he under estimates his return when he gives it at 95 per cent. of salmon fry returned to the river from the ova placed in the hatchery boxes. Grilses, although apparently up to an average upon the rod fishing stretches of the river during the season, were all along the sea coast and River Spey net fishings considerably less numerous than of last year. This falling off in grilse, which, however, was more than counterbalanced by abundance of salmon all the year over, is not easily explained or accounted for, more especially when the descending smolts during last spring and early summer months were much more numerous than that of the preceding season. From the large size of the River Spey, no certainty, it may be supposed, can be given whether descending smolts do vary as much in apparent numbers as to allow of comparisons, one year with another, being given. Those employed at the river mouth net salmon fishings have the best means of judging a season's appearance of descending smolts. When dragging their nets through the river in the darkness of the nighc the shoals of descending smolts can be seen rushing through the net meshes by the glitter and gleam of their silvery scales. Some of the oldest men emplcyed say that, during the last smolt season, the appearance of descending smolts in regard to numbers was the best that they had seen for forty years.

The full force of bailiffs or Spey police is constituted as follows:—The superintendent, residing at Aberlour; the inspector, stationed at Grantown; eight sergeants, and thirty-seven constables.

GEORGE K. MACGREGOR, *Superintendent.*

THE DISTRICT OF THE RIVER FINDHORN.

Take of Fish—

1. (*a*) Salmon above average; grilse below average; (*b*) below average; (*c*) salmon above average; (*d*) about an average.
3. (*a*) 11th February; (*b*) April and May; (*c*) May, June and July. Trout may be got throughout season.
5. (*a*) Salmon 34 lbs.; trout 4 lbs; (*b*) Salmon 45 lbs.; (*c*) Salmon 17 lbs.

Protection—

1. £3436.
2. £345.
3. Head constable, two permanent bailiffs and fifteen occasional bailiffs.
4. No.

Obstructions to the Passage of Fish—
None.

Pollutions—
None.

The Salmon Disease—
No disease.

The Spawning Season—
1. Upper district, 16th October ; lower district, 20th November.
2. Upper district, between 25th October and 27th November ; lower district, December and January.
3. Upper district, 2nd December ; lower district, end of February.
4. Upper district above ordinary level.
5. About an average.
6. Main river between Waterford and Sluie, and between Drynachan and Coignafearn.

Kelts—
1. Kelts begin to migrate seawards immediately after the spawning season is over.
2. January and beginning of February.
3. May.
5. Sometimes flood, half-flood, and small.

Smolts—
1. From the middle of March till the end of May.
2. A good average.

Artificial Propagation of Salmon—
No.

THE DISTRICT OF THE RIVER NAIRN.

Take of Fish—
1. (*a*), (*b*), (*c*) and (*d*) Below average throughout the district.
2. (*b*) About 6000 ; (*c*) 175.
3. (*a*) 13th February ; (*b*) from 10th April to 20th May ; (*c*) sea-trout in June, grilse in August and September.
5. (*b*) 35 lbs. ; (*c*) 22½ lbs.

Protection—
1. £1135, 10s.
2. £85, 3s. 3d.
3. Two.
4. No.

Obstructions to the Passage of Fish—
1. None.
2. No.
3. Yes.
4. No.
5. There is a free pass at all times unless when the water is very low.
6. None.
7. No changes.

Pollutions—
1. No.

The Salmon Disease—
1. No disease this season.

The Spawning Season—
1. 1895, between the 6th and 8th November ; 1896, between the 8th and 10th November.
2. Between 20th November and 20th December.
3. About 15th January.
4. Between low and half-flood.
5. Less.
6. The River Nairn and the Invereruie Burn.

Kelts—
1. About 15th February.
2. From the 15th to the end of March.
3. By the 20th April.
4. Half-flood.

Smolts—
1. From 20th April to 1st June.
2. Very good.

Artificial Propagation of Salmon—
No.

Proportion of Male to Female Salmon—
Upon an estimate there are about 5 per cent. more females.

General Question—
No.

THE DISTRICT OF THE RIVER NESS.

Take of Fish—
1. (*a*) Better ; (*b*), (*c*) and (*d*) about the average
2. (*a*), (*b*) and (*c*) about 35,000 or 40,000.
3. (*a*) Opening of fishing 11th February ; (*b*) February ; (*c*) end of June, July, and August.
4. (*a*) and (*b*) Can't say.
5. (*a*) Salmon, 42 lbs.

Protection—
1. £3662, rental.
2. 1s. 9d. per £.
3. Four permanent men ; three temporary men.
4. Yes.

Obstructions to the Passage of Fish—
1. None.
2. None.
3. Yes.
4. No.
5. Yes.
6. No.
7. None.

Pollutions—
1. None.
2. No cause for any.

The Salmon Disease—
1. No.

The Spawning Season—
1. Between the middle of October and November.
2. From November to January.
3. End of January.
5. More in 1896.
6. The Garry, the Kingie, Morrison, and Ness.

Kelts—
1. February.
2. March and April.
3. Middle of June.

Smolts—
1. April.
2. Yes.

Artificial Propagation of Salmon—
Lord Burton, Glenquoich, has a trout hatchery. Can't say the number of fish hatched.

Proportion of Male to Female Salmon—
In the month of January I netted the river and found the males had the majority—about six males to four females.

General Question—
None.

THE DISTRICT OF THE RIVER ALNESS.

Take of Fish—
1. (*a*) Above the average ; (*b*) below the average.
2. (*a*) The lessees of the net and coble-fishing are not disposed to give the information.
3. (*a*) About beginning of the net fishing ; (*b*) July ; (*c*) June, July, and August.
5. (*a*) About 30 lbs. ; (*c*) about 18 lbs.

Protection—
1. £613, 10s.
2. 6s. 3d. per £.
3. One permanent inspector and three temporary bailiffs.
4. None.

Obstructions to the Passage of Fish—
2. No cruives in district.
3. Yes ; on River Alness.
4. No.
5. Yes ; at all times.

The Salmon Disease—
1. No salmon disease in the district.

The Spawning Season—
1. About 28th October.
2. Between 5th November and 1st December.
3. About 10th December.
4. First half in flood ; end, half-flood.
5. Less.
6. Upper reaches of Alness River.

Kelts—
1. About middle of April.
2. About end of April.
3. June.
4. About half-flood.

Smolts—
1. 1st May.
2. Yes ; very good.

Artificial Propagation of Salmon—

There are two hatcheries in the district; one capable of hatching 150,000 ova, belonging to the Board, the other supported by private enterprise capable of hatching 80,000. The former is newly erected; the latter has been in use for upwards of three years.

No.

General Question—

The District Board would again direct the attention of the Fishery Board to the destruction to fish occasioned by the illegal mode of fishing pursued in the Cromarty Firth, and to which reference is made in the Appendix to the *Fourteenth Annual Report of the Fishery Board* (see Part II., p. 52).

THE DISTRICT OF THE RIVER CONON.

Take of Fish—

1. (*a*) and (*b*) Salmon considerably above the average; grilse a little above the average; (*c*) and (*d*) above the average.
3. (*a*) 11th February; (*b*) June and July; (*c*) grilse ran from the beginning of May to the close of the fishing. The main run of sea-trout is in March and April. Clean sea-trout in tidal waters of Conon at all seasons.
5. (*a*) Several were caught weighing about 24 lbs.; (*b*) about 30 lbs.; (*c*) about 23 lbs.

Protection—

1. One permanent inspector and four temporary bailiffs.

Obstructions to the Passage of Fish—

2. The cruives in this district have not been fished in 1896.
3. There is one dam in this district; it is not worked in accordance with the bye-law, Schedule F. There are two cruives in this district; they are worked in accordance with the bye-law, Schedule G, regulating the same.
5. Yes; at all times.
7. The Brahan net and cruive fishing have not been worked during the last seven seasons, whereby large numbers of salmon and grilse have ascended to the angling waters.

The Spawning Season—

1. About the 8th October.
2. Between the 1st and 15th November.
3. About 6th December.
4. Half-flood and low.
5. There was a splendid show of salmon and grilse on all the spawning streams of the rivers Conon, Blackwater, Orrin, and Meig. The numbers were fully up to the two previous spawning seasons.
6. There are good spawning grounds in the River Conon from the tidal waters, and in the tributaries Blackwater, Orrin, and Meig.

Kelts—

1. In the beginning of March.
2. From the middle of March to the end of April
3. About the beginning of June.
4. Flood, half-flood, and low.

Smolts—

1. March, April, May, and June
2. Yes; very good.

Artificial Propagation of Salmon—

There is a salmon hatchery in this district at Conon Bridge. It partly belongs to Colonel M'Kenzie of Seaforth, and partly to the District Board. Since the beginning of 1891 about 470,000 ova have been taken from the Conon, Tweed, and other rivers in Scotland, hatched in this hatchery, and the fry, when seven weeks old, transferred to the Conon and tributaries.

General Question—

I have noticed in the last two fishing seasons (especially in 1896) that the run of salmon in the tidal waters of the Conon during the months of June and July has been much more plentiful than in former fishing seasons. I have also noticed that the increase in weight of these salmon was considerably above the average of salmon caught in former years.

THE DISTRICT OF THE KYLE OF SUTHERLAND.

Take of Fish—

1. About the average; generally throughout the district.
2. The number cannot be given as the lessees refuse to give information on this head. The catch, however, was a very good one, by net and rod.
3. (*a*) In February; (*b*) in April and May; (*c*) in July and August.
4. It is not possible to condescend on numbers in either case A or B.
5. (*a*) 34 lbs. by net and coble; (*c*) no information.

Protection—

1. £2634.
2. 1s. 8d. per £.
3. Fifteen watchers in all.
4. One for allowing bag net leaders to remain in the sea during the weekly close time. Result 'Not proven.'

Obstructions to the Passage of Fish—

1. None.
2. There are no cruives in the district.
3. There are only two dams in the district, one at Gruids, Lairg, and the other at Evelix, Dornoch. The miller at Gruids was reported in 1893 and 1894 for contraventions, and on both occasions he was tried and convicted, on 20th June 1893 and 6th November 1894 respectively. The Evelix mill-lade has, however, been a source of great irritation for some years. The Dornoch Burgh Local Authority were permitted to take the water from the lade to the town of Dornoch some years ago, and consequently the sluice cannot, as it should, be shut at the intake when the mill is not being worked. The water is being used for a lawful purpose in terms of Schedules F and G, but not the whole of it. Up till now all attempts (and there have been many) at improvement have been abortive.
4. No.
5. Always.
6. No.
7. There is no change from 1895.

Pollutions—

1. No.
2. No.

The Salmon Disease—

1. No.

The Spawning Season—
1. About 10th September.
2. Between 1st and 30th November.
3. About the middle of January.
4. In flood the most of the time.
5. Less.
6. Carron, Oykell, and Cassley.

Kelts—
1. 6th January.
2. In February.
3. In April.
4. In flood the most of the time.

Smolts—
1. In May.
2. Yes.

Artificial Propagation of Salmon—
No.

Proportion of Male to Female Salmon—
No.

General Question—
At a meeting of the Kyle Board held on 12th October 1895 (at which Mr Archer was present), the Board agreed, *inter alia*, unanimously to recommend that there should be a close time for trout for the same period as for salmon. Reference is made to the clerk's letter of 14th October 1895 to Mr Archer communicating the resolution of the Board.

SUTHERLAND, EAST AND WEST COAST DISTRICTS.

Take of Fish—
1. (*a*) Slightly above the average ; (*b*) above the average.
2. (*a*)

	Salmon.		Grilse.		Trout.	
	No.	lbs.	No.	lbs.	No.	lbs.
Helmsdale—	760	9280	956	4622	82	123
Brora—	1774	19,222	884	4461	293	455

(*b*) Coast bag-nets. East Coast—salmon, 1256, 14,977 lbs. ; grilse, 2431 10,602 lbs. West Coast—salmon, 1823, 23,097 lbs. ; grilse, 8130, 45,926 lbs. ; (*c*) 1300 to 2000.

3. (*a*) 13th January on Helmsdale by rod ; (*b*) nets, June and July ; rods, March ; (*c*) June and July.
4. (*a*) February, 6 ; March, 10 ; April, 6 ; May, 16 ; June, 26 ; July, 31 ; August, 5.
5. (*a*) 35 lbs. ; (*b*) 42½ lbs. ; (*c*) 34 lbs.

Protection—
1 and 2. No assessment ; all belong to the Duke of Sutherland.
3. Four regular watchers. Keepers both on east and west coasts bound to assist in watching.
4. Yes ; poaching on Helmsdale. Fined £2 each (3).

Obstructions to the Passage of Fish—
1. None.
2. No cruives.
4. No.

5. The only fish pass (salmon ladder) on Carnach, a tributary of the River Fleet.
6. No.
7. No.

Pollutions—
No.

The Salmon Disease—
1. Very slightly; appeared first in March on the Helmsdale; at its height about middle of May; disappeared in July.

2. Very low.
3. Eighteen in all from Helmsdale and Brora; nearly all male kelts.
4. No.

The Spawning Season—
1. 12th October.
2. 20th October to 20th November.
3. End of November.
4. Very high all through the season.
5. More.
6. Helmsdale, Brora, Fleet (on East coast), Inver, Laxford, Inchard (on west coast), with their tributaries.

Kelts—
1. 13th March (East coast); 10th March (West Coast).
2. April.
3. End of May.
4. High.

Smolts—
1. 1st May.
2. Yes.

Artificial Propagation of Salmon—
There is one small hatchery on the Brora; one at Inchnadamph, Assynt; and one at Badcall, Scourie. Not now used for salmon hatching.

Proportion of Male to Female Salmon—
No reliable information.

General Question—
The close time for angling should begin about 15th October instead of 31st October, by which time many fish in most of the river have spawned.

SUTHERLAND, NORTH COAST DISTRICT.

Take of Fish—
1. (*a*), (*b*), (*c*) and (*d*) Below the average.
2. (*a*) and (*b*) Salmon, 1511; grilse, 7202; trout, 284; cannot separate; (*c*) about 800.
3. (*a*) February; (*b*) May; (*c*) May to September.
4. (*a*) and (*b*) Not known.
5. (*a*) 26 lbs.; (*b*) 37 lbs.; (*c*) 23 lbs.

Protection—
1 and 2. No assessment.
4. None.

Obstructions to the Passage of Fish—
1. None.
2. No cruives.
3. None.
4. None.
5. Yes.
6. None.
7. Nothing.

Pollutions—
No pollutions.

The Salmon Disease—
No disease.

The Spawning Season—
1. 27th October.
2. 1st November to 20th November.
3. 1st December.
4. High.
5. Above the average.
6. All the rivers within the district.

Kelts—
1. March.
2. March and April.
3. May.
4. Low.

Smolts—
1. 25th April.
2. Yes.

Artificial Propagation of Salmon—
Private hatchery at Sandside, near Eastern end of district ; about 200,000 annually.

Proportion of Male to Female Salmon—
More males than females.

THE DISTRICT OF THE RIVER KENNART.

Take of Fish—
1. (*b*) and (*c*) Above the average.
2. (*b*) 4500 ; (*c*) 43.
3. (*a*) 27th February ; (*b*) June.
5. (*b*) 30 lbs. ; (*c*) 19 lbs.

Obstructions to the Passage of Fish—
We have no artificial obstructions.

Pollutions—
Not aware of any.

The Salmon Disease—
No.

THE DISTRICT OF THE RIVER BALGAY.

Take of Fish—
1. About the usual average.
2. No.
3. Main take of salmon in May and June. Grilse and sea-trout ran in July.

Protection—

1. £40.
2. £31 contributed by two proprietors.
3. Two.
4. No ; one case of poaching where accused paid a voluntary fine to avoid a prosecution.

The Salmon Disease—

One large sea-trout at the mouth of the Kinloch River and taken out all over with *fungus.* (*River low, month of June.*) I have seen no diseased salmon this year.

The Spawning Season—

1. Sea-trout began spawning about the beginning of October, and salmon 20 days or so later.
2. The greater number spawned between the middle of October and the middle of November.
3. The spawning season finished about the middle of December.
5. The number of spawning fish was about the average.
6. The principal spawning streams are the Kinloch and Balgay.

Kelts—

2. Kelts were noticed migrating seawards in December.
4. River generally high.

Artificial Propagation of Salmon—

No.

THE DISTRICT OF THE RIVER LOCHY.

Take of Fish—

1. (*a*), (*b*), (*c*) and (*d*) Below the average.
2. (*a*) and (*b*) Nil ; (*c*) exact number not kept. The River Lochy is entirely let for angling.
3. (*a*) 30th March 1896 ; (*b*) June, July, and August ; (*c*) about the end of June.
4. (*a*) and (*b*) Nil.
5. (*a*) and (*b*) Nil ; (*c*) 33 lbs.

Protection—

1. £2093, 17s. 2d.
2. 1d. per £.
3. Fifteen.
4. None.

Obstructions to the Passage of Fish—

1. None.
2. None.
3. There are none.
4. No.
5. At all times.
6. No.
7. None.

Pollutions—

1. No.
2. None

The Salmon Disease—

1. No disease has shown itself.
4. In my opinion salmon disease is mainly if not entirely caused by river pollution.

The Spawning Season—
1. Last week in October in the tributaries of the River Lochy.
2. Last week in November and first week in December.
3. Last year the spawning finished about the end of December, and this is a fair average.
4. High.
5. Less.
6. The rivers Roy, Spean, Cour, Lochy, Loy, Nevis, Lundy, Arkaig, and Gloy.

Kelts—
1. Not known. Every flood in spring takes down great numbers of kelts.
2. Not known.
3. In the month of April.
4. High.

Smolts—
1. End of April.
2. Not very good.

Artificial Propagation of Salmon—
Yes. On the Spean.
About 100,000.

Proportion of Male to Female Salmon—
The average this season as regards the River Lochy was 2 females to 1 male as the result of actual enumeration.

General Question—
Yes. That the Saturday slap should begin at sunset on Friday night instead of Saturday, or at latest should begin with the commencement of the flood-tide on Saturday afternoon. Fish in this district approach the rivers with the flood-tide.

THE DISTRICT OF THE RIVER GIRVAN.

Take of Fish—
1. (*a*) None ; (*b*) average ; (*c*) above ; (*d*) above.
2. (*a*) About 6 salmon in one pool of the river ; (*b*) 300 salmon, 850 grilse, and 2260 trout ; (*c*) about a dozen salmon and grilse (sea trout not known).
3. (*a*) 1st April ; (*b*) August ; (*c*) about 15th June.
4. (*a*) and (*b*) Not known.
5. (*a*) Not known ; (*b*) 40 lbs. ; (*c*) 23 lbs.

Protection—
1. £524.
2. None.
3. None.
4. None.

Obstructions to the Passage of Fish—
1. None.
2. No cruives fished.
3. Yes.
4. No.
5. When in flood.
6. No.
7. None.

Pollutions—
1. No.
2. No.

The Salmon Disease—
1. Salmon disease has never yet appeared in the River Girvan.

The Spawning Season—
1. Latter end of December.

Smolts—
1. 1st May.
2. Average.

Artificial Propagation of Salmon—
No.

Proportion of Male to Female Salmon—
Not known.

General Question—
There being no bailiff many of the questions cannot be answered. The take of trout was unusually heavy last year.

THE DISTRICT OF THE RIVER STINCHAR.

Take of Fish—
1. (*a*), (*b*) and (*c*) About an average ; (*d*) average.
2. (*a*) and (*b*) no information ; (*c*) about 100.
3. (*a*) March ; (*b*) July and August ; (*c*) June, July, and August.
4. (*a*) and (*b*) No information, but the fishing tenants can supply this.
5. (*b*) 40 lbs ; (*c*) 38 lbs.

Protection—
1. None.
2. None.
3. None ; but the Earl of Stair has a private watcher for his own fishings
4. None.

Obstructions to the Passage of Fish—
1. None.
2. No cruives.
6. No natural obstructions.
7. Nothing done.

Pollutions—
1. No.
2. No.

The Salmon Disease—
No disease this year.

The Spawning Season—
1. 17th November.
2. End of December.
3. Middle of January.
4. Normal.
5. Good average.
6. Stinchar.

Kelts—
1. 1st March.
2. 14th March.
3. 2nd April.
4. Medium.

Smolts—
1. 1st April.
2. Yes.

Artificial Propagation of Salmon—
No.

Proportion of Male to Female Salmon—
Female salmon in excess of male. Based on estimate.

THE DISTRICT OF THE RIVER CREE.

Take of Fish—
1. (*a*), (*b*), (*c*) and (*d*) No special information, but it is believed the take has been a full average.
2. No.
3. No information.
4. No information.
5. No information.

Protection—
1. £671.
2. £89, 9s. 4d. being the assessment at 2s. 8d. per £.
3. Two.
4. No.

Obstructions to the Passage of Fish—
1. No changes.
2. There are no cruives in this district.
3. Yes.
4. No.
5. Yes.
6. No.

Pollutions—
1. No.
2. None required.

The Salmon Disease—
No disease.

The Spawning Season—
No information.

Kelts—
No information.

Smolts—
No information.

Artificial Propagation of Salmon—
No.

Proportion of Male to Female Salmon—
No.

General Question—
No.

THE DISTRICT OF THE RIVER DEE (KIRKCUDBRIGHT).

Take of Fish—
1. (*a*), (*b*), (*c*) and (*d*) Average.
2. No.
3. (*a*), (*b*) and (*c*) Same as last year.
4. (*a*) and (*b*) Cannot be ascertained.
5. (*a*), (*b*) and (*c*) Not known.

Protection—
1. £1603.
2. £5 per cent.
3. Sixteen.
4. No offences.

Obstructions to the Passage of Fish—
1. None.
2. No.
3. Yes.
4. None.
5. Yes.
7. No.

Pollutions—
1. None.
2. None.

The Salmon Disease—
No.

The Spawning Season—
1. 26th October 1896.
2. 1st and 30th November 1896, when finished.
5. More.
6. Barneywater, Black Water of Dee.

Kelts—
1. December.
2. January.
3. Not known.

Smolts—
1. As usual.
2. Good year.

Artificial Propagation of Salmon—
Yes ; Billies, near River Dee. Practically unlimited.

Proportion of Male to Female Salmon—
No.

THE DISTRICT OF THE RIVER NITH.

Take of Fish—
1. (*a*) Even better than last year ; (*b*) and (*c*) better than last year ; (*d*) better than last year, except rod fishing.
2. (*a*), (*b*) and (*c*) Cannot be given.
3. (*a*) In March ; (*b*) in July ; (*c*) grilse in July, and sea-trout in May and June.
4. (*a*) and (*b*) Cannot be got.
5. (*a*) 30 lbs. ; (*b*) 30 lbs. ; (*c*) 28 lbs.

Protection—
1. £815, 0s. 6d.
2. 2s. 6d. per £.
3. One man employed and paid by Board, and twenty-seven gamekeepers sworn as special watchers.
4. Eight prosecutions for contravention of the Solway Act :—4 persons each fined £1 or 7 days' imprisonment, and 4 persons admonished.

Obstructions to the Passage of Fish—
1. Caul on Cairn, at Cairnmill, in Keir and Penpont parishes. There is a question under consideration of the Board as to whether this caul, which has recently been reconstructed, does not obstruct the passage of fish more than formerly.
2. Been fished as usual.
3. The cruives are, but the dams are not. Nearly all the latter have neither passes, hecks, or sluices in accordance with Schedule.
4. No.
5. Yes, at the time fish are running after a flood ; but when rivers are low, the passes do not facilitate the passage of fish.
6. No.
7. No.

Pollutions—
1. No.
2. No.

The Salmon Disease—
1. Very little. It was only in March, and few were affected.
2. Low, when it was seen.
3. None taken.
4. No.

The Spawning Season—
1. In October.
2. In January, February, and March.
3. About end of March.
4. Fish only spawn after a flood, and not when river is low.
5. Less.
6. There are spawning streams all along its course.

Kelts—
1. March.
2. April.
3. In the beginning of June.
4. Kelts only go to the sea when river is rising to a flood, or at least rising.

Smolts—
1. April and May.
2. No.

Artificial Propagation of Salmon—
No. Armistead's private hatchery.

Proportion of Male to Female Salmon—
Cannot be given.

General Question—
No.

THE DISTRICT OF THE RIVER ANNAN.

Take of Fish—

1. (*a*) Salmon and trout a good average, grilse below average ; (*b*) good average in lower portion of river, not so good in upper portion ; (*c*) salmon and trout a good average, grilse below average ; (*d*) a good average.
2. (*a*), (*b*) and (*c*) The lessees of some of the different fishings, say they do not keep notes of number caught, therefore number cannot be given.
3. (*a*) 25th February first open day ; (*b*) in August ; (*c*) sea-trout commenced third week in March, main run middle of June, grilse commenced first week in June, main run second week in July.
4. (*a*) The run was earlier than last year, with exception of on Newbie fishings ; (*b*) no record is kept, therefore number caught in each month cannot be given.
5. (*a*) No net and coble fishing for salmon ; (*b*) 45 lbs. on poke-nets, Annan Burgh Fishings ; (*c*) 34½ lbs. on Mount Annan Water.

Protection—

1. £3181, 10s.
2. 3s. per £=£477, 4s. 6d.
3. Four. Twenty-eight gamekeepers sworn in as water bailiffs.
4. For offences in Annan division, ten persons were prosecuted, nine of whom were convicted, viz.:—Two for contravention Sec. 33 Annan Act. Fishing with net between high and low water-mark, without leave, fined £1, 17s. each or 14 days ; five fishing during weekly close time, one fined £1, 18s. or 14 days ; one fined £3, 13s. or 30 days ; two fined £2 or 14 days ; one fined £5, 15s. or 30 days ; one during annual close time fined £2, 19s. or 14 days ; one for rod-fishing without leave fined £3, 5s. 6d. or 30 days.

Obstructions to the Passage of Fish—

1. None destroyed, given up, or new ones built, with exception of Newbie Mill, on the Annan, which was burned and has not been repaired.
2. None in the district.
3. Yes, with the following exceptions, viz. :—On the Annan no heck at intake or tail of race at Annan Mill ; and no heck at tail of mill race at Brydekirk Mill. On the Kirtle there are three dams, viz. at Rigg, Beltenmount Mill, and Kirtlebridge, none of which have fish-passes or hecks and never had.
4. One new one at Brydekirk Caul.
5. It is not yet known exactly how the new pass at Brydekirk will answer, but notes are being taken, and report will be made when it is fairly tried.
6. No.
7. No change.

Pollutions—

1. No.
2. No. The Annan is almost free from pollution.

The Salmon Disease—

1. Yes. First appeared in end of November 1895 ; at its height beginning of February ; disappeared middle of March.
2. Low.
3. In November, one (a female kelt) ; December, five (four male, one female), all clean ; January, fifty-six (forty male, sixteen female), eleven clean, forty-five kelts ; February, 200 (ninety-nine male, 101 female), eighty-seven clean, 113 kelts ; March, two (female) kelts.
4. None.

The Spawning Season—
1. 25th November.
2. 1st to 16th January.
3. About middle of March.
4. Medium.
5. Below average.
6. Northfield, Mount Annan, Luce, Meinfoot, Hoddom Bridge, Mainholm, at Rotchell in the Annan.

Kelts—
1. First week in February.
2. During March.
3. About end of April.
4. Medium.

Smolts—
1. End of April, principally in May.
2. A good average.

Artificial Propagation of Salmon—
None.

Proportion of Male to Female Salmon—
This cannot be accurately given, as notes are not taken at all different fisheries.

General Question—
Seeing the Royal Commission appointed to inquire into the laws affecting the Solway Firth have recently issued their Report, I have nothing to suggest.

NOTE

ABSTRACT of Sums Raised and Expended by District

DISTRICT BOARDS OF RIVERS.	Precise Date to which Accounts are made up.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balance).				
			Assessments, 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	Total.	
		£	£	£	£	£	
Annan, ...	1881 15 May	1,391	278	74	.	352	1
Cree, ...	,, ,,	501	63	.	2	65	2
Dee (Solway), . .	,, ,,	1,175	88	.	.	88	3
Dee (Aberdeen) . .	30 July	9,857	542	2	.	544	4
Deveron, ...	1880 28 Aug.	2,354	302	.	.	302	5
Don, ...	1881 30 July	3,303	663	9	.	672	6
Esk (North), . .	1880 27 Aug.	6,385	447	.	.	447	7
Esk (South), . .	1881 31 Aug.	2,045	149	3	.	152	8
Findhorn, . . .	1880 – Sept.	4,055	210	2	.	212	9
Forth, ...	1881 15 May	3,793	357	6	6	369	10
Girvan, ...	,, ,,	574	58	1	.	59	11
Kyle of Sutherland, .	,, ,,	2,762	138	.	.	138	12
Lochy, ...	,, ,,	1,582	7	8	419	434	13
Ness, ...	,, ,,	3,075	461	.	.	461	14
Nith, ...	26 ,,	568	142	12	1	155	15
Spey, ...	1880 6 Oct.	10,563	880	.	.	880	16
Tay, ...	20 Aug.	21,698	1,410	90	8	1,508	17
Ugie, ...	9 ,,	322	33	.	.	33	18
Ythan, ...	31 Oct.	746	112	5	.	117	19
Tweed, ...	1881 30 June	13,477	20 & 21 Vict. c. 148 ; 22 & 23 Vict. c. 70 ; 27 Vict. c. 50. 2,695	(*a*) 272	6	2,973	20
	Total	90,226	9,035	484	442	9,961	21

II.

FISHERY BOARDS, during Year ended 15th May 1881.

	EXPENDITURE (Exclusive of Balances).			LOANS.		SINKING FUND.	
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Other Expenses.	TOTAL.	Outstanding at close of previous Year.	Outstanding at 15th May 1881.	Total Amount, if any, remaining Invested at the close of the Year.	NOTES. (Details of "Other Expenses.)
	£	£	£	£	£	£	
1	319	15	334	.	.	.	For Travelling Expenses, advertising, &c.
2	31	1	32	.	.	.	Incidental.
3	72	.	72	.	.	.	
4	539	57	596		.	.	Inquiry into Pollution of River, £31 ; Disbursements by Inspector and Bailiffs, £13 ; Prosecution of Poachers and Incidental Outlays, £13.
5	279	14	293	.	.	31	Prosecutions, £7 ; Incidental, £7.
6	430	60	490	.	.	.	Disbursements by Inspector, &c., and Incidental, £17 ; Law Expenses and Prosecutions, £43.
7	401	6	407	.	.	.	Prosecutions of Offenders, £5 ; Printing, £1.
8	140	14	154	.	.	.	Prosecutions.
9	205	4	209	.	.	.	Incidental.
10	412	42	454	.	.	.	Superintendent of Fisheries, £19 ; Fishing for Ova, £13 ; Sundries, £10.
11	15	4	19	.	.	.	Prosecutions.
12	144	2	146	.	.	.	Contingencies.
13	424	8	432	. .	.	.	Prosecutions.
14	272	23	295	383	184	.	Inspectors and Travelling Outlays and Incidental.
15	88	27	115	.	.	.	Prosecutions, £25 ; Inciden- £2.
16	874	3	877	.	.	82	Incidental.
17	1,228	392	1,520	.	.	.	Prosecutions, £187 ; Propagation Pond Expenses, £99 ; Miscellaneons, £6.
18	31	2	33	.	.	.	Incidental.
19	109	7	116	.	.	.	Travelling, £1 ; Law Expenses, £2 ; Printing, £1 ; Interest, £3.
20	2,383	(*b*) 634	3,017	.	.	.	(*a*) The expense of Prosecutions was £545, being a loss to the Commission of £273. (*b*) Prosecutions, £545 ; Rents, £16 ; Stationery Printing, &c., £ 39 Experiments, £1 1 ; Miscellaneous, £23.
21	8,396	1,215	9,611	383	184	113	

NOTE 11. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Precise Date to which Accounts are made up.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balances).				
			Assessments, 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	1882.	£	£	£	£	£	
Annan, ...	15 May	1,719	344	.	.	344	1
Cree, ...	,, ,,	522	65	.	23	88	2
Dee (Solway), . .	27 Aug.	1,195	60	.	.	60	3
Dee (Aberdeen), . .	15 May	9,556	669	28	.	697	4
Deveron, ...	28 Aug.	2,575	300	5	.	305	5
Don, ...	15 May	3,025	529	20	.	549	6
Esk (North), . . .	25 Aug	5,942	386	3	.	389	7
Esk (South), . . .	1 Sept.	2,200	154	3	.	157	8
Findhorn, ...	,, ,,	3,493	250	.	.	250	9
Forth, ...	15 May	3,862	386	.	1	387	10
Girvan, ...	12 June	571	57	18	.	75	11
Kyle of Sutherland, .	15 May	2,828	141	.	.	141	12
Lochy, ...	,, ,,	1,484	6	1	158	165	13
Ness, ...	,, ,,	3,198	320	13	.	333	14
Nith, ...	,, ,,	478	119	5	1	125	15
Spey, ...	1881. 4 Oct.	9,724	866	4	.	870	16
Tay, ...	1882. 20 Aug.	19,630	1,273	105	12	1,390	17
Ugie, ...	1881. 9 Aug.	343	25	3	.	28	18
Ythan, ...	25 July	746	92	.	.	92	19
			20 & 21 Vict. c. 48; 22 & 23 Vict. c. 70; 27 Vict. c. 50.				
Tweed, ...	1882. 30 June	13,563	2,713	130	11	2,854	20
	TOTAL,	86,654	8,755	338	206	9,299	21

by District Fishery Boards, during Year ended 15th May 1882.

	EXPENDITURE (Exclusive of Balances).				LOANS.				SINKING FUND.	
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Debt.	Other Expenses.	Total.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount, if any, remaining Invested at the close of the Year.	NOTES.
	£	£	£	£	£	£	£	£	£	
1	297	(*a*) 12	.	309	.	.	.	.	.	(*a*) To bank.
2	58	.	37	95	.	.	.	.	.	
3	66	.	.	66	.	.	.	.	.	
4	625	.	43	668	.	.	.	.	.	
5	315	.	36	351	.	.	.	.	.	
6	527	.	67	594	.	.	.		.	
7	440	.	16	456	.	.	.		.	
8	155	.	.	155	.	.			.	
9	231	.	10	241	.				.	
10	428	.	38	466	.		.	.	.	
11	15	.	2	17	.		.	.		
12	144	.	2	146	.			.	.	
13	164	.	3	167	.	.	.	.	.	
14	276	16	21	313	184	7	.	191	.	
15	107	.	3	110	.	.	.	.	.	
16	854	.	5	859	.	.	.	.		
17	1,159	.	285	1,444	.	.	.	.		
18	26	.	2	28	.	.	.	.		
19	88	.	4	92	.	.		.	.	
20	2,313	.	368	2,681	.	.	.	.	.	
21	8,288	28	942	9,258	184	7	.	191	.	

NOTE II. (*continued*).—ABSTRACT OF SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Precise Date to which Accounts are made up.	Rateable Value of Fisheries	RECEIPTS (Exclusive of Balances).				
			Assessments, 25 & 26 Vict c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
		£	£	£	£	£	
Annan, ...	1882 31 Dec.	1,720	688	25	20	733	1
Cree, ...	1883 15 May	532	27	9	10	46	2
Dee (Solway), . .	,, ,,	1,200	60	.	.	60	3
Dee (Aberdeen), . .	,, ,,	9,931	597	16	11	624	4
Deveron, . . .	28 Aug.	2,569	302	1	.	303	5
Don, ...	15 May	3,016	480	23	9	512	6
Esk (North), . . .	24 Aug.	5,624	478	5	.	483	7
Esk (South), . . .	31 ,,	2,475	186	.	.	186	8
Findhorn, . . .	– Sept.	3,493	320	.	.	320	9
Forth, ...	15 May	3,896	390	4	18	412	10
Girvan, ...	,, ,,	571	.	18	.	18	11
Kyle of Sutherland, .	,, ,,	2,388	119	.	.	119	12
Lochy, ...	1 Oct.	1,873	7	406	.	413	13
Ness, ...	15 May	3,238	405	.	.	405	14
Nith, ...	15 ,,	499	125	1	.	126	15
Spey, ...	1882 9 Oct.	8,654	865	.	.	865	16
Tay, ...	1883 20 Aug.	19,223	1,346	78	11	1,435	17
Ugie, ...	9 ,,	339	25	.	.	25	18
Ythan, ...	1882 31 Oct.	790	151	1	.	152	19
Tweed, ...	1883 30 June	13,745	2,749	170	14	2,933	20
	TOTAL	85,776	9,320	757	93	10,170	21

by District Fishery Boards, during Year ended 15th May 1883.

	EXPENDITURE (Exclusive of Balances).				LOANS.				SINKING FUND.	
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	Total.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount, if any, remaining Invested at the close of the Year.	NOTES.
	£	£	£	£	£	£	£	£	£	
1	420	17	7	444	.	.	.	.	.	
2	51	.	2	53	.	.	.	.	.	
3	62	.	.	62	.	.	.	.	.	
4	612	.	53	665	.	.	.	.	.	
5	290	.	11	301	.	.	.	.	.	
6	510	.	61	571	.	.	.	.	.	
7	389	.	16	405	.	.	.	.	.	
8	165	.	24	189	.	.	.	.	.	
9	280	.	15	295	.	.	.	.	.	
10	418	.	15	433	.	.	.	.	.	
11	15	.	1	16	.	.	.	.	.	
12	87	.	7	94	.	.	.	.	.	
13	411	.	2	413	.	.	.	.		
14	273	15	29	317	191	.	35	156		
15	82	.	9	91	.	.	.	.		
16	903	.	6	909	.	.	.	.	.	
17	993	.	560	1,553	.	.	.	.	.	
18	21	.	2	23	.	.	.	.	.	
19	143	.	10	153	.	.	.	.	.	
20	2,337	.	613	2,950	.	.	.	.	.	
21	8,462	32	1,443	9,937	191	.	35	156	.	

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Precise Date to which Accounts are made up.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balances).				
			Assessments 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	1884		£	£	£	£	
Annan, ...	15 May	1,864	373	18	.	391	1
Cree, ...	,, ,,	530	27		10	37	2
Dee (Solway), . .	27 Aug.	1,200	60	1	.	61	3
Dee (Aberdeen), . .	31 July	10,504	630	4	.	634	4
Deveron, . . .	15 May	2,549	303	6	.	309	5
Don, ...	31 July	3,499	595	24		619	6
Esk (North), . . .	25 Aug.	6,349	413	6		419	7
Esk (South), . . .	31 ,,	2,546	178	2	.	180	8
Findhorn, . . .	15 Sept.	3,501	320	.	.	320	9
Forth, ...	15 May	3,862	386	.	.	386	10
Girvan, ...	,, ,,	571	.	73	.	73	11
Kyle of Sutherland, .	,, ,,	2,280	114	.	1	115	12
Lochy	,, ,,	1,677	7	.	405	412	13
Ness, ...	,, ,,	2,924	327	2	8	337	14
Nith, ...	,, ,,	505	126	8	.	134	15
Spey, ...	,, ,,	8,454	881	.	.	881	16
Tay, ...	20 Aug.	17,773	1,244	62	7	1,313	17
Ugie, ...	9 ,,	339	28	.	.	28	18
Ythan, ...	31 July	726	99	.	.	99	19
Tweed, ...	30 June	13,658	2,725	170	11	2,906	20
	TOTAL	85,311	8,836	376	442	9,654	21

by District Fishery Boards, during Year ended 15th May 1884.

	EXPENDITURE (Exclusive of Balances).				LOANS.				Sinking Fund.	NOTES.
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	Total.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount, if any, remaining Invested at the close of the Year.	
	£	£	£	£	£	£	£	£	£	
1	322	10	172	504	.	.	.	.	.	
2	27	.	2	29	.	.	.	.	.	
3	64	.	.	64	.	.	.	.	.	
4	599	.	81	680	.	.	.	.	.	
5	301	.	13	314	.	.	.	.	.	
6	470	.	103	573	.	.	.	.	.	
7	382	.	1	383	.	.	.	.	.	
8	176	.	3	179	.	.	.	.	.	
9	324	2	6	332	.	.	.	.	.	
10	414	.	18	432	.	.	.	.	.	
11	20	.	.	20	.	.	.	.	.	
12	173	.	6	179	.	.	.	.	.	
13	410	.	.	410	.	.	.	.	.	
14	276	12	30	318	156	.	21	135	.	
15	83	.	64	147	.	.	.	.	.	
16	873	.	3	876	.	.	.	.		
17	1,064	.	372	1,436	.	.	.	.		
18	26	.	2	28	.	.	.	.	.	
19	91	.	8	99	.	.	.	.	.	
20	2,386	.	386	2,772	.	.	.	.	.	
21	8,481	24	1,270	9,775	156	.	21	135	.	

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Precise Date to which Accounts are made up.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balances). Assessments, 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	1885.	£	£	£	£	£	
Annan, ...	15 May	1,933	387	76	.	463	1
Cree, ...	,, ,,	645	32	.	.	32	2
Dee (Solway), . .	27 Aug.	1,235	64	.	.	64	3
Dee (Aberdeen), . .	26 ,,	10,791	755	13	.	768	4
Deveron, . . .	28 ,,	2,340	302	.	.	302	5
Don, ...	26 ,,	3,395	611	7	.	618	6
Esk (North), . . .	,, ,,	6,757	338	.	.	338	7
Esk (South, . . .	31 Aug.	2,889	202	6	.	208	8
Findhorn, . . .	15 Sept.	3,546	354	.	.	354	9
Forth, ...	15 May	3,931	393	.	2	395	10
Girvan, ...	,, ,,	571	.	.	.	.	11
Kyle of Sutherland, .	,, ,,	2,222	157	.	.	157	12
Lochy, ...	,, ,,	1,677	7	.	243	250	13
Ness, ...	,, ,,	3,030	471	.	3	474	14
Nith, ...	,, ,,	553	160	.	.	160	15
Spey, ...	8 Oct.	8,430	913	1	.	914	16
Tay, ...	20 Aug.	19,656	1,572	95	39	1,706	17
Ugie, ...	9 ,,	334	28	.	.	28	18
Ythan, ...	31 Oct.	726	146	2	.	148	19
Tweed, ...	30 June	13,557	2,711	215	17	2,943	20
	TOTAL,	88,218	9,603	415	304	10,322	21

by District Fishery Boards, during Year ended 15th May 1885.

	EXPENDITURE (Exclusive of Balances).				LOANS.				Sinking Fund.	
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	Total.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount, if any, remaining Invested at the close of the Year.	NOTES.
	£	£	£	£	£	£	£	£	£	
1	322	15	246	583	.	.	.	.	.	
2	41	.	.	41	.	.	.	.	.	
3	63	.	1	64	.	.	.	.	.	
4	694	.	138	832	.	.	.	.	.	
5	277	4	6	287	.	.	.	.	.	
6	490	.	148	638	.	.	.	.	.	
7	348	.	7	355	.	.	.	.	.	
8	180	.	9	189	.	.	.	.	.	
9	333	.	10	343	.	.	.	.	.	
10	392	.	12	404	.	.	.	.	.	
11	18	.	.	18	.	.	.	.	.	
12	144	.	12	156	.	.	.	.	.	
13	250	.	.	250	.	.	.	.	.	
14	277	7	25	309	135	.	135	.	.	
15	91	.	50	141	.	.	.	.	.	
16	874	.	9	883	.		.	.	.	
17	1,000	.	635	1,635	.	.	.	.	.	
18	26	.	2	28	.	.	.	.	.	
19	134	.	14	148		.	.	.	.	
20	2,460	.	390	2,850	.	.	.	.	.	These figures are for 15 months, viz., from 31st July 1884 to 31st Oct. 1885.
21	8,414	26	1,714	10,154	135	.	135	.		

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and expended

DISTRICT BOARDS OF RIVERS.	Precise Date to which Accounts are made up.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balances).				
			Assessments, 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	1886.	£	£	£	£	£	
Annan, ...	15 May	1,998	399	52	.	451	1
Cree, ...	,, ,,	530	40	.	12	52	2
Dee (Solway), . .	1 Oct.	1,565	78	.	.	78	3
Dee (Aberdeen), . .	26 ,,	10,805	864	11	.	875	4
Deveron, ...	28 ,,	1,790	300	5	.	305	5
Don, ...	26 ,,	3,588	718	14	.	732	6
Esk (North), ...	,, ,,	7,216	361	3	.	364	7
Esk (South), . . .	31 ,,	2,934	205	8	.	213	8
Findhorn, . . .	15 Sept.	3,546	350	.	.	350	9
Forth, ...	15 May	4,240	424	9	1	434	10
Girvan, ...	,, ,,	571	.	.	.	.	11
Kyle of Sutherland, .	,, ,,	2,545	191	.	.	191	12
Lochy, ...	,, ,,	1,682	7	.	645	652	13
Ness, ...	,, ,,	3,225	346	1	.	347	14
Nith, ...	,, ,,	534	134	11	.	145	15
Spey, ...	8 Oct.	9,483	889	4	.	893	16
Tay	20 Aug.	20,447	1,534	70	4	1,608	17
Ugie, ...	9 ,,	301	26	.	.	26	18
Ythan, ...	31 Oct.	726	136	1	.	137	19
Tweed, ...	30 June	13,681	2,736	235	24	2,995	20
	TOTAL,	91,407	9,738	424	686	10,848	21

by DISTRICT FISHERY BOARDS, during Year ended 15th May 1886.

	EXPENDITURE (Exclusive of Balances).				LOANS.				SINKING FUND.	
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	TOTAL.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount, if any, remaining Invested at the close of the Year.	NOTES.
	£	£	£	£	£	£	£	£	£	
1	360	20	226	606	.	.	.	.	.	
2	44	.	.	44	.	.	.	.	.	
3	68	.	.	68	.	.	.	.	.	
4	650	.	75	725	.	.	.	.	.	
5	318	5	32	355	.	.	.	.	.	
6	497	.	301	798	.	.	.	.	.	
7	362	.	21	383	.	.	.	.	.	
8	223	.	65	288	.	.	.	.	.	
9	326	.	4	330	.	.	.	.	.	
10	418	.	14	432	.	.	.	.	.	
11	18	.	.	18	.	.	.	.	.	
12	146	.	.	146	.	.	.	.	.	
13	652	.	.	652	.	.	.	.	.	
14	282	3	24	309	.	.	.	.	.	
15	72	.	4	76	.	.	.	.	.	
16	915	.	2	917	.	.	.	.	.	
17	1,125	.	711	1,836	.	.	.	.	.	
18	26	.	1	27	.	.	.	.	.	
19	129	.	8	137	.	.	.	.	.	
20	2,513	.	456	2,969	.	.	.	.	.	
21	9,144	28	1,944	11,116	.	.	.	.	.	

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Precise Date to which Accounts are made up.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balances).				
			Assessments, 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	1887	£	£	£	£	£	
Annan, ...	31 Dec.	1,993	399	25	.	424	1
Cree, ...	15 ,,	540	40	.	10	50	2
Dee (Solway), . .	1 Oct.	1,615	69	.	.	69	3
Dee (Aberdeen), . .	26 ,,	11,220	785	5	.	790	4
Deveron, ...	28 Aug.	1,834	302	10	.	312	5
Don, ...	26 ,,	3,703	741	42	.	783	6
Esk (North), . . .	19 ,,	6,400	354	13	.	367	7
Esk (South), . . .	31 ,,	3,104	248	6	.	254	8
Findhorn, . . .	15 Sept.	3,661	330	.	.	330	9
Forth, ...	15 May	4,382	438	15	1	454	10
Girvan, ...	,, ,,	542	81	.	.	81	11
Kyle of Sutherland, .	,, ,,	2,558	149	.	.	149	12
Lochy, ...	,, ,,	1,749	7	4	648	659	13
Ness, ...	,, ,,	3,239	320	.	.	320	14
Nith, ...	,, ,,	515	129	13	.	142	15
Spey, ...	8 Oct.	9,559	916	7	.	923	16
Tay, ...	20 Aug.	22,542	1,691	95	93	1,879	17
Ugie, ...	9 ,,	290	17	21	.	38	18
Ythan, ...	25 July	816	125	3	.	128	19
Tweed, ...	30 June	14,382	2,876	251	19	3,146	20
	TOTAL,	94,644	10,017	510	771	11,298	21

by DISTRICT FISHERY BOARDS, during Year ended 15th May 1887.

	EXPENDITURE (Exclusive of Balances).				LOANS.				SINKING FUND.	NOTES.
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	TOTAL.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount, if any, remaining Invested at the close of the Year.	
	£	£	£	£	£	£	£	£	£	
1	349	.	84	433	.	.	.	.	.	
2	45		1	46	.	.	.	.	.	
3	80	.	.	80	.	.	.	.	.	
4	729	.	136	865	.	.	.	.	.	
5	273	3	11	287	.	.	.	.	.	
6	535	.	219	754	.	.	.	.	.	
7	337	.	48	385	.	.	.	.	.	
8	243	.	16	259	.	.	.	.	.	
9	317	.	10	327	.	.	.	.	.	
10	445	.	55	500	.	.	.	.	.	
11	15	.	.	15	.	.	.	.	.	
12	142	.	6	148	.	.	.	.	.	
13	659	.	.	659	.	.	.	.	.	
14	273	2	25	300	.	.	.	.	.	
15	100	.	43	143	.	.	.	.	.	
16	942	.	9	951	.	.	.	.	.	
17	1,137	.	384	1,521	.	.	.	.	.	
18	26	.	12	38	.	.	.	.	.	
19	113	8	7	128	.	.	.	.	.	
20	2,500	.	833	3,333	.	.	.	.	.	
21	9,260	13	1,899	11,172	.	.	.	.	.	

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balances).				
		Assessments, 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	£	£	£	£	£	
Annan, ...	2,007	272	81	4	357	1
Cree, ...	530	40	.	10	50	2
Dee (Solway), ...	1,517	76	.	.	76	3
Dee (Aberdeen), ...	12,532	1,002	41	.	1,043	4
Deveron, ...	1,865	301	7	.	308	5
Don, ...	3,908	860	6	.	866	6
Esk (North), ...	6,419	353	2	.	355	7
Esk (South), ...	3,124	312	2	.	314	8
Findhorn, ...	3,551	318	.	.	318	9
Forth, ...	4,241	424	19	1	444	10
Girvan, ...	542	.	.	.	.	11
Kyle of Sutherland, . . .	2,585	151	.	.	151	12
Lochy, ...	1,628	7	3	(*a*)672	682	13
Ness, ...	3,291	295	.	.	295	14
Nith, ...	447	(*b*)112	4	.	116	15
Spey, ...	10,663	978	32	.	1,010	16
Tay, ...	22,103	1,437	135	12	1,584	17
Tweed, ...	14,199	2,840	173	23	3,036	18
Ugie, ...	284	31	10	.	41	19
Ythan, ...	876	164	14	.	178	20
TOTAL, . .	96,312	9,973	529	722	11,224	21

by District Fishery Boards, during Year ended 15th May 1888.

	EXPENDITURE (Exclusive of Balances).				LOANS.				SINKING FUND.	
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	Total.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount remaining Invested at the close of the Year.	NOTES.
	£	£	£	£	£	£	£	£	£	
1	45	.	181	526	.	.	.	.	.	
2	47	.	2	49	.	.	.	.	.	
3	66	.	.	66	.	.	.	.	.	
4	923	.	110	1,033	.	323	107	216	.	
5	276	4	9	289	.	.	.	.	.	
6	627	.	117	744	.	100	34	66	.	
7	356	.	14	370	.	.	.	.	.	
8	215	.	108	323	.	.	.	.	.	
9	322	.	7	329	.	.	.	.	.	
10	421	.	52	473	.	.	.	.	.	
11	15	.	.	15	.	.	.	.	.	
12	142	.	9	151	.	.	.	.	.	
13	682	.	.	682	.	.	.	.	.	(*a*) Contributed by Lord Abinger.
14	274	1	24	299	.	.	.	.	.	
15	83	.	38	121	.	.	.	.	.	(*b*) Two proprietors instead of paying assessment provide two water-bailiffs—not appearing in Return.
16	988	.	7	995	.	.	.	.	.	
17	1,081	.	570	1,651	.	.	.	.	.	
18	2,752	.	358	3,110	.	.	.	.	.	
19	25	.	16	41	.	.	.	.	.	
20	149	7	22	178	.	.	.	.	.	
21	9,789	12	1,644	11,445	.	423	141	282	.	

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balances).				
		Assessments, 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	£	£	£	£	£	
Annan,	2,007	551	59	.	610	1
Cree,	530	40	.	8	48	2
Dee (Solway),	1,517	75	.	.	75	3
Dee (Aberdeen),	12,036	1,204	18	.	1,222	4
Deveron,	1,748	271	1	.	272	5
Don,	929	864	12	.	876	6
Esk (North),	6,608	380	8	1	389	7
Esk (South),	3,104	312	2	.	314	8
Findhorn,	3,551	307	.	.	307	9
Forth,	4,187	414	7	.	421	10
Girvan,	542	.	.	.	.	11
Kyle of Sutherland,	2,610	152	1	.	153	12
Lochy,	1,866	8	4	(*a*) 678	690	13
Ness,	3,185	303	12	.	315	14
Nith,	402	(*b*) 100	.	.	100	15
Spey,	10,663	977	32	.	1,009	16
Tay,	19,701	1,379	106	162	1,647	17
Tweed,	14,254	(*c*) 2,842	184	12	3,038	18
Ugie,	351	29	2	.	31	19
Ythan,	876	138	18	.	156	20
TOTAL,	93,667	10,346	466	861	11,673	21

by District Fishery Boards, during Year ended 15th May 1889.

	EXPENDITURE (Exclusive of Balances).				LOANS.				SINKING FUND.	
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	Total.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount remaining Invested at the close of the Year.	NOTES.
	£	£	£	£	£	£	£	£	£	
1	342	.	333	675	.	.	.	.	.	
2	47	.	.	47	.	.	.	.	.	
3	69	.	.	69	.	.	.	.	.	
4	846	9	231	1,086	216	.	106	110	.	
5	260	1	26	287	.	.	.	.	.	
6	584	3	159	746	66	.	35	31	.	
7	350	.	25	375	.	.	.	.	.	
8	192	.	14	206	.	.	.	.	.	
9	327	.	.	327	.	.	.	.	.	
10	423	.	25	448	.	.	.	.	.	
11	15	.	.	15	.	.	.	.	.	
12	143	.	3	146	.	.	.	.	.	
13	690	.	.	690	.	.	.	.	.	(*a*) Contributed by Lord Abinger.
14	281	1	35	317	.	.	.	.	.	
15	87	.	10	97	.	.	.	.	.	(*b*) Two proprietors, instead of paying assessment, provide three water bailiffs: their cost does not appear in Return.
16	1,055	.	8	1,063	.	.	.	.	.	
17	1,025	.	417	1,442	.	.	.	.	.	
18	2,739	.	686	3,425	.	.	.	.	.	(*c*) Under Acts 20 & 21 Vict. c. 148, and 22 & 23 Vict. c. 70.
19	25	.	6	31	.	.	.	.	.	
20	139	3	13	155	.	.	.	.	.	
21	9,639	17	1,991	11,647	282	.	141	141	.	

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARD OF RIVERS.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balances).				
		Assessments, 25 & 26 Vict. c. 57.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	£	£	£	£	£	
Annan, ...	2,107	737	28	.	765	1
Awe, ...	701	.	4	.	4	2
Balgay, ...	40	50	.	.	50	3
Bervie, ...	585	73	3	20	96	4
Conon, ...	2,624	196	.	.	196	5
Cree, ...	530	40	.	8	48	6
Dee (Aberdeen), ...	12,274	1,105	8	5	1,118	7
Dee (Solway), ...	1,627	76	.	20	96	8
Deveron, ...	1,800	270	.	.	270	9
Don, ...	3,905	703	18	2	723	10
Esk (North), ...	6,725	370	.	1	371	11
Esk (South), ...	3,012	211	1	1	213	12
Findhorn, ...	3,551	320	.	.	320	13
Forth, ...	4,257	426	4	.	430	14
Girvan, ...	542	.	.	.	.	15
Kyle of Sutherland, . . .	2,693	146	.	.	146	16
Lochy, ...	1,674	7	.	(*a*)707	714	17
Nairn, ...	1,542	99	.	.	99	18
Ness, ...	3,079	321	.	.	321	19
Nith, ...	423	(*b*)106	33	.	139	20
Spey, ...	10,669	978	2	.	980	21
Tay, ...	17,731	1,507	14	5	1,526	22
Tweed, ...	14,278	(*c*)2,855	102	13	2,970	23
Ugie, ...	348	29	.	.	29	24
Urr, ...	.	(*d*) .	.	.	.	52
Ythan, ...	876	115	2	.	117	26
TOTAL, . .	97,593	10,740	219	782	11,741	27

by District Fishery Boards during Year ended 15th May 1890.

	EXPENDITURE (Exclusive of Balances).				LOANS.				SINKING FUND.	NOTES.
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	Total.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount remaining Invested at the close of the Year.	
	£	£	£	£	£	£	£	£	£	
1	325	.	52	377	.	.	.	.	.	
2	63	.	.	63	.	.	.	.	.	
3	25	.	25	50	.	.	.	.	.	
4	89	.	.	89	.	.	.	.	.	
5	153	.	51	204	.	.	.	.	.	
6	54	.	.	54	.	.	.	.	.	
7	792	5	187	984	107	.	107	.		
8	76	.	.	76	.	.	.	.	.	
9	289	.	.	289	.	.	.	.	.	
10	546	2	118	666	34	.	34	.	.	
11	354	.	5	359	.	.	.	.	.	
12	192	.	18	210	.	.	.	.	.	
13	322	.	4	326	.	.	.	.	.	
14	402	.	32	434	.	.	.	.	.	
15	15	.	.	15	.	.	.	.	.	
16	144	.	.	144	.	.	.	.	.	
17	711	.	.	711	.	.	.	.	.	(*a*) Contributed by Lord Abinger.
18	73	.	5	78	.	.	.	.	.	
19	296	1	43	340	.	.	.	.	.	
20	87	.	19	106	.	.	.	.	.	(*b*) Two proprietors, instead of paying assessment, provide three water bailiffs; their cost does not appear in Return.
21	918	.	7	925	.	.	.	.	.	
22	972	.	866	1,838	.	.	.	.	.	
23	2,773	.	300	3,073	.	.	.	.	.	(*c*) Under Acts 20 & 21 Vict. c. 148, 22 & 23 Vict. c. 70.
24	25	.	4	29	.	.	.	.	.	
25	.	.	.	.	.	.		.	.	(*d*) No receipt or expenditure.
26	108	2	7	117	.	.	.	.	.	
27	9,804	10	1,743	11,557	141	.	141	.	.	

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balance).				
		Assessments, 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	£	£	£	£	£	
Annan,	2,112	533	96	2	631	1
Awe,	701	96	.	.	96	2
Balgay,	40	41	.	.	41	3
Bervie,	586	88	1	20	109	4
Conon,	2,560	181	.	.	181	5
Cree,	530	40	.	8	48	6
Dee (Aberdeen),	11,968	957	35	.	992	7
Dee (Solway),	1,463	73	.	.	73	8
Deveron,	2,047	307	.	.	307	9
Don,	3,646	656	4	.	660	10
Esk (North),	6,476	356	7	1	364	11
Esk (South),	3,012	211	3	.	214	12
Findhorn,	3,541	320	.	.	320	13
Forth,	3,890	389	4	.	393	14
Girvan,	542	54	5	.	59	15
Kyle of Sutherland,	2,640	154	.	.	154	16
Lochy,	1,895	8	.	(*b*) 753	761	17
Nairn,	1,543	109	.	.	109	18
Ness,	3,366	323	.	.	323	19
Nith,	443	(*c*) 102	5	1	108	20
Spey,	9,669	926	1	.	927	21
Sutherland, Northern District,	1,315	110	.	.	110	22
Tay,	17,820	1,515	38	5	1,558	23
Torridon,	40	8	.	.	8	24
Tweed,	14,414	2,883	92	9	2,984	25
Ugie,	358	76	7	.	83	26
Urr,	.	.	.	.	.	27
Ythan,	931	178	7	.	185	28
Total,	97,548	10,694	305	799	11,798	29

by District Fishery Boards, during Year ended 15th May 1891.

	EXPENDITURE (Exclusive of Balances).				LOANS.				SINKING FUND.	NOTES.
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	Total.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total amount remaining Invested at the close of the Year.	
	£	£	£	£	£	£	£	£	£	
1	320	.	180	500	240	.	130	110	.	
2	70	.	.	70	.	.	.	.	.	
3	41	.	.	41	.	.	.	.	.	
4	101	.	2	103	.	.	.	.	.	
5	136	.	41	177	.	.	.	.	.	
6	53	.	.	53	.	.	.	.	.	
7	848	.	118	966	.	.	.	.	.	
8	76	.	1	77	.	.	.	.	.	
9	280	2	8	290	.	.	.	.	.	
10	600	.	(*a*)210	810	.	.	.	.	.	(*a*) Includes alterations on dam, dyke, and pass, £106.
11	363	.	30	393	.	.	.	.	.	
12	209	.	31	240	.	.	.	.	.	
13	321	1	5	327	.	.	.	.	.	
14	423	.	17	440	.	.	.	.	.	
15	5	.	14	19	.	.	.	.	.	
16	116	.	9	125	.	.	.	.	.	
17	761	.	.	761	.	.	.	.	.	(*b*) Contributed by Lord Abinger.
18	73	.	4	77	.	.	.	.	.	
19	290	2	49	341	.	.	.	.	.	
20	98	.	16	114	.	.	.	.	.	(*c*) Two proprietors, instead of paying assessment, provide three water bailiffs; their cost does not appear in Return.
21	913	2	23	938	.	.	.	.	.	
22	98	.	12	110	.	.	.	.	.	
23	951	.	(*d*)461	1,412	.	.	.	.	.	(*d*) Includes prosecutions, £290; steam launch furnishings, £47; upkeep of hatcheries, £36.
24	8	.	.	8	.	.	.	.	.	
25	2,725	.	(*e*)315	3,040	.	.	.	.	.	(*e*) Includes prosecutions, £215.
26	25	.	58	83	.	.	.	.	.	
27	.	.	.	.	.	.	.	.	.	
28	161	6	18	185	.	.	.	.	.	
29	10,065	13	1,622	11,700	240	.	130	110	.	

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Rateable Value of Fisheries.	RECEIPTS (Exclusive of Balances).				
		Assessments, 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	£	£	£	£	£	
Annan, ...	2,099	524	83	19	617	1
Awe, . . , ...	718	99	11	.	110	2
Balgay, ...	40	41	.	.	41	3
Bervie, ...	586	88	1	20	109	4
Conon, ...	2,756	195	5	2	202	5
Cree, ...	530	40	.	8	48	6
Dee (Aberdeen), ...	12,336	863	25	.	888	7
Dee (Solway), ...	1,463	73	3	.	76	8
Deveron, ...	2,071	285	.	.	285	9
Don, ...	3,623	725	7	.	732	10
Esk (North), ...	6,519	375	.	2	377	11
Esk (South), ...	3,012	226	8	.	234	12
Findhorn, ...	3,501	316	.	.	316	13
Forth, ...	3,704	463	.	.	463	14
Girvan, ...	542	.	4	.	4	15
Kyle of Sutherland, . . .	2,665	355	.	.	355	16
Lochy, ...	1,961	8	.	756	764	17
Nairn, ...	1,343	70	.	.	70	18
Ness, ...	3,254	325	36	.	361	19
Nith, ...	423	(*a*)112	37	1	150	20
Spey, ...	9,687	1,009	5	2	1,016	21
Sutherland, Northern District, .	1,315	133	.	.	133	22
Tay, ...	17,227	1,206	31	8	1,245	23
Torridon, ...	40	8	.	.	8	24
Tweed, ...	14,746	2,904	101	2	3,007	25
Ugie, ...	358	27	.	.	27	26
Urr, ...	.	.	.	.	.	27
Ythan, ...	1,004	141	8	.	149	28
TOTAL, . .	97,523	10,611	365	811	11,787	29

by DISTRICT FISHERY BOARDS, during Year ended 15th May 1892.

	EXPENDITURE (Exclusive of Balances).				LOANS.				SINKING FUND.	NOTES.
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	TOTAL.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount remaining Invested at the close of the Year.	
	£	£	£	£	£	£	£	£	£	
1	304	.	119	423	110	.	110	.	.	
2	70	.	7	77	.	.	.	.	.	
3	41	.	.	41	.	.	.	.	.	
4	99	.	4	103	.	.	.	.	.	
5	124	.	23	147	.	.	.	.	.	
6	53	.	.	53	.	.	.	.	.	
7	845	.	151	996	.	.	.	.	.	
8	67	.	.	67	.	.	.	.	.	
9	278	.	13	291	.	.	.	.	.	
10	588	.	90	678	.	.	.	.	.	
11	362	.	21	383	.	.	.	.	.	
12	209	.	48	257	.	.	.	.	.	
13	313	1	3	317	.	.	.	.	.	
14	440	.	83	523	.	.	.	.	.	
15	5	.	2	7	.	.	.	.	.	
16	288	3	73	364	.	.	.	.	.	
17	763	.	.	763	.	.	.	.	.	
18	74	.	6	80	.	.	.	.	.	
19	305	1	59	365	.	.	.	.	.	
20	76	.	34	110	.	.	.	.	.	(*a*) Two proprietors, instead of paying assessment, provide three water bailiffs; their cost does not appear in Return.
21	932	.	17	949	.	.	.	.	.	
22	123	.	10	133	.	.	.	.	.	
23	889	.	366	1,255	.	.	.	.	.	
24	8	.	.	8	.	.	.	.	.	
25	2,753		287	3,040	.	.	.	.		
26	25	1	1	27	.	.	.	.	.	
27	.	.	.	.	.	.	.	.	.	
28	137	4	7	148	.	.	.	.	.	
29	10,171	10	1,424	11,605	110	.	110	.	.	

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Rateable Value of Fisheries.	RECEIPTS (exclusive of Balances).				
		Assessments, 25 & 26 Vict. c. 97.	Penalties and Expenses.	Other Sources of Income.	TOTAL.	
	£	£	£	£	£	
Alness,	.	.	.	.	.	1
Annan,	2,165	432	80	.	512	2
Awe,	723	90	.	.	90	3
Balgay,	40	26	.	.	26	4
Bervie,	586	88	.	20	108	5
Conon,	2,975	211	3	.	214	6
Cree,	544	41	.	8	49	7
Dee (Aberdeen),	13,911	1,113	4	.	1,117	8
Dee (Solway),	1,463	73	.	.	73	9
Deveron,	2,073	285	.	4	289	10
Don,	3,964	793	17	.	810	11
Esk (North),	6,609	379	3	1	383	12
Esk (South),	3,012	241	14	.	255	13
Findhorn,	3,491	320	.	.	320	14
Forth,	3,765	455	8	1	464	15
Girvan,	542	.	4	.	4	16
Kyle of Sutherland,	2,613	261	.	.	261	17
Lochy,	1,961	8	.	680	688	18
Nairn,	1,343	.	.	2	2	19
Ness,	3,253	325	13	.	338	20
Nith,	756	99	24	1	124	21
Spey,	9,687	1,009	5	.	1,014	22
Stinchar,	.	.	.	.	.	23
Tay,	19,008	1,141	46	.	1,187	24
Torridon,	40	8	.	.	8	25
Tweed,	14,573	2,940	156	20	3,116	26
Ugie,	358	27	.		27	27
Urr,	.	.	.	.	.	28
Ythan,	1,004	125	2	.	127	29
TOTAL,	100,459	10,490	379	737	11,606	30

by District Fishery Boards, during Year ended 15th May 1893.

	EXPENDITURE (Exclusive of Balances).				LOANS.				Sinking Fund.
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Interest of Loans.	Other Expenses.	Total.	Outstanding at the beginning of the Year.	Borrowed during the Year.	Repaid during the Year.	Outstanding at the close of the Year.	Total Amount remaining Invested at the close of the Year.
	£	£	£	£	£	£	£	£	£
1	20	.	3	23	.	.	.	.	.
2	333	.	58	391	.	.	.	.	.
3	70		3	73	.	.	.	.	.
4	25	.	1	26	.	.	.	.	.
5	99	.	1	100	.	.	.	.	.
6	133	.	17	150	.	.	.	.	
7	56	.	1	57	.	.	.	.	.
8	687	.	552	1,239	.	.	.	.	.
9	60	.	.	60	.	.	.	.	.
10	280	1	12	293	.	.	.	.	.
11	531	.	321	852	.	.	.	.	.
12	359	.	11	370	.	.	.	.	.
13	211	.	36	247	.	.	.	.	.
14	322	1	3	326	.	.	.	.	.
15	425	.	83	508	.	.	.	.	.
16	5	.	2	7	.	.	.	.	.
17	189	.	5	194	.	.	.	.	.
18	685	.	2	687	.	.	.	.	.
19	74	.	2	76	.	.	.	.	.
20	282	1	38	321	.	.	.	.	.
21	90	.	69	159	.	.	.	.	.
22	982	.	17	999	.	.	.	.	.
23	.	.	.	.	.	.	.	.	.
24	864	.	336	1.200	.	.	.	.	.
25	8	.	.	8	.	.	.	.	.
26	2,766	.	341	3,107	.	.	.	.	.
27	25	.	2	27	.	.	.	.	.
28	.	.	.	.	.	.	.	.	.
29	117	3	7	127	.	.	.	.	.
30	9,698	6	1,923	11,627	.	.	.	.	.

NOTE II. (*continued*).—ABSTRACT of SUMS Raised and Expended

DISTRICT BOARDS OF RIVERS.	Rateable Value of the Fisheries.*	RECEIPTS other than from Loans.				
		Assessments.	Penalties and expenses.	Other Sources.	TOTAL.	
	1.	2.	3.	4.	5.	
	£	£	£	£	£	
Alness,	579	198	.	.	198	1
Annan,	2,778	417	75	.	492	2
Awe,	723	.	9	.	9	3
Balgay,	40	24	.	.	24	4
Bervie,	536	134	.	10	144	5
Conon,	2,944	122	.	1	123	6
Cree,	554	42	.	8	50	7
Dee (Aberdeen),	14,498	1,160	1	.	1,161	8
Dee (Solway),	1,463	73	.	.	73	9
Deveron,	2,138	312	1	.	313	10
Don,	3,743	749	12	.	761	11
Esk (North),	6,812	381	6	2	389	12
Esk (South),	3,002	240	10	.	250	13
Findhorn,	3,501	330	.	.	330	14
Forth,	3,806	446	11	.	457	15
Girvan,	554	46	.	.	46	16
Kyle of Sutherland,	2,658	222	.	.	222	17
Lochy,	2,122	9	.	†764	773	18
Nairn,	1,343	147	1	.	148	19
Ness,	3,468	323	.	.	323	20
Nith,	775	47	.	.	47	21
Spey,	9,316	1,242	8	.	1,250	22
Tay,	21,763	1,306	29	.	1,335	23
Torridon,	40	8	.	.	8	24
Tweed,	15,583	3,117	143	.	3,260	25
Ugie,	356	28	.	.	28	26
Ythan,	1,004	178	1	.	179	27
TOTAL,	106,099	11,301	307	785	12,393	28

* This value is ascertained in terms of the Salmon Fisheries Act of 1862.
† Contributions from Lord Abinger.

by District Fishery Boards, during Year ended 15th May 1894.

	EXPENDITURE, not defrayed out of Loans.						LOAN TRANSACTIONS.		
	Wages and Salaries of Clerks, Constables, Bailiffs, Watchers, &c.	Loans.			Other Expenses.	Total.	Borrowed during the Year.	Loans outstanding at the close of the Year.	Sinking Fund at close of Year.
		Instalment repaid.	Payment into Sinking Fund.	Interest.					
	6.	7.	8.	9.	10.	11.	12.	13.	14.
	£	£	£	£	£	£	£	£	£
1	157	.	.	.	27	184	.	.	.
2	312	.	.	.	75	387	.	.	.
3	70	.	.	.	1	71	.	.	.
4	24	.	.	.	.	24	.	.	.
5	100	.	.	.	52	152	.	.	.
6	179	.	.	.	12	191	.	.	.
7	56	.	.	.	.	56	.	.	.
8	884	.	.	.	145	1,029	.	.	.
9	75	.	.	.	.	75	.	.	.
10	288	.	.	.	12	300	.	.	.
11	623	.	.	.	83	706	.	.	.
12	358	.	.	.	10	368	.	.	.
13	232	.	.	.	29	261	.	.	.
14	324	.	.	.	6	330	.	.	.
15	439	.	.	.	27	466	.	.	.
16	5	.	.	.	4	9	.	.	.
17	224	.	.	.	7	231	.	.	.
18	674	.	.	.	80	754	.	.	.
19	74	.	.	.	9	83	.	.	.
20	255	.	.	.	54	309	.	.	.
21	73	.	.	.	27	100	.	.	.
22	1,035	.	.	.	51	1,086	.	.	.
23	828	.	.	.	377	1,205	.	.	.
24	8	.	.	.	.	8	.	.	.
25	2,786	.	.	.	320	3,106	.	.	.
26	25	.	.	.	3	28	.	.	.
27	159	.	.	.	20	179	.	.	.
28	10,267	.	.	.	1,431	11,698	.	.	.

Note.—A blank return was received from the District Board of the river Stinchar, there being no receipts or expenditure.

NOTE III.

ANNUAL CLOSE TIME APPLICABLE TO THE SALMON RIVERS IN SCOTLAND.

N.B.—Observe that, in the following List, the days fixing the commencement and termination of the Annual Close Time for Net-fishing, and for Rod-fishing respectively, are in all cases inclusive, as in the case of the Add, the first river in the List.

Name of River.	Annual Close Time for Net-fishing.	Annual Close Time for Rod-fishing.
Add, ...	From Sept. 1 to Feb. 15, both days inclusive.	From Nov. 1 to Feb .15, both days inclusive.
Aline, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Alness, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Annan, ...	From Sept. 10 to Feb. 24.	From Nov. 16 to Feb. 24.
Applecross, . . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Arnisdale (*Loch Hourn*), .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Awe, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Aylort (*Kinloch*), . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Ayr, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Baa and Glencoilleadar, .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Badachro and Kerry (*Gairloch*), ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Balgay and Shieldag, .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Beauly, ...	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 10.
Berriedale, . . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Bervie, ...	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Bladenoch, . . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Broom, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Brora, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Carradale (*in Cantyre*), .	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Carron, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Clayburn, Finnisbay, Avennangeren, Strathgravat, North Lacastile, Scalladale and Mawrig (*East Harris*), . . .	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Clyde and Leven, . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Conon, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Cree, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Creed or Stornoway, and Laxay (*Island of Lews*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Creran (*Loch Creran*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Crowe and Shiel (*Loch Duich*), ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Dee (*Aberdeenshire*), . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Dee (*Kirkcudbright*), . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Deveron, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Don, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Doon, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Drummachloy or Glenmore (*Isle of Bute*), . .	From Sept. 1 to Feb. 15.	From Oct. 16 to Feb. 15.
Dunbeath, . . .	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 10.
Earn, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Jan. 31.
Eckaig, ...	From Sept. 1 to Feb. 15.	From Nov. 1 to Feb. 15.
Esk, North, . . .	From Sept. 1 to Feb. 15.	From Nov. 1 to Feb. 15.
Esk, South, . . .	From Sept. 1 to Feb. 15.	From Nov. 1 to Feb. 15.
Ewe, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.

Name of River.	Annual Close Time for Net-fishing.	Annual Close Time for Rod-fishing.
Fincastle, Meaveg, Ballanachist, South Lacastile, Borve, and Obb (*West Harris*), . . .	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Findhorn, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Fleet (*Sutherlandshire*), .	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Fleet (*Kirkcudbrightshire*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Forss, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Forth, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Fyne, Shira, and Aray (*Loch Fyne*), . . .	From Sept. 1 to Feb. 15.	From Nov. 1 to Feb. 15.
Girvan, ...	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Glenelg, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Gour, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Greiss, Laxdale, or Thunga,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Grudie or Dionard, . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Gruinard and Little Gruinard, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Halladale, Strathy, Naver, and Borgie, . . .	From Aug. 27 to Feb. 10.	From Oct. 1 to Jan. 10.
Helmsdale, . . .	From Aug. 27 to Feb. 10.	From Oct. 1 to Jan. 10.
Hope and Polla or Strathbeg,	From Aug. 27 to Feb. 10.	From Sept. 11 to Jan. 10.
Howmore, ...	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Inchard, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Inner (*in Jura*), . .	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Inver, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Iorsa (*in Arran*), . .	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Irvine and Garnock, . .	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Kennart, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Kilchoan or Inverie (*Loch Nevis*), ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Kinloch (*Kyle of Tongue*), .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Kirkaig, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Kishorn, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Kyle of Sutherland, . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Laggan and Sorn (*Island of Islay*), ...	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Laxford, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Leven, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Little Loch Broom, . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Lochy, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Loch Duich, . . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Loch Luing, . . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Loch Roag, . . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Lossie, ...	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 10.
Luce, ...	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Lussa (*Island of Mull*), .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Moidart, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Morar, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Mullanageren, Horasary, and Lochnaciste (*North Uist*), ...	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Nairn, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Nell, Feochan, and Euchar,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Ness, ...	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 10.
Nith, ...	From Sept. 10 to Feb. 24.	From Nov. 15 to Feb. 24.
Orkney Islands (*River from Loch of Stenness, &c.*), .	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Ormsary (*Loch Killisport*), Loch Head, and Stornoway (*Mull of Cantire*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Penygowan or Glenforsa, and Aros, . . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Resort, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Ruel, ...	From Sept. 1 to Feb. 15.	From Nov. 1 to Feb. 15.

Name of River.	Annual Close Time for Net-fishing.	Annual Close Time for Rod-fishing.
Sanda, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Scaddle, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Shetland Islands (*River of Sandwater, &c.*), . .	From Sept. 10 to Feb. 24.	From Nov. 16 to Jan. 31.
Shiel (*Loch Shiel*), . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Sligachan, Broadford, and Portree (*Isle of Skye*), .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Snizort, Orley, Oze, and Drynoch (*Isle of Skye*), .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Spey, ...	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 10.
Stinchar, ...	From Sept. 10 to Feb. 24.	From Nov. 16 to Feb. 24.
Tay, ...	From Aug. 27 to Feb. 10.	From Oct. 16 to Jan. 14.
Thurso, ...	From Aug. 27 to Feb. 10.	From Sept. 15 to Jan. 10.
Torridon, Balgay, and Shieldag, . . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Ugie, ...	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Ullapool (*Loch Broom*), .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Urr, ...	From Sept. 10 to Feb. 24.	From Dec. 1 to Feb. 24.
Wick, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Ythan, ...	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.

NOTE IV.

List of Chairmen and Clerks of Salmon Fishery District Boards in Scotland.

DISTRICT.	Name and Address of Chairman.	Name and Address of Clerk.
Alness, . . .	Col. A ex. J. C. Warrand, Ryefield House, Conon Bridge, Dingwall.	William J. Duncan, Solicitor, Dingwall.
Annan, . . .	A. Johnstone Douglas, Esq., Comlongan Castle, Ruthwell.	J. F. Cormack, Solicitor, Lockerbie.
Awe, ...	The Marquis of Breadalbane, Taymouth Castle, Perthshire.	Alex. MacArthur, Solicitor, Oban.
Ayr, ...	Richard A. Oswald, Esq., of Auchincruive, Ayr.	William Macrorie, Commercial Bank, Ayr.
Baa and Glencoilleader (Mull),	The Duke of Argyll, Inveraray Castle, Inveraray.	Alex. MacArthur, Solicitor, Oban.
Balgay, . . .	C. R. Manners, Esq., C.E., 12 Lombard St., Inverness.	Duncan Shaw, W.S., 42 High Street, Inverness.
Bervie, . . .	James Farquhar, Esq., of Hallgreen, per his factor Patrick Dickson, Esq., Solicitor, Laurencekirk.	Arthur Dickson, Solicitor, Montrose.
Conon, . . .	Vacant.	Edmund J. Gunn, Solicitor, Dingwall.
Cree, ...	The Earl of Galloway, Cumloden, Newton-Stewart.	A. B. Matthews, Solicitor, Newton-Stewart.
Dee (Aberdeen),	The Lord Provost of Aberdeen.	Alex. Duffus, Advocate, Aberdeen.
Dee (Solway), .	H. G. Murray Stewart, Esq., of Broughton, Gatehouse.	W. Nicholson, Sheriff-Clerk, Kirkcudbright.
Deveron, . .	A. F. Leslie, Esq., of Montcoffer, Banff.	Francis George, Solicitor, Banff.
Don, ...	George Falconer, Esq., as mandatory for the Aberdeen Ship-masters' Society.	Alex. Duffus, Advocate, Aberdeen.
Esk (North), .	The Rev. J. S. More Gordon, of Charleton and Kinnaber, Vicar of St John's, Redhill, Surrey.	Arthur Dickson, Solicitor, Montrose.
Esk (South), .	James Johnston, Esq., Montrose.	James Don and David G. Shiel, Solicitors, Brechin.
Findhorn, . .	J. J. R. Meiklejohn, Esq., Novar, Ross-shire, factor for R. C. Munro-Ferguson, Esq., M.P.	W. Grant, National Bank Buildings, Forres.
Forth, . . .	Mandatory of Commissioners of Woods and Forests.	Thomas L. Galbraith, Town-Clerk, Stirling.
Girvan, . . .	John Campbell Kennedy, Esq., of Dunure (per D. Brown, Esq., Solicitor, Maybole).	T. Gerald Tait, Solicitor, Girvan.
Kyle of Sutherland,	Sir Charles Lockhart Ross, Bart., of Balnagowan.	John Leslie, Solicitor, Dornoch.
Lochy, . . .	Lord Abinger, Inverlochy Castle, Kingussie.	N. B. Mackenzie, Solicitor, Fort William.
Lussa (Mull) and River from Loch Misk to Loch Buy,	Murdoch G. Maclaine, Esq., of Lochbuie, Mull.	Alex. MacArthur, Solicitor, Oban.
Nairn, . . .	Brodie of Brodie, Brodie Castle, Forres.	H. T. Donaldson, Solicitor, Nairn.
Ness, ...	Charles Innes, Esq., Solicitor, Inverness.	A. Macdonald, Solicitor, 51 Church St., Inverness.
Nith, ...	Vacant.	C. Stewart Phyn, Procurator-Fiscal, Dumfries.
Pennygown or Glenforsa, and Aros (Mull),	Vacant.	Alex. MacArthur, Solicitor, Oban.
Spey, . . .	The Duke of Richmond and Gordon, Gordon Castle, Fochabers.	John Wink and George A. Cooper, Solicitors, Elgin.
Stinchar, . .	The Earl of Stair, Lochinch, Wigtownshire.	Thomas C. Greig, Rephad, Stranraer.
Tay, ...	Sir Robert Moncrieff, of Moncrieff, Bart., Moncrieff House, Perthshire.	Mackenzie & Dickson, Solicitors, Perth.
Torridon, . .	C. R. Manners, Esq., C.E., 12 Lombard St., Inverness.	Duncan Shaw, W.S., 42 High Street, Inverness.
Ugie, . . .	Lieut.-Col. Ferguson, of Pitfour, Mintlaw.	Robert Gray, Solicitor, Peterhead.
Ythan, . . .	Earl of Errol, Slains Castle, Aberdeenshire.	D. M. A. Chalmers, Advocate, Abedeen.
Tweed (Police Committee of the Commissioners),	Sir William Crossman, Cheswick, Beal, Northumberland.	James and David W. B. Tait, W.S., Kelso.

Note.—In addition to the districts specified above, the Duke of Sutherland is sole proprietor of the districts of the following rivers, viz.:—Helmsdale, Brora, Fleet, Kirkaig, Inver, Laxford, and Inchard (under the charge of his factor, Mr Donald M'Lean, Dunrobin Office, Golspie); and the Halladale, Strathy, Naver, Borgie, Kinloch, Hope, Polla or Strathbeg, Dionard or Grudie (under the charge of his factor, Mr John Box, Tongue); and the Countess of Cromartie is proprietrix of the district of the river Kennart (under the charge of her factor, Mr William Gunn, Cromartie Estate Office, Strathpeffer).

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FIFTEENTH

ANNUAL REPORT

OF THE

FISHERY BOARD FOR SCOTLAND,

Being for the Year 1896.

IN THREE PARTS.

PART I.—GENERAL REPORT.
PART II.—REPORT ON SALMON FISHERIES.
PART III.—SCIENTIFIC INVESTIGATIONS.

PART II.—REPORT ON SALMON FISHERIES.

Presented to Parliament by Command of Her Majesty.

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1897.

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CONTENTS.

SCIENTIFIC REPORTS.

FIFTEENTH ANNUAL REPORT.

TO THE RIGHT HONOURABLE

LORD BALFOUR OF BURLEIGH,

Her Majesty's Secretary for Scotland.

OFFICE OF THE FISHERY BOARD
FOR SCOTLAND,
EDINBURGH, *June* 2, 1897.

MY LORD,

In continuation of our Fifteenth Annual Report, we have the honour to submit—

PART III.—SCIENTIFIC INVESTIGATIONS.

GENERAL STATEMENT.

This part of the Fifteenth Annual Report, deals with the principal scientific investigations conducted by the Board in 1896, in connection with the sea fisheries under their charge. In the course of the year the investigations, which were carried on under the supervision of the Scientific Superintendent, were prosecuted on the same general lines as in previous years, and have resulted in further extensions of knowledge respecting the life-history and habits of the food fishes, and by the physical conditions and changes in the sea which bear upon fishery problems. Special attention has been given to certain hydrographical questions concerning the circulation of the water in the North Sea and the adjacent parts of the North Atlantic. In addition to such inquiries the hatching and artificial propagation of some of the important food fishes have been continued at the Board's Marine Hatchery at Dunbar.

A considerable part of the scientific inquiries, both biological and physical, have been carried on or rendered possible by means of the 'Garland,' the small steamer obtained by the Board some years ago for the purpose of carrying on scientific work. As explained in previous Reports the small size of this vessel has caused the work to be restricted for the most part to the territorial waters. It has not been possible with the means at disposal to carry on adequate investigations as to the results of the closure of certain waters to beam-trawl fishing, nor to extend the inquiries which have yielded valuable results in the inshore waters to the breeding grounds situated at some distance from the shore, and which form the principal source of fish supply to the territorial seas.

One of the most important results of the Board's scientific work has been to show that the food fishes which form the basis of the fishing industry—such as plaice, cod, haddock, ling, turbot, etc.,—do not spawn on the east coast within the three-mile limit, as was previously supposed. On the other hand it is not known at what distances from the shore or in what precise localities the spawning areas are chiefly situated. It would obviously be of great advantage to obtain accurate information on this subject and to be able to map out on a chart the regions where the various species of the food fishes spawn.

Were the 'Garland' replaced by an efficient sea-going vessel of the type recommended, by the Parliamentary Committee on sea fisheries in 1893, or were the Board placed in possession of such a vessel properly equipped for the work, it would be possible to conduct these and allied investigations in the offshore waters at very little additional cost. It may be stated that the Lancashire Sea Fisheries Committee possess a steam vessel, much superior to the 'Garland'; and which is exclusively employed in the fishery work of the Committee, both for police purposes and for scientific investigations; and that the Government of the Cape of Good Hope are having a high-class trawler built specially equipped for conducting scientific investigations in connection with the Cape fisheries.

The Influence of Beam Trawling.

p. 17. The results of the trawling experiments carried on in 1896, together with the tables embodying the details of the observations, are given in a special Report. As stated last year, the trawling experiments have for the present been suspended in the Firth of Forth and St Andrews Bay, where they were most systematically and regularly conducted for a number of years. The general results, so far as concerns the most important subject of the experiments in these waters, the increase or decrease in the abundance of the food-fishes since beam trawling was prohibited, showed that while the relative numbers of most of the round-fishes, such as cod and haddock, and the unimportant flat-fishes, the dabs, had slightly increased, there was a decrease among the more valuable flat-fishes, the plaice and lemon sole; a circumstance probably due to the increased trawling in the offshore areas where these fishes spawn.

During the year 1896, the trawling operations of the 'Garland' were for the most part confined to the Moray Firth and the Clyde. For the reasons previously adverted to, the examination of the stations in each of these areas has been necessarily imperfect, and sufficient information has not yet been acquired to enable any definite statement to be made respecting the results of the closure, or the position and extent of breeding grounds and nurseries of immature fish within their limits.

The statistics of the fish caught by line-fishermen within the Moray Firth during the last three years, and the average weight of fish captured per shot of the lines are as follows:—

Fish.	1894.		1895.		1896.	
	Cwts.	Average.	Cwts.	Average.	Cwts.	Average.
Cod, . .	32,571	0·52	47,646	0·81	64,663	1·07
Ling, . .	2,169	0·035	2,937	0·005	3,868	0·062
Torsk, . .	25	0·0015	24	0·0004	94	0·001
Saithe, . .	6,120	0·09	5,083	0·087	10,636	0·17
Haddock, . .	153,529	2·47	178,370	3·056	156,703	2·6
Whiting, . .	5,845	0·094	5,114	0·087	4,836	0·08
Turbot, . .	5	...	...	...	15	...
Halibut, . .	254	0·004	403	0·007	691	0·011
Lemon Sole, .	...	...	...	...	19	...
'Flounder, Plaice, Brill,' . .	5,477	0·088	5,765	0·09	3,402	0·056
Conger, . .	1,244	0·02	777	0·013	823	0·013
Skates, . .	3,281	0·053	3,014	0·051	3,683	0·061
Other kinds of white-fish, .	7,976	0·128	9,456	0·16	7,483	0·12

When the figures in the above table, indicating the quantities of white fish caught by line fishermen within the closed waters of the Moray Firth last year, are compared with the figures published in the ordinary statistical tables in Part I. of the Board's Report, showing the total quantities of white fish (exclusive of herrings, mackerel, and sprats), landed on the coasts of the same districts, it will be found that about 88 per cent. of the total quantity landed is taken from the closed area.

In the Wick district, which includes only a relatively small part of the coast of the Moray Firth, while it comprises the whole of the northern coast of Scotland from Duncansby Head to Cape Wrath, the total quantity of white fish landed last year was 61,429 cwts., of which 31,556 cwts., or over half, were caught by line fishermen in the Moray Firth. In the district of Findhorn the total quantity landed was 63,521 cwts., all of which were taken from the closed waters. In the district of Cromarty 15,317 cwts. were landed, and in the Lybster district 4,241 cwts.; and in both cases the whole of the fish were caught by line in the closed waters. In the Banff district, of a total quantity of 66,565 cwts. landed, 66,471 cwts., or all, except 94 cwts., were taken from the closed area. In the Buckie district the total quantity landed was 61,088 cwts., and of this amount 57,450 cwts., or all, except 3,638 cwts., were obtained in the Moray Firth; and of the 18,360 cwts. landed in the Helmsdale district, all save 30 cwts. were drawn from the closed area.

These comparisons show the importance of the Moray Firth as the great fishing area for the line fishermen along its coasts. The total quantity of line-caught fish drawn from its waters last year amounted to 12,845 tons.

The number of 'shots' of the lines made in the closed waters has steadily increased on the part of the large boats, while it has diminished on the part of the small boats. Thus, in 1894, 7082 'shots' of the long lines were made; in 1895 the number was 7710; and in 1896, 11,915. The small boats in 1894 made 54,866 'shots'; in 1895 the number was 50,643; and in 1896, 48,346. In the three years, therefore, 'shots' of the great lines increased by 4833, while the 'shots' of the small lines diminished by 6520.

An obvious feature in the table given above is that the great bulk of the fish landed in each year within the whole area consisted of haddocks, which made up about two-thirds of the catches, and of cod. The quantity of flatfishes landed in each year was small. In the three years together only twenty cwts. of turbot were landed. The total quantity of all kinds of flatfishes landed in the three years was as follows: 5736 cwts., or 2·6 per cent., of the whole, in 1894; 6170 cwts., or 2·3 per cent., in 1895; and 4127 cwts., or 1·6 per cent., in 1896. On the other hand a marked increase took place in the quantity of cod, and also, but to a lesser extent, in haddocks: the increase in cod was common to almost all the districts. The quantity of saithe also increased while that of whiting diminished.

The figures therefore indicate, for the most part, an increase in the abundance of round-fishes caught by line within the closed waters of the Moray Firth during the last three years, a result that one would expect from the reservation of these waters to line fishing. It is somewhat surprising that the quantity of flatfishes should have decreased. It would have been desirable to compare the returns given above with the quantities of round-fish and flat-fish caught in the Moray Firth before trawling was prohibited, but there does not appear to be information available on this point.

The Hatching and Rearing of Food Fishes.

In previous reports, detailed descriptions were given of the methods and processes adopted at the Dunbar Hatchery in connection with the artificial propagation of marine food fishes. Operations have been conducted for the most part with the valuable flatfishes, especially the plaice, but also the turbot, sole, and lemon sole, and also on a lesser scale with certain round-fishes, such as the cod and haddock. The number of the various species which have been hatched and placed on the fishing grounds since the work was begun are as follows:—

	Plaice.	Cod.	Lemon Soles.	Turbot.	Others.	Total,
1894	26,060,000	500,000	...	...	...	26,560,000
1895	38,615,000	2,760,000	4,145,000	3,800,000	1,050,000	50,370,000
1896	11,350,000	750,000	1,580,000	1,360,000	950,000	15,990,000
	76,025,000	4,010,000	5,725,000	5,160,000	2,000.000	92,920,000

During the current season (1897) the artificial propagation of plaice is being proceeded with on a large scale, but owing to the earlier publication of the Annual Report this year, it is not possible to give here a statement of the results of the work, which is still in progress. As stated in last year's Report the fry produced in the hatchery are being transferred to certain sea-lochs, which are to a large extent cut off from free communication with the open sea, and observations are being made to test the results on the relative abundance of the same species within the areas selected.

The hatching work has hitherto been much impeded by the want of suitable ponds or enclosures of sea-water in which the adult spawners could be retained from one season to another, and by means of which it would be possible to retain the fry until towards the close of the post-larval stage, when they begin to assume the form and habits of the adult, and are in a much better condition to successfully meet the influences tending towards their destruction. In the present Report will be found a paper by Mr Harald Danne- p. 175.
vig, giving the results of experiments he has made with the view of ascertaining the methods by which this may be accomplished. Some of the fry of the plaice which were hatched in the establishment were kept in suitable vessels of unfiltered water, to which tow-net collections — that is to say, the gatherings of minute organisms found naturally in sea-water—were added. By this means the fry were reared through their post-larval stages, until they had undergone their transformation into little plaice and settled on the bottom. Their food consisted to a small extent of diatoms, and chiefly of minute crustæcea and larval mollusks.

These experiments point to a method by which the utility of artificial propagation might be considerably extended, namely, by retaining the fry for a few weeks in suitable enclosures of sea-water before they are transferred to the sea.

The Currents in the North Sea and their Relation to Fisheries.

In recent years, the attention of a number of investigators has been directed to the hydrography of the North Sea, and several enquiries and series of observations have been made with the object of determining its principal physical conditions with especial relation to the movement of its waters. During the last two years and a half some thousands of drift-bottles have been thrown into various parts of the North Sea, principally from the 'Garland,' of which about five hundred have been recovered, and from careful comparison of the course taken, combined with a study of the prevailing winds throughout the period, it has been possible to ascertain the general circulation of the surface water. The results are given in a paper in the present Report by Dr p. 334.
T. Wemyss Fulton, the Scientific Superintendent, in which it is shown (1) that surface water passes into the North Sea from the Atlantic round the north of Scotland and in the neighbourhood of the Orkney and Shetland Isles, and then moves southwards along

the East coast of Scotland and England to the neighbourhood of the Wash ; (2) that it then travels in an easterly direction towards the coast of Denmark, and then northwards to the Skagerak, which it may or may not enter, and finally passes northwards along the west coast of Norway, at least as far as the Loffoden Islands.

Drift bottles were found scattered along a stretch of about 1700 miles of coast, in Scotland, England, Holland, Germany, Denmark, Sweden, and Norway, between 53° and 69° N. latitude.

A detailed study of the winds prevailing during the time the experiments were in progress, based upon over 12,000 observations, appears to show that this circulation of the surface water in the North Sea is principally due to the preponderance of south-westerly and westerly winds, which tend to heap up the surface water on the western, or continental coasts, when, as it cannot escape southwards owing to the shallows and the narrow orifice of the Channel, it passes to the north ; but subsidiary influences may aid the movement. For some weeks last winter, owing to prolonged gales and strong winds, first from a south-easterly and then from a north-easterly direction, the circulation was reversed, the surface water passing rapidly northwards along our east coast, from Norfolk to the Shetlands.

The main object of the experiments was to determine the part taken by the surface currents in transporting the floating eggs and larvæ of the food fishes from the great spawning areas lying off the coast to the territorial waters and inshore grounds. It is shown that as the normal current moves along our east coast in a southerly direction at a mean rate of about two or three geographical miles a day, and as the floating eggs, according to the species and the season, take from about a week to over three weeks to hatch, and the larvæ are exposed for some weeks additional to the action of the current, they may be carried for very considerable distances from the place where they are spawned.

From a study of the mean temperature of the surface waters off the east coast of Scotland in each month throughout the spawning season, namely, from January to August, and of the duration of the development of the embryonic fishes within the eggs of the various species at such temperature, it is shown that the spawning grounds of early spawners, as the cod, haddock, and especially the plaice, may be normally situated more than fifty or sixty miles to the north of the locality where the young fishes are found. With summer spawners, on the other hand, whose eggs develop with much greater rapidity, owing to the higher temperature of the surface waters, the distance between the spawning area and the 'nurseries' of the young fishes is much less. The spawning areas off a particular part of the coast do not normally supply the inshore waters opposite to them, but those situated further south ; thus, for example, the breeding grounds off the coasts of Forfarshire and Kincardine stand in relation to St Andrews Bay and the Firth of Forth, while the breeding grounds situated to the east of the latter stand in relation to the coasts of Berwickshire and Northumberland.

It is shown that the southward drift of the floating eggs and larvæ of the plaice is in agreement with the migratory movement of the adults and growing fish, which is in the opposite, or northerly, direction.

The easterly surface drift from the neighbourhood of the Dogger Bank also tends to explain the enormous aggregation of immature flat-fishes in the great bight between the north coast of Holland and the coast of Denmark. The southerly drift is not improbably related to the movements of the herring shoals during summer and autumn, but the connection has not yet been thoroughly investigated.

The Life-Histories and Development of the Food Fishes.

In the present Report, Professor M'Intosh describes the life- p. 194.
histories of the cod, haddock, and whiting from very early stages. It is shown that, while the spawning grounds of the cod are off-shore, the eggs and larvæ are wafted inshore, or that the post-larval stage is attained in the former region, the young fish moving shorewards subsequently, when from about half an inch to three-quarters of an inch in length. During June and July they frequent the shallow rock-pools at ebb-tide in company with the green-cod or saithe, and as they grow older many of them pass outwards again to the off-shore waters. Young haddocks have a different distribution from the young cod, and are found in the deeper water at a distance from shore, as appears also to be the case with the younger stages of the whiting. The appearance and diagnostic characters of the various stages, which have frequently been difficult to distinguish in the past, are described very fully and are illustrated by a series of figures.

The Distribution of Pelagic Eggs.

Mr A. T. Masterman furnishes a review of the work done by p. 219.
the 'Garland' in connection with the distribution of the pelagic eggs of food fishes in the years 1890–1896, with special reference to the determination of the spawning areas and seasons of the various species and the direction taken by the eggs after they are shed. The observations made in the Firth of Forth and St Andrews Bay throughout the above period are brought together and compared, lists being furnished of the principal species dealt with. The more important conclusions drawn from the study of the distribution of the pelagic eggs agree with those previously derived from the investigations into the distribution of spawning adults, namely, the season at which the various species spawn, and the place where the eggs are shed. It is shown that the more valuable forms, such as the cod, haddock, plaice, coal-fish, turbot and ling, spawn outside the three-mile limit, the floating eggs appearing first at the seaward stations and being gradually drifted in; on the other hand, less important species, such as the gurnard, flounder, and dabs spawn within the limit as well as beyond it, and the sprat spawns principally within the limits of the Firth of Forth.

p. 24C. A description of the pelagic eggs and young fishes obtained by the 'Garland' last year in the Firth of Forth, Moray Firth, and Firth of Clyde, is furnished by Mr H. M. Kyle.

Seine-Net Fishing for Herrings.

Arrangements were again made in the spring of the present year, before the time that the herring fishing on Ballantrae Bank usually begins, to conduct an investigation as to the action of the seine-net in capturing herrings on that spawning ground, particularly with reference to the main allegations against its use, namely, the destruction of herring-spawn and the capture of large quantities of immature herrings. However, as has been the case during previous seasons when similar arrangements were made, the seine-net was scarcely ever employed on the bank, and hence it was not possible to make the necessary investigations. Such being the case, the Board have arranged to extend the inquiry as opportunity occurs to other districts in the West Coast where this mode of fishing for herrings is employed.

The Oyster-Beds in the Firth of Forth.

In last year's Report a description was given of the present exhausted condition of the oyster-beds in the Firth of Forth, and of the measures which might be taken with the view of restoring part of them to their previous state. Communications on the subject have passed between the Board and the Town Council of Edinburgh, as well as the other proprietors, and a preliminary conference for the consideration of the report dealing with the beds was held during the present year. In view of the importance of the matter to the public and to the fishermen along the shores of the Firth of Forth, the Board are desirous of giving all the assistance in their power to facilitate a satisfactory arrangement being reached.

The Rearing of Larval and Post-Larval Plaice and other Flat-Fishes.

p. 175. In connection with the artificial propagation of the food fishes a series of experiments were made by Mr H. Dannevig in the rearing of the young fishes derived from the artificially fecundated eggs, which have yielded results of scientific interest. The natural food of the early post-larval plaice has been determined, and also the duration of the larval and post-larval periods. It was found that the larvæ from plaice eggs which were fertilised on the 28th April and hatched on the 10th May, took eight days to absorb the yolk and enter on the post-larval stage, and other thirty-four days, or forty-two days from the date of hatching, before they settle permanently on the bottom as typical little flat-fishes. The changes during their development are described and illustrated in a plate.

Marine Diatoms.

Mr George Murray, Keeper of the Department of Botany of the British Museum, conducted on board the 'Garland' during part of the year an investigation into the distribution and reproduction of diatoms and minute floating vegetation found in the sea, which form an important constituent of the food of minute crustaceans and of fishes in their very early stages. In the paper describing the results it is pointed out that during the first months of the year there is a remarkable prevalence of diatom life in the sea off both the east and west coasts, the quantity diminishing towards the end of March, and thereafter remaining at a fairly constant minimum. The part taken by these minute vegetable forms in furnishing food for crustacea and young fishes is described, as well as the reproductive processes of the diatoms, respecting which the observations have been of great scientific importance. p. 212.

Professor Cleve, of Upsala, Sweden, the eminent authority on diatoms, also contributes a paper to the present report, describing the characters and distribution of the diatoms and minute plant-life collected by tow-nets in the Faroe-Shetland channel during the expedition of H.M.S. 'Research' to that region in August last year. The chief object of the inquiry was to determine by comparison of the abundance and distribution of minute floating organisms, the movements of the water towards and from the North Sea. p. 297.

The Invertebrate Fauna.

In the present Report will be found a paper by Mr Thomas Scott, F.L.S., describing the invertebrate fauna, as well as the fishes, of Loch Fyne, and furnishing lists of all the species which have been found in that loch, together with notes of their distribution. The list is a very full one, comprising over eight hundred species, of which 62 are fishes, 219 mollusks, 345 crustacea, 55 foraminifera, and 52 worms. In an appendix several new and rare species are described which have been observed during the past year in the seaward part of the Clyde area, and an account is also given of the parasites of the common copepod, *Calanus finmarchicus*, which forms an important constituent of the food of fishes. In another paper Mr Scott gives the results of his continued investigations on the invertebrate fauna of the inland waters of Scotland, including that of several lochs in Cantyre, Bute, and Forfarshire, as well as of Shetland, in the examination of which he was assisted by Mr Robert Duthie. Through these investigations some important additions have been made to the fresh water fauna of Scotland. In a third paper the invertebrate fauna, collected by tow-nets used on board H.M.S. 'Research' in the Faroe-Shetland Channel, in August, is described, notes being furnished showing the distribution of the various species obtained. p. 107. p. 316. p. 305.

Physical Investigations.

In addition to the regular determinations of the temperature and density of the sea water at various stations by the 'Garland,' special physical investigations were made last year in the Faroe-Shetland Channel and in Loch Fyne. By the courtesy of Admiral Wharton, the Hydrographer to the Admiralty, a series of temperature observations were taken in the former area by the officers of H.M.S. 'Research,' under the command of Captain Moore, and a large number of samples of water were secured from various depths for the subsequent determination of the density. Mr H. N.
p. 280. Dickson, F.R.G.S., has prepared a special report on the subject, which is printed in the present Report. The work was undertaken with the view of forming part of the continued hydrographic survey of the North Sea and the North Atlantic instituted as an international scheme with Sweden, Denmark, Norway, and Germany in 1893, and the observations made on board H.M.S. 'Research' form an important contribution to the subject. The observations in Loch Fyne and the Firth of Clyde were made by Dr H. R. Mill in
p. 262. April and September, and are dealt with in a paper in the present Report. They serve to confirm the previous conclusions as to the circulation of the waters in Loch Fyne.

We have the honour to be,

Your Lordship's most obedient servants.

ANGUS SUTHERLAND, *Chairman.*
D. CRAWFORD, *Deputy Chairman.*
JOHN MURRAY.
J. RITCHIE WELCH.
W. R. DUGUID.
ARCHIBALD JAMESON.

Wm. C. ROBERTSON, *Secretary.*

I.—REPORT ON THE TRAWLING EXPERIMENTS OF THE 'GARLAND,' AND ON THE STATISTICS OF EAST COAST FISHERIES RELATING THERETO.

INTRODUCTORY.

As stated in last year's Report the trawling experiments carried on by means of the 'Garland' have for the present been suspended in the Firth of Forth and St Andrews Bay, where they were most systematically and regularly conducted for a number of years. The general results, so far as concerns the most important subject of the experiments in these waters, the increase or decrease in the abundance of the food-fishes since beam-trawling was prohibited, were set forth in the Report last year.* They showed that while the relative numbers of most of the round-fishes, such as cod and haddock, and the unimportant flat-fishes, the dabs, had slightly increased, there was a decrease among the more valuable flat-fishes, the plaice and lemon sole; a circumstance probably due to the increased trawling in the offshore areas where these fishes spawn.

During the year 1896 the trawling operations of the 'Garland' were for the most part confined to the Moray Firth and the Clyde. In January and February 32 hauls of the trawl-net were made in the Firth of Forth and St Andrews Bay, and thereafter 147 hauls were made in the Moray Firth and in the Clyde area, the stations in one or other of these areas being examined in April, August, October, and November. In addition to the trawling operations, other investigations and observations were made on board the 'Garland' during the year, such as on the nature and distribution of the pelagic fauna, on the invertebrate fauna obtained in the trawl-net, on the distribution of the pelagic eggs and larvæ of the food-fishes, and the distribution of immature and spawning fishes. In April and August the vessel was employed in making investigations on the distribution and reproduction of diatoms, under Dr George Murray of the British Museum; a report on this subject is contained in the present Report. In April and September Dr H. R. Mill carried on an investigation on the physical conditions of the Clyde sea-area, the results of which are also embodied in a paper in this Report. In connection with the sea-fish hatchery at Dunbar the 'Garland' was engaged in procuring adult flat-fishes, and in transporting the fry; and physical observations on the temperature, salinity, and transparency of the sea were made at the various trawling stations.

The statistics collected in connection with the trawling experiments in the Moray Firth, showing the quantities of the various kinds of fish caught by line fishermen within the closed waters in each month of the year, and for the whole year, are appended to this Report, and are discussed below. The collection of these statistics was made by the Fishery Officers of the respective districts, or by their correspondents. The trawling records were almost all kept by Mr Thomas Scott, F.L.S.; occasionally by Captain Campbell in command of the 'Garland.' I have to thank Mr J. G. Anderson for assistance in tabulating the statistics.

* *Fourteenth Annual Report*, Part iii. p. 128.

The Trawling Experiments in the Moray Firth.

In this important area the means taken to ascertain the influence of its closure to beam-trawlers on the abundance of the food-fishes within it, have consisted, in the first place, of direct trawling experiments made by the 'Garland' at sixteen stations, and, in the second place, by the collection of special statistics around the coast, to show, as far as possible, the quantities of the various kinds of fishes caught by line fishermen within the closed area in each month of the year, and the number of 'shots' of the lines. During last year the inshore stations in the Moray Firth were examined on three occasions, in August, October, and November. Owing, for the most part, to the exposed situation of the stations at Smith Bank and the offshore grounds it is not always practicable for a small vessel like the 'Garland' to continue trawling operations at them; these stations were therefore not examined so frequently as the others lying closer to the shore. So far as the results go, they show that the average numbers of flat-fishes captured per haul at each of the stations in 1896 were as follows ;—

Flat-Fishes.

Station.	Plaice.	Lemon Soles.	Witch Soles.	Common Dab.	Long Rough Dab.	Turbot.	Brill.	Total.
1	32·9	1·0	...	81·7	0·3	...	3·3	119·0
2	7·0	0·7	7·7	25·7	16·3	...	...	57·7
3	25·3	2·3	...	1·7	...	...	...	29·3
4	46·3	...	...	12·0	...	...	1·0	59·3
5	27·3	2·7	...	21·3	1·3	...	1·0	53·7
6	28·0	2·0	...	58·0	...	...	1·0	89·0
7	1·3	2·3	...	188·0	34·0	...	...	225·7
8	0·3	5·0	5·7	58·7	55·3	0·3	...	125·3
9	1·0	0·7	0·7	83·7	42·7	...	...	128·7
10	3·3	10·7	65·7	11·3	...	0·3	...	91·3
11	7·0	7·0	...	117·0	...	1·0	...	132·0
12	6·0	5·0	...	99·0	2·0	...	...	112·0
13	...	5·0	...	...	...	...	...	5·0
14	2·0	3·0	...	35·0	3·0	...	...	43·6
15	1·0	15·0	1·0	159·0	36·0	...	...	212·0
16	1·0	15·0	...	109·0	37·0	...	...	162·0

The average number of round-fishes, comprising cod, haddock, whiting, and gurnard, varied from 5 to 120 per haul of the net at the various stations. It is at present of little use to make comparison between the results of the trawling experiments last year and those of previous years in this area, because of the fact that the number of hauls in previous years was small, and the months in which the stations were examined were not always the same.

Among the more important questions yet to be determined in the Moray Firth are the definition of the spawning or breeding grounds of white-fish, and the distribution of immature fishes throughout the area at different seasons. It is known from the scientific work carried on in previous years that great shoals of plaice, as well as of cod and haddock, frequent Smith Bank, the well-known fishing-ground lying off the coast of Caithness. But our knowledge of this bank at the spawning season is very imperfect, and we have no scientific knowledge of the other spawning areas within the limits of the Firth, or of the distribution of immature fish at different seasons.

The statistics of the fish caught within the closed area by line fishermen above referred to, have been collected for the past three years. The totals and the average per 'shot' for each fishery district for that period are as follows :—

District.	1894.		1895.		1896.	
	Cwts.	Average.	Cwts.	Average.	Cwts.	Average.
Wick,	19,008	2·47	23,009	4·03	31,556	5·40
Lybster,	4,408	4·91	3,977	3·77	4,241	2·87
Helmsdale,	15,826	3·52	16,669	4·15	18,360	4·71
Cromarty,	21,346	3·07	19,193	2·93	15,317	2·51
Findhorn,	60,074	4·04	68,761	4·86	63,521	4·46
Buckie,	48,540	4·21	50,489	4·66	57,450	5·05
Banff,	49,292	2·94	76,491	4·77	66,471	3·82
Totals,	218,494	3·05	258,590	4·43	256,916	4·26

It is interesting to compare the figures given in this table, which show the total quantity of fish caught by line within the closed waters, with the figures showing the total quantity of the same kinds of fish landed in each district, and caught both within and without the closed area.

Thus, excluding herrings, sprats, and mackerel, which are, of course, not comprised in the special statistics appended to this report, it is found that the total quantities (cwts.) of white-fish landed in each of the districts, in 1896, were as follows :—

Wick.	Lybster.	Helmsdale.	Cromarty.	Findhorn.	Buckie.	Banff.
61,429	4241	18,390	15,317	63,521	61,088	66,565

Comparison of the figures show that almost all the line-caught fish landed in these districts are taken from the closed waters of the Moray Firth. The Wick district comprises only a comparatively small part of the coast of the Moray Firth, while it includes the north coast of Scotland as far as Cape Wrath ; and the totals for the whole district are, of course, derived from the whole extent of coast within its limits. Yet rather more than half the total quantity of fish landed in the district is drawn from the Moray Firth. All the line-caught fish in the districts of Lybster, Cromarty, and Findhorn are returned has having been obtained from the closed waters. In Helmsdale district 18,360 cwts. were taken from the closed waters and 30 cwts. from the open waters ; in Buckie district the respective quantities were 57,450 cwts. and 3638 cwts. ; and in Banff district they were 66,471 cwts. and 94 cwts. respectively.

With regard to the increase or decrease in the quantities taken in each year in the closed waters it will be observed that a considerable increase occurred in most of the districts as between the years 1894 and 1896, and a relatively small decrease as between 1895 and 1896, both as regards the absolute quantity of fish landed and the average quantity caught per 'shot' of the lines. Only the two districts, Lybster and Cromarty, show a continuous decrease, both in total quantity landed and in the average per 'shot.' The number of 'shots' made in the closed waters have steadily increased on the part of the large boats, while they have diminished on the part of the small boats. Thus, in 1894, 7082 'shots' of the long lines were made ; in 1895 the number was 7710 ; and in 1896, 11,915. The small boats in 1894 made 54,866 'shots'; in 1895 the number was 50,643; and in 1896, 48,346. In the three years, therefore, 'shots' of the great lines increased by 4833, while the 'shots' of the small lines diminished by 6520.

The number of 'shots' made by the large boats increased in all the districts except Cromarty, where they diminished; the increase was greatest in Wick district, the figures being 396 in 1894; 1553 in 1894; and 2774 in 1895. The number of 'shots' made by the small boats decreased at all the districts except at Lybster and Findhorn. At Wick the figures given in the returns for the three years are as follows:—1894, 7295 shots; 1895, 4155 shots; 1896, 3063 shots.

The greatest quantity of the fish caught by line within the closed waters of the Moray Firth is landed in the Banff district, and the next greatest quantity in the Findhorn district. Then comes Buckie, Wick, Cromarty, Helmsdale, and Lybster.

With respect to the quantities and averages of the different kinds of fish caught in each of the three years, the figures are given in the following table:—

Fish.	1894.		1895.		1896.	
	Cwts.	Average.	Cwts.	Average.	Cwts.	Average.
Cod, . .	32,571	0·52	47,646	0·81	64,663	1·07
Ling, . .	2,169	0·035	2,937	0·005	3,868	0·062
Torsk, . .	25	0·0015	24	0·0004	94	0·001
Saithe, . .	6,120	0·09	5,083	0·087	10,636	0·17
Haddock, . .	153,529	2·47	178,370	3·056	156,703	2·6
Whiting, . .	5,845	0·094	5,114	0·087	4,836	0·08
Turbot, . .	5	...	...	...	15	...
Halibut, . .	254	0·004	403	0·007	691	0·011
Lemon Sole, .	...	...	...	...	19	...
* 'Flounder, Plaice, Brill,' . .	5,477	0·088	5,765	0·09	3,402	0·056
Conger, . .	1,244	0·02	777	0·013	823	0·013
Skates, . .	3,281	0·053	3,014	0·051	3,683	0·061
Other kinds of white-fish, .	7,976	0·128	9,456	0·16	7,483	0·12

The most obvious feature in this table is that the great bulk of the fish landed in each year within the whole area consisted of haddocks, which made up about two-thirds of the catches, and of cod. The preponderance of haddocks is most marked in the districts on the south coast, Cromarty, Findhorn, Buckie, and Banff. At Wick and Lybster the quantity of cod landed in each year exceeded the quantity of haddocks. Ling, conger, halibut, and torsk, which are rather deep-water fish, were caught in comparatively small quantity, and the greatest proportion was landed at the northern stations in the Wick and Helmsdale districts and at Buckie.

It will be observed that the quantity of flat-fishes landed in each year was small. In the three years together only 20 cwts. of turbot are returned from all the districts. The flat-fishes included under the title 'flounder, plaice, and brill,' and which consist principally of plaice and dabs, form the great bulk of those landed. The total quantity of flat-fishes landed in each of the years was as follows:—5736 cwts., or 2·6 per cent. of the whole, in 1894; 6170 cwts., or 2·3 per cent., in 1895; and 4127 cwts., or 1·6 per cent., in 1896, showing, therefore, a falling off in relative abundance compared with the round-fishes. The decrease is in

* The fish included under this head comprise, for the most part, plaice and dabs.

the group 'flounder, plaice, and brill,' the quantity of which fell from 5477 cwts. in 1894, and 5767 cwts. in 1895, to 3402 cwts. last year. The quantity of halibut, on the other hand, increased from 254 cwts. in 1894, and 403 cwts. in 1895, to 691 cwts. in 1896.

In the three years under consideration a marked increase occurred in cod, both in the gross quantity landed and in the average quantity captured per 'shot' of the lines. In 1894, 32,571 cwts. were landed, as against 47,646 cwts. in 1895, and 64,663 cwts. in 1896; so that the amount was as nearly as possible doubled during the three years. The average per 'shot' also increased from 0·52 cwt. in 1894 to 0·81 cwt. in 1895 and 1·07 cwt. in 1896.

The averages for each district in the different years are as follows:—

	1894.	1895.	1896.
Wick . . .	0·99	1·83	3·22
Lybster . .	1·92	1·79	1·71
Helmsdale . .	0·75	1·31	2·01
Cromarty . .	0·59	0·617	0·74
Findhorn . .	0·48	0·75	0·85
Buckie . .	0·55	1·0	1·3
Banff . .	0·13	0·27	0·22

It will thus be seen that in nearly every district a continuous increase in the quantity of cod captured per 'shot' of the lines took place; that shown in the returns for the Wick district is remarkable.

The increase in the amount of haddocks landed from the Moray Firth was not so steady throughout the period, the statistics showing a falling off both in the gross quantity landed and the average per 'shot' last year as compared with the previous year, although 1895 showed a considerable increase in both as against 1894. The total quantity landed in 1894 was 153,529 cwts., the average per 'shot' being 2·47 cwts.; in 1895 the total was 178,370 cwts. and the average 3·056 cwts.; and in 1896 the total was 156,703 cwts. and the average 2·6.

The average quantities per 'shot' in each of the years in the various districts are as follows:—

	1894.	1895.	1896.
Wick . . .	0·54	0·508	0·22
Lybster. . .	1·63	1·29	0·69
Helmsdale . .	2·16	2·11	2·2
Cromarty . .	2·18	1·96	1·51
Findhorn . .	3·31	3·73	3·32
Buckie . . .	3·178	3·19	3·16
Banff . . .	2·47	4·07	3·06

These figures show that the average catch of haddocks per 'shot' was less in 1895 than in 1894 in the northern districts, Wick, Lybster, Helmsdale, and Cromarty, and greater in the southern districts, Findhorn, Buckie, and Banff. In the latter the increase was very marked. Almost the exact opposite prevailed in the following year, the averages increasing at Lybster and Helmsdale, and diminishing at Findhorn, Buckie, and Banff, but also at Cromarty and Wick. The latter district is the only one which shows a continuous decrease in the average throughout the three years.

The next most abundant line-caught fish is the saithe or coalfish, and the figures show a considerable increase in the quantity landed during the period. In 1894 the total for the whole of the Moray Firth was 6120 cwts., the average per 'shot' being 0·09 cwts.; in 1895 the total and average were somewhat less, namely, 5083 cwts. and 0·087, while in 1896 the total quantity landed was 10,636 cwts., and the average per 'shot' 0·17 cwts. In the districts of Wick, Helmsdale, and Buckie the averages continuously augmented throughout the period, while they diminished or fluctuated in the other districts.

Both the total quantity and the average per 'shot' of whiting landed decreased during the three years, a result which was also found to occur in the Firth of Forth and St Andrews Bay; but this fish is not of great importance. In 1894 the total for the whole area was 5842 cwts., the average per 'shot' being 0·094 cwts.; in 1895 the total was 5114 cwts. and the average 0·087; and in 1896 the respective quantities were 4836 cwts. and 0·08. Whiting were, for the most part, landed in the Banff and Findhorn districts.

The quantity of conger landed also diminished, but the totals are small. Skate increased somewhat in amount, the figures for 1894 showing a total of 3281 cwts. and an average of 0·053, compared with totals of 3014 and 3683 cwts. in 1895 and 1896 respectively, with averages of 0·051 and 0·061. The quantity and average of fish not separately enumerated included under the heading of 'other kinds of white-fish' remained much the same throughout, the averages for the three years being 0·128, 0·16, and 0·12 cwts. respectively.

The figures given above, therefore, indicate, for the most part, an increase in the abundance of round-fishes caught by line within the closed waters of the Moray Firth during the last three years, a result that one would expect from the reservation of these waters to line fishing. I was desirous of ascertaining what relation the total quantity of fish obtained annually from this area since trawling was prohibited would bear to the total quantity in previous years when trawling was permitted, but there do not appear to be statistics available on the point. It is surprising that the quantity of flat-fish caught in the Moray Firth should have diminished since 1894, although trawling has been interdicted during the whole time.

The trawling stations in Aberdeen Bay, Montrose Bay, and at the Orkney Islands were not examined during the year.

The Firth of Clyde.

During last year the twelve trawling stations in the Firth of Clyde were examined on two occasions, once in April and once in October; and a number of special hauls were made at other stations along selected lines, in order to determine the distribution of spawning fish and of immature fish at various parts of the area. As in the case of the Moray Firth, the examination of the stations selected with the view of ascertaining the influence of the prohibition of beam-trawling on the fishing-grounds, has been imperfect and insufficient to supply satisfactory information on the subject. The particulars of each haul are given in the tables appended to this Report (p. 55).

Comparison of the results obtained in the various years when the stations were examined shows that, taking all the stations together, and all kinds of fish, the average per haul of the trawl has somewhat increased over the whole period. In 1888 the general average was 109·7 per haul; in 1890 it was 99·5 per haul; in 1895 it was 113·4; and in 1896, 120·7; showing, therefore, a diminution in 1890 as compared with 1888, and an increase in the other years. The averages for flat-fishes and round-fishes respectively in the various years are as follows:—

	1888.	1890.	1895.	1896.
Flat-Fishes . .	61·2	61·1	64·7	75·5
Round-Fishes . .	44·7	35·1	43·6	35·1

These figures indicate a gradual increase in flat-fishes and a fluctuation in the abundance of round-fishes. An examination of the statistics relating to the different kinds of fish captured, shows that the increase among flat-fishes was confined almost entirely to dabs and witch flounders, plaice having diminished in numbers. It would be of little value with the rather scanty returns at present available to institute a comparison between the quantities caught at the different stations in the various years, especially as the months do not correspond.

T. WEMYSS FULTON,
Scientific Superintendent.

TABLE A.—Showing Summary of Fish taken by the 'Garland' Trawling Operations in 1896.

Station and Date.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.			
Firth of Forth—																	
Station I.																	
Jan. 24, .	.	3	.	3	22	.	.	.	28	24	4	3	.	31	.	14	73
Feb. 14, .	5	7	.	2	23	.	.	.	37	26	18	14	.	58	1	13	109
	5	10	.	5	45	.	.	.	65	50	22	17	.	89	1	27	182
Station II.																	
Jan. 24, .	1	.	.	3	11	.	.	.	15	6	.	.	.	6	1	1	23
Feb. 24, .	2	.	.	2	2	.	.	.	6	9	36	8	.	53	2	5	66
	3	.	.	5	13	.	.	.	21	15	36	8	.	59	3	6	89
Station III.																	
Jan. 20, .	1	4	1	3	12	.	.	.	21	18	5	3	.	26	2	7	56
Feb. 13, .	3	5	1	9	27	.	.	.	45	12	13	14	.	39	2	12	98
	4	9	2	12	39	.	.	.	66	30	18	17	.	65	4	19	154
Station IV.																	
Jan. 21, .	249	.	.	12	.	.	.	.	261	1	.	1	.	2	1	1	265
Feb. 20, .	286	1	.	15	2	1	.	.	305	1	.	1	.	2	.	5	312
	535	1	.	27	2	1	.	.	566	2	.	2	.	4	1	6	577
Station V.																	
Jan. 30, .	1	.	6	1	31	.	.	.	39	5	23	3	.	31	.	.	70
Feb. 19, .	1	.	3	2	49	.	.	.	55	12	82	8	.	102	.	2	159
	2	.	9	3	80	.	.	.	94	17	105	11	.	133	.	2	229
Station VI.																	
Jan. 30, .	47	3	.	2	.	.	.	2	54	2	1	.	.	3	.	.	57
Feb. 19, .	12	2	.	5	13	.	.	.	32	5	9	1	.	15	.	.	47
	59	5	.	7	13	.	.	2	86	7	10	1	.	18	.	.	104
Station VII.																	
Jan. 30, .	2	1	2	1	19	.	.	.	25	1	41	4	.	46	8	2	81
Feb. 19, .	6	1	4	17	26	1	.	.	55	.	13	2	.	15	3	1	74
	8	2	6	18	45	1	.	.	80	1	54	6	.	61	11	3	155

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1896—*continued.*

Station and Date.	Flat-Fish. Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Round-Fish. Cod.	Haddocks.	Whitings.	Gurnards.	Total.	Skate.	Other Fish.	Total.
Firth of Forth—*continued.*																	
Station VIII.																	
Jan. 29, .	2	1	1	5	10	.	.	.	19	3	9	2	.	14	2	2	37
Feb. 18, .	1	1	2	7	23	1	.	.	35	2	43	8	2	55	3	2	95
	3	2	3	12	33	1	.	.	54	5	52	10	2	69	5	4	132
Station IX.																	
Jan. 29, .	1	.	1	3	4	.	.	.	9	.	45	5	.	50	.	1	60
Feb. 18, .	.	.	1	6	20	.	.	.	27	1	35	6	.	42	.	.	69
	1	.	2	9	24	.	.	.	36	1	80	11	.	92	.	1	129
Station X.																	
Jan. 25, .	.	6	.	.	2	.	.	.	8	3	.	.	.	3	1	4	16
Feb. 12, .	.	3	.	.	.	.	.	.	3	9	.	7	.	16	1	6	26
	.	9	.	.	2	.	.	.	11	12	.	7	.	19	2	10	42
St Andrews Bay—																	
Station I.																	
Jan. 14, .	.	.	.	3	2	.	.	.	5	.	1	1	.	2	.	.	7
Feb. 6, .	11	.	.	5	1	.	.	.	17	.	.	.	.	.	1	.	18
	11	.	.	8	3	.	.	.	22	.	1	1	.	2	1	.	25
Station II.																	
Jan. 17, .	.	.	.	.	1	.	.	.	1	.	1	.	.	1	3	1	6
Feb. 7, .	10	.	.	3	2	.	.	.	15	1	.	.	.	1	.	.	16
	10	.	.	3	3	.	.	.	16	1	1	.	.	2	3	1	22
Station III.																	
Jan. 17, .	1	.	.	.	5	.	.	.	6	2	3	1	.	6	.	1	13
Feb. 7, .	11	.	.	7	3	.	.	.	21	.	1	.	.	1	1	.	23
	12	.	.	7	8	.	.	.	27	2	4	1	.	7	1	1	36
Station IV.																	
Jan. 14, .	95	.	.	9	.	6	.	1	111	.	2	1	.	3	.	.	114
Feb. 6, .	106	.	.	3	.	9	.	1	119	.	.	.	.	.	2	.	121
	201	.	.	12	.	15	.	2	230	.	2	1	.	3	2	.	235

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1896—*continued.*

Station and Date.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.			
St Andrews Bay—*continued.*																	
Station V.																	
Jan. 14,	3	.	.	1	15	.	.	.	19	5	8	2	.	15	1	.	35
Feb. 6,	4	1	.	3	16	.	.	.	24	.	1	1	.	2	.	.	26
	7	1	.	4	31	.	.	.	43	5	9	3	.	17	1	.	61
Station VI.																	
Jan. 17,	2	.	2	.	9	.	.	.	13	9	23	3	.	35	4	1	53
Feb. 5,	1	2	.	7	16	.	.	.	26	.	23	2	.	25	1	2	54
	3	2	2	7	25	.	.	.	39	9	46	5	.	60	5	3	107
Moray Firth—																	
Station I.																	
Aug. 26,	24	1	.	131	1	.	.	1	158	.	.	.	13	13	3	.	174
Oct. 16,	55	1	.	110	.	.	.	2	168	.	.	.	3	3	2	.	173
Nov. 27,	19	1	.	4	.	.	.	7	31	.	.	.	.	.	1	.	32
	98	3	.	245	1	.	.	10	357	.	.	.	16	16	6	.	379
Station II.																	
Aug. 21,	9	.	5	6	15	1	.	.	36	.	6	3	2	11	.	4	51
Oct. 16,	9	1	12	47	17	.	.	.	86	.	3	.	1	4	2	.	92
Nov. 23	3	1	6	24	17	.	.	.	51	.	4	.	2	6	.	.	57
	21	2	23	77	49	1	.	.	173	.	13	3	5	21	2	4	200
Station III.																	
Aug. 22,	22	4	.	.	.	.	.	.	26	14	2	.	.	16	.	1	43
Oct. 20,	25	.	.	4	.	.	.	.	29	5	2	2	2	11	10	1	51
Nov. 24,	29	3	.	1	.	.	.	.	33	47	6	.	.	53	.	4	90
	76	7	.	5	.	.	.	.	88	66	10	2	2	80	10	6	184
Station IV.																	
Aug. 24,	13	.	.	12	.	.	.	.	25	.	3	.	14	17	1	.	43
Oct. 23,	84	.	.	20	.	.	.	2	106	.	1	.	.	1	9	1	117
Nov. 25,	42	.	.	4	.	.	.	1	47	.	.	.	.	.	1	.	48
	139	.	.	36	.	.	.	3	178	.	4	.	14	18	11	1	208
Station V.																	
Aug. 24,	5	3	.	19	.	.	.	.	27	1	6	1	20	28	1	.	56
Oct. 23,	65	.	.	15	.	.	.	2	82	1	2	.	1	4	3	1	90
Nov. 25,	12	5	.	30	4	.	.	1	52	4	18	.	.	22	.	5	79
	82	8	.	64	4	.	.	3	161	6	26	1	21	54	4	6	225

TABLE A.—SHOWING SUMMARY OF FISH TAKEN BY THE 'GARLAND' IN TRAWLING OPERATIONS IN 1896—*continued.*

Station and Date.	Flat-Fish.									Round-Fish.							
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.	Skate.	Other Fish.	Total.
MORAY FIRTH —*continued.*																	
Station VI.																	
Aug. 25, .	32	4	.	136	.	.	.	.	172	.	1	.	41	42	1	1	216
Oct. 23, .	50	2	.	15	.	.	.	1	68	1	16	.	.	17	6	3	94
Nov. 25, .	2	.	.	23	.	.	.	2	27	.	.	.	.	.	1	.	28
	84	6	.	174	.	.	.	3	267	1	17	.	41	59	8	4	338
Station VII.																	
Aug. 25, .	2	1	.	80	10	.	.	.	93	9	5	.	50	64	1	1	159
Oct. 23, .	2	6	.	276	42	.	.	.	326	1	124	7	14	146	.	3	475
Nov. 26, .	.	.	.	208	50	.	.	.	258	1	74	.	4	79	.	5	342
	4	7	.	564	102	.	.	.	677	11	203	7	68	289	1	9	976
Station VIII.																	
Aug. 25, .	1	8	9	52	57	.	1	.	138	1	49	7	21	78	.	4	210
Oct. 24, .	.	4	8	51	34	.	.	.	97	.	223	7	5	235	.	16	348
Nov. 26, .	.	3	.	73	75	.	.	.	151	1	34	1	12	48	.	4	203
	1	15	17	176	166	.	1	.	376	2	306	15	38	361	.	24	761
Station IX.																	
Aug. 25, .	1	1	1	79	75	.	.	.	157	.	.	.	9	9	1	3	170
Oct. 24, .	1	1	1	80	44	.	.	.	127	.	57	2	10	69	.	1	197
Nov. 26, .	1	.	.	92	9	.	.	.	102	1	8	.	11	20	1	4	127
	3	2	2	251	128	.	.	.	386	1	65	2	30	98	2	8	494
Station X.																	
Aug. 26, .	3	5	.	10	8	.	.	.	26	1	5	10	11	27	1	2	56
Oct. 24, .	6	15	.	95	4	.	.	.	120	1	34	2	133	170	1	2	293
Nov. 27, .	1	12	.	92	22	.	1	.	128	2	81	1	9	93	4	6	231
	10	32	.	197	34	.	1	.	274	4	120	13	153	290	6	10	580
Station XI.																	
Oct. 15, .	7	7	.	117	.	.	1	.	132	.	5	.	81	86	1	2	221
Station XII.																	
Oct. 15, .	6	5	.	99	2	.	.	.	112	.	1	.	78	79	.	2	193
Station XIII.																	
Oct. 14, .	.	5	.	.	.	.	.	.	5	3	16	.	14	33	.	6	44
	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1896—*continued.*

Station and Date.	Flat-Fish.									Round-Fish.							
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.	Skate.	Other Fish.	Total.
Moray Firth—*continued.*																	
Station XIV.																	
Oct. 14, .	2	3	.	35	3	.	.	.	43	1	.	.	30	31	2	1	77
Station XV.																	
Oct. 14, .	1	15	1	159	36	.	.	.	212	.	5	.	32	37	2	.	251
Station XVI.																	
Oct. 14, .	1	15	.	109	37	.	.	.	162	.	45	9	41	95	1	4	262
	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Firth of Clyde—																	
Station I.																	
April 13, .	4	14	1	30	28	.	.	..	77	.	2	1	1	4	3	9	93
Nov. 2, .	1	36	1	68	5	.	.	.	111	1	19	2	12	34	3	5	153
	5	50	2	98	33	.	.	.	188	1	21	3	13	38	6	14	246
Station II.																	
April 13, .	.	2	19	1	7	.	.	.	29	1	.	1	4	6	1	1	37
Oct. 29, .	4	17	3	72	5	.	1	.	102	2	4	.	18	24	.	15	141
	4	19	22	73	12	.	1	.	131	3	4	1	22	30	1	16	178
Station III.																	
April 10, .	.	5	19	2	24	.	.	.	50	.	2	.	5	7	3	8	68
Oct. 29, .	4	6	94	.	8	.	.	.	112	.	.	2	7	9	.	14	135
	4	11	113	2	32	.	.	.	162	.	2	2	12	16	3	22	203
Station IV.																	
April 10, .	.	6	22	.	9	.	.	.	37	.	.	.	4	4	.	1	42
Oct. 29, .	.	2	49	.	15	.	.	2	68	.	2	.	28	30	6	13	117
	.	8	71	.	24	.	.	2	105	.	2	.	32	34	6	14	159
Station V.																	
April 10, .	7	13	.	34	25	.	1	.	80	2	6	.	3	11	2	4	97
Oct. 30, .	.	16	.	8	4	.	.	.	28	2	10	.	.	12	9	7	56
	7	29	.	42	29	.	1	.	108	4	16	.	3	23	11	11	153

TABLE A.—Showing Summary of Fish taken by the 'Garland' in Trawling Operations in 1896—*continued.*

Station and Date.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Rough Dabs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.			
Firth of Clyde—*continued.*																	
Station VI.																	
April 13, .	10	41	.	34	1	.	.	.	86	2	11	13	19	45	11	16	158
Oct. 28, .	.	.	.	28	.	.	1	.	29	1	2	1	60	64	28	7	128
	10	41	.	62	1	.	1	.	115	3	13	14	79	109	39	23	286
Station VII.																	
April 15, .	1	2	16	4	2	.	.	.	25	.	1	.	9	10	1	3	39
Oct. 30, .	.	3	1	4	.	.	.	.	8	.	.	.	17	17	18	10	53
	1	5	17	8	2	.	.	.	33	.	1	.	26	27	19	13	92
Station VIII.																	
April 15, .	.	.	179	11	7	.	.	.	197	1	4	6	34	45	2	13	257
Oct. 31, .	.	.	32	.	.	.	.	.	32	.	.	.	18	18	2	13	65
	.	.	211	11	7	.	.	.	229	1	4	6	52	63	4	26	322
Station IX.																	
April 14, .	1	2	143	7	13	.	.	.	166	.	.	4	20	24	2	8	200
Oct. 31, .	.	.	17	.	.	.	.	.	17	.	.	.	28	28	.	5	50
	1	2	160	7	13	.	.	.	183	.	.	4	48	52	2	13	250
Station X.																	
April 14, .	2	1	97	10	17	.	.	2	129	.	28	10	54	92	10	9	240
Oct. 28, .	.	1	1	4	.	.	.	1	7	.	9	3	88	100	16	96	219
	2	2	98	14	17	.	.	3	136	.	37	13	142	192	26	105	459
Station XI.																	
April 16, .	1	.	22	15	45	.	.	.	83	.	.	2	6	8	.	27	118
Oct. 30, .	13	5	29	24	11	.	.	1	83	.	.	1	16	17	1	22	123
	14	5	51	39	56	.	.	1	166	.	.	3	22	25	1	49	241
Station XII.																	
April 16, .	.	.	4	1	18	.	.	.	23	.	.	.	.	.	.	1	24
Oct. 30, .	3	.	112	1	118	.	.	.	234	.	.	2	13	15	4	33	286
	3	.	116	2	136	.	.	.	257	.	.	2	13	15	4	34	310

TABLE B.—ANALYSIS OF THE 'GARLAND'S' STATISTICS RELATING TO THE RELATIVE ABUNDANCE OF FISH.

A. SHOWING THE AVERAGE PER 'SHOT' OF EACH KIND OF FISH TAKEN IN 1896.

Station.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Sole.	Witch Sole.	Common Dabs.	Long Roughs.	Flounder.	Turbot.	Brill.	Total.	Cod.	Haddock.	Whiting.	Gurnard.	Total.			
I. *Firth of Forth.*																	
Closed Area.																	
I.	2·5	5·0	–	2·5	22·5	–	–	–	32·5	25·0	11·0	8·5	–	44·5	0·5	13·5	91·0
II.	1·5	–	–	2·5	6·5	–	–	–	10·5	7·5	18·0	4·0	–	29·5	1·5	3·0	44·5
III.	2·0	4·5	1·0	6·0	19·5	–	–	–	33·0	15·0	9·0	8·5	–	32·5	2·0	9·5	77·0
IV.	267·5	0·5	–	13·5	1·0	0·5	–	–	283·0	1·0	–	1·0	–	2·0	0·5	3·0	288·5
V.	1·0	–	4·5	1·5	40·0	–	–	–	47·0	8·5	52·5	5·5	–	66·5	–	1·0	114·5
VI.	29·5	2·5	–	3·5	6·5	–	–	1·0	43·0	3·5	5·0	0·5	–	9·0	–	–	52·0
VII.	4·0	1·0	3·0	9·0	22·5	0·5	–	–	40·0	0·5	27·0	3·0	–	30·5	5·5	1·5	77·5
Average per shot of 14 shots.	44·0	1·9	1·21	5·5	16·92	0·14	–	0·14	69·85	8·71	17·5	4·42	–	30·64	1·42	4·5	106·42
Unclosed Area.																	
VIII.	1·5	1·0	1·5	6·0	16·5	0·5	–	–	27·0	2·5	26·0	5·0	1·0	34·5	2·5	2·0	66·0
IX.	0·5	–	1·0	4·5	12·0	–	–	–	18·0	0·5	40·0	5·5	-	46·0	–	0·5	64·5
X.	–	4·5	–	–	1·0	-	–	–	5·5	6·0	–	3·5	–	9·5	1·0	5·0	21·0
Average per shot of 6 shots.	0·66	1·83	0·83	3·5	9·83	0·16	–	–	16·83	3·0	22·0	4·66	0·33	30·0	1·16	2·5	50·5
II. *St Andrews Bay.*																	
Closed Area.																	
I.	5·5	–	–	4·0	1·5	–	–	–	11·0	–	0·5	0·5	–	1·0	0·5	–	12·5
II.	5·0	–	–	1·5	1·5	–	–	–	8·0	0·5	0·5	–	–	1·0	1·5	0·5	11·0
III.	6·0	–	-	3·5	4·0	–	–	–	13·5	1·0	2·0	0·5	–	3·5	0·5	0·5	18·0
IV.	100·5	–	–	6·0	–	7·5	–	1·0	115·0	–	1·0	0·5	–	1·5	1·0	–	117·5
Average per shot of 8 shots.	29·25	–	–	3·75	1·75	1·87	–	0·25	36·87	0·37	1·0	0·37	–	1·75	0·87	0·25	39·75
Unclosed Area.																	
V.	3·5	0·5	–	2·0	15·5	–	–	–	21·5	2·5	4·5	1·5	–	8·5	0·5	–	30·5
VI.	1·5	1·0	1·0	3·5	12·5	–	–	–	19·5	4·5	23·0	2·5	–	30·0	2·5	1·5	53·5
Average of 4 shots.	2·5	0·75	0·5	2·75	14·0	–	–	–	20·5	3·5	13·75	2·0	–	19·25	1·5	0·75	42·0

TABLE B.—ANALYSIS of the 'GARLAND'S' STATISTICS RELATING to the relative ABUNDANCE of FISH—*continued.*

Station.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Soles.	Witch Soles.	Common Dabs.	Long Roughs.	Flounders.	Turbot.	Brill.	Total.	Cod.	Haddocks.	Whitings.	Gurnards.	Total.			
III. *Moray Firth.*																	
I.	32·9	1	–	81·7	0·3	–	–	3·3	119	–	–	–	5·3	5·3	2	–	126
II.	7·0	0·7	7·7	25·7	16·3	0·3	–	–	57·7	–	4·3	1·0	1·7	7·0	0·7	1·3	66·7
III.	25·3	2·3	–	1·7	–	–	–	–	29·3	22	3·3	0·7	0·7	26·7	3·3	2·0	61·3
IV.	46·3	–	–	12·0	–	–	–	1·0	59·3	–	1·3	–	4·7	6·0	3·7	0·3	69·3
V.	27·3	2·7	–	21·3	1·3	–	–	1·0	53·7	2·0	8·7	0·3	7·0	18·0	1·3	2·0	75·0
VI.	28·0	2·0	–	58·0	–	–	–	1·0	89·0	0·3	5·7	–	13·7	19·7	2·7	1·3	112·7
VII.	1·3	2·3	–	188·0	34·0	–	–	–	225·7	3·7	67·7	2·3	22·7	96·3	0·3	3·0	325·3
VIII.	0·3	5·0	5·7	58·7	55·3	–	0·3	–	125·3	0·7	102·0	5·0	12·7	120·3	–	8·0	253·7
IX.	1·0	0·7	0·7	83·7	42·7	–	–	–	128·7	0·3	21·7	0·7	10	32·7	0·7	2·7	164·7
X.	3·3	10·7	65·7	11·3	–	–	0·3	–	91·3	1·3	40·0	4·3	51·0	96·7	2·0	3·3	193·3
XI.	7	7	–	117	–	–	1	–	132	–	5	–	81	86	1	2	221
XII.	6	5	–	99	2	–	–	–	112	–	1	–	78	79	–	2	193
XIII.	–	5	–	–	–	–	–	–	5	3	16	–	14	33	–	6	44
XIV.	2	3	–	35	3	–	–	–	43	1	–	–	30	31	2	1	77
XV.	1	15	1	159	36	–	–	–	212	–	5	–	32	37	2	–	251
XVI.	1	15	–	109	37	–	–	–	162	–	45	9	41	95	1	4	262
IV. *Firth of Clyde.*																	
I.	2·5	25·0	1·0	49·0	16·5	–	–	–	94	0·5	10·5	1·5	6·5	19	3	7	123
II.	2·0	9·5	11	36·5	6	–	0·5	–	65·5	1·5	2	0·5	11	15	0·5	8	89
III.	2	5·5	56·5	1·0	16	–	–	–	81	–	1	1	6	8	1·5	11	101·5
IV.	–	4	35·5	–	12	–	–	1	52·5	–	1	–	16	17	3	7	79·5
V.	3·5	14·5	–	21	14·5	–	0·5	–	54	2	8	–	1·5	11·5	5.5	5·5	76·5
VI.	5	20·5	–	31	0·5	–	0·5	–	57·5	1·5	6·5	7·0	39·5	54·5	19·5	11·5	143
VII.	0·5	2·5	8·5	4	1·0	–	–	–	16·5	–	0·5	–	13	13·5	9·5	6·5	46
VIII.	–	–	105·5	5·5	3·5	–	–	–	114·5	0·5	2	3	26	31·5	2·0	13	161
IX.	0·5	1·0	80	3·5	6·5	–	–	–	91·5	–	–	2	24	26	1·0	6·5	125
X.	1·0	1·0	49	7·0	8·5	–	–	1·5	68	–	18·5	6·5	71	96	13·0	52·5	229·5
XI.	7·0	2·5	25·5	19·5	28	–	–	0·5	83	–	–	1·5	11	12·5	0·5	24·5	120·5
XII.	1·5	–	58	1·0	68	–	–	–	128·5	–	–	1·0	6·5	7·5	2·0	17	155

B. Showing the Monthly Average Per 'Shot' of each kind of Fish taken in 1896.

Date.	Flat-Fish.									Round-Fish.					Skate.	Other Fish.	Total.
	Plaice.	Lemon Sole.	Witch Sole.	Common Dabs.	Long Roughs.	Flounder.	Turbot.	Brill.	Total.	Cod.	Haddock.	Whiting.	Gurnard.	Total.			
I. *Firth of Forth.*																	
Closed Area.																	
Jan.	43·0	1·6	1·2	3·5	13·5	–	–	0·2	63·2	8·1	10·5	2·0	–	20·7	1·7	3·5	89·2
Feb.	45·0	2·2	1·1	7·4	20·2	0·2	–	–	76·4	9·2	24·4	6·8	–	40·5	1·1	5·4	119·2
Unclosed Area.																	
Jan.	1·0	2·3	0·6	2·6	5·3	–	–	–	12·0	2·0	18·0	2·3	–	22·3	1·0	2·3	37·6
Feb.	0·3	1·3	1·0	4·3	14·3	0·3	–	–	21·6	4·0	26·0	7·0	0·6	37·6	1·3	2·6	3·3
II. *St Andrews Bay.*																	
Closed Area.																	
Jan.	24·0	–	–	3·0	2·0	1·5	–	0·25	30·75	0·5	1·75	0·75	–	3·0	0·75	0·5	35·0
Feb.	34·5	–	–	4·5	1·5	2·25	–	0·25	43·0	0·25	0·25	–	–	0·5	1·0	–	44·5
Unclosed Area.																	
Jan.	2·5	–	1·0	0·5	12·0	–	–	–	16·0	7·0	15·5	2·5	–	25·0	2·5	0·5	44·0
Feb.	2·5	1·5	–	5·0	16·0	–	–	–	25·0	–	12·0	1·5		13·5	0·5	1·0	40·0

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—I. Firth of Forth.

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
Station I. 1896. Jan. 24. 1½ hours.	Lemon soles,	.	.	.	.	.	1	.	1	1	.	.	.	.	.	.	.	.	.	.	.	3
	Common dabs,	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Long rough dabs,	.	5	2	3	9	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	22
	Haddocks,	.	.	.	.	.	1	.	1	1	.	1	.	.	.	.	.	.	.	.	.	4
	Cod,	.	.	1	.	.	1	4	7	.	.	.	4	.	.	.	.	.	3	1	2*	24
	Whitings,	.	.	.	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	3
	Angler fish.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	1	.	.	.	3
	Catfish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11†	11
																						73
Feb. 14. 2 hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	2	2	1	.	.	.	.	.	.	.	.	.	5
	Lemon soles,	.	.	1	.	.	.	2	.	.	2	2	.	.	.	.	.	.	.	.	.	7
	Common dabs,	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Long rough dabs,	.	2	6	7	4	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23
	Haddocks,	.	.	.	.	4	3	8	2	.	.	.	.	.	.	.	.	.	1	.	.	18
	Cod,	.	.	1	.	.	.	6	.	7	.	.	6	2	.	.	.	.	3	.	1‡	26
	Whitings,	.	.	.	.	.	6	.	7	1	.	.	.	.	.	.	.	.	.	.	.	14
	Angler fish,	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
	Catfish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11§	12
																						109
Station II. 1896. Jan. 24. 1$\frac{8}{12}$ hours.	Thornback skate,	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	.	.	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Long rough dabs,	.	2	2	.	4	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	11
	Cod,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1‖	6
	Catfish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1¶	1
																						23
Feb 24.	Thornback skate,	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	2
	Starry ray,	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	2
	Common dabs,	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Long rough dabs,	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Haddocks,	.	.	.	2	7	9	11	3	2	.	1	1	.	.	.	.	.	.	.	.	36
	Cod,	.	.	1	.	.	.	1	.	2	.	.	.	.	.	.	.	.	.	.	3**	9
	Whitings,	.	.	.	.	1	2	1	.	2	1	.	.	.	.	1	.	.	.	.	.	8
	Angler fish,	.	.	.	.	.	.	.	2	.	.	.	.	.	.	1	.	.	.	.	.	3
	Catfish.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1††	1
																						66
Station III. 1896. Jan. 20. 3$\frac{1}{12}$ hours.	Thornback skate,	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	2
	Plaice,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Common dabs,	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Lemon soles,	.	.	.	.	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.	4
	Witch soles,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Long rough dabs,	.	4	.	.	3	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	12
	Haddocks,	.	.	.	.	.	2	.	1	2	.	.	.	.	.	.	.	.	.	.	.	5
	Cod,	.	.	.	.	.	.	1	1	7	.	1	.	.	.	.	.	.	.	3	3‡‡	18
	Whitings,	.	.	.	1	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Angler fish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1
	Catfish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1§§	1
	Herring,	2	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Sprats,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						56

* One 28 inches, one 30 inches. † One 27 inches, two 28 inches, three 31 inches, four 34 inches, and one over 40 inches. ‡ 28 inches. § Four 28 inches, three 32 inches, three 34 inches, and one over 40 inches. ‖ 26 inches. ¶ 29 inches. ** Two 28 inches, one 31 inches. †† One 31 inches. ‡‡ Two 30 inches, one 36 inches. §§ 29 inches.

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1896.

A. FISH CAUGHT—I. FIRTH OF FORTH—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
1896. Feb. 13. 3 hours.	Grey skate,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	3
	Lemon soles,	.	.	.	.	.	1	.	2	2	.	.	.	.	.	.	.	.	.	.	.	5
	Common dabs,	.	2	2	2	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	9
	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1
	Long rough dabs,	1	4	8	2	5	4	1	1	1	.	.	.	.	.	.	.	.	.	.	.	27
	Haddocks,	.	.	.	.	3	3	3	1	1	2	.	.	.	.	.	.	.	.	.	.	13
	Cod,	.	.	.	1	.	.	.	1	3	.	.	1	.	.	.	.	1	.	.	3*	12
	Whitings,	.	.	2	.	4	3	2	.	2	1	.	.	.	.	.	.	.	.	.	.	14
	Angler fish,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	2†	4
	Catfish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2‡	2
	Hake,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1§	1
	Herring,	3	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	5
																						98
Station IV. 1896. Jan. 21. 3 5/12 hours.	Starry ray,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	1	.	11	55	105	26	41	2	5	3	.	.	.	.	.	.	249
	Common dabs,	2	.	2	2	2	1	1	2	.	.	.	.	.	.	.	.	.	.	.	.	12
	Cod,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Whitings,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Angler fish,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						265
Feb. 20. 3½ hours.	Plaice,	.	.	.	.	.	.	2	91	79	65	49	.	.	.	.	.	.	.	.	.	286
	Lemon soles,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Flounders,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	2	2	.	3	2	2	2	2	.	.	.	.	.	.	.	.	.	.	.	15
	Long rough dabs,	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Cod,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
	Whitings,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Angler fish,	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	4
	Father-lasher,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						312
Station V. 1896. Jan. 30. 1 11/12 hours.	Plaice,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Common dabs,	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	2	3	.	1	.	.	.	.	.	6
	Long rough dabs,	2	.	6	2	13	.	4	3	1	.	.	.	.	.	.	.	.	.	.	.	31
	Haddocks,	.	3	.	.	2	11	.	.	3	4	.	.	.	.	.	.	.	.	.	.	23
	Cod,	.	.	.	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	1	.	5
	Whitings,	.	.	.	.	.	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	3
																						70
Feb. 19. 1 10/12 hours.	Plaice,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Witch soles,	.	.	.	.	.	.	.	.	.	.	2	.	.	.	1	.	.	.	.	.	3
	Long rough dabs,	.	.	9	8	17	11	4	.	.	.	.	.	.	.	.	.	.	.	.	.	49
	Haddocks,	.	.	1	.	7	50	14	.	5	4	.	.	.	.	1	.	.	.	.	.	82
	Cod,	.	.	.	.	.	.	1	.	.	4	.	.	.	.	.	.	2	.	4	.	12
	Whitings,	.	.	.	.	.	.	5	.	2	.	.	.	1	.	.	.	.	.	.	.	8
	Dory,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Catfish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1‖	1
																						159
Station VI. 1896. Jan. 30. 10/12 hour.	Plaice,	.	.	.	.	.	.	.	1	5	.	29	9	.	3	.	.	.	.	.	.	47
	Lemon soles,	.	.	.	.	.	.	.	1	.	1	1	.	.	.	.	.	.	.	.	.	3
	Common dabs,	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Brill,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	2
	Haddocks,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Cod,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	2
																						57

* One 34 inches. † One 38 inches, one over 40 inches. ‡ 34 and 37 inches. § Over 40 inches. ‖ 28 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—I. Firth of Forth—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
1896. Feb. 19. $\frac{8}{12}$ hour.	Plaice,	.	.	.	.	.	.	1	.	2	.	4	2	.	.	2	.	1	.	.	.	12
	Lemon soles,	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	2
	Common dabs,	.	.	2	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	5
	Long rough dabs,	.	.	6	2	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13
	Haddocks,	.	.	.	.	2	3	4	.	.	.	.	.	.	.	.	.	.	.	.	.	9
	Cod,	.	.	1	.	.	1	.	.	1	2	.	.	.	.	.	.	.	.	.	.	5
	Whitings,	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						47
Station VII. 1896. Jan. 30. $1\frac{8}{12}$ hours.	Grey skate,	.	.	.	.	.	.	.	.	.	1	.	.	.	3	.	.	.	.	.	.	
	Starry ray,	.	.	.	.	.	2	.	.	2	.	.	.	.	.	.	.	.	.	.	.	
	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	
	Lemon soles,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	2
	Long rough dabs,	.	.	7	11	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19
	Haddocks,	.	.	.	.	10	12	8	6	1	.	4	.	.	.	.	.	.	.	.	.	41
	Cod,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1
	Whitings,	.	.	.	.	.	2	.	2	.	.	.	.	.	.	.	.	.	.	.	.	4
	Angler fish.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
	Herring	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						81
Feb. 19. $1\frac{10}{12}$ hours.	Thornback skate,	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	2
	Starry ray,	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	4	.	1	1	.	.	.	.	.	.	6
	Lemon soles,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	4
	Common dabs,	.	.	2	5	8	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	17
	Flounders,	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Long rough dabs,	.	.	9	10	5	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	26
	Haddocks,	.	.	.	.	.	11	.	2	.	.	.	.	.	.	.	.	.	.	.	.	13
	Whitings,	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2
	Butter fish.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						74
Station VIII. 1896. Jan. 29. $1\frac{11}{12}$ hours.	Thornback skate,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Starry ray,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	2
	Lemon soles,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	1	1	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
	Witch soles,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Long rough dabs,	.	.	1	5	3	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	10
	Haddocks,	.	.	1	1	.	.	5	2	.	.	.	.	.	.	.	.	.	.	.	.	9
	Cod,	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	1	.	.	3
	Whitings,	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	2
	Angler fish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1	2
																						37
Feb. 18. 2 hours.	Grey skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
	Starry ray,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Lemon soles,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	2	.	3	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	7
	Witch soles,	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	2
	Sail-flukes,	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2
	Flounders,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Long rough dabs,	.	.	6	12	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23
	Haddocks,	.	.	2	.	19	14	.	.	5	.	3	.	.	.	.	.	.	.	.	.	43
	Cod,	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Whitings,	.	.	.	.	1	2	.	.	5	.	.	.	.	.	.	.	.	.	.	.	8
	Gurnards,	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	2
																						95

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1896.

A. FISH CAUGHT—I. FIRTH OF FORTH—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
Station IX.																						
1896. Jan. 29.	Plaice,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
1 1/12 hours.	Common dabs,	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Long rough dabs,	.	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Witch soles,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Haddocks,	.	7	.	.	3	30	.	2	.	.	.	.	.	3	.	.	.	.	.	.	45
	Whitings,	.	.	.	.	1	.	1	2	1	.	.	.	.	.	.	.	.	.	.	.	5
	Catfish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1*	1
																						60
Feb. 18.	Common dabs,	1	1	1	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	6
2 hours.	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Long rough dabs,	.	4	5	3	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20
	Haddocks,	.	.	13	4	9	1	7	.	.	1	.	.	.	.	.	.	.	.	.	.	35
	Cod,	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
	Whitings,	.	.	1	.	.	.	.	1	2	1	.	.	.	.	1	.	.	.	.	.	6
																						69
Station X.																						
1896. Jan. 25.	Thornback skate,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
8/12 hour.	Lemon soles,	.	.	1	1	3	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	6
	Long rough dabs,	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Cod,	.	.	.	.	.	.	.	1	.	.	1	1	.	.	.	.	.	.	.	.	3
	Herring,	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Father-lasher,	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
																						16
Feb. 12.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
3/4 hour.	Lemon soles,	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Cod,	.	.	.	.	.	.	.	.	1	.	.	2	1	1	1	2	.	.	.	1	9
	Whitings,	1	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
	Pogge,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Liparis vulgaris,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1†
	Father-lasher,	.	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
																						26

II. ST ANDREWS BAY.

Station, Date, and Time Trawl down.	Kind of Fish.	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
Station I.																						
1896. Jan. 14.	Common dabs,	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
2 1/12 hours.	Long rough dabs,	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Haddocks,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
	Whitings,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
																						7
Feb. 6.	Plaice,	.	.	.	.	.	.	1	1	5	3	.	.	1	.	.	.	.	.	.	.	11
2 hours.	Starry ray,	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	2	2	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	5
	Long rough dabs,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						18
Station II.																						
1896. Jan. 17.	Starry ray,	.	.	.	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	3
2 hours.	Long rough dabs,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Haddocks,	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Herring,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						6

* 29 inches. † 3 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
1896. Feb. 7. $1\frac{3}{4}$ hours.	Plaice,									6	2	1	1									10
	Common dabs,			1	2																	3
	Long rough dabs,		1	1																		2
	Cod,																		1			1
																						16
Station III.																						
1896. Jan. 17. $1\frac{7}{12}$ hours.	Plaice,				1																	1
	Long rough dabs,			2	1	1		1														5
	Haddocks,						1		1	1												3
	Cod,													1						1		2
	Whitings,			1																		1
	Herring,		1																			1
																						13
Feb. 7. $1\frac{7}{12}$ hours.	Starry ray,								1													1
	Plaice,								1	6	3		1									11
	Common dabs,		3		1		1		2													7
	Long rough dabs,			2	1																	3
	Haddocks,						1															1
																						23
Station IV.																						
1896. Jan. 14. $2\frac{7}{12}$ hours.	Plaice,						6	20	25	20	15	6		3								95
	Common dabs,	1	2	2		1	3															9
	Flounders,						1	1	1				2			1						6
	Brill,											1										1
	Haddocks,								1	1												2
	Whitings,							1														1
																						114
Feb. 6. $2\frac{7}{12}$ hours.	Thornback skate,									2												2
	Plaice,		5	3	14	38	61	11	29	5												166
	Common dabs,	2		1																		3
	Flounders,					1		3	4		1											9
	Brill,							1														1
																						181
Station V.																						
1896. Jan. 14. 2 hours.	Starry ray,					1																1
	Plaice,								1	1	1											3
	Common dabs,			1																		1
	Long rough dabs,		2		6	4	3															15
	Haddocks,			1			1	5				1										8
	Cod,												1					2		1	1	5
	Whitings,								2													2
																						35
Feb. 6. 2 hours.	Plaice,						1			1	2											4
	Lemon soles,									1												1
	Common dabs,		1			1	1															3
	Long rough dabs,		5	4	2	3	2															16
	Haddocks,			1																		1
	Whitings,								1													1
																						26

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—II. St Andrews Bay—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
Station VI.																						
Jan. 17. 1¼ hours.	Grey skate,	.	.	.	.	.	1	.	2	.	1	.	.	.	.	.	.	.	.	.	.	4
	Plaice,	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	2
	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	2
	Long rough dabs,	.	.	6	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9
	Haddocks,	.	.	.	.	.	1	4	5	.	7	.	3	1	1	.	1	.	.	.	.	23
	Cod,	.	.	.	.	.	1	2	.	2	2	.	.	.	.	.	.	.	.	.	.	9
	Whitings,	.	.	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Ling,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
																						53
Feb. 5. 1¼ hours.	Starry ray,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Lemon soles,	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	2
	Common dabs,	.	1	4	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
	Sail flukes,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Long rough dabs,	1	2	4	4	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	16
	Haddocks,	.	.	3	1	5	9	4	.	.	.	1	.	.	.	.	.	.	.	.	.	23
	Whitings,	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	2
	Anglers,	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						54

III. Moray Firth.

Station, Date, and Time Trawl down.	Kind of Fish.	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
Station I.																						
1896. Aug. 26. 2 hours.	Thornback skate,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	1*	3
	Plaice,	.	.	.	.	.	.	.	.	.	.	7	9	4	3	.	.	.	.	.	1†	24
	Lemon soles,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	4	29	31	24	31	10	2	.	.	.	.	.	.	.	.	.	.	.	.	.	131
	Long rough dabs,	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Brill,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
	Gurnards,	.	7	.	.	2	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	13
																						174
Oct. 16. 2 hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	2
	Plaice,	.	.	.	.	.	.	4	.	4	4	10	14	5	6	.	1	3	.	.	.	55
	Lemon soles,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	16	30	16	21	13	3	.	1	.	.	.	.	.	.	.	.	.	.	.	110
	Brill,	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2
	Gurnards,	.	.	.	.	.	.	1	.	.	2	.	.	.	.	.	.	.	.	.	.	3
																						173
Nov. 27. $2\frac{1}{12}$ hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	2	.	.	2	.	6	3	.	.	2	3	1	.	.	.	19
	Lemon soles,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	.	5	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Brill,	.	.	.	.	.	.	1	.	.	.	.	1	.	3	.	2	.	.	.	.	7
																						34
Station II.																						
1896. Aug. 21. 2 hours.	Plaice,	.	.	.	.	.	1	1	3	3	.	1	.	.	.	.	.	.	.	.	.	9
	Common dabs,	.	.	1	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
	Witch soles,	.	.	.	.	.	.	.	.	3	1	1	.	.	.	.	.	.	.	.	.	5
	Flounders,	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Long rough dabs,	.	.	2	5	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15
	Haddocks,	.	.	.	.	.	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	6
	Whitings,	.	.	.	.	.	1	.	.	.	2	.	.	.	.	.	.	.	.	.	.	3
	Gurnards,	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
	Hake,	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
																						51

* 26 inches. † 26 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—III. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
1896. Oct. 16. 2 hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	2
	Plaice,	.	.	.	.	2	6	1	.	.	.	.	.	.	.	.	.	.	.	.	.	9
	Lemon soles,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Cemmon dabs,	.	6	16	17	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	47
	Witch soles,	.	.	.	.	.	.	.	.	5	2	2	2	.	1	.	.	.	.	.	.	12
	Long rough dabs,	.	.	.	3	7	2	5	.	.	.	.	.	.	.	.	.	.	.	.	.	17
	Haddocks,	.	.	1	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	3
	Gurnards,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
																						92
Nov. 23. 1 hour 55 min.	Plaice,	.	.	.	.	.	.	.	.	1	.	1	1	.	.	.	.	.	.	.	.	3
	Lemon soles,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	1	7	5	5	2	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24
	Witch soles,	.	.	.	.	.	.	.	.	.	1	1	3	.	1	.	.	.	.	.	.	6
	Long rough dabs,	.	.	4	7	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17
	Haddocks,	.	.	.	.	.	.	1	.	2	.	.	1	.	.	.	.	.	.	.	.	4
	Gurnards,	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	2
																						57
Station III.																						
1896. Aug. 22. 1$\frac{1}{12}$ hours.	Plaice,	.	.	.	.	.	.	.	3	2	5	5	2	4	.	1	.	.	.	.	.	22
	Lemon soles,	.	.	.	.	.	.	.	1	.	.	3	.	.	.	.	.	.	.	.	.	4
	Haddocks,	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	2
	Cod,	.	.	.	.	.	6	2	1	3	.	.	.	1	.	.	.	.	.	.	.	14
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
																						43
Oct. 20. 1$\frac{4}{12}$ hours.	Thornback skate,	1	.	.	.	.	1	.	.	.	.	.	.	.	1	2	1	1	1	.	.	8
	Grey skate,	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2
	Plaice,	.	.	.	.	.	3	.	5	.	4	4	5	.	2	.	2	.	.	.	.	25
	Common dabs,	.	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Haddocks,	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	2
	Cod,	.	.	.	.	.	1	2	.	1	1	.	.	.	.	.	.	.	.	.	.	5
	Whitings,	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Gurnards,	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	2
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						51
Nov. 24. 1¼ hours.	Plaice,	.	.	.	.	.	1	.	.	1	4	7	8	.	7	.	1	.	.	.	.	29
	Lemon soles,	.	.	.	.	.	1	.	1	.	.	1	.	.	.	.	.	.	.	.	.	3
	Common dabs,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Haddocks,	.	.	.	.	.	.	.	.	.	1	2	.	.	.	.	2	1	.	.	.	6
	Cod,	.	.	.	3	2	5	6	9	9	3	.	4	.	3	.	.	2	.	.	1*	47
	Ling,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1†	3
																						90
Station IV.																						
1896. Aug. 24. 1$\frac{0}{12}$ hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
	Plaice,	.	.	.	.	1	2	.	1	.	.	.	5	1	3	.	.	.	.	.	.	13
	Common dabs,	.	1	9	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	12
	Haddocks.	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	3
	Gurnards,	.	.	1	3	3	2	.	.	5	.	.	.	.	.	.	.	.	.	.	.	14
																						43
Oct. 23. 2 hours.	Thornback skate,	.	.	.	.	.	1	.	1	.	1	1	1	1	.	2	1	.	.	.	.	9
	Plaice,	.	1	1	3	4	16	10	15	10	17	5	.	4	.	2	3	.	.	1	2‡	84
	Common dabs,	.	1	5	3	3	1	2	4	1	.	.	.	.	.	.	.	.	.	.	.	20
	Brill,	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	2
	Haddocks,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						117

* 36 inches. † 36 inches. ‡ One 26 inches, one 27 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—III. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
1896 Nov. 25. 2 hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	1	3	8	8	4	5	6	3	3	1	.	.	.	.	.	.	.	42
	Common dabs,	.	.	1	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	4
	Brill,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
																						48
Station V.																						
1896. Aug. 24. $1\frac{3}{4}$ hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	§ .	1
	Plaice,	.	.	.	.	.	.	.	.	.	2	.	1	1	1	.	.	.	.	.	.	5
	Lemon soles,	.	.	.	.	.	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	3
	Common dabs,	.	3	5	10	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19
	Haddocks,	.	.	.	.	.	.	.	.	.	1	.	3	.	1	.	1	.	.	.	.	6
	Cod,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Whitings,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Gurnards,	.	4	.	3	11	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	20
																						56
Oct. 23. $1\frac{1}{2}$ hours.	Thornback skate,	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	.	1	.	.	.	3
	Plaice,	.	.	1	5	11	11	15	2	7	2	1	3	.	3	.	.	.	3	.	1*	65
	Common dabs,	1	3	2	5	.	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	15
	Brill,	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	2
	Haddocks,	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	2
	Cod,	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Gurnards,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
																						90
Nov. 25. 1 hour 50 minutes	Plaice,	.	.	.	.	2	2	.	2	.	2	1	.	1	.	1	.	.	.	1	.	12
	Lemon soles,	.	.	.	.	1	1	.	.	.	.	1	1	1	.	.	.	.	.	.	.	5
	Common dabs,	2	.	8	14	3	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30
	Long rough dabs,	.	.	.	3	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Brill,	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
	Haddocks,	.	.	.	.	.	.	.	2	.	7	7	2	.	.	.	.	.	.	.	.	18
	Cod,	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	1†	4
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	1	.	.	2‡	5
																						79
Station VI.																						
1896. Aug. 25. $1\frac{5}{12}$ hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
	Plaice,	.	.	.	1	4	5	3	.	.	5	.	.	7	1	3	.	.	.	.	3§	32
	Lemon soles,	.	.	.	1	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	4
	Common dabs,	2	19	43	40	22	9	1	.	.	.	.	.	.	.	.	.	.	.	.	.	136
	Haddocks,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Gurnards,	.	.	9	6	10	10	.	.	4	.	.	2	.	.	.	.	.	.	.	.	41
	Anglers,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
																						216
Oct. 23. $1\frac{3}{4}$ hours.	Thornback skate,	.	.	.	.	.	.	1	.	1	.	1	.	1	.	.	1	.	1	.	.	6
	Plaice,	.	.	7	.	7	12	10	6	4	.	1	.	.	1	.	.	1	.	.	3‖	50
	Lemon soles,	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	2
	Common dabs,	.	1	2	6	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	15
	Brill,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Haddocks,	.	.	.	.	.	.	1	2	4	2	6	.	.	.	1	.	.	.	.	.	16
	Cod,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Anglers,	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	2
	Butter-fish,	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						94
Nov. 25. $1\frac{3}{4}$ hours.	Thornback skate,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	2
	Common dabs,	.	4	10	1	5	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	23
	Brill,	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	2
																						28

* 26 inches. † 34 inches. ‡ One 29 inches. § One 25 inches, one 27 inches, one 28 inches. ‖ 27 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—III. Moray Firth—*continued.*

Station Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
Station VII.																						
1896. Aug. 25. 1¾ hours.	Grey skate,															1						1
	Plaice,						1						1									2
	Lemon soles,				1																	1
	Common dabs,	6	12	40	21	1																80
	Sail flukes,										1											1
	Long rough dabs,			5	4		1															10
	Haddocks,						1	2	2													5
	Cod,						9															9
	Gurnards,		31		6	2		3	7		1											50
																						159
Oct. 23. 2 hours.	Plaice,									1		1										2
	Lemon soles,			1	3	2																6
	Common dabs,		12	51	109	103	1															276
	Long rough dabs,			4	21	17																42
	Haddocks,						3	52	40	24	5											124
	Cod,								1													1
	Whitings,								1	6												7
	Gurnards,							4		4	2	4										14
	Hake,							1		1	1											3
																						475
Nov. 26. 1 hour 50 minutes	Common dabs,	5	35	92	65	11																208
	Sail flukes,									1												1
	Long rough dabs,			7	37	4	2															50
	Haddocks,					1		22	22	23	6											74
	Cod,					1																1
	Gurnards,			2			1		1													4
	Anglers,			1											1						2*	4
																						342
Station VIII.																						
1896. Aug. 25. 1 1/12 hours.	Plaice,										1											1
	Lemon soles,			1	1	3	1			1		1										8
	Common dabs,		4	9	24	15																52
	Witch soles,						1			3	3	2										9
	Sail flukes,									1												1
	Long rough dabs,		3	16	37		1															57
	Turbot,																				1†	1
	Haddocks,						14	12	8	15												49
	Cod,						1															1
	Whitings,								4	2		1										7
	Gurnards,					9	9			1	2											21
	Anglers,																1				1‡	2
	Hake,								1													1
																						210
	Shrimp Trawl.																					
Aug. 25. ½ hour.	Common dabs,																					3‖
	Long rough dabs,				1																	1
																						4
Oct. 24. 1 1/12 hours.	Lemon soles,				3			1														4
	Common dabs,		7	24	20																	51
	Witch soles,								4		3	1										8
	Sail flukes,															1					1	2
	Long rough dabs,			2	31			1														34
	Haddocks,							22	95	115		1										223
	Whitings,								5				2									7
	Gurnards,		1					1					3									5
	Brassie,				6																	6
	Anglers,																				2§	2
	Hake,								2		2	2										6
																						348

* 42 inches. † 27 inches. ‡ 26 inches. ‖ 3 inches. § One 31 inches, one 35 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—III. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
1896. Nov. 26. 1½ hours.	Lemon soles,	.	.	.	.	1	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	3
	Common dabs,	1	14	28	29	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	73
	Long rough dabs,	.	2	19	50	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75
	Haddocks,	.	.	.	.	1	5	15	12	1	.	.	.	.	.	.	.	.	.	.	.	34
	Cod,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
	Whitings,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Gurnards,	.	.	7	.	.	1	2	2	.	.	.	.	.	.	.	.	.	.	.	.	12
	Brassie,	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Hake,	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2
	Anglers,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
																						203
Station IX.																						
1896. Aug. 25. 1¾ hours.	Starry ray,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Lemon soles,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	2	.	36	40	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	79
	Witch soles,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Sail flukes,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Long rough dabs,	.	13	.	44	17	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75
	Gurnards,	.	.	.	.	.	3	5	.	1	.	.	.	.	.	.	.	.	.	.	.	9
	Hake,	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	2
																						170
Oct. 24. 1½ hours.	Plaice,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Lemon soles,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	2	9	57	.	11	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	80
	Witch soles,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Long rough dabs,	.	.	3	20	20	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	44
	Haddocks,	.	.	.	2	.	.	10	21	24	.	.	.	.	.	.	.	.	.	.	.	57
	Whitings,	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	2
	Gurnards,	.	1	3	.	.	2	1	2	.	.	.	1	.	.	.	.	.	.	.	.	10
	Anglers,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
																						197
Nov. 26. 1½ hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
	Common dabs,	.	8	41	34	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	92
	Long rough dabs,	.	.	4	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9
	Haddocks,	.	.	.	.	.	.	.	4	1	3	.	.	.	.	.	.	.	.	.	.	8
	Gurnards,	.	2	6	1	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	11
	Cod,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1*	1
	Ling,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1†	1
	Anglers,	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1‡	3
																						127
Station X.																						
1896. Aug. 26. 2 hours.	Grey skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1§	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	.	.	.	.	3
	Lemon soles.	.	.	.	.	.	.	.	.	.	1	2	.	2	.	.	.	.	.	.	.	5
	Common dabs.	.	6	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10
	Sail flukes,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
	Long rough dabs,	.	2	1	3	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8
	Haddocks,	.	.	.	.	.	1	.	1	2	.	1	.	.	.	.	.	.	.	.	.	5
	Cod,	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Whitings,	.	.	.	.	.	.	1	.	8	1	.	.	.	.	.	.	.	.	.	.	10
	Gurnards,	.	.	.	.	4	2	2	.	3	.	.	.	.	.	.	.	.	.	.	.	11
	Pogge,	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						56

* 27 inches. †34 nches. ‡ 50 inches. § 36 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—III. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
1896. Oct. 24. 1½ hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	1	1	.	.	.	.	4	.	.	.	.	.	.	6
	Lemon soles,	.	.	1	3	3	4	.	1	.	1	1	.	1	.	.	.	.	.	.	.	15
	Common dabs,	4	19	50	22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	95
	Long rough dabs,	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Haddocks,	.	.	.	.	.	.	1	9	18	.	5	1	.	.	.	.	.	.	.	.	34
	Cod,	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Whitings,	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	2
	Gurnards,	.	.	2	9	13	26	17	23	27	.	14	2	.	.	.	.	.	.	.	.	133
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
	Conger,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1*
																						293
Nov. 27. 1½ hours.	Thornback skate,	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	2
	Starry ray,	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Sandy ray,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Lemon soles,	.	.	.	2	1	.	1	.	1	4	2	.	1	.	.	.	.	.	.	.	12
	Common dabs,	.	6	34	38	12	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	92
	Long rough dabs,	.	.	3	18	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22
	Turbot,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
	Haddocks,	.	.	.	.	.	.	9	35	21	.	14	2	.	.	.	.	.	.	.	.	81
	Cod,	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	2
	Whitings,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Gurnards,	.	.	4	4	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	9
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	1	1†
	Ling,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Butter-fish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1‡
																						231
Station XI. 1896. Oct. 15. 2 hours.	Thornback skate,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	1	.	.	5	.	.	.	1	.	.	7
	Lemon soles,	.	.	.	2	3	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	7
	Common dabs,	.	4	49	60	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	117
	Turbot,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
	Haddocks,	.	.	.	.	.	.	.	.	4	.	1	.	.	.	.	.	.	.	.	.	5
	Gurnards,	.	.	2	15	22	18	8	16	.	.	.	.	.	.	.	.	.	.	.	.	81
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	2
																						221
Station XII. 1896. Oct. 15. 2 hours.	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	5	1	.	.	.	.	.	.	6
	Lemon soles,	.	.	.	3	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	5
	Common dabs,	.	30	43	25	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	99
	Long rough dabs,	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Haddocks,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Gurnards,	.	5	.	8	19	18	.	6	10	12	.	.	.	.	.	.	.	.	.	.	78
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	2
																						193
Station. XIII. 1896. Oct. 14. 2 hours.	Lemon soles,	.	.	.	2	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	5
	Haddocks,	.	.	.	.	.	.	.	.	4	5	6	.	.	.	1	.	.	.	.	.	16
	Cod,	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	1	.	.	.	.	3
	Gurnards,	.	.	1	.	3	6	.	3	.	1	.	.	.	.	.	.	.	.	.	.	14
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
	Brassie,	.	1	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Conger,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1§	1
																						44

* 51 inches. † 49 inches. ‡ 2 inches. § 56 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—III. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
Station XIV.																						
1896. Oct. 14. 2 hours.	Grey skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1*
	Sandy ray,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1†
	Plaice,	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	2
	Lemon soles,	.	.	.	.	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	3
	Common dabs,	.	.	11	23	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	35
	Long rough dabs,	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Cod,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Gurnards,	.	.	11	.	3	6	.	3	5	.	.	2	.	.	.	.	.	.	.	.	30
	Dragonets,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						77
Station XV.																						
1896. Oct. 14. 2 hours.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Starry ray,	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
	Lemon soles,	.	.	1	8	5	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	15
	Common dabs,	3	.	101	54	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	159
	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1
	Long rough dabs,*	.	.	3	11	18	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	36
	Haddocks,	.	.	.	.	.	.	2	.	3	.	.	.	.	.	.	.	.	.	.	.	5
	Gurnards,	.	.	.	20	10	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	32
																						251
Station XVI.																						
1896. Oct. 14. 2 hours.	Starry ray,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Lemon soles,	.	.	.	6	2	6	.	1	.	.	.	.	.	.	.	.	.	.	.	.	15
	Common dabs,	.	7	41	54	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	109
	Long rough dabs,	.	.	13	18	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	37
	Haddocks,	.	1	.	.	.	.	8	15	13	.	8	.	.	.	.	.	.	.	.	.	45
	Whitings,	.	.	.	.	.	1	.	5	3	.	.	.	.	.	.	.	.	.	.	.	9
	Gurnards,	.	.	14	11	13	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	41
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	2
	Hake,	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	2
																						262

IV. Firth of Clyde.

Station, Date, and Time Trawl down.	Kind of Fish.	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
Station I.																						
1896. Apr. 13. 1½ hours.	Grey skate,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Thornback skate,	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Plaice,	.	.	.	.	1	.	.	.	.	1	1	.	1	.	.	.	.	.	.	.	4
	Lemon soles,	.	1	.	2	3	1	1	2	2	.	.	1	1	.	.	.	.	.	.	.	14
	Common dabs,	.	12	13	4	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30
	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
	Long rough dabs,	.	7	11	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	28
	Black soles,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Haddocks,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.	2
	Whitings,	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
	Gurnards,	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Angler fish,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	.	.	1	.	1	4
	Dragonet,	.	.	.	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
																						93

* 27 inches. † 3 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—IV. Firth of Clyde—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
1896. Nov. 2. 1½ hours.	Thornback skate,						1	1			1											3
	Plaice,								1													1
	Lemon soles,				10	6	8	6		3	2	1										36
	Common dabs,		6	34	21	6				1												68
	Witch soles,												1									1
	Long rough dabs,			5																		5
	Haddocks,				2	5	6	4				2										19
	Cod,				1																	1
	Whitings,							1	1													2
	Gurnards,		2	4	4	2																12
	Brassies,					1																1
	Ling,																		1			1
	Hake,								2													2
	Anglers,												1									1
																						153
Station II.																						
1896. Apr. 13. $1\frac{5}{12}$ hours.	Thornback skate,							1														1
	Lemon soles,				2																	2
	Common dabs,			1																		1
	Witch soles,							2	3	4	6	1	2	1								19
	Long rough dabs,			1	4	2																7
	Zengopterus punctatus,		1																			1
	Cod,												1									1
	Whitings,								1													1
	Gurnards,				1		2	1														4
																						37
Oct. 29. 1¾ hours.	Plaice,										1	1		1					1			4
	Lemon soles,		1	2	4	5		4		1												17
	Common dabs,	1	11	42	11	6				1												72
	Witch soles,												3									3
	Long rough dabs,		1	4																		5
	Black soles,							1														1
	Turbot,												1									1
	Haddocks,						1	1				1	1									4
	Cod,										1	1										2
	Gurnards,			6	5	2	3			2												18
	Hake,						1	1	9			1										12
	Anglers,												1					1				2
																						141
Station III.																						
1896. Apr. 10. 1.40 p.m. to 2.45 p.m.	Sandy ray,			1		1	1															3
	Lemon soles,			2			2		1													5
	Common dabs,	1			1																	2
	Witch soles,					1	2		3	2	1		9	1								19
	Long rough dabs,			2	7	13			1	1												24
	Haddocks,				2																	2
	Brassies,			1																		1
	Gurnards,				1				1		3											5
	Angler fish,																		1		1*	2
	Hake,										1					3	1					5
																						68
Oct. 29. 1¾ hours.	Plaice,															2					1†	4
	Lemon soles,					3		1	1		1											6
	Witch soles,					10	5	7	10	20	8	11	21	2								94
	Long rough dabs,		1	3	2	2																8
	Whitings,						1	1														2
	Gurnards,				2				2		1	2										7
	Hake,								2													2
	Anglers,											1									1‡	3
	Brassies,			4	3			2														9
																						135

* 31 inches. † 27 inches. ‡ 42 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—IV. Firth of Clyde—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
Station IV.																						
1896. Apr. 10. 11.45 a.m. to 12.30 p.m.	Lemon soles,			1		2	3															6
	Witch soles,					1	3	8	4	1	1	2	1	1								22
	Long rough dabs,	1	6		1	1																9
	Gurnards,				3		1															4
	Hake,															1						1
																						42
Oct. 29. 40 min.	Thornback skate,				1			1		1												4*
	Sandy ray,								1				1									2
	Lemon soles,					2																2
	Witch soles,				1	5	13	8	16	4	2											49
	Long rough dabs,		1	4	5	5																15
	Brill,																			1	1†	2
	Haddocks,						1	1														2
	Gurnards,				3	5	10			5		4	1									28
	Hake,							5	4					2								11
	Anglers,																		1			2
																						117
Station V. 1896. Apr. 10. 6.35 a.m. to 7.45 a.m.	Thornback skate,									1												1
	Sandy ray,												1									1
	Plaice,						1			1	1	1	2	1								7
	Lemon soles,				5	2		1	1	1	1	1		1								13
	Common dabs,		9	20	1	3			1													34
	Long rough dabs,		3	3	17	2																25
	Black soles,							1														1
	Turbot,													1								1
	Haddocks,			1	1	1				2				1								6
	Cod,				1				1													2
	Gurnards,			1	2																	3
	Ling,																				‡	1
	Anglers,																		1			1
	Hake,																	1			1§	1
																						97
Oct. 30 1 hour.	Thornback skate,			2	1		2	2			1											8‖
	Sandy ray,												1									1
	Lemon soles,			1	2	4	6		1	2												16
	Common dabs,		3	1	3	1																8
	Long rough dabs,			2	2																	4
	Haddocks,						5	2	1			1				1						10
	Cod,					1									1							2
	Brassies,				1																	1
	Hake,								1	1											1‡	3
	Anglers,																		1	1		2
	Conger,																				1§	1
																						56
Station VI. 1896. April 13. $2\frac{1}{2}$ hours.	Thornback skate,								1			1			1							3
	Sandy ray,									2			3									8‖
	Plaice,					1						1		4		2			1	1		10
	Lemon soles,			1	5	11	10	8		4	1		1									41
	Common dabs,			7	21	3	1	2														34
	Long rough dabs,					1																1
	Black soles,							1														1
	Haddocks,				3	2		1		4							1					11
	Cod,							1		1												2
	Whitings,							2		6	3	2										13
	Gurnards,				2	5	4		4	3	1											19
	Red gurnards,						1		1						1							3
	Brassies,				2	6	2	2														12
																						158

* One 3 inches. † 27 inches. ‡ 30 inches. § One 45 inches. ‖ Three 3 inches.

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1896.

A. FISH CAUGHT—IV. FIRTH OF CLYDE—*continued.*

Station, Date and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
1896. Oct. 28. 2 hours.	Thornback skate,	1	.	.	.	.	3	2	.	1	1	4	.	.	2	.	.	.	.	.	.	15*
	Sandy ray,	2	2	.	.	.	.	.	.	2	.	.	2	.	.	.	.	.	.	.	.	13†
	Common dabs,	1	11	10	4	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	28
	Black soles,	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Turbot,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
	Haddocks,	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Cod,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Whitings,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Common gurnards	.	6	14	15	.	6	5	.	10	.	4	.	.	.	.	.	.	.	.	.	60
	Red gurnards,	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	2
	Poor-cod,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1‡
	Angler,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
																						128
Station VII. 1896. April 15. $1\frac{10}{12}$ hours.	Grey skate,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
	Lemon soles,	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Common dabs,	.	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Witch soles,	.	.	.	.	.	.	.	3	.	1	6	6	.	.	.	.	.	.	.	.	16
	Long rough dabs	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Haddocks,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
	Gurnards,	.	.	3	2	.	1	.	1	1	.	1	.	.	.	.	.	.	.	.	.	9
	Angler fish,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Hake,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1§	1
	Labrus (?) *maculatus*,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
																						39
Oct. 30. $1\frac{1}{2}$ hours.	Thornback skate.	1	8	1	1	2	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	17
	Sandy rays,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Lemon soles,	.	.	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Common dabs,	.	.	3	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Witch soles,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Common gurnards	.	.	.	8	6	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	17
	Red gurnards,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Hake,	.	.	.	.	.	.	1	4	.	.	.	.	.	.	.	.	.	.	.	.	6
	Nursehound,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1‖	1
	Lesser spotted dog-fish.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	2
																						54
April 20.‡‡ 9.15 p.m. to 11.15 p.m.	Plaice,	.	.	.	.	.	.	.	.	1	2	3	5	.	2	.	.	.	.	.	.	13
	Lemon soles,	.	.	1	.	.	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	5
	Common dabs,	.	.	8	5	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17
	Witch soles,	.	.	.	2	2	13	10	10	12	10	4	7	.	1	.	.	.	.	.	.	71
	Long rough dabs,	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Haddocks,	.	.	.	.	1	.	.	.	1	.	.	1	1	.	.	.	.	.	.	.	4
	Cod,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6¶
	Whitings,	.	.	.	2	2	9	8	8	12	.	3	.	1	.	.	.	.	.	.	.	45
	Common gurnards	.	.	1	2	2	1	3	1	2	1	.	.	.	.	.	.	.	.	.	.	13
	Red gurnards,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Angler,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
	Hake,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2**
	Brassie,	.	.	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
	Poor cod,		.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Conger,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1††
																						187

* One 3 inches. † Five 3 inches. ‡ 3 inches. § 28 inches. ‖ 30 inches.
¶ One 35, four 36, one 42 inches. ** One 37 inches. †† 36 inches. ‡‡ Hauls made at night.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—IV. Firth of Clyde—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
1896. Nov. 3.* 1 hour 35 minutes.	Thornback skate,		2	2	1			2		2												9
	Flapper skate,					1																1
	Lemon soles,				1		1															2
	Common dabs,	1	14	24	11	3																53
	Haddocks,					2	11	23		1	1	1										39
	Whitings,						2		1													3
	Gurnards	1									1											2
	Ling,																					1†
	Hake,							4														4
	Brassies,			3	2																	5
	Angler,																				1	2‡
																						121
Station VIII. 1896. April 15. 2 hours.	Thornback skate,													1					1			2
	Common dabs,			2	4	4	1															11
	Witch soles,					13		28	45	50			37	6								179
	Sail flukes,				1				4	1							1		1			8
	Long rough dabs,			4	3																	7
	Haddocks,					4																4
	Cod,																					1§
	Whitings,						3	1	2													6
	Gurnards,			7			7	6	7		5	1	1									34
	Angler,																					1‖
	Hake,											1			2							4
																						257
Oct. 31. 1 hour 40 minutes.	Thornback skate,				1						1											2
	Witch soles,						7	7	8	7		2	1									32
	Sail flukes,				1			1		3	1											6
	Gurnards,				5		3		7	3												18
	Hake,							5														5
	Anglers,															1				1		2
																						65
April 21.* 12.15 p.m. to 2.20 p.m.	Thornback skate,		1		2	3						2										9¶
	Sandy ray,		1																			1
	Plaice,										1											1
	Lemon soles,			1	1	1						2										5
	Common dabs,	3	7	16	16	1	3															46
	Witch soles,						11	5	12	16	10	7	2	1								64
	Black soles,												1				1					2
	Long rough dabs,		1																			1
	Haddocks,			5	14	9												1				29
	Cod,											1										1
	Whitings,			1	1	2	5	4	3	4												20
	Common gurnards		1	8	16	4	5	1	2	2		3										42
	Hake,							1										1			1	3
	Brassies,		1	3	1		1															6
																						230
Nov. 3.* 1¾ hours.	Thornback skate,	1			1		1		2		2											7
	Sandy ray,		1																			1
	Common dabs,			1	1																	2
	Witch soles,					3	7	4		3			1									18
	Sail flukes,						2			1	5		1		1							10
	Long rough dabs,			1																		1
	Haddocks,						3															3
	Whitings,						6	4					1									11
	Red gurnards,								1													1
	Hake.								7													7
	Brassies,	1																				1
	Anglers,																		1			1
	Conger,																					1**
																						64

* Hauls made at night. † 55 inches. ‡ One 27 inches. § 43 inches. ‖ 27 inches. ¶ One 3 inches. ** 43 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—IV. Firth of Clyde—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
Station IX.																						
1896. April 14. 2 hours.	Thornback skate,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2*
	Plaice,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Lemon soles,	.	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2
	Common dabs,	.	.	3	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
	Witch soles,	.	.	.	.	17	.	20	14	28	.	45	16	3	.	.	.	.	.	.	.	143
	Long rough dabs,	.	.	2	7	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13
	Whitings,	.	.	.	1	.	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	4
	Gurnards,	.	.	4	4	.	9	2	.	1	.	.	.	.	.	.	.	.	.	.	.	20
	Angler	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
	Hake,	.	.	.	.	.	.	1	2	.	1	.	.	1	.	.	.	.	.	.	.	7†
																						200
Oct. 31. $1\frac{3}{4}$ hours.	Witch soles,	.	.	.	3	1	9	3	1	.	.	.	.	.	.	.	.	.	.	.	.	17
	Sail flukes,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1‡
	Gurnards,	.	.	.	2	.	3	.	9	12	2	.	.	.	.	.	.	.	.	.	.	28
	Hake,	.	.	.	.	.	.	1	.	3	.	.	.	.	.	.	.	.	.	.	.	4
																						50
Station X.																						
1896. April 14. 2 hours.	Thornback skate,	.	.	1	.	1	.	1	1	2	.	1	1	.	1	.	1	.	.	.	.	10
	Plaice,	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	2
	Lemon soles,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	.	4	5	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10
	Witch soles,	.	.	.	.	.	4	18	.	29	.	29	17	.	.	.	.	.	.	.	.	97
	Sail fluke,	.	.	.	.	.	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	3
	Long rough dabs,	.	3	.	12	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	17
	Black soles,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Brill,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2§
	Haddocks,	.	.	2	8	8	4	1	3	1	.	.	.	1	.	.	.	.	.	.	.	28
	Whitings,	.	.	.	.	.	6	1	.	3	.	.	.	.	.	.	.	.	.	.	.	10
	Gurnards,	.	.	.	14	20	.	8	7	5	.	.	.	.	.	.	.	.	.	.	.	54
	Red gurnard,	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Dragonet,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Hake,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	2
																						240
Oct. 28. 1 hour 50 minutes.	Thornback skate,	.	.	.	.	.	.	7	.	.	1	4	.	.	.	.	.	.	.	.	.	12
	Sandy ray,	.	2	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	4
	Lemon soles,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	.	1	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Witch soles,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Sail flukes,	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	2
	Brill,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1
	Haddocks,	.	.	.	.	.	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9
	Whitings,	.	.	.	.	1	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	3
	Gurnards,	.	3	15	14	2	.	.	15	.	33	6	.	.	.	.	.	.	.	.	.	88
	Hake,	.	.	.	.	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	6
	Brassies,	.	.	15	43	27	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	86
	Angler,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
	John Dory,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						219
Station XI.																						
1896. April 16. $1\frac{1}{12}$ hours.	Plaice,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Common dabs,	1	2	6	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15
	Witch soles,	.	.	.	.	8	10	.	.	4	.	.	.	.	.	.	.	.	.	.	.	22
	Long rough dabs,	.	10	19	11	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	45
	Whitings,	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	2
	Gurnards,	.	.	.	4	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	6
	Brassie,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Angler	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
	Hake,	.	.	.	.	.	.	.	.	8	8	.	.	.	1	.	.	3	.	.	3	25‖
																						118

* One at 24 inches. † One 27, one 28 inches. ‡ One at 22 inches. § One 26, one 29 inches. ‖ Two at 27 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—IV. Firth of Clyde—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	
1896. Oct. 30. 1 hour 50 minutes	Thornback skate,	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	1	2	1	1	.	3	3	.	1	.	.	1	.	.	.	.	.	13
	Lemon soles,	.	.	.	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
	Common dabs,	.	7	.	13	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24
	Witch soles,	.	.	.	.	.	5	14	7	1	.	1	.	1	.	.	.	.	.	.	.	29
	Long rough dabs,	.	.	7	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11
	Brill,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
	Whitings,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Gurnards,	.	.	.	.	10	.	4	.	.	2	.	.	.	.	.	.	.	.	.	.	16
	Hake,	.	.	.	.	.	7	10	.	.	.	.	.	.	2	.	.	.	1	.	.	21*
	Angler,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
																						123
Station XII. 1896. April 16. 1½ hours.	Common dabs,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Witch soles,	.	.	.	.	.	.	2	.	.	.	1	1	.	.	.	.	.	.	.	.	4
	Long rough dabs,	.	1	5	6	4	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18
	Black-mouthed dog-fish.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1
																						24
	(Night haul)																					
April 21. 9.15 p.m. to 11.20 p.m.	Grey skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1†	1
	Witch soles,	.	1	.	2	2	6	3	2	10	8	14	10	4	.	.	.	.	.	.	.	62
	Long rough dabs,	3	9	7	18	8	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50
	Cod,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1‡	1
	Whitings,	.	.	3	.	1	4	4	.	.	.	.	.	.	.	.	.	.	.	.	.	12
	Angler	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Hake,	.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1	.	.	3§	6
																						133
Oct. 30. 2 hours.	Thornback skate,	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	3
	Flapper skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1‖
	Plaice,	.	.	.	.	.	.	.	.	.	.	.	1	.	2	.	.	.	.	.	.	3
	Common dabs,	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Witch soles,	.	.	.	9	21	36	.	36	5	4	.	1	.	.	.	.	.	.	.	.	112
	Long rough dabs,	1	5	33	51	21	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	118¶
	Whitings,	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Gurnards,	.	.	.	.	.	.	6	4	2	.	1	.	.	.	.	.	.	.	.	.	13
	Poor cod,	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Ling,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1
	Hake,	.	.	.	.	.	.	17	.	10	.	.	.	.	.	.	.	.	.	.	.	27
	Anglers,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	2	.	.	.	3
	Picked dog-fish,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
																						276
Ordinary	trawl, night haul.																					
Nov. 4. 2 hours 5 minutes (8.35 p.m. to 10.40 p.m.)	Thornback skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1**	2
	Flapper skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2††	3‡‡
	Witch soles,	.	.	.	.	12	20	26	42	40	23	9	.	2	.	.	.	.	.	.	.	174
	Long rough dabs,	3	6	50	55	30	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	148
	Whitings,	2	.	.	3	.	9	2	.	.	.	.	.	.	.	.	.	.	.	.	.	16
	Hake,	.	.	.	.	.	.	.	6	.	.	.	.	.	.	4	.	.	1	.	.	12§§
	Angler,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
	Conger,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1‖‖	1
	Picked dog-fish,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1¶¶	1
																						388

V. Upper Loch Fyne.

Station, Date, and Time Trawl down.	Kind of Fish.	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
'From Furnace to Islands outside'*** (a) down to Inverae.																						
April 28. 1¼ hours.	Skate (? thornback)	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Plaice,	.	.	.	.	.	.	.	.	.	1	.	2	1	1	1	.	.	.	.	.	6
	Lemon soles,	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Common dabs,	.	1	3	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
	Witch soles,	.	.	.	.	1	1	6	10	18	9	5	.	.	.	.	.	.	.	.	.	50
	Long rough dabs,	.	.	.	.	57	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	57
	Haddocks,	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Gurnards,	.	.	.	2	2	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	8
	Hake	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	2
																						133

* One at 22 inches. † 32 inches. ‡ 33 inches. § One at 26 inches, two at 29 inches. ‖ 22 inches. ¶ Two at 2 inches, two at 3 inches.
** 27 inches. †† 32 and 40 inches. ‡‡ One at 24 inches. §§ One at 24 inches. ‖‖ 51 inches. ¶¶ 26 inches.
*** From Dannevig's Notes.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—V. Upper Loch Fyne—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
Off Minard Castle to off Loch Gair, distance trawled, 2 miles.* 1896.																						
April 28.	Plaice,										1	1		1								3
	Common dabs,				2																	2
	Witch soles,										1	1										2
	Long rough dabs,			1	1	2																4
	Haddocks,												1									1
	Gurnards,					1	1															2
																						14
Penmore to off Inveraray, Mid-channel.†																						
April 30.	Witch soles,					10	12	20	18	21	11	6	4	2								104
	Long rough dabs,				2	1																3
	Haddocks,																			1		2‡
																						109
Off Dunderave Castle to off Lowburn, Mid-channel.																						
May 5. 1½ hours.	Plaice,											1	4		5	3						13
	Common dabs,			3	3	2	2	1		1												12
	Witch soles,				1			1		8	16	7										33
	Flounders,							1														1
	Long rough dabs,		1	6	7	1	4															19
	Cod,								1		1											2
	Whitings,											2										2
	Gurnards,				1	1		1		1												4
	Ling,																				1§	1
	Poor-cod,				1																	1
																						88
Lowburn to Dunderave Castle.																						
Nov. 12. 2 hours 10 minutes.	Thornback skate,																		1			1
	Plaice,											1										1
	Lemon soles,									2		3										5
	Common dabs,				1		2															3
	Witch soles,		1		1	8	4	3	5		11	8			4							45
	Long rough dabs,	2	3	6	7	9	4															31
	Haddocks,																	1				1
	Cod,						1			1							1					3
	Hake,									1											1	2
	Congers,																				3‖	3
	Gobius niger,	1																				1
																						96
Penmore to off Inveraray.																						
Nov. 12. 2 hours 10 minutes.	Witch soles,				6	16	19	18	24	18		4										105
	Long rough dabs,				8	9																17
	Haddocks,											1	1				1					3
	Cod,																			1		1
																						126
Inverae to Furnace.																						
Nov. 13. 1 hour 20 minutes.	Common dabs,		2																			2
	Witch soles,			1			10	10	9	6		1										37
	Long rough dabs,				6	6	1															13
	Cod,								1													1
	Gurnards,				2	3				1	1											7
																						60

* From Dannevig's Notes. † From Captain Campbell's Notes. ‡ One at 22 inches. § 38 inches. ‖ 29, 37, and 50 inches

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT—V. Upper Loch Fyne—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	21 +	23 +	25 +	Total.
Off Loch	Gair to Minard.																					
1896. Nov. 13.	Thornback skate,	.	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	2
1 hour 25	Lemon soles,	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	2
minutes.	Common dabs,	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Witch soles,	.	.	.	.	.	.	.	2	2	2	2	.	.	.	.	.	.	.	.	.	8
	Long rough dabs,	.	7	17	9	3	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	38
	Haddocks,	.	.	.	.	.	1	2	.	.	.	1	.	.	.	.	.	.	.	.	.	4
	Cod,	.	.	.	.	.	.	.	2	2	1	2	.	2	.	.	.	.	.	.	.	9
	Gurnards,	.	.	.	.	2	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	4
	Hake,	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	2
	Brassies,	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
																						73
Off Loch	Gair to Largymore.																					
1896.	Sandy ray,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1*
Nov. 14.	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
1 hour 10	Witch soles,	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	2
minutes.	Long rough dabs,	.	.	13	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20
	Haddocks,	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Cod,	.	.	.	.	.	.	1	.	2	.	1	.	.	.	.	.	.	.	.	.	5†
	Whitings,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Gurnards,	.	.	.	.	3	.	1	2	1	.	.	.	.	.	.	.	.	.	.	.	7
	Hake,	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Liparis, sp.,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4‡
																						46

* 3 inches. † One at 22 inches. ‡ One at 1 inch, three at 2 inches, and one at 3 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—VI. Moray Firth.

Station, Date, and Time Trawl down.	Kind of Fish	Size in Inches. 1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	Total.
Station V. 1896. Aug. 24. 35 minutes	Plaice,																1					1
	Lemon soles,								1	1												2
	Common dabs,			24	23	5	5	3			1											61
	Haddocks,					1							2									3
	Cod,		4	2																		6
	Gurnards,					15	12		2													29
																						102
Oct. 23. 30 minutes	Thornback skate,																		1			1
	Plaice,							2		2			1									5
	Common dabs,		2		8	1	1	1	1	2												16
	Solenette,		2	1																		3
	Brill,														1							1
	Cod,																					.
	Whitings,		1	5	2	5																13
	Gurnards,		1																			1
	Pipe fish,				1																	1
																						41
Station VII. 1896. Aug. 25. 35 minutes	Lemon soles,						1															1
	Common dabs,			23	24	18	10	10	1													86
	Witch soles,										1											1
	Long rough dabs,						4	5	1													10
	Haddocks,												1									1
	Gurnards,				1	1	1		1													4
	Hake,								1													1
	Dragonet,			13																		13
	Pogge,				4																	4
																						121
Oct. 23. 35 minutes	Lemon soles,							3														3
	Common dabs,					35	27	18														80
	Long rough dabs,			9			11	5														25
	Haddocks,								1		15	18	21									55
	Cod,																	1				1
	Whitings,						30			5			7									42
	Gurnards,			1			3		1	1		1		3								10
	Hake,			13										1		1						15
	Dragonets,				5																	5
																						236
Nov. 26. 35 minutes	Common dabs,		7		27	7	14	6														61
	Long rough dabs,		2	9	4		5	6														26
	Haddocks,										2	3	3									8
	Whitings,					2																2
	Cod,				1	1																2
	Gurnards,		4	5	4																	13
	Gadus minutus,			1		1																2
	Hake,		2	11	21																	34
	Gobius minutus,		1																			1
	Dragonets,				8	1																9
																						158
Station VIII. 1896. Nov. 26. 30 minutes	Common dabs,				7	6	3	3														19
	Long rough dabs,		10	14			1	2														27
	Haddocks,											1										1
	Cod,					2	2															4
	Gurnards,		2	1		1	2															6
	Brassies,		1	5	14	2		3														25
	Poor Cod,		48	62	21																	131
	Hake,			9	2								1	1								13
	Dragonet,			2																		2
																						228

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—VI. Moray Firth—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	Total.
Station IX.																						
1896. Aug. 25.	Lemon soles,					1																1
30 minutes	Common dabs,			5	11	14	8		2													40
	Witch soles,												1									1
	Long rough dabs,					6	29	6	1													42
	Haddocks,			4																		4
	Cod,		2																			2
	Zeugopterus norvegicus,			1																		1
	Sand smelt,					1																1
																						92
Nov. 26.	Common dabs,		1		5	2	1	2														11
30 minutes	Long rough dabs,					5	1	5														11
	Solenette,		1																			1
	Haddocks,								1				1									2
	Whitings,				1	2	20	2														25
	Gurnards,		5	2		1	2		1	1												12
	Pogge,			1																		1
																						63
Station XI.																						
1896. Oct. 15.	Plaice,																					
30 minutes	Lemon soles,									1												1
	Solenette,			2																		2
	Common dabs,				27	22	12		8													62
	Gurnards,				1		5			1												7
																						72
Station XIII.																						
1896. Oct. 14.	Lemon soles,				1		2		2		1											6
30 minutes	Common dabs,		22		6	6	8		1		1											44
	Haddocks,												1									1
	Cod,				1	1													1			3
	Gadus minutus,		2	2	77	102																183
	Dragonets,				2	1																3
																						240
Station XVI.																						
1896. Oct. 14.	Common dabs,		11	4	29	35	9	12	3													113
30 minutes	Sail fluke				1										1							2
	Long rough dabs,						2	1	2													5
	Haddocks,											1										1
	Gurnards,		18	1		2	1	1		2												25
	Dragonets,		1		4																	5
	Pogges,	1			3																	4
																						155

VII. Clyde.

Station, Date, and Time Trawl down.	Kind of Fish.	1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	Total.
Station I.																						
1896. Apr. 13.	Lemon soles,			2																		2
30 minutes	Common dabs,		2	5	4	3	3															17
	Long rough dabs,			2	12	7	3	2	1													
	Haddocks,																	1				
																						19

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—VII. Clyde—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	
Station V. 1896.																						
Apr. 13.	Lemon soles,					1																1
30 minutes	Common dabs,				2	4	5															11
	Long rough dabs,				5	2		4														11
	Haddocks,							1														1
	Cod,								1			2										3
	Gurnards,						1															1
	Dragonet,					1																1
																						29
Station VIII. 1896.																						
Apr. 15.	Plaice,														1							1
30 minutes	Lemon soles,							1														1
	Common dabs,			1			3	2														6
	Witch soles,						2		1	1		5	1	5								15
	Long rough dabs,		1	2	4	1	2															10
	Gurnards,									2												2
	Hake,			1	2	2																5
	Dragonets,		2	3	4																	9
	Goby,		1																			1
																						50
Oct. 31.	Witch soles,											1	2									3
30 minutes	Long rough dabs,		13	3																		16
	Gurnards,									1												1
	Hake,										2											2
	Dragonets,		3	23																		26
	Four bearded rockling (*Motella cimbria*).					1																1
																						49
Station IX. 1896.																						
Apr. 14.	Lemon soles,										1											1
40 minutes	Common dabs,					1																1
	Witch soles,								1	2	3	3		3		1						13
	Long rough dabs,		3	1	10	3																17
	Gurnards,								1													1
	Hake,						1															1
	Dragonet,				1																	1
																						35
Oct. 31.	Witch soles,									1	1											2
30 minutes	Long rough dabs,			1																		1
	Gurnards,				1			1														2
	Poor cod,			12	30	9																51
	Dragonet,		9	12																		21
	Motella cimbria,						1			1												2
	Gobius minutus,	2		$\frac{2\frac{1}{2}}{9}$																		11
																						90
Station X. 1896.																						
Apr. 14.	Witch soles,								1	3		5	6									15
30 minutes	Sail fluke,							1														1
	Long rough dabs,		5	9	5	3	3															25
	Whitings,									1												1
	Gurnards,							1														1
	Hake,				3	4																7
	Gadus minutus,						1															1
	Dragonets,			2	3	4																9
	Goby,			1																		1
																						61

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—VII. Clyde—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	Total.
1896. Oct. 28. 30 minutes	Sail fluke,	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Long rough dabs,	.	7	6	10	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	27
	Gurnards,	1	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
	Poor cod,	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Gobius minutus,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Dragonets,	.	14	44	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	67
	Motella cimbria,	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	4
																						108
Station XII 1896 Apr. 16. 30 minutes	Witch soles,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Long rough dabs,	.	.	6	14	3	15	2	1	.	.	.	.	.	.	.	.	.	.	.	.	41
	Cod,	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Whitings,	.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	3
	Gurnards,	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Gadus minutus,	.	.	2	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
	Hake,	.	.	.	14	17	7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	39
	Lumpenus lamp-petræformis,	.	.	.	.	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.	3
																						96
Oct. 30. 30 minutes	Witch soles,	.	.	.	.	.	.	2	3	1	2	2	1	.	.	.	.	.	.	.	.	11
	Long rough dabs,	.	10	5	2	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	21
	Poor cod,	.	.	16	.	12	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	29
	Gobius minutus,	.	2½ / 5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
	Motella cimbria,	.	.	.	2	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
	Liparis, sp.,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Hake,	.	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2
																						75

VIII. Firth of Clyde.

		1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	Total.
Sanda to	Bennan Head.																					
Station I. 1896. Apr. 20. 30 minutes	Sandy ray,	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
	Lemon soles,	.	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	2
	Cod,	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Brassie,	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Zeugopterus,	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Dragonets,	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
																						11
Station II. 1896. Apr. 20. 45 minutes	Sandy ray,	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Lemon soles,	.	.	.	.	1	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	4
	Dragonet,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
																						6
Station III. 1896. Apr. 20. 45 minutes	*Gadus minutus*,	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						1

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—VIII. FIRTH OF CLYDE—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	
Station IV. 1896.																						
Apr. 20.	Common dabs,					1																1
40 minutes	Witch soles,						1		3	1					1							6
	Long rough dabs,						1															1
	Hake,				1																	1
	Dragonets,			4	1																	5
	Four-bearded rockling,				1																	1
																						15
Station V. 1896.																						
Apr. 20.	Grey skate,																					1*
45 minutes	Plaice,														1							1
	Lemon soles,					1	1	2														4
	Common dabs,				5	11	2	12	4	4	1											39
	Witch soles,									1		2	1		1							5
	Long rough dabs,			4	2	1																7
	Haddocks,						2	5	3													10
	Whitings,						2	2		2												6
	Gurnards,					1	1	1	1													4
	Dragonet,			1				2														3
																						80
Sanda to	Bennan Head.																					
Station I. 1896.																						
Nov. 11.	Poor cod,		2	1		1																4
30 minutes	Gobies,		2																			2
	Pogges,	2		1																		3
	Triglops Murrayi,		2¼ / 1																			1
																						10
Station II. 1896.																						
Nov. 11.	*Zeugopterus* (?) *norvegicus*,		2	4																		6
30 minutes	Common dabs,									1												1
	Lemon soles,			7																		7
	Whitings,										1											1
	Poor cod,		1	9	3		2															15
	Brassie,							3	2													5
	Pogge,		2	3																		5
	Dragonets,		7	21	1		2		2													33
	John Dory,			3																		3
																						76
Station III. 1896.																						
Nov. 11.	Whitings,												2									2
30 minutes	Gurnards,									2												2
	Poor-cod,		6	40	8																	54
	Hake,											1										1
	Dragonets,		5	33	7	1	1															47
																						106
Station IV. 1896.																						
Nov. 11.	Common dabs,					1																1
30 minutes	Witch soles,							2		3	1	1										7
	Long rough dabs,		11																			11
	Gurnards,					1	1	1														3
	Hake,										4											4
	Gobies,		8																			8
	Dragonets,		5	18		2																25
	Motella cimbria,						1															1
																						60

* 24 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—VIII. Firth of Clyde—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	Total
Station V.																						
1896. Nov. 11. 35 minutes	Thornback skate,									1		1										2
	Lemon soles,							1														1
	Common dabs,					2	3		1													6
	Sail flukes,			3	5	5																13
	Long rough dabs,			2	3	2	1															8
	Gurnard,		2			2					1											5
	Hake,										5											5
	Poor-cod,			1																		1
	Dragonets,		2	16	5		2															25
	Motella cimbria,					1																1
																						67
Corsewall	to Mull of Cantyre.																					
Station VI.																						
1896. Apr. 21. 25 minutes	Thornback skate,																					1*
	Witch soles,				6					1			1									8
	Haddocks,												1									1
	Cod,					1																1
	Whitings,						1			1			1									3
	Gurnards,							1														1
	Poor-cod,				30	2	1	2														35
	Sand-eels,				1																	1
	Liparis,		1																			1
	Sand smelt,					2	3															5
																						57
Station VII.																						
1896. Apr. 21. 55 minutes	Poor-cod,			1	3	1																5
																						5
Station VI.																						
1896. Nov. 4. 35 minutes	Long rough dabs,					1																1
	Poor-cod,			37	2																	39
	Brassies,				1	1																2
	Gobies,		2½ / 6																			6
																						48
Station VII.																						
1896. Nov. 4. 25 minutes	Thornback skate,																		1			2†
	Poor-cod,			4	22																	26
	Liparis, sp.,		3	7																		10
																						38
Pladda to	Turnberry Point.																					
Station VIII.																						
1896. Apr. 22. 45 minutes	Lemon soles,							1														1
	Witch soles,											1	1	6	5	4		1				18
	Sail fluke,																	1				2‡
	Long rough dabs,		18	32	13	5	7	3	1	1												80
	Whitings,							1	1													2
	Poor-cod,				4		1	1														6
	Rockling (four bearded)								1													1
																						110

* 29 inches. † One at 24 inches. ‡ One at 21 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—VIII. Firth of Clyde—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	Total.
Station IX.																						
1896. Apr. 22. 45 minutes	Lemon soles,				1																	1
	Witch soles,							3			1			4	5	3						16
	Long rough dabs,		8	27	13	11	3															62
	Whitings,						1					1										2
	Gurnards,			1				1														2
	Hake,				1																	1
	Four-bearded rockling,				1		1															2
	Gobies,			1																		1
																						87
Station X.																						
1896. Apr. 22. 45 minutes	Lemon soles,			1																		1
	Common dabs,						3															3
	Witch soles,							1	3	5	3		5	6			1	2				26
	Sail fluke,						1															1
	Long rough dabs,		4	27	32	10	5	4	1													83
	Zeugopterus,		1																			1
	Gurnards,		1	2																		3
	Hake,												1									1
	Dragonets,		3	5	1	1																10
	Rockling (four bearded)										1											1
	Gobies,		1																			1
	Lumpenus,						1															1
																						132
Pladda to	Turnberry Point.																					
Station VIII.																						
1896. Nov. 5. 35 minutes	Witch soles,											1		1								2
	Long rough dabs,		14	10	4		1															29
	Whitings,							1		1												2
	Gurnards,											1										1
	Hake,				1																	1
	Poor-cod,			3	11	3	2	2														21
	Gobies,		2½ / 3																			3
	Motella cimbria,						2															2
	Angler,																					1*
																						53
Station IX.																						
1896. Nov. 5. 30 minutes	Witch soles,					1	1		2		3	2	1	1								11
	Long rough dabs,		31	2	8	1	1	1	1	1												46
	Gurnards,			1																		1
	Hake,											2	1									3
	Poor-cod,		2	30	53																	85
	Gobius niger,		3	2																		5
																						151
Station X.																						
1896. Nov. 5. 35 minutes	Common dabs,					2	2															4
	Witch soles,							1		5	3	2			1							12
	Long rough dabs,		11	30	10	5	3	1														60
	Gurnards,			1		3																4
	Hake,									2												2
	Poor-cod,		9	82	18																	109
	Gobius minutus,		3																			3
	Gobius niger,			2																		2
	Dragonets,			1	1																	2
	Motella cimbria,							1														1
																						199

* 23 inches.

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—IX. UPPER LOCH FYNE.

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	Total.
Dunderave to Carndow *																						
1896. Apr. 27. 1 hour.	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	2	.	.	4
	Common dabs,	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Witch soles,	.	.	.	.	.	.	.	1	1	4	6	4	5	.	1	1	.	.	.	.	23
	Long rough dabs,	.		(1½″	-5″)	52			11		.	.	.	.	.	.	.	.	.	.	.	63
	Brassie,	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Hake,	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Lumpenus,	.	.	.	.	.	.	.	1	1	1	1	.	.	.	.	.	.	.	.	.	4
																						100
At the very bottom (lower end) of the Loch.†																						
Apr. 27. 45 minutes	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
	Common dabs,	.	.	.	.	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	4
	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	7	7	5	2	4	.	.	.	.	23
	Long rough dabs,	.	4	17	19	6	3	1	.	1	1	.	.	.	.	.	.	.	.	.	.	52
	Cod,	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	2
	Gobies,	.	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
	Lumpenus,	.	.	.	.	.	.	.	.	3	2	.	1	.	.	.	.	.	.	.	.	6
																						93
Also at the head of the Loch.†																						
Apr. 27. 30 minutes	Lemon soles,	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
	Common dabs,	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	2
	Long rough dabs,	.	3	16	7	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	30
																						34
Off Largymore. 1st haul.‡																						
Apr. 28.	Pipe-fish,	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						1
Same locality. 2nd haul.‡																						
Apr. 28.	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
	Flounders,	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
																						2
Loch Gair.†																						
Apr. 28. 20 minutes	Plaice,	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
	'Skate,	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1§
																						2
Luce Bay.†																						
Apr. 28.	Plaice,	.	.	.	.	4¾ / 1	.	.	1	.	.	.	.	.	.	.	.	.		.	.	2
																						2
Ardrishaig Bay.†																						
Apr. 28. 15 minutes	Plaice,	.	.	.	.	.	.	.	.	.	1	2	.	.	3	.	.	.	1	.	.	7
	Common dabs,	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
																						8
Loch Gair to Minard Castle.‡																						
Apr. 29.	Common dabs,	.	.	.	.	6	4	2	.	.	.	.	.	.	.	.	.	.	.	.	.	12
	Witch soles,	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	2
	Long rough dabs,	.	.	.	4	6	6	4	3	.	.	.	.	.	.	.	.	.	.	.	.	23
	Gurnards,	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Dragonet,	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						40

* From Notes by Captain Campbell and Mr Dannevig.
‡ From Captain Campbell's Notes.
† From Mr Dannevig's Notes.
§ 24 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—IX. Upper Loch Fyne—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	
Castle Lachlan Bay.* 1896.																						
Apr. 29.	Common dabs, .	.	.	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
	Long rough dabs,	.	.	.	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2
	Pogge.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						9
Inverae to Crearae.*																						
Apr. 29.	Common dabs, .	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Long rough dabs,	.	.	3	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
																						9
Crearae to Furnace.*																						
Apr. 29.	Long rough dabs,	.	4	6	10	6	9	6	.	.	.	.	.	.	.	.	.	.	.	.	.	41
	Gobies, . .	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						42
Penmore Bay.*																						
Apr. 29.	Long rough dabs,	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
																						4
Off Inveraray, round head of Loch Shira. 1st haul.																						
May 5. 15 minutes	Plaice, . .	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Butter-fish, .	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1
	Common eel, .	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						3
2nd haul.																						
May 5. 15 minutes	Long rough dabs,	.	.	2	1	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	5
	Cod, ...	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	2
	Gobies, . .	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
																						10
3rd haul.																						
May 5. 15 minutes	Common dabs, .	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Long rough dabs,	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Gobies, . .	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
																						6
Off Carndow.																						
May 6. 30 minutes	Plaice, . .	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	.	2
	Lemon soles, .	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
	Common dabs, .	.	.	.	1	3	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	5
	Witch soles, .	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Long rough dabs,	.	.	.	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Cod, ...	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	1
	Brassie, . .	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Gurnards, . .	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
	Gobies, . .	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
																						17
Off Kinglass Spit (inshore)																						
May 6. 30 minutes	Lemon soles, .	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	2
	Common dabs, .	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Cod, ...	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Gobies, . .	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
	Zeugopterus, .	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						6
Off Ardno Farm.																						
May 6. 30 minutes	Lemon soles, .	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
	Cod, . . .	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Gobies, . .	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
																						3

* From Captain Campbell's Notes.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—IX. Upper Loch Fyne—*continued*.

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches. 1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	Total.
Strachur Bay. 1896. May 6. 30 minutes	No fish																					.
Castle Lachlan Bay. May 6. 30 minutes	Plaice,							1														2*
	Long rough dabs,					1				1												2
																						4
Loch Gair. May 6. 30 minutes	Plaice,										1		1	1		2						5
	Cod,								3		4		1									8
	Dragonet,										1											1
	Gobies,		3																			4
	15 Spined stickleback						1															1
																						19
North side of Otter Spit (in-shore). May 6. 40 minutes	Plaice,											1		1								2
	Cod,						1							1								2
																						4
Tarbert Bank (off Tarbert). May 7. 40 minutes	Lemon soles,						2			1			1			1						5
	Zeugopterus,		1																			1
	Common dabs,					1				1												2
	Long rough dabs,		2	1	1			1														5
	Gurnard,							1														1
	Brassie,					1																1
	Dragonet,			1																		1
																						16
Castle Lachlan Bay. Nov. 10. 30 minutes	Common dabs,		1		2			3		1												7
	Witch soles,															1						1
	Long rough dabs,			1	1	2	1															5
	Cod,				1																	1
	Hake,										1											1
																						15
Loch Shira (off Inveraray). Nov. 11. 30 minutes	Thornback skate,																					1†
	Common dabs,							2	1													3
	Witch soles,													2	1	1						4
	Long rough dabs,	1½ / 1	-2 / 4	12	19	3	4	1		1	1											55
	Dragonet,				1																	1
	Gobies,		11	4																		15
																						79
Off Ardno. Nov. 11. 30 minutes	Common dabs,					1																1
	Witch soles,												1	1								2
	Long rough dabs,		2	18	16	3	5															44
	Gobies,	1	3																			4
																						51
Kinglass to Cairndow. Nov. 11. 35 minutes	Witch soles,											1			1							2
	Long rough dabs,		1	1	1	3		1	1													8
	Cod,												2									2
	Gobies,	1½ / 2	-2 / 3	4	1																	28
	Liparis, sp.,		1½ / 1																			1
																						41

* 23 inches. † 24 inches.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

A. FISH CAUGHT (*Shrimp Trawl*)—IX. Upper Loch Fyne—*continued.*

Station, Date, and Time Trawl down.	Kind of Fish.	Size in Inches.																				Total.
		1 +	2 +	3 +	4 +	5 +	6 +	7 +	8 +	9 +	10 +	11 +	12 +	13 +	14 +	15 +	16 +	17 +	18 +	19 +	20 +	
Off Lowburn (at the head of the Loch). 1896.																						
Nov. 11.	Common dabs, .	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2
35 minutes	Witch soles, .	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
	Hake, . . .	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
	Poor cod, . .	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
	Gobies, . .	$1\frac{1}{2}$–2 / 28		24	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	52
	Pipe-fish, . .	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
																						59
Loch Gair.																						
Nov. 13.	Plaice, . . .	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
30 minutes	Fatherlasher, .	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
(1 p.m.	Butterfish, . .	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
to 1.30 p.m.)	15 Spined sticklebacks,	.	.	5	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8
																						11

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—I. Firth of Forth.

Station, Date, and Time Net down.	Net.	Organisms Captured.
Station I.		
1896. Jan. 24. $1\frac{1}{2}$ hours.	S.	*Thysanoessa*, sp. fr.; *Parathemisto oblivia*, ab.; *Calanus finmarchicus*, fr.; *Sagitta*, fr.; young herring, f.
	B.	*Thysanoessa*, sp. r.; *Parathemisto oblivia*, r.; *Hyperoche tauriformis*, r.; *Metopa*, sp. r.; *Calanus finmarchicus*, fr.; *Caligus rapax*, fr.; *Sagitta*, c.; *Tomopteris*, c.
Feb. 14. 2 hours.	S.	*Parathemisto oblivia*, c.; *Calanus finmarchicus*, c.; *Sagitta*, fr.; Ctenophora, f.
	B.	*Thysanoessa*, fr.; *Parathemisto oblivia*, f.; *Hyperoche tauriformis*, r.; *Peroculodes longimanus*, f.; *Calanus finmarchicus*, fr.; *Candace pectinata*, f.; *Alteutha*, sp. f.; *Caligus rapax*, fr.; *Sagitta*, fr.; *Tomopteris*, f.; Ctenophora, f.; young Crustacea, f.; young Ophiuroid, starfish, f.
Station II.		
1896. Jan. 24. $1\frac{8}{12}$ hours.	S.	*Thysanoessa*, sp. f.; *Parathemisto oblivia*, fr.; *Calanus finmarchicus*, c.; *Sagitta*, f.
	B.	*Polycera*, sp. one specimen; *Thysanoessa*, sp. r.; *Parathemisto oblivia*, r.; *Hyperoche tauriformis*, r.; *Calanus finmarchicus*, c.; *Caligus rapax*, fr.; *Sagitta*, fr.; *Tomopteris*, r.; young starfish, r.
Station III.		
1896. Jan. 20. $3\frac{1}{12}$ hours.	S.	*Thysanoessa*, sp. fr.; *Parathemisto oblivia*, c.; *Calanus finmarchicus*, fr.; *Sagitta*, f.
	B.	*Thysanoessa*, sp. c.; *Mysidopsis gibbosa*, f.; *Pandalus Montagui*, r.; *Hyperoche tauriformis*, fr.; *Parathemisto oblivia*, f.; *Calanus finmarchicus*, c.; *Caligus rapax*, f.; *Sagitta*, ab.; *Tomopteris*, f.; Ctenophora, f.; young herring, r.
Feb. 13. 3 hours.	S.	*Thysanoessa*, sp. r.; *Parathemisto oblivia*, c.; *Calanus finmarchicus*, f.
	B.	*Macropsis Slabberi*, f.; *Mysis flexuosus*, f.; *Erythrops Goesii*, fr.; *Mysis ornatus*, f.; *Mysis spiritus*, f.; *Parathemisto oblivia*, fr.; Lyanasidea, f.; *Paratylus swammerdami*, f.; *Iphimidea obesa*, f.; *Calanus finmarchicus*, f.; *Alteutha*, sp. f.; *Caligus rapax*, f.; *Sagitta*, ab.; *Tomopteris*, f.; (additional), *Pandalus Montagui*, r.; *Hyperoche tauriformis*, r.; *Diastylus*, sp. f.; *Perioculodes longimanus*, f.; young lamellibranchs, fr.; post-larval fishes, one specimen; Ctenophora, f.
Station IV.		
1896. Jan. 21. $3\frac{5}{12}$ hours.	S.	Euphansidæ, r.; *Parathemisto oblivia*, c.; *Eurydice pulchra*, one; *Calanus finmarchicus*, f.; *Sagitta*, f.
	B.	Euphansidæ, r.; *Hyperoche tauriformis*, r.; *Hyperia galba*, r.; *Calanus finmarchicus*, fr.; *Caligus rapdx*, f.; *Sagitta*, fr.
Feb. 20. $3\frac{1}{2}$ hours.	S.	*Parathemisto oblivia*, r.; *Caligus rapax*, r.; a considerable quantity of mud in suspension in the water.
	B.	*Eolis viridis* (?), one specimen; *Eolis Landsburghi* (?), one specimen; *Polycera ocellata*, r.; *Mysis spiritus*, one specimen; *Pandalus Montagui*, one specimen; *Calanus finmarchicus*, c.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, fr.; *Acartia*, sp. r.; *Caligus rapax*, fr.; young lamellibranchs, f.; young Crustacea, f.; *Sagitta*, fr.; young pipe-fish, one specimen; post-larval fishes, f.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—I. Firth of Forth—*continued.*

Station, Date, and Time Net down.	Net.	Organisms Captured.
Station V. 1896.		
Jan. 30. $1\frac{11}{12}$ hours.	S.	*Parathemisto oblivia*, f.; *Hyperoche tauriformis*, r.; *Calanus finmarchicus*, c. ; *Sagitta*, fr.; *Tomopteris*, f. ; Ctenophora, f.
	B.	*Thysanoessa*, sp. f.; *Parathemisto oblivia*, f.; *Hyperoche tauriformis*, r. ; *Paratylus*, sp. fr. ; *Calanus finmarchicus*, fr. ; *Sagitta*, fr. ; *Tomopteris*, f.; Ctenophora, f.
Feb. 19. $1\frac{10}{12}$	S.	*Parathemisto oblivia*, f. ; *Calanus finmarchicus*, r.; *Sagitta*, f.
	B.	*Thysanoessa*, sp. r.; *Mysis*, sp. r.; *Pseudocuma cercaria*, r., *Calisoma crenata*, fr.; *Paratylus*, sp. f.; *Calanus finmarchicus*, fr. ; *Caligus rapax*, fr. ; *Sagitta*, c. ; young lamellibranchs, fr. ; young Ophiurids, fr.
Station VI.		
Jan. 30. $\frac{10}{12}$ hours.	S.	*Parathemisto oblivia*, fr.; *Paratylus*, sp. f.; *Calanus finmarchicus*, fr.; *Sagitta*, c. ; *Tomopteris*, fr. ; Ctenophora, fr.
	B.	*Mysis*, sp. r.; *Parathemisto oblivia*, f.; *Calanus finmarchicus*, fr.; *Caligus rapax*, fr.; *Sagitta*, fr.
Feb. 19. $\frac{8}{12}$ hours.	S.	*Parathemisto oblivia*, f.; *Calanus finmarchicus*, f.; *Sagitta*, r.
	B.	*Thysanoessa*, sp. f. ; *Mysis spiritus*, r. ; *Parathemisto oblivia*, r. ; *Calisoma crenata*, f.; *Calanus finmarchicus*, f.; *Temora longicornis*, r.; *Caligus rapax*, fr. ; *Sagitta*, c.; young Crustacea, f. ; young starfishes, f.
Station VII.		
Jan. 30. $1\frac{8}{12}$ hours.	S.	*Parathemisto oblivia*, c.; *Calanus finmarchicus*, f.; *Sagitta*, f.
	B.	*Erythrops Goesii*, f.; *Parathemisto oblivia*, fr.; *Hyperoche tauriformis*, r.; *Calisoma crenata*, f.; *Paratylus*, sp. f.; *Calanus finmarchicus*, f.; *Caligus rapax*, f.; *Sagitta*, c.; *Tomopteris*, fr.; Ctenophora, f.
Feb. 19. $1\frac{10}{12}$ hours.	S.	*Parathemisto oblivia*, f.; *Calanus finmarchicus*, r.; *Sagitta*, r.
	B.	*Parathemisto oblivia*, r. ; *Calisoma crenata*, r.; *Paratylus swammerdami*, f. ; *Calanus finmarchicus*, f.; *Caligus rapax*, fr.; *Sagitta*, c.; young Lamellibranchs, f.; young Ophiurids, r.
Station VIII.		
Jan. 29. $1\frac{11}{12}$ hours.	S.	*Parathemisto oblivia*, fr.; *Calanus finmarchicus*, c.; *Sagitta*, f.
	B.	*Parathemisto oblivia*, r.; *Hyperoche tauriformis*, r.; *Paratylus*, sp. r.; *Calanus finmarchicus*, f.; *Caligus rapax*, r.; *Sagitta*, c.; *Tomopteris*, fr.; Ctenophora, f.
Feb. 18. 2 hours.	S.	*Parathemisto oblivia*, f. ; *Calanus finmarchicus*, r.; *Acartia*, sp. f.; *Caligus rapax*, r.; *Sagitta*, r.
	B.	*Thysanoessa*, sp. f.; *Parathemisto oblivia*, f.; *Calisoma crenata*, r.; *Metopa*, sp. r.; *Paratylus*, sp. f.; *Calanus finmarchicus*, fr.; *Alteutha*, sp. r.; *Caligus rapax*, f.; *Sagitta*, ab.; *Tomopteris*, c.; young starfish (Ophiuroids), f.
Station IX.		
Jan 29. $1\frac{11}{12}$ hours.	S.	*Parathemisto oblivia*, fr.; *Calanus finmarchicus*, c.; *Sagitta*, fr.
	B.	*Thysanoessa*, sp. f.; *Erythrops Goesii*, r.; *Mysis*, sp. r.; *Pseudocuma cercaria*, f.; *Parathemisto oblivia*, f.; *Calisoma crenata*, r.; *Paratylus*, sp. f.; *Cleone borealis*, 1 specimen; *Calanus finmarchicus*, f.; *Caligus rapax*, r.; *Sagitta*, c.; *Tomopteris*, f.; Ctenophora, f.
Feb. 18. 2 hours.	S.	*Parathemisto oblivia*, r.; *Calanus finmarchicus*, f.; *Sagitta*, r.
	B.	*Parathemisto oblivia*, f. ; *Paratylus*, sp. f. ; *Calanus finmarchicus*, f.; *Caligus rapax*, f.; *Sagitta*, c.; young Gastropod Mollusca, f. ; young Lamellibranch Mollusca, fr.; young Ophiurids, fr.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—I. Firth of Forth—*continued.*

Station, Date, and Time Net down.	Net.	Organisms Captured.
Station X. 1896.		
Jan. 25. $\frac{8}{12}$ hour.	S.	*Parathemisto oblivia*, f.; *Calanus finmarchicus*, r.; a considerable quantity of mud in suspension in the water.
	B.	*Macropsis slabberi*, fr.; *Parathemisto oblivia*, r.; *Calanus finmarchicus*, f.; *Sagitta*, f.; two young herrings.
Feb. 12. $\frac{3}{4}$ hour.	S.	*Macropsis Slabberi*, f.; *Parathemisto oblivia*, f.; *Calanus finmarchicus*, r.; *Caligus rapax*, f.; *Sagitta*, f.; young Crustacea, r.
	B.	*Crengon Allmanni*, fr.; *Pandalus Montagui*, 1 specimen; *Hippolyte pusiola*, 1 specimen; *Virbius fasciger*, r.; *Macropsis, Slabberi*, f.; *Gastrosaccus spinifer*, f.; *Mysis flexuosus*, r.; *Mysis ornatus*, f.; *Diastylus*, sp. f.; *Parathemisto oblivia*, f.; *Hyperoche tauriformis*, *Paratylus*, sp. f.

II. St Andrews Bay.

Station, Date, and Time Net down.	Net.	Organisms Captured.
Station I.		
Jan. 14. $2\frac{1}{12}$ hours.	S.	*Thysanoessa*, sp. f.; *Parathemisto oblivia*, c.; *Calanus finmarchicus*, f.
	B.	*Mysis ornatus*, f.; *Leptomysis*, sp. r.; *Erythrops*, (jun.), r.; *Parathemisto oblivia*, f.; *Calanus finmarchicus*, f.; *Temora longicornis*, r.; *Sagitta*, ab.; *Tomopteris*, fr.; Ctenophora, f.
Feb. 6. 2 hours.	S.	*Parathemisto oblivia*, c.; *Calanus finmarchicus*, fr.; *Sagitta*, fr.
	B.	*Parathemisto oblivia*, f.; *Calanus finmarchicus*, f.; *Caligus rapax*, f.; *Sagitta*, f.; young starfish, f.
Station II.		
Jan. 17. 2 hours.	S.	*Thysanoessa*, sp. f.; *Parathemisto oblivia*, c.; *Hyperoche tauriformis*, r.; *Calanus finmarchicus*, f.; Ctenophora, f.
	B.	*Thysanoessa*, sp. f.; *Mysis*, sp. fr.; *Erythrops Goesi*, f.; *Diastylus*, sp. r.; *Parathemisto oblivia*, f.; *Hyperoche tauriformis*, f.; *Perioculodes longimanus*, r.; *Calanus finmarchicus*, fr.; *Caligus rapax*, r.; *Sagitta*, ab.; *Tomopteris*, fr.
Feb. 7. $1\frac{3}{4}$ hours.	S.	*Parathemisto oblivia*, fr.; *Calanus finmarchicus*, f.; *Caligus rapax*, r.; *Sagitta*, f.
	B.	*Macropsis Slabberi*, f.; *Parathemisto oblivia*, r.; *Calanus finmarchicus*, f.; *Candace pectinata*, r.; *Caligus rapax*, fr.; *Sagitta*, f.; young Crustacea, f.
Station III.		
Jan. 17. $1\frac{7}{12}$ hours.	S.	*Thysanoessa*, sp. f.; *Parathemisto oblivia*, c.; *Calanus finmarchicus*, f.
	B.	*Thysanoessa*, sp. f.; *Parathemisto oblivia*, fr.; *Hyperoche tauriformis*, f.; *Paratylus*, sp. r.; *Diastylus*, sp. r.; *Calanus finmarchicus*, fr.; *Candace pectinata*, r.; *Caligus rapax*, f.; *Sagitta*, c.; *Tomopteris*, fr.; young lamellibranch mollusca, f.; young Crustacea, f.
Feb. 7. $1\frac{7}{12}$ hours.	S.	*Parathemisto oblivia*, c.; *Calanus finmarchicus*, f.; *Sagitta*, f.; Ctenophora, r.
	B.	*Macropsis Slabberi*, f.; *Parathemisto oblivia*, r.; *Calanus finmarchicus*, f.; *Caligus rapax*, c.; *Sagitta*, f.; young Crustacea, f.
Station IV.		
Jan. 14. $1\frac{7}{12}$ hours.	S.	*Thysanoessa*, sp. f.; *Parathemisto oblivia*, fr.; *Calanus finmarchicus*, f.; *Caligus rapax*, r.; *Sagitta*, f.
	B.	*Crangon allmanni*, r.; *Mysis lamorne*, r.; *Mysis flexuosus*, r.; *Macropsis Slabberi*, f.; *Parathemisto oblivia*, r.; *Hyperoche tauriformis*, f.; *Paratylus Swammerdami*, f.; *Idotea linearis*, r.; *Calanus finmarchicus*, f.; *Sagitta*, fr.; Ctenophora, f.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—II. St Andrews Bay—*continued.*

Station, Date, and Time Net down.	Net.	Organisms Captured.
1896. Feb. 6. $2\frac{7}{12}$ hours.	S.	*Parathemisto oblivia*, fr.; *Eurydice pulchra*, 1 specimen; *Calanus finmarchicus*, f.; *Acartia*, sp. r.; *Caligus rapax*, r.; *Sagitta*, f.
	B.	*Macropsis Slabberi*, fr.; *Thysanoessa*, r.; *Parathemisto oblivia*, f.; *Hyperoche tauriformis*, r.; *Paratylus Swammerdami*, f.; *Idotea marina*, r.; *Idotea linearis*, 4 specimens; *Calanus finmarchicus*, f.; *Caligus rapax*, fr.; *Sagitta*, f.
Station V.		
Jan. 14. 2 hours.	S.	*Thysanoessa*, sp. r.; *Parathemisto oblivia*, c.; *Calanus finmarchicus*, fr.; *Sagitta*, f.
	B.	*Thysanoessa*, sp. f.; *Parathemisto oblivia*, f.; *Calanus finmarchicus*, fr.; *Sagitta*, c.; *Tomopteris*, f.; Ctenophora, f.; *Caligus rapax*, f.;
Feb. 6. 2 hours.	S.	*Parathemisto oblivia*, fr.; *Calanus finmarchicus*, f.; *Caligus rapax*, r.; *Sagitta*, f.
	B.	*Hyperoche tauriformis*, r.; *Calanus finmarchicus*, f.; *Caligus rapax*, f.; Ctenophora, fr.
Station VI.		
Jan. 17. $1\frac{1}{2}$ hours.	S.	*Thysanoessa*, sp. r.; *Parathemisto oblivia*, fr.; *Calanus finmarchicus*, f.
	B.	*Crangon allmanni*, fr.; *Parathemisto oblivia*, f.; *Calanus finmarchicus*, f.; *Sagitta*, ab.; *Tomopteris*, f.
Feb. 5. $1\frac{1}{2}$ hours.	S.	*Parathemisto oblivia*, f.; *Hyperoche tauriformis*, r.; *Calanus finmarchicus*, f.; *Sagitta*, f.
	B.	Euphausidæ, f.; *Parathemisto oblivia*, fr.; *Hyperia*, sp. f.; *Calisoma crenata*, fr.; *Paratylus*, sp. fr.; *Calanus finmarchicus*, f.; *Caligus rapax*, f.; *Sagitta*, c.

III. Moray Firth.

Station, Date, and Time Net down.	Net.	Organisms Captured.
Station I.		
Aug. 26. 2 hours.	S.	Young lumpsuckers, 2. Young pipe-fish, 1. *Calanus finmarchicus*, r.; Ctenophora, c. Fish ova, r. Young Crustacea, f.
	B.	*Calanus finmarchicus*, r.; Ctenophora, c. Young Crustacea, f.; P.L. fishes, r.
Oct. 16. 2 hours.	S.	*Idotea marina*, 3. *Parathemisto oblivia*, r.; *Calanus finmarchicus*, r.; *Caligus rapax*, r.; *Sagitta*, r.; *Tomopterus*, r.; Ctenophora, f.; young Crustacea, f.; young flat fish, 1.
	B.	*Parathemisto*, r.; *Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Sagitta*, c.; Ctenophora, fr.; *Tomopteris*, fr.; young Crustacea, fr.
Nov. 27. $2\frac{1}{12}$ hours.	S.	*Clione borealis*, six. *Spirialis retroversus*, f.; *Salpa*, sp., two. (?) *Hyperia*, sp.; two. *Parathemisto*, sp. fr.; *Melita obtusata*, one. *Idotea tricuspidata*, one. *Calanus finmarchicus*, f.; *Centropages typicus*, f.; *Sagitta*, fr.; *Tomopteris*, 1. Ctenophora, fr.; young Crustacea, f. A quantity of *zostera*.
	B.	*Ægirus punctilucens*, one. *Spirialis retroversus*, f.; *Acartia*, sp., r.; *Caligus rapax*, one. Ctenophora, r.
Station II.		
Aug. 21. 2 hours.	S.	*Parathemisto* (?) *oblivia*, f.; *Calanus finmarchicus*, fr.; *Centropages typicus*, f.; *Anomalocera Patersonii*, f.; Ctenophera, fr.; young Crustacea, fr.; young fishes, f.
	B.	*Eolis*, sp. r.; *Hyperia galba*, r.; *Calanus finmarchicus*, f.; *Centrcpages typicus*, r.; *Anomalocera Patersonii*, r.; *Caligus rapax*, r.; *Anceus*, sp. (♀) r.; young Crustacea, f.

TABLE C.—Record of Observations made on board the 'Garland' during 1896.

B. PELAGIC FAUNA—III. Moray Firth—*continued.*

Station, Date, and Time Net down.	Net.	Organisms Captured.
1896. Oct. 16. 2 hours.	S.	Boreophausidæ, f.; *Idotea marina*, one. *Parathemisto* (?) *oblivia* (jun), f.; *Calanus finmarchicus*, f.; *Centropages typicus*, r.; *Sagitta*, r.; *Tomopteris oniciformis*, fr.; *Ctenophora*, f.; young decapod Crustacea, f.
	B.	*Hyperia galba*, one. *Hyperoche tauriformis*, (Bate), one. *Calanus finmarchicus*, ab.; *Rhincalanus Gigas*, one. *Sagitta*, c.; *Tomopteris*, fr. *Ctenophera*, fr.
Nov. 23. 1 hour 55 minutes.	S.	*Parathemisto oblivia*, f.; *Paratylus swammerdami*, one. *Calanus finmarchicus*, fr.; *Acartia Clausii*, f.; *Centropages hamatus*, f.; *Sagitta*, fr.; Ctenophora, r.; young Crustacea, fr.
	B.	*Salpa*, one. *Calanus finmarchicus*, r.; *Temora longicornis*, f.; *Centropages hamatus*, f.; *Caligus*, f.; *Sagitta*, fr.; Ctenophora, r.; *Tomopteris*, r.; young starfish, r.
Station III.		
Aug. 22. $1\frac{1}{12}$ hours.	S.	*Hyperoche*, r.; *Acartia Clausii*, r.; *Centropages typicus*, r.; *Caligus rapax*, r.; *Ctenophora*, f.; Diatomacea and Infusoria, f.; young *Idotea*, one. young pipe fishes, five. fish ova, r.
	B.	*Paratylus*, sp. r.; *Hyperoche*, f.; *Acartia*, f.; *Caligus rapax*, r.; Ctenophora, c.; young Crustacea, f. post-larval fishes, fr.
Oct. 20. $1\frac{4}{12}$ hours.	S.	*Idotea marina*, one. *Parathemisto* (?) *oblivia*, one. *Gammarus*, sp. one. *Caligus rapax*, r.; *Ctenophora*, r.; young Crustacea, f.
	B.	*Virbius fasciger*, r.; *Pandalus Montagui*, one. *Mysis flexuosus*, f.; *Gastrosaccus spinifer*, f.; *Hyperoche*, one. *Iphimedia*, sp., one. *Microprotopus maculatus*, r.; *Paratylus Swammerdami*, f.; *Acartia Clausii*, r.; *Temora longicornis*, fr.; *Parapontella*, one. *Centropages typicus*, r.; *Alteutha*, sp. f.; *Caligus rapax*, f.; Ctenophora, fr.; young *Idotea*, r.
Nov. 24. $1\frac{1}{4}$ hour.	S.	*Mysis flexuosus*, r.; *Parathemisto*, r.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Acartia Clausii*, f.; *Idotea marina*, one. *Caligus rapax*, f.; *Jonesiella*, sp. r.; Ctenophora, f.
	B.	*Pseudocuma cercaria*, one. *Amphilochus manudens*, one. *Gitana Sarsii*, one. *Temora longicornis*, f.; *Alteutha*, sp. r.; young Crustacea, f.; a considerable quantity of half rotten comminuted weed.
Station IV.		
Aug. 24. $1\frac{10}{12}$ hours.	S.	*Hyperia galba*, f.; *Hyperoche*, r.; *Calanus finmarchicus*, f.; *Centropages typicus*, r.; Ctenophora, fr.; young Crustacea, f.; young Gastropod Mollusca, f.; fish ova, r.
	B.	*Calanus finmarchicus*, f.; *Acartia Clausii*, r.; *Parathemisto* (?) *oblivia*, r.; Ctenophora, fr.; young Crustacea, ab.; post-larval fishes, c.
Oct. 23. 2 hours.	S.	*Idotea marina*, one.; *Acartia Clausii*, r.; *Temora longicornis*, r.; *Parathemisto* (?) *oblivia*, r.; *Sagitta*, f.; *Tomopteris*, r.; *Ceratium fuscus*, f.; Ctenophora, f.; young Crustacea. f.
	B.	*Hyperia galba* (jun.), f.; *Parathemisto* (?) *oblivia* (jun.), r.; *Calanus finmarchicus*, fr.; *Temora longicornis*, r.; *Caligus rapax*, fr.; *Sagitta*, fr.; *Tomopteris*, f.; Ctenophora, c.; young Crustacea, f.; young pipe-fish, one; post-larval fishes, r.
Nov. 25. 2 hours.	S.	*Pleurobrachia*, ab.
	B.	*Calanus finmarchicus*, v. f.; *Temora longicornis*, f.; *Sagitta*, f.; *Tomopteris*, r.; Ctenophora, r.; a small quantity of comminuted weed.
Station V.		
Aug. 24. $1\frac{3}{4}$ hours.	S.	*Hyperoche*, r.; *Parathemisto*, r.; *Calanus finmarchicus*, f.; *Centropages typicus*. r.; Ctenophora, fr.; young Crustacea, ab.; *Aurelia aurita*, one; post-larval fish, one; fish ova, f.
	B.	*Calanus finmarchicus*, f.; *Acartia Clausii*, r.; *Parathemisto*, r.; Ctenophora, f.; young Crustacea, c.; post-larval fishes, fr.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—III. Moray Firth—*continued.*

Station, Date, and Time Net down.	Net.	Organisms Captured.
1896. Oct. 23. $1\frac{1}{2}$ hours.	S.	*Hyperoche,* one; *Parathemisto* (jun.), f.; *Calanus finmarchicus,* r.; *Acartia Clausii,* f.; *Temora longicornis,* r.; *Sagitta,* f.; Ctenophora, f.; young Crustacea, r.
	B.	*Hyperoche tauriformis* (sp. Bate), fr.; *Parathemisto* (jun.), f.; *Calanus finmarchicus,* fr.; *Temora longicornis,* r.; *Centropages typicus,* r.; *Caligus rapax,* f.; *Sagitta,* fr.; *Tomopteris,* fr.; Ctenophora, fr.; young Cephalopod, one; young Crustacea, f.; post-larval fishes, f.
Nov. 25. $1\frac{1}{12}$ hours.	S.	*Hyperoche,* v. r.; *Parathemisto,* v. r.; *Pleurobrachia,* ab.
	B.	*Calanus finmarchicus,* r.; *Caligus rapax,* f.; *Sagitta,* r.; *Tomopteris,* r.
Station VI.		
Aug. 25. $1\frac{8}{12}$ hours.	S.	*Hyperia galba,* fr.; *Calanus finmarchicus,* f.; *Acartia,* sp., f.; *Ctenophora,* fr.; *Aurelia aurita,* one; young Crustacea, fr.; post-larval fishes, r.; fish ova, f.
	B.	*Hyperia galba,* ♂ (most jun.), f.; *Calanus finmarchicus,* f.; *Acartia,* sp., f.; *Sagitta,* f.; Ctenophora, c.; young Crustacea, fr.; young Gastropod Mollusca, fr.; young fish, fr.
Oct. 23. $1\frac{3}{4}$ hours.	S.	*Hyperoche tauriformis,* one; *Sagitta,* r.; *Tomopteris,* r.; Ctenophora, c.; young Crustacea, f.
	B.	*Hyperoche,* f.; *Calanus finmarchicus,* f.; *Temora longicornis,* f.; *Caligus rapax,* f.; *Sagitta,* f.; Ctenophora, ab.; young fishes, f.
Nov. 25. $1\frac{3}{4}$ hours.	S.	*Pleurobrachia,* ab.
	B.	*Paratylus Swammerdami,* r.; *Temora longicornis,* f.; *Acartia Clausii,* f.; *Caligus rapax,* r.; *Sagitta,* r.; *Tomopteris,* r.; *Alteutha,* sp., r.; young Crustacea (*Mysis,* sp. ?), r.; *Pleurobrachia,* f.; comminuted weed, a small quantity.
Aug. 25. $1\frac{1}{4}$ hours.	S.	*Calanus finmarchicus,* r.; *Acartia,* sp., f.; Ctenophora, f.; young Crustacea, fr.; young rockling, two; young lumpsucker, one; fish ova, f.
	B.	*Hyperoche tauriformis,* f.; *Parathemisto* (?) *oblivia,* f.; *Anceus,* sp., r.; *Calanus finmarchicus,* fr.; *Caligus rapax,* f.; *Sagitta,* f.; young Cephalopoda, r.; young Crustacea, f.; young Gastropod Mollusca, c.; young Ophiuridæ, f.; post-larval fishes, fr.
Station VII.		
Oct. 23. 2 hours.	S.	*Salpæ,* r.; Ctenophora, fr.
	B.	*Hyperoche tauriformis,* f.; *Parathemisto,* r.; *Calanus finmarchicus,* f.; *Temora longicornis,* f.; *Salpæ,* fr.; *Sagitta,* fr.; Ctenophora, c.; young *Mytilus,* f.; young *Ophiuridæ,* f.
Nov. 26. $1\frac{1}{12}$ hours.	S.	*Hyperoche,* r.; *Calanus finmarchicus,* r.; *Temora longicornis,* r.; *Acartia Clausii,* f.; *Tomopteris,* r.; *Pleurobrachia,* fr.
	B.	*Calanus finmarchicus,* r.; *Temora longicornis,* f.; *Acartia Clausii,* r.; *Sagitta,* fr.; *Tomopteris,* r.; Ctenophora, f.
Station VIII.		
Aug. 25. $1\frac{1}{12}$ hours.	S.	*Calanus finmarchicus,* f.; *Centropages typicus,* f.; *Anomalocera Patersonii,* f.; *Salpa,* one; *Ctenophora,* f.; large Medusa, f.; young fishes (Rockling, &c.), f.; Fish ova, f.; young Crustacea, c.
	B.	*Hyperoche tauriformis,* f.; *Calanus finmarchicus,* f.; *Caligus rapax,* fr.; *Sagitta,* f.; *Tomopteris,* f.; Ctenophora, fr.; young Crustacea, fr.; young Gastropod molusca, c.; *Anceus,* sp. f.
Oct. 24. $1\frac{1}{12}$ hours.	S.	*Acartia,* sp. r.; very little in net.
	B.	*Boreophausidæ,* f.; *Crangon Allmanni,* f.; *Mysis ornatus,* r.; *Erythrops pygmæa,* r.; *Pseudocuma,* sp. r.; Amphipods (*Parathemisto, Calisoma, Tryphosites,* &c.), several; *Anceus,* sp. (♂) one; *Philomedes interpuncta,* one; *Calanus finmarchicus,* r.; *Temora longicornis,* f.; *Caligus rapax,* f.; *Planaria,* sp., one; Ctenophora, c.; young Crustacea, f.; several young fishes (*Gobius*).

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1896.

B. PELAGIC FAUNA—III. MORAY FIRTH—*continued.*

Station, Date, and Time Net down.	Net.	ORGANISMS CAPTURED.
1896. Nov. 26.	S.	*Pleurobrachia*, ab.; young Crustacea, r.; *Calanus finmarchicus*, r.;
$1\frac{9}{12}$ hours.	B.	*Temora longicornis*, fr.; *Caligus rapax*, r.; *Sagitta*, f.; *Tomopteris*, r.; Ctenophora, f.
Station IX.		
Aug. 25. $1\frac{3}{4}$ hours.	S.	*Calanus finmarchicus*, f.; *Centropages typicus*, f.; *Salpa*, sp. r.; Ctenophora, f.; young Crustacea, f.; young fish, r.; Fish ova, f.
	B.	*Spirialis retroversus*, f.; *Gastrosaccus spinifer*, f.; Amphipoda (*Hyperoche*, *Parathemisto*, *Argissa*), fr.; *Calanus finmarchicus*, fr.; *Temora longicornis*, r.; *Caligus rapax*, f; *Podon intermedius*, f.; *Sagitta*, fr.; *Echinospira* (?), several specimens; Ctenophora, r.; Pycnogons, r.; young Gastropod Mollusca, c.; post-larval fishes, fr.
Oct. 24.	S.	Too much sea for surface tow-net work.
$1\frac{9}{12}$ hours.	B.	Euphausidæ, r.; *Erythrops pygmæa*, f.; *Salpa*, fr.; *Parathemisto* (?) *oblivia*, f.; *Calanus finmarchicus*, fr.; *Caligus rapax*, fr; *Sagitta*, fr.; *Tomopteris*, fr.; Ctenophora, fr.; young Crustacea, f.; young Ophiuridæ, f.; young fish, r.
Nov. 26.	S.	*Pleurobrachia*, ab.
$1\frac{9}{12}$ hours.	B.	*Mysis ornatus*, one; *Erythrops pygmæa*, r.; *Thysanoessa*, sp. r.; *Pseudocuma cercaria*, r.; *Parathemisto*, sp. r.; *Calisoma*, r.; *Tryphosites longimanus*, one; *Orchomenella*, sp., one; *Perioculodes longimanus*, r.; *Protella phasma*, one; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Caligus rapax*, r.; *Sagitta*, fr.; *Tomopteris*, r.; Ctenophora, fr.
Station X.		
Aug. 26. 2 hours.	S.	*Hyperia galba* (♂ and ♀), two; *Calanus finmarchicus*, f.; *Acartia Clausii*, fr.; *Temora longicornis*, r.; *Centropages typicus*, f.; *Anomalocera Patersonii*, f.; *Caligus rapax*, f.; *Salpa*, r.; *Appendicularia*, f.; Ctenophora, f.; *Aurelia aurita*, one; young Crustacea, f.; Fish ova, f.
	B.	*Spirialis retroversus*, f.; *Hyperoche tauriformis*, f.; *Parathemisto* (?) *oblivia*, f.; *Argissa hamatipes*, f.; *Calanus finmarchicus*, f.; *Acartia Clausii*, f.; *Temora longicornis*, f.; *Centropages typicus*, r.; *Metridia hibernica*, r.; *Sagitta*. fr.; *Tomopteris*, f.; Ctenophora, c.; young Gastropod mollusca, c.; young Crustacea, fr.; young starfishes, f.
Oct. 24.	S.	*Acartia Clausii*, r.; Ctenophora, r.; young Crustacea, r.
$1\frac{10}{12}$ hours.	B.	*Crangon Allmanni*, r.; *Parathemisto* (?) *oblivia*, f.; *Calanus finmarchicus*, r.; *Acartia Clausii*, r.; *Temora longicornis*, f.; *Centropages typicus*, r.; *Caligus rapax*, f.; *Sagitta*, f.; *Tomopteris*, f.; Ctenophora, c.; *Salpa*, f.; young Crustacea, f.
Nov. 27.	S.	*Hyperia*, sp., one; *Hyperoche*, sp., six; *Parathemisto*, sp., six; *Idotea tricuspidata*, one; Ctenophora, c.; also a quantity of *Zostera*.
$1\frac{1}{12}$ hours.	B.	*Spirialis retroversus*, r.; *Calanus finmarchicus*, f.; *Temora longicornis*, r.; *Centropages*, sp. r.; *Caligus rapax*, f.; *Sagitta*, f.; young Crustacea, f.; post-larval fish, one; Ctenophora, fr.
Station XI.		
Oct. 15.	S.	*Parathemisto* (?) *oblivia*, *Salpa*, f.; Ctenophora, f.; *Calanus finmarchicus*, f.; *Acartia Clausii*, r.; *Temora longicornis*, r.; *Salpa*, fr.;
2 hours.	B.	Ctenophora, c.; post-larval fish, one.
Station XII.		
Oct. 15.	S.	Surface net, *nil.*
2 hours.	B.	*Calisoma crenata*, one; *Parathemisto oblivia*, r.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Centropages typicus*, f.; *Salpa*, fr.; *Tomopteris*, f.; Ctenophora, fr.; *Caligus rapax*, r.; post-larval fish (turbot, one, *Gadus*, one), two.

TABLE C.—Record of Observations made on Board the 'Garland' during 1895.

B. PELAGIC FAUNA—III. Moray Firth—*continued.*

Station, Date, and Time Net down.	Net.	Organisms Captured.
Station XIII. 1896. Oct. 14.	S.	*Parathemisto* (?) *oblivia*, r. ; *Calanus finmarchicus*, r. ; *Salpa*, r. *Sagitta*, r.; Ctenophora, fr.
2 hours.	B.	*Proto pedata*, one ; *Parathemisto*, sp. f.; *Hyperoche*, r.; *Calanus finmarchicus*, f.; *Temora longicornis*, f. ; *Centropages typicus*, f.; *Caligus rapax*, f.; *Spirialis retroversus*, fr.; *Salpa*, f.; *Sagitta*, f.; *Tomopteris*, f.; Ctenophora, fr.; young Crustacea, f.; young fish, two.
Station XIV. Oct. 14.	S.	*Parathemisto* (?) *oblivia*, r. ; *Caligus rapax*, one ; *Salpa*, f.; Ctenophora, c.
2 hours.	B.	*Spirialis retroversus*, several; Boreophausidæ, f.; Cumacea (*Diastylus Pseudocuma*), f.; Amphipoda (*Halimedon*, *Tryphosites*, *Apherusa*, *Paratylus*), several *Anceus*, sp. (♀) f.; *Calanus finmarchicus*, f.; *Temora longicornis*, r.; *Centropages typicus*, f.; *Caligus rapax*, f.; *Salpa*, one; *Sagitta*, f.; *Tomopteris*, f.; Ctenophora, ab.; young Crustacea, f.
Station XV. Oct. 14. 2 hours.	S, B.	*Salpa*, r.; Ctenophora, r.; young Crustacea, r.; Ctenophora, fr.
Station XVI. Oct. 14.	S.	*Parathemisto* (?) *oblivia*, r.; *Calanus finmarchicus*, r.; *Salpa*, r.; young Cephalopods, r.; Fish-ova, r.
2 hours.	B.	*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Caligus rapax*, r.; *Salpa*, c.; *Sagitta*, r.; *Tomopteris*, r. ; Ctenophora, fr. ; young Cephalopod, one ; young Crustacea, (Brachyura, Anomara, Carida, Schizopoda), fr.

IV. Firth of Clyde.

Station, Date, and Time Net down.	Net.	Organisms Captured.
Station I. April 13. 1½ hours.	S.	*Calanus finmarchicus*, fr. ; *Centropages hamatus*, f.; *Parapontella brevicornis*, r.; *Podon polyphemoides*, f.; young *Balani*, f.; Fish ova, fr.; post-larval fish, one.
	2 fms.	*Calanus finmarchicus*, fr. ; *Temora longicornis*, r. ; *Centropages hamatus*, f.; *Euchæta norvegica*, v.r.; *Evadne*, f.; *Appendicularia*, f.; young *Balani*, fr.; *Evadne*, f.; Fish ova, fr.; post-larval fishes, six.
Nov. 2. 1½ hours.	B.	*Megaluropus agilis*, f.; *Phtisica marina*, r.; *Calanus finmarchicus*, fr.; *Temora longicornis*, fr.; *Pseudocalanus elongatus*, r.; *Monstrilla*, sp., one; *Centropages hamatus*, f.; young Crustacea, f ; young starfishes, r.; Fish ova, f,; post-larval fishes, two.
	S.	*Calanus finmarchicus*, f. ; *Temora longicornis*, f.; *Pseudocalanus elongatus*, f.; *Acartia Clausii*, f.; *Centropages typicus*, f.; *Podon intermedius*, very few ; *Appendicularia*, f.; young Crustacea, f.
	B.	*Cressa dubia*, one ; *Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, f.; *Acartia Clausii*, fr.; *Centropages typicus*, f.; *Idya*, sp. r.; *Caligus rapax*, r.; *Sagitta*, f.; young Cephalopoda, r.; young Crustacea (*Mysis*, *Gastrosaccus*, Decapoda), f.; (?) *Microniscus calani* (Parasitic on Calanus), one.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—IV. Firth of Clyde—*continued.*

Station, Date, and Time Net down.	Net.	Organisms Captured.
Station II. 1896.		
Apr. 13. $1\frac{5}{12}$ hours.	S.	*Calanus finmarchicus*, ab. ; *Centropages hamatus*, f. ; *Sagitta*, f. ; young *Balani*, f. ; fish ova, f.
	B.	*Metopa*, sp. r. ; *Calanus finmarchicus*, c. ; *Temora longicornis*, f. ; *Pseudocalanus elongatus*, fr. ; *Centropages hamatus*, f. ; *Euchæta norvegica*, r. ; *Sagitta*, f. ; *Caligus rapax*, one ; young Crustacea, f. ; Crust. ova (?) c.
Oct. 29. $1\frac{3}{4}$ hours.	S.	*Calanus finmarchicus*, c. ; *Pseudocalanus elongatus*, f. ; *Acartia Clausii*, (†) *Centropages typicus*, f. ; *Anomalcera Patersonii*, r. ; *Sagitta*, f. ; young Crustacea, r.
	B.	*Erythrops pygmæa*, r. ; *Metopa*, sp. r. ; *Halimedon Mülleri*, r. ; *Melphidipella macera*, r. ; *Apherusa bispinosa*, r. ; *Calanus finmarchicus*, c. ; *Pseudocalanus elongatus*, f. ; *Metridia hibernica*, r. ; *Euchæta norvegica*, r. ; *Sagitta*, fr. ; *Acartia Clausii*, fr.
Station III.		
Apr. 10. $1\frac{1}{12}$ hours.	S.	*Calanus finmarchicus*, f. ; *Euchæta norvegica*, r. ; *Anomalocera Patersonii*, r. ; *Evadne*, f. ; *Sagitta*, r. ; Ctenophora, r. ; young *Balani*, f. ; fish ova, fr. ; post-larval fish, r.
	B.	Euphausidæ, r. ; *Munna*, sp. r. ; *Metopa*, sp. r. ; *Cressa dubia* r. ; *Stegocephalodes christianiensis*, (?) one ; *Calanus finmarchicus*, c. ; *Temora longicornis*, f. ; *Euchæta norvegica*, fr. ; *Caligus rapax*, r. ; *Sagitta*, f.
Oct. 29. 1 hour 25 minutes.	S.	*Calanus finmarchicus*, f. ; *Pseudocalanus elongatus*, r. ; *Centropages typicus*, f. ; *Anomalocera Pattersonii*, one ; *Euchæta norvegica*, one ; *Ectinosoma atlanticum*, r. ; Infusoria, f.
	B.	*Mysidopsis didelphys*, one ; *Tryphosa*, sp. one ; *Dexamine*, sp. r. ; Euphausidæ, r. ; *Calanus finmarchicus*, fr. ; *Centropages*, sp. r. ; *Euchæta norvegica*, r. ; *Sagitta*, f. ; young Crustacea, (Schizopoda), f. ; post-larval fish, two ; *Caligus rapax*, r. (?) *Microniscus*, (parasitic on Calanus), one.
Station IV.		
Apr. 10. $\frac{3}{4}$ hour.	S.	*Calanus finmarchicus*, fr. ; *Temora longicornis*, f. ; *Pseudocalanus elongatus*, f. ; *Cetropages hamatus*, f. ; *Anomalocera Patersonii*, f. ; *Evadne*, f. ; *Sagitta*, f. ; Ctenophora, f. ; young *Balani*, fr. ; fish ova, fr. ; young fish, three.
	B.	*Ampelisca*, sp. r. ; *Melphidippella macera*, r. ; *Pontocrates*, sp. r. ; *Metopa Bruzelii*, r. ; *Halimedon Mulleri*, r. ; *Peroculodes longimanus*, r. ; *Paratylus uncinatus*, r. ; *Anceus*, sp. r. ; *Calanus finmarchicus*, f. ; *Temora longicornis*, f. ; *Pseudocalanus elongatus*, f. ; *Centropages hamatus*, f. ; *Evadne*, f. ; young *Balani*, and other Crustaceans, f. ; *Sagitta*, f. ; young fish, r.
Oct. 29. 40 minutes.	S.	*Calanus finmarchicus*, f. ; *Acartia*, sp. r. ; *Sagitta*, f. ; Ctenophora, r.
	B.	*Calanus finmarchicus*, fr. ; *Pseudocalanus elongatus*, f. ; *Acartia*, sp. f. ; *Caligus rapax*, r. ; *Sagitta*, f.
Station V.		
Apr. 10. $1\frac{2}{12}$ hours.	S.	*Calanus finmarchicus*, c. ; *Temora longicornis*, f. ; *Pseudocalanus elonguatus*, f. ; *Centropages hamatus*, f. ; *Anomalocera Patersonii*, r. ; *Sagitta*, f. ; young decapod Crustacea, f. ; young Cirripedia, fr. ; fish ova, f. ; Post-larval fish, three.
	B.	*Calanus finmarchicus*, fr. ; *Temora longicornis*, f. ; *Pseudocalanus elongatus*, f. ; *Centropages hamatus*, r. ; *Anomalocera Patersonii*, r. ; *Altentha*, sp. fr. ; *Caligus rapax*, f. ; *Monstrilla*, sp. v. rare ; *Sagitta*, f. ; *Tomopteris*, f. ; *Appendicularia*, f. ; *Thalestris*, sp. v. r. ; young lamellibranch shell-fish, r. ; young ophiurids, r. ; fish ova, r. ; Post larval fish, r.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—IV. Firth of Clyde—*continued.*

Station, Date, and Time Net down.	Net.	Organisms Captured.
1896. Oct. 30. 1 hour.	S.	*Calanus finmarchicus*, f. ; *Acartia Clausii*, r. ; *Centropages*, sp. r. ; *Podon intermedius*, r. ; *Appendicularia*, r. ; *Sagitta*, r. ; (?) *Microniscus calani*, one.
	B.	*Velutina lævigata*, one ; *Pecten opercularis*, one, *Nannasticus unguiculatus*, two ; *Anceus*, sp. (♀), one ; *Calanus finmarchicus*, f. ; *Temora longicornis*, r. ; *Acartia*, sp. f. ; *Pseudocalanus armatus*, one ; *Alteutha*, sp one ; *Caligus rapax*, r. ; *Sagitta*, f. ; *Tomopteris*, r. ; young Crustacea (Schizopods, mostly), f. ; young lamellibranchs, f.
Station VI. Apr. 13. $2\frac{1}{12}$ hours.	S.	*Calanus finmarchicus*, f. ; *Centropages hamatus*, r. ; Amphipoda, r. ; young *Balani*, fr. ; fish ova, c. ; post-larval fishes, f.
	2 fath.	*Calanus finmarchicus*, r. ; Amphipoda, r. ; young *Balani*, fr. ; fish ova, c.
	B.	*Calanus finmarchicus*, f. ; *Temora longicornis*, f. ; *Sagitta*, f. ; young Crustacea, f.
Oct. 28. 2 hours.	S.	*Calanus finmarchicus*, r. ; *Pseudocalanus elongatus*, r. ; *Acartia Clausii*, f, ; *Centropages typicus*, f. ; *Anomalocera Patersonii*, one ; *Sagitta*, r. ; Ctenophora, r.
	B.	*Metopa*, sp. r. ; *Apherusa*, sp. r. ; *Calanus finmarchicus*, f. ; *Pseudocalanus elongatus*, r. ; *Pseudocalanus armatus*, r. ; *Centropages*, sp. f. ; *Sagitta*, f. ; Ctenophora r. ; young Crustacea, fr. ; Infusoria (*Ceratium fuscus*, etc.), f.
Station VII. April 15. $1\frac{10}{12}$ hours.	S.	*Calanus finmarchicus*, fr. ; *Centropages hamatus*, f.; *Anomalocera, Patersonii*, f.; *Evadne*, c.; *Sagitta*, f.; youug Crustacea, f.; fish ova, ab.
	2 fms.	*Calanus finmarchicus*, c.; *Centropages hamatus*, f. ; *Anomalocera Patersonii*, f.; *Sagitta*, f.; young *Balani*, fr.; fish ova, ab.
	B.	*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Centropages hamatus*, f.; *Sagitta*, f.; young Crustacea, f.; young fish, f.
April 20. 2 hours. (Night haul).	S.	Surface net damaged—it contained only a few Ctenophora and young *Balani*.
	B.	*Crangon nanus* (?) *Hippolyte pusiola* (?) one, *Mysis ornatus*, r.; *Leptomysis gracilis*, r. ; *Mysidopsis angusta*, one ; *Erythrops pygmæa*, r.; *Erythrops serrata*, r.; *Siriella crassipes*, r.; *Eudorella truncatula*, f.; *Eudorella hispida*, f.; *Iphinoe gracilis* (*serrata*, Norman), r.; *Pseudocuma cercaria*, f.; *Campylaspis affinis*, r.; *Diastylus rugosa*, f.; *Diastylus*. sp. f.; *Halimedon Mülleri*, fr.; *Ampelisca typica* (?) one ; *Stenothoe marina*, r.; *Calisoma crenata*, one ; *Argissa hamatipes*, r.; *Peroculodes longimanus*, f.; *Laphistius sturionis*, r.; *Melphidippella macira*, one ; *Epimerca cornigera*, two ; *Calanus finmarchicus*, c.; *Temora longicornis*, fr.; *Pseudocalanus elongatus*, fr.; *Centropages hamatus*, fr.; young Crustacea, c.
Oct. 31. $1\frac{1}{2}$ hours.	S.	Sea too rough for surface net.
	B.	*Halimedon Mülleri*, *Perioculodes longimana* and one or two other Amphipods; *Anceus*, sp. r.; *Calanus finmarchicus*, f.; *Temora longicornis*, r.; *Pseudocalanus armatus*, r.; *Pseudocalanus elongatus*, *Centropages typicus*, r.; *Scolocithrix hibernicus*, r.; *Acartia Clausii*, f.; *Sagitta*, f.; *Tomopteris*, r.; young Crustacea (*Erythrops*, *Mysis*, Cumacea, Decapoda), f.; young Lamellibranchs, r.; young starfishes, r.; Zoophytes, *Botryllus*, etc., f.
Nov. 3. 1 hour 35 minutes. (Night haul).	S.	*Hyperoche tauriformis*, r.; *Argissa hamatipes*, one ; *Mysis lamornæ*, f.; *Calanus finmarchicus*, c.; *Centropages*, sp. f.; *Monstrilla*, sp., one; *Anomalocera Patersonii*, r.; *Philomedes*, sp., one; *Sagitta*, fr.; Ctenophora, f.
	B.	*Mysidopsis gibbosa*, one ; *Tryphosa*, sp., f.; *Tryphos'tes longipes*, f.; *Urothoe*, sp. r.; *Halimedon Mülleri*, f.; *Perioculodes longimanus*, f.; *Synchelidium brevicarpum*, f.; *Calanus finmarchicus*, f.; *Sagitta*, f.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—IV. Firth of Clyde—*continued.*

Station, Date, and Time Net down.	Net.	Organisms Captured.
Station VIII. 1896. April 15. 2 hours.	S.	*Calanus finmarchicus*, f.; *Anomalocera Patersonii*, r.; *Podon polyphemoides*, f.; fish ova, ab.
	2 fms.	*Calanus finmarchicus*, fr.; *Centropages hamatus*, f.; *Anomalocera Patersonii*, f.; *Evadne*, f.; *Appendicularia*, f ; *Sagitta*, r.; young *Balani*, fr.; fish ova, ab.; post-larval fishes, three.
	B.	*Dulichia*, sp. r.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, f.; *Centropages hamatus*, f.; *Caligus rapax*, r.; *Evadne*, f.; *Sagitta*, f.; Ctenophora, f.; young Crustacea, (Decapoda and *Balani*), f.; fish ova, f.; post-larval fishes, f.
April 21. $2\frac{1}{12}$ hours. (Night haul).	S.	*Calanus finmarchicus*. ab.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, f.; *Centropages hamatus*, f.; *Caligus rapax*, r.; young Crustacea, fr.; fish ova, c.
Oct. 31.	S.	Sea too rough for surface tow-net.
1 hour 40 minutes.	B.	*Perioculodes longimanus*, r.; *Ampelisca*, sp. r.; *Calanus finmarchicus*, fr.; *Temora longicornis*, r.; *Pseudocalanus armatus*, r.; *Sagitta*, fr.; young Crustacea, fr.; Foraminifera (*Miliolina*, *Haplophragmium pseudospirale*, *Rotalia*, etc.), f.
Nov. 3. $1\frac{3}{4}$ hours. (Night haul).	S.	*Nyctiphanes norvegicus*, one; *Boreophausia*, sp. r.; *Metopa*, sp. r.; *Calanus finmarchicus*, ab.; *Temora longicornis*, r.; *Pseudocalanus elongatus*, f.; *Centropages typicus*, f.; *Anomalocera Patersonii*, r.; *Sagitta*, c.; Ctenophora, f.; young Crustacea (chiefly Mysidæ), fr.;
	B.	*Pandalus* (?) *Montagui*, one; *Nika edulis*, one ; *Crangon allmanii*, one ; *Mysis lamornæ*, f.; *Mysidopsis didelphys*, r.; *Mysidopsis angusta*, r.; *Erythrops pygmæa*, f.; *Erythrops serratus*, f.; *Gastrosaccus spinifer*, f.; *Cirolana spinifer*, two ; *Anceus*, sp. (♀), r.; *Campylaspis* (?) *rubicunda*, one; *Pseudocuma cercaria*, f.; *Diastylus biplicatus Diastylus rugosa* and *Diastylus lævis*, f.; *Metopa*, sp. r.; *Ampelisca*, sp. f.; *Halimedon Mülleri*, f.; *Perioculodes longimanus*, r.; *Argissa hamatipes*, r.; *Eusirus longipes*, one ; *Epimeria*, sp., one *Melphidipella macera*, r.; *Apherusa bispinosa*, r.; *Temora longicornis*, f.; *Pseudocalanus armatus*, f.; *Centropages typicus*, f.; young Gastropoda and young Lamellibranchiata, r. A few Ostracoda and Foraminifera.
Station IX. April 9. 2 hours.	S.	*Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Anomalocera Patersonii*, f.; *Appendicularia*, f.; *Sagitta*, f.; young Crustacea, fr.; fish ova, c.; Post-larval fishes, f..
	2 faths	*Parathemisto oblivia*, v. r.; *Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Sagitta*, f.; young Crustacea, fr.; fish ova, c.; several post-larval fishes.
	B.	*Siriella crassipes*, one ; *Diastylus*, sp. f.; *Monoculodes*, sp. r.; *Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Sagitta*, f.; young Crustacea, f.; young Echinoderms, f.
Oct. 31. $1\frac{3}{4}$ hours.	S.	Sea too rough for surface tow-net.
	B.	*Calanus finmarchicus*, f.; *Pseudocalanus elongatus*, f.; *Centropages typicus*, f.; *Sagitta*, fr.; young Gastropoda, r.; young Lamellibranchiata, r.
Station X. April 14. 2 hours.	S.	*Calanus finmarchicus*, f.; *Temora longicornis*, r.; *Anomalocera Patersonii*, f.; *Centropages hamatus*, f.; *Evadne*, f.; *Appendicularia*, f.; young *Calani*, c.; fish ova, c.; post-larval fishes, f.
	B.	*Calanus finmarchicus*, f.; *Temora longicornis*, f.; *Acartia Clausii*, r.; *Halimedon Mülleri*, one ; *Peroculodes longimanus*, one ; *Melphidippella macera*, one ; *Ampelisea*, sp. one ; *Metopa*, sp. r.; *Caligus rapax*, r.; young Crustacea, (*Crangon*, *Balanus*, &c.), fr.; young Echinoderms, f.; *Appendicularia*, f.; post-larval fishes several.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—IV. Firth of Clyde—*continued.*

Station, Date, and Time Net down.	Net.	Organisms Captured.
1896. Oct 28. 1 hour 50 minutes.	S.	*Calanus finmarchicus*, r.; *Centropages typicus*, f.; Ctenophora, r.
	B.	*Leptomysis gracilis*, r.; *Argissa hamatipes*, f.; *Anceus*, sp. r.; *Calanus finmarchicus*, fr.; *Pseudocalanus elongatus*, r.; *Pseudocalanus armatus*, f.; *Metridia hibernica*, r.; *Acartia*, sp. f.; *Centropages typicus*, f.; *Caligus rapax*, f.; young Cephalapods, r.; young Lamellibranchiata, f.; young Gasteropoda, f.; young Crustacea, fr. (?); *Podon intermedius*, r. A few of the *Calanus* are infested with Nematode parasites.
Station XI.		
April 16. $1\frac{1}{12}$ hours.	S.	Sea too rough for surface net.
	B.	*Perioculodes longimanus*, one; *Calanus finmarchicus*, fr.; *Caligus rapax*, r.; *Evadne*, fr.; young Crustacea (*Balani*, etc.), fr.; *Sagitta*, f.; post-larval fishes, f.
Oct. 30. 1 hour 50 minutes.	S. B.	Both tow-nets' gatherings contained very few organisms; the bottles containing these gatherings were overturned by the rocking of the boat, before the contents were examined.
Station XII.		
April 16. $1\frac{11}{12}$ hours.	S.	Sea too rough for the surface net.
	B.	*Calanus finmarchicus*, c.; *Euchæta norvegica*, r.; Amphipods, sp. r.; young Crustacea, f.; post-larval fishes, f.
April 21. $2\frac{1}{12}$ hours. (night haul).	S.	*Calanus finmarchicus*, c.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, f.; *Centropages hamatus*, f.; *Anomalocera Patersonii*, fr.; *Euchæta norvegica*, r.; *Evadne*, f.; *Podon polyphemoides*, r.; *Sagitta*, f.; young Crustacea, fr.; fish ova, r.; young fishes, r.
	B.	Euphausidæ, r.; *Leptomysis gracilis*, r.; *Erythrops serrata*, f.; *Eudorella*, sp. f.; *Leucon*, sp. f.; *Cuma* (gen. et sp. ?), f.; *Diastylus*, sp. f.; *Pseudocuma cercaria*, r.; *Limnoria lignorum*, one; *Anceus*, sp. r.; *Monoculodes Packardi*, fr.; *Perioculodes longimanus*, f.; *Halimedon Mülleri*, r.; *Argissa hamatipes*, r.; *Calanus finmarchicus*, ab.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, fr.; *Pseudocalanus armatus*, r.; *Centropages hamatus*, r.; *Anomalocera Patersonii*, r.; *Euchæta norvegica*, r.; *Nika edulis*, v. r.; *Scolocithrix hibernicus*, r.; *Caligus rapax*, r.
Oct. 30. 2 hours.	S.	*Calanus finmarchicus*, r.; *Pseudocalanus elongatus*, r.; *Acartia*, sp. r.; young Crustacea, r.
	B.	Euphausidæ, f.; *Mysis*, sp. f.; *Nannasticus unguiculatus*, r.; *Calanus finmarchicus*, fr.; *Pseudocalanus armatus*, f.; *Candace pectinata*, r.; *Caligus rapax*, f.; *Sagitta*, c.; Ctenophora, f.; *Tomopteris*, fr.; young Crustacea (mostly Schizopoda), f.; post-larval fishes, very rare.
Nov. 4. 2 hours 5 minutes. (night haul).	S.	Euphausidæ, r.; *Siriella norvegica*, r.; *Calanus finmarchicus*, c.; *Pseudocalanus elongatus*, f.; *Pseudocalanus armatus*, f.; *Centropages*, sp. f.; *Anomalocera Patersonii*, r.; *Sagitta*, ab.
	B.	*Metopa*, sp. one; *Calanus finmarchicus*, r.; *Scolocithrix hibernicus*, r.; *Philomedes brenda*, two; a quantity of mud.
Sanda to Bennan Hd.		
April 20. 8.20 to 9.10 a.m. (1st) haul.	S.	*Calanus finmarchicus*, c.; *Pseudocalanus elongatus*, f.; *Acartia Clausii*, f.; *Centropages hamatus*, fr.; *Anomalocera Patersonii*, f.; *Evadne*, fr.; *Appendicularia*, r.; young Crustacea, f.; fish ova. fr.
	2 fms.	*Calanus finmarchicus*, ab.; *Pseudocalanus elongatus*, f.; *Acartia Clausii*, f.; *Centropages hamatus*, f.; *Evadne*, f.; *Sagitta*, f.; young Crustacea, fr.; fish ova, fr.

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1896.

B. PELAGIC FAUNA—IV. FIRTH OF CLYDE—*continued.*

Station, Date, and Time Net down.	Net.	ORGANISMS CAPTURED.
1896. April 20. 9.30 to 10.15 a.m. (2nd haul).	S.	*Calanus finmarchicus*, ab. ; *Evadne*, f. ; young Crustacea, f. ; fish ova, f.
	2 fms.	*Calanus finmarchicus*, c. ; *Euchæta norvegica*, f. ; *Evadne*, f. ; young Crustacea, f. ; fish ova, fr.
April 20. 10.45 to 11.30 a.m. (3rd haul).	S.	*Calanus finmarchicus*, fr. ; *Pseudocalanus elongatus*, f. ; *Centropages hamatus*, fr. ; *Anomalocera Patersonii*, fr. ; *Evadne*, fr. ; young Crustacea, c. ; fish ova, fr.
	2 fms.	*Calanus finmarchicus*, ab. ; *Pseudocalanus elongatus*, f. ; *Acartia clausii*, f. ; *Centropages hamatus*, f. ; *Evadne*, f. ; *Sagitta*, f. ; young Crustacea, fr. ; fish ova, fr.
April 20. 1.0 to 1.40 p.m. (4th haul).	S.	*Calanus finmarchicus*, c. ; *Acartia Clausii*, fr. ; *Centropages hamatus*, f. ; *Anomalcera Patersonii*, f. ; *Parapontella brevicornis*, r. ; *Evadne*, fr. ; young Crustacea, c. ; fish ova, f.
	2 fms.	*Calanus finmarchicus*, ab. ; *Pseudocalanus elongatus*, f. ; *Centropages hamatus*, f. ; *Evadne*, f. ; *Appendicularia*, f. ; young Crustacea, fr. ; fish ova, f.
April 20. 2.15 to 3.0 p.m. (5th haul).	S.	*Calanus finmarchicus*, c. ; *Acartia Clausii*, fr. ; *Centropages hamatus*, f. ; *Anomalocera Patersonii*, f. ; *Evadne*, fr. ; young Crustacea, c. ; fish ova, f.
	2 fms.	*Calanus finmarchicus*, c. ; *Pseudocalanus elongatus*, f. ; *Centropages hamatus*, f. ; young Crustacea, fr. ; *Evadne*, f. ; fish ova, f.
Corsewall Mull of Cantyre.	to	
April 21. 9.45 to 10.10 a.m. (1st haul).	S.	*Calanus finmarchicus*, f. ; *Evadne*, f. ; young Crustacea, f. ; fish ova, f. (very little in net).
	2 fms.	*Calanus finmarchicus*, fr. ; *Centropages hamatus*, f. ; *Evadne*, r. ; young Crustacea, f. ; fish ova, f. ; post-larval fishes, r.
April 21. 11.45 a.m. to 12.40 p.m. (2nd haul).	S.	*Calanus finmarchicus*, f. ; *Anomalocera Patersonii*, r. ; young *Balani*, f. ; fish ova, f.
	2 fms.	*Calanus finmarchicus*, fr. ; *Centropages hamatus*, f. ; *Anomalocera Patersonii*, r. ; young Crustacea, r. ; fish ova, f. ; post-larval fishes, r.
Pladda to Turnberry Pt.		
April 22. 9.40 to 10.25 a.m. (1st haul).	S.	*Calanus finmarchicus*, fr. ; *Centropages hamatus*, f. ; *Anomalocera Patersonii*, fr. ; *Appendicularia*, f. ; young Crustacea, fr. ; fish ova, fr. ; post-larval fishes, two.
	2 fms.	*Calanus finmarchicus*, fr. ; *Anomalocera Patersonii*, fr. ; young Crustacea, fr. ; *Evadne*, f. ; fish ova, fr. ; post-larval fishes, one.
April 22. 11.0 to 11.45 a.m. (2nd haul).	S.	*Calanus finmarchicus*, f. ; *Anomalocera Patersonii*. c. ; young Crustacea, f. ; fish ova, fr.
	2 fms.	*Calanus finmarchicus*, c. ; *Anomalocera Patersonii*, f. ; Ctenophora, f. ; young Crustacea, f. ; fish ova, f.
April 22. 12.5 to 12.50 p.m. (3rd haul).	S.	*Calanus finmarchicus*, fr. ; *Centropages hamatus* f. ; *Anomalocera Patersonii*, fr. ; young Crustacea, fr. ; fish ova, fr.
	2 fms.	*Calanus finmarchicus*, ab. ; *Anomalocera Patersonii*, f. ; *Sagitta*, f. ; young Crustacea, f. ; fish ova, f.
Nov. 5. Station VIII. 35 minutes.	S.	*Calanus finmarchicus*, f. ; *Temora longicornis*, f. ; *Acartia*, sp., fr. ; *Pseudocalanus elongatus*, f. ; *Pseudocalanus armatus*, r. ; *Anomalocera Patersonii*, r. ; *Sagitta*, f.
		Surface tow-net gatherings from Stations IX. and X. similar to the above.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—V. Upper Loch Fyne.

Station, Date, and Time Net down.	Net.	Organisms Captured.
1896. Off Loch Gair to Largymore.		
Nov. 14.	S.	*Erichthonius*, sp., v. r.; *Phtisica marina*, r.; *Calanus finmarchicus*, f.; *Pseudocalanus elongatus*, f.; *Acartia clausii*, r.; *Centropages hamatus*, r.; *Caligus rapax*, f.
	B.	*Leptomysis gracilis*, r.; *Calanus finmarchicus*, f.; *Pseudocalanus elongatus*, f.; *Pseudocalanus armatus*, r.; *Acartia Clausii*, f.; *Euchæta norvegica*, one; *Caligus rapax*, three; *Sagitta*, f.; young Crustacea, f.
Lowburn to Dunderave.		
Nov. 12.	S.	*Calanus finmarchicus*, r.; *Pseudocalanus elongatus*, r.; *Acartia clausii*, r.; *Euchæta norvegica*, one.
2 hours 10 minutes.	B.	*Nyctiphanes norvegicus*, one; *Mysis ornatus*, one; *Leptomysis gracilis*, several (mostly immature); *Leptomysis lingvura*, one; *Jaera albifrons*, one; *Janira maculosa*, r.; *Campylaspis costatus*, two; *Campylaspis* (?) *rubicunda*, one; *Eudorella truncatula*, r.; *Leucon nassica*, r.; *Isopod*, sp., two; *Tryphosa harringi*, one; *Calisoma crenata*, one; *Monoculodes* (?) *Packardi*, f.; *Leucothoe Lilljeborgii*, one; *Halimedon Mülleri*, r.; *Amphilochus manudens*, one; *Iphimedia minuta*, one; *Perioculodes longimanus*, one; *Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Acartia Clausii*, f.; *Pseudocalanus armatus*, f.; *Euchæta*, f.: *Monstrilla* (?) *danæ*, one; *Sagitta*, ab.; *Idya* sp., one; *Scolocithrix* (♂), one; *Miliolina seminulum*, r.
Penmore to Inveraray.		
Nov. 12. 2 hours 10 minutes.	B.	*Nyctiphanes norvegicus*, fr.; *Boreophausia* sp., fr.; *Calanus finmarchicus*, very ab.; *Euchæta norvegica*, c. (This gathering nearly filled a large drop jar).
Loch Gair to Minard.		
Nov. 13. 1 hour 25 minutes.	B.	*Calanus finmarchicus*, c.; *Temora longicornis*, fr.; *Pseudocalanus elongatus*, fr.; *Acartia Clausii*, f.; *Centropages hamatus*, f.; *Euchæta norvegica*, r.; *Scolocithrix hibernicus*, f.; *Appendicularia*, f. (?) *Microniscus calani* (parasitic on Calanus), one; *Sagitta*, f.; young Crustacea, f.
Inverae to Furnace.		
Nov. 13. 1 hour 20 minutes.	B.	*Boreophausia* sp., r.; *Mysis ornatus*, r.; *Mysis* (?) *inermis*, (damaged), one; *Leptomysis gracilis*, f.; *Hemilamprops* (?) *rosea*, one; *Calanus finmarchicus*, fr.; *Temora longicornis*, f.; *Pseudocalanus elongatus*, fr.; *Pseudocalanus armatus*, f.; *Caligus rapax*, several.
Carndow Dundera ve—Mid-Channel.		
April 23. 9 a.m. to 11·43 a.m.	About 1 fm.	Copepoda (chiefly *Calanus*), c.; *Evadne*, c.; Fish ova, c.
	About $2\frac{1}{2}$fms.	Copepoda (chiefly *Calanus*), ab.; *Sagitta*, f.; Fish ova, c.
	Mid-water net $6\frac{1}{2}$ fms.	Copepoda (chiefly *Euchæta*) moderately abundant; Fish ova, c.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

B. PELAGIC FAUNA—V. Upper Loch Fyne—*continued.*

Station, Date, and Time Net down.	No.	Organisms Captured.
1896. Furnace to Cladich—Mid-Channel.		
April 23. 1 p.m. to 2 p.m.	Tow-net down 1 fm.	Catch similar to the last.
	Tow-net down $2\frac{1}{3}$ fms.	
	Mid-water net $6\frac{1}{2}$ fms.	
Loch Gair to Quay Ferry—Mid-Channel.		
April 23. 2·40 p.m. to 3·30 p.m.	1 fm.	Catch similar to that of the 1st and 2nd hauls.
	$2\frac{1}{3}$ fms.	
	Mid-water net $6\frac{1}{2}$ fms.	
Off Tarbert to Avidh Island.		
April 24.	1 fm.	Copepoda, (chiefly *Calanus*), f. ; Fish ova, fr.
	$2\frac{1}{3}$ fms.	Copepoda (chiefly *Calanus*), c.; Fish ova, f.
	Mid-water net $6\frac{1}{2}$ fms.	Copepoda (chiefly *Calanus*), f.; *Sagitta* and *Tomopteris*, r.; Ctenophora, fr.; post-larval fishes, f.; Fish ova, fr.
April 27.	Mid-water net (?) 50 fms.	*Pasiphœa sivado*, one ; *Nyctiphanes*, sp. f. ; *Boreophausia*, sp. fr. ; *Calanus finmarchicus*, f.; *Euchæta norvegica*, v. ab.; *Sagitta*, f.; post-larval Crustacea, f.
Penmore to Inverarary—Mid-Channel.		
April 30.	B.	*Nyctiphanes*, sp. f.; *Euchæta norvegica*, ab.; (a large quantity of fine mud was mixed up with the bottom tow-net gathering).
Dunderave to Lowburn—Mid-Channel.		
May 5.	B.	Copepoda (chiefly *Calanus*), abundant.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

C. INVERTEBRATE FAUNA, &c., IN THE TRAWL NET—
I. Firth of Forth.

Station and Date.	Organisms Captured.
Station I. 1896. Jan. 24. $1\frac{1}{2}$ hours.	*Pecten opercularis*, f.; *Nephrops norvegicus*, r.; *Mytilus modiolus*, r.; *Asterias rubens*, r.; *Echinus esculentus*, r.
Feb. 14. 2 hours.	*Pecten opercularis*, r.; *Buccinum undatum*, r.; *Fusus antiquus*, r.; *Nephrops norvegicus*, f.; *Asterias rubens*, f.; *Echinus esculentus*, r.; *Alcyonium digitatum*, f.; *Actinoloba dianthus*, f.; some *Buccinum* spawn.
Station II. Jan. 24. $1\frac{8}{12}$ hours.	*Pecten opercularis*, r.; Ascidians, f.; *Asterias rubens*, fr.; Brittle starfish, f.; *Alcyonium digitatum*, f.; dead shells, f.
Feb. 24.	*Pecten opercularis*, r.; *Eupagurus bernhardus*, r.; *Nephrops norvegicus*, f.; *Asterias rubens*, r.
Station III. Jan. 20. $3\frac{1}{12}$ hours.	*Pecten opercularis*, fr.; *Nephrops norvegicus*, f.; *Asterias rubens*, f.; *Ophiura albida*, f.; *Solaster papposa*, f.; *Echinus esculentus*, f.; *Alcyonium digitatum*, f.; a small quantity of sea-weed.
Feb. 13. 3 hours.	*Pecten opercularis*, fr.; *Buccinum undatum*, f.; *Fusus antiquus*, r.; *Hyas coarctatus*, r.; *Eupagurus bernhardus*, r.; *Nephrops norvegicus*, r.; *Asterias rubens*, f.; *Solaster papposa*, f.; brittle starfish, fr.; *Echinus esculentus*, one specimen; *Actinoloba dianthus*, f.; a quantity of sea-weed.
Station IV. Jan. 21. $3\frac{5}{12}$ hours.	*Pecten opercularis*, f.; *Buccinum undatum*, fr.; *Hyas araneus*, f.; *Eupagurus bernhardus*, fr.; *Asterias rubens*, f.; brittle starfish, f.; *Solaster papposa*, r.; *Pandalus annulicornis*, r.; *Alcyonium digitatum*, f.
Feb. 20. $3\frac{1}{2}$ hours.	*Pecten opercularis*, f.; *Mytilus modiolus*, f.; *Buccinum undatum* (and spawn), fr.; *Fusus antiquus*, r.; *Hyas araneus*, f.; *Eupagurus bernhardus*, f.; Ascidians, f.; *Asterias rubens*, f.; *Solaster papposa*, f.; brittle starfish, f.; *Echinus esculentus*, r.; *Alcyonium digitatum*, fr.; *Chalina occulata*, f.
Station V. Jan. 30. $1\frac{1}{12}$ hours.	*Fusus antiquus*, r.; *Nephrops norvegicus*, r.; *Asterias rubens*, f.; *Alcyonium digitatum*, f.
Feb. 19. $1\frac{1}{12}$ hours.	*Nephrops norvegicus*, f.; *Asterias rubens*, f.; a small quantity of sea-weed.
Station VI. Jan. 30. $\frac{10}{12}$ hours.	*Buccinum undatum*, r.; *Asterias rubens*, f.; (scarcely anything in trawl net except the fishes).
Feb. 19. $\frac{8}{12}$ hours.	*Fusus gracilis*, one specimen; *Asterias rubens*, f.; (invertebrates very scarce).
Station VII. Jan. 30. $1\frac{8}{12}$ hours.	*Fusus antiquus*, r.; *Eupagurus bernhardus*, f.; *Asterias rubens*,, f.; *Solaster endeca*, f.; *Alcyonium digitatum*, fr.; a small quantity of sea-weed.
Feb. 19. $1\frac{1}{12}$ hours.	Ascidians, r.; *Pandalus Montagui*, one specimen; *Asterias rubens*, c.; *Solaster endeca*, f.; *Alcyonium digitatum*, f.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

C. INVERTEBRATE FAUNA, &c.—I. Firth of Forth—*continued.*

Station and Date.	Organisms Captured.
Station VIII.	
1896. Jan. 29. $1\frac{1}{12}$ hours.	*Tritonia Hombergi*, one specimen ; *Nephrops norvegicus*, r.; *Asterias rubens*, r.; brittle starfish, r.; land starfish, r.; *Alcyonium digitatum*, f.; *Actinoloba dianthus*, f.
Feb. 18. 2 hours.	*Nephrops norvegicus*, f.; *Asterias rubens*, f.; *Alcyonium digitatum*, r.
Station IX.	
Jan. 29. $1\frac{1}{12}$ hours.	*Nephrops norvegicus*, fr.; (no other invertebrates in trawl-net).
Feb. 18. 2 hours.	*Pecten opercularis*, r.; *Nephrops norvegicus*, r.; *Asterias rubens*, rare ; large medusæ, r.
Station X.	
Jan. 25. $\frac{8}{12}$ hour.	*Eupagurus bernhardus*, f.; *Asterias rubens*, f.; sea-anemones, f.; a small quantity of weed.
Feb. 12. $\frac{3}{4}$ hour.	*Buccinum undatum*, one specimen ; *Hyas araneus*, f. ; *Carcinus mœnas*, f.; *Portunus holsatus*, f.; *Eupagurus bernhardus*, fr.; *Crangon allmanni*, f.; *Pandalus Montagui*, f.; *Asterias rubens*, f.; *Neries*, sp. f.; a quantity of mud ; *Filogiana implexa*, r.; *Stenorhynchus*, sp. r.

II. St Andrews Bay.

Station and Date.	Organisms Captured.
Station I.	
Jan. 14. $2\frac{1}{12}$ hours.	*Asterias rubens*, f.; *Alcyonium digitatum*, f.; a small quantity of sea-weed.
Feb. 6. 2 hours.	*Buccinum undatum*, one ; *Hyas araneus*, five ; *Asterias rubens*, fr.; a small quantity of sea-weed ; *Ophiura albida*, r.
Station II.	
Jan. 17. 2 hours.	*Asterias rubens*, f.; a small quantity of sea-weed.
Feb. 7. $1\frac{3}{4}$ hours.	*Asterias rubens*, f.; a small quantity of sea-weed.
Station III.	
Jan. 17. $1\frac{7}{12}$ hours.	*Asterias rubens*, f.; a small quantity of sea-weed.
Feb. 7. $1\frac{7}{12}$ hours.	*Asterias rubens*, f.; *Solaster endeca*, one specimen ; *Actinoloba dianthus*, one specimen ; a small quantity of weed.
Station IV.	
Jan. 14. $2\frac{7}{12}$ hours.	*Eupagurus bernhardus*, r.; *Asterias rubens*, f.; a quantity of sea-weed.
Feb. 6. $2\frac{7}{12}$ hours.	*Asterias rubens*, f.; a considerable quantity of sea-weed.
Station V.	
Jan. 14. 2 hours.	*Asterias rubens*, f.; *Alcyonium digitatum*, f.; a small quantity of sea-weed.
Feb. 6. 2 hours.	*Cerebratulus angulatus*, one specimen; *Asterias rubens*, fr. ; *Alcyonium digitatum*, r.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

C. INVERTEBRATE FAUNA, &c.—II. St Andrews Bay—*continued.*

Station and Date.	Organisms Captured.
Station VI. 1896. Jan. 17. $1\frac{1}{12}$ hours.	*Cancer pagurus*, f. ; *Nephrops norvegicus*, fr. ; *Asterias rubens*, f.
Feb. 5. $1\frac{1}{12}$ hours.	*Eupagurus bernhardus*, r. ; *Nethrops norvegicus*, r. ; *Asterias rubens*, c. ; *Solaster papposa*, f. ; *Alcyonium digitatum*, f.
	III. Moray Firth.
Station I. 1896. Aug. 26. 2 hours.	*Pecten opercularis*, one ; *Asterias rubens*, r. ; *Astropecten irregularis*, one ; *Aurelia aurita*, one.
Oct. 16. 2 hours.	*Portunus holsatus*, f. ; *Hyas coarctatus*, r. ; *Asterias rubens*, f. ; a small quantity of weed and zoophytes.
Nov. 27. $2\frac{1}{12}$ hours.	*Pecten opercularis*, r. ; *Stenorhynchus rostratus*, several ; *Hyas coarctatus*, r. ; *Eupagurus bernhardus*, r. ; *Tubularia indivisa*, and one or two other zoophytes, r.
Station II. Aug. 21. 2 hours.	*Portunus holsatus*, one ; *Nephrops norvegicus*, twenty-four.
Oct. 16. 2 hours.	*Portunus holsatus*, r. ; *Eupagurus bernhardus*, r. ; *Nethrops norvegicus*, f. ; Ascidians, f. ; *Asterias rubens*, f. ; *Solaster papposa*, r. ; *Alcyonium digitatum*, f. ; sea anemone, r. ; a small quantity of weed and zoophytes.
Nov. 23. $1\frac{1}{12}$ hours.	*Pecten opercularis*, r. ; Ascidians, f. ; *Galathea*, sp. r. ; *Asterias rubens*, f. ; *Solaster papposa*, f. ; Anemone sp. r. ; *Alcyonium digitatum*, f. ; a small quantity of sea-weed.
Station III. Aug. 22. $1\frac{1}{12}$ hours.	*Pecten opercularis*, six ; *Tapes pullastra*, one ; *Modiola modiolus*, one ; *Buccinum undatum*, r. ; *Eupagurus bernhardus*, r. ; *Eupagurus pubescens* (surrounded by a sponge), one ; *Asterias rubens*, f. ; Brittle starfish, f. ; *Echinus esculentus*, five ; *Echinus miliaris*, one ; *Cucumaria* (?) *frondosa*, twelve ; *Alcyonium digitatum*, r. ; a quantity of weed in which a few zoophytes were mixed up.
Oct. 20. $1\frac{4}{12}$ hours.	*Pecten opercularis*, one ; *Buccinum undatum*, two ; *Portunus holsatus*, f. ; *Solaster papposa*, one ; *Cucumaria*, (?) *frondosa*, two ; *Echinus esculentus* f. ; some zostera and zoophytes.
Nov. 24. $1\frac{1}{4}$ hours.	*Pecten opercularis*, r. ; *Mytilus modiolus*, f. ; *Buccinum undatum*, r. ; *Trochus cinerarius*, f. ; *Hyas araneus*, r. ; *Eupagurus bernhardus*, r. ; *Pandalus Montagui*, f. ; *Asterias rubens*, f. ; Brittle starfish, f. ; *Echinus esculentus*, f. ; *Cucumaria*, f. ; *Alcyonium digitatum*, f. ; a quantity of sea-weed.
Station IV. Aug. 24. $1\frac{10}{12}$ hours.	*Cardium echinatum*, (dead) one ; several large medusæ.
Oct. 23. 2 hours.	*Portunus holsatus*, f. ; *Eupagurus bernhardus*, r. ; *Asterias rubens*, f. ; zoophytes, f. ; large medusæ, r. ; a small quantity of weed.
Nov. 25. 2 hours.	*Portunus holsatus*, one ; *Asterias rubens*, c. ; *Solaster endeca*, r. ; *Astropecten irregularis*, one ; a small quantity of weed.
Station V. Aug. 24. $1\frac{3}{4}$ hours.	*Asterias rubens*, one ; *Echinus esculentus*, one ; Sea anemone, one ; *Alcyonium digitatum*, r. ; *Aurelia aurita*, f. ; a small quantity of weed.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

C. INVERTEBRATE FAUNA, &c.—III. Moray Firth—*continued.*

Station and Date.	Organisms Captured.
1896. Oct. 23. $1\frac{1}{2}$ hours.	*Portunus holsatus*, f. ; *Asterias rubens*, r. ; *Astropecten irregularis*, r. ; zoophytes, f. ; some weed.
Nov. 25. $1\frac{1}{12}$ hours.	*Asterias rubens*, fr. ; *Solaster papposa*, f. ; *Solaster endeca*, f. ; *Echinus esculentus*, fr. ; *Cucumaria*, sp. one ; a small quantity of zoophytes and weed.
Station VI.	
Aug. 25. $1\frac{8}{12}$ hours.	*Hyas coarctatus*, r. ; *Eupagurus bernhardus*, r. ; *Asterias rubens* f. ; *Aurelia aurita*, f. ; sponges, f.
Oct. 23. $1\frac{3}{4}$ hours.	*Hyas coarctatus*, one ; *Portunus holsatus*, r. ; *Eupagurus hernhardus*, r. ; *Asterias rubens*, f. ; zoophytes, f. ; a small quantity of weed.
Nov. 25. $1\frac{3}{4}$ hours.	*Modiola modiolus*, r. ; *Eupagurus bernhardus*, f. ; *Asterias rubens*, fr. ; *Solaster papposa*, f. ; *Solaster endeca*, f. ; *Alcyonium digitatum*, r. ; zoophytes (*Diphasia*, *Flustra*, *Sertularia*, &c.), f. ; a small quantity of weed.
Station VII.	
Aug. 25. $1\frac{3}{4}$ hours.	*Eupagurus bernhardus*, r.; *Nephrops norvegicus*, r.; *Asterias rubens*, f.; *Echinus esculentus*, one sea ; anemonea, one.
Oct. 23. 2 hours.	*Portunus holsatus*, one ; Ascidians, r. (Scarcely any invertebrates in the trawl-net.)
Nov. 26. $1\frac{1}{12}$ hours.	*Pecten opercularis*, three ; *Eledon cirrhosa*, one ; *Ascidia*, sp., one ; *Eupagurus Prideauxii*, r. ; *Nephrops norvegicus*, r. ; *Galathea dispersa*, one ; *Asterias rubens*, f. ; *Solaster papposa*, r. ; *Solaster endeca*, one ; *Goniaster phrygianus*, one ; *Astropecten irregularis*, r.
Station VIII.	
Aug. 25. $1\frac{1}{12}$ hours.	*Cyprina islandica*, one ; *Fusus gracilis* (dead), one ; *Eupagurus bernhardus*, one ; *Asterias rubens*, r. ; *Echinus esculentus*, several ; *Actinolcba dianthus*, several ; *Filograna implexa*, a piece.
Oct. 24. $1\frac{1}{12}$ hours.	*Inachus dorsettensis*, two; *Eupagurus bernhardus*, r. ; *Eupagurus Prideauxii*, (with investing *Adamsia*), f. ; *Nephrops norvegicus*, fr. ; *Asterias rubens*, f. ; *Cucumaria* (?) *frondosa*, one.
Nov. 26. $1\frac{1}{12}$ hours.	*Eupagurus Prideauxii*, one ; *Stenorhynchus longirostris*, one ; *Asterias rubens*, r. ; Ascidians, one ; *Cucumaria*, sp., one ; *Filograna implexa*, small portion ; *Actinoloba dianthus*, five.
Station IX.	
Aug. 25. $1\frac{3}{4}$ hours.	*Ophiura texturata*, one ; *Echinus esculentus*, f. ; *Spatangus purpureus*, f. ; *Actinoloba dianthus*, several.
Oct. 24. $1\frac{1}{12}$ hours.	*Pecten opercularis*, one ; *Octopus vulgaris*, one ; Ascidians, f. ; *Asterias rubens*, f. ; *Luidia sarsi*, one ; *Goniaster phrygianus*, two ; *Actinoloba dianthus*, several ; *Alcyonium digitatum*, fr. ; *Cucumaria* (?) *frondosa*, one ; *Filograna implexa*, one or two small pieces. *Echinus esculentus* (jun.), three ; (a single specimen of *Stylifer Turtoni* was obtained on one of these young *Echini*).
Nov. 26. $1\frac{1}{12}$ hours.	*Pecten opercularis*, one ; *Fusus antiquus*, one ; *Loligo vulgaris*, one ; *Cancer pagurus*, one ; *Asterias rubens*, f. ; *Luidia ciliaris*, one ; *Goniaster phrygianus*, two ; *Actinoloba dianthus*, fr. ; *Alcyonium digitatum*, f. ; zoophytes (*Hydrallmannia*, *Flustra*), f. ; a small quantity of weed.
Station X.	
Aug. 26. 2 hours.	*Fusus antiquus*, one ; *Eupagurus bernhardus*, f. ; *Asterias rubens*, f. ; *Solaster papposa*, one ; *Goniaster phrygianus*, one ; *Actinoloba dianthus*, one ; *Alcyonium digitatum*, f. ; *Pennatula phosphorea*, one ; *Aurelia aurita*, one ; *Pontobdella muricata* (on skate), one.

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1896.

C. INVERTEBRATE FAUNA, &c.—III. MORAY FIRTH—*continued.*

Station and Date.	ORGANISMS CAPTURED.
1896. Oct. 24. $1\frac{1}{12}$ hours.	*Pecten opercularis*, r.; *Cancer pagurus*, one; *Asterias rubens*, f.; *Luidia ciliaris*, one; *Goniaster phrygianus*, f.; *Palmipes membranaceus*, one; *Echinus miliaris*, one; *Inachus dorsettensis*, three; *Alcyonium digitatum*, r.; a very small quantity of zoophytes and sea-weed.
Nov. 27. $1\frac{1}{12}$ hours.	*Pecten opercularis*, fr.; *Fusus antiquus*, one; Ascidians, r.; *Stenorhynchus, rostratus*, one; *Hyas coarctatus*, r.; *Eupagurus bernhardus*, r.; *Cancer pagurus*, one; *Galathea*, sp., one; *Asterias rubens*, fr.; *Solaster papposa*, f.; *Solaster endeca*, r.; *Goniaster phrygianus*, eleven; *Astropecten irregularis*, one; *Cucumaria*, sp. r.; *Botryllus*, sp. r.; *Filograna implexa*, small quantity; zoophytes (*Flustra*, *Tabularia indivisa*, *Hydrallmannia*), f.
Station XI. Oct. 15. 2 hours.	*Modiola modiolus*, f.; *Buccinum*, spawn, a small quantity; *Eupagurus bernhardus*, f.; Ascidians, f.; *Cucumaria* (?) *frondosa*, r.; *Alcyonium digitatum*, f.
Station XII. Oct. 15. 2 hours.	*Pecten opercularis*, f.; *Eupagurus bernhardus*, f.; Ascidians, f.; *Asterias rubens*, fr.; *Goniaster phrygianus*, f.; *Spatangus purpureus*, several; *Cucumaria* (?) *frondosa*, f.; *Alcyonium*, fr.; a quantity of weed and a few zoophytes.
Station XIII. Oct. 14. 2 hours.	*Pecten opercularis*, f.; *Ascidians* (common), several; *Modiola modiolus*, r.; *Eupagurus bernhardus*, f.; *Echinus esculentus*, r.; *Alcyonium digitatum*, f.; a small quantity of sea-weed.
Station XIV. Oct. 14. 2 hours.	*Pecten opercularis*, f.; Ascidians, f.; *Portunus holsatus*, r.; *Eupagurus bernhardus*, f.; *Asterias rubens*, several; *Cucumaria* (?) *frondosa*, r.; a small quantity of sea-weed.
Station XV. 1895. Oct. 14. 2 hours.	*Pecten opercalaris*, f.; *Fusus antiquus*, r.; Ascidians, several *Eupagurus Bernhardus*, f.; *Asterias rubens*, fr.; *Ophiura albida*, f.; *Goniaster phrygianus*, r.; *Echinus esculentus*, f.; *cucumaria* (?) *frondosa*, r.; *Actinoloba dianthus*, f.; *Filograna implexa*, one or two small pieces; a small quantity of weed.
Station XVI. Oct. 14. 2 hours.	*Pecten opercularis*, f.; *Buccinum undatum*, one; a small quantity of *Buccinum* spawn. Ascidians, f.; *Eupagurus Bernhardas*, f.; *Asterias rubens*, several; *Goniaster phrygianus*, r.; *Echinus esculentus*, r.; *Spatangus purpureus*, r.; a small quantity of sea-weed.
	IV. FIRTH OF CLYDE.
Station I. April 13. $1\frac{1}{2}$ hours.	*Pecten opercularis*, several. *Buccinum* 'spawn,' fr.; *Ascidians*, fr.; *Stenorhynchus*, sp. r.; *Inachus*, sp. r.; *Lithodes maia*, two; *Hyas coarctatus*, f.; *Eupagurus Prideauxii*, f.; *Asterias rubens*, f.; zoophytes and sea-weed, fr.
Nov. 2. $1\frac{1}{2}$ hours.	*Pecten opercularis*, c.; *Loligo vulgaris*, one. *Inachus dorynchus*, r.; *Stenorhynchus rostratus*, r.; *Stenorhynchus longirostris*, r.; *Munida Rondelettii*, one. *Eupagurus Prideauxii*, f.; *Galathea dispersa*, r.; *Pandalus Montagui*, r.; *Asterias rubens*, f.; *Asterias glacialis*, r.; *Porania pulvillus*, f.; *Echinus esculentus*, fr.; a quantity of sea-weed. *Diphasia pinaster*, *Sacculina*, sp. (on *Munida*), one specimen.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

C. INVERTEBRATE FAUNA, &c.—IV. Firth of Clyde—*continued.*

Station and Date.	Organisms Captured.
1896. **Station II.** April 13. $1\frac{5}{12}$ hours.	*Eledone cirrhosa*, one. Ascidians, f.; *Lithodes maia*, one. *Eupagurus Thompsoni*? in sponge, one; *Nephrops norvegicus*, r.; *Asterias rubens*, f.; *Ophiothrix fragilis*, r.; *Palmipes placenta*, one; sea anemones (*Actinoloba*, &c.), fr.; *Echinus esculentus*, fr.; zoophytes, f.
Oct. 29. $1\frac{1}{4}$ hours.	*Pecten opercularis*, f.; *Eypræa europea*, two; *Trochus*, sp. r.; *Eupagurus Prideauxii*, fr. (with *Adamsia*) *Lithodes maia*, one; *Nephrops norvegicus*, f.; *Asterias rubens*, f.; *Asterias glacialis*, one; *Astropecten irregularis*, one; *Porania pulvillus*, one; *Echinus esculentus*, fr.; Brittle starfish, f. sea anemone, r.; a considerable quantity of weed.
Station III. April 10. $1\frac{1}{12}$ hours.	*Buccinum undatum*, one; *Hyas coarctatus*, f.; *Eupagurus Prideauxii*, r.; *Nephrops norvegicus*, r.; *Echinus esculentus*, fr.; *Brissopsis lyrifera*, one; *Lineus marinus*, one; sea anemones, f.
Oct. 29. 1 hour 25 minutes.	*Pecten opercularis*, r.; *Hyas coarctatus*, f.; *Nephrops norvegicus*, f.; *Asterias rubens*, f.; *Asterias glacialis*, one; *Porania pulvillus*, f.; *Astropecten irregularis*, one; *Echinus esculentus*, fr.; sea anemones, fr.; a considerable quantity of sea weed.
Station IV. April 10. $\frac{3}{4}$ hour.	*Pecten opercularis*, f.; *Cyprina islandica*, one and several dead shells. *Eupagurus Prideauxii*, f.; *Asterias rubens*, fr.; *Solaster* endeca, two; *Porania pulvillus*, f.; *Echinus esculentus*, fr.; sea anemones, f.; sea-weed, a considerable quantity.
Oct. 29. 40 minutes.	*Pecten opercularis*, r.; *Modiola modiolus*, one; Ascidians, r.; *Asterias rubens*, f.; *Lithodes maia*, one; *Porania pulvillus*, r.; *Palmipes*, one; *Echinus esculentus*, f.; sea anemones (*Actinoloba dianthus*, &c.), fr.; a small quantity of sea-weed.
Station V. April 10. $1\frac{7}{12}$ hours.	*Pecten opercularis*, fr.; Acidians, several; *Portunus depurator* (jun.), one. *Eupagurus Prideauxii*, f.; *Asterias rubens*, f.; *Palmipes placenta*, one; *Porania pulvillus*, one; *Echinus esculentus*, fr.; zoophytes (*flustra*, &c.), a large quantity of sea-weed also a piece of decayed wood containing specimens of *Xylophaga dorsalis*.
Oct. 30. 1 hour.	*Anomia ephippium*, one; *Pecten opercularis*, fr.; *Velutina lævigata*, one; *Inachus*, sp. one; *Lithodes maia*, six; *Eupagurus Prideauxii*, fr.; *Asterias rubens*, f.; *Asterias glacialis*, two; *Luidia ciliaris*, two; *Palmipes placenta*, one; *Porania pulvillus*, one; *Echinus esculentus*, ?; *Actinoloba dianthus*, f.; a few zoophytes and a considerable quantity of sea-weed.
Station VI. April 13. $2\frac{1}{12}$ hours.	*Pecten opercularis*, f.; *Fusus antiquus*, f.; *Fusus gracilis*, f.; *Eupagurus bernhardus*, f.; *Eupagurus Prideauxii* (with *Adamsia*), f.; *Eupagurus Thompsoni* (with sponge), f.; *Asterias rubens*, f.; *Solaster papposa*, f.; *Astropecten irregularis*, one; *Echinus esculentus*, f.; *Spatangus purpureus*, f.; zoophytes (*Flustra*, &c.), fr.; a considerable quantity of sea-weed.
Oct. 28. 2 hours.	*Pecten opercularis*, ab.; *Inachus dorcynchus*, f.; *Stenorhynchus*, sp. f.; *Cancer pagurus*, one; *Eupagurus Prideauxii*, fr.; *Munida Rondelettii*, one; *Eupagurus bernhardus*, one; *Loligo vulgaris*, one; *Asterias rubens*, f.; *Asterias glacialis*, two; *Solaster papposa*, f.; *Solaster endeca*, one; *Astropecten irregularis*, one; *Porania pulvillus*, f.; *Palmipes placenta*, one; *Echinus esculentus*, one; *Flustra*, sp. fr.; a quantity of sea-weed.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

C. INVERTEBRATE FAUNA, &c.—IV. Firth of Clyde—*continued.*

Station and Date.	Organisms Captured.
Station VII. 1896.	
April 15. 1 11/12 hours.	*Pecten opercularis,* one; *Nephrops norvegicus,* f.; *Asterias rubens,* f.; *Solaster endeca,* f.; *Echinus esculentus,* one; zoophytes, f.; a small quantity of weed.
April 20. 2 hours. (Night haul.)	*Pecten opercularis,* r.; *Eupagurus bernhardus,* r.; *Nephrops norvegicus,* f.; *Brissopsis lyrifera,* f.; *Pennatula phosphorea,* r.
Oct. 31. 1½ hours.	*Pecten opercularis,* f.; *Inachus,* sp. f.; *Cancer pagurus,* one; *Lithodes maia,* one; *Eupagurus Prideauxii,* f.; *Nephrops norvegicus,* f.; *Asterias glacialis,* one; *Luidia ciliaris,* three; *Porania pulvillus,* f.; *Echinus esculentus,* fr.
Nov. 3. 1 hour 35 minutes. (Night haul.)	*Pecten opercularis,* fr.; *Stenorhynchus,* sp. one; *Cancer pagarus,* one; *Eupagurus Prideauxii,* fr.; *Nephrops norvegicus,* f.; *Asterias rubens,* fr.; *Astropecten irregularis,* f.; *Alcyonium digitatum,* r.; a small quantity of sea-weed.
Station VIII.	
April 15. 2 hours.	*Nephrops norvegicus,* f.; *Asterias rubens,* r.; *Palmipes placenta,* one; *Brissopsis lyrifera,* r.; *Pennatula phosphorea,* f.; a small quantity of sea-weed.
April 21. 2 1/12 hours. (Night haul.)	*Pecten opercularis,* r.; *Stenorhynchus,* sp.; *Eupagurus Prideauxii,* r.; *Nephrops norvegicus,* several; *Asterias rubens,* f.; *Asterias glacialis,* r.; *Ophiura ciliaris,* f.; a small quantity of sea-weed.
Oct. 31. 1 hour 40 minutes.	*Eledon cirrosa,* one; *Nephrops norvegicus,* fr.; *Asterias rubens,* one; *Palmipes placenta,* one; a small quantity of sea-weed.
Nov. 3. 1¾ hours. (Night haul.)	*Gonoplax angulatus* (♂), one; *Stenorhynchus,* sp. f.; *Eupagurus bernhardus,* one; *Eupagurus Prideauxii,* f.; *Nephrops norvegicus,* f.; *Asterias rubens,* f.; *Palmipes placenta,* four; a small quantity of sea-weed.
Station IX.	
April 14. 2 hours.	*Nucula sulcata,* one; *Nephrops norvegicus,* several; *Asterias rubens,* one; *Brissopsis lyrifera,* several; *Pennatula phosphorea,* several; *Flustra foliacea* and other zoophytes, f.; a small quantity of sea-weed.
Oct. 31. 1¾ hours.	Cephalopoda (*Eledone*), one; *Nephrops norvegica,* fr.; *Galathea dispersa,* one; *Asterias rubens,* r.; a small quantity of weed.
Station X. April 14. 2 hours.	*Pecten opercularis,* f.; *Inachus dorsettensis,* one; *Nephrops norvegicus,* f.; *Asterias rubens,* f.; *Palmipes placenta,* one; *Alcyonium digitatum,* f.; zoophytes and sea-weed, fr.
Shrimp Trawl.	
April 14. 11·35 a.m. to 12.5 p.m.	*Nucula sulcata,* fr.; *Scrobicularia alba,* one; *Natica sordida,* one; *Doris Johnstoni,* f.; (one with *Lichomolgus agilis* (Leydig); *Pandalus Montagui,* one; *Brissopsis lyrifera,* one; *Pennatula phosphorea,* several; zoophytes (*Flustra*), f.
Oct. 28. 1 hour 50 minutes.	*Pecten opercularis,* ninety-eight; *Tritonia Hombergi,* one; *Inachus dorsettensis,* f.; *Loligo vulgaris,* one; *Stenorhynchus,* sp. r.; *Eupagurus Prideauxii,* f.; *Nephrops norvegicus,* f.; *Asterias rubens,* f.; *Goniaster phrygianus,* two; *Solaster papposa,* f.; *Echinus esculentus,* one.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

C. INVERTEBRATE FAUNA, &c.—IV. Firth of Clyde—*continued.*

Station and Date.	Organisms Captured.
1896. Oct. 28. ½ hour.	Cephalopoda ((?) *Eledone*), five; *Portunus depurator*, f.; *Nephrops norvegicus*, c.; *Asterias rubens*, r.
Station XI.	
April 16. $1\frac{1}{12}$ hour.	*Echinus esculentus*, one; *Brissopsis lyrifera*, one; *Porania pulvillus*, one; a considerable quantity of sea-weed.
Oct. 30. 1 hour 50 minutes.	Cephalopoda (*Eledone*), one; *Inachus*, sp. one; *Asterias rubens*, f.; *Solaster endeca*, one; *Luidia ciliaris*, one; *Porania pulvillus*, f.; *Echinus norvegicus*, fr.; *Actinoloba dianthus*, f.; a considerable quantity of sea-weed.
Station XII.	
April 16. $1\frac{1}{12}$ hours.	*Nephrops norvegicus*, r.; *Pandalus Montagui*, one; *Brissopsis lyrifera*, r.; zoophytes, r.; a small quantity of sea-weed.
Shrimp Trawl.	
April 16. 1.55 p.m. to 2.25 p.m.	*Pecten pes lutræ*, r.; *Nucula sulcata*, fr.; *Nephrops norvegicus*, f.; *Crangon Almanni*, f.; *Pandalus Montagui*, f.; *Amphiura*, sp. r.; small cuttle-fish, f.; *Pennatula phosphorea*, several; sponge, sp. r.
Ordinary Trawl. (Night haul.)	
April 21. 9.15 to 11.20 p.m.	*Nephrops norvegicus*, f.; *Asterias rubens*, r.; *Brissopsis lyrifera*, f.; sea anemone, f.; *Pennatula phosphorea*, f.; a small quantity of sea-weed.
Oct. 30. 2 hours.	Young Cephalopoda, r.; *Hyas coarctus*, f.; *Nephrops norvegicus*, fr.; *Pandalus Montagui*, r.; *Galathea dispersa*, r.; *Echinus esculentus*, f.; *Actinoloba dianthus*, f.; a considerable quantity of weed.
Oct. 30. ½ hour.	*Nucula sulcata*, fr.; *Brissopsis lyrifera*, f.; *Rhizostoma*, one.
Nov. 4. 2 hours 5 minutes.	*Hyas coarctatus*, r.; *Nephrops norvegicus*, f.; *Brissopsis lyrifera*, r.; *Echinus esculentus*, f.; a large quantity of sea-weed.
Sanda to Bennan Head (5 hauls with the shrimp trawl).	
Apr. 20. 8.20 to 9.10 a.m. (1st haul).	*Lima hians*, f.; *Sepiola Rondeletii*, one; *Hyas coarctatus*, f.; *Munida Rondeletii*, one; *Porania pulvillus*, one; *Pennatula phosphorea*, one; Ascidians, f.; *Asterias glacialis*, one; *Antedon bifida*, one; *Trochus zizyphinus*, two; zoophytes, f.
Apr. 20. 9.30 to 10.15 a.m. (2nd haul).	*Mactra elliptica*, two; *Stenorhynchus*, sp., one; *Sepiola Rondeletii*, one; *Pecten opercularis*, one; *Hyas coarctatus*, two; *Portunus depurator*, one; *Pandalus Montagui*, f.; *Luidia ciliaris*, one; *Solaster papposa*, one; *Stichaster roseus*, two; *Porania pulvillus*, r.; *Spatangus purpureas*, two; Zoophytes (*Flustra*, *Hydrallmannia*, &c.), f.
Apr. 20. 10.45 to 11.30 a.m. (3rd haul).	*Pleurobranchus plumula*, three; Ascidians, f.; *Stenorhynchus*, sp., r.; *Hyas coarctatus*. f.; *Galathea* sp., f.; *Hippolyte* sp., f.; *Ophiothrix fragilis*, r.; *Antedon bifida*, v. r.; *Aphrodita aculeata*, one; *Alcyonium digitatum*, f.; sponges, f.; zoophytes, f.; *Sabella* sp., r.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

C. INVERTEBRATE FAUNA, &c.—IV. Firth of Clyde—*continued.*

Station and Date.	Organisms Captured.
1896. Apr. 20. 1.0 to 1.40 p.m. (4th haul).	A large quantity of shell sand.
Apr. 20. 2.15 to 3.0 p.m. (5th haul).	No invertebrates.
Nov. 3. ½ hour. Station IV.	A large Rhizostoma.
Corsewall to Mull of Cantyre (2 hauls with Shrimp Trawl).	
Apr. 21. 9.45 to 10.10 a.m. (1st haul).	*Stenorhynchus* sp., r. ; *Eupagurus bernhardus,* f. ; *Crangon Allmanni,* f. ; *Pandalus Montagui,* f.; *Pasiphœa sivado,* three ; *Antedon bifida,* one.
Apr. 21. 11.45 a.m. to 12.40 p.m. (2nd haul).	*Hippolyte securifrons* (?), one ; *Crangon Allmanni,* f.; *Pandalus Montagui,* c.; zoophytes (*Flustra,* &c.), fr.
Nov. 4. 35 minutes. Station VI.	*Pasiphœa sivado,* several ; *Pandalus Montagui,* c. ; *Hippolyte securifrons,* f.; *Munida,* several ; *Crangon spinosus,* several ; *Crangon* (?) *echinulatus,* several ; *Nika edulis,* several.
Station VII. Nov. 4. 25 minutes.	*Pasiphœa,* four ; *Hippolyte securifrons,* r. ; *Stenopleustes nodifer,* r. ; *Paramphithoe bicuspis,* r.
Pladda to Turnberry Point (3 hauls with Shrimp Trawl.	
Apr. 22. 9.40 to 10.25 a.m. (1st haul).	*Sepiola Rondeletii,* f. ; *Nephrops norvegicus,* f. ; *Crangon Allmanni,* r. ; *Pandalus Montagui,* f.; *Pennatula phosphorea,* f. (A few invertebrates in trawl net.)
Apr. 22. 11·0 to 11.45 a.m. (2nd haul).	*Nucula sulcata,* fr. ; *Sepiola Rondeletii,* one ; *Nephrops norvegicus,* r. ; *Crangon Allmanni,* r.; *Brissopsis lyrifera,* one ; *Pennatula phosphorea,* f.
Apr. 22. 12.5 to 12.50 p.m. (3rd haul).	*Fusus antiquus,* one ; *Sepiola Rondeletii,* r.; *Hyas coarctatus,* one ; *Nephrops norvegicus,* one ; *Asterias rubens,* f. ; *Parania pulvillus,* one ; *Echinus esculentus,* one ; *Brissopsis lyrifera,* f.; *Pennatula phosphorea,* c.; a quantity of weed.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

C. INVERTEBRATE FAUNA, &c.—I. Upper Loch Fyne.

Station and Date.	Organisms Captured.
1895. Shrimp Trawl. Strachur Bay.	
May 6. ½ hour.	*Pecten opercularis*, f.; *Trochus cinerarius*, fr.; *Buccinum undatum*, one; *Asterias rubens*, one; *Solaster papposa*, one; *Echinus miliaris*, c.; a large quantity of sea-weed.
Castle Lachlan Bay.	
May 6. ½ hour.	*Pecten opercularis*, f.; *Trochus cinerarius*, fr.; *Hyas coarctatus*, one; *Ophiocoma nigra*, f.; *Echinus miliaris*, f.; *Echinus esculentus*, one; *Arenicola piscatorum*, one.
Loch Gair.	
May 6. 40 minutes.	*Trochus cinerarius*, f.; *Ophiocoma nigra*, c.; *Echinus miliaris*, f.; *Echinus esculentus*, two, a large quantity of sea-weed.
Otter Spit.	
May 6. 40 minutes.	*Modiola modiolus*, two; *Echinus miliaris*, c.; *Echinus esculentus*, one; a large quantity of sea-weed.
Ordinary Trawl. Dunderave to Low-burn.	
May 5. 1¼ hours.	*Buccinum undatum*, two; *Fusus antiquus*, two; *Amphidotus cordatus*, three; *Amphiurus* sp., one; *Echinus esculentus*, one. A large quantity of weed.
Nov. 12. 2 hours 10 minutes.	*Pecten opercularis*, f.; *Trochus* sp., f.; Ascidians, f.; *Eupagurus* sp., f.; *Galathea* sp., r.; *Asterias rubens*, f.; *Solaster papposa*, r.; *Echinus esculentus*, f. A quantity of sea-weed.
Penmore to Inver-aray.	
Nov. 12. 2 hours 10 minutes.	*Hyas coarctatus*, f.; *Lithodes maia*, one; *Echinus esculentus*, f.; sea anemones, f.; a quantity of sea weed.
Loch Gair to Minard.	
Nov. 13. 1 hour 25 minutes.	*Pecten opercularis*, f.; *Hyas coarctatus*, f.; *Asterias rubens*, f.; brittle star-fish, f.; *Eupagurus* sp., r.; *Echinus esculentus*, f.; sea anemones, f. A quantity of sea-weed.
Inveræ to Furnace.	
Nov. 13. 1 hour 20 minutes.	*Pecten opercularis*, f.; *Trochus* sp., f.; *Eupagurus* sp., f.; *Lithodes maia*, f.; *Nephrops norvegicus*, f.; *Asterias rubens*, f.; sea anemones, f.; a quantity of sea-weed.
Loch Gair to Largy-more.	
Nov. 14. 1 hour 10 minutes.	*Buccinum undatum*, r.; *Nucula* sp., f.; *Trochus* sp., f.; Ascidians, f.; *Pecten opercularis*, f.; *Eupagurus* sp., r.; *Asterias rubens*, f.; brittle starfish, f.; *Echinus esculentus*, f.; sea anemones, r.; a quantity of sea-weed.

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

D. PHYSICAL OBSERVATIONS—I. Firth of Forth.

Station, Date, and Hour.	End of Station.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Depth in faths.	Wind. Direction.	Wind. Force.	Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
Station I.												
1895.												
Jan. 24.												
10.20 a.m.	W.	46·7	41·2	43·1	16	W.S.W.	4	Cloudy.	Slight.	2 h. ebb.	29·70	2½
11.50 a.m.	E.	47·8	41·2	42·2	16	W.	5	Showery.	Moderate.	3½ ,,	29·71	2
Feb. 14.												
11 a.m.	E.	44·6	42·9	42·8	16½	W.N.W.	3	Cloudy.	Slight.	1¾ ,,	30·30	3
1 p.m.	W.	46·0	42·8	42·5	16	W. by N.	4	,,	,,	3¾ ,,	30·27	2½
Station II.												
Jan. 24.												
11.25 p.m.	W.	45·5	41·2	42·0	13	W.	5	Cloudy.	Moderate.	4 h. ebb.	29·69	2¾
2.5 p.m.	E.	45·6	41·2	42·0	10	W. by S.	4	Showery.	,,	5¾ ,,	29·66	3
Feb. 24.												
	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..
Station III.												
Jan. 20.												
12.10 p.m.	E.	41·1	41·4	41·7	7	W.S.W.	5	Hazy.	Moderate.	near h. w.	30·36	1½
3.15 p.m.	W.	42·2	41·9	42·2	10½	S.W.	3	Slight haze.	Slight.	3 h. fl.	30·33	2
Feb. 13.												
11.20 a.m.	E.	43·3	43·0	43·3	..	E.S.E.	1	Overcast.	Slight E. swell.	2¾ ,,	30·40	2
2.20 p.m.	W.	44·2	42·8	42·6	..	E.S.E.	Light	,,	,,	5¾ ,,	30·38	2½
Station IV.												
Jan. 21.												
11.10 a.m.	E.	40·1	40·9	41·9	6½	W.S.W.	3	Hazy.	Slight.	5¼ h. ebb.	30·27	2
2.35 p.m.	W.	42·8	40·9	41·7	5	S.W.	3	,,	,,	2½ h. fl.	30·18	..
Feb. 20.												
8.55 a.m.	W.	47·1	42·4	42·2	5	S.	Light	,,	Smooth.	3 h. ebb.	29·57	3
12.25 p.m.	E.	49·1	42·6	42·2	5½	S.S.W.	1	,,	,,	½ h. fl.	29·60	2
Station V.												
Jan. 30.												
12.30 p.m.	E.	45·1	41·5	44·0	23	W.	5	Hazy.	Moderate.	3½ h. fl.	30·60	4½
2.25 p.m.	W.	45·6	43·0	42·8	29	W.	,,	,,	,,	5½ ,,	30·60	3½
Feb. 19.												
2 p.m.	E.	44·4	42·7	42·7	23	S.E.	4	,,	S.E. swell.	2½ ,,	29·64	5
3.50 p.m.	W.	44·0	42·7	42·8	31	S.S.E.	,,	,,	,,	4¼ ,,	29·62	4½
Station VI.												
Jan. 30.												
3 p.m.	W.	45·5	42·9	43·1	12	W.	5	Hazy.	Moderate.	¼ h. ebb.	30·60	3
3.50 p.m.	E.	45·6	43·0	42·9	15	W.	4	,,	Slight.	1¼ ,,	30·60	3½
Feb. 19.												
4.20 p.m.	E.	44·6	42·5	42·7	13	S.S.E.	5	,,	S.E. swell.	4¾ h. fl.	29·59	3¼
5.5 p.m.	W.	43·7	43·0	42·6	14½	S.S.E.	,,	,,	,,	5½ ,,	29·58	3
Station VII.												
Jan. 30.												
9.30 a.m.	E.	43·1	41·8	43·8	18	W.	5	Hazy.	Moderate.	1¼ h. fl.	30·61	2¾
11.10 a.m.	W.	44·2	41·3	42·8	10	W.	6	,,	,,	3¼ ,,	30·62	2

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1896.

D. PHYSICAL OBSERVATIONS—I. FIRTH OF FORTH—*continued.*

Station, Date, and Hour.	End of Station.	Temperature.				Wind.		Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
		Air.	Water.									
		Dry Bulb.	Surface.	Bottom.	Depth in faths.	Direction.	Force.					
1896. Feb. 19. 10.50 a.m.	E.	40·6	42·3	42·8	20¼	S.S.E.	Light	Hazy.	S.E. swell.	5¼ h. ebb.	29·70	3
12.40 p.m.	W.	44·7	42·4	42·4	11½	S.S.W.	3	,,	Slight.	1 h. fl.	29·68	2½
Station VIII.												
Jan. 29. 12.25 p.m.	S.W.	45·5	41·4	43·1	22½	W.	3	Hazy.	Slight	5 h. fl.	30·62	3
2.20 p.m.	N.E.	44·6	41·2	43·3	29	W. by N.	5	,,	Moderate.	1 h. ebb.	30·61	3
Feb. 18. 2.10 p.m.	N.E.	40·1	42·6	43·0	27½	W. by S.	1	,,	Slight.	3¼ h. fl.	30·15	5
4.10 p.m.	S.W.	40·2	42·6	42·9	22½	Calm.	,,	,,	Smooth.	5¼ ,,	30·14	3½
Station IX.												
Jan. 29. 2.50 p.m.	N.W.	44·9	41·2	42·9	29	W. by N.	5	Hazy.	Moderate.	1½ h. ebb.	30·61	4½
4.45 p.m.	S.E.	44·0	42·1	43·1	31	W.	,,	,,	Choppy.	3¼ ,,	30·60	5
Feb. 18. 11.30 a.m.	S.E.	38·8	42·5	43·0	31½	W. by S.	1	,,	Slight.	¾ h. fl.	30·22	7
1·30 p.m.	N.W.	39·2	42·6	43·1	29	W. by S.	,,	,,	,,	2¾ ,,	30·17	5¾
Station X.												
Jan. 25. 11 a.m.	W.	42·2	41·0	42·0	7	E.	1	Hazy.	Smooth.	1 h. ebb.	29·84	1¼
11.40 a.m.	E.	42·8	40·9	41·5	11	E.	,,	,,	,,	1¾ ,,	29·84	1¼
Feb. 12. 1.3 p.m.	E.	49·1	43·0	44·2	9½	W.N.W.	6	Cloudy.	Choppy.	4 h. fl.	29·95	½
1.45 p.m.	W.	48·2	44·5	43·1	8½	W.N.W.	5	Dull.	Slight.	4¾ ,,	29·96	½

II. ST ANDREWS BAY.

Station, Date, and Hour.	End of Station.	Dry Bulb.	Surface.	Bottom.	Depth in faths.	Direction.	Force.	Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
Station I.												
Jan. 14. noon.	W.	38·8	45·1	42·6	8	N.N.E.	3	Cloudy.	N.E. swell.	4 h. fl.	29·60	2¾
2.5 p.m.	E.	39·0	45·0	43·5	14	N.N.W.	2	,,	,,	near h. w.	29·61	2¼
Feb. 6. 8.20 a.m.	E.	44·0	42·2	42·8	14	W.S.W.	2	Hazy.	Slight.	1 h. ebb.	30·34	3
10·20 a.m.	W.	44·6	42·0	43·1	9	W.	1	,,	,,	3 ,,	30·34	3
Station II.												
Jan. 17. 12.20 p.m.	W.	49·8	42·0	42·6	7	W.	5	Cloudy.	Moderate.	2¼ h. fl.	29·72	2
2.20 p.m.	E.	49·6	41·2	42·6	13	S.W. by W.	5	,,	,,	4¼ ,,	29·76	1½
Feb. 7. 8.45 a.m.	W.	46·5	41·8	43·7	9½	W.	2	Hazy.	Smooth.	..	30·14	4
10.30 a.m.	E.	47·6	41·6	42·6	12¾	W.S.W.	2	,,	Slight.	..	30·14	3½
Station III.												
Jan. 17. 9·30 a.m.	E.	48·5	41·6	42·8	12½	S.W. by W.	5	Cloudy.	Moderate.	5¼ h. ebb.	29·70	2
11.5 a.m.	W.	48·9	42·0	42·6	10	W. by S.	5	,,	,,	¾ h. fl.	29·71	2

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

D. PHYSICAL OBSERVATIONS—II. St Andrews Bay—*continued.*

Station, Date, and Hour.	End of Station.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Temperature. Water. Depth in faths.	Wind. Direction.	Wind. Force.	Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
1896. Feb. 7.												
10.50 a.m.	E.	47·4	42·0	43·5	13	W.S.W.	2	Slight haze.	Slight.	,,	30·12	3½
12·25 p.m.	W.	49·1	41·6	43·1	9	W.	4	,,	,,	,,	30·10	3½
Station IV.												
Jan. 14.												
8.55 a.m.	E.	42·0	45·0	42·4	7¼	N.E.	4	Cloudy.	N.E. swell.	1 h. fl.	29·56	1¾
11.30 a.m.	W.	42·4	45·0	42·6	6½	N.N.E.	3	,,	,,	3½ ,,	29·58	2
Feb. 6.												
2·5 p.m.	W.	45·8	42·0	42·8	7	W.S.W.	2	Hazy.	Slight.	1 ,,	30·32	3
4.40 p.m.	E.	44·6	42·0	41·3	7	W.S.W.	1	,,	,,	3½ ,,	30·28	2½
Station V.												
Jan. 14.												
2.25 p.m.	S.	38·3	45·0	42·8	16½	N.N.W.	2	Cloudy.	N.E. swell.	¼ h. ebb.	29·61	2½
4.25 p.m.	N.	36·8	42·1	43·3	15	N.N.W.	,,	,,	,,	2¼ ,,	29·62	2
Feb. 6.												
11.30 a.m.	S.	46·2	42·2	42·8	14½	W.	1	Hazy.	Slight.	4¼ ,,	30·33	2¾
1.30 p.m.	N.	44·9	42·0	42·2	13	W.S.W.	2	,,	,,	¼ h. fl.	30·32	2½
Station VI.												
Jan. 17.												
3.5 p.m.	E.	47·8	42·2	43·1	20	W.	5	Cloudy.	Moderate.	4¼ h. fl.	29·77	3
5 p.m.	W.	47·6	42·2	43·3	25	S.W. by W.	5	,,	,,	1¼ h. ebb.	29·80	2½
Feb. 5.												
2.45 p.m.	W.	46·4	42·1	43·8	23	W.	3	Hazy.	,,	2¼ h. fl.	30·31	3½
4.40 p.m.	E.	46·9	42·0	43·1	22	W. by S.	3	,,	,,	4¼ ,,	30·32	3¼

III. Moray Firth.

Station I.												
Aug. 22.												
3.30 p.m.	W.	58·10	56·4	55·3	9	N.E.	1	Cloudy.	Smooth.	1½ h. ebb.	29·74	7
5.30 p.m.	E.	55·40	55·9	55·3	7½	E.N.E.	1	,,	Slight.	3½ ,,	29·78	7
Oct. 16.												
11.30 a.m.	W.	48·56	48·6	51·0	7¼	W.N.W.	2	Hazy.	,,	3 ,,	30·40	3½
1.30 p.m.	E.	50·72	46·6	51·3	10	W.N.W.	3	,,	,,	5 ,,	30·35	3¾
Nov. 27.												
11.45 a.m.	E.	42·8	46·4	47·0	9	S.	Light	Hazy.	Smooth.	1¾ h. fl.	30·38	7
1.50 p.m.	W.	43·7	46·0	47·0	7¼	Variable	,,	,,	,,	3¾ ,,	30·37	5½
Station II.												
Aug. 21.												
12.35 p.m.	W.	60·62	56·1	53·0	12	N.W.	4	Cloudy.	Slight.	2 h. ebb.	30·0	7
2.35 p.m.	E.	58·64	56·0	52·8	15½	N.W.	,,	,,	,,	4 ,,	,,	7½
Oct. 16.												
8.25 a.m.	W.	42·44	48·0	52·0	13½	W.	2	Hazy.	,,	Near h. w.	30·40	3
10.25 a.m.	E.	48·92	46·5	52·2	11¼	W.	1	,,	,,	2 h. ebb.	,,	,,
Nov. 23.												
12.10 p.m.	W.	50·7	48·0	46·3	12	W.S.W.	5	Cloudy.	Moderate.	4½ h. fl.	30·26	5
2.5 p.m.	E.	50·7	46·5	47·9	12	W.	4	,,	,,	½ h. ebb.	30·32	,,

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

D. PHYSICAL OBSERVATIONS—III. Moray Firth—*continued.*

Station, Date, and Hour.	End of Station.	Temperature.				Wind.		Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
		Air.	Water.									
		Dry Bulb.	Surface.	Bottom.	Depth in faths.	Direction.	Force.					
Station III.												
1896.												
Aug. 22.												
10.55 a.m.	E.	64·58	55·7	55·1	17	W.	3	Cloudy.	Slight.	About h.w.	30·0	4¾
12 noon.	W.	62·06	56·0	55·5	5	W. by S.	2	,,	,,	1 h. ebb.	30·0	4¼
Oct. 20.												
11.15 a.m.	W.	44·78	47·0	49.1	8¼	N.	2	,,	Smooth.	h. w.	29·49	1½
12.35 a.m.	E.	45·68	47·0	49·2	15	N.E.	4	,,	Slight.	1½ h. ebb.	29·49	1¾
Nov. 24.												
10.35 a.m.	E.	50·9	46·8	47·3	13½	W.S.W.	2	Clear.	,,	2½ h. fl.	30·45	2¾
11.50 a.m.	W.	51·4	46·2	47·1	12	W.S.W.	3	,,	,,	3¾ ,,	..	3
Station IV.												
Aug. 24.												
3.20 p.m.	W.	57·20	54·9	54·7	11	W.N.W.	5	Cloudy.	Moderate.	2¾ h. ebb.	29·62	6½
5.10 p.m.	E.	58·46	55·0	54·0	13¼	W.	4	,,	,,	4 ,,	29·61	5½
Oct. 23.												
9.40 a.m.	W.	39·20	48·6	49·2	9	W.	3	,,	N.E. swell.	3¼ h. fl.	29·87	5
11.40 a.m.	E.	43·52	48·6	49·4	14	N.W. by W.	3	,,	,,	5¼ ,,	29·85	4¾
Nov. 25.												
2.5 p.m.	W.	46·7	46·3	47·9	11	W. by S.	1	Hazy.	Smooth.	About h.w.	30·48	6¾
4.5 p.m.	E.	45·8	46·5	47·8	13½	W.S.W.	1	,,	,,	1¾ h. ebb.	,,	5
Station V.												
Aug. 24.												
5.30 p.m.	N.E.	57·92	55·0	53·0	17	W.	4	Cloudy.	Moderate.	4½ h. ebb.	29·61	5½
7.15 p.m.	S.W.	54·86	54·9	54·4	10	W.	3	,,	Slight.	l.w.	29·60	5
Oct. 23.												
12 noon.	S.W.	44·60	49·0	49·2	9	N.W. by W.	3	,,	N.E. swell.	5½ h. fl.	29·84	5
1.30 p.m.	N.E.	44·06	48·9	49·4	14	S.W.	1	,,	,,	1 h. ebb.	29·82	4¾
Nov. 25.												
11.5 a.m.	N.E.	47·3	46·7	47·5	20½	W.S.W.	1	Hazy.	Smooth.	2¾ h. fl.	30·50	6¼
12.55 p.m.	S.W.	47·3	46·6	46·9	13	S.W.	1	,,	,,	4¾ h. fl.	..	6
Station VI.												
Aug. 25.												
6.35 a.m.	W.	51·80	55·1	55·0	8	W.N.W.	3	Cloudy with showers.	Slight.	5½ h. ebb.	29·57	5
8.15 p.m.	E.	57·62	54·5	53·3	15¼	W. by N.	3	Cloudy.	,,	1¼ h. fl.	..	8
Oct. 23.												
7.30 a.m.	E.	38·30	48·0	49·5	16½	N.W.	4	Cloudy.	N.E. swell.	¾ ,,	29·89	3¼
9.15 a.m.	W.	39·92	48·7	48·2	9	W.	3	,,	,,	2½ ,,	29·88	5
Nov. 25.												
8.35 a.m.	E.	46·7	46·3	47·6	16½	S.W.	1	Hazy.	Smooth.	¼ ,,	30·49	6½
10.20 a.m.	W.	47·1	46·5	47·6	10	W.S.W.	1	,,	,,	2 ,,	30·50	5¾
Station VII.												
Aug. 25.												
9.15 a.m	W.	53·42	55·0	52·6	24	W.N.W.	4	Cloudy.	Slight.	2¼ h. fl.	29·56	8
11.0 a.m.	E.	55·58	54·9	52·4	31	W.N.W.	,,	,,	,,	4 ,,	..	8¼
Oct. 23.												
3.10 p.m.	W.	44·06	49·9	50·7	26	W.S.W.	4	,,	N.E. swell.	2¾ h. ebb.	29·77	7
5.10 p.m.	E.	44·06	50·1	50·4	32	W.S.W.	5	Overcast.	,,	4¾ ,,	29·73	..

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

D. PHYSICAL OBSERVATIONS.—III. Moray Firth—*continued.*

Station, Date, and Hour.	End of Station.	Temperature.				Wind.		Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
		Air.	Water.									
		Dry Bulb.	Surface.	Bottom.	Depth in faths.	Direction.	Force.					
1896. Nov. 26.												
7.45 a.m.	W.	46·4	46·9	47·7	29	W.S.W.	1	Hazy.	Smooth.	4½ h. ebb.	20·49	4
9.35 a.m.	E.	45·5	47·2	48·0	33	W.S.W.	1	,,	,,	¼ h. fl.	..	7
Station VIII.												
Aug. 25.												
12.55 p.m.	N.	56·30	55·0	52·8	34	W.N.W.	5	Cloudy.	Moderate.	Near h. w.	29·54	9
2.45 p.m.	S.	57·02	55·0	52·3	30¼	N.W.	4	,,	,,	1¾ h. ebb.	29·55	..
Oct. 24.												
6.5 a.m.	N.	44·24	50·0	51·3	35	W.S.W.	4	Overcast.	N.E. swell.	5¼ ,,	29·31	too dark to see.
7.55 a.m.	S.	44·24	50·0	50·5	33	W.	5	,,	Choppy.	1 h. fl.	29·30	5½
Nov. 26.												
11.20 a.m.	N.	45·5	47·0	48·0	34	S.W.	1	Hazy.	Smooth.	2 h. fl.	30·48	8
1.10 p.m.	S.	45·3	47·0	47·9	34	S.W.	..	,,	,,	3¾ ,,	30·48	7½
Station IX.												
Aug. 25.												
4.20 p.m.	S.	55·22	54·9	53·2	38	N. W.	4	Cloudy.	Moderate.	3¼ h. ebb.	29·53	12
6.5 p.m.	N.	54·86	54·6	53·1	32	W.	5	,,	,,	5 ,,	..	9
Oct. 24.												
8.35 a.m.	S.	42·80	50·3	50·9	39	W.	5	Cloudy.	Choppy.	1¾ h. fl.	29·30	7½
10.25 a.m.	N.	43·16	50·0	50·5	32	W.	..	,,	,,	3½ ,,	29·27	7
Nov. 26.												
2.35 p.m.	N.	45·5	47·0	47·9	33	S.W.	1	Hazy.	Smooth.	5¼ ,,	30·47	7½
4.25 p.m.	S.	45·1	47·0	47·9	37	S.W.	Light	,,	,,	1 h. ebb.	30·46	too dark.
Station X.												
Aug. 26.												
11.10 a.m.	S.E.	55·40	55·1	54·9	19½	N.E.	2	Cloudy.	Slight.	3¼ h. fl.	30·52	11
1.10 p.m.	N.W.	58·64	55·3	52·1	35½	N.E.	1	,,	,,	5¼ ,,	..	13¼
Oct. 24.												
12.5 p.m.	S.E.	41·90	49·3	50·3	18	W.	3	Cloudy.	Slight.	5¼ ,,	29·24	6
1.55 p.m.	N.W.	42·80	50·1	50·5	36	W.S.W.	3	,,	,,	¾ h. ebb.	29·25	7
Nov. 27.												
8·10 a.m.	S.E.	42·8	47·0	48·0	18½	S.E	1	Hazy.	Slight	4¼ ,,	30·42	7½
10.5 a.m.	N.W.	42·9	47·0	47·9	31	S.E.	Light.	,,	Smooth.	l. w.	30·39	8
Station XI.												
Oct. 15.												
9.25 a.m.	E.	50·0	51·1	51·3	23	N.	1	Hazy.	S.E. swell.	2½ h. ebb.	30·46	10
11.5 a.m.	W.	50·0	51·1	51·3	26	N.N.E.	1	,,	,,	4½ ,,	30·46	10
Station XII.												
Oct. 15.												
6.45 a.m.	S.	48·92	51·0	51·4	22½	Calm.	..	Hazy.	S.E. swell.	near h. w.	30·48	8¾
8.45 p.m.	N.	49·64	51·3	49·0	31	N. W.	1	,,	,,	2 h. ebb.	30·46	11
Station XIII.												
Oct. 14.												
11.30 a.m.	S.	52·70	51·3	52·0	29	S.E.	3	Hazy.	N.E. swell.	1½ h.	30·52	7½
1.30 p.m.	N.	52·52	51.2	51·8	27½	S.E.	4	,,	,,	3½ ,,	,,	8

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

D. PHYSICAL OBSERVATIONS—III. Moray Firth—*continued.*

Station, Date, and Hour.	End of Station.	Temperature. Air.	Temperature. Water.			Wind.		Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
		Dry Bulb.	Surface.	Bottom.	Depth in faths.	Direction.	Force.					
Station XIV. 1896.												
Oct. 14.												
4.10 p.m.	N.	52·70	51·0	51·5	25	S.E.	1	Hazy.	S E. swell.	4¼ h. fl.	30·53	8½
6.10 p.m.	S.	51·62	51·3	52·0	41	S.S.E.	3	,,	,,	h. w.	30·53	too dark.
Station XV.												
Oct. 15.												
1.10 p.m.	N.	50·90	51·5	51·7	34	N.N.E.	Light.	Hazy.	S.E. swell.	½ h. fl.	30·44	10½
3.10 p.m.	S.	57·26	51·1	51·6	30	N.N.W.	,,	,,	,,	2½ ,,	30·43	10½
Station XVI.												
Oct. 14.												
7.35 a.m.	S.	50·36	51·3	52·0	39	N.E.	2	Hazy.	N.E. swell.	1½ h. ebb.	30·52	7½
9.30 a.m.	N.	48·20	51·2	51·8	32	N.E.	3	Rain.	,,	3½ ,,	30·52	8
IV. Firth of Clyde.												
Station I.												
April 13.												
10.45 a.m.	S.	47·3	45·0	45·3	22½	N.N.E.	3	Cloudy.	Slight.	3¼ h. fl.	30·13	7
12.15 a.m.	N.	46·9	45·0	45·8	22½	N.N E.	3	,,	,,	4¾ ,,	30·13	9½
Nov. 2.												
7.40 a.m.	N.	44·0	49·1	49·8	22	N.W.	1	Overcast.	Smooth.	5½ h. ebb.	29·97	5
9.10 a.m.	S.	46·4	49·6	50·0	21	N.	2	Cloudy.	Slight.	1 h. fl.	29·92	6
Station II.												
April 13.												
7.20 a.m.	Outer.	41·9	44·4	44·7	29	N. by E.	5	Cloudy.	Moderate.	1 h. fl.	30·11	6
8.45 a.m.	Inner.	43·5	44·5	44·5	24	N. by E.	2	,,	Slight.	2½ ,,	30·11	6
Oct. 29.												
10.5 a.m.	Outer.	43·1	50·8	51·0	25	N.N.E.	4	,,	,,	¼ h. fl.	29·74	5
11.50 a.m.	Inner.	45·3	50·9	51·1	15	N.N.E.	3	,,	,,	2 ,,	29·76	5½
Station III.												
April 10.												
1.40 p.m.	N.	47·8	46·1	44·8	26¼	W.S.W.	6	Cloudy.	Choppy.	2¼ h. ebb.	29·98	10½
2.45 p.m.	S.	47·1	45·5	44·8	27	W.S.W.	6	,,	,,	3¼ ,,	29·94	10½
Oct. 29.												
7.40 a.m.	S.	40·2	51·3	51·0	27½	E.	2	,,	Smooth.	3¾ ,,	29·69	5
9.5 a.m.	N.	42·2	51·2	51·5	30½	E.N.E.	2	,,	,,	5¼ ,,	29·73	6¼
Station IV.												
April 10.												
11.45 a.m.	N.	46·7	45·8	45·2	32½	W.S.W.	5	Cloudy.	Moderate.	¼ h. ebb.	29·97	11
12.30 p.m.	S.	47·4	45·9	45·0	25	W.S.W.	5	,,	,,	1½ ,,	29·98	11
Oct. 29.												
1 p.m.	S.	44·6	51·1	50·4	28½	E.N.E.	3	,,	Slight.	3¼ h. fl.	29·76	5
1.40 p.m.	N.	46·2	51·0	51·4	35	E.N.E.	3	,,	,,	5 ,,	29·76	0

TABLE C.—RECORD OF OBSERVATIONS MADE ON BOARD THE 'GARLAND' DURING 1896.

D. PHYSICAL OBSERVATIONS—IV. FIRTH OF CLYDE.

Station, Date, and Hour.	End of Station.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Depth in faths.	Wind. Direction.	Wind. Force.	Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
Station V.												
1896. April 10.												
6.35 a.m.	N.	47·3	44·8	44·8	16⅓	S.W.	4	Cloudy.	Slight.	1 h. fl.	30·02	6½
7.45 a.m.	S.	45·6	44·8	44·5	18	S.W.	6	,,	,,	2¼ ,,	30·01	6¾
Oct. 30.												
7.20 a.m.	N.	44·0	50·2	51·0	17	N.	4	,,	,,	2½ h. ebb.	29·90	5
8.20 a.m.	S.	45·6	50·5	51·0	20	N.N.E.	,,	,,	,,	3¼ ,,	29·92	5½
Station VI.												
April 13.												
1.45 p.m.	N.	46·9	45·2	45·2	25	N.N.E.	2	Cloudy.	Slight.	¼ h. ebb.	30·14	10
3.50 p.m.	W.	47·1	45·2	45·2	20	N.W. by W.	2	,,	,,	2¼ ,,	30·13	7½
Oct. 28.												
2.50 p.m.	W.	44·0	54·1	52·8	24	W.N.W.	2	,,	,,	h. w.	29·60	6½
4.50 p.m.	N.	42·9	50·2	51·6	27	N.W.	2	,,	,,	2 h. ebb.	29·58	7
Station VII.												
April 15.												
1.30 p.m.	S.W.	47·4	45·6	45·2	16	S.S.W.	2	Cloudy.	Slight.	h. w.	30·18	10
3.20 p.m.	N.E.	48·9	46·2	45·1	14	S.W.	2	Overcast.	,,	1¾ h. ebb.	30·18	7½
April 20. (Night haul).												
9.15 p.m.	N.E.	51·6	48·0	45·7	23	S.W.	2	Hazy.	,,	..	30·39	..
11.15 p.m.	S.W.	48·2	46·5	45·6	22	S.W.	2	,,	,,	..	30·39	..
Oct. 31.												
2.10 p.m.	S.W.	48·3	51·0	51·9	20	N.E.	7	Slight haze.	Choppy.	1¾ h. fl.	29·83	7
3.40 p.m.	N.E.	47·6	50·6	51·2	27	,,	5	Cloudy.	,,	3¼ ,,	29·83	5
Nov. 3. (Night haul).												
7.40 p.m.	S.W.	39·2	50·0	51·2	21½	E.S.E.	1	Hazy.	Slight.	3¾ ,,	30·09	..
9.15 p.m.	N.E.	41·7	50·3	51·0	23	S.S.E.	1	,,	,,	5¼ ,,	30·12	..
Station VIII.												
April 15.												
9.35 a.m.	W.	45·5	45·5	45·7	36	W.S.W.	2	Cloudy.	Slight.	2½ ,,	30·15	8
11.35 a.m.	E.	48·0	45·5	45·6	29	S.S.W.	3	,,	,,	4¼ ,,	30·20	10½
April 21. (Night haul).												
12.15 a.m.	W.	48·5	47·2	45·7	32	S.S.E.	3	Hazy.	,,	..	30·39	..
2.20 a.m.	E.	49·8	47·5	45·8	..	S. by W.	4	,,	,,	..	30·39	..
Oct. 31.												
10.30 a.m.	E.	45·5	50·2	51·6	29	N.E.	6	Cloudy.	Choppy.	4½ h. ebb.	29·84	10
12.10 p.m.	W.	47·3	50·1	51·0	34	,,	5	,,	,,	near l. w.	29·85	9
Nov. 3. (Night haul).												
10.15 p.m.	E.	41·5	50·0	51·0	31½	S.S.E.	1	Hazy.	Slight.	½ h. ebb	30·13	..
Midnight.	W.	41·9	51·0	51·2	35	S.W.	Light	,,	,,	2 ,,	30·15	..

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

D. PHYSICAL OBSERVATIONS—IV. Firth of Clyde—*continued.*

Station, Date, and Hour.	End of Station.	Temperature. Air. Dry Bulb.	Temperature. Water. Surface.	Temperature. Water. Bottom.	Temperature. Water. Depth in faths.	Wind. Direction.	Wind. Force.	Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
Station IX. 1896.												
April 14.												
1.20 p.m.	N.E.	42·2	45·0	45·8	27½	E.	3	Thick haze.	Slight.	¼ h. ebb.	29·98	10
3.20 p.m.	S.W.	44·2	45·2	45·6	27	N.E. by E.	2	Hazy.	,,	2¼ ,,	30·02	9¾
Oct. 31.												
7.5 a.m.	N.E.	41·9	51·0	51·7	28	N.	6	Cloudy.	Choppy.	¾ ,,	29·82	6
8.50 a.m.	S.W.	43·3	50·1	51·0	29	,,	..	,,	,,	2½ ,,	29·84	9
Station X.												
April 14.												
9.20 a.m.	W.	41·7	45·1	45·5	26	E.S.E.	4	Fog.	Moderate.	2¼ l. fl.	29·97	8½
11.20 a.m.	E.	41·9	45·0	45·5	27	E.	4	Hazy.	,,	4¼ ,,	29·98	9½
Oct. 28.												
11.35 a.m.	W.	43·8	50·1	52·3	27½	W.N.W.	2	Overcast.	Slight.	2¾ ,,	29·67	7
1.25 p.m.	E.	44·0	50·4	52·4	27½	N.W.	2	Cloudy.	,,	4½ ,,	29·65	8
Station XI.												
April 16.												
9.30 a.m.	W.	48·9	45·8	45·1	34½	S.W. by S.	6	Showery.	Choppy.	1½ ,,	29·78	12½
10.35 a.m.	E.	48·7	45·7	45·0	31	,,	..	Heavy rain.	,,	2½ ,,	29·78	10½
Oct. 30.												
1.30 p.m.	W.	46·7	51·0	51·2	34	N.E.	4	Slight haze.	Moderate.	¾ ,,	29·92	7
3.20 p.m.	E.	45·5	49·8	51·5	12½	,,	..	Cloudy.	,,	2¼ ,,	29·89	6½
Station XII.												
April 16.												
11.30 a.m.	E.	46·7	45·7	45·0	38	W.	5	Heavy rain.	Choppy.	3½ h. fl.	29·77	11½
1.25 p.m.	W.	50·0	45·4	45·0	39	,,	..	Cloudy.	,,	5½ ,,	29·80	11
April 21. (Night haul).												
9.15 p.m.	E.	49·8	48·3	45·0	39	Calm.	..	Hazy.	Smooth.	..	30·34	..
11.20 p.m.	W.	47·8	47·0	45·0	41½	,,	..	,,	,,	..	30·35	..
Oct. 30.												
9.55 a.m.	W.	46·0	51.0	52·9	45	N.E.	5	Cloudy.	Slight.	4¾ h. ebb.	29·92	7
11.55 a.m.	E.	45·8	51·0	51·2	36½	,,	4	Slight haze.	,,	¾ h. fl.	29·93	7½
Nov. 4. (Night haul).												
8.35 p.m.	W.	45·1	50·0	51·2	43	S.W.	2	Hazy.	,,	3 ,,	30·35	..
10.40 p.m.	E.	44·0	50·2	51·3	47	W.S.W.	..	Overcast.	,,	5 ,,	30·34	..
2 miles S.E. of Sanda Island.												
April 20.												
8.20 a.m.	W.	50·9	46·9	46·0	30	Calm.	..	Hazy.	Smooth.	..	30·39	12
Nov. 3.												
8.45 a.m.	W.	41·0	52·2	52·8	40¼	N.N.E.	2	Cloudy.	Slight.	5¼ h. fl.	30·0	3½

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

D. PHYSICAL OBSERVATIONS—IV. Firth of Clyde—*continued.*

Station, Date, and Hour.	End of Station.	Temperature. Air. Dry Bulb.	Water. Surface.	Water. Bottom.	Water. Depth in faths.	Wind. Direction.	Wind. Force.	Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
1896. 10 miles S.E. of Sanda Island.												
April 20. 11.30 a.m.	E.	53·6	46·8	45·9	30	Calm.	..	Hazy.	Smooth.	..	30·40	13½
Nov. 3. 10.50 a.m.	W.	46·0	52·0	53·3	33	N.W.	1	Cloudy. Fine.	Smooth.	1¼ h. ebb.	30·02	4½
3 miles N.W. of Bennan Head.												
Apr. 20. 3 p.m.	E.	53·2	47·9	45·8	24	S.W.	1	Hazy.	Slight,	..	30·39	10½
Nov. 3. 1.10 p.m.	E.	43·7	50·5	51·3	26	N.E.	1	Slight haze.	Slight.	3½ h. ebb.	30·03	7
2½ miles S.E. by [illegible] of Pladda Lighthouse.												
April 22. 9.40 a.m.	N.W.	50·9	46·6	45·3	55	W.N.W.	3	Slight haze.	Slight.	—	30·33	12
Nov. 5. 8.35 a.m.	N.W.	43·1	50·0	49·8	50	W.	3	Cloudy.	Slight.	3¾ h. fl.	30·44	5½
6 miles S.E. by S. of Pladda.												
April 22. 11 a.m.	N.W.	51·8	47·8	45·0	31	W.N.W.	2	Slight haze.	Slight.	..	30·33	13½
Nov. 5. 9.40 a.m.	N.W.	44·9	50·0	51·0	33½	W.	3	Cloudy.	Slight.	4¾ h. fl.	30·47	8
3 miles N.W. by N. of Turnberry Point.												
April 22. 12.50 p.m.	S.E.	55·9	47·8	45·3	28	W.N.W.	2	Cloudy.	Smooth.	..	30·31	13
Nov. 5. 11.15 a.m.	S.E.	46·9	49·8	50·3	26½	W.	3	Hazy.	Slight.	h.w.	30·48	7
7 miles W. by N., ½ N. of Corsewall Point.												
April 21. 9.45 a.m.	S.E.	50·0	46·0	46·0	70	S.	2	Hazy.	Slight.	..	30·39	9
Nov. 11. 8.35 a.m.	S.E.	45·3	52·0	52·5	71	S.W.	1	Slight haze.	Slight.	4¼ h. fl.	30·22	3
7½ miles S.S.W., ½ W. of Sanda Island.												
April 21. 11.45 a.m.	SE .	56·6	46·7	45·2	64	Variable	Light	Hazy.	Smooth.	..	30·39	11
Nov. 11. 11 a.m.	S.E.	46·9	52·1	52·8	65½	W.	1	Slight haze.	Slight.	½ h. ebb.	30·24	4

TABLE C.—Record of Observations made on Board the 'Garland' during 1896.

D. PHYSICAL OBSERVATIONS—V. Upper Loch Fyne.

Station, Date, and Hour.	End of Station.	Temperature.				Wind.		Weather.	Sea.	Tide.	Barometer.	Transparency. Fathoms.
		Air.	Water.									
		Dry Bulb.	Surface.	Bottom.	Depth in faths.	Direction.	Force.					
Station 1896.												
Dunderave to Lowburn.												
May 5. 4.15 p.m.	S.	56·3	51·7	45·1	29	W.	1	Hazy.	Smooth.	..	30·29	5½
5.30 p.m.	N.	56 4	53·4	45·0	13½	W.	Light.	,,	,,	..	30·28	5
Station												
Dunderave to Lowburn.												
Nov. 12. 8.40 a.m.	N.	48·2	48·9	50·0	14	Calm.	..	,,	,,	2¾ h. ebb.	29·96	3½
10.50 a.m.		48·9	49·0	48·9	38	W.S.W.	Light	,,	,,	5 ,,	29·94	3¼
Station												
Penmore to off Inveraray.												
Nov. 12. 1·40 p.m.	S.	49·1	50·0	47·2	63	W.S.W.	1	,,	,,	1¾ h. fl.	29·90	7
3.50 p.m.	N.	48·2	49·5	50·5	66	S.	1	,,	,,	4 ,,	29·87	3½
Station												
Off Loch Gair to Minard.												
Nov. 13. 1.50 p.m.	S.	49·6	49·8	50·5	35	W.	6	Rain.	Slight.	1¾ ,,	29·52	6½
3.15 p.m.	N	48·5	50·7	50·5	27½	W.	4	Hazy.	,,	3¼ ,,	..	5½
Station												
Off Inveræ to off Furnace.												
Nov. 13. 3.40 p.m.	S.	48·0	50·0	51·0	21	W.	4	,,	,,	3¾ ,,	29·52	7
5 p.m.	N.	47·6	50·0	50·4	35½	W.	3	,,	,,	5 ,,	29·56	too dark
Station												
Off Loch Gair to Largymore.												
Nov. 14. 8.15 a.m.	N.	46·9	49·7	50·4	32	S.S.W.	5	Cloudy.	,,	1½ h. ebb.	29·48	5½
9.25 a.m.	S.	47·6	50·0	50·3	35	S.S.W.	6	Heavy rain.	Choppy.	2¾ ,,	29·40	7

TABLE D.—Showing the Quantities of Fish caught by Line in 1896 within the Moray Firth (inside a Line between Duncansby Head and Rattray Point), and the Number of Shots of the Boats by which the Fish were caught.

WICK DISTRICT.

Months.	Number of Shots.		Cod.		Ling.		Torsk (Tusk).		Saithe (Coalfish).		Haddock.		Whiting.		Turbot.		Halibut.		Sole (Lemon Sole).		Flounder, Plaice, Brill.		Conger-Eel.		Skate.		Other kinds of White Fish.		Total of Line-caught Fish.	
	Large Boats.	Small Boats.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.
Jan.	530	356	1,834	2·06	170	0·19	.	.	691	0·77	79	0·08	2	0·002	2	0·002	47	0·05	.	.	23	0·02	32	0·03	229	0·25	301	0·33	3,410	3·84
Feb.	789	325	3,061	2·74	272	0·24	.	.	328	0·29	84	0·075	.	.	.	.	56	0·05	.	.	10	0·009	35	0·03	205	0·18	241	0·21	4,292	3·85
March	608	400	5,039	5·00	853	0·84	54	0·05	1,182	1·17	136	0·13	.	.	3	0·003	240	0·23	.	.	53	0·05	62	0·06	1,023	1·01	345	0·34	8,990	8·91
April	164	349	1,616	3·15	463	0·9	.	.	444	0·86	305	0·59	.	.	.	.	20	0·03	.	.	7	0·01	11	0·02	60	0·11	121	0·23	3,047	5·93
May	169	356	2,067	3·93	.	.	.	.	802	1·52	142	0·27	.	.	.	.	.	.	.	.	5	0·009	.	.	.	.	123	0·23	3,139	5·97
June	366	169	2,336	4·36	.	.	.	.	548	1·02	99	0·18	.	.	.	.	3	0·005	.	.	24	0·04	8	0·01	30	0·05	85	0·15	3,133	5·85
July	50	181	801	3·46	.	.	.	.	575	2·48	11	0·04	.	.	.	.	.	.	.	.	18	0·07	11	0·04	.	.	24	0·1	1,440	6·23
Aug.	50	71	887	7·33	.	.	.	.	434	3·58	5	0·04	.	.	.	.	.	.	.	.	40	0·33	.	.	.	.	5	0·04	1,371	11·33
Sept.	19	186	185	0·9	.	.	.	.	123	0 6	123	0·6	4	0·01	.	.	.	.	.	.	.	.	.	.	.	.	11	0·05	446	2·17
Oct.	9	217	310	1·37	36	0·15	.	.	247	1·09	192	0·84	2	0·008	4	0·016	4	0·016	.	.	25	0·11	.	.	11	0·04	20	0·08	851	3·76
Nov.	.	273	424	1·55	63	0·23	.	.	131	0·47	117	0·42	2	0·007	.	.	12	0·043	2	0·007	27	0·098	67	0·24	39	0·14	32	0·11	916	3·35
Dec.	20	180	290	1·45	46	0·23	.	.	50	0·25	32	0·16	.	.	.	.	4	0·02	.	.	4	0·02	55	0·27	13	0·065	27	0·13	521	2·60
Totaals,	2,774	3,063	18,850	3·22	1903	0·32	54	0·009	5,555	0·95	1,325	0·22	10	0·001	9	0·001	386	0·066	2	0·0003	236	0·04	281	0·048	1,610	0·27	1,335	0·22	31,556	5·40

TABLE G.—*continued.*—LYBSTER DISTRICT.

Months.	Number of Shots.		Cod.		Ling.		Torsk (Tusk).		Saithe (Coalfish).		Haddock.		Whiting.		Turbot.		Halibut.		Sole (Lemon Sole).		Flounder, Plaice, Brill.		Conger-Eel.		Skate.		Other kinds of White Fish.		Total of Line-caught Fish.	
	Large Boats.	Small Boats.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average	Cwt.	Average.
Jan.	10	148	343	2·17	.	.	.	.	10	0·06	153	0·96	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	0·06	516	3·26
Feb.	87	97	485	2·63	7	0·038	.	.	15	0·08	72	0·39	.	.	.	.	3	0·016	.	.	.	.	3	0·016	.	.	.	.	585	3·17
March	59	134	402	2·08	2	0·01	.	.	13	0·067	133	0·68	.	.	.	.	2	0·01	.	.	.	.	.	.	.	.	.	.	552	2·86
April	25	116	208	1·47	.	.	.	.	8	0·056	20	0·14	.	.	.	.	.	.	.	.	.	.	3	0·021	.	.	10	0·07	249	1·76
May	.	140	219	1·56	.	.	.	.	27	0·19	50	0·35	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	296	2·11
June	.	76	93	1·22	.	.	.	.	36	0·47	12	0·15	.	.	.	.	.	.	.	.	.	.	3	0·039	.	.	.	.	144	1·89
July	.	71	112	1·57	.	.	.	.	74	1·04	.	.	.	.	3	0·04	.	.	.	.	.	.	12	0·16	.	.	.	.	201	2·83
Aug.	.	64	100	1·56	.	.	.	.	80	1·25	.	.	.	.	.	.	.	.	.	.	.	.	14	0·21	.	.	.	.	194	3·03
Sept.	7	26	43	1·3	.	.	.	.	21	0·63	21	0·63	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	85	2·57
Oct.	.	82	103	1·25	.	.	.	.	39	0·47	123	1·5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33	0·4	298	3·63
Nov.	.	183	280	1·53	.	.	.	.	30	0·16	284	1·55	.	.	.	.	.	.	.	.	.	.	.	.	.	.	59	0·32	653	3·56
Dec.	20	129	237	1·58	.	.	.	.	43	0·28	142	0·95	.	.	.	.	.	.	.	.	.	.	.	.	.	.	46	0·3	468	3·51
Totals,	208	1,266	2,625	1·71	9	0·006	.	.	396	0·26	1,010	0·69	.	.	3	0·002	5	0·002	.	.	.	.	35	0·023	.	.	158	0·1	4,241	2·87

TABLE G.—*continued.*—HELMSDALE DISTRICT.

Months.	Number of Shots.		Cod.		Ling.		Torsk (Tusk).		Saithe (Coalfish).		Haddock.		Whiting.		Turbot.		Halibut.		Sole (Lemon Sole).		Flounder, Plaice, Brill.		Conger-Eel.		Skate.		Other kinds of White Fish.		Total of Line-caught Fish.	
	Large Boats.	Small Boats.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.
Jan.	81	528	1,088	1·78	8	0·013	.	.	41	0·067	1,534	2·51	73	0·11	.	.	4	0·006	.	.	106	0·17	15	0·024	22	0·036	24	0·039	2,915	4·78
Feb.	87	310	1,424	3·58	30	0·075	.	.	18	0·045	176	0·44	6	0·015	.	.	16	0·040	.	.	273	0·68	34	0·085	53	0·13	51	0·12	2,081	5·24
March	162	284	2,671	5·98	12	0·026	.	.	12	0·026	627	1·42	28	0·062	.	.	6	0·013	3	0·006	86	0·19	20	0·044	8	0·017	.	.	3,473	7·78
April	33	393	800	1·87	.	.	.	.	51	0·11	1,028	2·41	31	0·072	.	.	4	0·009	.	.	34	0·079	10	0·023	3	0·007	.	.	1,961	4·60
May	.	318	214	0·67	.	.	.	.	86	0·27	676	2·12	71	0·22	.	.	.	.	.	.	5	0·015	.	.	.	.	.	.	1,052	3·30
June	.	185	183	0·98	.	.	.	.	57	0·30	384	2·07	11	0·059	.	.	.	.	.	.	9	0·048	.	.	.	.	.	.	644	3·48
July	.	51	83	1·62	.	.	.	.	40	0·78	143	2·80	.	.	.	.	.	.	.	.	5	0·098	.	.	.	.	.	.	271	5·31
Aug.	.	85	109	1·28	.	.	.	.	18	0·21	211	2·48	5	0·058	.	.	.	.	.	.	4	0·047	9	0·10	.	.	.	.	356	4·18
Sept.	.	225	76	0·33	.	.	.	.	.	.	728	3·23	40	0·17	.	.	.	.	.	.	5	0·022	.	.	.	.	.	.	849	3·77
Oct.	.	448	165	0·36	.	.	.	.	26	0·058	1,189	2·65	26	0·058	.	.	.	.	9	0·020	17	0·037	.	.	.	.	.	.	1,432	3·19
Nov.	.	482	485	1·006	.	.	31	0·064	12	0·024	1,448	3·004	39	0·08	.	.	4	0·008	5	0·01	.	.	21	0·043	15	0·031	.	.	2,060	4·27
Dec.	.	226	540	2·38	5	0·022	.	.	47	0 2	556	2·46	7	0·03	.	.	3	0·013	.	.	17	0·075	73	0·32	18	0·079	.	.	1,266	5·61
Totals,	363	3,535	7,838	2·01	55	0·014	31	0·007	408	0·1	8,700	2·2	337	0·086	.	.	37	0·009	17	0·004	561	0·14	182	0·045	119	0·03	75	0·019	18,360	4·71

TABLE G.—*continued.*—CROMARTY DISTRICT.

Months.	Number of Shots.		Cod.		Ling.		Torsk (Tusk).		Saithe (Coalfish).		Haddock.		Whiting.		Turbot.		Halibut.		Sole (Lemon Sole).		Flounder, Plaice, Brill.		Conger-Eel.		Skate.		Other kinds of White Fish.		Total of Line-caught Fish.	
	Large Boats.	Small Boats.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.	Cwt.	Average.
Jan.	.	679	673	0·99	.	.	.	.	.	.	1,249	1·83	.	.	.	.	.	.	.	.	36	0·05	68	0·1	.	.	42	0·06	2,068	3·04
Feb.	1	629	433	0·68	.	.	.	.	.	.	717	1·13	.	.	.	.	.	.	.	.	311	0·49	.	.	.	.	42	0·06	1,503	2·38
March	12	619	562	0·89	.	.	.	.	.	.	683	1·08	4	0·006	.	.	.	.	.	.	232	0·36	.	.	1	0·001	61	0·09	1,543	2·44
April	.	562	502	0·89	.	.	.	.	1	0·001	730	1·29	1	0·001	.	.	.	.	.	.	66	0·11	.	.	4	0·007	74	0·13	1,378	2·45
May	.	538	279	0·51	.	.	.	.	.	.	607	1·12	.	.	.	.	.	.	.	.	37	0·06	.	.	3	0·005	70	0·13	996	1·85
June	.	349	307	0·87	.	.	.	.	.	.	733	2·1	.	.	.	.	.	.	.	.	12	0·03	.	.	.	.	64	0·18	1,116	3·19
July	.	134	47	0·35	.	.	.	.	.	.	307	2·29	2	0·01	.	.	.	.	.	.	10	0·07	.	.	.	.	40	0·29	406	3·02
Aug.	.	192	72	0·37	.	.	.	.	2	0·01	366	1·9	.	.	.	.	.	.	.	.	22	0·11	.	.	1	0·005	40	0·2	503	2·62
Sept.	.	508	207	0·4	.	.	.	.	.	.	682	1·34	.	.	.	.	.	.	.	.	20	0·03	.	.	.	.	53	0·1	962	1·89
Oct	.	436	165	0·37	.	.	.	.	.	.	717	1·64	.	.	.	.	.	.	.	.	40	0·09	.	.	.	.	39	0·08	961	2·2
Nov	.	757	460	0·6	.	.	.	.	.	.	1,014	1·33	.	.	.	.	.	.	.	.	.	.	40	0·05	.	.	59	0·077	1,573	2·07
Dec.	.	675	805	1·19	.	.	.	.	.	.	1,402	2·07	.	.	.	.	.	.	.	.	.	.	22	0·03	2	0·002	77	0·11	2,308	3·41
Totals,	13	6,078	4,512	0·74	.	.	.	.	3	0·0004	9,207	1·51	7	0·001	.	.	.	.	.	.	786	0·12	130	0·021	11	0·001	661		15,317	2·51

TABLE G.—*continued.*—FINDHORN DISTRICT.

Months.	Number of Shots.		Cod.		Ling.		Torsk (Tusk).		Saithe (Coalfish).		Haddock.		Whiting.		Turbot.		Halibut		Sole (Lemon Sole).		Flounder, Plaice, Brill.		Conger-Eel.		Skate.		Other kinds of White Fish.		Total of Line-caught Fish.	
	Large Boats.	Small Boats.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.
Jan.	249	868	1,617	1·44	76	0·068	.	.	104	0·093	7,440	6·75	266	0·23	.	.	.	.	.	.	78	0·069	.	.	35	0·031	6	0·005	9,622	8·61
Feb.	244	945	4,363	3·66	27	0·011	.	.	7	0·005	7,263	6·10	325	0·27	.	.	8	0·006	.	.	331	0·27	7	0·005	107	0·089	7	0·005	12,445	10·46
March	243	772	2,860	2·81	34	0·033	5	0·004	41	0·040	4,961	4·88	200	0·19	.	.	16	0·015	.	.	280	0·27	6	0·005	112½	0·11	4	0·063	8,519½	8·39
April	112	559	1,027	1·53	74	0·11	.	.	21	0·031	2,581	3·84	.	.	.	.	1	0·001	.	.	352½	0·52	2	0·002	29	0·043	4	0·005	4,091½	6·09
May	106	439	175	0·32	.	.	.	.	59	0·10	1,700½	3·12	4	0·007	.	.	.	.	.	.	26	0·047	.	.	.	.	6	0·011	1,970½	3·60
June	129	374	76	0·15	.	.	.	.	7	0·013	1 2 ½	2·54	8	0·015	.	.	.	.	.	.	6	0·011	.	.	2	0·003	5	0·009	1,384½	2·75
July	524	579	47	0·042	.	.	.	.	11	0·009	1,234	1·11	64	0·058	.	.	.	.	.	.	6	0·005	.	.	.	.	15	0·013	1,377	1·24
Aug.	180	594	20	0·025	.	.	.	.	10	0·012	1,380	1·78	63	0·081	.	.	.	.	.	.	9	0·011	.	.	.	.	9	0·011	1,491	1·92
Sept.	387	1,001	111	0·079	.	.	.	.	21	0·015	4,796	3·45	204	0·14	.	.	.	.	.	.	109	0·079	.	.	7	0·005	16	0·011	5,264	3·79
Oct.	484	949	205	0·14	.	.	.	.	8	0·005	3,136	2·18	13	0·009	.	.	.	.	.	.	99	0·069	.	.	.	.	2	0·001	3,463	2·41
Nov.	627	1,669	583	0·25	.	.	.	.	27	0·011	5,088	2·21	277	0·12	.	.	.	.	.	.	241	0·10	.	.	7	0·003	15	0·006	6,238	2·71
Dec.	487	1,701	1,015	0·46	.	.	.	.	28	0·012	6,407	2·92	183	0·08	.	.	.	.	.	.	11	0·005	.	.	.	.	11	0·005	7,655	3·49
Totals,	3,772	10,450	12,099	0·85	211	0·014	5	0·0003	344	0·024	4 ,267	3·32	1,607	0·11	.	.	25	0·001	.	.	1548½	0·1	15	0·001	299½	0·021	100	0·007	63,521	4·46

TABLE G.—*continued.*—BUCKIE DISTRICT.

Months.	Number of Shots.		Cod.		Ling.		Torsk (Tusk).		Saithe (Coalfish).		Haddocks.		Whiting.		Turbot.		Halibut.		Sole (Lemon Sole).		Flounder, Plaice, Brill.		Conger-Eel.		Skate.		Other kinds of White Fish.		Total of Line-caught Fish.	
	Large Boats.	Small Boats.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age
Jan.	393	711	1,465	1·32	274	0·24	.	.	109	0·098	3,287	2·97	55	0·049	.	.	18	0·016	.	.	.	.	8	0·007	185	0·16	265	0·24	5,666	5·13
Feb.	391	594	3,191	3·23	335	0·34	.	.	26	0·026	4,065	4·12	20	0·020	2	0·002	34	0·034	.	.	.	.	8	0·008	146	0·14	534	0·54	8,361	8·48
March	537	327	4,555	5·26	367	0·42	.	.	208	0·24	5,130	5·93	20	0·023	1	0·001	70½	0·081	.	.	.	.	9	0·010	262	0·30	380	0·45	11,002½	12·72
April	309	513	2,458	2·99	363	0·44	.	.	88	0·10	3,660	4·45	.	.	.	.	79	0·096	.	.	4½	0·005	5	0·006	706	0·85	350	0·42	7,713½	9·38
May	.	776	126	0·16	.	.	.	.	43	0·055	1,314	1·56	.	.	.	.	.	.	.	.	.	.	.	.	.	.	85	0·10	1,568	2·02
June	.	638	329	0·51	.	.	.	.	65	0·10	898	1·41	.	.	.	.	1½	0·002	.	.	4	0·006	.	.	.	.	71	0·11	1,368½	2·14
July	.	153	84	0·54	.	.	.	.	16	0·10	284	1·20	.	.	.	.	1	0·006	.	.	.	.	29	0·18	.	.	18	0·11	432	2·82
Aug.	.	229	45	0·19	.	.	.	.	.	.	404	1·76	7	0·030	.	.	1	0·004	.	.	.	.	25	0·10	.	.	50	0·21	532	2·32
Sept.	181	888	425	0·39	.	.	.	.	.	.	3,287	3·07	10	0·009	.	.	.	.	.	.	.	.	.	.	.	.	124	0·11	3,846	3·59
Oct.	369	1,012	365	0·22	.	.	.	.	.	.	4,235	3·06	22	0·015	.	.	1	0·0007	.	.	5	0·003	.	.	.	.	293	0·21	4,921	3·56
Nov.	443	1,385	757	0·41	.	.	.	.	.	.	5,638	3·13	.	.	.	.	.	.	.	.	.	.	.	.	20	0·01	318	0·17	6,733	3·68
Dec.	312	1,194	1,049	0·68	.	.	.	.	44	0·029	3,773	2·5	.	.	.	.	.	.	.	.	2	0·001	23	0·015	78	0·05	338	0·22	5,307	3·52
Totals,	2,935	8,420	14,849	1·3	1,339	0·11	.	.	599	0·053	35,975	3·16	134	0·011	3	0·0002	206	0·018	.	.	15½	0·001	107	0·009	1,397	0·12	2,826	0·24	57,450½	5·05

TABLE G.—*continued.*—BANFF DISTRICT.

Months.	Number of Shots.		Cod.		Ling.		Torsk (Tusk).		Saithe (Coalfish).		Haddock.		Whiting.		Turbot.		Halibut.		Sole (Lemon Sole).		Flounder, Plaice, Brill.		Conger-Eel.		Skate.		Other kinds of White Fish.		Total of Line-caught Fish.	
	Large Boats.	Small Boats.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.
Jan.	223	1,566	705	0·39	49	0·02	.	.	38	0·02	5,031	2·86	382	0·21	.	.	5	0·002	.	.	17	0·009	15	0·008	50	0·02	215	0·12	6,507	3·63
Feb.	215	1,722	502	0·25	39	0·02	.	.	54	0·02	7,966	4·11	246	0·12	.	.	7	0·003	.	.	45	0·02	12	0·006	27	0·01	256	0·13	9,154	4·72
March	241	1,642	603	0·32	37	0·01	.	.	66	0·03	8,091	4·29	460	0·24	.	.	4	0·002	.	.	36	0·01½	5	0·002	43	0·02	295	0·15	9,640	5·11
April	105	1,686	432	0·24	30	0·01	.	.	977	0·51	7,292	4·07	177	0·09	.	.	2	0·001	.	.	20	0·01	6	0·003	34	0·01	218	0·12	9,188	5·13
May	7	843	140	0·16	21	0·02	.	.	1,385	1·62	1,977	2·32	79	0·09	.	.	10	0·01	.	.	11	0·01	6	0·007	23	0·02	122	0·14	3,774	4·44
June	2	568	112	0·19	12	0·02	.	.	204	0·35	1,585	2·78	81	0·14	.	.	.	.	.	.	11	0·01	4	0·007	10	0·01	93	0·16	2,112	3·7
July	.	401	70	0·17	.	.	.	.	161	0·4	882	2·19	97	0·24	.	.	.	.	.	.	9	0·02	.	.	.	.	78	0·19	1,297	3·23
Aug	.	318	61	0·19	9	0·028	.	.	108	0·34	563	1·36	77	0·24	.	.	.	.	.	.	15	0·047	8	0·025	.	.	51	0·16	892	2·8
Sept.	57	2,020	182	0·087	32	0·015	.	.	102	0·049	5,515	2·65	278	0·13	.	.	.	.	.	.	18	0·008	.	.	10	0·004	387	0·18	6,524	3·14
Oct.	134	1,292	143	0·10	13	0·009	.	.	54	0·037	3,319	2·32	235	0·16	.	.	.	.	.	.	42	0·029	.	.	10	0·007	157	0·11	3,973	2·78
Nov.	444	1,923	273	0·11	34	0·014	.	.	69	0·029	6,789	2·86	401	0·16	.	.	.	.	.	.	18	0·007	.	.	10	0.004	213	0·089	7,807	3·29
Dec.	422	1,553	667	0·33	75	0·037	4	0·002	113	0·057	4,209	2·13	228	0·11	.	.	4	0·002	.	.	13	0·006	17	0·008	30	0·015	243	0·12	5,603	2·83
Totals,	1,850	15,534	3,890	0·22	351	0·02	4	0·0002	3,331	0·19	53,219	3·06	2,741	0·15	.	.	32	0·001	.	.	255	0·014	73	0·004	247	0 014	2,328	0·13	66,471	3·82

TABLE E.—TOTAL QUANTITIES OF FISH CAUGHT BY LINE IN 1896 WITHIN THE MORAY FIRTH (INSIDE A LINE BETWEEN DUNCANSBY HEAD AND RATTRAY POINT), AND THE NUMBER OF SHOTS OF THE BOATS BY WHICH THE FISH WERE CAUGHT.

District.	Number of Shots.		Cod.		Ling.		Torsk (Tusk).		Saithe (Coalfish).		Haddock.		Whiting.		Turbot.		Halibut.		Sole (Lemon Sole).		Flounder, Plaice, Brill.		Conger-Eel.		Skate.		Other kinds of White Fish.		Total of Line-caught Fish.	
	Large Boats.	Small Boats.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.	Cwt.	Aver-age.
Wick, .	2,774	3,063	18,850	3·22	1,903	0·32	54	0·009	5,555	0·95	1,325	0·22	10	0·001	9	0·001	386	0·66	2	0·0003	236	0·04	281	0·048	1,610	0·27	1,335	0·22	31,556	5·40
Lybster,	208	1,266	2,625	1·71	9	0·006	.	.	396	0·26	1,010	0·69	.	.	3	0·002	5	0·003	.	.	.	.	35	0·023	.	.	158	0·1	4,241	2·87
Helmsdale.	363	3,535	7,838	2·01	55	0·014	31	0·007	408	0·1	8,700	2·2	337	0·086	.	.	37	0·009	17	0·004	561	0·14	182	0·045	119	0·03	75	0·019	18,360	4·71
Cromarty,	13	6,078	4,512	0·74	.	.	.	.	3	0·0004	9,207	1·51	7	0·001	.	.	.	.	.	.	786	0·12	130	0·021	11	0·001	661	0·1	15,317	2·51
Findhorn,	3,772	10,450	12,099	0·85	211	0·014	5	0·0003	344	0·024	47,267	3·32	1,607	0·11	.	.	25	0·001	.	.	1 548½	0·1	15	0·001	229½	0·021	100	0·007	63,521	4·46
Buckie,	2,935	8,420	14,849	1·3	1,339	0·11	.	.	599	0·053	35,975	3·16	134	0·011	3	0·0002	206	0·018	.	.	15½	0·001	107	0·009	1,397	0·12	2,826	0·24	57,450½	5·05
Banff, .	1,850	15,534	3,890	0·22	351	0·02	4	0·0002	3,331	0·19	53,219	3·06	2.741	0·15	.	.	32	0·001	.	.	255	0·014	73	0·004	247	0·014	2,328	0·13	66,471	3·82
Totals,	11,915	48,346	64,663	1·07	3,868	0·062	94	0·001	10,636	0·17	156,703	2·6	4,836	0·08	15	0·0002	691	0·011	19	0·0003	3,402	0·056	823	0·013	3,683½	0·061	7,483	0·12	256,916½	4·26

II.—THE MARINE FISHES AND INVERTEBRATES OF LOCH FYNE. By Thomas Scott, F.L.S., Mem. Soc. Zool. de France. (Plates I.-III.)

CONTENTS.

Introductory.

In the following catalogue an endeavour has been made to include, as far as possible, the various species of marine fishes and invertebrates that are known to have been obtained in Loch Fyne. But though the records brought together here—the most of which are believed to be authentic,—comprise a large number of fishes, and include representatives of almost every group of the marine invertebrates, the catalogue can only be considered as preliminary to further research. The investigation of the lower forms of life existing in Loch Fyne has already been in some respects very successful, and has yielded interesting results; still, there are several groups of the Invertebrata, such as the Tunicata, the Polyzoa, the smaller Crustacea, the Annelida, the Cœlenterata, and the Porifera, that have only been very partially studied, and it may reasonably be expected that numbers of species belonging to these various groups will yet be discovered in Loch Fyne.

In this catalogue the total number of species enrolled is 837, which includes several not before recorded from the Clyde, and also one Copepod new to Britain, and one new to science.

An appendix at the end of the catalogue of the Loch Fyne fauna contains records and descriptions of several new and rare species that have been observed during the past year in the seaward part of the Clyde area, and which, therefore, could not find a place in the catalogue.

These records include three apparently undescribed species of Cop epoda two Amphipods, and a parasitic Isopod, new to Britain; and a few others that are either new records for the Clyde, or that refer to species that are comparatively rare.

As *Calanus finmarchicus* is a very important constituent of the food of fishes, attention is also directed in the appendix to three different kinds of parasites that have been found more or less infesting the *Calani* in the Firth of Clyde.

The following is a tabular view of the principal groups represented in the catalogue, their principal sub-divisions, and the number of species belonging to each :—

Names of the Principal Groups represented in the Catalogue.	Names of the Principal Sub-divisions.	Number of Species belonging to each of the Principal Sub-divisions	Number of Species belonging to each of the Principal Groups.	Remarks.
Fishes	Teleostei	56	62	
	Ganoidei	1		
	Elasmobranchii	5		
Tunicata	Larvacea	1	9	
	Ascidiacea	8		
Mollusca	Cephalopoda	5	221	
	Pteropoda	1		
	Opisthobranchiata	20		
	Nudibranchiata	18		
	Pulmonata	2		
	Prosobranchiata	84*		* One is doubtful.
	Polyplacophora	5		
	Scaphopoda	2		
	Pelecypoda	84		
Branchiopoda	. . . .	. . .	2	
Crustacea	Brachyura	27	349	
	Macrura	18		
	Schizopoda	18		
	Cumacea	15		
	Isopoda	18		
	Amphipoda	76†		† Two are doubtful.
	Phyllocarida	1		
	Cladocera	3‡		‡ One is doubtful.
	Ostracoda	67		
	Copepoda	99§		§ Includes a new genus and two new species.
	Cirripedia	7		
Polyzoa	Cheilostomata	15	22	
	Cyclostomata	5		
	Ctenostomata	2		
Vermes	Chætopoda	47‖	52	‖ One is doubtful.
	Gephyrea	2		
	Chætognatha	1		
	Nemertea	1		
	Turbellaria	1		
Echinoderma	Crinoidea	1	32	
	Asteroidea	9¶		¶ One is doubtful.
	Ophiuroidea	11**		** Two are doubtful.
	Echinoidea	5		
	Holothurioidea	6		
Actinozoa	Alcyonaria	3	12	
	Actiniaria	9		
Hydrozoa	Hydroida	14	14	
Spongozoa	. . . .	. . .	7	
Foraminifera	Miliolidæ	14	55	
	Astrorhizidæ	1		
	Lituolidæ	5		
	Textulariidæ	3		
	Lagenidæ	18		
	Globigerinidæ	1		
	Rotuliidæ	8		
	Nummulinidæ	5		
Total number of Species			837	

I desire to explain, though it may hardly be necessary to do so, that the information contained in this catalogue is partly at least a compilation from the recorded results of past investigations, and has only to a limited extent been obtained as the result of independent study. The following are the principal sources from whence the information contained in the catalogue has been derived :—

(1) An extensive and valuable series of MS. records from the steam yacht 'Medusa,' which Dr John Murray has kindly placed at my disposal.*
(2) *The Decapod and Schizopod Crustacea of the Clyde*, by Dr (now Professor) J. R. Henderson,
(3) *A Contribution towards a Catalogue of the Amphipoda and Isopoda of the Clyde* (in two parts), by the late Dr Robertson of Millport.
(4) 'A List of the Marine Fauna collected at the Tarbert (Loch Fyne) Laboratory during 1885,' by George Brook and Thomas Scott (published as an Appendix in the *Fourth Annual Report of the Fishery Board for Scotland*).
(5) *The Mollusca of the Firth of Clyde*, by Alfred Brown.
(6) 'Notes on the Copepods of Loch Fyne,' by W. L. Calderwood (published as an Appendix in the *Fourth Annnal Report of the Fishery Board for Scotland*).
(7) The scientific researches in Loch Fyne during the past year of the Fishery steamer 'Garland.' These researches have yielded a considerable number of new records.

The following abbreviations are used in the catalogue :—

(M.) Refers to the MS. Records of the steam yacht 'Medusa,' as the source of information.
(H.) Dr Henderson's *Higher Crustacea of the Clyde.*
(R.) Dr Robertson's *Amphipoda and Isopoda of the Clyde.*
(B. & S.) The List of Tarbert Fauna for 1885.
(G.) Records obtained by means of the Investigations of the 'Garland.'

Other sources of information are, wherever necessary, duly acknowledged.

I have to acknowledge my indebtedness to Captain Campbell of the 'Garland' for his unwearied interest in the work, and for his efforts to render it successful. I have also, as in former years, been greatly indebted to the Rev. T. R. R. Stebbing, F.R.S., for the kindly manner in which he has from time to time endeavoured to assist me with the identification of Crustacean species. Professor G. S. Brady, F.R.S., has also kindly assisted me on various occasions. My son, Mr Andrew Scott, has prepared the series of interesting drawings which illustrate this paper.

FISHES OF LOCH FYNE.

Note.—In this catalogue the names and arrangement in Dr Day's work on the British Fishes are followed.

Teleostei.

Cottus scorpius, Bloch.—Common in Loch Fyne and generally distributed; the large and richly coloured variety, *Grœnlandicus*, is also more

* A very large number of the specimens referred to in these lists were collected by Captain Alexander Turbyne and Mr Fred. G. Pearcey in Dr Murray's steam yacht 'Medusa,' and the species were determined by Dr A. Günther, F.R.S. (Fishes); Professor F. Jeffrey Bell, F.R.S. (Echinodermata); Professor A. C. Haddon, F.R.S. (Actiniaria); Professor Arthur Dendy, F.L.S. (Sponges); E. A. Smith, Esq., F.L.S. (Mollusca and Tunicata); Miss F. Buchanan (Worms); R. I. Pocock, Esq. (Crustacea); and R. Kirkpatrick, Esq. (Hydrozoa and Polyzoa).

or less frequent (B. & S.).—Upper Loch Fyne at Minard, and on east side in 10 to 20 fathoms (M.).

Cottus bubalis, Euph.—Moderately common in Loch Fyne (B. & S.).

Trigla Gurnardus, Linné.—Upper Loch Fyne (M.). In trawl-net near the head of the loch, and in the vicinity of Furnace and Minard (G.).

Trigla lineata, Gmelin.—East Loch Tarbert, Loch Fyne, not common (B. & S.).

Agonus cataphractus, Linné.—East Loch Tarbert, occasionally (B. & S.). Off Castle Lachlan, rare (G.). Ardrishaig (Dr Scouler).

Scomber scomber, Linné.—Abundant during the summer, particularly along the west shore of Loch Fyne (B. & S.).

Zeus faber, Linné.—Usually enters East Loch Tarbert in September to feed on herring offal (B. & S.).

Gobius Ruthensparri, Euph.—Common amongst *Zostera* in East Loch Tarbert (B. & S.). Upper Loch Fyne (M.). Off Ardno, Upper Loch Fyne (G.). Loch Fyne (Dr Scouler).

Gobius minutus, Gmelin.—Frequent in East Loch Tarbert (B. & S.). Upper Loch Fyne at Minard, west and east sides, and centre in 10 to 70 fathoms (M.). Loch Gair, off Ardno, Kinglass Spit, and near the head of the loch (G.).

Gobius niger, Linné. Upper Loch Fyne (M.). Taken by the fishery steamer 'Garland' in various parts of, and at various depths in, Upper Loch Fyne.

Gobius, sp.—West side of Upper Loch Fyne in 10 to 15 fathoms (M.).

Calionymus lyra, Linné.—East Loch Tarbert, frequent but small (B. & S.). Upper Loch Fyne, east side, in 15 fathoms (M.). Loch Gair, Tarbert Bank, and other places (G.).

Cyclopterus lumpus, Linné.—Adult specimens are not common, but the young are moderately frequent (B. & S.). Upper Loch Fyne, in the centre near the head (M.). Otter Spit, one 45 mm. in length (G.).

Liparis vulgaris, Linné.—Taken between tide marks in East Loch Tarbert (B. & S.). Upper Loch Fyne, on the shore (M.).

Liparis Montagui, Donovan.—Taken in East Loch Tarbert between tide marks (B. & S.) (?). Upper Loch Fyne, west side and shore (M.).

Carelophus Ascanii, Walh.—One specimen taken amongst boulders at low water in East Loch Tarbert (B. & S.).

Lumpenus lampretæformis (Walbaum).—Four specimens taken with shrimp-trawl between Dunderave and Carndow (G., April 1896).

Centronotus gunnellus, Linné.—Plentiful between tide-marks East Loch Tarbert (B. & S.). Upper Loch Fyne on the shore (M.). In Inveraray Bay (G.).

Atherina presbyter (Jenyns).—Frequent amongst *Zostera* in East Loch Tarbert in the spring of 1885, but not met with later (B. & S.).

Gasterosteus spinachia, Linné.—Frequent in the in-shore water amongst sea-weed and *zostera;* East Loch Tarbert and other places (B. & S.). Upper Loch Fyne, not uncommon among the contents of the shrimp-trawl (G.).

Labrus maculatus, Blainville.—Frequent in Loch Fyne in the autumn (B. & S.).

Labrus mixtus, Frees and Eks.—Occasionally in Loch Fyne, at the mouth of East Loch Tarbert (B. & S.).

Ctenolabrus rupestris, Linné.—Common, especially near Skate Island, Loch Fyne (B. & S.).

Centrolabrus exoletus, Linné.—Taken occasionally in Loch Fyne (B. & S.).

Gadus morhua, Linné.—Not very abundant in Loch Fyne (B. & S.). Upper Loch Fyne, east side, in 10 to 20 fathoms (M.). In Loch Gair, off Ardno, Kinglass Spit, and off Carndow (G.).

Gadus æglefinus, Linné.—Not abundant in Loch Fyne (B. & S.). Upper Loch Fyne, in the centre, in 65 to 70 fathoms (M.). Between Penmore and Inveraray (G.).

Gadus luscus, Linné.—Occasionally in Tarbert Harbour (B. & S.). Tarbert Bank, Lower Loch Fyne; and between Dunderave and Carndow, Upper Loch Fyne (G.).

Gadus minutus, Linné.—Frequent in Tarbert Harbour (B. & S.). Upper Loch Fyne, in the centre, near the head (M.). Off Lowburn, Upper Loch Fyne (G.). Tarbert, Loch Fyne (Dr Scouler).

Gadus merlangus, Linné.—Not abundant in Loch Fyne (B. & S.). Upper Loch Fyne, in the centre (M.). Two nearly ripe males were taken in the trawl-net in May 1896 (G.).

Gadus virens, Linné.—Abundant, but mostly immature; these immature forms—termed 'podlies'—frequent the shallow in-shore water, especially in the neighbourhood of wharfs or piers.

Gadus pollachius, Linné.—This species is also of more or less frequent occurrence, but is usually of small size; large specimens are, however, occasionally brought to East Tarbert.

Molva vulgaris, Fleming.—Frequently brought into Tarbert by the fishermen (B. & S.). A ripe male, 38 inches in length, was taken by trawl-net near the head of Loch Fyne in May 1896 (G.).

Merluccius vulgaris, Cuvier.—Upper Loch Fyne, in the centre, in 34 to 36 fathoms (M.). In the vicinity of Furnace, and between Dunderave and Carndow, taken with the beam-trawl (G.).

Motella mustela, Linné.—Taken between tide-marks in East Loch Tarbert, not common (B. & S.).

Raniceps trifurcatus, Yarrell.—Loch Fyne (Dr Scouler, in *Trans. of Nat. Hist. Soc. of Glasgow*, vol. i., p. 8).

Ammodytes lanceolatus, Lesauvage.—Occasionally in the neighbourhood of East Loch Tarbert (B. & S.).

Hippoglossus vulgaris (Fleming).—Occasionally taken in Loch Fyne (B. & S.).

Hippoglossoides limandoides (Bloch).—Upper Loch Fyne, east side and centre, in 10 to 70 fathoms (M.). Tarbert Bank, Lower Loch Fyne; off Minard; off Castle Lachlan; Inveraray Bay; and between Dunderave and Lowburn, Upper Loch Fyne (G.). A common and widely-distributed species.

Rhombus maximus (Linné).—Occasionally taken in Loch Fyne (B. & S.).

Zeugopterus unimaculatus (Risso).—A few specimens of this interesting species were taken near Barmore (B. & S.).

Zeugopterus punctatus (Bloch).—Upper Loch Fyne, west side, in 10 to 25 fathoms (M.).

Pleuronectes platessa (Linné).—More or less common in Loch Fyne where the conditions are suitable. Upper Loch Fyne, on west and east sides and centre, in 10 to 36 fathoms (M.). A number of large plaice, measuring from 14 to 18 inches in length, and most of which were either spawning or spent, were captured in the trawl-net near the head of Loch Fyne in May 1896 (G.).

Pleuronectes microcephalus, Donovan.—Frequent in suitable localities (B. & S.). On May 6, 1896, a scarcely ripe female, 13 inches in length, was taken near the head of the loch; two nearly ripe specimens—one a male 13 inches in length, the other a female 17 inches in length—were captured at Kinglass Spit; and another, 11 inches, was taken off Ardno. On the 7th, several other specimens were trawled on Tarbert Bank, Lower Loch Fyne (G.).

Pleuronectes cynoglossus (Linné).—Upper Loch Fyne, at west side and centre, in 15 to 36 fathoms (M.). Moderately common in deep water, from off Inveraray to the head of the loch (G.).

Pleuronectes limanda, Linné (=(?) *Hippoglossoides platessoides*).—Barmore Bay, Lower Loch Fyne (B. & S.). Upper Loch Fyne, west and east sides and centre, in 10 to 70 fathoms (M.). Lowburn to Dunderave, off Inveraray, Kinglass Spit, off Castle Lachlan, off Minard, Ardrishaig Bay, Tarbert Bank. Common all over the Loch (G.).

Pleuronectes flesus, Linné.—Common in Tarbert Harbour (B. & S.). Occasionally in Upper Loch Fyne. One specimen, a scarcely ripe male, was taken near the head of the loch in May 1896, and another off Largymore (G.).

Solea vulgaris, Quensel.—Small specimens have been captured in Barmore Bay (B. & S.).

Salmo salar, Linné.—Taken occasionally in herring-nets between Tarbert and Barmore (B. & S.).

Salmo trutta, Linné.—Regularly taken in small quantities just outside East Loch Tarbert (B. & S.).

Clupea harengus, Linné.—The herring usually enters Loch Fyne in May, and the fishing usually continues till November (B. & S.).

Anguilla vulgaris, Turton.—The common eel affords a small but regular fishery in Tarbert Harbour (B. & S.). One specimen was taken in the shrimp trawl-net in Inveraray Bay in May 1896 (G.).

Conger vulgaris, Cuvier.—Frequent in Loch Fyne, but small (B. & S.).

Siphonostoma typhle (Linné).—Captured in East Loch Tarbert amongst *zostera* (B. & S.).

Syngnathus acus, Linné.—Generally distributed throughout the loch, especially inshore, where the water is shallow.

Nerophis æquoreus (Linné).—East Loch Tarbert, amongst *Zostera* (B. & S.).

Nerophis lumbriciformis (Willughby).—In East Loch Tarbert, amongst *zostera*, with the previous species (B. & S.).

Ganoidei.

Acipenser sturio, Linné.—Fine specimens are often noticed during the herring fishery, but are seldom captured (B. & S.).

Elasmobranchii.

Pristiurus melanostomus (Bonaparte).—Occasionally brought in amongst the *Acanthii* in the winter fishing (B. & S.). Upper Loch Fyne, east side, in 10 to 20 fathoms (M.).

Acanthius vulgaris, Risso.—Frequent during the herring fishing. They are occasionally the cause of serious injury to the herring-nets. Upper Loch Fyne, east side, in 10 to 20 fathoms (M.).

Raia clavata, Linné.—Frequent during the winter fishing (B. & S.). Occasionally in Upper Loch Fyne (G.).

Raia maculata, Montagu.—Upper Loch Fyne, east side, in 10 to 20 fathoms (M.).

Raia circularis, Couch.—Between Loch Gair and Largymore. Taken with the beam-trawl (G.).

TUNICATA OF LOCH FYNE.

Comparatively little appears to have yet been done towards the investigation of the Loch Fyne Tunicates. This group is a somewhat difficult one to study; and in the discrimination of many of the species, and especially of the *Botrylledæ*, it is all but absolutely necessary that living specimens should be available. Nine species are here recorded, and, with one exception, these records are all obtained from the MS. notes of the steam yacht 'Medusa.' The number of species will doubtless be considerably increased when the Tunicata come to be more thoroughly worked up.

Larvacea.

Oikopleura (?) *flabellum*, J. Müller.—Lower Loch Fyne in surface tow-net; Upper Loch Fyne, near Minard, in bottom tow-net (G.).

Ascidiacea.

Botrylloides, sp.—Upper Loch Fyne, west side, in about 15 fathoms.

Ciona intestinales, Linné.—Upper Loch Fyne, in the centre, in 60 to 65 fathoms (M.).

Ascidiella virginea, O. F. Müller.—Upper Loch Fyne, at Minard Narrows; on both sides and centre, in 10 to 70 fathoms; and also on the shore (M.).

Ascidiella scabra, O. F. Müller.—Upper Loch Fyne, at Minard Narrows, and on the east side and centre, in 12 to 65 fathoms (M.).

Ascidia mentula, O. F. Müller.—Upper Loch Fyne, at Minard; and on both sides and centre, in about 10 fathoms (M.). Tarbert Bank, Lower Loch Fyne; and in East Loch Tarbert, frequent and large (Mihi).

Corella parallelogramma, O. F. Müller.—In the centre of Upper Loch Fyne, in 60 to 65 fathoms (M.).

Styelopsis grossularia (Van Beneden).—At Minard Narrows, Upper Loch Fyne, on the east side, and in the centre, in 10 to 36 fathoms; and also on the shore (M.).

Polycarpa rustica, Linné.—At Minard Narrows, Upper Loch Fyne, west and east sides and centre, in 10 to 70 fathoms (M.).

MOLLUSCA OF LOCH FYNE.

Note.—The arrangement and nomenclature of Part IV. of the Rev. A. M. Norman's Catalogues (Museum Normanianum) are followed for the Mollusca. The *Revision of British Mollusca*, by the same author, as far as, and inclusive of, Order III. (Nudibranchiata),* has also been consulted; also the *Mollusca of the Firth of Clyde*, by Alfred Brown.

Cephalopoda.

Octopus vulgaris, Lamk.—In herring-net in the summer, Laggan Bay (B. & S.).

Scæurgus cirrhosa (Lamk.). Taken in herring-net in Laggan Bay, in December; young specimen (B. & S.); east side of Upper Loch Fyne, 30 fathoms (M.).

* *Revision of British Mollusca, Ann. and Mag. Nat. Hist.*, sixth series, vol. v. pp. 452–484, and vol. vi. pp. 60–91 (1890).

Sepiola Rondeletii, Leach.—Laggan Bay; eggs frequent, attached to Ascidians and other objects (B. & S.); west and east sides of Upper Loch Fyne, 10 to 30 fathoms (M.).

Rossia macrosoma (D. Ch.).—Laggan Bay (B. & S.). Mid-channel, near the head of Upper Loch Fyne (M.).

Rossia Oweni, Ball.—Off Minard, and at east side of Upper Loch Fyne, 10 to 30 fathoms (M.). Dr Jeffreys says that Steenstrup considers *R. Oweni* of Ball to be the male of *R. macrosoma.**

PTEROPODA.

Limacina retroversa (Flem.). Occasionally taken with the tow-net in Loch Fyne.

OPISTHOBRANCHIATA.

Actæon tornatilis (Linné).—Laggan Bay, Loch Fyne (B. & S.). Ardrishaig, dead specimens (Alf. Brown). Upper Loch Fyne, at Minard Narrows, in 12 fathoms (M.). Variety, *bullæformis*, Jeffreys, in Loch Fyne, in 40 to 50 fathoms, muddy bottom (M'Nab; see *Jeffreys' Brit. Conch.*, vol. iv., p. 435).

Tornatina obtusa (Montagu).—Off Silvercraigs, Loch Fyne (Alf. Brown). Loch Fyne (Robertson).

Tornatina mamillata (Philippi).—Off Silvercraigs, Loch Fyne; scarce in the living state; dead shells not uncommon (Alf. Brown).

Tornatina truncatula (Bruguiere). East Loch Tarbert (B. & S.). Off Silvercraigs (Alf. Brown).

Tornatina umbilicata (Montagu). In Upper Loch Fyne, at Minard Narrows, and on the west side and centre in 15 to 70 fathoms. Var. *strigella*, Lovén, has been taken on the east side in 20 fathoms (M.).

Tornatina nitidula, Lovén.—Loch Fyne (Mr Barlee and Dr J. G. Jeffreys). East side of Upper Loch Fyne, in 15 fathoms (M.).

Volvula acuminata (Bruguiere).—Loch Fyne (Barlee, Alder, J. G. Jeffreys, Robertson).

Cylichna cylindracea (Pennant).—Tarbert Bank (Mihi). In Upper Loch Fyne at Minard Narrows, and at both sides and centre in 10 to 70 fathoms (M.). Loch Fyne (Jeffreys; var., *linearis*).

Diaphana hyalina (Turton).—East Loch Tarbert (B. & S.). Moll Dhu and Silvercraigs, Loch Fyne (Alf. Brown).

Scaphander lignarius (Linné). Furlong Bay, and off Moll Dhu Point in 15 fathoms (B. & S.). Off Silvercraigs and Otter Spit, Loch Fyne (Alf. Brown). In Upper Loch Fyne, on both sides, in 10 to 15 fathoms (M.).

* *British Conchology*, vol. v. p. 134. See also the *Revision of British Mollusca*, already referred to.

Bulla utriculus, Brocchi.—Tarbert Bank, Loch Fyne (Mihi). Dr Jeffreys dredged a single specimen of the variety *oblonga* in Loch Fyne, (*Brit. Conch.*, vol. iv. 441).

Haminea hydatis (Linné).—Has hitherto been found only in the deep water of Upper Loch Fyne (M.).

Acera bullata, Müller.—East Loch Tarbert—living (Mihi).

Philine scabra (Müller).—Tarbert Bank, Loch Fyne—living (Mihi). In Upper Loch Fyne, both sides, in 10 to 20 fathoms (M.).

Philine catena (Montagu).—In the centre of Upper Loch Fyne, in 35 fathoms (M.).

Philine punctata (Clark).—Found in deep water (70 fathoms), Upper Loch Fyne (M.).

Philine pruinosa (Clark).—Loch Fyne (Barlee).

Aplysia punctata, Cuvier.—White Shore, E. Loch Tarbert, rare (B. & S.).

Pleurobranchus plumula (Montagu).—Between tide-marks and dredged, East Loch Tarbert (B. & S.).

Runcina coronata (Quatrefages) (=*R. Hancocki*, Forbes).—Shallow water amongst weed in East Loch Tarbert, rare (Mihi).

NUDIBRANCHIATA.

Doris tuberculata, Cuvier.—Frequent in East Loch Tarbert (B. & S.). Shore, Upper Loch Fyne (M.).

Doris repanda, Alder and Hancock.—East Loch Tarbert, rare (B. & S.). This species is readily distinguished by its white colour, and by the row of spots along each side.

Doris Johnstoni, Alder and Hancock.—East Loch Tarbert—frequent (B. & S.). Shore, Upper Loch Fyne (M.).

Acanthodoris pilosa (Müller).—Occasionally in East Loch Tarbert (B. & S.).

Goniodoris nodosa (Montagu). East Loch Tarbert, between tide-marks (B. & S.).

Triopa clavigera (Müller).—Between tide-marks, East Loch Tarbert; not common (B. & S.).

**Polycera quadrilineata* (Müller).—East Loch Tarbert (B. & S.). Both the ordinary form and a dark-coloured variety were occasionally obtained.

Ægirus punctilucens (D'Orbigny).—Obtained occasionally on the under-side of stones in East Loch Tarbert (B. & S.).

**Polycera ocellata*, Alder and Hancock, has also been obtained in East Loch Tarbert.

Tritonia Hombergi, Cuvier.—Obtained in the vicinity of Minard, Upper Loch Fyne, in 11 to 25 fathoms (M.).

Dendronotus frondosus (Ascanius) [= *D. arborescens* (Müller)].—Frequent in Loch Fyne in 10 to 20 fathoms (B. & S.).

Eolis papillosa (Linné).—Frequent between tide-marks in East Loch Tarbert (B. & S.).

Galvina picta, Alder and Hancock (= *Eolis picta*), Alder and Hancock.—Obtained in East Loch Tarbert; rare.

Galvina Farrani, Alder and Hancock (= *Eolis farrani*), Alder and Hancock).—Rare in East Loch Tarbert (B. & S.). One specimen, of a rich orange colour.

Favorinus albus, Alder and Hancock (= *Eolis alba*), Alder and Hancock.—Frequent amongst *Zostera* in East Loch Tarbert (B. & S.).

Facelina Drummondii (W. Thompson) (= *Eolis Drummondii*, W. Thompson).—Moderately common amongst *zostera* in East Loch Tarbert (B. & S.). On the shore between tide-marks, Upper Loch Fyne (M.).

Hermæa bifida (Montagu).—East Loch Tarbert; rare (B. & S.).

Alderia modesta (Lovén).—Amongst *Zostera* near the head of East Loch Tarbert (Mihi).

Elysia viridis (Montagu).—Common amongst *Zostera* in East Loch Tarbert. Colour variable from pale green to brown (B. & S.).

Pulmonata.

Alexia bidentata (Montagu).—Common under stones between tide-marks, East Loch Tarbert, especially round towards Garvald Point (B. & S.).

Oncidium celticum, Cuvier.—Shore, Upper Loch Fyne (M.). Only two British localities are mentioned by Dr Jeffreys for this species—viz., Lantivet Bay, Cornwall; and Whitsand Bay, near Plymouth.

Prosobranchiata.

Clathurella linearis (Montagu).—Off Battle Island, Loch Fyne, and in East Loch Tarbert; dead shells occasionally containing small hermit crabs (B. & S.).

Clathurella purpurea (Montagu).—West side of Upper Loch Fyne, 10 to 20 fathoms (M.).

Clathurella reticulata (Renier).—West side of Upper Loch Fyne, 12 to 15 fathoms (M.).

Clathurella teres (Forbes).—In the vicinity of Minard, Upper Loch Fyne, 12 to 15 fathoms (M.). East Loch Tarbert (Mihi).

Mangelia attenuata (Montagu).—In the vicinity of Minard, in 15 to 20 fathoms (M.).

Mangelia lævigata (Philippi).—In the same locality as the last (M.).

Bela turricolla (Montagu).—East Loch Tarbert (living); off Battle Island, dead (B. & S.); Upper Loch Fyne, in the vicinity of Minard, on both east and west sides and in the centre, in 11 to 70 fathoms (M.).

Bela Trevellyana (Turton).—Upper Loch Fyne, in 11 to 20 fathoms (M.).

Neptunea antiqua (Linné).—Taken in the vicinity of Minard; on the east and west sides and centre, and near the head of the loch, in 10 to 70 fathoms, and between tide-marks (M.). East Loch Tarbert, living (Mihi).

Sipho gracilis (Da Costa).—Loch Fyne (B. & S.). Vicinity of Minard; on the east and west sides and centre; and near the head of the loch in 10 to 70 fathoms (M.).

Buccinum undatum, Linné.—East Loch Tarbert (B. & S.). At various places from the vicinity of Minard to near the head of the loch, and from between tide-marks down to 70 fathoms (M.). In deep water, Upper Loch Fyne (G.).

Nassa incrassata (Ström).—East Loch Tarbert (B. & S.). Minard, in 12 to 20 fathoms, and between tide-marks (M.).

Nassa reticulata (Linné).—East Loch Tarbert (B. & S.). Minard, in 12 to 20 fathoms, and between tide-marks (M.).

Nassa pygmæa (Lamarck).—In the vicinity of Minard, in 11 to 20 fathoms (M.).

Trophon truncatus (Ström).—Tarbert Bank, Loch Fyne; not very rare in suitable localities.

Trophon muricatus (Montagu).—In Upper Loch Fyne, in 12 to 25 fathoms (M.). Tarbert Bank, Loch Fyne (Mihi). Alfred Brown does not include this species in his work on the *Mollusca of the Clyde*, probably because *Trophon clathratus* may sometimes have been mistaken for it. I have both species in my collection, and when they are placed side by side the difference between them is quite apparent. There can be no doubt that the specimen from Tarbert Bank is *Trophon muricatus.*

Purpura lapillus (Linné).—Commonly distributed, especially in shallow water. Vicinity of Minard, in 12 to 20 fathoms (M.).

Trivia europæa (Montagu).—On rocks at extreme low water in Loch Fyne, also in East Loch Tarbert, living (B. & S.). West side, Upper Loch Fyne, in 10 to 25 fathoms, and also on the shore (M.).

Aporrhaïs pes-pelicani (Linné).—Furlong Bay; off Battle Island, &c. (B. & S.). Minard; west and east side and centre; and near the head of the loch, in 10 to 70 fathoms (M.).

Triforis perversa, Linné.—Tarbert Bank, Loch Fyne, dead shell (Mihi).

Cerithiopsis tubercularis (Montagu).—East Loch Tarbert (B. & S.). Living shells not very common.

Trichotropis borealis, Broderip and Sowerby.—Furlong Bay, Loch Fyne (B. & S.). Minard, west side and centre, in 11 to 35 fathoms (M.).

Turritella terebra (Linné).—East Loch Tarbert, dead shells (B. & S.). Minard, west and east sides, in 10 to 30 fathoms (M.).

Cæcum glabrum (Montagu).—Loch Fyne and East Loch Tarbert; not common (B. & S.).

Littorina littorea (Linné).—Common, especially between tide-marks (B. & S.). On west and east sides of Upper Loch Fyne, 10 to 25 fathoms, and on the shore (M.).

Littorina rudis (Maton).—Common between tide-marks (B. & S.).

Littorina obtusata (Linné).—Common between tide-marks. The variety *ornata*, Jeffreys, is also occasionally obtained; specimens of the variety were collected at 'White Shore,' East Loch Tarbert (B. & S.). West and east sides and centre, and near the head of Upper Loch Fyne, in 10 to 20 fathoms; and also on the shore (M.).

Lacuna pallidula (Da Costa).—Taken on *Laminaria* in Loch Fyne, in shallow bays in the vicinity of East Loch Tarbert (B. & S.). The variety *albescens*, Jeffreys, was also occasionally obtained (B. & S.).

Lacuna divaricata (Fabricius).—Off Battle Island, Loch Fyne, and East Loch Tarbert. The variety *canalis* (Montagu) was obtained in East Loch Tarbert (B. & S.). West and east sides and centre of Upper Loch Fyne, and near the head of the loch, in 10 to 20 fathoms (M.).

Skenea planorbis (Fabricius).—Common; Loch Fyne and East Loch Tarbert (B. & S.).

Homologyra atomus (Philippi).—East Loch Tarbert; not very common (B. & S.).

Zippora membranacea (Adams).—Common amongst *Zostera* in East Loch Tarbert (B. & S.). The specimens were usually thin, and without, or with nearly obsolete, ribs; they are probably the variety *elata* of Philippi.

Rissoa parva (Da Costa).—Loch Fyne and East Loch Tarbert, amongst weed in shallow water.

Rissoa violacea, Desmarets.—East Loch Tarbert, between tide-marks, and dredged (B. & S.). Off Silvercraigs, Loch Fyne (Alf. Brown). Head of Upper Loch Fyne (G.).

Alvania cancellata (Da Costa).—Loch Fyne (Jeffreys and Barlee).

Alvania reticulata (Montagu).—Off Battle Island, Loch Fyne (B. & S.). In the vicinity of Minard, in 12 to 15 fathoms (M.). Off Silvercraigs, Loch Fyne (Alf. Brown).

Alvania abyssicola, Forbes.—Loch Fyne, amongst mud, in 50 to 100 fathoms (M'Andrew and Forbes, A. M. Norman, and others).

Alvania carinata (Da Costa) [= *Rissoa striatula* (Montagu)].—'I obtained a single dead specimen and some fragments off Silvercraigs, Loch Fyne, in about 12 fathoms nullipore and sand' (Alf. Brown, in *Mollusca of the Firth of Clyde*, p. 62).

Flemingia zetlandica (Montagu).—Tarbert Bank, Loch Fyne (Mihi). In 20 fathoms, off Silvercraigs, Loch Fyne (Alf. Brown).

Cingula trifasciata (Adams) [= *Rissoa cinguillus* (Montagu)].—Common in Loch Fyne and East Loch Tarbert (B. & S.).

Onoba striata (Adams).—Common between tide-marks and in shallow water, especially where there is a weedy bottom, Loch Fyne and East Loch Tarbert (B. & S.).

Hydrobia stagnalis (Bast.) [= *H. ulvæ* (Penn.)].—At the head of Upper Loch Fyne (G.).

Capulus hungaricus (Linné).—Furlong Bay in 15 fathoms (B. & S.). Vicinity of Minard, west and east sides, in 10 to 25 fathoms (M.).

Velutina lævigata (Pennant).—East Loch Tarbert (B. & S.). In Upper Loch Fyne, at Minard, on both the west and east sides, in the centre, and near the head of the loch, in 10 to 70 fathoms (M.). Off Moll Dhu and Silvercraigs (Alf. Brown).

Velutella flexilis (Montagu) [= *Velutina plicatilis* (Müller)].—'One specimen in Loch Fyne, on stony ground, in 25 fathoms' (Forbes and M'Andrew; see *Mollusca of the Firth of Clyde*, by Alf. Brown, p. 83).

Lamellaria perspicua (Linné).—East Loch Tarbert, on stones between tide-marks, frequent (B. & S.). Off Silvercraigs (Alf. Brown).

Lunatia (Natica) sordida (Philippi).—Taken in the vicinity of Minard in 15 to 20 fathoms (M.).

Lunatia pulchella (Risso) [= *Natica Alderi*, Forbes].—East Loch Tarbert and off Battle Island, Loch Fyne (B. & S.). In the vicinity of Minard, west and east sides and centre, and also near the head of Upper Loch Fyne, in 5 to 30 fathoms (M.).

Adeorbis subcarinatus (Montagu).—A few dead specimens were obtained in the coralline zone off Silvercraigs, Loch Fyne, by Alfred Brown (*Mollusca of the Firth of Clyde*, p. 82).

Aclis supranitida (S. Wood).—Tarbert Bank, Loch Fyne; rare (Mihi).

Eulima polita (Linné).—West and east sides and centre of Upper Loch Fyne, in 10 to 65 fathoms (M.). Off Moll Dhu and Silvercraigs (Alf. Brown).

Eulima intermedia, Cantraine; var. *rubro-tincta* (Jeff.).—Loch Fyne (Jeffreys, see *Brit. Conch.*, vol. iv. p. 204).

Eulima incurva (Ren.) [= *Eulima distorta* (Deshayes)]. East Loch Tarbert (B. & S.). West and east sides and centre of Upper Loch Fyne, in 10 to 35 fathoms (M.).

Eulima bilineata, Alder.—West side of Upper Loch Fyne, in 10 to 15 fathoms (M.). Off Silvercraigs, one living, and a few dead specimens (Alf. Brown).

Turbonilla rufa (Philippi).—Taken alive off the pier at Ardrishaig in 5 fathoms, where it is rather common (Alf. Brown).

Parthenia interstincta (Montagu).—Tarbert Bank, Loch Fyne (Mihi).

Parthenia rufescens (Forbes).—Off Silvercraigs, Loch Fyne, dead shells only (Alf. Brown as *Odostomia scalaris*; variety, *rufescens*). Upper Loch Fyne, in 12 to 25 fathoms (M.). Dr Jeffreys in *British Conchology*, vol. iv. p. 161, and Alfred Brown in the *Mollusca of the Firth of Clyde*, p. 77, consider *Parthenia* (*Odostomia*) *rufescens* to be only a variety of *Parthenia* (*Odostomia*) *scalaris* (Philippi).

Parthenia spiralis (Montagu).—Loch Fyne and East Loch Tarbert; not uncommon (B. & S.).

Odostomia conspicua, Alder.—Loch Fyne (M'Nab; see Jeffreys' *Brit. Conch.*, vol. iv. p. 133).

Odostomia unidentata (Montagu).—Loch Fyne and East Loch Tarbert (B. & S.).

Odostomia acuta, Jeffreys.—Loch Fyne (Barlee).

Odostomia pallida (Montagu).—Off Moll Dhu and Silvercraigs, Loch Fyne (Alf. Brown). Usually found on the shells of living *Pecten opercularis*, and sometimes on *Pecten maximus*.

Odostomia umbilicaris (Malm).—Loch Fyne (Barlee, see Jeffreys' *op. cit.*, vol. iv. p. 130).

Auriculina (*Odostomia*) *obliqua* (Alder).—Tarbert Loch Fyne.

Auriculina insculpta (Montagu).—Off Silvercraigs, Loch Fyne, living shells (Alf. Brown).

Eulimella (*Odostomia*) *Scillæ* (Leacchi).—Off Silvercraigs, Loch Fyne, in sand and nullipore (Alf. Brown).

Eulimella acicula (Philippi).—Tarbert, Loch Fyne (Robertson; see Brown's *Mollusca of the Firth of Clyde*, p. 78).

[*Molleria costulata* (Möller).—A single specimen, dead but perfect, off Silvercraigs, Loch Fyne, in 12 fathoms nullipore (Alf. Brown). Probably a post-tertiary fossil, as suggested by Mr Brown.]

Cyclostrema nitens (Philippi).—Off Silvercraigs, Loch Fyne, living (Alf. Brown).

Zizyphinus zizyphinus (Linné).—Laggan Bay and other localities in Loch Fyne (B. & S.). Off Moll Dhu, Loch Fyne (Alf. Brown).

Zizyphinus millegranus (Philippi).—Off Battle Island (B. & S.). Fairly abundant at Minard Narrows, Upper Loch Fyne, and along the sides of the loch, in 10 to 25 fathoms (M.). Fine specimens obtained off Silvercraigs, where the species is plentiful (Alf. Brown).

Zizyphinus Montagui (W. Wood).—Off Otter, Loch Fyne ; a few dead specimens (Alf. Brown).

Gibbula magus (Linné).—White Shore, East Loch Tarbert and Loch Fyne (B. & S.). Has been found in Upper Loch Fyne in 10 fathoms (M.).

Gibbula umbilicata (Montagu).—Common near low-water mark East Loch Tarbert (B. & S.). Taken in Upper Loch Fyne, near the head, in shallow water (M.).

Gibbula cineraria (Linné).—Common in East Loch Tarbert (B. & S.). Vicinity of Minard, west and east sides and centre, and near the head of Upper Loch Fyne, in 5 to 70 fathoms (M.).

Gibula tumida (Montagu).—East Loch Tarbert (B. & S.). Vicinity of Minard, west and east sides and centre of Upper Loch Fyne, in 10 to 20 fathoms (M.). Off Silvercraigs (Alf. Brown).

Margarita helicina (Fabricius).—East Loch Tarbert (B. & S.). This species was not uncommon at extreme low-water on the fronds of *Laminaria* and on boulders, both in East Loch Tarbert and in the neighbouring bays in Loch Fyne.

Emarginula crassa, J. Sowerby.—Off Battle Island, dead shells (B. & S.). Upper Loch Fyne at Minard Narrows, and on both sides, in depths of 10 to 20 fathoms (M.).

Emarginula fissura (Linné).—Off Battle Island, and in other localities ; dead shells (B. & S.). Upper Loch Fyne at Minard Narrows, and on both sides and in the centre of the loch, as well as on the shore (M.).

Puncturella noachina (Linné).—Laggan Bay (B. & S.). In Upper Loch Fyne at Minard Narrows, and on both sides, in 10 to 30 fathoms (M.).

Acmæa testudinalis (Müller). — White Shore, East Loch Tarbert (B. & S.). In Upper Loch Fyne, on the shore (M.).

Pilidium fulvum (Müller).—Tarbert Bank, Loch Fyne (Mihi). Off Moll Dhu and Silvercraigs (Alf. Brown).

Helcion pellucidum (Linné).—White Shore, East Loch Tarbert ; var. *lævis* (B. & S.).

Patella vulgata, Linné.—Common throughout the district on stones between tide-marks.

POLYPLACOPHORA.

Chiton fascicularis, Linné.—East Loch Tarbert ; rare (B. & S.).

Chiton cinereus, Linné.—In Upper Loch Fyne at Minard Narrows, in 15 to 20 fathoms (M.).

Chiton marginatus, Pennant.—White Shore, East Loch Tarbert (B. & S.). In Upper Loch Fyne at Minard Narrows, on the west and east sides and centre, in 10 to 36 fathoms, and on the shore (M.).

Chiton ruber, Linné.—Under stones between tide-marks (B. & S.). In Upper Loch Fyne at Minard Narrows, on both sides, in 10 to 20 fathoms, and on the shore (M.). Off Moll Dhu (Alf. Brown).

Chiton marmoreus, Fabricius.—East Loch Tarbert (B. & S.). Has been found abundantly in Achagoil Bay, in Upper Loch Fyne (M.).

Scaphopoda.

Dentalium entalis, Linné.—Common off Barmore and in other localities (B. & S.). In Upper Loch Fyne at Minard Narrows, and on both sides and centre, in 10 to 70 fathoms (M.).

**Siphonodentalium* (*Pulsellum*) *lofotense*. M. Sars.—Lower Loch Fyne (Robertson, in *Trans. Nat. Hist. Soc. Glasgow*, vol. ii., N.S., p. 151).

Pelecypoda.

Tetrabranchia.

Anomia ephippium, Linné,—Common in the Loch Tarbert district (B. & S.). In Upper Loch Fyne at Minard Narrows, and on both sides and centre, in 10 to 65 fathoms—the variety *striata* at Minard and on the east side, in 12 to 20 fathoms (M.).

Anomia patelliformis, Linné.—In Upper Loch Fyne at Minard Narrows, and on the east side in 10 to 20 fathoms (M.).

Ostrea edulis, Linné.—Generally distributed in the Tarbert district, but small and scarce, the variety *deformis*, Jeff., between tide-marks East Loch Tarbert (B. & S.). Upper Loch Fyne, between tide-marks, both the ordinary form and the variety *parasitica*, Turt. (M.). Loch Fyne near Tarbert (Alf. Brown).

Lima hians (Gmelin).—Off Battle Island, in 40 fathoms (B. & S.). In Upper Loch Fyne, near the shore on both sides, in about 15 fathoms (M.).

Lima subauriculata (Montagu).—Off Battle Island in 40 fathoms—dead shells (B. & S.). Off Silvercraigs, Loch Fyne; common in 10 fathoms in muddy sand and shells (Alf. Brown).

Lima Loscombi, G. B. Sowerby.—Rather rare in Upper Loch Fyne, in 10 to 15 fathoms on the west side (M.).

Pecten maximus (Linné).—Off Skate Island in 14 fathoms, and in other localities, but not very plentiful (B. & S.). Living specimens have been taken in Upper Loch Fyne (M.). Off Moll Dhu and Silvercraigs, Loch Fyne (Alf. Brown). Adult living specimens have been taken in East Loch Tarbert (Mihi).

Pecten varius, Linné.—East Loch Tarbert (B. & S.). Found abund-

* Dr Robertson (*op. cit.*, p. 152) also records the discovery of *Siphonodentalium* (*Pulsellum*) *affine*, M. Sars, 'off Skate Island at the mouth of Loch Fyne, in 90 to 100 fathoms.'

antly at extreme low water in Upper Loch Fyne (M.). In 10 fathoms, off Silvercraigs, in stony and shelly ground—young live specimens only (Alf. Brown).

Pecten tigrinus, O. F. Müller.—Not uncommon off Battle Island in 40 fathoms, both the typical form and the variety *costatus*, Jeff. (B. & S.). In Upper Loch Fyne at Minard Narrows, and at both sides, in 10 to 30 fathoms (M.).

Pecten striatus, O. F. Müller.—Furlong Bay and Moll Dhu Point, not common (B. & S.). Upper Loch Fyne at Minard Narrows, at both sides and in the centre, and also near the head of the loch, in 10 to 30 fathoms (M.).

Pecten pusio (Linné).—A few off Skate Island in 14 fathoms, and in East Loch Tarbert (B. & S.). Upper Loch Fyne at Minard Narrows, and on the east side in 10 to 25 fathoms, as well as also between tide marks (M.).

Pecten pes-lutræ (Linné), (= *Pecten septemradiatus*, Müller).—Common in Upper Loch Fyne in the deepest water, where also the largest specimens are found. Very large and fine specimens were taken below Strachur—much finer than towards the head of the loch—the specimens procured towards the head of the loch in about 10 fathoms, and at Minard Narrows, being smaller than those from the deep water. All the specimens taken in a haul off Skate Island in 104 fathoms were dead. In deep water the shells are always associated with much manganese (M.). Plentiful in deep water off Skate Island (B. & S.).

The variety *albus*, Jeff., is not very rare in Loch Fyne; perhaps one in every fifty belongs to this variety (M.).

The variety *Dumasii*, Payr., has been taken in Upper Loch Fyne in 70 fathoms (M.).

Pecten opercularis (Linné).—Common in the neighbourhood of Tarbert (B. & S.). Upper Loch Fyne at Minard Narrows; at both sides and in the centre, and also near the head in 10 to 70 fathoms; and also on the shore between tide marks (M.). At Moll Dhu and Silvercraigs (Alf. Brown).

Pecten similis, Laskey.—Dredged at Tarbert Bank, Loch Fyne (Mihi). A local and gregarious species, Moll Dhu, Loch Fyne (Alf. Brown). The fry of *Pecten maximus* are liable to be mistaken for this species by those who have not had an opportunity of seeing both forms.

Mytilus edulis, Linnê.—Found at the heads of all the Clyde lochs. This is a widely distributed species both in the northern and southern hemispheres; it has been recorded from Rio de la Plata, Falkland, and Kerguelen Islands, and from New Zealand (M.). There is an extensive bed of *Mytilus edulis* at Ardrishaig (Alf. Brown).

Modiola modiolus (Linné).—Common in the neighbourhood of East Loch Tarbert (B. & S.). Abundant at extreme low water in all the Clyde lochs, also at Minard Narrows, and at both sides of Upper Loch Fyne in 10 to 30 fathoms (M.).

Modiolaria marmorata (Forbes).—Common; usually found embedded in the test of large Ascidians which are frequent on Tarbert Bank, in Loch Fyne, and common at extreme low water in East Loch Tarbert (B & S.). Upper Loch Fyne at Minard Narrows, in 12 to 20 fathoms (M.). Moll Dhu, Loch Fyne (Alf. Brown).

Modiolaria discors (Linné).—Attached to the roots of *Laminaria* and other algæ in East Loch Tarbert, and in neighbouring bays in Loch Fyne (B. & S.).

Nucula nucleus.—(Linné).—Upper Loch Fyne at Minard Narrows, in 12 to 20 fathoms (M.).

Nucula sulcata, Brown.—Upper Loch Fyne at Minard Narrows, in 12 to 15 fathoms (M.). Tarbert, Loch Fyne (Barlee).

Nucula nitida, G. B. Sowerby.—Battle Island; not common (B. & S.). Upper Loch Fyne at Minard Narrows, and on the west and east sides and in the centre, in 10 to 70 fathoms (M.).

Nucula tenuis (Montagu).—Occasionally off Battle Island (B. & S.). On both sides and in the centre of Loch Fyne, in 10 to 70 fathoms (M.). Locally plentiful opposite Otter, Loch Fyne (Alf. Brown).

Leda minuta (O. F. Müller).—Off Battle Island (B. & S.). Abundant in Lower Loch Fyne in 100 to 105 fathoms (M.).

Astarte sulcata (Da Costa).—Laggan Bay and East Loch Tarbert (B. & S.). Upper Loch Fyne at Minard Narrows, and on both sides and in the centre, in 11 to 70 fathoms (M.). Off Otter Spit and Moll Dhu (Alf. Brown).

Astarte elliptica (Brown).—Laggan Bay (B. & S.). Upper Loch Fyne at Minard Narrows, and on the east side in 10 to 20 fathoms; also in Lower Loch Fyne in 12 fathoms (M.). This, which is sometimes described as a variety of *Astarte sulcata*, is reinstalled to specific rank in Dr Norman's catalogue.

Astarte compressa (Montagu).—Upper Loch Fyne at Minard Narrows, in 11 to 20 fathoms, abundant (M.). In sand and nullipore, in 10 to 12 fathoms, off Silvercraigs, Loch Fyne; not uncommon (Alf. Brown). The variety *striata* (Leach), has been dredged at Tarbert Bank (Mihi).

Astarte triangularis (Montagu).— Off Silvercraigs, Loch Fyne—dead shells (Alf. Brown).

Turtonia minuta (Fabricius).—White Shore, East Loch Tarbert (B. & S.).

Lasæa rubra (Montagu).—East Loch Tarbert (B. & S.); var. *pallida*, Jeff., Loch Fyne (Alf. Brown).

Montacuta substriata (Montagu).—Off Otter, Loch Fyne (Alf. Brown). This species is frequently found on the spines of living *Spatangus purpureus.*

Montacuta bidentata (Montagu).—East Loch Tarbert (B. & S.). Off the pier at Ardrishaig—living (Alf. Brown).

Montacuta tumidula, Jeffreys.—Off Tarbert in 25 fathoms; Loch Fyne in 45 to 56 fathoms. (Somerville and J. T. Marshall in *Journal of Conchology*, vol. viii. p. 349, Jan. 1897.)

Decipula ferruginosa (Montagu).—Off the pier at Ardrishaig in rather less than 6 fathoms—fine specimens, living (Alf. Brown).

Lepton nitidum, Turton.—Off Silvercraigs, and at Otter Spit, Loch Fyne; living specimens (Alf. Brown).

Cardium echinatum, Linné.—Generally distributed, East Loch Tarbert and Loch Fyne (B. & S.). Upper Loch Fyne at Minard Narrows, and from the shore to 60 fathoms (M.). Loch Fyne (Alf. Brown).

Cardium papillosum, Poli.—Upper Loch Fyne (M.). This is an addition to Alf. Brown's Catalogue.

Cardium edule, Linné.—More common in West than in East Loch Tarbert (B. & S.). Found on shores, in bays, and in all the lochs of the Clyde district (M.). Loch Fyne (Alf. Brown).

Cardium exiguum, Gmelin.—East Loch Tarbert (B. & S.). Off Otter, Loch Fyne (Alf. Brown).

Cardium nodosum, Turton.—Has been taken in Upper Loch Fyne, on the east side and in the centre, in 30 to 70 fathoms (M.).

Cardium fasciatum, Montagu.—East Loch Tarbert (B. & S.). Upper Loch Fyne at Minard Narrows, and on east side in 10 to 30 fathoms (M.). Off Silvercraigs and off Otter, Loch Fyne (Alf. Brown).

Lœvicardium norvegicum (Spengler).—East Loch Tarbert, and in Loch Fyne—single valves (B. & S.). At Minard Narrows, Upper Loch Fyne (M.).

Cyprina islandica (Linné).—Dead, but fresh, shells, near Laggan in 30 fathoms (B. & S.). At Minard Narrows; and on both sides and in the centre of Upper Loch Fyne, as well as near the head of the loch, in 5 to 65 fathoms; has also been obtained on the shore (M.).

Tapes pullastra (Montagu).—Common at White Shore, East Loch Tarbert (B. & S.). Upper Loch Fyne, on the shore—very plentiful on the Spit at Minard Narrows (M.).

Tapes virginea (Linné).—Has been observed in Upper Loch Fyne at Minard Narrows in 11 to 20 fathoms, and also at low water (M.).

Circe minima (Montagu).—Valves and dead, but fresh, shells in East Loch Tarbert and Loch Fyne (B. & S.). Upper Loch Fyne at Minard Narrows in 11 to 25 fathoms (M.). Sivercraigs, Loch Fyne (Alf. Brown).

Dosinia exoleta (Linné).—Upper Loch Fyne at Minard Narrows, also on the west side from the shore to 25 fathoms (M.).

Dosinia lincta (Pulteney).—Upper Loch Fyne, from the shore to 70 fathoms (M.).

Venus casina, Linné.—Upper Loch Fyne at Minard Narrows, in 12 to 20 fathoms, and in Lower Loch Fyne in 104 fathoms (M.). Off Silvercraigs, Loch Fyne (Alf. Brown).

Venus gallina, Linné.—Common along all the shores and in all the lochs of the Clyde district (M., Alf. Brown, and others).

Venus ovata, Pennant.—Off Battle Island, and in East Loch Tarbert (B. & S.). Common in all the Clyde lochs in depths of 10 to 70 fathoms (M.).

Venus fasciata (Da Costa).—Common in East Loch Tarbert and Loch Fyne (B. & S.). Minard Narrows, Upper Loch Fyne, in 12 to 20 fathoms (M.). Colour and sculpture variable.

Lucinopsis undata (Pennant).—Off Otter Spit, Loch Fyne; generally in about 8 to 12 fathoms (Alf. Brown).

Axinus flexuosus (Montagu). East Loch Tarbert (B. & S.). In all the upper lochs of the Clyde district in depths varying from 5 to 70 fathoms (M.).

Axinus ferruginosus (Forbes).—Loch Fyne, off Tarbert, in 16 to 18 fathoms (B. & S.). Upper Loch Fyne in 10 to 35 fathoms, and in Lower Loch Fyne in 20 to 100 fathoms (M.). Alive at Moll Dhu, Loch Fyne, on a muddy bottom (Alf. Brown).

Axinus croulinensis, Jeffreys.—Lower Loch Fyne (Robertson, *Trans. Nat. Hist. Soc. of Glasgow*, vol. ii., N.S., p. 152).

Psammobia ferröensis (Chemnitz).—At Minard Narrows, Upper Loch Fyne, in 10 to 30 fathoms, and also on the west and east sides (M.).

Solen siliqua, Linné.—East Loch Tarbert—variety *arcuata*, Jeff. (B. & S.). Large and fine specimens are occasionally obtained at extreme low water near Strachur in Upper Loch Fyne (M.).

* *Solen ensis*, Linné.—Taken in all the lochs of the Clyde district (M.).

Solen pellucidus, Pennant.—Loch Fyne, off Silvercraigs, and off Otter (Alf. Brown). Not very uncommon, but very fragile.

Mactra subtruncata (Da Costa).—Frequent in East Loch Tarbert (B. & S.). Upper Loch Fyne at Minard Narrows, in 12 to 20 fathoms, and also on the shore (M.).

Mactra elliptica, Brown.—Off the Otter Spit, Loch Fyne (Alf. Brown). Upper Loch Fyne, at Minard Narrows in 11 to 25 fathoms (M.). Jeffreys in *British Conchology* and Brown in *Mollusca of the Firth of Clyde*, include *M. elliptica*, Brown, under *M. solida*, Linné, as a variety of that species, but in Dr Norman's catalogue it is entered as a separate species.

Lutraria elliptica, Lamarck.—Upper Loch Fyne at Minard Narrows, in 12 to 20 fathoms (M.).

* *Solen siliqua* var. *arcuata* has sometimes been mistaken for *Solen ensis;* the latter, however, is usually considerably smaller than the variety *arcuata* of *S. siliqua*.

Mya arenaria, Linné.—Upper Loch Fyne, between tide marks (M.). Between tide marks East Loch Tarbert (Mihi).

Mya truncata, Linné.—East Loch Tarbert—dead shells (B. & S.). Between tide marks throughout the Clyde district where the conditions are favourable (M.).

Corbula gibba (Olivi).—Loch Fyne and East Loch Tarbert, not common (B. & S.). At Minard Narrows, and on both sides and in the centre, as well as near the head of Upper Loch Fyne, in 10 to 70 fathoms (M.). Off Silvercraigs, Loch Fyne (Alf. Brown).

Saxicavella plicata (Montagu).—A living specimen was obtained in muddy sand and nullipore at the mouth of Loch Gilp (Alf. Brown).

Saxicava rugosa (Linné).—Shores of East Loch Tarbert (B. & S.). Minard Narrows, and on both sides and in the centre of Upper Loch Fyne, in 10 to 36 fathoms (M.). The variety *artica* (Linné) has also been obtained at Minard (M.).

Xylophaga dorsalis, Turton.—A considerable number of specimens were obtained in a piece of partially rotten wood dredged in East Loch Tarbert; the species was also obtained under similar conditions off Skate Island, Loch Fyne (B. & S.). Also from a piece of old wood obtained off Inveraray (G.).

Teredo, sp. (?).—Specimens of a *Teredo* were observed in a piece of wood obtained on the east side of Upper Loch Fyne (M.).

Dibranchia.

Lucina borealis (Linné).—Dead shells frequent on the shore (B. & S.). On the shores of Upper Loch Fyne (M.). Off Silvercraigs, Loch Fyne (Alf. Brown).

Lucina spinifera (Montagu).—Taken on one occasion in Upper Loch Fyne, in 60 fathoms (M.). Off Otter and Moll Dhu, Loch Fyne; scarce, and not full grown (Alf. Brown).

Tellina crassa, Pennant.—One specimen off Silvercraigs, Loch Fyne (Alf. Brown). Single valves are frequent.

Tellina tenuis, Da Costa.—On the shore, Upper Loch Fyne (M.). East Loch Tarbert and neighbourhood; common (B. & S.).

Tellina fabula, Gronovius.—Off the pier at Ardrishaig (Alf. Brown).

Tellina balthica, Linné.—On the shore of Upper Loch Fyne (M.). Plentiful and fine at Lochgilphead; the variety *attenuata* (Jeff.) also occurs here (Alf. Brown).

Abra alba (S. Wood).—Off Battle Island, in muddy sand (B. & S.). In Upper Loch Fyne, on the east side and in the centre, and also near the head, in 25 to 70 fathoms (M.). Plentiful in Loch Gilp, in 5 to 7 fathoms, at the mouth of the loch (Alf. Brown).

Abra prismatica (Montague).—In muddy sand, in 6 fathoms, off Ardrishaig Pier; rather common (Alf. Brown).

Cuspidaria cuspidata (Olivi).—Off Battle Island; rare (B. & S.). At Minard Narrows, and on both sides and in the centre of Upper Loch Fyne, in 10 to 70 fathoms (M.). Loch Fyne (Robertson, see Brown's *Mollusca of the Firth of Clyde*, p. 41).

Cuspidaria costellata (Deshayes).—Tarbert Bank, Loch Fyne, and off Battle Island, in 40 fathoms (B. & S.). Minard Narrows, on the east and west sides; and off Furnace, in 10 to 25 fathoms (M.). Loch Fyne (M'Andrew, Forbes, and Barlee).

Cuspidaria abbreviata, Forbes.—In the deeper portions of Loch Fyne, rare (B. & S.). Minard Narrows, east side and centre, in 15 to 70 fathoms (M.). Loch Fyne (M'Andrew, Barlee, A. M. Norman).

Lyonsia norvegica (Chemnitz).—Loch Fyne; not common (B. & S.). Upper Loch Fyne, at Minard Narrows, and along both sides, in 8 to 20 fathoms (M.).

Cochlodesma prætenue (Pulteney).—Upper Loch Fyne, in depths of 5, 36, and 70 fathoms, as well as at low-water (M.).

Thracia papyracea (Poli).—Upper Loch Fyne, on the shore (M.).

Thracia villosiuscula (Macgillivray), variety *distorta* (Montagu).—Off Silvercraigs, Loch Fyne (Alf. Brown).

BRACHIOPODA OF LOCH FYNE.

Terebratulina caput-serpentis (Linné).—Fairly common of Battle Island, in 40 fathoms (B. & S.). At Minard, west and east sides and centre, in 10 to 65 fathoms (M.). Off Moll Dhu and Silvercraigs (Alf. Brown).

Crania anomala (O. F. Müller).—Abundant and large near Moll Dhu Point; frequent also in other parts of the loch; usually at a depth of less than 20 fathoms (B. & S.). Upper Loch Fyne, at Minard Narrows, in 11 to 20 fathoms, and towards the east side in 45 fathoms (M.).

CRUSTACEA OF LOCH FYNE.

A History of the Crustacea, by the Rev. T. R. R. Stebbing, has been followed as to the nomenclature of the MALACOSTRACA (the AMPHIPODA excepted).

BRACHYURA.

Inachus dorsettensis (Pennant).—Frequent in 10 to 20 fathoms in Loch Fyne (B. & S.). Upper Loch Fyne at Minard, and on both sides, in 10 to 30 fathoms (M.).

Hyas araneus (Linné).—Common between tide-marks (B. & S.). Upper Loch Fyne at Minard, on both sides and centre, and near the head of the loch, in 10 to 30 fathoms, and on the shore between tide-marks (M.).

Hyas coarctatus, Leach.—Common in the off-shore waters of Loch Fyne (B. & S.). Upper Loch Fyne at Minard, and on both sides, in 10 to 30 fathoms (M.).

Macropodia rostrata (Linné).—Upper Loch Fyne at Minard, and west side, in 10 to 25 fathoms (M.).

Macropodia longirostris (Fabricius).—Not common in Loch Fyne (B. & S.).

Achæus Cranchii, Leach.—Upper Loch Fyne, east side, in 10 fathoms (M.).

Cancer pagurus, Linné.—Frequent on the rocky shores of Loch Fyne (B. & S.).

Carcinus mœnas (Linné).—Common (B. & S.). Both sides of Upper Loch Fyne, in 10 to 30 fathoms, and on the shore (M.). A specimen of this crab was obtained having a *Sacculina carcini* adhering to its abdomen (G.).

Portunus puber (Linné).—Frequent in 10 to 15 fathoms or more in Loch Fyne (B. & S.). Taken in fair numbers in 1885, but not observed during 1892 (M.).

Portunus depurator (Linné).—Frequent in Loch Fyne (B. & S.). At Minard and east side of Upper Loch Fyne, in 5 to 30 fathoms; one of the commonest species of *Portunus* in the Clyde district (M.).

Portunus marmoreus, Leach.—Frequent in Loch Fyne (B. & S.).

Portunus pusillus, Leach.—Frequent in Loch Fyne (B. & S.). Upper Loch Fyne, east side, in 5 fathoms (M.).

Ebalia tuberosa (Pennant).—Tarbert Bank, Loch Fyne (Mihi).

Anomura.

Porcellana longicornis (Pennant).—Between tide-marks; not very plentiful (B. & S.).

Lithodes maia (Linné).—Common in Loch Fyne, but mostly of medium size (B. & S.). Vicinity of Furnace (G.). Loch Fyne (Dr Scoular *).

Eupagurus bernhardus (Linné).—Common in Loch Fyne (B. & S.). Upper Loch Fyne at Minard, on the west and east sides, and in the centre, in 10 to 70 fathoms, and also near the head of the loch (M.). ('*Pagurus ulidianus*' is a synonym of this species.)

Eupagurus Prideaux (Leach).—Common in Loch Fyne, and usually associated with *Adamsia palliata* (B. & S.). Upper Loch Fyne at Minard, on west and east sides and in the centre, in 10 to 70 fathoms (M.).

Eupagurus sculptimanus, Lucas.—Upper Loch Fyne at Minard, on the west side, in 10 to 25 fathoms (M., as *Pagurus Forbesii*). *Eupagurus Forbesii* is a synonym of *Eupagurus sculptimanus*.

* *Proceedings of Nat. Hist. Soc. of Glasgow*, First Series, vol. i. p. 8.

Eupagurus pubescens (Kroyer).—East Loch Tarbert (Mihi). Upper Loch Fyne at Minard, on the west side and in the centre, in 10 to 20 fathoms, also off Dunderave (M.). This species is usually surrounded more or less by a sponge—*Suberites suberea.*

Anapagurus Hyndmanni (Thompson).—East Loch Tarbert (Mihi).

Anapagurus lævis (Thompson).—Frequent in East Loch Tarbert and Loch Fyne (B. & S.). Upper Loch Fyne at Minard, on the west and east sides and in the centre, off Dunderave, in 10 to 36 fathoms (M.). A female with ova dredged in 105 fathoms in Loch Fyne in August (Henderson).

Anapagurus chiroacanthus, Lilljeborg (= *Eupagurus ferrugineus*, Norman).—East Loch Tarbert (B. & S.). Upper Loch Fyne, west side, in 10 to 15 fathoms (M.).

Munida rugosa (Fabricius).—Upper Loch Fyne at Minard, and on east side, in 12 to 20 fathoms (M.). Loch Fyne; common (Dr Scouler, *op. cit.*).

Galathea squamifera, Leach.—Common in East Loch Tarbert and Loch Fyne (B. & S.). Upper Loch Fyne, west side, in 10 to 15 fathoms (M.).

Galathea nexa, Embleton.—Upper Loch Fyne at Minard, and in the centre, near the head of the loch, in 12 to 20 fathoms (M.). Loch Fyne (Dr Scouler, *op. cit.*).

Galathea dispersa, Spence Bate.—Upper Loch Fyne at Minard, and on both sides, and in the centre near the head, in 10 to 30 fathoms (M.).

Galathea intermedia, Lilljeborg.—East Loch Tarbert and Buck Bay (B. & S.). Loch Fyne at Minard, and on both sides, in 10 to 20 fathoms (M.).

Macrura.

Calocaris Macandreæ (Bell).—Occurs sparingly in the deeper portions of Loch Fyne, in 60 to 90 fathoms (B. & S.). Upper Loch Fyne, in the centre, in 60 to 65 fathoms (M.). Loch Fyne (M'Andrew). Loch Fyne, in 40 to 105 fathoms (Henderson).

Palinurus vulgaris, Latr.—A single specimen taken in herring-nets by Ardrishaig fishermen in the spring (B. & S.).

Astacus Gammarus (Linné).—The common lobster is generally distributed in Lower Loch Fyne, where the shores are rocky. There is a small summer lobster fishing carried on in Buck Bay (B. & S.). East Loch Tarbert (Mihi). The fresh-water lobster of the English rivers is not an *Astacus*, but belongs to the genus *Potamobius* of Leach (see Stebbing's *History of Crustacea*, p. 207).

Pontophilus spinosus (Leach).—Upper Loch Fyne at Minard, in 11 to 25 fathoms (M.). East Loch Tarbert; rare (B. & S.).

Crangon vulgaris, Fabricius.—Obtained in East Loch Tarbert, but not plentiful (B. & S.). Inshore, Upper Loch Fyne (M.).

Crangon Allmani, Kinahan.—Frequent in the offshore water (B. & S.). Upper Loch Fyne, both sides and centre, and near the head, in 10 to 70 fathoms (M.). Off Inveraray (G.).

Cheraphilus echinulatus, M. Sars.—A single specimen off Skate Island, Loch Fyne, in 105 fathoms—mud (Henderson).

Cheraphilus neglectus, G. O. Sars.—Obtained occasionally in East Loch Tarbert and in neighbouring parts of Loch Fyne (Mihi).

Nika edulis, Risso.—Several specimens off Skate Island, Loch Fyne, in 105 fathoms (Henderson).

Spirontocaris Cranchii (Leach).—Loch Fyne (Forbes and M'Andrew. East Loch Tarbert (Mihi).

Spirontocaris Gaimardii (M. Edwards).—Loch Fyne (Forbes and M'Andrew), East Loch Tarbert as *Hippolyte pandaliformis* (B. & S.). Upper Loch Fyne, both sides, and in the centre, in 10 to 60 fathoms (M.).

Spirontocaris securifrons (Norman).—Common in 20 to 40 fathoms in Loch Fyne (B. & S.). Upper Loch Fyne at Minard, east side, centre, and near the head, in 10 to 70 fathoms (M.).

Hippolyte varians, Leach.—*Zostera* bed in East Loch Tarbert, abundant (B. & S.).

Hippolyte fasciger, Gosse.—East Loch Tarbert, amongst *Zostera*, frequent (Mihi).

Caridion Gordoni (Spence Bate).—Upper Loch Fyne, on both sides, in 10 to 20 fathoms (M.).

Pandalus Montagui, Leach, (= *P. annulicornis*).—Common, East Loch Tarbert and Loch Fyne (B. & S.). Abundant and of large size in Upper Loch Fyne in 70 fathoms. The species is generally found everywhere in depths greater than 40 fathoms; but is also obtained in comparatively shallow water (M.).

Pandalus brevirostris, Rathke.—East Loch Tarbert (B. & S.). West side of Upper Loch Fyne, in 10 to 15 fathoms (M.). Loch Gair and Strachur Bay (G.).

Pasiphæa sivado (Risso).—Four specimens taken off Skate Island in 105 fathoms; one measures 4 inches in length, and two others are scarcely inferior in size (Henderson). Off Strachur, in Upper Loch Fyne, in 70 fathoms (M.). A specimen of *Pasiphæa* was obtained in the large mid-water-net of the 'Garland,' at 5 fathoms below the surface, between Tarbert and Avidh Island, Loch Fyne.

Schizopoda.

Euphausiidæ.

Nyctiphanes norvegica (M. Sars).—Loch Fyne; found also in the stomachs of herring and *Acanthias* (B. & S.). In great abundance in

Upper Loch Fyne just above the mud in the deepest water; also in Lower Loch Fyne, in 80 to 100 fathoms. The young are found in great profusion at all seasons of the year, in from 5 to 20 fathoms above the mud in the deepest water in Loch Fyne (M.).

Boreophausia Raschii (M. Sars).—Loch Fyne (B. & S.). Upper Loch Fyne, between Lowburn and Dunderave, taken in the bottom tow-net (G.).

Mysidæ.

Mysidopsis gibbosa, G. O. Sars.—East Loch Tarbert (B. & S.). In Barmore Bay and other parts of Loch Fyne. Head of Upper Loch Fyne (G.).

Mysidopsis didelphys (Norman).—Near the head of Loch Fyne, May 1896 (G.).

Mysidopsis augusta, G. O. Sars.—Barmore Bay, Loch Fyne, in 4 fathoms; rare (B. & S.)

Leptomysis linguara, G. O. Sars.—East Loch Tarbert; moderately frequent (B. & S.).

Leptomysis gracilis, G. O. Sars.—Between Loch Gair and Largymore, and between Lowburn and Dunderave Castle, Upper Loch Fyne (G.).

Macromysis flexuosa (O. F. Müller).—East Loch Tarbert, among *Zostera*; frequent (B. & S.). Upper Loch Fyne, inshore (M.).

**Praunus inermis* (Rathke).—East Loch Tarbert, among *Zostera* (B. & S.). Upper Loch Fyne, between Inverae and Furnace (G.).

**Praunus neglectus* (G. O. Sars).—Mouth of Loch Fyne, 60 fathoms, mud; a single specimen from a tow-net attached to the trawl (Henderson).

Hemimysis Lamornæ (R. Q. Couch).—East Loch Tarbert, among *zostera*, not very rare (B. & S.). Tarbert Bank, in 20 to 25 fathoms (G.). When alive, the species is of a bright red or scarlet colour.

Neomysis vulgaris (J. V. Thompson).—Loch Dhu, near Inveraray (J. Pringle). Prof. Bell, in *British Stalk-eyed Crustacea*, in describing this species, refers to a *Mysis* obtained by Dr Leach at Loch Ranza, Arran, and described by him as *M. integer*. The description of *M. integer* by Dr Leach is imperfect, but Prof. Bell is of the opinion that it is identical with *M. vulgaris*, J. V. Thompson. Dr Leach's record appears to be the only one for the Clyde district, hitherto—it is the only one referred to by Dr Henderson, in his *Decapod and Schizopod Crustacea of the Clyde*. It is of interest, therefore, to have this confirmation of the fact that *Mysis* (now *Neomysis*) *vulgaris* is a member of the Clyde fauna. Loch Dhu is a small brackish water loch at the mouth of the river Shira, near Inveraray, into which the tide flows and ebbs. Mr Pringle, of H.M. Ordnance Survey, who obtained the species in Loch Dhu, kindly handed his specimens over to me for examination, when I found them to belong to the *Mysis* referred to. This *Mysis* is not an uncommon species in Scotland

* See *History of Crustacea*, by the Rev. T. R. R. Stebbing, p. 227, as to the priority of *Praunus*.

—it is sometimes frequent in the Forth; I have also obtained it in Loch Wester, in Caithness; in a small loch on the Island of Barra, Outer Hebrides; and in a gathering from Loch Belmont in Shetland.

Schistomysis ornatus (G. O. Sars).—Near the head of Loch Fyne, among trawl refuse (G.).

Schistomysis arenosa (G. O. Sars).—East Loch Tarbert, among *Zostera* (B. & S.).

Siriella armata (M. Edwards).—East Loch Tarbert and neighbouring parts of Loch Fyne (B. & S.).

Siriella Brooki, Norman.—East Loch Tarbert, among *Zostera* (B. & S.). This requires careful examination to distinguish it from the next species.

Siriella Clausii (G. O Sars).—East Loch Tarbert, among *Zostera;* a somewhat rare species (B. & S.).

Erythrops elegans (G. O. Sars).—East Loch Tarbert, and in the vicinity of Barmore, Loch Fyne (Mihi).

CUMACEA.

Iphinoë trispinosa (Goodsir).—At the head of Upper Loch Fyne, in the bottom tow-net (G.).

Vaunthompsonia cristata, Spence Bate.—East Loch Tarbert, not common (B. & S.). Off Largabruach, Upper Loch Fyne; dredged (G.).

Lamprops fasciata, G. O. Sars.—East Loch Tarbert, Loch Fyne, frequent near low water, at White Shore (B. & S.).

Hemilamprops rosea, Norman.—A single specimen of this Cumacean was taken in the bottom tow-net between Inverae and Furnace, Upper Loch Fyne (G.). In this specimen the telson was furnished with eight terminal spines.

Hemilamprops uniplicata, G. O. Sars.—East Loch Tarbert (B. & S.).

Leucon nasicus, Kroyer.—Between Lowburn and Dunderave, at the head of Upper Loch Fyne (G.).

Eudorella truncatula (Spence Bate).—Upper Loch Fyne, between Lowburn and Dunderave Castle, in the bottom tow-net (G.).

Diastylis rugosa, G. O. Sars.—East Loch Tarbert; not very common (B. & S.).

Diastylis Rathkii, Kroyer.—East Loch Tarbert; not common (Mihi).

Diastylus biplicata (Sars).—Head of Loch Fyne, in bottom tow-net (G.).

Pseudocuma cercaria, Van Beneden.—East Loch Tarbert; frequent (Mihi). Upper Loch Fyne, off Largabruach (G.).

Campylaspis costata, G. O. Sars.—Upper Loch Fyne, between Lowburn and Dunderave, in the bottom tow-net (G.).

Campylaspis rubicunda, Lilljeborg.—Upper Loch Fyne, between Lowburn and Dunderave, in the bottom tow-net (G.).

Cumella pygmæa, G. O. Sars.—East Loch Tarbert (Mihi). Tarbert Bank, Lower Loch Fyne, in 20 to 25 fathoms; and at Largabruach, Upper Loch Fyne (G.).

Nannasticus unguiculatus, Spence Bate.—Upper Loch Fyne, between Lowburn and Dunderave, on the bottom tow-net, and at Tarbert Bank, Lower Loch Fyne, dredged (G.).

Isopoda.

Tanais tomentosus, Kroyer [= *T. vitatus*, (Rathke)].—Loch Fyne, near the mouth of East Loch Tarbert, on rocks which are situated between tide-mark, and more or less covered with barnacles; frequent (Mihi).

Tanaopsis laticaudatus, G. O. Sars (= **Leptognathia laticaudata*, G. O. Sars).—Moderately frequent in Loch Gair, and in dredged material collected off Largabruach, Upper Loch Fyne (G.).

Eurycopa phalangium, G. O. Sars.—This curious little Isopod was obtained in the bottom tow-net, between Lowburn and Dunderave Castle, Upper Loch Fyne; very rare (G.). I am indebted to the Rev. Mr Stebbing for the identification of this species.

Anceus maxillaris (Montagu).—Upper Loch Fyne (M.). Off Inverary (G.).

Æga bicarinata, Leach.—Dredged in Loch Fyne in 15 fathoms; bottom, mud, shells and gravel (Robertson).

Cirolana spinipes, Bate and Westwood.—Dredged at the mouth of Loch Fyne, in 37 fathoms; bottom, mud and small gravel (Robertson). Loch Fyne, in 30 fathoms (Mihi). This last was a female with ova.

Eurydice pulchra, Leach.—Upper Loch Fyne (M.). East Loch Tarbert, not unfrequent (Mihi).

Sphæroma curtum, Leach.—East Loch Tarbert, not common (Mihi).

Limnoria lignorum (Rathke).—East Loch Tarbert, on old wood; generally distributed throughout Loch Fyne (Mihi).

Idotea tricuspidata (Desmarest).—Upper Loch Fyne, at Minard, and on the west side, in 10 to 25 fathoms (M.). East Loch Tarbert (Mihi).

Idotea pelagica Leach.—Upper Loch Fyne (M.). East Loch Tarbert, not very common (Mihi). *Idotea pelagica* is a much smaller Isopodthan *I. tricuspidata*, as well as being of a different habit, and it is also proportionally stouter. I have a specimen of the former (*with ova*) not more than

* Professor Sars, in his new work on the *Crustacea of Norway* (vol. ii.), has instituted a new genus for this Isopod, viz. *Tanaopsis*.

7 mm. in length. (Notwithstanding the marked difference between ova-bearing specimens of *I. tricuspidata* and *I. pelagica*, it is now customary to consider both as belonging to the one species, viz. *Idotea marina*, Linné.)

Astacilla longicornis (Sowerby).—Upper Loch Fyne, in the centre, in 36 to 70 fathoms; also off Dunderave (M.). East Loch Tarbert (Mihi). Off Skate Island, in 105 fathoms (Robertson).

Janira maculosa, Leach.—East Loch Tarbert, under stones at low water, and dredged; generally distributed (Mihi).

Jæra (?) *Nordmanni*, Rathke.—Upper Loch Fyne, between Lowburn and Dunderave Castle, in a bottom tow-net gathering (G.). East Loch Tarbert (Mihi).

Leptaspidia brevipes, Bate and Westwood.—East Loch Tarbert, not common (Mihi).

Cryptothir balani (Spence Bate).—East Loch Tarbert, associated with *Balanus balanoides.* While examining a number of specimens of *Balanus balanoides* at Tarbert Laboratory, a specimen of *Cryptothir*, a female, was obtained in the sixth *Balanus* examined, but though several hundreds of the same species of *Balanus* were afterwards carefully dissected, no more *Cryptothir balani* were found (Mihi).

Athelgue paguri (Rathke).—Occasionally obtained on *Eupagurus bernhardus* in East Loch Tarbert and neighbouring parts of Loch Fyne.

Pseudione Hyndmanni (Bate and Westwood).—This species (both the form known as "*Phryxus Hyndmanni*" and that described as "*Phryxus fusticaudatus*"),* was obtained in Loch Fyne, near Tarbert. "*Phryxus Hyndmanni*" was taken from a specimen of *Hippolyta varians*, but "*Phryxus fusticaudatus*" was obtained from a specimen of *Eupagurus bernhardus.* As regards "*Phryxus fusticaudatus*" the following note was made at the time of its discovery—"It agrees very well with the figure given in Bate and Westwood's monograph; the clavate lobes on each side of pleon and the "spathulate" terminal segment are well developed." (This specimen was unfortunately lost.)

Amphipoda.

The Amphipoda of Norway, by Professor G. O. Sars, is followed in the classification and nomenclature of this group.

Hyperiidea.

Hyperia galba (Montagu).—East Loch Tarbert, associated with *Aurelia aurita* (B. & S.).

Hyperoche tauriformis (Spence Bate).—Loch Gair, near Quay Ferry, Upper Loch Fyne (G.). These two species of the *Hyperiidea*, though

* This specimen of *Phryxus fusticaudatus* was a mature female with numerous embryo young enclosed under the ovigerous plates: these embryos closely resemble the parasitic Epicaride known as *Microniscus*, and which is found sometimes on *Calanus.*

occasionally observed within the Clyde area, are somewhat uncommon; very few specimens of either have, so far as known, been obtained in Loch Fyne. Both species are moderately common on the east coast of Scotland.

Gammaridea.

Talitrus locusta (Pallas).—Upper Loch Fyne, off Inveraray (G.)

Orchestia littorea (Montagu), [= *O. Gammarellus* (Pallas)].—East Loch Tarbert. This is a species of frequent occurrence wherever the conditions are suitable.

Hyale Lubbockiana (Spence Bate), [= *Allorchestes imbricates*, Spence Bate, and *Hyale Nelssoni*, Boeck (in part)].—East Loch Tarbert, moderately frequent.

Lysianax Costæ (Milne Edwards).—Upper Loch Fyne (M.). East Loch Tarbert (Mihi).

Perrierella Audouiniana (Spence Bate), (= *Lysianassa Audouiniana*, Spence Bate, and *Pararistias Audouiniana*, Robertson).—Upper Loch Fyne, at Minard, in 11 to 25 fathoms (M.). Tarbert Bank, Lower Loch Fyne (G.).

Calisoma crenata (Spence Bate).—Loch Fyne, in 80 fathoms (Robertson). Upper Loch Fyne in the centre in 36 to 70 fathoms—inside a dead *Brissopsis lyrifera* (M.). Between Lowburn and Dunderave, rare (G.).

Hippomedon denticulatus, Spence Bate (= *Hippomedon Holbölli*, Boeck).—Loch Fyne in 80 fathoms, bottom mud (Robertson). East Loch Tarbert (Mihi). Tarbert Bank, Lower Loch Fyne, in 20 to 25 fathoms (G.).

Sophrosyne Robertsoni, Stebbing and Robertson.—(?) Upper Loch Fyne (M.).

Orchomene Batei, G. O. Sars.—Loch Fyne, in 10 to 12 fathoms (Robertson). Tarbert Bank, Loch Fyne (G.).—Upper Loch Fyne, west and east sides and centre, in 10 to 70 fathoms (M.)

**Orchomenella minuta* (Kroyer).—This species is reported from Minard, where it was obtained in 11 to 25 fathoms (M.).

Tryphosa Sarsi (Bonnier).—Upper Loch Fyne, near Largabruach, and off Inveraray (G.).

Tryphosites longipes (Spence Bate).—East Loch Tarbert (Mihi). Upper Loch Fyne (M.).

Hoplonyx cicada (Fabricius), [= *Anonyx Holbölli*, Spence Bate (not Kroyer)].—Tarbert Bank, Lower Loch Fyne, in 20 to 25 fathoms (G.).

Bathyporeia Robertsonii, Spence Bate.—East Loch Tarbert. (Prof.

*"*Orchomene propinquus*" is also recorded as having been obtained on the west side of Upper Loch Fyne, in 10 to 25 fathoms (M.). I do not find this species in Robertson's catalogue, or in Sars' monograph.

G. O. Sars seems to have no doubt as to *B. Robertsoni* being a 'good' species).

Urothoe marina, Spence Bate.—Near Barmore, Loch Fyne (Mihi). Upper Loch Fyne (M.).

Urothoe norvegica, Boeck.—Upper Loch Fyne, west and east sides and centre, in 10 to 70 fathoms (M.).

Phoxocephalus Holbölli (Kroyer).—Upper Loch Fyne, on the east side and in the centre, in 10 to 70 fathoms (M.). *Phoxus simplex*, Spence Bate, is probably synonymous with this species.

Harpinea neglecta G. O. Sars.—East Loch Tarbert (Mihi). Loch Fyne, in 80 fathoms (Robertson). Loch Gair, frequent (G.).

Ampelisca typica (Spence Bate).—East Loch Tarbert (Mihi). Upper Loch Fyne, west side, in 10 to 25 fathoms (M.).

Ampelisca lævigata, Lilljeborg.—Taken by the sieve in pure sand, at low water, at Crarae, Loch Fyne (R.). Upper Loch Fyne, in the centre, in 36 to 70 fathoms (M.).

Ampelisca tenuicornis, Lilljeborg.—Dredged in Loch Fyne, in 80 fathoms, bottom soft mud (R.). Upper Loch Fyne, at Minard, west and east sides and centre, in 10 to 70 fathoms (M.). Loch Gair (G.).

Ampelisca spinipes, Boeck.—Loch Fyne, near Skate Island, in 100 fathoms and also in 80 fathoms (R.).

Ampelisca Eschrichtii, Kroyer.—Upper Loch Fyne, at Minard, in 11 to 25 fathoms (M.).

Haploops setosa, A. Boeck.—Dredged off Skate Island, Loch Fyne, in 100 fathoms; two only were met with (Robertson).

Stegocephaloides christianiensis, Boeck.—Loch Fyne, in 40 to 70 fathoms. Upper Loch Fyne (M.).

[*Stegocephaloides aurates*, G. O. Sars, is inserted among the MS. records of the steam yacht 'Medusa' for Upper Loch Fyne, east side and centre, in 15 to 70 fathoms, but this species is not recorded in the catalogue of the late Dr Robertson.]

Amphilochus manudens, Spence Bate.—Upper Loch Fyne, between Lowburn and Dunderave, in the bottom tow-net (G.).

Cyproidea damnoniensis, Stebbing.—Upper Loch Fyne (M.).

Stenothoe marina (Spence Bate).—Upper Loch Fyne (M.). At Tarbert Bank, Lower Loch Fyne, in 20 to 25 fathoms (G.),

Stenothoe monoculodes (Montagu).—Upper Loch Fyne, west and east sides and centre, in 10 to 70 fathoms (M.).

Metopa, sp.—Upper Loch Fyne, between Lowburn and Dunderave (G.).

Cressa dubia (Spence Bate).—Tarbert Bank, Loch Fyne, dredged (G.).

Leucothoë spinicarpa (Abildgaard).—Taken in Loch Fyne, in 92 fathoms (R.). In the branchial chamber of large Ascidians (*Ascidia mentula*) collected at low water in East Loch Tarbert; also in Ascidians dredged on Tarbert Bank, Loch Fyne (G.).

* *Leucothoë Lilljeborgii*, Boeck.—Loch Gair, and between Lowburn and Dunderave, Upper Loch Fyne (G.).

Monoculodes carinatus, Spence Bate.—East Loch Tarbert (Mihi). Upper Loch Fyne (M.).

Monoculodes Packardi, Boeck.—Upper Loch Fyne, between Lowburn and Dunderave in the bottom tow-net (G.).

Perioculodes longimanus (Spence Bate).—Upper Loch Fyne, between Lowburn and Dunderave (G.).

Pontocrates altamarinus (Spence Bate).—Upper Loch Fyne (M.).

Synchelidium brevicarpum (Spence Bate).—Upper Loch Fyne (M.). Tarbert Bank, Lower Loch Fyne (G.).

Halimedon parvimanus (Spence Bate †).—Upper Loch Fyne, west and east sides and centre, in 10 to 70 fathoms (M.). Near Largabruach, dredged, and between Lowburn and Dunderave, in the bottom tow-net (G.). This species, which is the *Œdiceros parvimanus* of Spence Bate, is not uncommon in Loch Fyne.

Epimeria cornigera (Fabricius).—Upper Loch Fyne, at Minard, in 11 to 25 fathoms (M.).

Iphimedia obesa, Rathke.—Upper Loch Fyne, on both the west and east sides and in the centre, in 10 to 70 fathoms (M.). Near Largabruach, dredged; and in the vicinity of Carndow, near the head of the loch (G.).

Iphimedia minuta, G. O. Sars.—Upper Loch Fyne, between Lowburn and Dunderave, in the bottom tow-net; also taken with the dredge at Tarbert Bank, Lower Loch Fyne, in 20 to 25 fathoms (G.).

Eusirus longipes, Boeck.—Upper Loch Fyne, at Minard, and on the west side, in 10 to 25 fathoms (M.). Between Lowburn and Dunderave, in the bottom tow-net (G.).

Apherusa bispinosa (Spence Bate).—Upper Loch Fyne, at Minard, west and east sides and centre, in 10 to 70 fathoms (M.). Loch Gair and near Largabruach (G.).

* I have a *Leucothoë* from East Loch Tarbert (Loch Fyne) that differs from *L. Lilljeborgii* in having the penultimate as well as the last pair of epimeral plates strongly toothed at the lateral corners—the last pair having the corner tooth defined above by a sinus as in L. Lilljeborgii; the palm of the second gnathopode of this Tarbert specimen differs also in its general outline. This is probably the form described by Dr Robertson as *Leucothoë incisa* (see Dr Robertson's *Amphipoda of the Clyde*, Part ii., p. 23.

† See 'The Amphipoda of Bate and Westwood's "British Sessile-eyed Crustacea,"' by A. O. Walker (*Ann. and Mag. Nat. Hist.*, Sixth Series, vol. xv. p. 466, 1895).

Paratylus Swammerdami (Milne Edwards).—East Loch Tarbert (Mihi).

Paratylus vedlomensis (Spence Bate).—Upper Loch Fyne, in the middle of the loch, in 36 to 70 fathoms (M.).

Dexamine spinosa (Montagu).—Upper Loch Fyne, west and east sides and centre, in 10 to 70 fathoms (M.). Off Largabruach, dredged (G.).

Dexamine Thea, Boeck.—Upper Loch Fyne (M.). A small species, and easily overlooked.

Amathilla homari (Fabricius).—East Loch Tarbert, at extreme low water. This was one of the largest specimens I have seen (Mihi).

Gammarus marinus, Leach.—East Loch Tarbert (Mihi).

Gammarus locusta (Linné).—Upper Loch Fyne, at Minard, in 11 to 25 fathoms (M.). Off Inveraray (G.). East Loch Tarbert (Mihi).

Melita obtusata (Montagu).—Upper Loch Fyne, west side, in 10 to 25 fathoms (M.). Off Inveraray, and near Carndow at the head of the loch (G.).

Mœra Othonis (Milne Edwards).—Upper Loch Fyne, at Minard, on the west and east sides and in the centre, in 10 to 70 fathoms (M.). Loch Fyne in 90 fathoms [Robertson, as *Mœra longimana* (Thompson)]. Tarbert Bank, Loch Fyne, dredged (G.). *Mœra longimana* (Thompson) is considered to be the male of *M. Othonis*, but Spence Bate's figure of the hand of the second *gnathopods* of *Mœra (Megamœra) longimana* is quite different from that of Sars' figure of the hand of the same gnathopods of the male of *Mœra Othonis*.

Cheirocrates Sundewalli (Rathke).—Upper Loch Fyne, at Minard Narrows and in the centre of the loch, in 11 to 70 fathoms (M.). Dredged near Largabruach, and also at Tarbert Bank (G.).

Cheirocrates intermedius, G. O. Sars.—Dredged in Loch Gair in Upper Loch Fyne, rare (G.). East Loch Tarbert, 1886 (Mihi).

Cheirocrates assimilis (Lilljeborg).—Lower Loch Fyne, in 104 fathoms (Robertson). Tarbert Bank, in 20 to 25 fathoms (G.).

Microdeutopus anomalus (Rathke).—Upper Loch Fyne, on the east side, in 15 to 30 fathoms (M.). East Loch Tarbert (Mihi).

Microdeutopus danmoniensis (Spence Bate).—Upper Loch Fyne, at Minard, on the east side and in the centre, in 11 to 70 fathoms (M.). According to Sars this is the *Microdeutopus gryllotalpa* of Spence Bate, but not of Costa.

Aora gracilis (Spence Bate).—Loch Gair, Upper Loch Fyne, dredged; not common (G.).

Leptocheirus pilosus, Zaddach.—Tarbert Bank, Lower Loch Fyne, in 20 to 25 fathoms (G.). The antennal appendages are two-jointed in these Tarbert Bank specimens.

Gammaropsis erythrophthalma, Lilljeborg.—Upper Loch Fyne, at Minard, on the east side and in the centre, in 11 to 70 fathoms (M.).

Podoceropsis Sophiæ, Boeck.—Upper Loch Fyne, at Minard, west and east sides, in 10 to 30 fathoms (M.).

Podoceropsis excavata (Spence Bate).—Upper Loch Fyne (M.).

Amphithoe rubricata (Montagu).—Upper Loch Fyne (M.). East Loch Tarbert (Mihi).

Pleonexes gammarodes, Spence Bate.—East Loch Tarbert, at low-water, and dredged (Mihi).

Podocerus pusillus, G. O. Sars.—Tarbert Bank, Loch Fyne, dredged (G.).

Erichthonius abditus (Templeton).—Upper Loch Fyne, on the east side, in 15 to 30 fathoms (M.). East Loch Tarbert, both ♂ and ♀ (Mihi). Loch Gair (G.).

Corophium Bonellii, Milne Edwards.—Off Inveraray, Loch Fyne, also near Carndow, and in Loch Gair (G.).

Corophium crassicorne, Bruzelius.—East Loch Tarbert (Mihi).

Dulichia falcata (Spence Bate).—Tarbert Bank, Lower Loch Fyne (G.).

Caprellidea.

Phtisica marina, Slabber.—Upper Loch Fyne (M.). Between Lowburn and Dunderave, and off Ardno (G.). East Loch Tarbert (Mihi). Tarbert Bank, in 20 to 25 fathoms (G.).

Pariambus typicus (Kroyer).—East Loch Tarbert, on the common star-fish *(Asterias rubens)* (Mihi).

Caprella linearis (Linné).—East Loch Tarbert, amongst *Zostera* (Mihi).

Caprella acanthifera, Leach.—East Loch Tarbert, amongst *Zostera* (Mihi).

PHYLLOCARIDA (PHYLLOPODA).

Nebalia bipes, Milne Edwards.—Upper Loch Fyne, off Inveraray, and off Largabruach (G.). East Loch Tarbert (Mihi).

CLADOCERA.

Evadne Nordmanni, Lovén.—Upper Loch Fyne, between Carndow and Dunderave, off Inveraray and off Furnace (G.). A generally distributed species, but sometimes it may occur in abundance; at other times it may be very scarce.

Podon polyphemoides, Leuckart.—Near the head of Loch Fyne; this species was found in considerable abundance about 12 inches or so below the surface of the water.

(?) *Podon intermedius*, Lilljeborg.—Upper Loch Fyne.

OSTRACODA.

Podocopa.

Paracypris polita, G. O. Sars.—Loch Fyne, off Tarbert, rare (Norman).

Pontocypris mytiloides, Norman.—East Loch Tarbert; not uncommon (B. & S.).

Pontocypris trigonella, G. O. Sars.—East Loch Tarbert (B. & S.). Loch Gair, and off Inveraray; not uncommon (G.).

Argillœcia cylindrica, G. O. Sars.—Off Tarbert, Loch Fyne, in 25 fathoms (Norman).

Bairdia complanata, G. S. Brady.—Loch Fyne (Norman).

Cythere lutea, Müller.—East Loch Tarbert (B. & S.). A moderately common species, especially in shallow water.

Cythere confusa, Brady and Norman.—East Loch Tarbert (B. & S.). Loch Gair, Upper Loch Fyne (G.). Generally distributed throughout the district.

Cythere porcellanea, G. S. Brady.—Off Inveraray, Upper Loch Fyne (G.).

Cythere (?) *semipunctata*, G. S. Brady.—Off Tarbert, Loch Fyne (Norman). Loch Fyne (Mihi).

Cythere crispata, G. S. Brady.—East Loch Tarbert (B. & S.).

Cythere gibbosa (Brady and Robertson).—Loch Gilp (Loch Fyne) (Brady and Robertson).

Cythere albo-maculata, Baird.—East Loch Tarbert (B. & S.). Generally distributed.

Cythere Robertsoni, G. S. Brady.—Loch Fyne, off East Loch Tarbert (Mihi). Not very uncommon.

Cythere convexa, Baird.—East Loch Tarbert (B. & S.). A moderately common species.

Cythere marginata, Norman.—Off Tarbert, Loch Fyne, in 25 fathoms (A. M. Norman).

Cythere cluthæ, Brady, Crosskey, and Robertson.—Loch Fyne, in 20 fathoms (Mihi—see *Monograph of the Marine and Fresh-Water Ostracoda of the North Atlantic and North-Western Europe*, Part i. p. 145).

Cythere villosa (G. O. Sars).—Off Inveraray (G.). East Loch Tarbert (B. & S.). Common and generally distributed.

Cythere tuberculata (G. O. Sars).—East Loch Tarbert (B. &. S.).

Cythere concinna, Rupert Jones.—Dredged in Loch Fyne (Brady and Robertson). East Loch Tarbert (B. & S.).

Cythere angulata (G. O. Sars).—Off Tarbert Loch Fyne (A. M. Norman). East Loch Tarbert (B. & S.).

Cythere antiquata (Baird).—East Loch Tarbert (B. & S.).

Cythere Jonesii (Baird).—Loch Fyne, off Tarbert, in 25 fathoms, and off Skipness in 41 fathoms (A. M. Norman). Loch Fyne (B. & S.).

Cytheridea papillosa, Bosquet.—Loch Fyne (B. & S.). More or less generally distributed.

Cytheridea punctillata, Brady.—Loch Fyne, off Inveraray, off Tarbert, and off Skipness (A. M. Norman). Loch Fyne (B. & S.). Upper Loch Fyne (G.).

Cytheridea (?) *subflavescens*, G. S. Brady.—Loch Fyne, in 40 fathoms; off Skipness, off Tarbert, in 25 fathoms (A. M. Norman). Loch Fyne (G. S. Brady and D. Robertson).

Eucythere declivis (Norman) = *Eucythere argus* (G. O. Sars).—Loch Fyne (B. & S.). A moderately common species.

Krithe bartonensis (Jones).—Loch Fyne, off Inveraray and off Tarbert, in 25 fathoms (A. M. Norman). Off Inveraray, and between Carndow and Ardno, north side of the loch (G.).

Loxoconcha impressa (Baird).—East Loch Tarbert (B. & S.). Loch Gair and off Largabruach (G.). A moderately common species.

Loxoconcha guttata (Norman).—Loch Fyne, at Inveraray, and off Skipness (A. M. Norman).

Loxoconcha multifora (Norman).—East Loch Tarbert (B. & S.). Loch Fyne, as *Cythere multifora* (A. M. Norman).

Loxoconcha tamarindus (Jones).—East Loch Tarbert (B. & S.). Moderately common everywhere.

Xestoleberis aurantia (Baird).—East Loch Tarbert (B. & S.). Not very rare in Loch Fyne.

Xestoleberis depressa (G. O. Sars).—Loch Fyne (Mihi). Loch Gair and off Inveraray (G.).

Cytherura gibba (Müller).—East Loch Tarbert (B. & S.).

Cytherura cornuta (G. S. Brady).—East Loch Tarbert (B. & S.). Off Inveraray, Upper Loch Fyne (A. M. Norman). Loch Fyne (G. S. Brady and D. Robertson).

Cytherura sella, G. O. Sars.—East Loch Tarbert, as *Cy. flavescens* (B. & S.). A moderately common species throughout the district.

Cytherura acuticostata, G. O. Sars.—Loch Fyne (A. M. Norman).

Cytherura striata, G. O. Sars.—East Loch Tarbert (B. & S.). A common and generally distributed species.

Cytherura angulata (G. S. Brady).—East Loch Tarbert (B. & S.).

Cytherura undata, G. O. Sars.—East Loch Tarbert (B. & S.). This is a small species and easily overlooked.

Cytherura producta, G. O. Brady.—Loch Fyne, off Tarbert, in 25 fathoms (A. M. Norman).

Cytherura nigrescens (Baird).—East Loch Tarbert (B. & S.). There is scarcely a haul made inshore with the dredge in which this species does not occur.

Cytherura similis, G. O. Sars.—Loch Fyne, off Skipness (A. M. Norman). Generally distributed throughout the Clyde area.

Cytherura cellulosa, Norman.—East Loch Tarbert (B. & S.). This is a very small species and easily overlooked.

Cytheropteron latissimum (Norman).—East Loch Tarbert (B. & S.). Loch Fyne (A. M. Norman).

Cytheropteron nodosum, G. S. Brady.—East Loch Tarbert (B. & S.). Loch Fyne, off Tarbert (A. M. Norman).

Cytheropteron inflatum, Brady, Crosskey, and Robertson.—Loch Fyne (A. M. Norman). This is the only British record for *Cytheropteron inflatum* as a recent species.

Cytheropteron punctatum, G. S. Brady.—Loch Fyne, off Tarbert, in 25 fathoms (A. M. Norman). East Loch Tarbert (Mihi).

Cytheropteron alatum, G. O. Sars.—Loch Fyne, off Tarbert, in 25 fathoms (A. M. Norman). East Loch Tarbert, as *Cytheropteron arcuatum* (B. & S.).

Cytheropteron angulatum, Brady and Robertson.—East Coast Tarbert (B. & S.). Loch Fyne, off Tarbert, in 25 fathoms (A. M. Norman).

Cytheropteron humile, Brady and Norman.—Off Inveraray, Upper Loch Fyne (G.). Hitherto this Ostracod has almost invariably been obtained from pieces of partially decayed wood brought up in the dredge or trawl—wood that has been more or less perforated by boring Mollusks or Crustacea. In such situations I have usually found this Ostracod associated with the Copepod *Laophonte simulans*, T. Scott.

Bythocythere constricta, G O. Sars.—Loch Fyne (G. S. Brady and D. Robertson).

Bythocythere turgida, G. O. Sars.—Furlong Bay, Loch Fyne (B. & S.).

Bythocythere simplex (Norman).—East Loch Tarbert (B. & S.). This is a moderately common species in Loch Fyne and in the Clyde generally.

Pseudocythere caudata, G. O. Sars.—Loch Fyne (B. & S.). This Ostracod is not very rare, but is easily overlooked.

Sclerochilus contortus (Norman).—Loch Fyne (B. & S.). A moderately common and widely distributed species.

Paradoxostoma variable (Baird).—East Loch Tarbert, Loch Fyne (B. & S.). A common and generally distributed species.

Paradoxostoma pulchellum, G. O. Sars.—Furlong Bay, Loch Fyne (B. & S.).

Paradoxostoma Hodgei, G. S. Brady.—Off Tarbert, Loch Fyne, in 25 fathoms (A. M. Norman).

Paradoxostoma flexuosum, G. S. Brady.—Loch Fyne, off Inveraray, in 25 to 40 fathoms, and also off Skipness (A. M. Norman).

Paradoxostoma affine, T. Scott.—Off Inveraray, Upper Loch Fyne, in 25 to 40 fathoms (A. M. Norman).

Machœrina tenuissima (Norman).—Loch Fyne as *Xiphichilus tenuissima* (B. & S.).

MYODOCOPA.

Asterope mariæ (Baird).—East Loch Tarbert (B. & S.). Off Tarbert, Loch Fyne (A. M. Norman). Off Largabruach, Upper Loch Fyne (G.).

Asterope teres (Norman).—East Loch Tarbert (B. & S.). This species is much less common in Loch Fyne than the previous one.

Philomedes interpuncta (Baird).—East Loch Tarbert (B. & S.). Off Largabruach, Upper Loch Fyne (G.).

CLADOCOPA.

Polycope orbicularis, G. O. Sars.—East Loch Tarbert (B. & S.). Loch Fyne (Brady and Norman).

Polycope punctata, G. O. Sars.—Some specimens dredged in Loch Fyne are doubtfully referable to this species (Brady and Norman).

THE COPEPODA OF LOCH FYNE.

In the preparation of this list, *The Monograph of the British Copepoda*, by Prof. G. S. Brady; *The Copepoda of the Bay of Naples*, by Dr Giesbrecht; Dr Canu's Monograph *Les Copepodes de Boulonnais*, besides many separate papers, have been consulted.

GNATHOSTOMATA.

Calans finmarchicus (Gunner).—Very abundant in Upper Loch Fyne in deep water, where they are found all the year through; less abundant towards the lower end of the loch.

Pseudocalanus elongatus, Boeck.—Generally distributed, and more or less frequent all over the loch. The following are a few of the localities where the species has been obtained: In surface and bottom tow-nets at the head of Loch Fyne, off Inveraray in a tow-net at 3 fathoms from the surface; in surface and bottom tow-nets, between Loch Gair and Largymore; and in surface tow-net between Tarbert and Avidh Island (G.).

(?) *Pseudocalanus armatus*, Boeck.—In bottom tow-net gatherings from the vicinity of Largymore and Furnace, and between Lowburn and Dunderave Castle (G.).

Stephos gyrans (Giesbrecht).—(Pl. II. fig. 9; Pl. III. figs. 17, 18). A single specimen—a female—of this interesting species was obtained in some dredged material from Loch Gair, Upper Loch Fyne. A careful comparison of the various appendages of this Loch Gair specimen with Dr Giesbrecht's description and figures, leaves no doubt as to its identity with the specimens obtained at Naples. Dr Giesbrecht discovered his specimens in the tanks of the Zoological Station at Naples. The species appears to be quite distinct from *Stephos minor* (T. Scott) from the Firth of Forth. The Loch Gair specimen measures ·8 mm. in length (about $\frac{1}{30}$th of an inch).

Euchæta norvegica, Boeck.—Common in the deep water of Upper Loch Fyne, and also obtained occasionally at the surface (G.). Upper Loch Fyne in 60 to 70 fathoms; taken at all seasons of the year in great abundance in Upper Loch Fyne, at from 5 to 15 fathoms above the mud in the deepest water. The females seem to carry a succession of ova, which are of a bluish colour, all through the year (M.).

Scolocithrix hibernica, A. Scott.*—Taken in a bottom tow-net gathering between Carndow and Dunderave Castle, and between Loch Gair and Minard Castle (G.). This species was first obtained in deep water off the coast of county Down, Ireland, by my son, Mr Andrew Scott.

Centropages typicus, Kröyer.—East Loch Tarbert and neighbouring parts of Loch Fyne (Calderwood).

Centropages hamatus (Lilljeborg).—East Loch Tarbert and Loch Fyne (Calderwood). Off Inveraray, between Carndow and Dunderave Castle, and in Loch Gair (G.). This species is moderately common all over the district; Loch Fyne (M.).

Temora longicornis (Müller).—This also is a moderately common and widely distributed species. It has been obtained off Garndow, off Inveraray, off Minard, and in Loch Gair (G.). In East Loch Tarbert and Loch Fyne (Calderwood).

Metridia hibernica (Brady and Robertson).—East Loch Tarbert and Loch Fyne (Calderwood). Off Largabruach, Upper Loch Fyne (G.). Dr W. Giesbrecht gives the following synonymy for this species.†

* *Ann. and Mag. Nat. Hist.*, Nov. 1896, p. 362, Pls. XVII. and XVIII.
† *Pelagischen Copepoden des Golfes von Neapel*, p. 340.

Metridia hibernica (Brady and Robertson).

1873 *Paracalanus hibernicus*, Brady and Robertson (*Ann. and Mag. Nat. Hist.*, S. 4, vol. xii. p. 126, Pl. VIII. figs. 1–3).

1878 *Metridia armata*, Brady (*Mon. Brit. Copep.*, vol. i. p. 42). (not *Metridia armata*, Boeck.)

1887 ? *Pleuromma armatum*, Pouchet and de Guerne (*Compt. Rend. Acad. Paris*, T. 104, pp. 712–715).

Anomalocera Patersonii, Templeton.—East Loch Tarbert and Loch Fyne (Calderwood). This copepod is at times moderately common in Lower Loch Fyne.

Parapontella brevicornis (Lubbock). East Loch Tarbert and Loch Fyne (Calderwood).

Acartia Clausii, Giesbrecht.—Head of Loch Fyne, between Carndow and Ardno. Off Inveraray, and in the vicinity of Minard (G.). Upper Loch Fyne, in 30 to 70 fathoms, as *Dias longiremis* (M.). ? East Loch Tarbert as *Dias longiremis* (Calderwood). I have examined specimens of *Acartia* from various parts of Upper and Lower Loch Fyne, and *A. Clausii* is the only species that has yet been observed in this part of the Clyde area.

Paramisophria, nov. gen.—Somewhat like *Misophria* in general appearance. Antennules short, and composed of about twenty-one joints. Antennæ, with the primary branch short, three-jointed; secondary branches longer than the primary, and two-jointed; mouth organs as in the *Calanidæ*. Swimming feet nearly as in *Pseudocyclops*; both branches three-jointed. Each part of the fifth pair consists of a more or less simple two-jointed branch.

This genus, though apparently a true member of the family *Misophriadæ*, differs from the two genera *Misophria* and *Pseudocyclops*, most closely allied to it, in the structure of the antennæ and of the fifth pair of thoracic feet.

Paramisophria cluthæ, nov. spec. (Pl. II., figs. 3–8; Pl. III., figs. 13–16). *Description of the female*—length, 1·4 mm. ($\frac{1}{18}$th of an inch). Body, robust; abdomen, short; only about one-fourth of the length of the cephalothorax (fig. 13, Pl. III.). Antennules short; twenty-one jointed; joints very short (fig. 14, Pl. III.). The formula shows approximately the proportionate lengths of all the joints:—

$$\frac{14\cdot5\cdot4\cdot2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot3\cdot4\cdot4\cdot6\cdot8\cdot9\cdot6\cdot6\cdot11.}{1\cdot2\cdot3\cdot4\cdot5\cdot6\cdot7\cdot8\cdot9\cdot10\cdot11\cdot12\cdot13\cdot14\cdot15\cdot16\cdot17\cdot18\cdot19\cdot20\cdot21.}$$

Antennæ short, three-jointed, end joint small; secondary branches considerably longer than the primary branches, and composed of two elongate sub-equal joints (fig. 3, Pl. III.). Anterior foot-jaws four-jointed, stout, the second and last joints short; the first and second joints, with a few small papilliform and setiferous appendages on the inner aspect; the end joint is furnished with a number of long plumose setæ (fig. 4, Pl. II.). Posterior foot-jaws elongate, moderately stout, (?) seven-jointed, first two joints large and sub-equal, the third, fifth, and sixth small, and of nearly equal length, fourth joint about one and a half times the length of the preceding joint, the (?) seventh is very minute; the three last are strongly setiferous (fig. 5, Pl. II.). Swimming feet are somewhat like those of *Pseudocyclops*, both branches are three-jointed and furnished with numerous plumose setæ on the inner margins; in the first pair the marginal spines are slender (fig. 6, Pl. II.). In the fourth pair the spines are short, stout, and sabre-like (fig. 7, Pl. II.). The fifth pair consists each of a single two-jointed branch, the first joint is short, but produced interiorly at the distal end into a cylindrical process about as long, and half as broad as the joint itself, and provided at the apex with a small spine and an elongate plumose seta; second joint sub-cylindrical, and fully three times the length of the first joint, and armed with five stout spines, arranged along the outer margin and apex (fig. 8, Pl. II.). Abdomen composed of four segments, the last two being together scarcely equal in length to the preceding segment; caudal stylets rather longer than the entire length of the last two abdominal segments (fig. 16, Pl. III.). Male unknown. *Habitat*—Off Largabruach, Upper Loch Fyne; dredged.

Misophria pallida, Boeck.—Dredged near Largabruach, Upper Loch Fyne (G.).

Thorellia brunnea, Boeck.—Head of Loch Fyne between Carndow and Ardno; off Largabruach and Loch Gair, Upper Loch Fyne (G.). This is not an uncommon copepod in the Clyde in dredged material.

Cyclopina littoralis, G. S. Brady.—In the vicinity of Carndow, near the head of Upper Loch Fyne; and also near Largabruach; in dredged material (G.).

Cyclopina gracilis, Claus.—This species has been obtained in Loch Gair; and also off Inveraray, Upper Loch Fyne (G.).

Oithona (?) similis, Claus.—East Loch Tarbert and Loch Fyne (Calderwood). Off Inveraray; and between Carndow and Ardno (G.). Upper Loch Fyne, in 30 to 70 fathoms (M.).

Notodelphys Allmani, Thorell.—East Loch Tarbert, and Tarbert Bank, Loch Fyne, in 20 to 25 fathoms; in branchial chamber of large Ascidians (Mihi).

Notodelphys agilis, Thorell.—Also found in the branchial chamber of large Ascidians collected at extreme low-water in East Loch Tarbert.

Notodelphys prasina, Thorell.—With the others in the branchial chamber of large Ascidians (Mihi). This species has short caudal stylets.

Doropygus porcicauda, Brady.—A copepod, belonging apparently to this species, was obtained in the branchial chamber of Ascidians from East Loch Tarbert, and also from Largabruach, Upper Loch Fyne (G.). Though slightly imperfect, the Largabruach specimen resembles this, and no other described British species.

Botachus cylindratus, Thorell.—Obtained in the branchial chamber of Ascidians collected in East Loch Tarbert.

Notopterophorus papilio, Hesse.—This curious copepod was of frequent occurrence in the branchial chamber of large Ascidians from East Loch Tarbert (Mihi).

Ascidicola rosea, Thorell.—Upper Loch Fyne, between Carndow and Ardno; from an Ascidian brought up in the trawl-net (G.).

Longipedia coronata, Claus.—Loch Gair, and off Largabruach, Upper Loch Fyne; in dredged material (G.).

Longipedia minor, T. and A. Scott.—In material dredged off Largabruach, Upper Loch Fyne (G.). This is not much more than half the size of the other; both forms were obtained off Largabruach, and specimens of both carried ova.

Ectinosoma Sarsi, Boeck (*E. spinipes*, Brady).—In material dredged off Largabruach, Upper Loch-Fyne (G.).

Ectinosoma melaniceps, Brady.—Head of Upper Loch Fyne, between Carndow and Ardno, and off Inveraray (G.).

Ectinosoma atlanticum, Brady and Robertson.—Upper Loch Fyne, in 30 to 64 fathoms (M.). Common in a tow-net gathering from Upper Loch Fyne. Collected by the late Mr Brook.

Ectinosoma curticorne, Boeck.—Dredged off Largabruach, Upper Loch Fyne; rare (G.).

Ectinosoma Herdmani, T. & A. Scott.—Dredged off Largabruach and in Loch Gair, Upper Loch Fyne (G.).

Ectinosoma pygmæum, T. & A. Scott.—Dredged at Tarbert Bank, Lower Loch Fyne, in 20 to 25 fathoms (G.).

Bradya elegans, T. and A. Scott.—Loch Gair, and near Largabruach, Upper Loch Fyne; dredged (G.).

Bradya similis, T. and A. Scott.—Upper Loch Fyne, near Largabruach, in dredged material (G.).

Zosima typica, Boeck.—In dredged material from Largabruach, Upper Loch Fyne (G.).

Amymone sphærica, Claus.—East Loch Tarbert and Loch Fyne (Calderwood).

Stenhelia hispida G. S. Brady.—In material dredged in Loch Gair and near Largabruach (G.). This distinct and fine species was not very uncommon in the Largabruach gathering. In the spirit specimens, the last abdominal segment and caudal stylets were usually of a more or less dusky hue.

Stenhelia ima (G. S. Brady).—East Loch Tarbert, Loch Fyne (Mihi)(?), off Inveraray (G.).

Ameira longiremis, T. Scott.—Dredged in Loch Gair, Upper Loch Fyne (G.).

Ameira longicaudata, T. Scott.—This well marked species was obtained near the head of Upper Loch Fyne (G.).

Jonesiella spinulosa (Brady and Robertson).—Near Largabruach, Upper Loch Fyne, in dredged material (G.). *Jonesiella fusiformis*, which in some localities appears to be a more common species than the one recorded here, has not yet been observed in any of the collections made by the 'Garland' in the Clyde.

Delavalia robusta (Brady and Robertson).—Near Largabruach, Upper Loch Fyne, in dredged material; not very rare (G.).

Delavalia mimica, sp. n. (Pl. I. figs. 1–9.).

Description of the Female.—Length, ·65 mm. ($\frac{1}{13}$th of an inch). Body moderately stout, and somewhat like *Delavalia reflexa* in general appearance. Antennules eight-jointed, the penultimate joint is smaller than any of the others, while the last is rather more elongate than either of the preceding three or four joints (fig. 2). The antennæ and mouth organs are somewhat similar to those of *D. reflexa;* the principal seta of the end joint of the mandible-palp is moderately stout and curved, and of considerable length (fig. 3). The inner branches of the first pair of swimming feet are three-jointed, the first joint is rather longer than the entire length of the three-jointed outer branches, but the second and third are short, and together scarcely equal to half the length of the first joint (fig. 5). The second, third, and fourth pairs do not differ much from those of other species of *Delavalia* (fig. 6 shows the fourth pair). The fifth pair, which have a general resemblance to those of other species of *Delavalia*, differ in the following points: the armature of the basal joint consists of three moderately short and rather stout spines, situated on the apex of the slightly produced inner portion, in addition to two spiniform setæ, one of which is exterior and the other interior to the spines; the innermost of the three spines, which is also the largest, bears two minute marginal hairs near its extremity—one on either side. The secondary joint is lamelliform, moderately broad, and subcylindrical. The margins, which, in the middle of the joint are somewhat parallel, converge towards both ends, and the distal end, which for this reason assumes a triangular form, is provided with five setæ and a short stout spine; this spine is situated at the beginning of the exterior distal slope, while the five setæ are arranged, two on each sloping distal margin, and one at the apex, as shown in the drawing (fig. 7).

Description of the Male.—The male differs little from the female except in the form and armature of the fifth pair of feet. The basal joint of the fifth pair bears interiorly a single, and somewhat peculiar, stout, and moderately large spine, and a small spiniform seta; the secondary joint is small, subovate, and armed with three spines on the oblique distal end of the exterior margin; there is also a seta at the apex and another on the inner margin, as shown by the drawing (fig. 8). The second pair in the male were not modified, as is sometimes the case, but resembled those of the female.

Habitat.—Loch Gair, Upper Loch Fyne. It has also been obtained in other parts of the Clyde district, and in the Firth of Forth at Granton.

Remarks.—This species differs very markedly from any other *Delavalia* known to me in the structure of the first pair of swimming feet; this pair are not very unlike those of some species of *Dactylopus* or *Ameira*; but as the structure of the mandibles and of the fifth pair of feet is that of a true *Delavalia*, I prefer for the present to give this Loch Gair form a place in the genus to which it has so close an affinity.

Pontopolites typicus, T. Scott.—In dredged material from Loch Gair nd from near Largabruach, Upper Loch Fyne (G.).

Diosaccus tenuicornis (Claus).—East Loch Tarbert (Mihi). A moderately large and well marked species.

Laophonte horrida (Norman).—East Loch Tarbert and Loch Fyne (Calderwood). Loch Gair, Largabruach, and near the head of Upper Loch Fyne (G.).

Laophonte thoracica, Boeck.—East Loch Tarbert (Mihi). Near Largabruach and off Inveraray, Upper Loch Fyne (G.).

Laophonte hispida (Brady and Robertson). Loch Gair, and near Largabruach Upper Loch Fyne, in dredged material (G.).

Laophonte simulans, T. Scott.—Off Inveraray. Several specimens from a piece of partially decayed wood brought up in the trawl-net (G.). This was associated with *Cytheropteron humile* (B. & N.).

Laophonte similis (Claus).—Taken in East Loch Tarbert and in Loch Fyne (Calderwood).

Laophonte lamellifera (Claus).—Also taken in East Loch Tarbert and Loch Fyne (Calderwood).

Laophonte serrata (Claus).—East Loch Tarbert (Mihi). This is quite a distinct and comparatively large species, and it is also one of the rarest species of the genus.

Laophonte depressa, T. Scott.—Loch Fyne, off Tarbert, in 20 to 25 fathoms, in dredged material.

Normanella dubia (Brady and Robertson).—Obtained in dredged material from Loch Gair and from near Largabruach (G.)

Cylindropsyllus laevis, G. S. Brady.—From pools between tide-marks in East Loch Tarbert.

Cletodes longicaudata (Brady and Robertson).—East Loch Tarbert, Largabruach, and Loch Gair, in dredged material (G.).

Cletodes linearis (Claus).—This somewhat rare species was obtained in material dredged in East Loch Tarbert, Loch Fyne.

Cletodes curvirostris, T. Scott.—In dredged material from Loch Gair and Largabruach (G.).

Itunella tenuiremis (T. Scott). = [Cletodes tenuiremis, T. Scott,* and Itunella (?) subsalsa, G. S. Brady†].—Dredged near Largabruach, Upper

* *Eleventh Annual Report of the Fishery Board for Scotland*, Part iii. p. 204, pl iii., figs. 21–28.

† *Nat. Hist. Trans. of Northumb., Durham, and Newcastle-upon-Tyne*, vol. xiii. p. 6, pl. i. Separate reprint.

Loch Fyne (G.). This copepod, when first described, was doubtfully referred to the genus *Cletodes* for reasons stated in the 'remarks' on the species. Sometime afterwards Dr Brady instituted the genus *Itunella* for what appears to be a closely allied form from the Solway. Having, during the last two or three years, examined many specimens of *Cletodes tenuiremis* from different localities, I now quite agree with Dr Brady in considering this copepod to be generically distinct from *Cletodes*, and have, therefore, adopted his generic appellation.

Enhydrosoma curvatum (Brady and Robertson).—This species was obtained in dredged material from Loch Gair and from near Largabruach (G.).

Dactylopus tisboides, Claus.—Loch Fyne and East Loch Tarbert (Calderwood). Dredged near Largabruach (G.).

Dactylopus similis, Claus.—East Loch Tarbert (Mihi). Near the head of Loch Fyne (G.). This is a distinct and moderately large species; it does not appear to be common in the Loch Fyne district.

Dactylopus flavus, Claus.—Obtained by the 'Garland' near the head of Loch Fyne.

Dactylopus stromii (Baird).—East Loch Tarbert, Loch Fyne, in dredged material (Mihi).

Thalestris Clausii, Norman.—Loch Fyne and East Loch Tarbert (Calderwood). Dredged near Largabruach (G.).

Thalestris mysis, Claus.—This fine species has been recorded from East Loch Tarbert by Mr Calderwood. I also have found it there.

Thalestris longimana, Claus.—Loch Fyne and East Loch Tarbert (Calderwood). This is one of the more common and widely distributed species of *Thalestris*.

Thalestris forficuloides, T. and A. Scott.—Obtained off Inveraray and near Largabruach (G.).

Westwoodia nobilis (Baird).—Loch Fyne and East Loch Tarbert (Calderwood).

Harpacticus chelifer (Müller).—East Loch Tarbert (Calderwood). Near Largabruach and near the head of Upper Loch Fyne (G.).

Zaus spinatus, Goodsir.—Loch Fyne and East Loch Tarbert (Calderwood).

Alteutha depressa, Baird.—Loch Fyne and East Loch Tarbert (Calderwood, as *Peltidium depressum*). This copepod may usually be obtained where *Laminaria* is more or less common—as in the bays, where the water is shallow.

Alteutha interrupta (Goodsir).—Loch Fyne and East Loch Tarbert (Calderwood as *Peltidium interruptum*).

Peltidium purpureum, Philippi.—East Loch Tarbert (Mihi). (See a description of the species by Dr Brady in the *Fifth Annual Report of the Fishery Board for Scotland.*) Near Largabruach, Upper Loch Fyne (G.).

Porcellidium fimbriatum, Claus.—Loch Fyne and East Loch Tarbert (Calderwood). Upper Loch Fyne, near Largabruach, and near the head of the loch (G.).

Porcellidium subrotundum, Norman.—Upper Loch Fyne, in 30 fathoms (M.).

Idya furcata (Baird).—East Loch Tarbert (Calderwood). Upper Loch Fyne, near Largabruach, and off Inveraray (G.).

Idya longicornis, T. and A. Scott.—East Loch Tarbert, Loch Fyne (Mihi). This is a large and well-marked species.

Idya gracilis, T. Scott.—This was obtained in Loch Gair, off Inveraray, and near the head of Loch Fyne (G.).

Idya minor, T. and A. Scott.—Upper Loch Fyne, near Largabruach, and near the head of the loch (G.).

Scutellidium fasciatum (Boeck).—East Loch Tarbert (Calderwood). Obtained by washing the 'roots' of *Laminaria* and other large marine algæ.

Monstrilla (?) Danæ, Claparède.—A single representative of this curious group of Copepods was obtained in a bottom tow-net gathering collected between Dunderave and Ardno, near the head of Loch Fyne (G.). The specimen is a female, and has three abdominal segments. The first segment is about twice as long as the second, and is more tumid; it is also rather longer than the third segment; it bears two long 'genital setæ,' which are united at the base so as to form a very short but quite distinct basal part; the caudal setæ are three on each furca. The antennules are in length scarcely equal to one-third the length of the body; the first joint is about four and a half times the length of the second, the third is about one and a half times the length of the second, and the second and fourth joints are nearly equal in length; the antennules are four-jointed. The Loch Fyne specimen thus agrees very well with the brief description of *Monstrilla Danæ*, Claparède, in Mr Bourne's memoir on the *Monstrillidæ.** The fifth feet, so far as I can make them out without dissection, resemble those of *Monstrilla gracilicauda*, Giesbrecht.

PARASITA.

Lichomolgus fucicolus, G. S. Brady.—Upper Loch Fyne, near Largabruach, in dredged material (G.).

Lichomolgus forficulus, Thorell.—In the branchial chamber of large Ascidians from Loch Fyne and East Loch Tarbert (Mihi).

Lichomolgus furcillatus, Thorell.—Off Inveraray, Upper Loch Fyne, from trawl refuse (G.).

* *The Quarterly Journal of Microscopical Science*, vol. xxx. (new series), p. 575 (February 1890). Reprint.

(?) *Lichomolgus maximus*, I. C. Thompson.—Obtained in specimens of the common *Pecten—Pecten opercularis*—from Loch Gair, off Inveraray, and from near the head of the loch (G.). This is not a true *Lichomolgus*, and is only provisionally placed here.

Pseudanthessius liber (Brady and Robertson).—This species is from the same localities as the last (G.).

†*Dermatomyzon nigripes* (Brady and Robertson).—This fine species has been obtained in East Loch Tarbert (Calderwood); and near the head of Upper Loch Fyne (G.).

Artotrogus orbicularis, Boeck.—A single ♂ and ♀ specimen of this fine species were taken in material dredged at Tarbert Bank, Loch Fyne, in 20 to 25 fathoms (G.).

†*Bradypontius magniceps* (G. S. Brady).—Has been recorded for East Loch Tarbert (Calderwood); it has also been obtained near the head of Upper Loch Fyne among trawl refuse (G.).

Bradypontius Normani (B. and R.) (Pl. II. figs. 1 and 2; Pl. III. figs. 1–11).

Description of the female.—Length of the specimen figured, 1·5 mm. ($\frac{1}{16}$ of an inch). In general appearance somewhat like *Bradypontius magniceps*, G. S. Brady, but the abdomen is more elongate and slender (fig. 1, Pl. III.). Antennules short and nine-jointed; the first joint is of moderate length, the third is fully three times the length of the preceding joint; the next five joints are small, while the last is nearly twice the size of the penultimate joint (fig. 3, Pl. III.). The formula shows approximately the proportionate lengths of the joints.

Proportionate lengths of the joints, .	13 · 5 · 17 · 7 · 5 · 6 · 5 · 7 · 13.
Number of the joints, . . .	1 · 2 · 3 · 4 · 5 · 6 · 7 · 8 · 9.

The antennæ are somewhat like those of *Asterocheres Boecki*, G. S. Brady; the secondary branch is small and uniarticulate, and bears a single apical seta (fig. 5, Pl. III.). The mandibles are elongate and very slender (fig. 6, Pl. III.). The maxillæ consist of two small branches, as shown by the figure (fig. 7, Pl. III.). Both foot-jaws are robust and strongly clawed (figs. 8 and 9, Pl. III.). The swimming feet, which are robust, have the inner margins of both branches furnished with numerous plumose setæ (figs. 1 and 2, Pl. II.). The secondary joint of the fifth pair is small and sub-quadrangular, and furnished with three setæ; a single seta also springs from the basal joint (fig. 10, Pl. III.). The abdomen is composed of four segments—genital segment larger than the others.

Description of the male.—The male differs slightly in its general outline from the female; the abdomen is five-jointed, and the genital segment is rather larger than the others. The antennules are ten-jointed; the first six are nearly as in the female; the seventh joint is about equal to the combined lengths of the three preceding joints; the eighth, ninth, and last are each rather smaller than the one that immediately precedes it; the antennæ are hinged and adapted for grasping (fig. 4, Pl. III.). The other appendages resemble those of the female.

† See Dr Giesbrecht on the family *Ascomyzontidæ*, Thorell. (*Zoologischen Anzeiger*, Nos. 521, 522, 1897.)

Habitat.—Loch Gair, Upper Loch Fyne.

Remarks.—Living specimens of this handsome species are very prettily ornamented with usually eight brick-red blotches, six of which are submarginal; and two central—one being at the anterior apex of the first body segment and one near the posterior portion of the thorax, as shown by figs. 1 and 2, Pl. III., which are reproduced from drawings of a living male and female specimen from Cromarty Firth. The markings on the cephalothoracic segment were similar in all the specimens examined, but one or other of the posterior marginal blotches were observed to be occasionally absent. The general colour of the dorsal surface was yellowish, tinged with brown. When examined under the microscope, the integument was also seen to be thickly besprinkled with minute circular markings. The secondary branches were quite distinct, though small. With the exception of the antennules, the various appendages were the same in the male as in the female.

†*Scottomyzon gibberum* (T. and A. Scott).—From specimens of the common star-fish (*Asterias rubens*) caught near the head of Loch Fyne (G.).

Caligus rapax, Milne Edwards.—East Loch Tarbert, on a coal-fish caught in Loch Fyne (Mihi).

Caligus diaphanus, Nordmann (with numerous specimens of *Udonella caligorum* adhering to the *Caligus*). From large Coalfish caught in Loch Fyne (Mihi).

Lepeoptheirus pectoralis (Müller).—From the pectoral fins of plaice (*Pleuronectes Platessa*), caught off Inveraray and in Ard-a-Eaolas Bay (G.).

Lernentoma cornuta (Müller).—Taken from the gills of long rough dabs (*Hippoglossoides limandoides*), caught off Inveraray (G.).

Lernentoma lophii (Johnston). From an Angler fish caught in Loch Fyne (Mihi).

Anchorella uncinata (Müller).—Found adhering to the inside of the mouth and on the gills of a young coal-fish caught in Loch Gair, Upper Loch Fyne (G.).

CIRRIPEDIA.

Balanus porcatus, Da Costa.—Upper Loch Fyne, at Minard, attached to Mytilus (M.).

Balanus Hameri, Ascanius.—Upper Loch Fyne, at Minard and on the west side, in 12 to 20 fathoms; also on the shore (M.).

Balanus balanoides (Linné).—Upper Loch Fyne, at Minard and on the west side, in 12 to 20 fathoms; also on the shore (M.).

Balanus crenatus (Brug.).—At Minard and on both sides of Upper Loch Fyne, in 10 to 20 fathoms, and between tide-marks (M.).

Verruca Strömia, O. F. Müller.—Off Inveraray, Upper Loch Fyne, in 4 to 10 fathoms (M.).

† See Dr Giesbrecht on the family *Ascomyzontidæ*, Thorell. (*Zoologischen Anzeiger*, Nos. 521, 522, 1897.)

Sacculina carcini (Thompson).—Parasitic on a specimen of *Carcinus mænas*, captured in the trawl-net near the head of Upper Loch Fyne (G.).

Peltogaster paguri (Rathke).—Parasitic on Eupagurus, East Loch Tarbert (Mihi).

POLYZOA OF LOCH FYNE.

The following list of Loch Fyne Polyzoa is compiled entirely from the MS. records of the steam-yacht 'Medusa.' The arrangement is that of the British Association *Report on the Marine Zoology, Botany, and Geology of the Irish Sea* (1896).

Cheilostomata.

Gemellaria loricata (Linné).—Upper Loch Fyne, at Minard Narrows, in 10 to 15 fathoms (M.).

Bugula turbinata, Alder.—Upper Loch Fyne, east side in 10 to 20 fathoms (M.).

Cellaria fistulosa (Linné).—Upper Loch Fyne, at Minard and at east side, in 10 to 20 fathoms (M.).

Membranipora pilosa (Linné).—Upper Loch Fyne, east side, in 15 fathoms (M.).

Membranipora Flemingii, Burk.—Upper Loch Fyne, at Minard, in 10 to 15 fathoms (M.).

Microporella impressa (Audouin).—Upper Loch Fyne, at Minard, in 10 to 20 fathoms (M.).

Schizoporella unicornis.—Upper Loch Fyne, at Minard and east side, in 10 to 30 fathoms (M.).

Hippothoa distans, MacGillivray (*Hippothoa flagellum* (Manzoni), (Hincks).—Upper Loch Fyne, at Minard, in 15 fathoms (M.).

Lepraїlia Pallasiana (Moll).—Upper Loch Fyne, at Minard (M.).

Leprailia cruenta, Norman.—Minard, Upper Loch Fyne (M.).

Porella compressa (Sowerby).—Upper Loch Fyne, east side, in 10 to 20 fathoms (M.).

Smittia reticulata (MacGillivray).—Upper Loch Fyne (M.).

Cellepora pumicosa (Linné).—Upper Loch Fyne, at Minard and east side, in 15 to 20 fathoms (M.).

Cellepora ramulosa (Linné).—East side of Upper Loch Fyne, in 15 to 20 fathoms (M.).

Cellepora avicularis, Hincks.—East side of Upper Loch Fyne, in 15 to 20 fathoms (M.).

Cyclostomata.

Crisia eburnea (Linné).—At Minard, Upper Loch Fyne, in 15 to 20 fathoms (M.).

Crisia denticulata (Lamarck).—Upper Loch Fyne, at Minard and east side, in 15 to 20 fathoms (M.).

Diastopora obelia (Johnston).—Upper Loch Fyne, east side, in 15 to 20 fathoms (M.).

Stomatopora granulata (Milne Edwards).—Upper Loch Fyne, at Minard (M.).

Lichenopora hispida (Fleming).—At Minard, Upper Loch Fyne, in 15 to 20 fathoms (M.).

Ctenostomata.

Vesicularia spinosa (Linné).—Upper Loch Fyne, east side, in about 15 fathoms (M.).

Incerta sedis.

Escaroides rosacea.—Upper Loch Fyne, at Minard (M.).

(Arachnida.)

(One or two species of *Pycnogons* and *Acarina* have been observed in Loch Gair and in other parts of Loch Fyne, but these have not yet been identified.)

THE VERMES OF LOCH FYNE.

Chætopoda.

The following records have almost all been obtained from the MS. notes of the steam yacht 'Medusa.'

Tomopteris onisciformis, Eschscholtz.—Obtained in a surface tow-net gathering collected in Lower Loch Fyne by the Fishery steamer 'Garland.'

Filigrana implexa, Berkeley.—Upper Loch Fyne, near Minard, in 15 to 20 fathoms (M).

Spirorbis borealis, Mörch.—Upper Loch Fyne, between tide-marks (M.).

Serpula triquetra (Linné).—At Minard, and on both sides and in the centre of Upper Loch Fyne, in 10 to 36 fathoms, and also between tide-marks (M.).

Serpula vermicularis (Ellis).—At Minard, and on both sides and in the centre of Upper Loch Fyne, in 10 to 36 fathoms (M.).

Serpula contortuplicata (Linné).—On the east side of Upper Loch Fyne, in 15 to 30 fathoms; and at Minard, in 11 to 25 fathoms (M.).

Dasychone argus.—This somewhat rare species was obtained on the east side of Upper Loch Fyne (M.).

Sabella pavonia (Savigny).—Taken in Upper Loch Fyne, on both sides and in the centre, in 10 to 70 fathoms (M.).

Sabella penicillus (Linné).—Taken in deep water, in the centre of Upper Loch Fyne and also near the head of the loch (M.).

Sabella, sp.—A form of *Sabella* that has not been identified was obtained on the west side of Upper Loch Fyne, in 10 to 25 fathoms (M.).

Polycirrus aurantiacus, Malmgren.—This annelide was obtained in the centre of Upper Loch Fyne, in 35 fathoms (M.).

Polymnia nasidensis, Chiaje.—Taken in Upper Loch Fyne, in 15 to 20 fathoms (M.).

Polymnia nebulosa.—This *Polymnia* was obtained in the same locality as the last, and it also occurred on the east side of Upper Loch Fyne (M.).

Notomastus, sp.—An annelide apparently belonging to this genus was obtained on the east side of Upper Loch Fyne (M.).

Thelepus circinatus, Fabricius.—Taken in 15 to 20 fathoms, in Upper Loch Fyne.

Terebella, sp.—A species of annelid was obtained in Upper Loch Fyne, in 15 to 20 fathoms, and also at Minard, that apparently belonged to this genus (M.).

Terebellides Stroemii, Sars.—Taken in Upper Loch Fyne, in 15 to 20 fathoms (M.).

Trophonia glauca, Malmgren.—This was obtained in the same locality as the last.

Pectenaria belgica (Pallas).—*Pectenaria* was taken at various depths from between tide-marks to the deep water in the centre of the loch; and also in various localities from near the head of the loch downwards (M.). It has also been obtained in East Loch Tarbert in Lower Loch Fyne.

Maldane biceps, Sars.—This was taken in Upper Loch Fyne, in the centre of the Loch in 60 fathoms (M.).

Rhodine Lovéni.—This, like a few of the others, appears to be a deep-water form; it occurred in the centre of the Loch in 70 fathoms (M.).

Clymene (*Paxilla*) *gracilis.*—This was obtained in Upper Loch Fyne, in 15 to 20 fathoms (M.).

Clymene amphistoma.—This also was procnred in Upper Loch Fyne, in 15 to 20 fathoms (M.).

Cirratulus, sp.—A species of *Cirratulus* was obtained on the west side of Upper Loch Fyne, in 10 to 15 fathoms, and also between tide-marks (M.).

Arenicola piscatorum, Lamarck.—This was obtained between tide-marks in Upper Loch Fyne (M.).

Chœtopterus variopedatus, Ren. [= *Chœt. insignis* (Baird)].*—Taken at Minard, and on both sides of Upper Loch Fyne, in 10 to 20 fathoms (M.).

Eumenia Jeffreysii.—Taken on the east side and in the centre of Upper Loch Fyne, in 20 to 70 fathoms, and also near the head of the Loch (M.).

Ammotrypane aulogaster, Rathke.—Upper Loch Fyne, in 15 to 20 fathoms (M.). In East Loch Tarbert, Lower Loch Fyne, dredged (Mihi).

Glycera tesselata, Grube ; variety *Macintoshii.*—This was taken in Upper Loch Fyne, at various depths from 15 to 20 fathoms, down to 60 fathoms in the centre of the Loch (M.).

Laetmonice filicornis, Kinberg, variety *Kinbergi*, was obtained in 70 fathoms in the centre of Upper Loch Fyne ; it also occurred on both sides of the Loch (M.).

Neomenia carinata.—This also was obtained in the centre of the loch in 70 fathoms (M.).

Eunice norvegica (Linné).—*Eunice norvegica* was procured on the east side of Upper Loch Fyne (M.).

Eunice, sp.—A species of this genus was obtained in 10 to 15 fathoms, in Upper Loch Fyne, but was not identified (M.).

Hyalinœcea tubicola (Müller).—This species, which appears to be widely distributed, was obtained at Minard, and also in the centre of the Loch, in 15 to 70 fathoms (M.).

[*Nothria tubicola* ((?) = *Hyalinœcea tubicola*) was obtained in somewhat similar localities as the last.]

Lumbriconereis nardonis, Grube.—Occurred on the east side of Upper Loch Fyne (M.).

Nereis Dumerilii (Aud. and M. Edw.) was obtained on the east side of Upper Loch Fyne in 10 to 15 fathoms (M.).

Nereis pelagica (Linné).—Taken at Minard, in the centre of Upper Loch Fyne, near the head, and also between tide-marks (M.). In east Loch Tarbert and neighbouring parts of Lower Loch Fyne.

Nereis, sp.—An unidentified species of *Nereis* was obtained at Minard, in the centre of the Loch, near the head, in 12 to 70 fathoms, and also between tide-marks (M.).

Nephthys Hombergi (Aud. and M. Edw.) was procured in Upper Loch Fyne, on the east side (M.).

* See J. Hornell, in *Tenth Annual Report of the L.M.B.C.*, p. 28 (1897).

Nephthys ciliata.—This form was obtained in Upper Loch Fyne, in 15 to 20 fathoms (M.).

Lepidonotus squamatus (Linné) was found on the east side of Upper Loch Fyne.

Halosydna gelatinosa, Sars.—This was taken on the east side of Upper Loch Fyne, and on the shore at low water (M.).

Polynoe squamata (Johnston).—At Minard; on both sides of Upper Loch Fyne, in 10 to 30 fathoms; and between tide-marks (M.).

Polynoe, sp.—A species of *Polynoë,* not identified, was obtained at Minard; and on both sides, as well as in the centre and near the head of the Loch, in 10 to 35 fathoms; it was also found on the shore between tide-marks (M.).

Aphrodite aculeata (Linné).—At Minard; and on the east side and in the centre of Upper Loch Fyne, in 15 to 70 fathoms, as well as near the head of the Loch (M.). East Loch Tarbert and adjacent parts of Lower Loch Fyne, not rare.

Hermione hystrix Savigny (= *Aphrodite hystrix*).—This species appears to be more restricted in its distribution than the last, and confined to deeper water; it was obtained in Upper Loch Fyne, in the deep water of the centre—65 to 70 fathoms (M.).

Gephyrea.

Sipunculus bernhardus was obtained at Minard, in about 10 fathoms (M.).

(?) *Phascolosoma strombi* (Mont.).—A species of *Sipunculus,* which was probably a *Phascolosoma,* was obtained at Minard, and also in the centre of the Loch in depths ranging from 10 to 70 fathoms, in the dead shells of *Dentalium* (M.).

Chætognatha.

Sagitta bipunctata, Quoy and Gainard, appeared to be generally distributed all over the Loch.

Nemertea.

Lineus marinus (Mont.) is occasionally obtained at the roots of tangle and other sea-weeds, specimens many yards in length being sometimes observed.

Turbellaria.

Planaria, sp.—Specimens of a *Planaria* (probably *Planaria littoralis*) are occasionally observed in Loch Fyne; but the *Planarians,* as well as the other groups of *Vermes,* require further study; and when that is done considerable additions will no doubt be made to the preceding list.

THE ECHINODERMATA OF LOCH FYNE.

The *Catalogue of the British Echinoderms in the British Museum,* by Prof. Jeffrey Bell, is followed as to the arrangement and names in this list.

CRINOIDEA.

Antedon bifida (Pennant).—Common near the east shore of Loch Fyne (B. & S.).

ASTEROIDEA.

Porania pulvillus (O. F. Müller).—In Upper Loch Fyne at Minard in 11 to 25 fathoms (M.).

Stichaster roseus (O. F. Müller).—Taken at Minard, west side, in 10 to 25 fathoms, also on the shore at low water (M.) East Loch Tarbert (B. & S.).

Solaster papposus (Fabricius).—Minard, on both sides, in 10 to 30 fathoms, and also on the shore (M.). Frequent in Loch Fyne, smaller specimens between tide marks (B. & S.). Strachur Bay (G.).

Solaster endeca (Linné). At Minard, on both sides, in 10 to 25 fathoms (M.). Frequent some distance from shore, and also occurs at low water (B. & S.).

Henricia sanguinolenta (O. F. Müller).—On both sides of Loch Fyne, at Minard, in 10 to 40 fathoms (M.). East Loch Tarbert (B. & S.).

Asterias glacialis, Linné.—On the west side of Upper Loch Fyne, in 10 to 25 fathoms (M.). Frequent in 20 to 30 fathoms in Loch Fyne, sometimes of large size (B. & S.).

Asterias rubens, Linné.—Generally distributed, and more or less frequent all over the loch, and at all depths; Minard, etc. (M.). East Loch Tarbert (B. & S.). Cairndow, Loch Gair, etc. (G.).

Asterias Murrayi, Bell.—Upper Loch Fyne, in 65 fathoms. (F. Jeffrey Bell, in *Catalogue of the Brit. Echin. in the British Museum*, p. 103, Pl. XII., figs. 1 and 2).

OPHIUROIDEA.

Ophiura ciliaris (Linné).—Frequent in East Loch Tarbert (B. & S.). Generally distributed in Upper Loch Fyne, in from 10 to 70 fathoms (M.).

Ophiura albida, Forbes.—Loch Fyne and East Loch Tarbert, common (B. & S.). Generally distributed in Upper Loch Fyne, in from 10 to 70 fathoms (M.).

Ophiura affinis, Lütken.—On both sides, and in the centre of Upper Loch Fyne, at Minard, in from 12 to 70 fathoms (M.).

Amphiura Chiajii, Forbes.—Off Inveraray (Robertson, in *Trans. N. H. S. Glasg.*, vol. i.). On both sides and centre of Upper Loch Fyne, and also near the head, in 15 to 70 fathoms (M.).

Amphiura filiformis (O. F. Müller). Off Buck Island, Loch Fyne (B. & S.). Both sides and centre of Upper Loch Fyne, in 10 to 70 fathoms (M.).

Amphiura elegans (Leach).—Frequent between tide-marks (B. & S.)

Ophiopholis aculeata (Linné).—Generally distributed, and more or less frequent in Loch Fyne, Upper and Lower (M., B. & S., G.).

Ophiocoma nigra (Abilgard).—Very abundant, in 15 to 20 fathoms (B. & S.). At Minard, Upper Loch Fyne, on both sides, in 10 to 30 fathoms (M). Abundant in Loch Gair (G.).

Ophiothrix fragilis (Abilgard).—Common, especially near the east shore of Loch Fyne (B. & S.) Upper Loch Fyne, on both sides, in from 10 to 30 fathoms, and also between tide-marks (M.).

Echinoidea.

Echinus miliaris, Linné.—Between tide marks, East Loch Tarbert (B. & S.). Upper Loch Fyne, at Minard, on both sides and in the centre, in from 10 to 60 fathoms, and also between tide-marks (M.). Strachur Bay, Loch Gair, etc. (G.).

Echinus esculentus, Linné.—More or less common all over the loch, both upper and lower, usually on hard ground.

Spatangus purpureus (O. F. Müller).—Upper Loch Fyne, at Minard, and in the centre of the loch, in 12 to 70 fathoms (M.).

Echinocardium cordatum (Pennant).—A moderately common species in Loch Fyne, where the conditions are suitable, as in East Loch Tarbert (B. & S.). At Minard (M.), and Cairndow (G.).

Brissopsis lyrifera, Forbes.—In the centre of Upper Loch Fyne, in 55 to 60 fathoms (M.). Tarbert Bank, Lower Loch Fyne (Mihi).

Holothurioidea.

Synapta digitata (Montagu).—Loch Fyne (Dr Scouler in *Trans. N. H. S. Glasg.*, vol. i. p. 8).

Cucumaria Hyndmani (Thompson).—Obtained on the east side of Upper Loch Fyne, in 20 fathoms (M.).

Cucumaria pentactes (?) (Linné).—Upper Loch Fyne, on the east side, in about 20 fathoms (M.).

Thyone fusus (O. F. Müller).—On the west side of Upper Loch Fyne, in from 10 to 15 fathoms (M.).

Thyone raphanus, Dub. and Kor.—East Loch Tarbert (Mihi). East side of Upper Loch Fyne, in about 20 fathoms (M.).

Psolus phantapus (Strassenfeldt).—Upper Loch Fyne, at Minard, and on the east side of the loch, in 11 to 25 fathoms (M.).

Doubtful species.

Cribella aculeata.—Said to have been found on the shore of Upper Loch Fyne (M.).

Ophiocoma minuta.—Reported from Minard, Upper Loch Fyne (M.).

Ophiactis Ballii (Thomp.) ?—*Zostera* bed, East Loch Tarbert (B. & S.).

THE ACTINOZOA OF LOCH FYNE.

Alcyonaria.

Alcyonium digitatum (Linné).—Upper Loch Fyne, at Minard, on both sides, in 10 to 25 fathoms, and also on the shore.

Sarcodictyon catenata, Forbes.—Upper Loch Fyne, in the centre near the head (M.).

Virgularia mirabilis (Linné).—Upper Loch Fyne, at Minard, and in the centre of the loch, in 11 to 70 fathoms.

Actiniaria.

Bolocera Tuediæ (Johnston).—Loch Fyne, off Tarbert; taken occasionally in the dredge (Mihi). In deep water between Penmore and Inveraray (G.). This is a large species with the tentacle scarcely retractile; it is of a red colour, and appears to be confined to moderately deep water. At Minard, and in the centre of the loch, in 15 to 70 fathoms (M.).

Anemonia sulcata, Pennant [*Anthea cereus* (Ellis and Solander)].—Frequent on the leaves of *Zostera* in East Loch Tarbert, at extreme low water (Mihi).

Adamsia palliata (Bohadsch.).—Minard, on both sides, and in the centre of the loch, in 10 to 70 fathoms (M.). Usually found adhering to the univalve shells inhabited by *Eupagurus Prideauxii.*

Actinia equina, Linné [*A. mesembryanthemum* (Ellis and Solander)].—Common between tide marks.

Tealia crassicornis (Müller).—Frequent between tide marks among stones, and usually with small gravel adhering to the test.

Stomphia Churchiæ, Gosse.—Upper Loch Fyne, at Minard, on the east and west side, and in the centre, in 12 to 36 fathoms (M.).

Edwardsia callimorpha (Gosse).—Taken in Upper Loch Fyne, on the east side, in 10 to 12 fathoms (M.).

Edwardsia carnea (Gosse).—Port Loy, at low water, attached to stones (M.).

Caryophyllia Smithii (Stokes).—Loch Fyne; rare (Mihi).

HYDROZOA OF LOCH FYNE.

The species recorded below were nearly all obtained by the steam-yacht 'Medusa'; their names are arranged in accordance with Hincks' *British Hydroid Zoophytes.*

Hydractinia echinata (Fleming).—Upper Loch Fyne, at Minard, on both sides, and in the centre, in 12 to 20 fathoms (M.).

Eudendrium rameum (Pallas).—Upper Loch Fyne, in the centre (M.).

Campanularia verticillata (Linné).—Upper Loch Fyne (M.). A moderately common species in deep water.

Lafoëa dumosa (Fleming).—At Minard and east side of Upper Loch Fyne, in 12 to 20 fathoms (M.).

Lafoëa fruticosa (M. Sars). At Minard, Upper Loch Fyne, in 12 to 20 fathoms (M.).

Halecium muricatum (Ellis and Solander).—At Minard, Upper Loch Fyne, in 15 to 20 fathoms (M.).

Sertularella rugosa (Linné).—At Minard, Upper Loch Fyne, in 12 to 20 fathoms (M.). The stem of *S. rugosa*, which may be found adhering to the fronds of *Laminaria* or *Flustra*, sends out more or less numerous and crowded shoots, scarcely an inch in height.

Sertularella fusiformis (Hincks).—On the east side of Upper Loch Fyne, in 15 fathoms (M.). This is a small species, measuring from a quarter of an inch to an inch in height.

Diphasia fallax (Johnston).—Loch Fyne (A. M. Norman, see *British Hydroid Zoophytes*, p. 251).

Sertularia pumila, Linné.—Upper Loch Fyne, between tide-marks (M.).

Sertularia filicula, Ellis and Solander.—Upper Loch Fyne, at Minard, in 17 to 25 fathoms (M.). This is one of the less common of the *Sertulariæ*.

Sertularia abietina, Linné.—At Minard, Upper Loch Fyne, in 12 to 20 fathoms (M.). A moderately common species.

Sertularia argentea, Ellis and Solander.—Upper Loch Fyne, in moderately deep water (M.). In this species the shoots extend to a foot or more in height.

Aglaophenia myriophyllum (Linné).—Loch Fyne (A. M. Norman,—see *British Hydroid Zoophytes*, p. 292).

SPONGOZOA.

Grantia compressa, Fleming.—Between tide-marks, Upper Loch Fyne (M.). East Loch Tarbert (Mihi).

Grantia ciliata, Fleming.—Upper Loch Fyne, east side, in 12 to 20 fathoms (M.).

Halichondria albescens, Johnston.—East and west sides of Upper Loch Fyne, and also between tide-marks.

Halichondria panicea (Pallas), variety *papillaris*.—East side of Upper Loch Fyne, and also between tide-marks (M.).

Suberites domuncula, Olivi.—Loch Fyne, in 48 fathoms; found by Mr Pearcy (M.). (?) (*Hymeniacidon suberea*, of Bowerbank, is a synonym of this).

Suberites ficus (Johnston).—At Minard Narrows, Upper Loch Fyne, in 15 to 20 fathoms.

Halisarca Dujardinii, Johnston.—Upper Loch Fyne, on *Inachus dorsettensis*, in 55 fathoms; found by Mr Pearcy (M.).

FORAMINIFERA OF LOCH FYNE.

Miliolidæ.

Biloculina ringens (Lamarck).—Loch Fyne, in dredged materials (B. & S.).

Biloculina depressa, D'Orbigny.—East Loch Tarbert (B. & S.).

Biloculina elongata, D'Orbigny.—Loch Fyne (Mihi).

Spiroloculina limbata, D'Orbigny.
Spiroloculina canaliculata, D'Orbigny.
} Loch Fyne, in dredged material (B. & S.).

Miliolina trigonula, Lamarck.
Miliolina tricarinata, D'Orbigny.
} Loch Fyne, in dredged material (B. & S.).

Miliolina seminulum, Linné.
Miliolina subrotunda, Montague.
Miliolina secans (D'Orbigny).
Miliolina Ferussacii (D'Orbigny).
Miliolina agglutinans (D'Orbigny).
} Dredged in East Loch Tarbert (B. & S.). *M. seminulum* and *M. subrotunda*, also off Inveraray (G.).

Miliolina contorta (D'Orbigny).—Dredged, Tarbert Bank, Loch Fyne, in 20 to 25 fathoms (Mihi).

Cornuspira foliacea (Philippi).—Dredged in East Loch Tarbert (B. & S.).

Astrorhizidæ.

Astrorhiza limicola, Sand.—Tarbert Bank, Loch Fyne, in 20 to 25 fathoms; dredged (Mihi).

LITHOLIDÆ.

Reophax scorpiurus, Montfort. *Haplophragmium canariense* (D'Orbigny). *Haplophragmium pseudospirale* (Williamson). *Ammodiscus gordialis*, Parker and Jones. *Trochamina squamata* (Parker and Jones).	Dredged at Tarbert Bank, Loch Fyne, in 20 to 30 fathoms (Mihi).

TEXTULARIIDÆ.

Textularia sagittula, Defrance.—East Loch Tarbert (B. & S.).

Textularia pygmæa, D'Orbigny.—Dredged in Loch Fyne, at Tarbert Bank, in 20 fathoms (Mihi).

Bulimina marginata, D'Orbigny.—Dredged in East Loch Tarbert (B. & S.).

LAGENIDÆ.

Lagena sulcata (Walker and Jacobs).—Dredged in East Loch Tarbert (B. & S.).

Lagena lævis (Montague). *Lagenal gracillima*, Sagz. *Lagena globosa* (Montague). *Lagena striata* (D'Orbigny).	Dredged in Loch Fyne, at Tarbert Bank, in 20 to 25 fathoms (B. & S.).

Lagena marginata (Walker and Jacobs).—Dredged in East Loch Tarbert (B. & S.).

Lagena melo (D'Orbigny).—Dredged in Loch Fyne (B. & S.).

Lagena squamosa (Montague).—Dredged in East Loch Tarbert (B. & S.).

Lagena hexagona (Williamson).—Loch Fyne, at Tarbert Bank (B. & S.).

Lagena Jeffreysii, Brady.—Dredged in Loch Fyne and East Loch Tarbert (B. & S.).

Nodosaria scalaris (Lamarck).—Not uncommon in Loch Fyne (B. & S.).

Nodosaria (*Dentalina*) *communis* (D'Orbigny).—Loch Fyne (B. & S.).

Cristellaria rotulata (Lamarck). *Cristellaria crepidula* (Fichtel and Moll).	Dredged at Tarbert Bank, Loch Fyne (Mihi).

Polymorphina lactea (Walker and Jacobs).—East Loch Tarbert; a moderately common species (B. & S.).

Polymorphina tubulosa (D'Orbigny).	These three species were obtained with the dredge in Loch Fyne, at Tarbert Bank, in 20 to 25 fathoms (Mihi).
Polymorphina gibba, D'Orbigny.	
Polymorphina rotundata, Born.	

GLOLIGERINIDÆ.

Orbulina universa, D'Orbigny.—East Loch Tarbert (B. & S.).

ROTALIIDÆ.

Patellina corrugata, Williamson.—Loch Fyne (B. & S.).

Discorbina rosacea (D'Orbigny).—East Loch Tarbert (B. & S.).

Discorbina globularis (D'Orbigny).—Loch Fyne, at Tarbert Bank, in 20 to 25 fathoms (Mihi).

Planorbulina mediterranensis, D'Orbigny.—East Loch Tarbert (B. & S.).

Truncatulina lobatula (Walker and Jacobs).	Dredged in East Loch Tarbert (B. & S.).
Rotalia Beccarii (Linné).	
Rotalia nitida (Williamson).	

Gypsina inhærens, Schultze.— Loch Fyne; rare (Mihi).

NUNMULINIDIÆ.

Nonionina asterizans.	East Loch Tarbert, usually in dredged material; common (B. & S.).
Nonionina depressula.	

Operculina ammoides, Gronovius.—Tarbert Bank, Loch Fyne, dredged in 20 to 25 fathoms (Mihi).

Polystomella crispa (Linné).	East Loch Tarbert; common (B. & S.).
Polystomella striato-punctata) Fichtel and Moll).	

APPENDIX TO THE FAUNA OF LOCH FYNE.

Several more or less interesting marine organisms have recently been obtained within the Clyde area, which could not, for obvious reasons, be included in the preceding catalogue. As it is desirable, however, that some, at least, of these should be noticed, it is proposed to do so here by way of an appendix. The seaward boundary of what is here called the "Clyde Area" is a line extending from the Mull of Cantyre to Corsewall Point at the mouth of Loch Ryan.

FISHES.

Among the fishes obtained, the following may be mentioned:—

Lumpenas lampretiformis.—A specimen of this species was captured in the deep water between Arran and the Heads of Ayr, and another midway between the Island of Sanda and Bennan Head.

Triglops Murrayi, Günther.—A young specimen of this somewhat rare species was taken in the shrimp-trawl, a short distance to the eastward of Sanda.

The 'Black mouthed dog-fish' (*Pristiurus melanostomus*) and the 'Lesser spotted dog-fish' (*Syllium canicula*) were captured in the 'Garland' trawl; the former was taken off Arran, and the latter in the vicinity of Ailsa Craig.

A few specimens of the 'Flapper skate' (*Raia macrorhynchus*) were obtained by the 'Garland' in different parts of the seaward area of the Clyde; a specimen, captured in the deep water to the east of Arran, measured 40 inches across the pectoral fins.

Mollusca.

Trochus granulatus, Born.—A single living specimen of this mollusc was taken off the Island of Sanda. This locality, though near the mouth of the estuary, is still within the Clyde area; and as this species does not appear to have been hitherto included among the recent mollusca of the Clyde, its occurrence here is of interest. Dr Jeffreys, in *British Conchology*, states that the species has been obtained off the Mull of Galloway in 50 fathoms, and also refers to it having been found in Belfast Bay; but adds that the two broken specimens found there had probably been accidentally introduced. These are the nearest to the Clyde, of the localities from which the species has been recorded.

Crustacea.

Gonoplax angulata (Fabricius).—A male specimen of this crab was captured on the 3rd of November 1896, in the vicinity of Ailsa Craig, and on the following day a female was obtained a few miles south-eastward of the Mull of Cantyre. This species has for many years past been included among the Clyde crustacea; but in recent years there seems to be a tendency to doubt the accuracy of the Clyde records. The capture of these two specimens, even though the localities be near the seaward boundary of the estuary, will therefore help to some extent to remove the uncertainty as to the correctness of these earlier records.

Nika edulis and *Pasaphæa sivado*, etc.—Both of these crustaceans are sometimes of more or less frequent occurrence near the mouth of the Clyde estuary.

Hippolyte prideauxiana, Leach.—A single specimen of this little shrimp (a female with ova) was obtained near the outer boundary of the Clyde in November last; it is an addition to the Clyde fauna. *H. prideauxiana* is sometimes captured off the coast of Devon. I am indebted to the Rev. T. R. R. Stebbing for the name of the species.

Siriella norvegica, G. O. Sars.—One or two specimens were recently identified among some surface tow-net material from the Clyde, collected a few miles to the east of the Island of Pladda. This is also an addition to the Clyde fauna.

Erythrops serrata, G. O. Sars.—During the past year this schizopod has been obtained in several parts of the Clyde area, sometimes alone, sometimes in company with another and smaller species,—*Erythrops elegans.* Neither of these are recorded in Prof. Henderson's *Decapod and Schizopod Crustacea of the Clyde.*

Monoculodes tuberculatus, G. O. Sars.—A single specimen of this amphipod occurred in a tow-net gathering, collected a few miles east of the Island of Arran. There does not appear to be any previous record of it in the British seas.

Epimeria tuberculata, G. O. Sars.—A single specimen was obtained in the vicinity of Ailsa Craig. There appears to be no previous British record of this species. I am indebted to the Rev. T. R. R. Stebbing for the names of both these amphipods.

Ephimedia Eblanæ, Spence Bate.—Two small specimens of an amphipod, which Mr Stebbing thinks may probably belong to this species, were obtained in the seaward part of the Clyde estuary. They resemble somewhat closely the figure of the species in Bate and Westwood's *British Sessile-Eyed Crustacea*, but are smaller than the size stated by these authors.

Philomedes (*Cypridina*) *brenda* (Baird).—Two specimens, both males, of this rare ostracod were obtained in the Clyde, in the deep water to the east of Arran. Dr Brady, who kindly examined one of the specimens, says: 'Your specimen is, I have no doubt, *P. brenda.*' The only previous British records for this ostracod appear to be the following:—Off the coast of Durham, near the Dogger Bank (Rev. A. M. Norman). Off Noss, in Shetland, 80–90 fathoms (M'Andrew). Ultra-British distribution, Greenland (Holsteinbourg Harbour); various parts of Norway and Sweden, from E. Finmark and Trondhjem to Drobak and Kullaberg.*

Aspidophryxus peltatus, G. O. Sars (Pl. III. fig. 19). Several specimens of this curious crustacean were obtained as parasites on *Erythrops serrata* and *Erythrops elegans* (already recorded), but chiefly on the former. Males appeared to be scarce, and any that were noticed were not adhering to the females, but were each some distance apart, and connected to the female by a slender filament, as shown by the drawing (fig. 19). Rev. Mr Stebbing also identified this species for me.

Copepoda.

A considerable number of copepods have, in addition to those recorded from Loch Fyne, been discovered in various parts of the Clyde area. It is not my intention, however, to record all these at present; that may probably be done more fully later on. Meantime, I only give detailed descriptions of three species that appear to be new to science.

Stenhelia intermedia, sp. n. (Pl. II. figs. 10–21).

Description of the Female.—Length about ·7 mm. ($\frac{1}{28}$th of an inch). Body robust. Antennules eight-jointed; the first four moderately stout and sub-equal; the fifth, sixth, and seventh small, but of nearly equal length, while the end joint is about as long as the fourth joint; the first four joints are together fully twice the entire length of the last four

* *Mon. of the Marine and Fresh-Water Ostracoda of the N. Atlantic and North-Western Europe*, by Drs Brady and Norman (Second Part), p. 656 (1896).

(fig. 11). Antennæ, with secondary branches elongate and slender, three-jointed; the middle joint very small, the other two sub-equal (fig. 13). Mandibles and other mouth organs somewhat similar to those of *Stenhelia hispida*, Brady (figs. 14, 15). The first pair of swimming feet are moderately stout; the inner branches, which are rather longer than the outer, have the first joint equal to nearly twice the entire length of the second and third, which are short and sub-equal; the joints of the outer branches are nearly of equal length, and armed with strong marginal spines; a stout spine springs from both the exterior and interior angles of the second basal joint (fig. 16). The inner branches of the next three pairs are rather shorter than the outer branches; in the fourth pair the outer branches are nearly one and a half times longer than the inner branches (fig. 18). The basal joints of the fifth pair are broadly ovate, and produced interiorly so as to extend to near the extremity of the secondary joints; a short stout seta springs from the distal half of the inner margin of the basal joint, and four setæ from the broad and somewhat truncate apex, the two middle setæ being considerably longer than the others; secondary joints sub-quadrangular, and furnished with five setæ of variable lengths round the distal end (fig. 19). Caudal stylets short, not half the length of the last abdominal segment; the principal seta of each stylet very stout, and somewhat fusiform (fig. 21).

Description of the Male.—The male differs from the female in having the antennules modified to form powerful grasping organs (fig. 12). The inner branches of the second pair of feet are, like those of the males of *Stenhelia ima*, two-jointed, and rather shorter than the outer branches, and are each provided with two stout spine-like terminal appendages (fig. 17). The fifth pair, which are smaller than those of the female, have the basal joint armed interiorly with two stout apical spines; the secondary joint is provided with two stout spines on the inner margin,—the posterior spine being longer than the other; two sub-apical spines exteriorly, one short and one of moderate length, and a moderately long apical seta; three setæ also spring from a small foliaceous appendage on the first abdominal segment, and immediately behind the fifth pair of feet (fig. 20).

Habitat.—Kilbrennan Sound; not very common.

Remarks.—This species is somewhat intermediate between *Stenhelia hispida* and *Stenhelia ima*. It has the stout build of the first, while the structure of the second feet in the male somewhat resembles those of the male of *Stenhelia ima*; but one of the characters which, at a glance, distinguishes this from the other species, is the remarkably stout seta on each of the caudal stylets.

Cletodes tenuipes, sp. n. (Pl. I. figs. 19–27).

Description of the Female.—Length about ·55 mm. ($\frac{1}{45}$th of an inch). Somewhat like *Cletodes propinqua* in general appearance (fig. 19). Antennule small, five-jointed; the second and last joints are longer than the others, but the fourth is very small; the last three joints bear moderately stout setiferous spines (fig. 20). The secondary branches and the antennæ are rudimentary; they are each reduced to a single seta (fig. 21). Mandibles well developed; palp small, one-jointed (fig. 22). Posterior foot-jaws moderately stout (fig. 23). All the swimming feet are slender, especially the inner branches,—those of the fourth pair being almost rudimentary. In the first pair the length of the inner branches is equal to about two-thirds the length of the outer branches; the first joint is very short, but the second is elongate (fig. 24). In the next three pairs the inner branches, which, like those of the first pair, are all two-jointed, are much shorter than the outer branches; those of the fourth pair are very slender, and scarcely half the length of the outer branches; the first joint is very minute, the second is elongate and setiform, and bears a single terminal hair; the outer branches are slender and elongate, and the marginal spines are also slender (fig. 25). In the fifth pair the basal joint is small, interiorly subquadrangular, but produced exteriorly to form the base of a moderately stout seta; an elongate plumose seta springs from the inner angle. Secondary joint narrow suborate, the length being equal to fully three times the width at the broadest part; it is furnished with six setæ, —three on the outer margin, one on the inner margin, and two at the apex (fig. 26). Caudal stylets elongate and narrow, rather longer than the last abdominal segment, and somewhat attenuated towards the distal end. Two small setæ spring from the outer edge of each stylet, and rather nearer the base than the apex. Terminal setæ, two—one small and one elongate (fig. 27).

Habitat.—Near Carradale, Kilbrennan Sound.

Remarks.—The species now described somewhat resembles *Cletodes propinqua*, Brady and Robertson; but the structure and slender form of the swimming feet readily distinguish it from that form, and also from the next. No males were observed.

Cletodes hirsutipes, sp. n. (Pl. I. figs. 11–18).

Description of the Female.—Length about ·6 mm. ($\frac{1}{40}$th of an inch). Somewhat like *Cletodes propinqua* in general appearance (fig. 10). Antennules five-jointed, short; the first three and the last joints sub-equal; the fourth is very small; the second, third, and fourth joints bear several strong spines (fig. 11). The antennæ are provided with short one-jointed secondary branches, each with two setæ (fig. 12). Mandibles rather feeble, armed with about four elongate slender teeth (fig. 13). Both branches of the first four pairs of swimming feet short and stout; the outer branches, three, the inner two, jointed; the inner branches of the first pair are equal to about three-fourths the length of the outer branches, and the end joint is scarcely twice the length of the first joint; both the inner and the outer branches are densely fringed with short hairs (fig. 15). The next three pairs have also both branches fringed with short setæ; in the fourth pair the outer branches are about one and a half times longer than the inner, and the apical setæ are very long and plumose (fig. 16). In the fifth pair the basal joint is produced interiorly, so as to form a narrow and sub-quadrangular lamina, the apex of which reaches beyond the middle of the secondary joint; it is armed with three stout spiniform setæ,—one being at the apex and two near the middle of the inner margin; the secondary joint is narrow oblong, the length being equal to nearly three times the width; the outer margin is densely fringed with hairs, and four spiniform setæ spring from the broadly rounded apex (fig. 17). Caudal stylets, about as long as the last abdominal segment, foliaceus, and somewhat distorted; the inner margin being broadly and obliquely rounded, while there is a slight concavity near the middle of the outer edge (fig. 18).

Habitat.—Kilbrennan Sound, near Carradale; rather scarce.

Remarks.—The structure of the mandibles and the stout and hirsute thoracic feet are characters sufficiently distinct to distinguish this from other British species; the fringe of hairs on the margin of the secondary joints of the fifth pair is frequently so coated with mud as to have the appearance of a continuous brownish-coloured border. No males were observed

SOME PARASITES OF *CALANUS FINMARCHICUS.*

First.

Calanus with (?) *Microniscus calani*, G. O. Sars (Pl. III. fig. 20). The drawing shows a *Microniscus* in situ on a *Calanus*, and this is the position in which I usually find the parasite when it happens to be attached to a *Calanus;* but the parasite is more frequently obtained free than in the position shown by the drawing, through its having, in one way or other, become detached from the copepod.

Second.

Calanus infested by a *Nematode* parasite (Pl. III. fig. 21). This drawing is that of a *Calanus*, bearing internally a *Nematode* parasite much longer than its host. It sometimes happens that a considerable proportion of the *Calani* contained in a tow-net gathering will be found infested by these parasites, while at other times the parasites are rarely observed.

Third.

Calanus with (?) *Infusorian* parasite (Pl. III. fig. 22). This drawing is that of a *Calanus* with an *Infusorian*-like parasite adhering to it. Specimens of *Calanus* are sometimes found with several of these organisms attached to them; the parasites are found adhering to the body of the copepods, to the antennules, to the antennæ, and to other appendages, but usually about the head; sometimes large numbers of *Calanus* will be found infested by these parasites.

All these three parasitic forms have been observed in the Clyde, up as far as the head of Loch Fyne, during the past year.

DESCRIPTION OF THE PLATES.

Plate I.

Delavalia mimica, n. sp.

Fig. 1.	Female, side view, . . .	× 50 diameters
Fig. 2.	Antennule, female, . . .	× 507 ,,
Fig. 3.	Mandible and Palp, . . .	× 507 ,,
Fig. 4.	Posterior foot-jaw, . . .	× 760 ,,
Fig. 5.	Foot of first pair of swimming feet, .	× 380 ,,
Fig. 6.	Foot of fourth pair of swimming feet,.	× 337 ,,
Fig. 7.	Foot of fifth pair of swimming feet, female, ...	× 380 ,,
Fig. 8.	Foot of fifth pair of swimming feet, male, (A) Appendage of first abdominal segment, male, . .	× 380 ,,
Fig. 9.	Last abdominal segments and caudal stylets, ...	× 253 ,,

Cletodes hirsutipes, n. sp.

Fig. 10.	Female, side view, . . .	× 80	diameters.
Fig. 11.	Antennule, ...	× 380	,,
Fig. 12.	Antenna, ...	× 380	,,
Fig. 13.	Mandible and Palp . . .	× 760	,,
Fig. 14.	Posterior foot-jaw, . . .	× 760	,,
Fig. 15.	Foot of first pair of swimming feet, .	× 380	,,
Fig. 16.	Foot of fourth pair of swimming feet,	× 507	,,
Fig. 17.	Foot of fifth pair, female, . .	× 380	,,
Fig. 18.	Last abdominal segments and caudal stylets, ...	× 190	,,

Cletodes tenuipes, n. sp.

Fig. 19.	Female, side view, . . .	× 160	,,
Fig. 20.	Antennule, ...	× 760	,,
Fig. 21.	Antenna, ...	× 760	,,
Fig. 22.	Mandible and Palp, . . .	× 760	,,
Fig. 23.	Posterior foot-jaw, . . .	× 760	,,
Fig. 24.	Foot of first pair of swimming feet, .	× 760	,,
Fig. 25.	Foot of fourth pair of swimming feet,	× 760	,,
Fig. 26.	Foot of fifth pair of swimming feet, .	× 760	,,
Fig. 27.	Last abdominal segments and caudal stylets, ...	× 507	,,

Plate II.

Bradypontius Normani (B. and R.).

Fig. 1.	Foot of first pair of swimming feet, .	× 190	,,
Fig. 2.	Foot of fourth pair of swimming feet,	× 126	,,

Paramisophria cluthæ, n. g. and n. sp. (female).

Fig. 3.	One of the antenna, . . .	× 126	,,
Fig. 4.	Anterior foot-jaw, . . .	× 190	,,
Fig. 5.	Posterior foot-jaw, . . .	× 190	,,
Fig. 6.	Foot of first pair of swimming feet, .	× 190	,,
Fig. 7.	Foot of fourth pair of swimming feet,	× 126	,,
Fig. 8.	Foot of fifth pair of swimming feet, .	× 190	,,

Stephos gyrans (Giesbrecht).

Fig. 9.	Antennule, ...	× 126	,,

Stenhelia intermedia, n. sp.

Fig. 10.	Female, lateral view, . .	× 80	,,
Fig. 11.	Antennule, female, . . .	× 380	,,
Fig. 12.	Antennule, male, . . .	× 380	,,
Fig. 13.	Antenna, ...	× 380	,,
Fig. 14.	Mandible and Palp, . . .	× 380	,,
Fig. 15.	Posterior foot-jaw, . . .	× 380	,,
Fig. 16.	Foot of first pair of swimming feet, .	× 380	,,
Fig. 17.	Foot of second pair of swimming feet, male, ...	× 337	,,

Fig. 18. Foot of fourth pair of swimming feet, × 253 diameters.
Fig. 19. Foot of fifth pair of swimming feet, female, ... × 380 ,,
Fig. 20. Foot of fifth pair of swimming feet, male . . . . × 380 ,,
Fig. 21. Last abdominal segments and caudal stylets, ... × 253 ,,

Plate III.

Bradypontius Normani (B. and R.).

Fig. 1. Female, dorsal view, . . . × 40 ,,
Fig. 2. Male, dorsal view, . . . × 52 ,,
Fig. 3. Antennule, female, . . . × 168 ,,
Fig. 4. Antennule, male, . . . × 126 ,,
Fig. 5. Antenna, ... × 253 ,,
Fig. 6. Mandible, ... × 190 ,,
Fig. 7. Maxilla, ... × 190 ,,
Fig. 8. Anterior foot-jaw, . . . × 190 ,,
Fig. 9. Posterior foot-jaw, . . . × 190 ,,
Fig. 10. Foot of fifth pair, female, . . × 380 ,,
Fig. 11. Appendage of the first abdominal segment (male), . . . × 380 ,,

Hersiliodes littoralis (T. Scott).

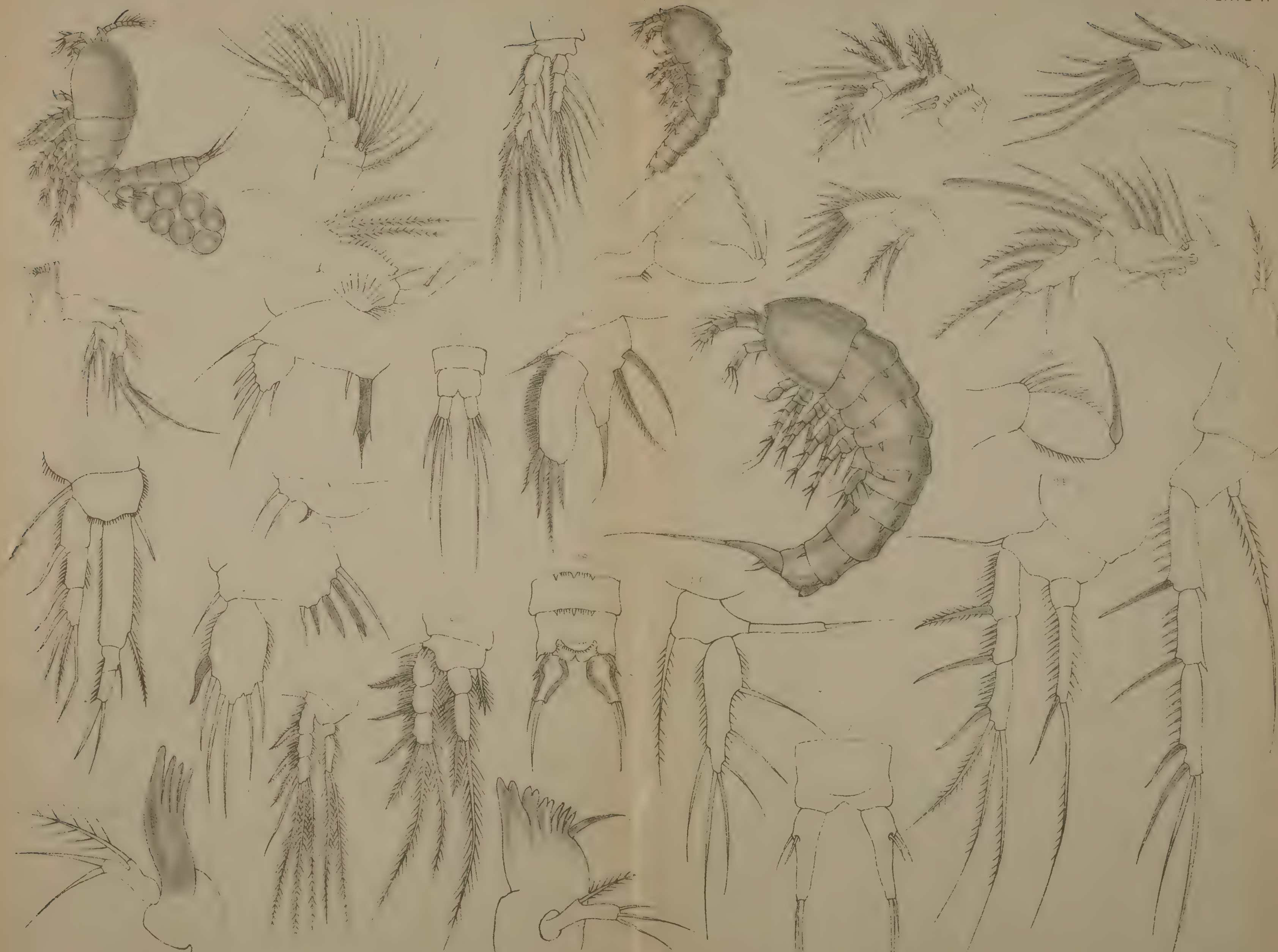
Fig. 12. Female, dorsal view, . . × 67

Paramisophria cluthæ, n. g. and n. sp.

Fig. 13. Female, side view, . . . × 70 ,,
Fig. 14. Antennule, ... × 127 ,,
Fig. 15. Maxilla, ... × 135 ,,
Fig. 16. Last abdominal segments and caudal stylets, ... × 104 ,,

Stephos gyrans (Giesbrecht).

Fig. 17. Female, side view, . . . × 52 ,,
Fig. 18. Foot of fifth pair, . . . × 380 ,,
Fig. 19. *Aspidophryxus peltatus*, G. O. Sars, male and female, . . . × 70 ,,
Fig. 20. *Calanus*, with *Microniscus calani* attached, ... × 35 ,,
Fig. 21. *Calanus*, with parasitic nematode, . × 35 ,,
Fig. 22. *Calanus*, with (?) Infusorian parasite, × 35 ,,



A. Scott *del. ad nat.*

FIGS. 1-9.—*Delavalia mimica*, sp.n.   FIGS. 10-18.—*Cletodes hirsutipes*, sp.n.   FIGS. 19-27.—*Cletodes tenuipes*, sp.n.

A. Scott *del. ad nat.*

FIGS. 1 and 2.—*Bradypontius Normani* (B. & R).

FIGS. 3-8.—*Paramisophria cluthæ*, G. et sp.n.

FIG. 9.—*Stephos gyrans* (Giesb.).

FIGS. 10-21.—*Stenhelia intermedia*, sp.n.

PLATE III.

A. Scott *del. et pinx. ad nat.*

Figs. 1-11.—*Bradypontius Normani* (B. & R.).
Figs. 17 and 18.—*Stephos gyrans* (Giesb.).

Fig. 12.—*Hersiliodes littoralis* (T. Scott)
Fig. 19.—*Aspidophryxus peltatus*, G. O. Sars. (♂ and ♀).

Figs. 13-16.—*Paramisophria cluthæ*, g. et. sp.n.
Figs. 20-22.—*Calanus finmarchicus* with parasites

III.—ON THE REARING OF THE LARVAL AND POST-LARVAL STAGES OF THE PLAICE AND OTHER FLAT-FISHES. By Harald Dannevig (Plate IV.).

The development of the eggs of the common food fishes is now relatively well known, only few species being yet undescribed. It has also been comparatively easy to obtain abundant materials for such studies, as the eggs are easily developed in glass jars or tanks in laboratories. All that is necessary for the maintenance of life in the majority of one or two hundred fish eggs, is to place them in a jar holding from one to three gallons of sea water. When the temperature is kept within reasonable limits, and the water changed perhaps twice a day, the development generally proceeds without difficulty. Within the last twenty or twenty-five years, such studies have been taken up systematically, and many valuable and important papers dealing with the early stages of development have more recently been published by a number of naturalists such as Prof. McIntosh, Mr Holt, Mr J. T. Cunningham, Dr Canu, Dr Pettersen, and others. And not only has the development of the eggs been closely followed, but detailed descriptions and drawings have also been given of the various stages of the young larvæ from the moment of hatching till the absorption of the yolk has been completed. The larvæ, during the time they are nourished from the yolk, merely require for their well-being protection and change of water, both of which are easily provided.

As the whole of the development from the impregnated egg till the end of the larval stage, when the yolk is all absorbed, has been studied from specimens kept in confinement, it has also been possible to ascertain the rate of development, always knowing the age of the egg or larva in question.*

It has, therefore, naturally been much desired by naturalists to be able to retain in confinement such young larval fish also after the absorption of the yolk in order to follow up the post-larval stages, so that the later part of the development could be studied as closely and accurately as the previous part. This has been so much the more desirable, as it is often very difficult to distinguish definitely between closely related species that occasionally are captured in tow-nets; and even, when the distinction has been possible, the age is unknown, and can only be given approximately.

But, as far as I have been able to ascertain, no experiment of this kind has hitherto succeeded, though most investigators have probably made one or more attempts. Dr C. G. Joh. Petersen, indeed, has stated that "At the pelagic stage, after the yolk has been absorbed (what I have called the post-larval stage), it (the plaice) cannot be kept in aquariums."† It may, therefore, be of interest to describe in detail the arrangements by which I succeeded in rearing plaice during the summer of 1896.‡

* It has been found that the larger fish eggs take longer time in hatching, and their larvæ a longer time in the absorption of the yolk than eggs and larvæ of a smaller size; and it has also been shown experimentally, that the rate of development of egg and larva is much influenced by the temperature. See my paper on "The Influence of the Temperature on the Development of Fish eggs." *Thirteenth Annual Report.* Part III., page 147. 1895.

† *Report of the Danish Biological Station,* Part IV., 1893, page 14.

‡ I am greatly indebted to Dr Fulton, the Scientific Superintendent of the Board for procuring for me the required literature, and for valuable advice relating to this paper, and I have also got to thank Mr Scott, Naturalist to the Board, who kindly identified the various forms of molluscs and crustaceans that I had drawn or preserved of the food materials; the diatoms were identified by Prof. Cleve of Upsala.

As already mentioned, artificial rearing of the post-larval fishes is of great interest from the scientific point of view, for there is a gap in our knowledge between the larval and adult stage of common fishes, which only in a few cases is partly bridged over. But it is also of interest for practical purposes in connection with the hatching and rearing of food fishes, and will, no doubt, in the future become much more important. It became desirable in 1885 at the Marine Hatchery at Flöderig to undertake an experiment to clearly show the vitality of artificially produced cod fry. A large tank was constructed on shore, into which cod fry from the hatchery was placed in the spring, and most of the young fishes survived the following winter. Some of them at that time had a size of about 10 to 12 inches; others were smaller. This experiment, which was carried out by Capt. G. M. Dannevig, the director of that Hatchery, is described in the annual report of that institution.* It is perhaps, the only one of its kind on a large scale, where the young fry could find suitable conditions for growth and development, and the only case, as pointed out by Mr. Cunningham,† in which larvæ artificially hatched from marine pelagic fish eggs have been successfully reared in captivity; the success he attributed to the fact that the young fry were turned into a large reservoir of clean sea water.

Later, Cunningham described rearing experiments that he undertook in the spring of 1894,‡ with whiting, flounder, and plaice. The fry were kept in a tank in the laboratory; it would seem that the two former species soon disappeared, while the yolk was absorbed in the plaice larvæ after the elapse of five days, when the fry began to feed. They soon died, however, without having undergone any important change in development. In another experiment he succeeded so far that two larvæ were found alive, thirty-seven days after the yolk had been absorbed; but it appears that the advance in development, also in this case, was very small. In the first experiment the yolk was absorbed in so short a time, that it is clear the temperature must have been high, probably at least about 12° C. or thereabout, and there is little reason to think the water became remarkably colder soon after. But then those two specimens that were left at an age of thirty-two days, ought, according to the results of my experiment this year, to have been far advanced in development, and signs of the transformation should have been visible. When such was not the case, the explanation can only be that one thing or another in connection with Cunningham's arrangements were unfavourable to the fry. The majority had died previously, and the two specimens left must have been in an abnormal condition. I have taken notice of this here, as the results of the above experiments partly correspond with what I experienced in the same season (1894). (*Twelfth Annual Report of Fishery Board for* 1895, part iii. p. 216.)

Experimenting at the same time, we both followed much the same system, trying filtered and unfiltered water in succession, and always maintaining a *constant current*, and we both sought for the food chiefly in tow-net collections. Our success was also much about the same, a few individuals being kept alive for a considerable length of time; but the advance in development that these reached was very small. Although these experiments were advances, and in the right direction, it was evident that something of importance was lacking with the arrangements, that accounted for the sickly and abnormal state of the fry.

* *Beretning for femaaret*, 1883-88. Arendal, 1889. *5th Annual Report Fishery Board*, Part III. 1886.

† *Jour. Marine Biological Ass., New Series*, vol. ii., No. 3, May. 1892.

‡ *Jour. Marine Biological Ass., New Series*, vol. iii. No. 3.

Below I shall mention what should principally be considered in rearing experiments with larvæ from pelagic fish eggs. It seems strange that a fish in the post-larval stage should be so difficult to keep in confinement, while the preceding and following stages offer no difficulty. It has been said, but without good foundation, that the difficulty lies in the supply of food alone and sufficient currents of water; but it will be shown later that the question of water is rather secondary, and that the food can be procured without the least trouble. In fact, when the water for the rearing-jar or tank is taken direct from the sea, it is difficult to avoid having forms of suitable food present. But the quantity of food would have to be increased artificially according to the number of larvæ present. The principal points are—(1) The water arrangements; (2) The question of light; (3) The temperature; and (4) The food.

An important point is the question whether or not a constant current of water should be employed. A stop was put to my most successful experiment in 1894 by an overflow carrying away the fry, which were all lost. This time, therefore, I thought that the constant current of water through the jar might be avoided. It is doubtful whether the passing of perhaps ten or twenty times more water through the jar than is necessary for the fry is of any use—a small number of larval fishes, such as are yet nourished by the yolk, will thrive in a small quantity of water for days, providing the air is not artificially forced out by an increased temperature. And the same is the case with young flat-fishes after they have passed the transformation. So it is difficult to see why similar circumstances should not suit this intermediate post-larval stage equally well. The constant current is clearly not necessary for the supply of air. In a hot season a constant run of cold, perhaps artificially cooled water, would be a means of keeping the temperature down as desired; but this may be done equally well by less injurious precautions.

There is now left the third point, that may be put forward in support of the necessity of the constant water supply, namely, *that the regular current has always been found to increase the activity of the fry.* This is undoubtedly so; the fry are always found more 'vivid' in appearance when the water is in movement, than when quiet. In the hatching-boxes, a certain amount of current is always found satisfactory and necessary for the welldoing of the fry. But it is to be remembered that a great number (perhaps a quarter of a million or more) of newly-hatched larvæ in this case are crushed into the narrow capacity of about one cubic foot of water. And as these fry, at this early stage, are nursed from the yolk and therefore take no active part in feeding, no attention can be derived from the latter in the perpetual activity on the part of the fry when striving against the constant currents. These, again, are of great advantage in preventing the fry from accumulating in great crowds, which naturally prove fatal to a great number of them; they are simply suffocated in the crush. And the perfect condition of the fry when turned out from the hatchery shows, that this exposure to the currents in the apparatus has done no harm. In a rearing experiment such crowding can be avoided, and matters are different as the young larva has then got to look for and catch its own food. When a constant circulation is maintained in a small jar, the small organisms which the larvæ require for nourishment are sure to be pressed against the outlet side, and thus be drawn away from the attention of the larvæ.

But I have found that a *slight movement* in the water, whether constant or not, is desirable, as it will always increase the activity amongst food organisms that otherwise remain quiet. Such a movement may easily be arranged artificially.

During my experiment last summer, I obtained most satisfactory movements in the water through the effect of variations in the temperature of the surrounding air. [See description of the arrangements.]

Another point in connection with the water supply is the filtration, which, if thoroughly applied, will remove, perhaps, all organic and inorganic matters, leaving the water as a pure and simple solution of salts. There may be no harm in this when food is put in artificially, and it certainly offers conveniences in several ways. But for rearing purposes I find that unfiltered water that is relatively free from decomposing organic substances is all that is wanted.

The answer to the question whether the presence of abundant light or occasional exposure to the direct rays of the sun is of importance to the development of larval and post-larval fish produced from pelagic eggs is given by nature herself. In the sea the eggs of a plaice, for instance, are developed near the surface in full exposure to the daylight. The larval stage (during the absorption of the yolk) is also passed much in the same level, and though the post-larval fish may occasionally be found at a greater depth, I think I am safe in saying that this stage should also be called a pelagic one. And since this early development is accomplished by nature in the full light of day, it would be a simple waste of energy even to attempt a rearing experiment in a dull or much shadowed place in a laboratory.

In accordance with this, it is a long recognized fact in hatcheries that such apparatus give by far the best result that are most abundantly supplied with light. The presence of abundant light is of importance for the well-doing of the larvæ directly, and it also has a marked effect upon the minute organisms that compose their food; but experiments are still required to show to what extent a dull light would be effective.

It is well known that a high temperature increases the rate of growth of the embryonic and larval fish, and it is therefore only reasonable to suppose that the chances of success in a rearing experiment with the post-larval stage would be increased relatively as the time was shortened. And we know that eggs and young larvæ are also able to resist considerable changes in the temperature. But this, of course, is limited; and it must be remembered that in a rearing experiment the circumstances have also to be made suitable for the living food. The various species of food fishes will here appear more or less different, so it will be necessary to experiment with each of them separately in order to be able to give even approximate figures for the most suitable temperatures. With the plaice I found it risky to allow the temperature to rise above 16°C when dealing with the post-larval stage, while it is known that the same fish, after the transformation has taken place, will thrive well in much hotter water.

What has now been said respecting the water supply, the influence of light and a high temperature on the success of rearing experiments on a small scale, is also proved by the success of my experiments in 1896, of which I shall now give an account. The question of food can then be more conveniently dealt with.

The apparatus and arrangements employed for the rearing experiment were very simple. As a rearing-jar, a large carboy-shaped glass vessel was used, with a diameter of 20 inches; it was a little flattened at the bottom, and 18 inches deep; the opening of the neck was 9 inches. This vessel or jar was placed in a shallow tub, filled with sand, so that its bottom was evenly supported all round to a height of about three or four inches, and it was placed at a height of about two feet above the floor, near a corner, having a window on each side four feet distant from the jar; one window faced to north and the other to east. Light was supplied from the back through more distant windows in the hatchery. The supply of light was therefore good, and any part could in the daytime be closely examined without interfering with the fry.

The water supply was taken direct from the harbour, and was in no case filtered. Heavy sediment, bits of sea-weed, etc., were easily separated out. The jar was filled to a height of about ten inches, or a little above the middle, and would contain about ten gallons. The water was generally renewed once a day, or twice, if the weather was hot, in order to prevent the temperature rising too high, which was injurious to the fry and the living food.

There were therefore no currents similar to those produced by a constant run, but all the same the water in the jar was perhaps never at rest. During most part of the day the temperature of the water was kept below that of the surrounding air. The consequence was, that the glass sides got heated first, and transferred this heat to the nearest layer of water. This would expand as its temperature increased, and consequently rise to the top, being always replaced with water from the lower and inner parts of the jar, where the temperature was lower. This led to a constant movement upwards of the water nearest the glass sides in the daytime, and it was particularly vivid when the sun-rays were allowed to strike the jar.

On the 6th of May the first experiment was begun when plaice larvæ, eight days old, which had just absorbed the yolk, were placed in the rearing jar. Natural food was provided by tow-net collections from the harbour, containing small organisms that were likely to suit. Some of the larvæ soon began to feed. When they were sixteen days old it was necessary for me to leave the station, and on my return I found the larvæ all dead ; food had been properly supplied during my absence, and I am inclined to think that an excessively high temperature was the cause of death. During the sixteen days, a few of the larvæ had attained a considerable size and advance in development, as will be seen from Pl. IV. fig. 2.

Though the larvæ died, this first attempt was encouraging, and gave good prospect of success, and another hatch was started soon after with the same arrangements. The plaice eggs had been artificially fertilized on April 28th, and hatched on the 9th to the 11th May. Most of the larvæ had the yolk absorbed on the 18th, when they were placed in the rearing jar. Tow-net collections from the harbour were supplied twice a day, and the water was at first changed at the same time. About 1200 larvæ were put into the jar, and they soon divided themselves into three different classes:—(1) the majority remained persistently swimming near the surface, with the head touching the waterline and the body forming an angle with the latter of from 30° to 45°.

These larvæ paid no attention to the food,—if they touched against anything they would swim frightened away, and showed more activity than ever. Though originally richly pigmented (which I consider a sign of well-doing), they gradually became pale, and, giving up this first-mentioned peculiarity, they soon joined the second class, (2) pale and thin individuals, that occasionally made an attempt to catch small crustaceans that appeared near them. They generally remained very quiet, and were mostly near to, or on, the bottom, resting on their head ; in all cases their head was inclined to drop downwards as soon as the body was at rest.*

* This, I think, is an old experience amongst investigators on this subject, but has been explained differently. Guided by an experiment, I suggested in 1894 [*F. B.* 12*th An. Rep.*, *Part III.*, *page* 216], that this sickly state of the fry with the above-mentioned tendencies, was due to want of currents ; and later Prof. McIntosh

Larvæ of this second class are in reality in an unhealthy condition, and I have never found any food in their stomachs.

I am not yet certain, but there is reason to think that these two classes of larvæ in reality had been starving while in the hatching apparatus, where they perhaps were retained rather long.

(3) The third class of fry in the rearing jar formed the minority ; they had a healthy appearance, and were richly pigmented. They were seen at all levels, as a rule swimming slowly, and were always looking for food. This they did so intently that hardly any object in the water was passed unobserved.

Tenth to Fifteenth day after Hatching.

Though appearing at all parts of the jar, these feeding larvæ were chiefly found in places where the living food most accumulated, viz. : at the side nearest the w ndow, where the light was strongest. The food, as mentioned, consisted of tow-net collections from the surface of the harbour, taken at all states of the tide. These collections varied in richness, according to the weather, but I never failed to get multitudes of diatoms, larval and adult crustaceans (chiefly copepoda), and larval mollusks, etc.

Although the feeding fry pay attention to perhaps anything suspended in the water, living or dead, only few forms were eaten at the time. The first food found in their stomachs was as follows :—(1) Diatoms (*Guinardia flaccida*), a commonly occurring form ; (2) A small larval mollusk (*Buccinum* ?), measuring 0·16 mm. in length and 0·112 mm. in breadth (Pl. I. fig. 11). The mollusk was found three or four times more frequently than the diatoms, and it is noteworthy that I in no case found both forms in the same specimen at the same time. However well filled the stomach was, its contents in this earliest post-larval stage were almost without exception one thing only. It seemed as if the young fish had become familiar with one particular kind of food, and took that alone for some time. But as different individuals fix upon different forms, there is no reason to conclude that one kind of food alone was of vital importance.

The larval stage of the plaice (from the time of hatching till the yolk is absorbed)* has been described by several authors ; M'Intosh and Prince,† Cunningham,‡ Fullarton,§ Ehrenbaum,‖ and others.

There is some difference between the various authors in respect to the size of the plaice at the end of the larval stage, due no doubt to the variation in the size of the egg, and my observations are in near correspondance with those of Ebenbaum ; he gives the average size at the end of the larval stage as 7·5 mm., or slightly more ; while I have found the average size of this stage to be 7·2 mm., while specimens are frequently found that measure 7·5 mm.

expressed the same view with reference to larval turbot [*F. B 13th An. Rep., Part III., page* 229]. This appears to be the case during the first few days of the post-larval stage, to which the experiments were confined ; but I now doubt whether this somewhat artificially produced activity will ever prove beneficial to the rearing fry.

* While Cunningham, and lately Ehrenbaum, apply the term 'larvæ' to the young fish, from the moment of hatching till it has acquired the form and habit of the adult, M'Intosh has divided this period into two stages—the larval, from hatching till the absorption of the yolk is completed, and post-larval, from this time till the adult form appears. The latter is at least the most definite, and has been followed in this paper.

† *Trans. Roy. Soc. Edin.*, vol. xxxv. part iii., 1887–88, p. 840.

‡ *Trans. Roy. Soc. Edin.*, vol. xxxiii. part i., 1887, p. 92.

§ *Ninth Annual Report of Fishery Board*, part iii. 1890, p. 311.

‖ *Eier und Larven von Fischen der deutschen Bucht.* Keil and Leipzig, 1897.

The general characters at the end of the larval stage of the plaice may be summed up as follows :—The larvæ is large, compared with others originating from pelagic eggs ; the eyes prominent, with a golden lustre (in reflected light) ; embryonic fin broad, with slight black pigment spots on the ventral side ; pectorals large ; and the gut, which at the time of hatching, forms a single lobe, is now divided into two parts, of which the foremost or middle gut is forming a single sling. This is more complete and distinct a few days later. The general pigmentation *of the larva* is bright yellow, with a few black spots, particularly on the ventral side. Cunningham mentions three rows of pigment along the body ; these are more prominent later. These characters remain nearly unchanged during the first seven days of the post-larval stage ; the chief difference being a rapid growth of the pectorals, and an increase of black pigment, which has now become stellated, particularly in the lateral line of the body ; and the pigmentation in general has spread more to the embryonic fin.

Sixteenth to Twentieth day after Hatching.

The active larvæ that first appeared at the surface, had in this period begun to quieten, got paler in pigmentation, more inclined to rest with the head downwards, and some of them died.

Those, again, that had been feeding from the beginning continued to do so ; they were always actively in search for food, which they captured with great voracity. Having discovered a prey, the larvæ would approach it slowly to within 1 or 1·5 mm., when it would contract its body laterally, forming part of an S, and then suddenly throw itself forward, catching the object instantly. Another form of larval mollusk was now commonly seen in the stomachs, a little larger than the one first mentioned (fig. 12). The stomach of fig. 1 shows how greedily this specimen had been feeding on this particular form. The young larvæ were often seen to catch various forms of larval crustaceans ; these, however, were not found in the stomachs at this period, so they had not been swallowed. Often I had an opportunity of observing how well armed forms were captured and then again rejected with violence.

At the end of this period most of those larvæ had died, that from the beginning showed the mentioned peculiar symptoms and never took food ; while the mortality amongst the feeding ones was very low.

On the 17th day the average length of three specimens was 7·40 mm., and the average breadth of same 1·44 mm. On the nineteenth day I found one specimen 8·00 mm. long and 1·52 mm. broad (measured just behind the gut). The difference from the previous period consists chiefly in a further increase in the black stellate pigment, which has now spread more evenly over the body, partly covering the original yellow pigmentation ; the appearance of the larvæ now is therefore a faint yellow-greyish colour. Only a few black pigment spots are seen on the dorsal marginal fin, while the ventral part of the body and fin is reachly covered with them ; very prominent is a row of black stellate pigment, which extends ventrally from near the snout backwards, along the abdomen and the edge of the marginal fin ; it extends over four-fifths of the length of the whole fish. Anterior to the posterior end of this pigment row is noticed an even development in breadth and thickness of the body, which now appears denser than before ; the posterior portion has remained thin, and a distinct narrow or tapering is therefore now formed on the body at this place.

The tail has remained unchanged (homocerc), and there is no appearance of fin rays.

The eyes are radiant and with a bright silvery hue, which makes them very prominent. Most of the vertebræ are now distinct and the clavicular bones prominent.

Twenty-first to Twenty-fifth day.

When changing, the old water in the jar was removed by means of a syphon; to the end of this was fixed a large glass filler, across the opening of which was tied a piece of fine cloth, so that food or fry should not be carried away. The latter remained in the jar constantly, and some water would therefore always be left each time. And while the upper part of the glass sides could be properly cleaned daily, the bottom had gradually become covered with accumulating sediment from the tow-nettings. In this sediment was soon gathered a great number of crustaceans and larval molluscs, and during this period the fry were frequently found at or near the bottom, though they were never seen resting on the latter.

Now I also found that the larvæ took a greater variety of food, the addition chiefly consisting in minute larval forms of crustaceans. It was difficult to come across well-preserved specimens without killing larger numbers of larvæ than was advisable at the time, but I have figured some forms as they appeared in the stomach of the living fish (figs. 13 and 14). I mentioned that during the previous stage the larvæ often caught hold of well-armed (and sometimes rather large) forms of crustaceans, which they could not swallow. During this period this was especially the case with *Evadne Nordmanni* (fig. 15), and a similar form, *Podon polyphemoides*, the former particularly being very abundant at that time. I often observed how a fish would repeatedly catch hold of one of those and give it away again. But, with perhaps rare exceptions, I never found remains of these forms amongst the food till in the next period.

While feeding chiefly on larval molluscs in the early stages, the stomachs of the young larvæ had a dense and sometimes slightly pale yellowish appearance. Later this colour became more vivid, and changed into dark brown, when the fry began to feed more freely on crustaceans.

During this period all those larvæ had died that did not take food from the beginning, while the others were constantly in search for food. It may be noticed that the latter, during the whole post-larval stage, moved about evenly and in a horizontal position.

At the end of this period, the 25th day after hatching, the average size of the larvæ was 7·84 mm. long and 1·6 mm. broad. The growth, as will be seen, was still small, but relatively largest in breadth. This gave the fish a stronger and more vigorous appearance.

The black stellate pigmentation had still increased, and spread more evenly over the marginal fins, though richest on the ventral part. The posterior extremity of the tail is still pigment free, but this portion has now been shortened from one-fifth to about one-seventh of the length of the larvæ, and the tail is losing its original homocerc character, as the end of the spine is slightly bent upwards. On the ventral side of this partly heterocerc tail are seen a few radiant elevated lines—the first formation of caudal fin rays (compare fig. 2.)

26th to 30th day.

During this period the majority of the larvæ were feeding near the bottom; only a few had remained all the time at the higher level, and were easily distinguished from the rest by the light colouration of their food.

It was first now that the larvæ were able to cope with *Evadne*, which soon became *the principal food.* It was not, however, so easily determined what crustacean those remains originated from which I found in the stomachs. I have figured some forms of them (fig. 16) just as they appeared after being spread out under a cover-glass. Amongst the bundles of small limbs and spines there were invariably patches of a black substance, which apparently had not been influenced by the digestive process in the fish. Through experiments with *Evadne* I found that its large 'black eye' took such an appearance, and was further satisfied in the identification by closer comparison of the limbs.

The larger part of the body of *Evadne* is almost transparent, but denser than the water, so that the light is refracted when passing it; this gives the crustacean a great resemblance to a glass-bowl or an air-bubble; and it is here of interest to remember my observation on the plaice larvæ in 1894 (*Twelfth Annual Report, Fishery Board*, Part III., p. 216).

Air had been forced into the water artificially, and minute bubbles that had been retained in the water were swallowed by the young fishes to such an extent that the accumulated air in the stomach ultimately killed such individuals. The same air-bubble-like part of *Evadne* seems to be readily digested in the stomachs of the post-larval plaice, as I always failed to see remains of it amongst the food.

Another form of molluscs was also common now amongst the food, namely, larval *Scrobicularia alba* (fig. 17), of which four to six specimens were sometimes found in one stomach. Of additional forms of crustaceans, I observed a copepoda, *Calanus finmarchicus.*

On the 30th day an average specimen measures 9·40 mm. in length and 1·91 mm. in breadth. The increase in size during this period was therefore greater than in any previous period; and the general development of the larvæ had also proceeded more rapidly than before.

Most noticeable was the increased number of caudal fin-rays, which had also appeared on the dorsal part of the now much more heterocercal-tail. About one dozen spinal processes had developed ventrally on the posterior half of the spine, and a few more on the dorsal side. No rays were yet seen in the marginal fins. The yellow pigment was chiefly confined to a row or line following the base of the dorsal marginal fins, while the latter had got a broad line of black stellate pigment along the edge on its posterior half. The lateral line was now also prominently marked with black pigment, while the latter as before was richest on the ventral side of the body and on the ventral fin. A few brick-red pigment corpuscles had appeared along the base of the marginal fins.

31*st to* 35*th day.*

The fry were now mostly all feeding at the bottom amongst the constantly increasing quantity of living and dead organisms, and the contents of the stomachs were coloured brown or black. It is difficult to say whether the larvæ took any dead food at all, or adhered to such alone that was alive. There is reason to believe that living food is the most natural for them, or at least suitable, judging from the smartness and ability exhibited on the part of the fry in pursuing quickly moving forms, and considering circumstances in the sea, where the post-larval stage is supposed to be spent in the higher levels, at least away from the bottom, dead forms of crustaceans, etc., will seldom be met with in nature. But while living forms appear the most natural, I would consider it quite possible that the larvæ could be reared successfully on dead matters of a more or less artificial origin.

New forms of food were occasionally observed; of larval molluscs, I have figured two specimens, which to all appearance were larval *Gastropods* (figs. 18 and 19). A new crustacean was also now seen in the stomachs (fig. 20), but from the best preserved specimen which is figured, it is difficult to recognize the species. There is reason to think it is also a larval form.

The more rapid progress in development that was observed in the previous period was continued during this, and, if anything, increased.

An average sample measured 9·64 mm. in length, and 2·16 mm. in breadth. The latter increase shows how the larvæ were now gradually getting broader compared with the length (fig. 3).

The posterior extremity of the spine had now begun to decrease in size and bend more upwards (dorsally), while the ventral portions of the tail had been much broadened.

The number of cordal spines had much increased, and dorsal and ventral fin-rays were present. The position of the stomach was changed, as the sling of the mid-gut had developed more in dorsal and ventral direction than posteriorly. The anus was therefore now situated relatively more anterior than in the earlier stages.

The left eye appeared at this time in a more anterior and dorsal position than the right, but the larvæ showed no other sign of transformation. The pigmentation was of a fainter appearance than in the previous stage; a large number of brick-red spots were scattered evenly over the body and mixed with the black pigment, but it had not appeared on the fins. The black pigment alone extended over the caudal fin.

36*th to* 40*th day.*

I have mentioned already how deposit from the tow-nettings had accumulated at the bottom of the jar, and that the larval plaice found abundant food there. By this time young jellyfish occurred in the tow-nettings, and some had been allowed into the jar. They ultimately died, and sank to the bottom where they decomposed. The consequence was that some larvæ, in one way or another, got such matters amongst their food and were quickly killed; I lost several good specimens in this way before this deposit could be removed. The *Evadne* continued as one of the principal forms of food; in fact, I never found a larvæ without it at this time. In the gut of one specimen I counted remains of five, while the stomach itself contained many more. Such was also the case with *Scrobicularia alba*, though not quite to the same extent. Additional forms, however, were often seen. I have figured another larval crustacean (fig. 23) which has not been identified. Of recognisable forms I now commonly found amongst the food the following copepoda :—*Temora longicornis* (Müller), *Centropages hamatus*, *Acartia longiremis* (Lilljeborg). At the end of this period the measurements along a central line were as follows on an average-sized specimen (fig. 4) :—

From the tip of the snout to the clavicular bones, . .	2·32 mm.
From the claviculæ to a vertical line touching the posterior curve of the gut, ...	1·92 mm.
From this line to the root of the tail, ...	5·20 mm.
The length of the tail, ...	1·52 mm.
Total length of larvæ, ...	10·96 mm.

The breadth of this specimen across the stomach was 3·56 mm., while a breadth of 3·76 mm. was measured more posteriorly. The left eye had now advanced further upwards, so that, when viewed laterally, the pupil was seen on a level with the dorsal outline of the skull. The rays in the dorsal and ventral marginal fins had become more prominent and were developed to the edges of the fins, while the tail had again attained a homocercal appearance—the urostyle being bent almost vertical dorsally. The pigmentation on the marginal fins was now arranged in radial lines from the edges, while black stellate spots formed a prominent line along the root of the same fins posteriorly. This was particularly prominent on the ventral side, where the line extended from the gut to the root of the tail. Radiant lines of black pigment were also present on the caudal fin.

41*st to* 45*th day.*

The following measurements are from a specimen forty-two days old (second day of the present period, fig. 5):—

From tip of the snout to the clavicular bones, . .	3·04 mm.
From these bones to a vertical line from the posterior curve of the gut, ...	1·84 mm.
From this line to the root of the tail, ...	5·92 mm.
Length of the tail, ...	1·60 mm.
Length of the larvæ, ...	12·40 mm.

The greatest breadth was 4·80 mm. In this specimen the left eye had reached the dorsal edge of the skull, and the pupil was directed horizontally or slightly upwards. The dorsal fin had not yet reached the eye. A few teeth were present on the mandibular bone, and a projecting fold showed the developing pelvic fins. This specimen had been resting flat on the bottom for the last twenty-four hours, and its post-larval stage had therefore now come to an end. Only a little pigment was visible on the left side, while on the right side it had become more systematically arranged. Four spots or patches of black stellate pigment were seen on the body near the root of the dorsal fin, and a fifth was developing in the same line near the tail. Two similar pigment patches were present on the middle of the body—the anterior just behind the stomach, and a posterior half-way between the former and the root of the tail.

On the 45th day an average specimen (fig. 9), which had been on the bottom for three or four days, had the following dimensions:—

From tip of the snout to the clavicular bones, ...	4·0 mm.
From these bones to a vertical line touching the posterior curve of the gut, ...	2·08 mm.
From this line to the root of the tail, ...	5·60 mm.
The tail, ...	2·08 mm.
Length of larvæ, ...	13·76 mm.
Greatest breadth, ...	6·40 mm.

Beside this increase in size, the most noticeable difference from the last specimen described was an increase in minute pigment spots, evenly spread over the right side of the body and fins. The left eye had passed the dorsal line, but had not yet reached its future position. The marginal (dorsal) fin was now in a line with the left eye, which was somewhat nearer the tip of the snout than the right. There was no noticeable advance in development of the pelvic fins.

The post-larval plaice remained swimming on the edge vertically till the left eye had begun to move upwards. After that time the body took a more and more sloping position as the eye approached the edge, and *it appeared as if the right and left eye were always kept on a horizontal level with one another.* As far as I could ascertain, the duration of this transformation or change from vertical to horizontal position of the body did not exceed three days and a half.

In Table I. is summed up some of the principal features during the post-larval development that have been recorded in the previous pages. It must be observed that all measurements are taken from what was considered an average specimen at the different times, and as these were subsequently preserved, I had not an opportunity of following one single larva all through its development till the transformation took place.

The average time that elapsed from the hatching till the transformation is given = 41 days from my experiment, but the duration of the post-larval stage varied considerably. The shortest time recorded was 37, and the longest 48 days. [This is respectively 29 and 40 days after the yolk had been absorbed.]

Though brought up under somewhat artificial conditions, I find that the size of my larvæ in the transformation stage corresponds with Petersen's (*l. c.*, 93, p. 126) observations made on the Danish east coast from specimens captured in the sea. He gives the average size at the termination of the post-larval stage as 10 to 11 mm. It appears that Holt (*l. c.*, p. 76–79) on the Irish coast found plaice in the transformation stage of a similar size as mine, or slightly longer (10 to 13 mm.), while Ehrenbaum (*l. c.*, p. 265) has recorded post-larval forms measuring from 13 to 17 mm., with the eye still looking to the left. Ehrenbaum's observations were made on specimens captured near Heligoland. The smallest sized plaice that he found on the bottom measured 13·8 mm.

From Table I. it will be seen that the larvæ increased little in size during the first 18 days after the yolk had been absorbed, though they were taking abundant food, and no great changes of appearance were observable during this period. It is noteworthy that just this period appeared the most difficult for them to pass. But as soon as the skeleton began to develop, an increase in growth, and particularly in breadth, took place, and the latter was especially noticeable during the transformation. I have observed that the plaice grows very quickly soon after it has become stationary on the bottom; and this seems natural, as this flat-fish spends its early life on the shallow sandy beaches, where the temperature of the water is often very high.

Before closing this chapter it may be of interest to review the records of food already given under the various periods into which the post-larval stage has been divided. As will be seen, diatoms were eaten by some larvæ during the first days of this stage, while a greater number at once began to feed on larval molluscs. Whether these had previously been feeding on diatoms, and were eaten by the fry for the sake of the latter, I cannot say, but do not think it at all probable. It was clear that the living diatoms played a comparatively small part as an article of nourishment to the larvæ, much less than what has generally been anticipated.* From the records it will also appear that relatively few forms of organisms were eaten of the many present.

The single individuals seemed to confine themselves to one or two forms at the time, particularly in the early stages, and this was repeatedly

* Ehrenbaum (*l. c.*, p. 266), found remains of diatoms (*Coscinodiscus* sp.), and afterwards remains of copepoda in some stomachs from plaice, in the later part of the post-larval stage. These larvæ had been captured in the sea.

proved from the contents of many stomachs that were examined. It was clear that the larvæ had been selecting their food, and I had also the opportunity to ascertain that the motive for doing so was not a question of size alone. Infusoria, for instance, occurred in abundance, but were never found in any stomach.

In the later part of the post-larval stage, when the larvæ were relatively large, a greater variety in their food was observed. The records show how various adult copepoda were then eaten, together with the larval molluscs.

TABLE I.—Showing some Features of the Post-larval Development of the Plaice.

Date.	Age in days after hatching.	Average length.	Average breadth.	General Features.
		mm.	mm.	
May 18th.	8	7·20	—	Larvæ symmetrical; tail homocerc; no fin-rays; yolk absorbed.
May 25th.	15	—	—	Larvæ symmetrical; tail homocerc; no fin-rays.
May 27th.	17	7·40	1·44	Larvæ symmetrical; tail homocerc; no fin-rays (fig. 1).
May 30th.	20	7·44	1·44	Larvæ symmetrical; tail homocerc; no fin-rays.
June 7th.	25	7·84	1·60	Larvæ symmetrical; tail slightly heterocerc; first appearance of caudal fin-rays (compare fig. 2).
June 9th.	30	9·40	1·92	Larvæ symmetrical; tail heterocerc; increased number of caudal fin-rays; first appearance of caudal spines.
June 14th.	35	9·64	2·16	Left eye has got a more anterior and dorsal position; increased number of caudal spines, and first appearance of rays in dorsal and ventral fin; tail heterocerc (fig. 3).
June 19th.	40	10·96	3·76	Left eye near dorsal edge of the skull; rays in the marginal fins further developed; tail again homocerc (fig 4).
June 21st.	42	12·40	4·80	Left eye on the edge of the skull; first appearance of pelvic fins; larvæ remains permanently on the bottom; a few teeth are present (fig. 5)
June 24th.	45	13·76	6·40	Left eye has passed the edge, and the dorsal fin is in line with the posterior edge of the latter (fig. 9).

Remarks on the Egg, Larva, and Post-Larva of Turbot, and on the Larval and Post-Larval Lemon Sole.

The turbot being such a valuable food-fish, great attention has been devoted to the study of its early development. But somehow or other it has been difficult to obtain the necessary materials (viz., impregnated eggs), as this flat-fish spawns on the offshore banks at a considerable depth. Several forms of eggs, obtained in tow-nets, were successively described as those of the turbot, the misleading features being chiefly the correspondence in size with such eggs that were found in the ovaries of ripe turbot.

On board a north sea trawler, Holt succeeded in getting turbot eggs that had been fertilised artificially, and he was thus able to give the first description of the development of this egg and its larva (*Jour. Marine Biol. Ass.*, vol. ii. p. 399).

Later (in 1893) Canu * obtained turbot eggs on the French coast, and was able to supplement Holt's records.

In 1895 M'Intosh † described the development of the turbot egg, and particularly the larvæ, of which some very fine coloured drawings were given.

Ehrenbaum ‡ has later described and figured the turbot eggs and larvæ at Heligoland Marine Station.

It was first observed by Holt, and later by Canu, that the turbot egg sinks to the bottom when the embryo is formed. I have found the same peculiarity with eggs dealt with at this station, and I am able to supplement the mere statements already referred to by records of some observations that I made on eggs while developing in the hatching apparatus.

The turbot eggs had been artificially fertilised on the west coast (at Girvan) and sent by rail to Dunbar; on arrival here the development was far advanced (in the multicellular stage), and as the eggs had been much exposed to changes of temperature and other hardships, I found the specific gravity so much affected, that records of it were misleading. But I have reason to think that it does not exceed 1024·5 shortly after fecundation. When 48 hours old I found the specific gravity increased to 1026·8 in water of 12° C. At this time the embryo reached across the egg, measuring 1·0 mm. in length. After this the turbot egg sinks in ordinary surface water; but, as I have never found their specific gravity to exceed 1028·0, these eggs will not sink to the bottom where the sea is sufficiently deep; perhaps 30 fathoms or more. This circumstance will therefore much reduce the chances of the turbot eggs that are spawned in the sea, as it is probable that most of those eggs that sink down and rest on the bottom, will succumb. The newly hatched turbot measures about 3·0 mm.; it has a hardy appearance, and is richly pigmented; this is well shown in M'Intosh's fig. 11, Pl VIII., where the true brick-red colour is represented. The larvæ grows rather quickly while the yolk is being absorbed, and the pigment is much increased, particularly along the seam of the dorsal marginal fin. The tail remains almost free from pigment. When the yolk is absorbed the larvæ measures about 5·0 mm. in length.

During the last season (in 1896) I made an experiment with the rearing of turbot during the post-larval stage, and the same apparatus was used that had proved so successful with the plaice. A couple of dozen larvæ, which had absorbed the yolk, were placed in the jar, and food was provided as before by tow-net collections.

During the first three days the larvæ appeared at all levels in the jar, and were eagerly in search of food. Only in one case I found remains of diatoms in the stomachs that were examined; the form observed was the

* *Annales Station Aquicole de Boulogne-sur-Mer.*

† *Thirteenth Annual Report of the Fishery Board*, Part III. p. 227.

‡ *Eier u. Larven v. Fischen d. deutschen Bucht.*, p. 282. Kiel und Leipzig, 1897.

same as I had previously seen in the plaice (*Guinardia flaccida*). The contents consisted of remains of minute larval crustaceans, and small larval *Scrobicularia* were occasionally seen; as an exception, I found a well-preserved infusorian.

In his elaborate paper on forms of post-larval turbot that were obtained from the sea, Ehrenbaum mentions that he found remains of Ostracoda in a still symmetric specimen. Though feeding so much, all the larvæ died on the fourth day, apparently as a consequence of excessive heat; in the afternoon the thermometer showed 17·5° C. in the rearing-jar. At this stage the larvæ measured 7·1 mm. in length. The pigmentation had altered in this way, that the brick-red colour was partly covered with black stellate pigment, which had also spread over the seams of the embryonic fins, particularly dorsally and partly on the caudal fin. The tail was still homocerc, and no changes in development were observed from the end of the larval stage.

Along with the turbot, a few larval lemon soles were also placed in the rearing-jar. They did not appear so hardy as the former, but had more features in common with the plaice. When the yolk was absorbed, the soles began to feed on larval crustaceans, and larval molluscs, larval gastropods were particularly frequent. The soles died at the same time as the turbot, and were then eleven days old. An increase in the black pigmentation was the most marked change during these first days of the post-larval stage.

These experiments with turbot and lemon sole were the first attempts to rear these forms, and I hope in the near future to have an opportunity of repeating those interesting, and from a practical point of view, most important experiments.

The experiments described in the preceding pages will show that the rearing of plaice through the post-larval stages is possible, and can be done in laboratories without much trouble or expenditure; and though we often find that the various species behave differently when artificially dealt with, there is no reason to think that experiments with other forms of our common food-fishes should not be equally successful. There may, of course, be peculiarities in different ways that are to be overcome in each case, but these can only be found out through practical experiments. And if this is so, the study of this now most unknown stage of development of our sea-fishes will get a push forward, as the investigator will be able to work with certainty and convenience, where he previously was often left in the dark.

But the rearing, as mentioned, is also of interest from a practical point of view; and it may be of interest to deal here also with this aspect of the experiments and observations already described.

The practical rearing of larval fish is closely related to artificial sea-fish culture, and I shall therefore first mention a few features connected with the latter. Fish-hatching has been proposed as one of the remedies to restore the abundance of the most valuable fishes on the inshore grounds, and work of this nature has lately been undertaken in various countries: in Norway, where cod has principally been dealt with,* in Newfoundland, in the United States, and in Canada. At the present time similar works are prepared for in Italy, and in France at St Vaast le Hougue, and in England by the Lancashire Sea Fisheries Committee. It is satisfactory to see how artificial fish-culture has gradually developed, as work on a sufficiently large scale has given some idea of

* As a consequence of the success of the work with the cod in previous years, it has lately been suggested to introduce valuable flat-fishes in Norway by means artificial culture.

the benefit that may be derived from such operations. In Norway, the hatching work was originally started quite experimentally, and on a small scale; it was necessary first to find out what difficulties there would be to overcome; the station was subsequently very much extended (in 1890) in order to show what practical results could be produced. Operations have now gone on for some years, and considerable numbers of fry of the cod have been distributed in the inshore waters along the south-east coast. The largest production in a season has been 320,000,000 fry, which were sent out from the hatchery last year; and a marked increase in the abundance of young cod has been observed where fry has been distributed in great numbers. But it would be of the greatest interest to have such experiments done that would more definitely show the effect on the abundance of fish when fry were distributed in a certain area. This would be a statistical test of the economy of sea-fish hatching. When carried out on a large scale, as it ought to be when practical results are looked for in the way of an increased fish supply, the fry can be produced at a very moderate cost; as an illustration it may be mentioned, that at the Flödevig hatchery during 1896, 320,000,000 cod fry were produced at the rate of more than 2,500 for a penny. But in order to work so cheaply it is necessary to have the station furnished with sufficient tanks and reservoirs, where the parent fishes may be retained safely from one year to another. And I must also mention, as easily may be seen, that once the capital expenditure is made, it will not cost much more to hatch 300,000,000 of fry than it will cost to produce say 60,000,000 a year.

From statements sometimes made it seems that some misapprehension exists as to the principles of fish culture. It has been said that the fishes produce such large numbers of eggs that the quantity of fry that may be developed artificially will have very little effect upon the abundance of fish in a certain area. Practical experiments have shown differently in such places where hatching work has been carried out on a large scale, and this experience may easily be accounted for. In order to maintain the equilibrium or balance within a species, it is necessary that on the average two adult individuals remain as the offspring from one male and one female fish; and this will apply to any species. We find that a cod will produce more than one hundred times as many eggs in a season as a herring, and the destruction of cod eggs or larvæ must therefore be about one hundred times as great as the destruction of herring eggs or larvæ. Many similar instances could be mentioned, which all would tend to show that the destruction of pelagic fish eggs and their larvæ must be enormous. As clearly shown by Dr Fulton in a paper on the principles of fish culture, the number of eggs produced by any fish is the best measure of the destruction that must take place. And that this destruction takes place at an early period is most probable. The newly born viviparous blenny (*Zoarces*) measures about 2 inches, and when only 100, or at the most, 120 embryos of this size, which are found in a female fish, are sufficient to maintain the species, it is clear that these 120 young blennies must have the same chance of reaching maturity as 6,000,000 of eggs produced by a turbot or any other fish in a season; in other words, one newly born blenny, about 2 inches long, is equal to 50,000 of such fish eggs; or, that out of 50,000 such eggs the 49,999 are destroyed before they reach a stage similar to that of a new-born blenny.

If we take the case of the flat-fishes, which are of most interest to this country, we will find that the young fish is very hardy, and has got good means of protection. From the moment it has passed the transformation stage it lives regularly on the bottom. The pigmentation on the upper side of the fish will quickly attain the same appearance as the sand or mud on which it lives, and as the fish is also able to cover itself in the sand and mud, I think the mortality amongst flat-fishes after this stage is reached must be very small indeed.

But then the above-mentioned great destruction must take place during the development of the egg, in the larval and post-larval stages. The time elapsing from the impregnation of the egg till the transformation takes place varies with the different seasons and with different species; but there is reason to think that eight weeks will be the maximum time for this more or less pelagic development.

I may therefore be right in saying that perhaps 80 per cent. or more of the five or six millions of eggs that a turbot may produce in a season are destroyed within the first few weeks, and when this is so, it seems reasonable that artificial protection during this difficult period must be of the greatest importance. And it is just with these views in mind that fish-culture has been adopted as a means of increasing the supply of the valuable food-fishes. If such artificial protection is possible, and can be realised in a practical way, it is, I think, clear that the results of such work would be well worth the trouble, and this so much the more as there is no other remedy known that may lead to the same end without serious interference with the practical fishing industry.

In the present hatcheries the eggs are protected during the whole of the development, and the larval stage is also passed safely in the apparatus. But as yet it has been necessary to plant the young larvæ in the sea by the time the yolk is absorbed, and the artificial protection has therefore only been extended to the earliest part of this difficult period. When planted in the sea, the larvæ can, of course, be placed in the most favourable localities, and so far the young fish gets a good start. But the advantage of fish-culture would clearly be ever so much greater if the protection could be extended all through, till the time the flat-fish lives on the bottom, with the habits of an adult.

Once it was considered impossible to rear post-larval fish in captivity, but this theory was untenable when Capt. Dannevig succeeded, in 1885, at Flödevig, in rearing cod fry in a large tank. Dannevig's success was attributed to the great capacity of the pond, and it was maintained that rearing on a small scale was impossible. My above described experiment with plaice in 1896 shows that this can also be done, and I feel sure that continued experiments will soon show how similar work may be undertaken on any scale with economy and facility. It is certainly much easier to rear larval fish in a large enclosure than in a small one, because the larger the enclosure is, the closer will the resemblance of its physical circumstances be with those in the open sea. I shall only give an outline of how I think such a rearing experiment with flat-fishes may successfully be carried out on a large scale. There would be required a large enclosure, the larger the better; if failing to find a natural basin on the shore that easily could be closed and modified, the most economical way, perhaps, would be to dig out such a place in a sand bed near the sea, and line it inside with concrete. Such a tank should not be deeper than from 8 to 12 feet, so the walls would not require to be strong. It should be on the level with the sea and in communication with the latter with large drain pipes with valves, so that the water supply may be taken directly from the tide without pumping. Most of the forms of the marine fauna and flora, which serve the post-larval fishes as food, can easily be produced in unlimited quantities through cultures, and great numbers of fry could therefore find nourishment within a comparativaly small area. The success of such an experiment would mean that such valuable fishes as the sole and turbot could be protected in captivity throughout the time of the early development while the enormous destruction takes place in the sea.

Judging from what has already been done on this subject, there are good prospects of the success of such an enterprise, and I think therefore it would be very desirable and important if such an experiment was made.

And not only fish, but lobsters ought also to be dealt with in this way. The desirability of hatching lobsters is often talked about, and to put out larvæ in certain selected localities soon after hatching. This is certainly a very good idea, when the berries are taken from such lobsters that have already been captured for the market. The idea is good so far as these berries are saved from destruction. But there is little advantage in catching the lobster for the sake of the hatching of its berries, as the latter are developed quite as well, or better, when attached to the mother in the sea, than if they had been kept in confinement. The destruction, in the case of the lobster does not take place till the larvæ have been hatched, and is swimming as a more or less pelagic crustacean ; so it is in this stage of development that artificial protection can be of the greatest benefit, and assist in keeping up the mature stock of lobsters in any locality. With reference to artificial rearing of young lobsters in ponds, I must say it is a thing which often has been tried in Norway and in England, but which, at the same time, in my opinion, never got a fair chance. It may here be put forward that the lobster larvæ are cannibal, and that the destruction from this cause will form a barrier to successful operations with this crustacean. It must certainly be admitted that these young larvæ do destroy one another; but, at the same time, I do not think that this feature has been sufficiently studied ; it may be found that the cannibalism only takes place under certain circumstances. In any case I should never consider artificial lobster culture in the way mentioned at all impossible; no one, I think, at the present time is able to give definite proofs for or against, but that is just the reason why we ought to be careful in criticism of this important question.

That the lobster larvæ can be reared in captivity has been proved first in Norway by Capt. Dannevig, and later in America by Prof. Herrick; but it is yet left to utilise these important observations for practical purposes that may lead to an increase in the supply of this valuable crustacean.

EXPLANATION OF PLATE IV.

Figs. 1 to 10, which represent the various stages of the post-larval plaice, were drawn by Mr F. G. Binnie, from my preserved specimens, the intention being to give a general view of the gradual advance in development; the figures have been arranged accordingly.

Fig. 1. Post-larval plaice, 17 days after hatching, 7·40 mm. long and 1·44 mm. broad.

Fig. 2. Post-larval plaice, 16 days old. This specimen does not belong to the present series, but was taken from an earlier batch of

PLATE IV.

larvæ. It corresponds in size and appearance with the larvæ of June 7th. (See Table I., page 187.)

Fig. 3. Post-larval plaice, 35 days old, 9·64 mm. long and 2·16 mm. broad.

Fig. 4. Post-larval plaice, 40 days old, 10·96 mm. long and 3·76 mm. broad.

Fig. 5. Head of post-larval plaice, 42 days old. The fish was 12·40 mm. long and 4·80 mm. broad.

Figs. 6, 7, 8 represent specimens in the transformation stage.

Fig. 9. Young plaice, 45 days old, 13·76 mm. long and 6·40 mm. broad; has just passed the transformation stage.

Fig. 10. Young plaice, 65 days old; about 27 days after the transformation took place.

Figs. 11 to 24 represent various forms of food that were observed in the stomachs of the post-larval plaice; they were drawn from nature by myself and identified by Mr T. Scott.

IV.—CONTRIBUTIONS TO THE LIFE-HISTORIES AND DEVELOPMENT OF THE FOOD AND OTHER FISHES. By Professor M'Intosh, Gatty Marine Laboratory, University of St Andrews. (Plates V., VI., and VII.)

CONTENTS.

1. The Life-Histories of the Cod, the Haddock, and the Whiting.

The Cod.

The history of the early stages of the cod in Scottish waters has, within recent years, been more or less elucidated, so that the remarks on this form will be comparatively brief. The chief spawning-grounds are in the offshore waters, such as east and south-east of the Isle of May, and the deep water off Montrose and Aberdeen, Smith Bank in the Moray Firth, and similar areas. The eggs are often wafted inshore, as also are the larvæ, which are distinguished by their speckled appearance, due to the presence of five blackish pigment-bars. The greater number of the larvæ, however, attain the post-larval stage in the offshore water, and only seek the more varied life of the inshore when they reach the length of ½ to ¾ of an inch, and have descended considerably in the water. They lose the speckled aspect of the larvæ, and the black pigment is aggregated dorsally and ventrally, so that their appearance is much altered at ½ an inch. Yet a further change occurs after they are a little older, and when they approach the tidal region at the end of May or beginning of June. The black pigment, which had been confined to the dorsal and the ventral borders, and to the median streak, now (as the fishes reach the length of an inch, or a little more) forms vertical or zig-zag bands connecting the former along the sides.

During June and July they frequent the shallow rock-pools, both of open bays and estuaries, at ebb-tide in company with the green cod, from which, as I have formerly shown, they are readily distinguished by the reddish hue of the head, and the beautifully variegated body, which, upon a pale greenish ground, is dotted all over with black pigment-specks, while larger ones occur over the brain, and on each side along the dorsum (Pl. VI. fig. 5). The first two dorsals are also dotted with black pigment, enlivened with touches of opalescent bluish, touches of the same hue occurring at intervals along the middle line of the dorsum when viewed from above, one of the brightest being between the second and the third dorsal. The pale patches between the dark bars have a beautiful pearly lustre. About eight dark blotches are placed along the median line, and as these are flecked by darker patches in the upper lateral region, they give a characteristic appearance to the fish. The upper lateral region (just above the lateral line) shows, from the operculum backward, nine dark spots. The first three are continued downward to the silvery belly, and then cease. The rest have connections with a series of median spots—five in number—in the middle line, bands in several instances passing from two upper spots to one median, and again bifurcating inferiorly. The lower part of the gill-region and belly are silvery, and, in certain views, those and the sides glance brightly, like burnished silver, with a slightly cupreous sheen. The ventral median line has, on each side, a band of pigment (continuous with the lateral bars described above), but the chromatophores are less regular than along the dorsum, though opposite the bases of the ventral fins the black pigment is regularly arranged, apparently at the base of each ray. Pigment also appears on the sides and under surface of the lower jaw, and a thin dark streak passes a short distance backward in the middle line. The breast-fins are translucent, their rays only glancing during their active vibratile movements. The first and the second dorsal fins have the blackish pigment best developed on the membrane between the rays, towards the free edge, the basal region being pale. The pigment occurs in the first six or seven spaces of the first dorsal; the third dorsal has none. The first anal fin, towards its distal half anteriorly, is speckled with black. The ventral fins are translucent, with a few grains of white on the two outer rays, the second of which is now elongating. The tail-fin is devoid of chromatophores. The eyes show an iridescent orange-hue, with minute specks of black on a silvery ground. From the dorsum they are blackish, with minute iridescent greenish specks. A small barbel is present. The arrangement of the pigment on a green cod of the same length is wholly different, for the large stellate pigment-spots are scattered over the entire area laterally, and the black streak in the median (lateral) line is more distinct. All the three dorsal fins are more deeply pigmented, and both anals have pigment. When viewed from the ventral surface, there is much more pigment in the hyoidean region. The pectorals and ventrals are slightly smaller than in the cod, the latter being devoid of black pigment in both. Of the two, the cod is the more precocious in regard to the development of the tips of the long rays of the ventrals.

Besides being found at this stage close inshore, it has occasionally happened that they are also captured a considerable distance offshore. Thus, for example, on the 21st July, one 29 mm. long was secured in the mid-water net 8 miles south-east of the Isle of May. Their general tendency, however, is shore-wards.

The pigment gradually increases until the sides of the young fish are boldly tessellated, the lighter patches often having a slightly pearly or iridescent lustre. Meanwhile, the length of the fish is increasing, and its form becoming more and more characteristic. At five inches, for instance, on the 22nd of September, most of the external characters of the adult are present, except that the sides are still boldly mottled by the pigment-bars (Pl. VI. fig. 6).

As they grow older, the young cod seek the offshore waters, and the tessellated condition becomes less marked, *e.g.*, about eight inches. They form considerable shoals off rocky coasts, such as south of Girdleness in Aberdeenshire, and, indeed, all along the east coast. Many, however, continue to haunt the shallower rocky shores and the tangle-forests beyond low-water mark, and are more brilliantly coloured. They are known to anglers by the name of rock-cod.

Their subsequent growth has been noted elsewhere, but the main point is the contrast which such a life-history affords to that of the haddock.

The Haddock.

The development of the eggs of the haddock was given by Professor Prince and the author, in the 'Researches,'* and the characters of the larval form indicated. The latter was chiefly recognised by the eyes, which are large and pigmented, by the blackish pigment on the head, by the deep band of pigment on the dorsal arch of the abdomen, and by a faint line below the muscle-plates of the same region. The larvæ are small,—about 3 mm. in length on hatching.

While the larval and earlier post-larval stages of the haddock have thus been fully elucidated at the St Andrews Marine Laboratory, the later post-larval and very young stages have hitherto eluded observation. Professor G. O. Sars, it is true, held that the post-larval haddock could be recognised amidst the swarms of young fishes on the spawning-grounds of Lofoten, and in this he was probably correct, though very considerable uncertainty existed. A re-examination of the whole question this year shows, as has been more than once pointed out at St Andrews, that the later post-larval and early stages of the adolescent haddock altogether diverge from those of the cod in regard to their haunts. The young cod, as shown in the preceding pages, gradually pass shore-wards, and when about an inch in length, approach the margin of the rocks, where they swim amidst the tangle-forests, and enter the tidal runlets for a considerable time. The haddock, on the other hand, at the stages mentioned, keeps to the offshore water until it has assumed a readily recognisable or adolescent condition.

The following is a succinct account of the various stages :—

Whilst the marginal fin is still continuous, the black pigment of these shorter forms of 7 to 8 mm. from the offshore water—probably the same as those mentioned by Professor G. O. Sars, is scattered over the head, along the dorsal and ventral edges—with a few specks on the sides posteriorly. At 11 mm., besides the foregoing coloration, a very distinct area of pigment-points occurs behind the pectorals. A few specks also appear on the latter and on the ventrals, which at this stage form short fins with true rays. True fin-rays are now present in the second and in the third dorsal (the marginal fins being still continuous), in the two anal and in the caudal fins, but the first dorsal has only embryonic rays. The body is comparatively short and thick, and the head large. The food consists of young copepods. At 12·5 mm., the marginal fin is likewise continuous with the caudal. True fin-rays are developing in the first dorsal. Such stages do not, so far as at present known, occur in numbers inshore, but frequent the fishing banks offshore, especially in May. Instead of seeking their way inshore, indeed, like the cod and green cod, the little haddock frequent the deeper water offshore, and they are found in great numbers, for instance, 25 to 30 miles east by south of the Island of May, and near the fishing grounds termed by the liners the 'Long Forties.' There the large mid-water net captures them, in the first weeks of July, along with swarms of young whiting, and ranging in length from 24 to 80 mm., as well as, in all probability, on both sides of these dimensions.

At 19 mm., the outline is short and thick-set, and the fins are well developed. The ventrals are lengthened; their long sensitive tips projecting beyond the vent. The head and eye are large, and the snout blunt. The only pigment left on the specimen is over the brain, but probably both dorsal and ventral edges and the sides were more or less coloured.

* *Trans. Roy. Soc. Edin.*, vol. xxxv. part iii. p. 822.

At 24 mm. (Pl. V. fig. 1), the little haddock is distinguished at once from the whiting of the same length by the more compact outline; by the shorter first anal fin; by the longer pelvic fins, which reach nearly as far backward as the tips of the long second ray of the pectorals, and extend beyond the anus; by the slightly larger eye; by the presence of a larger amount of dark pigment generally on the fins, the ventrals being quite pale in the whiting, On the other hand, the black pigment on the head of the whiting is better marked, and the same may be said of the tip of the snout, the premaxillary and the mandibular regions. Both species have the sides of the body dotted with pigment-specks from the pectorals backward, and dorsally forward to the snout, the belly being pale and slightly silvery. The mandibular region inferiorly, however, in the whiting, shows more numerous black chromatophores. Moreover, above and a little behind the pectoral in the haddock is an area dotted with very minute black chromatophores,—the future black spot, though not at present conspicuously differentiated. Lastly, in the haddock, the barbel is generally more distinct. The vent in the latter is nearly in the middle of the body, whereas in the whiting it is close to the anterior third, and thus the body of the whiting is proportionally elongated. No scales are yet present.

From a cod of the same length the young haddock is diagnosed by the shorter, thicker body, by the smaller barbel, by the more evident separation of the second and third dorsal fins and of the two anal, by the longer ventral fins, and by the absence of the tendency of the black pigment to form a lateral line along the middle of the body. Moreover, the chromatophores generally on the sides of the cod are less numerous.

At 29 mm. (Pl. V. fig. 2, and enlarged in fig. 5) the general bulk of the little haddock—in contrast with that at 24 mm.—has notably increased, and the shape and curves of the head have been modified. The ventral fins are proportionally longer,—a feature doubtless associated with the more purely pelagic life followed by the species at this stage. The black pigment is still present on these fins (pelvic). No scales are developed.

From the whiting of the same size it is recognised by the permanent characters in relation to the first anal fin, and by the much longer ventral fins, the second ray of which projects beyond the rest, as well as by the more compact outline and the more distinct barbel. Moreover, at this length, the aggregation of the dorsal pigment in the whiting to form the characteristic bars at once separates them. The pigment on the head of the haddock is now well marked; and the bones of the mouth are also better pronounced. The nasal openings are larger. The area with the minute black chromatophores, above the pectoral, though present, does not attract special notice in scanning the fish (haddock). All the fins of the latter are largely developed. From a cod of the same length, the characters formerly mentioned still hold, but the barbel in the cod is much larger, and the disproportion between the pectoral and the ventral fins greater. The second ray of the ventral in the cod is now longer than the first. The tendency of the lateral pigment to form bars in this species (cod) is also diagnostic.

In connection with this stage it may be mentioned that, in the 'Scandinavian Fishes,' it is stated that at Spitzbergen in September the young haddock are about 35 mm. long; while Collett, in Christiania Fjord, found them 40 to 50 mm. long on the 14th of June.

At 39 mm. (Pl. V. fig. 3, and enlarged in fig. 7) the chief changes in the young haddock are, a diminution of the proportional length of the ventral fins, the acutely pointed condition of the first dorsal fin, and the increase in the silvery hue of the sides. Microscopically, somewhat rounded granular areas at intervals indicate the development of scales. When the fish is 45 mm. in length, the developing scales are more evident, as minutely reticulated areas scattered throughout the skin, and causing a slight opacity where each is situated (Pl. VII. fig. 1). The area of finely dotted pigment above the pectoral is more densely covered. In contrast with the whiting of the same length, it is a much stouter fish, the head and eyes are larger, the belly more capacious; and though, in both, the tips of the ventrals (long second rays) project beyond the vent, yet the length and strength of the haddock's fins are characteristic, and they also retain their pigment in spirit. Parasitic *Caligi*, further, seem to be partial to this species. The long, sharp, recurved teeth of the whiting are more prominent than those of the haddock, the mouth of which is also more neatly formed. The vent of the former is considerably in front of that of the latter, and the first anal fin is in full development. There is little confusion with the young cod of similar length since—before it reaches this size—its sides are beautifully dappled, its mouth larger, the barbel much longer, the ventral fins fall short of the vent, and the body of the fish is less compact, while the head has a different outline. No black pigment occurs on the rays of the pectoral or pelvic fins. The dusky hue of the green cod and the pollack —both of which show the median line of black pigment along the centre of the body posteriorly—readily separates them. Both lean to the cod in regard to the proportions of the pectoral and pelvic fins.

At 48 mm. the general silvery hue is even better developed, and, whereas at the latter stage (39 mm.) the lateral line, though present, was but feebly marked, it now forms a prominent papillose ridge from the upper opercular region almost to the tail. The larger black chromatophores scattered amongst the minute are more conspicuous on the sides of the haddock than in the whiting, and, indeed, they give it a characteristic appearance. The condition of the vent at this and the previous stages is also noteworthy, for about eight isolated papillæ occur round its edge, with the genital papilla behind. It may be that slight sexual distinctions appear at these stages which afterwards disappear. The boldness of the pigment and the larger scales are characteristic features when compared with a young whiting of the same size. The tip of the mandible is nearly in a line with the premaxillary, and thus not evidently underhung.

The little haddock grows rapidly, and at 53 mm., that is about $2\frac{1}{8}$ inches, the dark patch behind the shoulder—so characteristic of the species—is readily seen by the unaided eye (Pl. VII. fig. 4). The cupreous lustre seems to bring out the pigment, since the condition is just as in the smaller forms, viz., a finer distribution of minute black pigment-specks. The pectoral fins have a yellowish-brown hue, with black chromatophores on both sides as before, and they stud the fin with minute black streaks arranged longitudinally. The amount of black pigment in the three dorsals is noteworthy. The ventrals are pale, but they still have black specks arranged in a linear manner in the centre. They are now proportionally shorter, a clear space existing between them and the vent,—which is papillose. Both anal fins are streaked with black pigment only in a less degree than the dorsals. The head and body are minutely and uniformly dotted with black, while the brain is reddish. The eyes are large and silvery, the latter likewise being the condition of the sides. The scales, which are now much larger, cover the skin much more closely, thus giving a regularly reticulate condition to the surface (under the microscope). Where they project from a torn surface, as in the sketch (Plate VII. fig. 2), reticulation of the margin is evident. The barbel is small in contrast with the cod. The mandible is underhung, as in the adult. The anterior nostril is surrounded by dark pigment, while the posterior is pale. There is no need to describe minutely the various points of difference between this species on the one hand and the whiting and the cod on the other, but a few remarks may be made on certain evident modifications occurring during the growth of the three forms at this stage. Thus, whereas the pale ventrals of the whiting fell short of the vent in the former stages, they now extend beyond it, the second ray with its sensitive tip, so carefully described in various fishes by Mr H. C. Williamson, being proportionally longer than in the haddock. On the other hand, the second ray of the somewhat short ventrals of the cod far exceed both, such a provision, in all probability, being of great service in its haunts inshore amongst the tangle-forests and tidal runlets at low-water. The large mouth of the cod, its long barbel, and its characteristic head, are noteworthy, as also are the prominent teeth of the whiting.

At 61 mm. the silvery region of the abdomen behind the pectoral fins presents a beautifully embossed or regularly facetted aspect from the development of the scales, which here and along the abdominal region are most apparent, though actually extending to the base of the tail. The silvery surface, perhaps, aids in making them more prominent. The scales are now marked by a somewhat regular series of reticulations concentrically arranged. Moreover, they now touch and overlap each other. The black pigment on the fins is the same, a little still being visible in the ventral, the tips of which distinctly fall short of the vent. The latter shows papillæ round the margin less prominently than at the earlier stages. Young *Caligi* have fixed themselves near the angle of the mouth. The head and sides are minutely dotted all over with black pigment. The pectorals are proportionally broader than in the adult.

Up to this stage not a single young haddock has ever been captured by the various nets so constantly in use during in-shore observations. It is a deep-water fish, of whose existence fishermen, as a rule, are not cognisant, unless when casually dropped on deck from the mouth of a larger form captured by the hook or by the trawl.

At 80 mm. (about $3\frac{1}{4}$ inches) the blackish mark behind the shoulder is very evident,—both in life and when preserved. It is due, as formerly, to a dense aggregation of minute black chromatophores, which thus, from the beginning, differ from these in any other part. The cupreous sheen of the little fish is well marked, and the sprinkling of black pigment over the body is less distinct than in the previous stages. The black pigment on the pectorals, ventrals, and first anal is also characteristic, and is equally seen on both sides. The tip of the second ray of the ventrals is proportionally more elongate than in the previous stage—in connection, perhaps, with a change of habit—either towards the bottom or towards the shore. This sensitive ray is fully as long as in a whiting of the same size; but whereas in the latter it extends considerably beyond the vent, it falls considerably short of it in the haddock. The cod of the same length has a much longer second ray than either.

At this stage, also, they seldom come under the cognisance of any fisherman.

Towards the end of the same month, viz., on the 30th of July, specimens of 4 inches occasionally take a hook, or are entangled in débris in a trawl. At this stage the ventral is proportionally shorter (though the second ray is still long),—a longer interval occurring between its tip and the vent.

In August the haddock of the season range from $3\frac{1}{2}$ to 6 inches,—all the specimens in the laboratory at and above 4½ inches being from the hooks of the liners. It is probable that others will extend on each side of these limits. The long ray (second) of the ventral fin is still prominent. The growth of the haddock is thus rapid,—more rapid than at first sight it would seem.

In September the specimens from the hooks range from 5 (Pl. V. fig. 6) to 6⅝ inches, and this agrees with what Yarrell,* formerly mentioned, viz., that the haddock spawns in February and March, and the young are 6 inches long in the beginning of September. Only 4 between 6 and 10 inches in length were obtained by Dr Fulton in May, July, September, and October, while 345 smaller and 155 larger examples were got during the same months. Most of those under 5 inches in length were captured in September at the mouth of the Frith of Forth, and up to 10 miles beyond it. In November some reach 7¼ inches, while in December the limits in the collection at St Andrews are 5¾ to 7¼ inches.

'In October and November,' says Fries,† 'some small haddocks, between 100 and 150 mm. in length, may occasionally be taken on the coast of Bohuslän; but, with this exception, the fry are never seen. Like the young of several other fishes, of the horse-mackerel and the cod, for example, the haddock-fry, according to Sars and Collett, seek shelter and food under the bodies of medusæ, together with which they drift about until they are more than 50 mm. long, and then they probably join their parents in the deeper water. Off Tromsö, however, Lilljeborg saw fairly large shoals of young haddocks keep near shore in from 4 to 6 fathoms of water.' This habit of seeking shelter and food under the discs of jellyfishes has not been observed in British waters, and it is difficult to see how the hordes of young haddocks could find a sufficient number for this purpose. Again, at this period (July and August), the young haddock frequents the deep water offshore, while the medusæ are partial to the surface, especially in quiet weather; and thus, in the latter case, the presence of the young fishes could not readily be overlooked. Of the filial instincts of those which reach more than 50 mm., nothing has been seen in this country, and it is unusual for such small fishes to venture amongst adults of their own or of other species. Again, the length of the young haddocks seen by Lilljeborg is not stated, but in all probability they were of the usual size, viz., over 4 inches, or from 5 to 6 inches, when they seek the inshore waters.

The following year the young haddock are familiar to fishermen as the 'summer haddock,'—immense shoals seeking the inshore water after sand-eels and other prey, and often proving a nuisance to the liners, and occasionally even to the trawlers. Dr Fulton found that in February, March, and April, individuals under 5 inches are very rare, while those between 6 and 10 inches are much more common. In May and June their length ranges from 7½ to 9 inches or thereabout.

The early life of the haddock is thus spent in deep water offshore, as all our former experience demonstrated, and as also shown by Dr Fulton,‡ in 1890, in his remarks on the distribution of immature fishes. Thus, for instance, he pointed out that, while the average number of immature haddocks within the three-mile limit was only 0·3, beyond that limit they were twenty times as numerous. 'None, moreover, were got in water under 10 fathoms in depth. The great majority of those 4 or 5 inches long were caught in water of between 20 and 30 fathoms in depth, and from 4 to 10 miles from shore.' If special nets, such as the mid-

* Vol. i. p. 537.
† 'Scandinavian Fishes,' p. 471.
‡ *Eighth Annual Report, Fishery Board*, p. 174, 1890.

water one, are used over the various fishing-banks offshore, multitudes of the little haddocks are obtained, but otherwise they do not come under the notice of fishermen until they are able to take a hook,—that is, when about 4 inches in length.

Why the very young haddock should frequent deep water, and the young cod seek the inshore water, and even the tidal margin at a similar stage, is one of those mysteries it is difficult to unravel. Such, at any rate, would appear to conduce to the extraordinary abundance of the haddock in the British area, and to enable it to hold its own in the struggle for existence. The species exhibits none of the mottled colouration so characteristic of the very young cod; indeed, it even shows less change in this respect than the whiting. It finds in the deeper waters abundance of food, and probably greater safety in its early condition; though, it is true, cod and other fishes find it out and prey on it. In whatever way we look at the subject, this divergence of habit in two of the best known and most esteemed food-fishes is a feature of great interest.

The Whiting.

The development of the egg, and the larval, post-larval, and young stages of the whiting, were described in the 'Researches,'* but a largely increased series of young examples at various stages necessitate a revision of the subject.

As a rule, the whiting sheds its eggs in the offshore waters, where the early stages of the species are passed, though there are grounds for believing that, in certain cases, it spawns somewhat nearer the shore than the two former.

The larval condition of this species is sufficiently diagnostic when contrasted with either cod or haddock, since it has canary-yellow pigment thickly distributed over the neck, yolk-sac, tail, and fin-membranes. The oldest larva reared in the laboratory was distinguished by its black pigment-spots arranged in a double series along the edges of the muscle-plates, the inner row in each case being somewhat fainter. A dense pigment-band exists in the sub-notochordal region of the abdomen, and scattered spots occur generally over the surface.

When about 9 mm. in length, in July, the dorsal and the anal fins form a continuous web, with only embryonic rays, but the caudal has its permanent rays developing distinctly, and in a somewhat symmetrical manner above and below the tip of the notochord, which here passes straight backwards to the middle of the tail. In spirit, a considerable amount of black pigment occurs on the dorsum of the head and some at the tip of the snout. On each side of the dorsal median fin a bold line of the same pigment stretches from above the pectorals to the base of the tail, the line along each side of the ventral median fin being much less distinct, though the broad band of black chromatophores which runs backwards above this is more conspicuous than that on the side below the dorsal black line. The latter (lateral pigment) is mostly in a single line, and shorter; whereas, that beneath is formed of two or three irregularly distributed from above downwards, and is longer. Ventrally, a line of chromatophores follows the mandible on each side, part of a Λ is similarly outlined over the hyoid, a group occurs below and in front of the breast-fin, and a median stripe runs along the abdomen. The head is nearly a third the length of the body.

Between the foregoing and 11 mm., permanent rays appear in the dorsal and anal fins, the first dorsal being somewhat behind the others in

* *Trans. Roy. Soc. Edin.*, vol. xxxv. pl. iii. p. 824.

developing them,—a feature of considerable interest. The larval marginal fin, however, still joins the various parts to each other and to the tail. The pectoral fins are large and fan-shaped, and the eyes are large and bluish-silvery. Generally speaking, the whiting has more black pigment in the postero-lateral region, both in this and in the previous stage, than the cod. No ventral fins are present.

At 12 mm. the dorsal and the anal fins are outlined, though not yet separated from each other, and the permanent rays are more distinct in them and in the caudal. Minute ventrals are now present, while the pectorals form large mobile fans. The ventrals at this stage are in a line with the posterior edge of the base of the pectorals, and thus differ from their position in the adult. Groups of black pigment-corpuscles are distributed along the base of the dorsal and the anal fins as well as over the brain, and a similar series exists along the ventral median line of the abdomen. Black specks also occur along the premaxillaries and the mandible. The head is disproportionately large. Minute copepods are the most conspicuous contents of the stomach at this stage.

At 15 mm. the species is distinguished from the cod by the more abundant distribution of black pigment-specks along the sides of the body and on the fins, and by the greater length and diminished depth of the first anal fin. The latter also readily separates it from the haddock. At this stage many show a series of black pigment-specks over the silvery lateral region of the abdomen from the dark dorsal arch (peritoneal) downward. The pelvic fins have moved slightly forward. There is proportionally less pigment when the ventral edge is surveyed than at the 9 mm. stage, but a more general distribution has taken place laterally.

At 20 mm. the first anal fin has assumed the characters of the adult organ, the body has considerably elongated, so that the head appears to be smaller. The ventral fins have their origin distinctly in front of the bases of the pectorals. A considerable aggregation of black pigment is present along the dorsal margin, and all the median fins are dotted with the same colour, especially the dorsals. Traces of the median ventral black line are still visible. The black pigment-corpuscles along the sides often present a more or less longitudinally linear arrangment. No scales are developed. A minute papilla in the median line of the mandible indicates a barbel.

Shortly after this stage, viz., when about 32 mm. in length, a tendency in the dorsal pigment to form separate touches is observable; the ventral surface of the abdomen becomes white. Besides the former touches, a few distinct bars occur at the base of the tail. The black pigment over the head, body, and fins has largely increased, the sides being minutely flecked all over. The ventrals are pale, their tips extend beyond the vent, and their bases are carried still further forward. A minute barbel is generally present. Scales are now developing, though the minutely granular areas which indicate them are separated by considerable intervals. The distinction between the young whiting at this stage, and the young cod of the same length, is marked. In the whiting, the median dorsal fin is less abruptly elevated than in the cod; and the elongation of the first anal, with the shortening of the abdomen, are diagnostic in the whiting. The pigment-specks closely cover the sides of the body in the whiting, as well as the membranous webs of the dorsal fins, and are continued on the head. The pigment at the base of the caudal rays is more distinct in the whiting, and the lancet-shaped caudal end of the trunk is longer in this species. The muscle-plates are coarser in the cod, and the surface has little of the dappled silvery sheen of the whiting. The chromatophores in the cod are grouped in blotches over the sides, with intermediate pale patches, and the shoulder and head have much less pigment than in the whiting. Both the pectoral and the ventral fins of the cod are shorter. The snout of the whiting is shorter and broader, as well as deeper, and the minute barbel of the latter is in contrast with the long barbel of the cod. The latter has the larger eye, and its scales seem to be developed somewhat later than in the whiting of the same length. The whiting would appear to attain a plump body and a finished outline sooner than the cod.

At 45 mm. the whiting clearly shows the scales along the sides, and the whole body is minutely speckled with black pigment, with the exception of the lower part of the cheeks, the ventral surface of the branchial region, and the silvery abdomen. The three dorsal fins are tinted with the same pigment, the first being darkest. Both anals also have a few dots, and the pectorals are similarly speckled minutely,—the pigment being best seen on their inner or posterior surfaces. The ventral fins are pale.

The foregoing stages are very abundant in July in the deep water off the Island of May and off the mouth of the Forth. They are, indeed, more characteristic of deep water than of the shallow water of such open bays as St Andrews; though, on reaching a larger size, they are common in the latter. Thus, the contrast between the numbers procured by the midwater-net 25 to 30 miles south-east of the Island of May, and those captured by the same net in inshore waters, is great. In the deep water their length varies from 9 to 58 mm. Comparatively few, however, being at either extremity.

As the whiting increases in size, great shoals are found in the offshore waters, though a few small are almost always found in inshore areas. It is rare, however, to find a whiting so small as 1⅝ inch amongst the multitudes of gadoids (chiefly cod and green cod) that seek the tangle-forests on the rocks at low-water.

The authors of the 'Scandinavian Fishes'* follow the opinion of Prof. Sars that the 'fry' of the whiting seek the shelter of the jelly-fishes, and feed on the crustaceans which live in the latter as parasites, or which adhere to their tentacles, whence Swedish fishermen draw the conclusion that the whiting is produced by the jelly-fishes, and reared by them. There is no reason to suppose, in this country at least, that a general habit of this kind prevails. Instead of looking for multitudes of the young whiting inshore, as the authors mention, it is necessary to go to the deep water offshore.

We have seen that in July the same haul of the midwater-net in the 'Garland' gave, on the 11th of July, in the deep water offshore, specimens ranging from 9 to 58 mm. During this month, individual specimens of 55 mm., in groups of two or three, and others of 80 mm., these sizes occurring separately, were captured by the midwater-net in the inshore waters. From their retreats in the offshore waters, therefore, it is probable that the young whiting pass to the inshore waters when between 50 and 80 mm., or thereabout, whether these stages be reached in July or in August. This is the more likely, since, on the 9th August, the same net, used under the care of Mr H. C. Williamson, in the Moray Firth, gave a series ranging from 22 to 65 mm. These, likewise, had not yet sought the inshore area.

The question—in relation to those of 55 to 80 mm., captured towards the end of July in the inshore area water, at a depth ranging from 5 to 15 fathoms—now arises: Are these the fishes of the season; that is, were they hatched in April, or are they late examples of last year's series,—hatched, perhaps, in June or July? It is apparent that so little difference exists

* P. 491.

between the largest in the swarms of young fishes undoubtedly pertaining to this season, on the 11th July, that it is reasonable to conclude that they are the fishes of the season. Very considerable variation in size of the several groups of whiting is permitted by the extension of the spawning-period over a considerable interval. Moreover, no evidence has hitherto been available of the occurrence of very small whitings in numbers during the first months of the year,—which specimens might justly be relegated to the previous season's spawning. The hiatus in this respect is pronounced.

The variability in size is as characteristic of August as of July, for, in the deep water south-east of the Isle of May, some small specimens, only 7·5 mm. in length, were obtained as late as the 31st August; while on the 9th, multitudes of whiting, from 22 to 68 mm., occurred. Others, caught in fewer numbers—for so active a fish readily avoids the conspicuous mid-water-net—range from 87 to 112 mm., or about $3\frac{1}{2}$ to $4\frac{1}{2}$ inches.

The black spot at the base of the pectoral fin superiorly is not present in those at 50 mm., but appears in those between 60 and 70 mm. The scales now cover the skin with a dense coating.

In September, multitudes of whitings, from 65 to 97 mm., or about $2\frac{3}{4}$ to $3\frac{3}{4}$ inches, appear in the inshore waters; the larger, and, in some cases, older examples, pushing ahead of their neighbours into the estuaries of rivers, such as the Eden and the Forth, where they are captured by various nets, and occasionally in enormous numbers. Thus, in the case related by Dr Fulton,* more than 3606 were taken in the Forth in one haul of a small trawl with a beam of 18 feet. None were obtained 20 miles seaward of the Island of May at this time. In the Eden such forms range from 125 to 135 mm., or about 5 to $5\frac{1}{2}$ inches. The growth, therefore, seems to be remarkably rapid during the latter part of July, in August, and in the following month or two. Smaller specimens, however, are occasionally caught in the tow-nets, especially offshore, as usual with most fishes. Thus, whiting of an inch or a little more (25 to 27 mm.) occur so late as the 22nd of September. In October, again, one of only 45 mm. was obtained inshore (St Andrews Bay). The authors of the 'Scandinavian Fishes' state that they make their way to the inshore water only in October, and when 10 to 12 cm. (4 to $4\frac{3}{4}$ inches) long. They keep such haunts, indeed, till spring, when they return to deep water.

In November the smaller specimens are from $3\frac{1}{2}$ to $5\frac{3}{4}$ inches, some exceeding the latter; while in December, the small examples are from 5 to 6 inches, such forms in both months being sometimes procured from the liners,—that is to say, they readily take a hook; indeed, in certain cases, the small whitings are almost as troublesome as the star-fishes.

Mr Cunningham,† reporting on Mr Holt's specimens of small fishes, observes that those measuring 4 to $7\frac{1}{2}$ inches in January may be divided into two groups, viz., those from 4 to $5\frac{7}{9}$ inches, which had evidently been hatched the preceding April; and secondly, those from 6 to $7\frac{1}{2}$ inches,—about which he is somewhat doubtful, though he enters them at eleven months. When, however, he comes to a fish $8\frac{1}{4}$ inches on February 20th, he thinks the limit has been reached, and he estimates it at two years old. But, according to what is shown above, if a whiting can reach $6\frac{3}{4}$ inches or a little more on November 25th, especially in northern waters, it is by no means impossible for it to attain $8\frac{3}{4}$ inches the following February. The whiting is a remarkably predaceous fish, and the rapidity of growth towards the end of autumn favours the view here

* *Eighth Annual Report of the Fishery Board*, p. 175.
† *Jour. Mar. Biol. Assoc.*, 1891-92, p. 358.

given. It is a saleable fish in its second year, and some imagine it is also capable of reproduction.

The whiting thus would seem to pass its early post-larval and its young stages chiefly in the deeper offshore waters,—coming inshore in immense swarms in September. It approaches, therefore, the haddock rather than the cod in such habits.

2. On a very young stage of a form resembling *Caranx trachurus*, L., the Scad or Horse-Mackerel.

The occurrence of a specimen apparently pertaining to this species on the 25th October 1893, in the centre of the Forth, opposite Kirkcaldy, gives an opportunity of referring to the growth of this form.

Day observes that it spawns in June, July, and August in our country; but in spring in the Mediterranean, according to Risso. In September the bays in Cornwall swarm with the young about 1 inch long. In October, numbers scarcely exceeding 2 inches are captured, while others are 7 or 8 inches (Couch). The stomachs of fishes contain examples of about an inch from the end of December to the middle of February. Couch found ripe scad in the middle of July; and since he met with the young, 3 or 4 inches in length, in August and September, he was in doubt as to whether they did not spawn twice a year. Those of 7 or 8 inches, however, were probably a year old.

The specimen captured in the Forth measures about 8 mm., but the tip of the tail, like the fins, has been injured. At this stage the head is large, the mandible bent upward somewhat more than in the adult, and the eyes are of considerable size. In lateral view (Plate VI. fig. 9), the body is short and thick, the precaudal region being deep, and thus differing from the attenuate condition in the adult. The first dorsal fin arises a little behind a vertical line from the base of the pectoral, and has permanent rays; the second also has permanent rays, and they stop short of the caudal. Immediately behind the prominent vent is a minute process representing apparently the first anal fin. The second anal stretches from the vent to the tail; a considerable interval, however, existing between its termination and the caudal rays, and thus it differs from the condition at a later stage. The pre-caudal region, however, undergoes modification as growth proceeds. Permanent rays are likewise present. The caudal rays are well developed (though injured), and all trace of the larval tail has disappeared.

The pectorals spring from a projecting fleshy base, and are broad fan-shaped organs. They appear to have the same relation to the first dorsal as in the adult. Their tips, unfortunately, are incomplete. The ventral fins are already considerably developed, forming a pair of stiff fins projecting from a firm basis, which is nearly in a line with the base of the pectorals, as in the later stages. The rays are injured in the specimen, the longest being short of the vent. The latter, if the tail had been complete, would occupy the centre of the body.

Recently Mr Holt* has described (in May) both the unripe† and the ripe eggs which are pelagic, from 1·03 to 1·09 mm. in diameter, and have an oil-globule. Moreover, the yolk was completely segmented. Mr Cunningham again found the young 2·1 inches in August, and in September some were only about half the length.‡

Long ago, A. W. Malm was familiar with the fry as frequenting

* *Jour. Mar. Brit. Assoc.*, 1893–94, p. 190.
† *Sci. Trans. Roy. Dub. Soc.*, v. ser. 3, p. 9.
‡ *Ibid.*, 1891–92, p. 113.

jelly-fishes (*Cyanea* and *Rhizostoma*). From the 22nd July to the 18th August they range from 12 to 36 mm.* He states that 'generally only from three to seven are found under the same 'jelly-fish.' If removed from the latter, and thrown into the water near it, they at once endeavour to regain their hiding-place. Like all very small fry, they are at first quite unlike the adult, being short, with a high head of peculiar shape, and with the mouth turned upwards. Until they are 20 mm. long, the greatest depth of the body exceeds the length of the head; but when they are no more than 70 mm. long, ... they have become normal in this respect, the greatest depth of the body being from about 84 to 82 per cent. of the length of the head. The plates of the lateral line first appear, though indistinctly, in specimens from 15 to 20 mm. long; afterwards they become more distinct, and the lateral carinæ appear. In young specimens, 35 mm. in length, these parts of the body have quite the same aspect as in the adult. Shortly after they have attained this size, they apparently leave the jelly-fishes, and live independently, in company with young herrings and sprats. Scads of this kind, from 75 to 100 mm. in length, are fairly common late in autumn.

By the kindness of Mr H. C. Williamson, a specimen, 33 mm. long, was procured at Naples on the 18th August. It has assumed most of the adult characters, even to the presence of keeled plates on the lateral line posteriorly. On the whole, however, it is a shorter and a deeper fish than the adult, with a larger head and eye. The pigment of the body is much less developed than that of the adult, and the two dorsal and the caudal fins are minutely dusted with black. The second dorsal and the anal almost touch the base of the tail. The bases of the ventrals are behind those of the pectorals, whereas in the adult they are nearly in the same perpendicular, and the abdomen has considerably lengthened. The lateral line shows indications of the hard plates (carinæ). This specimen would seem to have been spawned in spring, probably in April or May, and therefore the season is earlier than that mentioned by Day, viz., July.

3. On the Post-Larval and young stages of the Five-Bearded Rockling (*Onos mustela*, L.).

The development of the egg of this species was first studied by the late able worker, Mr George Brook,† in his own tanks at Huddersfield, where he reared the form to the early post-larval stage. It was also one of the earliest species dealt with at St Andrews, and, indeed, has been under observation almost every year since 1884.‡ The separation of the post-larval stages caught in the various tow-nets, however, has always been a task of difficulty. The following remarks, accordingly, are a contribution to the elucidation of this common species in these early stages.

In a form, measuring 7·5 mm., from St Andrews Bay, on the 17th June, the marginal fin is still continuous, but has true rays developing at its base, both in the dorsal and in the anal regions. True rays also occur in the caudal, in which the tip of the notochord is slightly bent up. In life, its head was slightly olive, with black pigment; the abdomen silvery, with reddish-brown. Blackish pigment occurred along the dorsum and the sides, chiefly over the former. The eyes were silvery-bluish. The rays of the moderately elongated ventrals were dull yellowish, and thus

* 'Scandinavian Fishes,' p. 88.

† *Jour. Linn. Soc.*, vol. xviii. p. 273, 1885.

‡ M'Intosh & Prince's 'Researches,' p. 832, etc.

in contrast with their general blackish dusting. The circulation was complete, and in full activity.

In contrast with the young four-bearded rockling of exactly the same length, the eye is brownish instead of bluish-black, and silvery,—a feature, however, to which no weight need be attached. No pigment occurs on the body, but the ventral fins are brownish throughout, and much shorter than in the other species. The snout is less blunt and heavy than in the four-bearded form,—a feature partly due to its diminished diameter.

At 16·5 mm. a large barbel occurs at the tip of the mandible, and short processes at the anterior nostrils, as well as traces of the labial barbels. The pectoral fins are considerably elongated, though they have not reached as far back as the tips of the ventrals. The body is silvery, with the exception of a small portion at the tail, and with dark pigment at the dorsum. The tail is symmetrical, so that the curve of the notochord would seem to be temporary.

A young parasite (*Caligus*) had fixed itself over the cardiac region.

At 24 mm. (Lochmaddy, in August), the characters are quite evident, viz., the presence of five barbels, the largest being that on the chin, and the last developed being the pair on the lips, the character of the head, and the greater depth of the trunk immediately in front of the caudal fin. Day states that the young of this form is brown, with blue eyes; but not a few of the length just mentioned, and larger, have the steel-blue of the dorsum, and the silvery sides so characteristic of the four-bearded species (*Onos cimbrius*). Perhaps, however, Dr Day alludes to a later stage, and variations may occur in regard to the assumption of the adult characters. The first ray of the dorsal is not much thickened in these bluish silvery pelagic forms.

When 28·5 mm. long, on the 9th of June, an example showed that at this stage variation also occurred, since the labial barbels were just indicated, and no more. The dorsum was not so deeply pigmented as in some, but the whole fish was silvery. The filament of the first dorsal fin was long. The ventrals were still long, though proportionally shorter than in the early stages, being apparently about a seventh the length of the body, and with black pigment at the tip.

One at 30 mm., in August, had so far altered its habit as to be found amongst muddy sand—when digging for littoral annelids at Lochmaddy, North Uist. Its more sober hue, deeper body, longer fins, and less attenuated form at once distinguished it from the preceding stage. The dorsum was of a dull green, dotted with black—merging inferiorly into the silvery lustre of the sides; though, towards the tail, the dull green again predominated. The cheeks behind the eyes were silvery, dotted with black; the black chromatophores, indeed, occurred over the entire body, with the exception of the anterior part of the abdomen, which was silvery, with a bluish-green iridescence. The irides were greenish-blue. In spirit, the colour of the dorsum became russet-brown, and a faint brownish hue appeared on the sides. The pectoral fins were kept in rapid vibration, and the first dorsal had the usual active ciliary motion. The first ray of the latter had a probe-point. The head had now assumed its characteristic proportions. The barbels were longer. The pelvic fins were still long; while the tactile extremities of the four anterior rays—especially the separate tips of the first and the second—were better developed, probably in connection with the change of habit.

A series of pelagic specimens, captured between the 6th and 27th of October, show that, in this species, the dark dorsum and silvery sides are characters pertaining to pelagic life; and, moreover, that some pursue this habit longer than others, or at least attain a considerably larger size before assuming the condition just noted in that of 30 mm. from Lochmaddy. The smallest of these range from 9·5 to 19 mm., but though they agree with the present species in pelagic dress, there may be a doubt. Not so with one of 25 mm. on the same date, and in the same locality, viz., October 9th, in the Moray Frith. The dark bluish-green dorsum and the silvery sides are as in the other species; but the depth of the trunk in front of the tail, and the small labial barbels, together with the condition of the first ray of the anterior dorsal, place the identity beyond question. Similar characters are present in an example 28 mm., procured in the same region on the 6th of October, though the first ray of the anterior dorsal is more slender. At 32 and 34 mm., in the same Frith, on the 26th and 23rd of October, all the features are better indicated, such as the proportional size of the head and eye, the somewhat thick and slightly probe-pointed first ray of the anterior dorsal, which projects beyond the rest, the barbels, and the depth in front of the caudal fin. The steel-grey of the dorsum, and the silvery sides, are well marked ; but the latter, with the exception of the abdomen, is minutely dotted with black points, so as to have a granular appearance. The ventrals are often injured at the tip, and young parasitic crustaceans (*Caligi*) cling to these and other parts, *e.g.*, the cheeks. Lastly, one of no less than 40 mm. comes, like several of the latter, from the surface, though from a different locality, viz., near Inchkeith. The colours agree with the foregoing, and the granular black pigment of the sides has now invaded the first half of the posterior dorsal fin. It is thus apparent that other questions than that of size determine the change of habit and colour in this species. A similar example, 39 mm. long, comes from the stomach of a cod in August.

Of those which present the change just mentioned, two were obtained amongst the rocks on the 26th July, and measure respectively 35 and 42 mm. All trace of the silvery hue has gone ; and the entire body, as well as the second dorsal fin, is minutely dotted with black chromatophores, those on the abdomen—both laterally and ventrally—being distinctly larger. The first rays of the anterior dorsal still shows a slight probe-point, but the ventral fins are injured.

Another, of 44 mm., also procured amongst the rocks in October, presents a silvery belly, and more or less silvery sides, with the usual brownish hue elsewhere ; the sides, but not the abdomen, being very minutely dotted with black chromatophores. Considerable variations are therefore exhibited by the five-bearded rocklings in this condition.

In January young five-bearded rocklings of a brownish hue, and of the following lengths, are met with between tide-marks :—37·5 mm., with silvery sides, minutely speckled with black ; 40 mm., also silvery, and with similar black specks ; 43 mm., without silvery lustre, and with bold black chromatophores all over the body and fins, while the filament of the first dorsal is long ; 52 mm., without silvery lustre, and with black specks all over. All these are the young of the preceding season. It is possible, also, that one of 70 mm., with black specks all over the head and body, as well as faintly on the fins, may be an early one of the same season as the foregoing. In April, again, young rocklings of $1\frac{3}{4}$ inches are occasionally met with at the surface. One of 80 mm., in July, between tide-marks (Guernsey), appears to be a continuation of the series. In August, at St Andrews, the smaller examples range from $1\frac{5}{8}$ to $4\frac{3}{4}$ inches ; while at Lochmaddy the higher limit is 5 inches during the same month. The larger are probably in their second year. The same may be said of those at 103 mm. in February, and of 110 and 133 mm. in November. Those of $6\frac{1}{4}$ inches are somewhat older.

Mr Cunningham found that specimens 1 inch long on the 21st May were $3\frac{1}{8}$ inches in August in the tanks of the laboratory at Plymouth; while, in May of the following year, one had grown to a length of fully 5 inches. He does not, however, clearly indicate the age of the examples measuring 1 inch.

Day observes that at an early stage the five-bearded rockling may be distinguished from the three-bearded by the presence of dull yellowish rays in the dark ventral fins; when nearly an inch long by the five barbels, by the brownish hue of the back and trunk. The eyes are smaller, the space between them broader, and the barbels are longer. The first dorsal fin is also longer from before backwards. Some of those characters, however, are of little avail in preserved material; and hence the necessity for a careful revision of all the more permanent features.

4. On the very young stages of the Tadpole Hake (*Raniceps raninus, L.*).

Parnell says that this species sheds its spawn in April, while R. Couch gives July. J. Couch observes that in April the roe appeared to be at the beginning of its enlargement. 'That the young ones are produced at 'no great distance from the coast appears probable, although they are 'rarely met with; but Mr Newman found several of small size amongst 'sprats in London; and I learn from Charles H. Gatty, Esq., F.L.S., that 'he obtained a small example at Great Yarmouth.'* Day, again, mentions that, in Mr Thompson's fish, taken on October the 8th, 'ova were contained 'in two small lobes, about an inch in length.' He also adds that Mr Dunn has taken very small ones from the stomachs of other fishes. In the 'Scandinavian Fishes' it is stated that 'Nilsson was told that the tadpole-fish 'spawns between Martinmas and Christmas, but this is probably an ex-'ception to the general rule.' It may also be an error. Further, 'In the 'month of July, Fries observed, on the coast of Bohuslän, two tadpole-fish 'that kept close to each other, and, caressing each other in every possible 'manner, came right up to a landing-place in 3 dm. of water, where they 'finally hid themselves under the frame of the pier.' It is also mentioned that two young tadpole-fishes, between 6 and $6\frac{1}{2}$ cm. long, were captured in October.

The foregoing contains all the information on the subject, until, on the 29th October 1894, a very young specimen was procured by the 'Garland,' in the Moray Frith, between Coversea and Burghead. The total length is about 9 mm. The outline of the little fish is remarkably clavate, the anterior end rising somewhat abruptly upwards from the slender body; while the prominent vent, with its anterior ridge along the ventral surface of the abdomen, still further gives bulk to the region (Plate VI. figs. 7 and 8). This anterior enlarged part of the fish occupies 4 out of the 9 mm. The skin seems to have been distinctly pigmented, a large shield-shaped area of brownish-black chromatophores, with its broad end in front, occurring between and behind the eyes, with a few isolated specks posteriorly. The cheeks below the eyes are also speckled with the same pigment. The sides of the body from the pectorals backward are minutely marked with blackish-brown pigment, which, in the preparation, does not reach the tail. On the ventral surface the pigment forms a V, with the apex forward, in the hyoidean region; and the angle of the ventral fin on each side is marked by the same chromatophores.

The snout is comparatively blunt, and the black eyes are (in spirit) of moderate or even small size for so large a head in a post-larval fish. They

* Couch, vol. iii. p. 123.

look forward, outward, and slightly downward. The nasal organ shows only a single large opening close in front of the angle of the eye. The mouth is large, and the tongue-like process of the hyoidean apparatus projects forward on its floor. The breadth of the lower jaw inferiorly is considerable, so that the little fish rests steadily on this surface. The vent occurs at the end of a ventral ridge.

The second dorsal fin begins like that of the adult, a little behind a line prolonged upwards from the base of the pectoral, and stretches almost continuously to the tail. At this stage true fin-rays are present, though the fragmentary condition of many of these gives a degree of uncertainty as to the actual continuation of the dorsal into the caudal. All that can be said is, that the broken caudal rays rise clear of the broken dorsal and anal rays, as if a slight hiatus existed. The anal commences immediately behind the vent, and extends in the same way almost to the caudal. The pectorals have a large, free, fleshy basis, and are apparently large; but as only one had a portion of its rays present, the exact condition cannot be determined. The pelvics spring from the ventral surface considerably anterior to the pectorals, and have evidently been of great length. Thus, in regard to their insertion, they differ from certain gadoids in which a change forwards takes place during the growth of the fish. The six filmy rays, all of which, however, are imperfect, extend considerably beyond the vent; whereas, in the adult, the longest ray falls considerably short of it. Like the ling, rockling, and other gadoids, therefore, the tadpole-fish has very long ventrals in his pelagic stage; and, as Malm states, the colour of these is also characteristic, viz., deep black. No trace of colour on the fins proper remained in the present example, which had been much damaged before preparation.

In all probability, such a specimen, if the date be correct, would issue from an egg spawned in July or August; and its capture in the region mentioned would show that the young are found on the same ground as their parents, which are often caught in crab-pots inshore, or thrown on shore after storms.

Of the other sizes known, one of 8½ inches was got at Portrush * on the 5th March; while, at St Andrews, those procured in February were respectively 9, 10, and 10½ inches, and that of the 21st November, 10 inches. The latter would appear to be an average specimen.

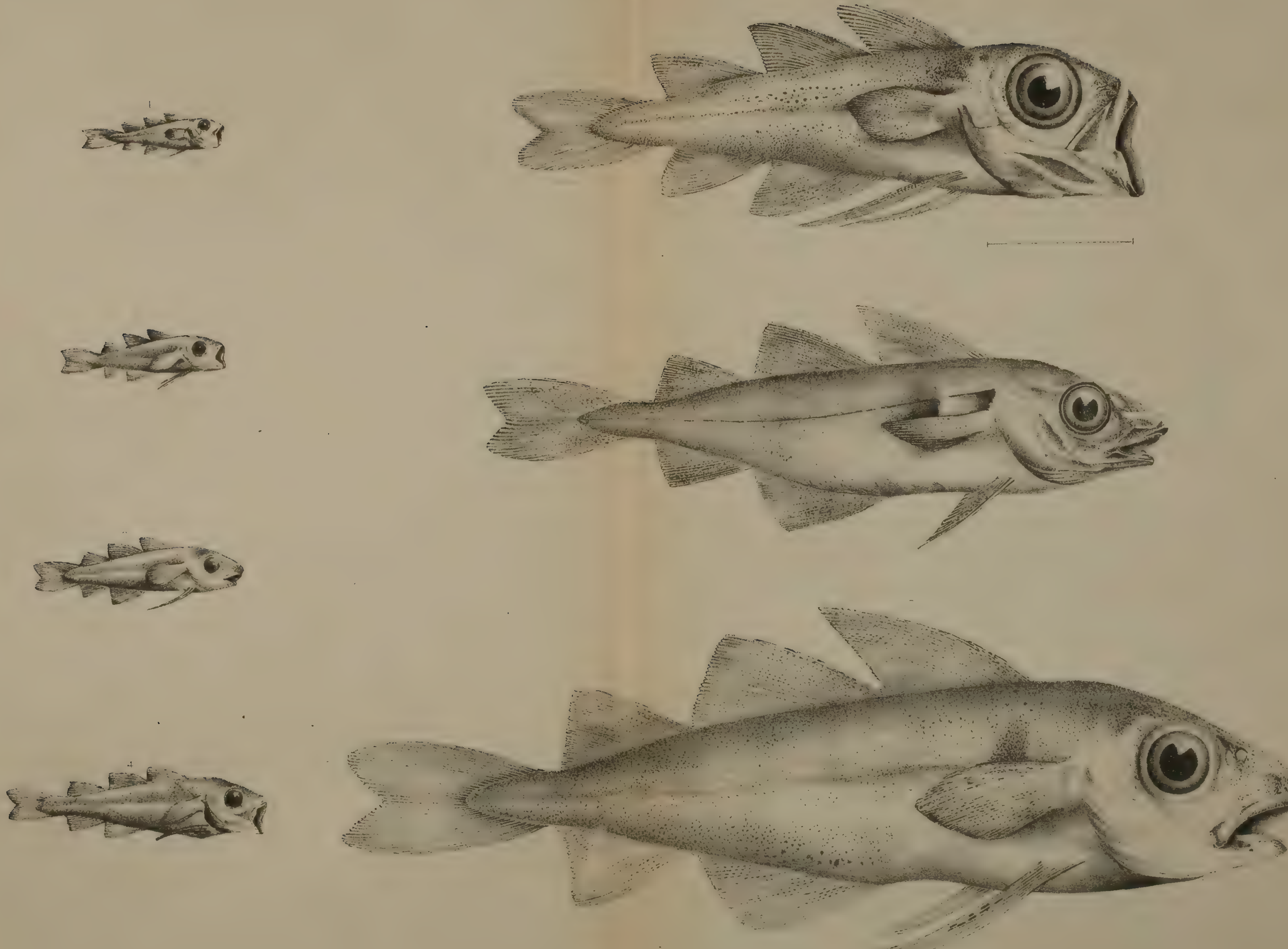
A. W. Malm caught a young example, 13 mm. long, on the 23rd July, at Lunnevik, Bohuslän. It 'was entirely whitish, with the exception of the ventral fins, which were deep black; while blackish-brown pigment also appeared on the head, the front part of the sides, and across the occipital region. Still, the typical form of the species was already developed.' †

At St Andrews, a specimen, 10 inches long, had, on the 21st November, its reproductive organs extremely small,—in fact, rudimentary.

* Ogilby, quoted from Day.

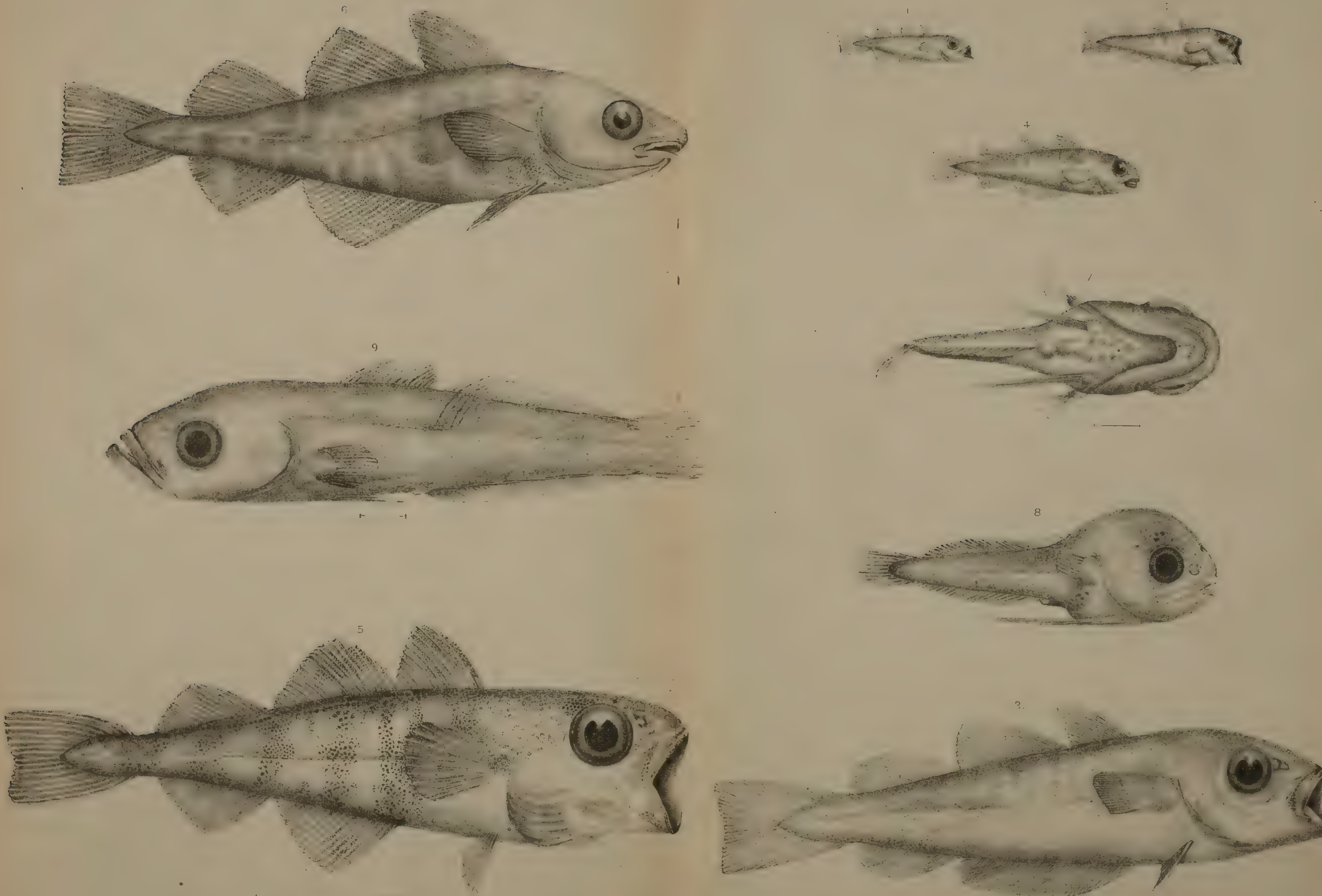
† 'Scandinavian Fishes,' p. 561; and A. W. Malm, 'Goteborgs, etc., Fauna,' p. 499, 1877.

PLATE V.



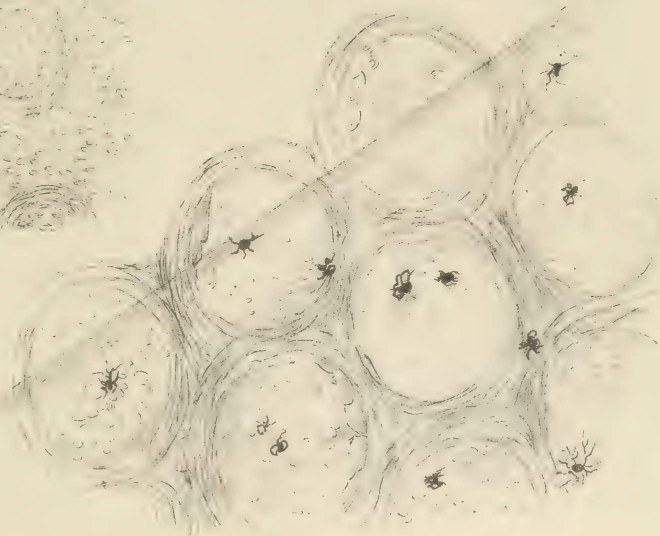
ADA WALKER, ad. nat.

EARLY STAGES OF THE HADDOCK.

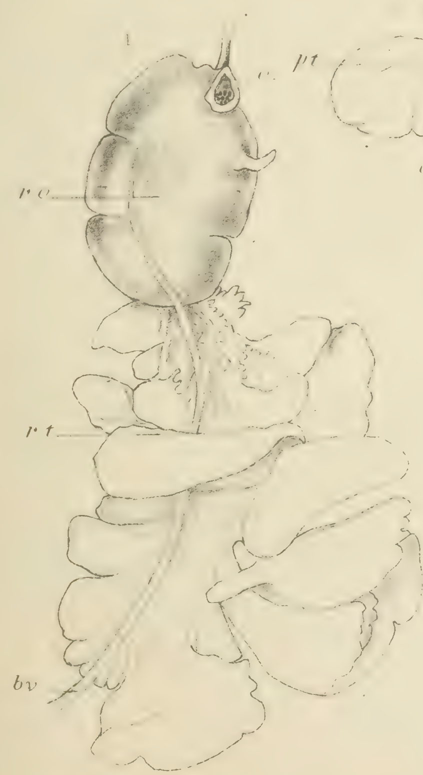


ADA WALKER, *ad. nat.*

EARLY STAGES OF COD, WHITING, &c.



W. C. M.



H. M. K.

EXPLANATION OF PLATES.

Plate V.

Fig. 1. Haddock, 24 mm. long. Natural size.
Fig. 2. Haddock, about 29 mm. long. Natural size.
Fig. 3. Haddock, about 39 mm. long.
Fig. 4. Haddock, about 50 mm. long. Natural size.
Fig. 5. Enlarged drawing of fig. 2. The rays of the second anal have been too much curved.
Fig. 6. Haddock, about 5 inches long. Natural size.
Fig. 7. Enlarged drawing of haddock, about 39 mm. long.

Plate VI.

Fig. 1. Young whiting, 26 mm. long. Natural size.
Fig. 2. The same, enlarged under a lens.
Fig. 3. Young whiting, 30 mm. long. Natural size.
Fig. 4. Young whiting, about 40 mm. long. Natural size.
Fig. 5. Young cod, 34 mm. long, enlarged under a lens to show the arrangement of the chromatophores. 28th May 1896. (Formalin.)
Fig. 6. Young cod, about 5 inches in length. 22nd September 1887. Natural size.
Fig. 7. Ventral view of a young tadpole-fish, 9 mm. long. 29th October 1894. Enlarged under a lens.
Fig. 8. Lateral view of the same form. Similarly enlarged.
Fig. 9. Lateral view of a young fish (8 mm. long) resembling the horse-mackerel (*Caranx*). 25th October 1893. The tail is imperfect. Enlarged under a lens.

Plate VII.

Fig. 1. Developing and widely separated scales of a haddock, 45 mm. in length × 100.
Fig. 2. Developing scales (almost touching) of a haddock 53 mm. long × 100.

Figs. 3.–5. Illustrating Mr Kyle's Note on a hermaphrodite ling (p. 396).

r. o. Right ovary, with small portion of testis attached.
o. Oviduct ; the two portions of the reproductive organs were joined round *o.*
r. t. Right testis.
b. v. Blood-vessel.
l. o. Left ovary, with small portions of testis attached.
l. t. Left testis.
p. o. Small ovary, posterior to oviduct.
p. t. Posterior portion of testis.
d. Duct, from right testis leading into right ovary, showing longitudinal ridges on its lower, and honeycombed appearance on its upper surface.
v. Fold or valve across the duct, with small opening.

V.—REPORT OF OBSERVATIONS ON PLANT PLANKTON. By George Murray, F.R.S.E., F.L.S., Keeper of the Department of Botany, British Museum.

At the request of the Board I have carried out a series of observations on the minute free-floating vegetation, especially of the west coast. The importance of a study of such organisms, as the basis of the nutrition of all life in the sea, has long been recognised, but very little has hitherto been done in the way of investigation. The main observations were made on board the 'Garland' in three series, viz., the first from 26th March to 6th April; the second from 28th July to 15th August; and the third from 2nd December to 8th December. In March to April, the observations were made in the North Sea, and on the west coast in Loch Linnhe, the Sound of Jura, and principally in the Clyde sea-area. In July to August a week was spent in visiting the former stations and others in the Clyde sea-area, and the remaining time in the Sound of Islay, Sound of Jura, Firth of Lorn, Loch Etive, Loch Linnhe, Loch Aber, Sound of Mull, the sea round Rum, Eigg, and Ardnamurchan, Loch Nevis, Loch Hourn, Raasay Sound, etc. In December, observations were made in Loch Aber, Loch Linnhe, Firth of Lorn, and the Clyde sea-area. The material obtained at these times was all preserved, and its working out in detail occupied me for a considerable period in London.

Methods.—In addition to tow-netting with fine silk nets—the method of capture usually employed—I have made use of a cylindrical silk bag, about 1½ feet long and 3 or 4 inches wide. This was tied to the nozzle of the hose, there being a lateral overflow vent near the top of the bag; and, on pumping through it with the donkey engine from an intake pipe 8 feet below the surface, good results were obtained. This method, first employed by Dr John Murray, enables one to work when steaming, and is often convenient in weather that is too rough for tow-netting. The fixing and preservative employed was a 0·5 per cent. aqueous solution of chromic acid; good results have also been obtained from Fleming's solution and from platinic chloride of various strengths. I carried tubes half filled with the chromic acid solution, which is about the same density as ordinary sea-water. The diatoms, etc., were turned out of the tow-net into a glass-jar, and allowed to settle for some time. They were then collected from the bottom by means of a dipping-tube, and added to the chromic acid solution. Several times during summer, while working in haste and having large quantities of diatoms to deal with, I removed some *en masse* with a spoon from the tail of the net to the chromic acid solution. The addition of a mass of diatoms, without the proper proportion of sea-water, proved to be a mistake, since the contents of the cells were disorganised in these cases.

Distribution.—The seasonal occurrence of diatoms in vast numbers in the sea has long been known, but no observations have been made that afford a satisfactory explanation of the causes that contribute to the phenomenon. On both the east and west coast, during the first months of the year, there is a remarkable prevalence of diatom life. We have no knowledge of the distance out in the Atlantic to which this extends, but in the coastal waters at this season the abundance of diatoms is extraordinary. Towards the end of March and beginning of April, the quantity diminishes, and for the rest of the year diatoms remain at a fairly constant quantity, except for here and there the occurrence of definite local banks of them. *Peridinieæ*, especially the species of *Ceratium*, are very few in number during the maximum period of diatom life, but they come upon the scene with the waning of the diatom season, reach a maximum about August, and linger on in fair quantities until December at least. Early in April, during four or five days' work in Loch Fyne, when diatoms were exceedingly plentiful, I succeeded in obtaining only one specimen of *Ceratium Tripos*, which, at other seasons, especially summer, is the predominant plant organism in the western lochs. During the period of most active diatom life, the surface of the sea is almost monopolised by a diatom *Skeletonema costatum*; while species of *Coscinodiscus*, *Biddulphia*, *Ditylum*, *Rhizosolenia*, etc., abound in the layers beneath, the greatest quantity of these being generally obtained at 5 fathoms, very few below 25 fathoms. The surface of the Clyde sea-area so teemed with *Skeletonema* in April that a tow-net could be one-third filled in a few minutes with a scum consisting of it and other diatoms in smaller quantity. When I revisited the same stations in the end of July, I could not obtain a single *Skeletonema*, and its absence (at all depths) continued to puzzle me during my examination of the west coast in August, except for a few specimens obtained near Oban, and its remarkable occurrence in this, Loch Etive. While (with this one exception) it could not be found outside, the surface of Loch Etive simply swarmed with *Skeletonema* in abundance, equal to if not greater than that of the Clyde sea-area in spring. While it occurred as a surface organism in spring, it was far more plentiful in Loch Etive at 5 fathoms than at the surface in summer. There was no local, low temperature condition that would serve to explain this, Loch Etive being, in point of fact, nearly two degrees warmer than the sea outside. In its greater abundance at 5 fathoms than at the surface it agrees with all other diatoms during the summer and winter,—at all seasons, in fact, except during the period of maximum occurrence. If one sets nets at the surface, 5 fathoms, 10 fathoms, and 20 fathoms, the result will be the greatest capture of diatoms in general at 5 fathoms, a nearly equal (smaller) quantity (often of the very same organisms) at the surface, and at 10 fathoms, and a much slighter quantity at 20 fathoms. Excluding March and April, I found no notable exception to this rule, except in several hauls in December, in the Dunoon basin, when I obtained more from 10 than from 5 fathoms. From the character of the special pigment *diatomine*, which masks the chlorophyll in diatoms, and its resemblance to the corresponding pigment in *Phæophyceae*, one would expect this vertical distribution of diatom life, since its maximum occurrence is nearly at the same depth beneath the surface as the Laminarian zone. It is plain that free-floating organisms like diatoms, from being subject to currents and immersions of layers of water, must be liable and adaptable to certain changes of depth, and to the varying quantity and quality of sunlight that reaches them at such depths, just as shore algæ are subject to such periodical changes in the rise and fall of the tides.

In March to April, the plant plankton of the east coast, judging by a hurried examination of it in bad weather, closely resembled that of the west coast outside the Clyde sea-area. The characteristic diatoms were, in the order of their abundance, *Coscinodiscus concinnus*, *Chætoceros borealis*, *Ditylum Brightwellii*, *Chætoceros decipiens*, *Rhizosolenia Shrubsolii*, *Skeletonema costatum*, and *Coscinodiscus radiatus*; while, of other organisms, *Ceratium Tripos*, in places here and there, almost rivalled *Ditylum*, but generally was about equal to *Rhizosolenia*. On entering the Clyde sea-area, however, *Ceratium* became much more scarce; and in Loch Fyne, as said above, only one specimen was obtained in several days' tow-netting. On the other hand, *Skeletonema*, from being scarce, at once leapt easily into first place, far exceeding any other Clyde diatom ; *Coscinodiscus concinnus* also became far more plentiful ; and both species of *Chætoceros*, named above, also increased greatly. There were numbers of other diatoms, now present, now absent, but these were the forms characteristic of the season. In summer, while diatom life was scarcer, there was a much greater variety of forms ; but only in the Sound of Mull and in Loch Etive an approach to the quantities obtained in the Clyde in spring. I sent nine typical tubes to Professor Cleve, who has kindly favoured me with the report on them in the accompanying table.

× = dead fragments. rr = very rare. cc = very common.
r = rare. c = common. + = not rare.

	Sound of Mull, Tobermory.	Sound of Mull, Tobermory.	Sound of Mull, Barony Point. Surface.	Sound of Mull, Barony Point. 5 fathoms.	Rum to Ardnamurchan.	Loch Nevis.	Loch Hourn.	Loch Etive.	Loch Aber.
Bacteriastrum varians, Laud.,					×r		×r		
Cerataulina Bergonii, Per.,		r		rr	r				
Chætoceros borealis, Bail.,					r	+	r		
,, *commutatus*, Cl.,	+	r		r	+			+	
,, *constrictus*, Gran,								r	
,, *contortus*, Schütt,	+				+	+		+	
,, *criophilus*, Cast.,					r				
,, *curvisetus*, Cl.,	cc	cc	cc	cc	cc		r	c	cc
,, *debilis*, Cl.,	+	c	+		+				+
,, *decipiens*, Cl.,	+	c	+	+	+	+	c	+	
,, *didymus*, Ehr.,	c	r	+	+	c	+	r	r	+
,, *diadema*, Gran,	r		+		r				
,, *septentrionalis*, Oestr.,					r			r	
,, *scolopendra*, Cl.,								×r	
Coscinodiscus concinnus, W. Sm.,		r	r	r	r			r	r
,, *excentricus*, Ehr.,					r			r	r
,, *radiatus*, Ehr.,					r		r	r	r
Ditylum Brightwellii, Grun.,	r				r			r	
Eucampia zodiacus, Ehr.,	c	r	+	+	+			c	+
,, *grœnlandica*, Cl.,								r	
Fragilaria striatula, Grev.,								r	
Guinardia flaccida, Per.,	r	r	r		r	r	r		r
Lauderia annulata, Cl.,					rr				
Leptocylindrus danicus, Cl.,		r	r	r	r				
Navicula membranacea, Cl.,					r				
Rhizosolenia setigera, Brightw.,	r			rr	+			+	
,, *Shrubsolii*, Cl.,	+	r	+	+	+	+	+	+	+
,, *Stolterfothii*, Per.,		rr	+		r				
,, *pungens*, Cl.,		+		+	r		+	+	
Roperia tessellata, Grun.,					r			r	
Skeletonema costatum, Cl.,								cc	
Stephanopyxis Turris, Ralfs.,	+	r	+	r	c	c	+	+	+
Thalassiosira Nordenskioldii, Cl.,	rr				r				
,, *gravida*, Cl.,		rr							
Thalassiothrix longissima, Cl. et Grun.,	rr								

These diatoms and their distribution were fairly typical of all the localities, now one form, now another, varying in abundance ; but *Chætoceros curvisetus*, *C. decipiens*, *C. didymus*, *Rhizosolenia Shrubsolii*, *Coscinodiscus concinnus*, *Eucampia zodiacus*, and *Stephanopyxis Turris* being the prevalent forms. Professor Cleve noted that the fronds of *C. curvisetus* were spore-bearing,—a fact which I had independently noted in this species, as well as in *C. borealis* and *C. constrictus.* In addition to the diatoms, and, as a rule, far exceeding them in total bulk, were the species of *Ceratium. C. Tripos, C. Fusus,* and *C. Furca* were all three present in nearly every haul of the nets, especially the first two species. Sometimes one predominated, sometimes the other ; but, as a general rule, *C. Tripos* prevailed in the Clyde sea-area, and *C. Fusus* in the northern lochs, but never to the exclusion of the other.

In December, on the west coast outside the Clyde sea-area, the characteristic diatoms were *Coscinodiscus concinnus, Biddulphia mobiliensis, Ditylum Brightwellii,* while species of *Chætoceros* and *Navicula* were casually present. Both *Ceratium Tripos* and *C. Fusus* appeared sparingly in all the captures. Within the Clyde area, *Skeletonema* became next abundant to *Coscinodiscus,* after it *Biddulphia,* and next *Chætoceros decipiens,* while *Ceratium Tripos* and *C. Fusus* were more plentiful than in the waters outside. Compared with these, other diatoms and plant organisms were of purely casual occurrence. These appeared more or less in every haul of the nets, and in fairly steady proportions, as cited. Not a single specimen of *Rhizosolenia* was obtained in December, while sometimes in August it was the predominant generic form, *e.g.,* in Kilbrennan Sound.

At all seasons of the year, especially near the shore, a small proportion of the diatoms captured are dead, their cell-contents either disorganised or gone. This is particularly noticeable in such large forms as *Coscinodiscus concinnus* and *Biddulphia mobiliensis ;* but it occurs frequently in other forms such as *Chætoceros decipiens,* and, above all, in *Skeletonema costatum.* I believe this phenomenon, which at first puzzled me greatly, to be due to the decline or loss of salinity of the water. My reasons for this belief are these : Such diatoms are mostly found at or near the surface and in the vicinity of land where a considerable mixture of fresh with salt water occurs. This may be seen in any of our western sea lochs, especially after rains, where a sheet of practically fresh water lies on the top very slowly mixing with the salt water. It is well known that seaweeds, in general, are extremely sensitive to variations in the degree of salinity. My belief is strengthened by the following observation : In April, on ascending Loch Fyne, the nearer we came to the top the larger the quantity of dead diatoms were found. This was particularly noticeable in *Skeletonema,* which almost monopolised the surface ; and on tow-netting in the waters between Inveraray and Cairndhu at the head of the loch, where there was a thick sheet of fresh water on the surface, owing to recent heavy rains, it was impossible to find a living cell in the vast mass of *Skeletonema.* This observation was confirmed in Loch Etive in summer. This loch was full of *Skeletonema,* some at the surface, but most in from 3 to 5 fathoms. A large quantity of fresh water was entering the loch, and the diatoms at the surface were in large proportion dead, while those in the lower layers were living. The observation is the more noteworthy, as I am led by other reasons to think this diatom mostly abounds in waters of a fairly low degree of salinity, and I have elsewhere taken the low degree of salinity of this loch in August as possibly accounting for the presence of *Skeletonema* in it at that season. However, this last idea is a purely speculative one, and does not in any way affect my general contention that the great numbers of dead diatoms in the sea are to be accounted for by the addition of fresh waters.

Diatoms as Food of Marine Animals.—When we reflect that the whole bulk of animal life in the ocean must be dependent on the vegetation of the ocean, it will be at once apparent that the small fringe of visible vegetation on the shallow bottoms round coasts cannot in the least degree suffice for the sustenance of the teeming animal life, which not only extends over the surface, but ranges into the depths. This rôle must be played almost entirely by the minute plant organisms, diatoms, *Protococcaceæ*, *Oscillatorieæ*, *Peridinieæ*, Coccospheres, Rhabdospheres, etc., which inhabit the surface layers down to 30 to 50 fathoms. Such organisms have been recorded from polar, temperate, and equatorial seas, sometimes in vast shoals, discolouring the water, but always found to be present when suitable apparatus is used for their capture. Their economic importance to the fisheries is therefore of a direct and vital character. We know that the stomachs of Holothuriæ, Ascidians, Salpæ; oysters, scallops, whelks, and other molluscs; crabs, lobsters, and other large crustacea, and even full grown fishes, have formed the happy hunting grounds of diatomists in search of material; but direct evidence has been wanting of the use of diatoms as a matter of daily food by animals in the sea. Observing that the excreta of copepoda and other small crustacea, largely fed upon by fishes, were in many cases tinged with a faint colour like diatomine, I subjected them in many cases to a minute microscopic analysis, with the result that nearly the whole could be resolved into minute fragments of diatom frustules and their chromatophores. In many cases, it was surprising to note that the chromatophores had passed through, almost unchanged in shape, and even retaining faintly their colour. It was, in fact, often possible, from the characteristic shapes of the chromatophores, and the minute finely sculptured fragments of frustules, to recognise them as belonging to diatoms found in the same capture. In a few cases it was possible to detect a whole unbroken diatom cell within the crustacean, but almost invariably the diatoms were reduced to fine fragments. *Coscinodiscus* and *Skeletonema* were the usual forms found, and these were the prevalent forms in the sea when my observations were being made.

It appears, then, to be clear that the animals which are themselves an important constituent of the food of fishes live in turn largely on diatoms. It has always seemed to me very highly probable that young fishes eat diatoms directly; and, in order to put this to the test, Dr Wemyss Fulton sent me some young sand-eels, taken in tow-net, 15 miles off Aberdeen, on 16th May 1894; some young flat-fish (? plaice), taken off Montrose, 21st May 1894; and some very small clupeoid fishes, taken 30th March 1889. They were preserved in spirit. After burning a few of each in platinum crucibles, the ash was examined, and diatoms discovered in every case. Four different genera, viz., *Skeletonema*, *Eucampia*, *Melosira*, and *Chœtoceros*, were found in the sand-eels; *Skeletonema* and *Nitzschia* in the flat-fish (in both cases *Skeletonema* was predominant); and *Coscinodiscus* (abundant) and *Melosira* (very rare) in the young clupeoids. In each case, complete valves (in *Skeletonema*, chains of several cells) were found, which appears to indicate that they were eaten directly by the fish themselves, and not within the bodies of small crustacea; in this latter case, they would have been broken up into minute fragments.*

* The late Mr R. Brown in a paper "On the Nature of the Discoloration of the Arctic Seas" (*Trans. Bot. Soc., Edin.*, vol. ix. p. 244, 1868), was the first, so far as I know, to point out that this discoloration is due the presence of large masses of diatoms. He found these diatoms within the Pteropoda, Medusae and Entomostraca that compose the "whale's food."

With reference to the association of diatoms with the food of fishes, Prof. M'Intosh refers me to the Seventh Annual Report of the Board, in which he anticipates my observations. At p. 272 (Part III.) he notes the occurrence of Appendicularians with *Rhizosolenia*. He says, "The stomachs of these were distended

During summer, I made a long series of attempts to discover whether the species of *Ceratium*, then so abundant in the sea, furnished a constituent of the food of small crustacea, but without result. In the first place, *Ceratium* could hardly be traced so easily as diatoms, and the matter is one of difficulty. Direct observations also yielded no result. I made an estimate of the relative abundance of diatoms, of species of *Ceratium*, and of animal life in all the captures, and I found a certain constancy in the proportions in the great majority of cases. When there were plenty of diatoms, there were *always* plenty of crustacea; when *Ceratium* predominated, and diatoms were scarce, there was little animal life. (In Loch Fyne, in July, I made two almost pure captures of *Ceratium Tripos*—merely one or two diatoms and copepoda mixed with it.) These facts, however, are merely suggestive. There is one more suggestion I should like to make. The spines of *Ceratium* may be a protection against being eaten. I could not fail to remark that there were no traces of spiny diatoms, such as the species of *Chætoceros*, having been eaten by small crustacea, though they were abundant in the sea. Against these negative observations, however, may be placed the fact that I found *Chætoceros* in the young sand-eels. Though one can suggest other uses for the spines and sharp projections of diatoms, especially the hollow spines of *Chætoceros*, it may yet be that they are a defence against crustacea, etc., as well, and this may be equally true of *Ceratium*. At all events, I failed to find evidence of *Ceratium* being eaten, though it was diligently sought for; and repeated observations and estimates appeared to point to there being a balance between the quantities of diatoms and animals, irrespective of *Ceratium*.

Reproduction of Diatoms.—In the ordinary process of reproduction, a diatom cell divides into two cells, which resemble the parent; and, in most cases, the successive generations remain attached to each other in chains of individuals. Since the division takes place at the girdle where one half of the wall overlaps the other, and each succeeding generation is similarly overlaped, and since (unless, perhaps, in a free state) there is no subsequent superficial growth, each succeeding generation is diminished in size by the thickness of the girdle membrane. When a minimum size is reached, diatoms become re-established at the maximum by the formation (in various ways) of auxospores. Mr Comber has called attention (*Jour. Roy. Micr. Soc.*, October 1896) to the formation in certain diatoms of 'Endocysts' resulting in the production of a dimorphic form, and Prof. Cleve has recorded the presence of a specimen of *Biddulphia aurita* within another,—the internal one being considerably smaller, and having no spines (*Bihang till K. Svenska Vet. Akad. Handlingar*, Bd I., No. 13). Besides these modes of reproduction, nothing was certainly known of any mode of multiplication until the observations I was enabled to make in spring and summer on board the 'Garland.' The minute botanical details and considerations have been discussed at length in a paper published, by permission of the Board, in the *Proceedings of the Royal Society of Edinburgh* (vol. xxi. p. 207. plates i.–iii.).

It was discovered in *Biddulphia mobiliensis* that the cell-contents contract and round themselves off, this more or less spherical body proceeding to secrete a membrane of approximately the same shape as the parent, but without the characteristic external spines, etc. This body is apparently of the same character as that recorded by Prof. Cleve in *B. aurita*

by chlorophyll granules, the same appearing in the fœcal pellets, both in the intestine and when discharged." I regret that his observation was unknown to me, and that I therefore did not cite it in my paper in *Proc. Roy. Soc., Edin.* The main point, however, is the full and complete establishment of the truth; and, since my observations were made in entire ignorance of his, this confirmation is all the more satisfactory].

(of which I was ignorant at the time). During summer, I found these internal bodies free in the water in large numbers, and in a state of active division, none of them having developed the characteristic external spines of the parent form. The parent form was almost wholly absent. In December, again, the parent form (with spines) was abundant, but none of the summer forms. Presumably these had grown into mature *Biddulphia mobiliensis*, either directly, as is most likely, or after some other development. The production of this internal form, so far as I have seen, in *Biddulphia*, is always a case of rejuvenescence of the cell, the whole of the cell-contents of the parent being used up in the formation of one new cell, which, when free, increases its kind by division. I have observed similar rounding off in the cell-contents of *Ditylum Brightwellii*, and very probably it goes through a similar life-history.

In *Coscinodiscus concinnus*, I have also found a young form within the parent, this time exactly resembling it in all essential characters. In this genus also, therefore, we have the production of a new individual by the rejuvenescence of the cell. That this often happens in spring I had abundant evidence; but, what is more interesting, I have found in this species two diatoms within the parent, showing that the protoplasm must have divided to form them. In Loch Fyne I found other specimens of *C. concinnus*, of which the protoplasm had divided into four, eight, and sixteen rounded-off portions (produced to judge by their positions, etc., by successive divisions into two); and free in the water at the same time, packets of eight and of sixteen young *Coscinodiscus concinnus*, of the same size as the rounded portions of protoplasm. The conclusion was inevitable that the packets of eight and of sixteen were produced from the rounded-off portions, having regard to the occurrence of single forms and pairs as described above. The membranes of the young individuals were either not silicified, or were imperfectly silicified, as proved by burning; and they were therefore capable of growth, and of attaining the full dimensions of *Coscinodiscus concinnus*, without the intervention of auxospores.

Both in spring and summer, I observed in several species of *Chætoceros* a series of divisions of the cell-contents, obviously similar to the divisions in *Coscinodiscus*, and doubtless preliminary to the formation of reproductive bodies. In *C. borealis* this sub-division of the contents is carried to four, eight, and sixteen; in *C. curvisetus* to four and eight; and in *C. constrictus* to four. Instances of higher numbers in the latter two species may and probably do occur, but they have escaped me. I have witnessed the actual processes of division up to four; but the farther sub-divisions into eight and into sixteen are known to me only from finding instances of them as accomplished facts. What the fate of these bodies may be I do not yet know, but I hazard the view that they resemble the corresponding bodies in *Coscinodiscus* in their life-history.

Having obtained a supply of sea-water, I am endeavouring to cultivate these organisms during the winter in two large tanks, and, if possible, to secure a continuous series of observations. There are enormous difficulties in cultivating such organisms in London, but so far I have a prospect of success.

There are numerous questions of both scientific and economic importance to be settled in connection with the study of marine vegetation. That little is known may be inferred from the fact that it was possible to make so many novel observations within so short a time. I would venture to recommend to the Board that a survey of the conditions be made farther out at sea, that we may know how far these banks of diatoms, *Peridinieae*, etc., extend seawards, especially in the early months of the year and in summer, or how far they may be coastal in their occurrence.

VI.—A REVIEW OF THE WORK OF THE 'GARLAND' IN CONNECTION WITH THE PELAGIC EGGS OF THE FOOD FISHES, 1890–1896. By Arthur T. Masterman, B.A. (Cant.), B.Sc. (Lond.), Lecturer and Assistant-Professor of Natural History in the University of St Andrews.

The method which has been pursued by the 'Garland' has been uniform since the outset. The various districts have been visited and divided up into stations. Samples of eggs have been taken by the tow-nets from each of these at different times, and they have been preserved and examined later. The aim of the work has been to increase our knowledge concerning the pelagic eggs. This falls under three heads, namely :—

1. *The Determination of the Spawning Areas of each Species of Fish.*
2. *The Determination of the Spawning Season of each Species.*
3. *The Determination of the Direction taken by, and subsequent Fate of, the Eggs after Spawning.*

For the two former, the undeveloped eggs alone come into the question, and all the eggs which have been found and labelled in the lists, without adding the stage of development at which they were caught, bring into the question elements of great difficulty. The only absolutely accurate method would be the immediate examination, when caught, of the eggs, and only those recorded which have evidence of being freshly-spawned It is evident that if the accurate determination of the three points above-noted were deemed absolutely essential, the eggs should be examined and identified immediately after capture, upon the spot.

1. *The Determination of the Spawning Areas of each Species of Fish.*—For the determination of this point the study of the pelagic eggs alone can be of little use, for an egg which is still at an early stage of development may yet have been carried a great distance from the spot at which it was spawned. Up to a certain point, however, we may employ the data for this purpose. It may, I think, be assumed that after an egg is laid its normal course is inshore, so that when the eggs of a species are reported to occur at a certain district we may suppose that they were either spawned at that spot or further seaward. The effect of the drift may be assumed to be the same on all the eggs, so that, if, for example, we proceed down the Firth of Forth seaward beyond the Isle of May, and first pass through areas in which occur eggs of sprat, whiting, cod, and plaice, with a maximum number of sprats' eggs, and that as we proceed seawards the sprats' eggs diminish, and the eggs of the whiting attain a maximum in numbers, followed respectively at further distances by those of the cod and plaice, the legitimate conclusion is that the maxima occur in the same order seawards as are the respective spawning-areas. This becomes practically a certainty, if the maximum numbers are at an earlier stage of development. The results thus attained may be checked by those obtained by the capture of spawning adults. In areas where eggs at an early stage occur in profusion, and the spawning adults are also caught, we can pronounce with certainty as to their being the normal spawning-grounds of the species under consideration. In those, on the other hand, such as the inner waters of St Andrews Bay, with regard to plaice, where eggs occur but the spawning adults are not caught, the balance of evidence must be in favour of the assumption that the eggs have drifted inshore from other parts.

In a general comparison of the spawning areas negative results may be said to be of value ; thus, if, *e.g.*, in the area of the Moray Firth, the eggs of a certain species are not found to occur, the inference is that the species does not spawn in that district ; for the reasons above cited, this inference must be applied very cautiously in the comparison of stations in one area, because the distance between the stations falls within the limits of the 'pelagic drift' of the young forms.

Thus we can first go over the data with respect to the four areas—Firth of Forth, St Andrews Bay, Moray Firth, and the Clyde district—and thereby institute (1) a comparison, firstly, between the stations within each area ; and (2) a comparison between each area.

2. *The Determination of the Spawning Season of each Species.*—The season of spawning may be fairly accurately determined by the occurrence of eggs over a certain period, for, although in this case the strictly accurate spawning-period is that represented by the occurrence of *freshly-spawned* eggs, yet the eggs found at the latter end of the season, and tending to lengthen the apparent spawning-period by the time taken in reaching such an advanced stage, develop rapidly at this season, and can only add to the spawning-period an error of a few days, more or less.

The results obtained by study of the pelagic eggs can in this case also be checked by means of direct experiment. Thus, the occurrence of spawning-adults may be noted and compared with that of the eggs, in the same manner as in the case of the determination of the spawning-areas.

In this section the questions to be determined are free from the disturbing elements of drift-currents which enter so largely into the first section, for we have no reason to believe that drifting eggs develop more rapidly than those floating more or less slowly, except in so far as a change to water of a different temperature would alter the rate of development, and this would only have the effect of shortening or lengthening by a very little the error of a few days at the end of the season mentioned above.

Under this section we can first determine the spawning-season of each species in each of the three areas under consideration, and compare the three results ; and, secondly, we can compound the results, and thereby obtain a general spawning-season for the whole coast for each species.

In the third section there is '*the Determination of the Direction taken by, and subsequent Fate of, the Eggs after Spawning.*'—In the former two sections there are more or less statical determinations, the place of deposition and the time of deposition, without reference to the further development, but under this section we have to consider the dynamic conditions in place and time of the eggs and embryos. The former of these, the rate at which, and direction in which, the eggs travel is determined by the rate and direction of the surface drift ; and the latter, by the bulk of the egg (as a constant for each species), and by the surface-temperature.

The solution of the problems here under discussion requires a complete knowledge of a number of factors which we have scarcely commenced to investigate.

The drift-bottle experiments of Dr Fulton may, if carefully persevered in, eventually give us a very good idea of the direction of the pelagic drift-currents, but they do not always admit of sufficient accuracy to give us definite knowledge regarding the rate of drift, mainly because we cannot always be sure of the bottles being returned as soon as drifted ashore.

In certain cases, the study of pelagic eggs may give us the rate and the direction of their 'drift,' for, with a sufficient number of experiments, one can follow the course of a certain mass of eggs, capturing them at different stages at different stations, but this would scarcely be worth the trouble in its execution; for the determination of the rate of drift is not of prime importance, and may be inferred upon a knowledge of the other factors.

There are now to hand a very complete series of temperature-observations taken in the different areas around our coasts, and these should be available for determining the time taken by the egg to develop.

An amplification of Dannevig's experiments would furnish us with the time of development of our common eggs under varying degrees of temperature, so that by experimental evidence we may be able to pronounce exactly how long an egg of a given species will take to develop when spawned in a certain area; in other words, we have the time of the 'pelagic period' as determined by developmental processes, as controlled by the temperature, and, as we have by the drift-bottles a possible means of determining the direction of drift, eventually inshore, we can, if desired, deduce the rate.

For all practical purposes we need only require to determine (1) the direction of drift after spawning; (2) the time taken in development. Although, in special cases, these might be determined by a study of pelagic eggs, and their distribution and their bearing on the consideration of the two preceding sections must be borne in mind, yet they are both more readily made out by the experimental processes as instanced above.

TABLE I.—EGGS OF COD.

The Cod (*Gadus morrhua*).

FIRTH OF FORTH.

Feb. 19, 1891.	Station VIII., . . .	Ova of cod.
,, 19, ,,	,, IX., ...	Numerous.
,, 21, 1893.	E. of May Island, . . .	2.
Mar. 16, 1892.	Station VIII., . . .	45.
,, 16, ,,	,, IX., ...	50.
,, 19, 1891.	,, V., ...	Ova of cod.
,, 19, 1895.	,, VII., . . .	6.
,, 19, ,,	,, VIII. and IX., .	3.
,, 29, 1894.	,, V., ...	3.
,, 30, 1891.	,, II., ...	Ova of cod.
April 3, 1893.	E. of May Island, . . .	40 (very advanced).
,, 4, ,,	10 miles S. of May Island, .	90 (cod and whiting).
,, 4, ,,	9 miles S. of May Island, .	85.
,, 5, 1895.	Prestonpans to mid-Forth, .	170.
,, 5, 1892.	E. of May Island, . . .	500 (cod and whiting).
,, 6, ,,	Cross-section I., . . .	Some cod ova.
,, 8, 1891.	South Bay, ...	Ova of cod.
,, 8, 1892.	Fidra to Elie Ness, . .	Considerable number of cod.
,, 9, ,,	Inchkeith, ...	91.
,, 10, 1891.	E. of Portobello, . . .	A few ova.
,, 11, 1892.	Cross-section III., . .	87.
,, 13, 1891.	Liston Bank, . . .	Vast number.
,, 14, ,,	Station VIII., . . .	,, ,,
,, 16, 1892.	,, V., ...	Many (all well-developed).
,, 16, 1894.	,, I., ...	12.
,, 16, ,,	,, III., ...	4.
,, 17, ,,	,, VIII. and IX., .	940.
,, 17, ,,	,, V., ...	101.
,, 18, ,,	,, VI., ...	13.
,, 19, 1893.	,, II., ...	Eggs in abundance.
,, 19, ,,	,, III., ...	Ova of cod.
,, 19, 1892.	Cross-section III., . .	Ova of cod (nearly hatching).
,, 20, 1893.	Station I., ...	36.
,, 21, 1892.	,, II., ...	Few (advanced).

TABLE I.—EGGS OF COD—*continued.*

April 23, 1895.	Station VI.,	161.
,, 24, 1890.	,, IX.,	Considerable number.
,, 25, 1892.	,, IV.,	26.
,, 25, 1893.	Cross-section I.,	270.
,, 26, 1892.	Station I.,	87 (nearly hatched).
,, 26, ,,	,, VI.,	21.
,, 28, ,,	,, III.,	Few.
May 2, ,,	,, VII.,	18.
,, 2, ,,	,, V.,	6.
,, 5, 1891.	,, VII.,	Ova of cod.
,, 6, 1892.	,, IX.,	30.
,, 6, 1891.	,, V.,	Ova of cod.
,, 6, ,,	,, VI.,	,,
,, 9, ,,	,, VIII.,	108.
,, 11, 1892.	,, I.,	93 (advanced).
,, 12, 1891.	12 miles S.E. May Island,	Ova of cod.
,, 14, 1892.	Station III.,	44 (advanced).
,, 22, 1891.	Aberlady Bay,	Large numbers.
,, 25, ,,	Station II.,	Ova of cod.

COD.

The accompanying table gives the data from 1890 to 1895 inclusive, which have been reported with respect to the occurrence of eggs of the cod in the Firth of Forth district. The ova are seen to have been found from February 19th to May 25th inclusive, a period of about three months and a half; both the limiting dates belong to the same year, 1891.

Fulton* gives the spawning period of the cod on the East Coast as extending from the end of January to the first week of June, a period which overlaps that of the actual occurrence of eggs in the Firth of Forth by about three weeks at each end. There is evidence, however, to be shown below, from the pelagic eggs, that in other parts of the East Coast cod spawn considerably later.

In the latter end of February the eggs are found in considerable numbers, and then during the month of March they appear to fall off. The greatest number recorded in one haul during March is 50, and such numbers as 6, 3, 3, etc., testify to the sparsity prevailing all over the Forth-area.

It is interesting to compare this with this table quoted from p. 234 of 10th Scottish Fishery Board Report:—

Numbers Examined and Percentage of Ripe Specimens (Cod).

January	158	0·0
February	418	0·3
March	192	0·0
April	86	1·7
May	99	0·0
June	86	0·0

The percentage of ripe specimens in March is seen to be *nil*, though a certain percentage is found both in February and April. This table is compiled from the work of the 'Garland,' which was conducted more or less inshore, including, no doubt, the area now under consideration.

The absence of spawning cod during March in this table, agreeing with the very few eggs found during this month, seems to point to the fact that the cod which spawn the ova found in the Firth of Forth do so more or less in two intermittent periods, separated by the month of March, a

* 10th Scottish Fishery Board Report, p. 242.

smaller period in the latter part of February, and a larger spawning period during April and May; but the demonstration of such an exceptional method of spawning would require more corroborative evidence, and the facts here recorded are probably due to other causes. With regard to the various stations of the Firth of Forth, the statistics of spawning adults show conclusively that cod do not spawn in the territorial waters. The eggs found in Stations I.-VII. have, in all probability, not been spawned *in situ*, but have been drifted in from more seaward areas.

This is corroborated by an inspection of the list of eggs. It is seen that all the eggs occurring in February are reported as being found in the seaward Stations VIII. and IX., and further eastwards, and the same applies to the only two occurrences of eggs in any numbers in the whole month of March.

As the middle of April is reached, the main spawning-period becomes evident, but again the great masses of eggs are found in the Liston Bank area and Stations VIII. and IX.

In 1891 the main mass appears to have been found in the second week of April (13th, 14th), whilst in 1892 the great abundance was manifest in the first week (5th), whilst again in 1894 they appear to be as late as the third week (17th). We therefore have good evidence of great numbers of cod-ova, usually at early stages, occurring fairly regularly in April of each year, over the areas of Station VIII., Station IX., and Liston Bank. Are we justified in supposing that it is the eggs spawned in these areas which, drifting westwards, supply the inner stations of the Firth of Forth with the eggs and larvæ found there later?

The great numbers occurring on 5th April 1892 in Station VIII. appear to have reached Station V. on April 16th, and to be 'all well-developed,' and by the 19th they are found in Cross-Section III. in the hatching condition. In 1891, the spawning appears to have been early, for although the main mass of eggs did not occur till April 14th, yet a great number were found at Stations VIII. and IX. as early as February 19th. The first appearance of eggs in Station V. is also in 1891 (March 19th), and the same applies to the inner stations (March 30th, 1891).

Thus (1) as regards the spawning-areas of the cod in the Firth of Forth district we may say, as far as can be supposed from the evidence to hand, that the eggs are probably spawned in the areas east and south-east of the Isle of May, in the region of Station VIII. and IX., and are not laid within the Firth; (2) as regards the spawning-period in this area, the occurrence of eggs dates from February 19th to May 25th, and, allowing for the fact that the eggs on the latter date are advanced, the spawning-time may be said to extend over the extreme period from February 19th to about May 10th, or, roughly, from the third week of February to the second week of May; (3) as regards the direction taken by, and subsequent fate of, the eggs after spawning, we can conjecture, with a fair degree of certainty, that of the eggs laid in the seaward stations some proportion drift within the Firth, and are there hatched.

TABLE II.—EGGS OF HADDOCK.

FIRTH OF FORTH.

Feb. 8, 1895.	Station VII.,	1.
,, 19, 1891.	,, VIII.,	Eggs, in moderate quantities.
,, 19, ,,	,, IX.,	Numerous eggs.
,, 21, 1894.	,, VIII.,	30.
,, 21, ,,	,, IX.,	1.

(None in Inner Stations).

TABLE I.—EGGS OF COD—*continued.*

Mar. 6, 1895.	Station VIII., ...	45.
,, 7, ,,	Carr to Barbetness, . .	18.
,, 15, 1892.	Station VIII., ...	464.
,, 16, ,,	,, IX., ...	5500.
,, 19, 1891.	,, V., ...	Eggs of.
,, 19, 1895.	,, VII., . . .	311.
,, 19, ,,	,, VIII. and IX., . .	147.
,, 20, ,,	,, V., ...	174.
,, 20, ,,	,, VI., ...	32.
,, 29, 1894.	,, VI., ...	600.
30, 1891.	,, II., ...	Eggs of.
April 3, 1893.	E. of May Island, . . .	215.
,, 4, ,,	9 miles E. of May Island, .	440 (mostly advanced).
,, 4, ,,	10 miles ,, ,, . .	700.
,, 5, 1895.	Prestonpans to mid-Forth, .	50.
,, 5, 1892.	8 to 12 miles E. of May Island,	10,000.
,, 6, ,,	Cross-section I., . . .	Large collections, most numerous (very advanced and ready to hatch).
,, 8, ,,	Cross-section II., . . .	540.
,, 8, ,,	Elie to Fidra, . . .	Most numerous, all stages.
,, 8, ,,	Inchkeith, ...	28.
,, 8, 1891.	South Bay, ...	Eggs of.
,, 11, 1892.	Cross-section III., . .	36 (some hatching).
,, 13, 1891.	Liston Bank, . . .	Many.
,, 13, ,,	,, ,, ...	Large number.
,, 14, ,,	Station VIII., . . .	Few.
,, 14, 1893.	,, IX., ...	6 (well advanced).
,, 16, 1894.	,, I., ...	32.
,, 16, ,,	,, III., ...	3.
,, 16, 1892.	,, V., ...	Considerable collection.
,, 17, 1894.	,, VIII. and IX., . .	5000.
,, 17, ,,	W. of May Island, . .	130.
,, 17, 1895.	Station III., . . .	1.
,, 18, 1894.	,, VI., ...	162.
,, 19, 1893.	,, II., ...	Eggs of, ready to hatch.
,, 19, ,,	,, III., ...	Eggs of, mostly far advanced.
,, 19, 1892.	Cross-section III., . .	Few ova, chiefly advanced.
,, 19, ,,	,, ,, ...	Nearly hatching.
,, 19, ,,	,, ,, ...	,, ,,
,, 20, 1893.	Station I., ...	16 (well advanced).
,, 21, ,,	,, V., ...	1, ,, ,,
,, 21, 1892.	,, II., ...	70 (nearly ready to hatch).
,, 24, 1890.	,, IX., ...	Considerable number.
,, 25, 1892,	,, III., ...	15.
,, 25, ,,	,, IV., ...	42 (nearly hatching).
,, 25, ,,	Cross-section I., . . .	10 (well advanced).
,, 26, 1892.	Station VI., ...	39 (nearly ready to hatch).
,, 26, ,,	,, I., ...	76.
,, 28, ,,	,, III., ...	A few, nearly hatching.
May 2, 1892.	,, VII., ...	56.
,, 2, ,,	,, V., ...	70.
,, 6, ,,	,, IX., ...	30.
,, 9, ,,	,, VIII., ...	5.
,, 11, ,,	,, I., ...	12 (almost ready to hatch).
,, 25, ,,	,, IX., ...	24.
,, 26, ,,	Liston Bank, . . .	14.
,, 26, ,,	W. of Liston Bank, . .	35.
,, 30, ,,	Cross-section I., . . .	8.
June 4, ,,	E. of Inchkeith, . . .	3.
,, 13, ,,	Station V., ...	1.

(None in May 1895 in any Stations).

HADDOCK.

It is well-known that the egg of the haddock is closely similar to that of the cod both in structure and size. The eggs of the two species largely overlap in size, although many haddocks' eggs attain a size unknown to the cod. Thus, it is not surprising that Dannevig found the effect of temperature on both species to be practically the same. This being so, we should expect to find that the conditions of spawning of the two are closely similar. This is borne out by the facts, at least in the Firth of Forth area. We find that the extreme occurrence of haddocks' eggs extends from February 8th to June 13th. In all the years but 1892 they were not found after the third week of April. The earliest occurrence of haddocks' eggs in 1892 was March 15th, or five weeks later than in 1895. The year 1892, therefore, appears to have been marked by a remarkedly late spawning-period for this species.

The general occurrence is closely similar to that of the cod. With a single exception (one egg), no eggs are found in the inner or middle stations till March 19th, whereas abundance were found in Stations VIII. and IX. Great numbers continue to occur up till April 24th, when a sudden cessation ensues. The large masses can be distinctly traced through Stations V., VI., and VII. into the inner part of the Firth, and here they are still found at the hatching-stage at the end of April, in some cases into May. The facts clearly point to the same conclusion as in the case of the cod, namely, that the myriads of ova, starting from Stations VIII. and IX., are, in great numbers, drifted into the Firth, and are not spawned there.

This is corroborated by the study of spawning adults. The main difference between the spawning of the cod and that of the haddock appears to be that the haddock seem to concentrate in certain areas to a greater extent. The number of haddock's eggs found together usually greatly exceeds that of the cod's, and this fact may be compared with the statement that the spawning haddock were not caught more than 30 miles from land, whilst spawning cod were found at 170 miles from shore. The more vagrant instinct of the cod may perhaps account for the necessity, in the case of this species, of a far higher fecundity. Fulton gives the spawning-period of the haddock on the East Coast as from the second week of January to the middle of May. As in the case of the cod, these limits extend in both directions beyond those of the reported occurrence of pelagic ova in the Firth of Forth (with the exception of 1892). There is little evidence of extensive migrations in a settled direction by the young haddock or young cod, though the migration seawards to the spawning-grounds, on the attainment of maturity, is undeniable.

With regard to the direction taken by the eggs and their subsequent fate, the same remarks apply to the haddock as to the cod, and it is in like manner probable that the Firth of Forth is dependent upon the prevalence of east winds for its supplies of floating ova. Hatching haddock's eggs can be found all over the Forth district.

TABLE III.—EGGS OF WHITING.

FIRTH OF FORTH.

Feb. 22, 1894.	Station V.,	
,, 26, ,,	,, VI.,	2.
Mar. 19, ,,	,, VII.,	4.
,, 19, ,,	,, VIII. and XI.,	23.
,, 20, ,,	,, V.,	1.
,, 26, ,,	,, VI.,	2.
,, 29, ,,	,, V.,	9.
,, 30, 1891.	,, II.,	Eggs of.
April 4, 1893.	10 miles E. of May Island,	90 (cod and whiting).
,, 5, 1892.	8 to 12 miles E. of May Island,	500 (cod and whiting).

TABLE III.—EGGS OF WHITING—*continued.*

April 5, 1892.	Cross-section I., N. and S., .	Whiting.
,, 8, ,,	Cross-section II., . . .	12.
,, 9, ,,	Inchkeith, ...	41 (embryo fairly advanced).
,, 11, ,,	Cross-section III., . .	A few (embryo advanced).
,, 13, 1891.	Liston Bank, . . .	Large number.
,, 16, 1894.	Station III., . . .	3.
,, 16, ,,	,, I., ...	15.
,, 17, 1895.	Cross-section III., . .	9.
,, 17, 1894.	Station VIII. and IX., .	1870.
,, 17, ,,	,, IX., ...	1.
,, 17, ,,	,, V., ...	14.
,, 18, ,,	,, VI., ...	43.
,, 18, 1893.	,, VI., ...	A few (advanced).
,, 18, 1895.	,, II., ...	1142.
,, 19, ,,	,, II., ...	Eggs of.
,, 19, ,,	,, III., . . .	Eggs of.
,, 19, ,,	,, VII., . . .	114 eggs of.
,, 20, ,,	,, I., ...	Eggs of (all stages).
,, 21, 1892.	,, II., ...	A few.
,, 22, 1895.	,, VII., . . .	2811.
,, 22, ,,	,, IX., . . .	1400.
,, 23, ,,	,, V., ...	2010.
,, 23, ,,	,, VI., . . .	1500.
,, 24, 1890.	,, IX., . . .	Eggs of.
,, 25, 1892.	,, III., . . .	Whiting.
,, 25, ,,	,, IV., ...	A few.
,, 25, 1893.	Cross-section I., . . .	600 (whiting and poor-cod).
,, 26, 1892.	Station I., ...	3.
,, 26, ,,	,, VI., . . .	9 (far advanced).
,, 28, ,,	,, III., . . .	Eggs of (advanced).
May 2, ,,	,, VII., . . .	21 (poor-cod and whiting).
,, 2, ,,	,, V., ...	25 ,, ,,
,, 6, 1891.	,, V., ...	Eggs of.
,, 9, ,,	,, IV., . . .	A number.
,, 9, 1892.	,, VIII., . . .	31 (poor-cod and whiting).
,, 22, 1895.	,, I., ...	210.
,, 22, ,,	,, III., . . .	26.
,, 22, 1891.	Aberlady Bay, . . .	Large number.
,, 23, ,,	Station I., ...	Ova of.
,, 24, 1893.	,, VIII., . . .	39 (Sprat and whiting).
,, 24, ,,	,, III., . . .	150 ,, ,,
,, 25, 1891.	,, VI., . . .	Large number.
,, 26, 1892.	West of Liston Bank, .	90.
,, 27, ,,	Cross-section II., . .	Abundance.
,, 27, 1893.	Station I., ...	86 (whiting and poor-cod, $\frac{1}{2}$ to $\frac{3}{4}$).
,, 27, 1891.	,, VII., . . .	Many.
,, 28, ,,	,, V., ...	Considerable number.
,, 28, 1895.	,, VIII., . . .	18.
,, 28, ,,	,, VIII., . . .	10.
,, 28, ,,	,, IX., . . .	9.
,, 30, 1892.	Cross-section I., . . .	26.
,, 30, 1893.	Station V., ...	9 (advanced).
,, 30, 1892.	Cross-section I., . . .	11 (sprat and whiting, advanced).
,, 31, ,,	,, III., . .	A few, nearly hatched.
,, 31, 1893.	Station II., ...	48 (fairly advanced).
June 1, ,,	,, III., . . .	100 (sprat, whiting, and poor-cod, fairly advanced).
,, 2, ,,	,, IX., . . .	16 (sprat and whiting).
,, 4, 1892.	E. of Inchkeith, . . .	130 (sprat, poor-cod, and whiting, mean of several hauls).
,, 4, ,,	,, ,, . . .	120 (poor-cod and whiting, mean of several hauls at various lengths).
,, 13, ,,	Station II., ...	26 (poor-cod and whiting).
,, 19, 1893.	,, VI., . . .	9 (whiting and sprat, various stages).
,, 21, ,,	,, III., . . .	200 (whiting and sprat, advanced).
,, 28, ,,	,, II., ...	200 (poor-cod, sprat, and whiting).
July 21, 1892.	,, VIII., . . .	4.
,, 22, ,,	,, V., ...	1.

Whiting.

The eggs of the whiting have been reported (in the accompanying list) from February 22nd to July 22nd, a period of five months.

Dr Fulton gives from early March to the third week of August for the whole East Coast, so that there is a considerable discrepancy. He states that 'in the Forth . . . . all were immature from July to October.'

His examination of the adults agrees in its conclusions with the distribution of pelagic ova in a remarkable manner. As previously stated, he found that spawning cod and haddock were only found outside the territorial waters, but that spawning whiting occurred even as far up the Firth as Stations I. and II. 'Whilst the great majority spawn outside 'the territorial waters, or near the margin, a few quite ripe specimens, both 'male and female, are found within the limit, and even pretty far up the 'Firth of Forth.'

An inspection of the accompanying list will bear this out. Thus, of the two solitary occurrences of eggs in February, both are in the middle Stations (V. and VI.). During March, again, there are only a few eggs of whiting, and all but one haul came from the inner stations. In the third week of April great numbers of whiting-eggs are found at Station II. (18th), Station VII. (22nd), Station IX. (22nd), and Station V. (23rd), and their almost simultaneous occurrence at these various districts plainly points to a wide spawning-area.

Throughout May, the eggs of the poor-cod commence to complicate matters, and also those of the sprat. In the fresh condition there is no possible confusion between the eggs of this latter species and those of the whiting, but they are in some cases, when preserved, quite inseparable.

Throughout June there is the same general occurrence, but in the whole month there is only one haul (and that only of 16 eggs) in an outer Station (IX.). We know from other evidence that the whiting does spawn in the later months, such as June, so that the absence of eggs from the outer stations shows, firstly, that the eggs which were already spawned there have drifted in to the inner stations, and possibly, in part, elsewhere; and, secondly, that the whiting spawn in the inner stations later in the year than they do at the outer stations.

It is evident, from consideration of general principles, that in the case of the eggs of one species (constant size) those spawned earlier should be spawned further off-shore; and there is here distinct evidence that the whiting spawn (*in any quantity*) first in early April, 8 to 12 miles east of the Isle of May, and by the third week in April, they commence spawning in the inner stations; and, in the same way, spawning is first completed in the outer stations, so that there is an almost complete absence of whiting's eggs after the second week of May in this area, whereas they occur in abundance (with poor-cod and sprat) in the inner stations throughout June.

It is thus seen that the whiting, in the extra-territorial waters, spawn along with the cod and haddock in the outer stations, and that later on they spawn in the inner stations in company with poor-cod and sprat.

The eggs of the whiting spawned in the former district will be subjected to the same physical conditions as the accompanying eggs of the haddock and cod, and will probably be drifted in to the inner stations. In mid April the incubation-period of the cod was taken as $14\frac{1}{2}$ days, and for the same temperature that of the whiting should be $12\frac{1}{2}$ days, an ample period for the eggs to arrive well within the Firth before hatching takes place. The temperature in mid-June varied in 1893 from 10·6° C. (Station VIII.) to 14·5° C. (Station IV.), with a mean temperature of 12° C.

for the nine stations. At this temperature the whiting's period of incubation is 6½ days, a very much shortened period, which would probably necessitate the deposition of the eggs nearer in-shore than before.

We thus see that the conditions of spawning of the whiting, and probably of the poor-cod, may be largely accounted for on physical grounds, though we cannot speak with certainty as to which particular feature 'causes' the others. We may start with the small size of the egg, which causes a shorter period of incubation, and so suppose that this has enabled the whiting to lay its eggs further inshore, and thus to escape the dangers of the outer stations; and this, again, enables the whiting to reproduce itself with a lower fecundity than the cod. In a similar manner we may argue the same sequence from the fact that the whiting breeds later in the year than the cod or haddock, and the small size of the eggs is an adaptation to still further assist in the approach shorewards.

We simply have a number of organic factors—such as fecundity, size of eggs, time of spawning, duration of spawning period, etc.—which, on the principles of variation, must be held to have been alterable in the past, and a number of physical factors; and we can clearly see that the former series has been adapted to the latter, and that the more complete adaptation is measured by the less fecundity.

Thus, as regards (1) the spawning-areas of the whiting, we may say that they extend at least from the outer stations well up the Firth of Forth. (2) The spawning-season must, from the evidence of the pelagic eggs, be from the third week of February to about the middle of July, allowing a few days prior to the 22nd for the incubatory period of the eggs occurring on that date. The spawning appears to take place slightly earlier in the outer than in the inner stations. (3) The direction taken appears to be similar to that of the cod in the earlier part of the year during the prevalent east winds, when the eggs spawned in the outer stations are probably drifted up the Firth.

During the latter part of May, and the month of June, the eggs, laid further up the Firth, seem, in the light of present knowledge, to be drifted hither and thither in a more or less indefinite direction, with the slight and changeable winds, for the short period of incubation.

TABLE IV.—EGGS OF PLAICE.

FIRTH OF FORTH.

Feb. 8, 1895.	Station VIII., . . .	2.
,, 12, ,,	,, IX., ...	3.
,, 19, 1891.	,, IX., ...	Numerous.
,, 21, 1993.	6 miles E. of May Island, .	1.
,, 21, 1894.	Station VIII., . . .	16.
,, 21, ,,	,, IX., ...	3.
,, 22, ,,	,, V., ...	1.
,, 22, 1890.	Cross-section I., . . .	Eggs of.
,, 1893.	. . . . . .	5400.
Mar. 6, 1894.	Station VI., ...	4 (ready to hatch).
,, 6, 1895.	,, VIII., . . .	15.
,, 14, 1892.	,, VII., . . .	1 (advanced).
,, 16, 1894.	Largo Bay, ...	9.
,, 16, 1892.	Station VIII., . . .	99 (early).
,, 16, ,,	,, IX., ...	1542 (early).
,, 18, 1890.	,, VIII., . . .	Eggs of.
,, 19, 1891.	,, V., ...	,,
,, 20, 1895.	,, V., ...	4.
,, 20, ,,	,, VI., ...	
,, 21, 1890.	Cross-section III., . . .	Eggs of.
,, 23, 1891.	Station VI., ...	A few.
,, 29, 1894.	,, VI., ...	12.
,, 30, 1891.	,, II., ...	Eggs of.

TAALE IV.—EGGS OF PLAICE—*continued.*

April 4, 1893.	9 miles E.S.E. of May Island,	5.
,, 4, ,,	10 ,, ,,	17.
,, 5, 1892.	8 to 12 miles E. of May Island,	250.
,, 5, ,,	A few miles E. of May Island,	26,
,, 5, 1895.	Prestonpans to mid-Forth, .	12.
,, 6, 1892.	Cross-section I., . . .	Eggs of (advanced).
,, 8, ,,	,, II., . . .	A few.
,, 8, ,,	,, II., . . .	150.
,, 9, ,,	Inchkeith, ...	A few, almost ready to hatch.
,, 11, ,,	Cross-section III., . . .	2 (almost ready to hatch).
,, 13, 1891.	Liston Bank, . . .	A few.
,, 16, 1894.	Station I., ...	6.
,, 17, 1892.	,, V., ...	Considerable number (advanced).
,, 17, 1894.	,, VIII. and IX., . .	20.
,, 18, 1893.	,, VI., ...	4 (nearly ready to hatch).
,, 18. 1895.	,, II., ...	19.
,, 19, 1893.	,, II., ...	A few.
,, 19, 1895.	,, VIII., . .	1.
,, 19, 1892.	Cross-section III., . . .	A few (advanced).
,, 20, 1893.	Station I., ...	1.
,, 21, 1892.	,, II., ...	5 (advanced, to hatching).
,, 23, 1895.	,, V., ...	7.
,, 24, 1890.	,, IX., ...	Eggs of.
,, 25, 1892.	,, III., ...	2.
,, 25, ,,	,, IV., ...	1.
,, 26, ,,	,, VI., ...	2 (one ready to hatch).
,, 28, ,,	,, III., ...	3 (nearly ready to hatch).
May 2, ,,	,, V., ...	7.
,, 5, 1891.	,, VII., ...	Eggs of.
,, 6, 1892.	,, IX., ...	3.
,, 6, 1891.	,, VI., ...	Eggs of.
,, 11, ,,	4 miles E. of May Island, .	,,
,, 29, ,,	Station IX.	1 or 2.
June 4, 1892.	Inchkeith, ...	1.

PLAICE.

There is a peculiar satisfaction in dealing with the eggs of this species, because, although in the case of some other species they can only with great difficulty be recognised, in this case we are certain that every observation must be well established, because the eggs of the plaice cannot possibly be mistaken for those of any other species.

In the Firth of Forth area, the eggs of the plaice are found between the limits of February 8th and June 4th. Dr Fulton gives from the second week of February to nearly the middle of May for the East Coast, with a maximum in early March. Allowing for the period of incubation of at least 14 days, the spawning-period derived from the evidence of pelagic eggs works out as from February 8th to about the 20th of May—a period closely similar to that derived from the evidence of spawning adults. The maximum in mid-March is at least indicated at Station IX. in 1892 (16th), when 1500 were found in one haul, at early stages.

The distribution referred to in 'the Haddock' and 'the Cod,' is also marked in this species. The eggs first make their appearance in the outer seaward stations; and, in fact, with a solitary exception on February 22nd, 1894, in Station V., all those found in February occurred in the extra-territorial waters. One vast mass of ova in February 1893, with another bottle labelled 'Carr,' is unfortunately unlabelled, but they were probably obtained in the off-shore water east of the North Carr. In early March, we notice the eggs which occur in the inner stations (even Station VI. and Station VII.) are advanced or ready to hatch, whereas the early stages are again found out at Station VIII. and Station IX., and in greater abundance. The first appearance of eggs of the plaice in the inclosed basin of the Forth, as examined at Stations I., II., III., and IV., and Cross-section III., is as late as March 21st in 1890, as March 30th in 1891, April 16th in 1892, April 18th in 1893, April 16th in 1894, and April 18th in 1895. In every case in which the stage of development is registered, the eggs found in these stations were at an advanced stage of development. During April and May, the eggs are found in small numbers dotted throughout the Firth, and in the outer stations as well. The last two appearances are in the outer stations, and a single specimen in June at Inchkeith completes the series.

These facts, although more clearly demonstrable by diagrams showing the distribution at each month, are sufficiently clear in their significance to point out that the eggs are laid from the early part of February onwards in the outer stations, east of the May Island; that these eggs are in part drifted in by the currents, as described in detail under the heading of the cod, in part carried elsewhere; that, as the season advances, the eggs become dotted about the Firth in more widely distributed numbers, and that in the outer stations the supply of freshly-spawned eggs, after reaching a maximum in about mid-March, tails off slowly till about the middle of May. From mid-February to mid-May is a period of three months, far exceeding the duration of the incubatory period, so it happens that it would be almost possible, by taking a series of hauls at different stations from without inwards, at a given date in the middle of the spawning-period, to obtain a series of stages from the eggs to the hatching stage. The next consideration is that the number of eggs, either in the outer or inner stations, are not nearly as great as should be the case for so common a species. Examination of the areas beyond Station IX., such as Liston Bank, and further north towards the Bell Rock, show that the main spawning-areas of the plaice are, in these places, further out from the shore. We may conjecture, from present knowledge, as in the case of the cod and haddock, that the Firth of Forth probably depends for its supply of floating eggs upon the section of eggs which are spawned within a few miles of the Isle of May. This applies still more to the plaice; and the comparative scarcity of the eggs of the plaice is probably to be accounted for by the tendency for the plaice to spawn further seawards. The plaice spawns at a markedly earlier period than the haddock or cod, and, in accordance with this, and with the fact that the egg is larger, the average incubatory period must be longer. This demands a spawning-area further out from the shore.

We thus note that (1) the spawning-areas of the plaice are well offshore, the nearest to the Firth of Forth being in Station IX., and in some degree Station VIII.; they do not extend into the Firth. (2) The spawning-season commences (for the Firth of Forth) in the early part of February, increases in the number of eggs spawned till April, and decreases through May. It is only very exceptional to find eggs of the plaice as late as June. (3) The distribution of the eggs after spawning is similar to that of the cod and haddock, but as the plaice, as a whole, spawn further out, fewer eggs of plaice are drifted into the Firth. These conclusions bear out in a remarkable degree those arrived at by Professor M'Intosh in the Trawling Report, and Dr Fulton, who both examined spawning plaice and their distribution.

TABLE V.—EGGS OF FLOUNDER.

FIRTH OF FORTH.

Mar. 6, 1895.	Station VIII., ...	27.
,, 16, 1894.	Largo Bay, ...	30.
,, 16, 1892.	Station IX., ...	57 (dab and flounder).

TABLE V.—EGGS OF FLOUNDER—*continued.*

Mar. 19, 1895.	,, VII.,	6.
,, 19, ,,	,, VIII. and IX.,	25.
,, 20, ,,	,, V.,	19.
,, 20, ,,	,, VI.,	9.
,, 29, 1894.	,, V.,	25.
,, 29, ,,	,, VI.,	50.
,, 30, 1891.	,, II.,	Eggs of.
April 5, 1895.	Prestonpans to mid-Forth,	12.
,, 11, 1892.	Cross-section III.,	A few.
,, 13, 1891.	Liston Bank,	Eggs of.
,, 16, 1894.	Station I.,	3.
,, 16, 1892.	,, V.,	A few.
,, 17, 1894.	,, V.,	1.
,, 17, ,,	,, VIII. and IX.,	120.
,, 17, 1895.	,, VII.,	14 (dab and flounder).
,, 17, ,,	,, IV.,	1.
,, 18, 1893.	,, VI.,	(Early) a few.
,, 18, 1894.	,, VI.,	7 (early).
,, 18, 1895.	,, II.,	191.
,, 19, ,,	,, VII.,	6.
,, 19, 1893.	,, III.,	A few.
,, 20, ,,	,, I.,	34 (dab and flounder).
,, 22, 1895.	,, VII.,	249.
,, 25, 1893.	Cross-section I.,	44 (flounder and sprat).
May 6, 1891.	Station V.,	Eggs of.
,, 6, ,,	,, VI.,	,,
,, 7, 1893.	,, I.,	7 (advanced).
,, 9, 1891.	,, IV.,	1 or 2.
,, 11, ,,	4 miles E. of May Island,	In great number.
,, 12, ,,	6 to 12 miles E. of May Island,	Eggs of.
,, 19, ,,	Station III.,	,,
,, 22, ,,	Aberlady Bay,	,,
,, 22, 1895.	Station III.,	154.
,, 23, 1891.	,, I.,	Eggs of.
,, 24, 1893.	,, III.,	75 (early to later).
,, 26, 1891.	,, VI.,	A few.
,, 25, ,,	,, II.,	Eggs of.
,, 28, ,,	,, V.,	,,
,, 29, ,,	,, IX.,	A few.
,, 29, 1895.	,, V.,	15.
,, 31, ,,	,, II.,	224.
,, 31, 1893.	,, II.,	22 (early to later).
June 1, ,,	Cross-section III.,	25 (advanced).
,, 2, ,,	Station IX.,	37 (early to later).
,, 4, 1894.	E. of Inchkeith,	1.
,, 14, 1893.	Station IX.,	1 (very advanced).
,, 19, ,,	,, VI.,	16.
,, 22, ,,	Cross-section II.,	23 (dab and flounders).

FLOUNDER.

The first appearance of the egg of the flounder is on March 6 (1895), and the latest is on the 22nd of June (1893). This is a far more circumscribed spawning-period than that given by Dr Fulton for the whole East Coast, namely, from the end of January to the middle of July, with a maximum at the end of April.

In the month of March the eggs appear in the course of three weeks, in Stations II., V., VI., VII., VIII., and IX., besides the inner reach of the Forth (Largo Bay.) The same feature is seen during April. In the early part of this month, the appearance of the eggs of the flounder, in some cases at early stages, in Stations I., IV., and Cross-section III., completes the whole area of the Firth. In this month, eggs in small numbers are found in every station in the Firth, from I. to IX., inclusive. The same distribution is characteristic of May (Stations VII. and VIII. alone excepted), and the greatest number occur east of May Island, and in Station II. In June, advanced eggs are found scattered over the whole area, from Cross-section III. to Station IX. The numbers of eggs spawned gradually increase through April, and attain a maximum in May, and tail off in June. Such items as '191,' '249,' 'great numbers,' appear at the end of April and beginning of May, and mark out this period as the time when the greatest amount of spawning takes place. There can be no doubt, from what we have remarked, that flounders spawn all over the Firth of Forth area below Inchkeith, and there is no indication to lead us to suppose that spawning begins any earlier in one part than in the other.

No doubt the eggs spawned in March and early April in the outer stations undergo the same drift inwards as in the case of the cod and haddock, and those in the inner stations will also steadily drift, apart from tidal fluctuations, westwards up the Firth. The egg of the flounder is minute, and takes less than seven days to develop at 6·6° C., a mean for the Firth of Forth during mid-April, so that it is enabled to be laid further inshore than that of the cod or haddock, and still more so than that of the plaice, and this is accentuated still more by the fact that the temperature of some of the inner stations may rise to so high as 8·3° C., at which temperature the egg of the flounder would hatch in about five days. In mid-May the mean temperature of all the stations, I.-VIII. inclusive, for 1893, was 10° C., at which the hatching-period of the flounder would be further reduced to four and a half days, so that, taking further into consideration the fact that the winds are neither so persistently 'east,' nor so violent when the summer approaches, and we can see how a species like the flounder, with a small egg and a comparatively late spawning-season, can spawn inshore with comparative impunity though a fecundity which is the highest for its size amongst food-fishes, tells a tale of loss amongst the young stages from which the plaice is comparatively immure, and the cod, to a lesser extent. In June, the temperature may rise as high as 14·6° C. (Station IV., 1893), at which the flounder's egg will probably hatch in a period under three days, thereby greatly reducing the time to which it is exposed to the freaks of wind and weather.

One other consideration is worth noting, taking the flounder as a type of a diffusely-spawned egg in a rather late season of the year. As the spring terminates, and the summer approaches, it is found that the temperatures of the different stations differ widely, and in this way that the temperature of the inner stations becomes higher than that of the outer. Thus, in 1892, the mean temperature for the end of May 1892 was in the inner stations (Stations I., II., III., and IV.) 7·9° C.; in the middle stations (Stations V., VI., and VII.) 7·5° C.; and for the outer stations (Stations IV., VIII., and IX.) 7·4° C. The difference in this month is, although perceptible, not very marked, and possibly falls within the error due to reading at different times in the day. On the other hand, in June, the difference becomes more pronounced. The mean temperature of the four inner stations (taken between 10 a.m. and 2 p.m.) is 11° C., that of the middle stations is 9·8° C., and the two outer stations, 9·9° C. The inner stations certainly have a higher temperature of about 1° C., and the same difference is shown in July. The differences are probably much greater some way below the surface, the usual position of pelagic eggs. At anyrate, these differences will all tend to make the eggs, laid further inshore, have a more rapid incubatory period, and will thus help to nullify the dangers of deposition of spawn near inshore. The nearer inshore the flounder spawns, the closer approach is there of the spawning-area to the habitat of the adult.

TABLE VI.—EGGS OF SPRAT.

FIRTH OF FORTH.

Mar. 23, 1891.	Station VI., ...	Swarms of.
April 6, 1892.	Cross-section II., . . .	Eggs of.
,, 8, ,,	Cross-section II., 6 to 10 fath.,	Considerable numbers of.
,, 8, ,,	,, surface, .	A few.
,, 9, ,,	Inchkeith, ...	A few.
,, 10, 1891.	E. of Portobello, . . .	A few.
,, 11, 1892.	Cross-section III., . .	A few.
,, 14, 1893.	Station IX., ...	4 (advanced).
,, 17, ,,	,, VII., . . .	5 (fairly advanced).
,, 17, 1895.	,, III., ...	14.
,, 18, ,,	,, II., ...	860.
,, 19, 1893.	,, II., ...	Abundance (early).
,, 19, ,,	,, III., ...	,, (very early).
,, 19, 1895.	,, VII., . . .	82.
,, 21, 1892.	,, II., ...	A few.
,, 22, 1895.	,, VII., . . .	1383.
,, 22, ,	,, IX., ...	183.
,, 23, ,,	,, V., ...	763.
,, 23, ,,	,, VI., ...	334.
,, 24, 1890.	,, IX., ...	Eggs of.
,, 25, ,,	,, V., ...	,,
,, 25, 1893.	Cross-section, I., . . .	16 (early to later).
May 7, 1892.	9 miles E. of May Island, .	2.
,, 11, ,,	Station I., ...	35 (advanced).
,, 12, 1891.	6 to 12 miles S. E. May Island,	Eggs of.
,, 17, 1892.	Station I., ...	209 (various stages).
,, 19, 1891.	,, III., ...	Eggs of.
,, 21, 1895.	,, IV., ...	7.
,, 22, ,,	,, I., ...	1134.
,, 22, ,,	,, III., ...	3800.
,, 22, ,,	,, III., ...	2667.
,, 23, 1891.	,, I., ...	Eggs of.
,, 24, 1893.	,, VII., . . .	39 (early to later).
,, 24, ,,	,, III., ...	150 (poor-cod, whiting, and sprat).
,, 25, 1891.	,, VI., ...	A few.
,, 25, ,,	,, II., ...	Eggs of.
,, 26, ,,	,, V., ...	,,
,, 27, ,,	,, VII., . . .	Many eggs of.
,, 27, 1892.	Cross-section II., . . .	697.
,, 27, ,,	,, II. (South), .	Abundance.
,, 27, ,,	,, II. (North), .	171.
,, 28, 1895.	Station VII., . . .	1400.
,, 28, ,,	,, VIII., . . .	95.
,, 28, ,,	,, IX., ...	1250.
,, 29, ,,	,, VI., ...	5.
,, 30, 1892.	Cross-section I., . . .	11 (advanced to hatching).
,, 31, ,,	,, III. (North), .	75.
,, 31, ,,	,, III. (South), .	48.
,, 31, 1895.	Station II., ...	3220.
June 1, 1893.	Cross-section III. (N.), .	100 (whiting, poor-cod, and sprat).
,, 2, ,,	Station IX., ...	16 (whiting and sprat).
,, 4, ,,	E. of Inchkeith, . . .	10.
,, 4, ,,	,, . . .	185 (poor-cod, sprat, and whiting).
,, 4, ,,	,, . . .	132.
,, 4, ,,	,, (8 fathoms),	38.
,, 4, ,,	,, (10 fathoms),	3.
,, 4, ,,	,, . (bottom),	11.
,, 9, 1891.	May Island, ...	181.
,, 9, ,,	,, ...	Considerable number.
,, 9, ,,	N. of May Island, . .	,, ,,
,, 11, ,,	Station I., ...	2900.
,, 11, ,,	Vicinity of Station I., .	1100.
,, 12, ,,	Station II., ...	3778.
,, 19, 1893.	,, VI., ...	9 (sprat and whiting, various stages).
,, 21, ,,	Cross-section III. (North), .	200.
,, 22, ,,	Cross-section III. (South), .	100 (early to advanced).

TABLE VI.—EGGS OF SPRAT—*continued*.

June 22, 1891.	Station I., ...	2875.
,, 28, 1893.	,, II., ...	54 (advanced).
,, 28, ,,	,, II., ...	200 (sprat, poor-cod, and whiting).
,, 30, ,,	,, V., ...	3 (advanced,.
July 8, 1891.	Largo Bay, ...	181.
,, 8, ,,	Kirkcaldy Bay, . . .	125 (very advanced).
,, 9, ,,	Station V., ...	97.
,, 9, ,,	Fidra to Cockenzie, . .	45 (surface).
,, 9, ,,	,, ,, . . .	200 (bottom).
,, 10, ,,	Gullane Ness to Kinghorn Ness	386 (very advanced to hatching, bottom).
,, 17, ,,	Station IV., ...	750 (advanced).
,, 17, ,,	,, V., ...	90 to 100.
,, 18, ,,	,, III., . . .	445.
,, 21, ,,	,, IX., ...	209 (advanced).
,, 22, ,,	,, V., ...	Eggs of.
,, 28, ,,	E. of Inchkeith, . . .	613 (very advanced).
,, 31, ,,	W. of May Island, . .	30 (advanced).
,, 31, ,,	,, ,, . . .	63 ,,
,, 31, ,,	E. of May Island, . .	35 (very advanced).
Aug. 4, 1891.	Elie to Crail, . . .	141 ,,
,, 6, ,,	Station VII., . . .	35 (advanced).
,, 14, ,,	,, I., ...	68. ,,
,, 19, ,,	,, IX., ...	5 (fairly advanced).

SPRAT.

The presence of the eggs of the sprat in great numbers is quite a feature of the Firth of Forth. The extreme limits during which the eggs occurred were March 23rd (1891) to August 19th (1891), a period comprising very nearly five months. Dr Fulton, in his table (10th Scottish Fishery Board Report), does not include the sprat, but from the data here given, the average spawning-period might be put down as from April to mid-August, inclusive. All through April, May, June, and July, an abundance of eggs occur dotted about the Firth, in all stages, but there is a very pronounced order in the way in which they occur. Firstly, we note that the eggs appear first in the middle stations (Station VI. and Cross-section II.), all the data from March 23rd up to April 8th being from this district, and the numbers being described as 'swarms of' and 'considerable numbers of.' Then follow 'a few' found in three parts of the inner stations, and a single occurrence of four (advanced) eggs in Station IX., as late as April 14th. Still they are confined to the middle and inner stations, with abundance of early eggs in Stations II. and III., to the end of the month, except for two items under Station IX., and one under Cross-section I. The same distribution is seen in May. In the third week, thousands of eggs occur in each haul (3220, 1134, 3800, 2667) in Stations I., II., and III., whilst the middle stations are also represented by 'many,' 'abundance,' 1400, 697, etc. Only four hauls during this month in the outer stations gave sprat's eggs. In June, the numbers were small in 1893, which alone represents the early part, but in the middle of the month there are found to be considerable numbers around the May Island district, and also the same abundance as in May in Stations I. and II., running into thousands per haul (2900, 1100, 3778, 2875).

Besides the three observations round May Island, which are scarcely out of the middle district, there is only one record during June, in the outer stations, and that in Station IX., 16 eggs in all, partly 'whiting.' Two more in July, and one in August, complete the whole series in outer stations; whereas, throughout June and July, nearly all the inner and middle districts are represented, showing that in these months the eggs of the sprat have become very generally distributed over the inner waters of the Firth.

In 1893, from a study of the eggs of 1892 and 1893, the following remark was made:—'The eggs of the sprat . . . seem to be most plentiful in the upper reaches of the Firth, and are abundant in the Inchkeith district, but they become less common out to, and beyond the Island of May' (11th Scottish Fishery Board Report, p. 251). A comparison, such as is here instituted, of the various stations through several years, enables us to corroborate this and also to go further.

The facts point out most clearly that the sprat commences to spawn in the middle stations, and shortly after, abundant spawning takes place in the inner stations, Stations I., II., II., and IV., with Cross-section III., throughout May, June, and July. Then the same characteristic is present as in the whiting, the spawning commencing further out and continuing further inshore. There is no indication that sprats spawn to any extent outside the Firth, in the extra-territorial waters. The eggs spawned in the middle stations, in March and April, probably are drifted up the Firth by the prevalent easterly winds, though a few find their way outwards to Station IX.

With an increasing mean temperature, as the season proceeds, and the cessation of violent easterly winds, the eggs of the sprat can be laid with impunity higher up the Firth. (Cunningham found the eggs of the sprat to hatch in three days at a temperature not exactly stated, but given as from 45° F. to 60° F.) These eggs, laid higher up, probably drift to and fro for a few days with the changes of the tide and the softer winds of the summer months, and they appear to be thus gradually distributed over the surface of the Firth. The eggs occurring in the middle stations in the later part of the spawning-season, to judge by their state of development and their relative numbers, have drifted outwards from the inner stations. All the July observations are in one year, so one cannot be too sure of a general rule here, but the facts would be explained very well if the predominant winds during July were westerly, or it might be that, in the absence of easterly winds, the resultant action of the tide would be to carry the eggs out seawards. One of these alternatives is, I think, capable of explaining the facts.

We may thus state that (1) the spawning-areas of the sprat are first in the middle stations, and shortly after in the inner district. (2) The spawning-time extends from the end of March to about the middle of August, in its extreme limits, with a maximum from mid-May to the end of June. (3) After spawning, the eggs spawned in the middle stations, as a whole, drift westwards up the Firth, and those spawned later in the inner stations spread over the Forth out to the middle, and some even to the outer stations.

The sprat, therefore, forms the end of the series formed by the plaice, cod, and haddock, whiting, and poor-cod. The accompanying diagram will assist in the demonstration of this fact. Whereas the plaice, cod, and haddock all spawn in the outer stations, but not further in, they also spawn earliest of the series; the three species also fall into a lesser series in the same way, but less marked. The whiting (and poor-cod) spawn in the outer stations, but rather later, and later still in the middle stations, whilst the sprat do not probably spawn to any great extent in the extra-territorial waters, but are slightly later than the whiting in the inner stations.

The sprat is essentially an estuarine fish, and, like many others of the clupeoids, it shows a predilection for brackish or fresh water. The difference with regard to place of spawning from the gadoids is therefore an instance, as in the whiting, of the tendency for the eggs to gradually acquire the habitat of the adult. The estuarine habits of the sprat have no doubt been acquired (as in the flounder), and at the present time the sprat only leaves this adult-habitat to as little an extent as is possible commensurate with a pelagic egg. In the case of its near relative, the herring, with a demersal egg, there are no difficulties of pelagic drifts to be overcome, and herrings may (*e.g.*, in the Schlei) lay their eggs in brackish or nearly fresh water, and again, the eggs of the shad appear more as if they were formerly pelagic, but now sink to the bottom in the river.

Dannevig gives us no data upon the incubatory period of the sprat's egg, but it is probably more rapid in development, in proportion to its size, than is the case with the gadoids or pleuronectids.

TABLE VII.—EGGS OF DAB.

Firth of Forth.

Feb. 19, 1891.	Station VIII., . . .	Eggs of.
Mar. 6, 1895.	,, . . .	2.
,, 16, 1894.	Largo Bay., ...	130.
,, 19, 1891.	Station V., ...	Eggs of.
,, 19, 1895.	,, VIII. and IX., .	3.
,, 20, ,,	,, V., ...	3.
,, 20, ,,	,, V., ...	1.
,, 25, 1891.	,, VI., ...	Eggs of.
,, 29, 1894.	,, V., ...	6.
,, 29, ,,	,, VI., ...	77.
,, 30, 1891.	,, II., ...	Eggs of.
April 3, 1893.	E. of May Island, . .	39 (early to later).
,, 4, 1892.	9 miles E. of May Island,	117 (early to advanced).
,, 4, ,,	10 ,, ,, ,,	113 advanced (dab and flounder).
,, 5, ,,	8 to 12 miles E. of May Island,	Considerable numbers.
,, 5, ,,	Cross-section I. (N. half),	Eggs of.
,, 5, 1895.	Prestonpans to mid-Forth,	60.
,, 8, 1892.	Cross-section II., . . .	A few.
,, 11, ,,	,, ,, III., . . .	A few.
,, 13, 1891.	Liston Bank, ...	Many eggs of.
,, 14, ,,	Station VIII., . . .	A few.
,, 14, 1893.	,, IX., ...	3 (advanced).
,, 16, 1894.	,, I., ...	33.
,, 16, ,,	,, III., ...	1.
,, 16, 1892.	Cross-section III., . . .	A few (fairly advanced).
,, 17, ,,	,, ,, VIII., IX.,	270.
,, 17, ,,	W. of May Island, . . .	6.
,, 17, 1895.	Station III., ...	71.
,, 18, 1894.	,, VI., ...	10 (early).
,, 18, 1895.	,, II., ...	383.
,, 18, 1893.	,, VI., ...	Fair abundance (advanced).
,, 19, 1895.	,, VII., ...	26.
,, 19, 1892.	Cross-section III., . . .	A few.
,, 19, ,,	,, ,, III. (N. half),	A few.
,, 20, 1893.	Station I., ...	34 (dab and flounder).
,, 21, 1892.	,, II., ...	6.
,, 22, 1895.	,, IX., ...	192.
,, 22, ,,	,, VII., ...	1567.
,, 23, ,,	,, V., ...	511.
,, 23, ,,	,, VI., ...	268.
,, 24, 1890.	,, IX., ...	Eggs of.
,, 25, 1892.	,, III., ...	Dab (advanced).
,, 25, ,,	,, IV., ...	10 (advanced to later).
,, 25, 1893.	Cross-section I., . . .	66 (early to later).
,, 26, ,,	Station I., ...	22 (flounder and dab) advanced.
,, 26, ,,	,, VI., ...	6.
,, 28, ,,	,, III., ...	Eggs of (advanced to later).
May 2, 1892.	,, VII., ...	7.

TABLE VII.—EGGS OF DAB—*continued.*

May	6, 1891.	Station V.,	Eggs of.
,,	7, ,,	,, II.,	One or two.
,,	11, ,,	4 miles E. of May Island,	Eggs of (surface).
,,	11, 1892.	Station I.,	4 (advanced).
,,	12, 1891.	12 to 17 miles S.-E. of May Island,	Eggs of.
,,	12, ,,	6 to 12 miles S.-E. of May Island,	Eggs of.
,,	16, 1892.	Station IX.,	57.
,,	16, ,,	,, VIII.,	13.
,,	19, 1891.	,, III.,	Eggs of.
,,	22, 1895.	,, I.,	399.
,,	22, ,,	,, III.,	300.
,,	22, ,,	,, III.,	187.
,,	23, 1891.	,, I.,	Eggs of.
,,	24, 1893.	,, VII.,	17 (advanced).
,,	24, ,,	,, III.,	11 (advanced).
,,	25, 1892.	,, IX.,	20 (nearly hatching).
,,	25, 1891.	,, II.,	Eggs of.
,,	26, ,,	,, IV.,	A few.
,,	26, ,,	,, V.,	A large number.
,,	26, 1892.	Liston Bank,	A few.
,,	26, ,,	W. of Liston Bank,	A few.
,,	26, ,,	Between Liston Bank and May Island,	21 (whiting and dab).
,,	28, 1895.	Station VII.,	73.
,,	28, 1891.	,, V.,	Considerable number.
,,	29, ,,	,, IX.,	A few.
,,	31, 1893,	,, II.,	6 (advanced).
June	1, ,,	Cross-section III. (N. half),	10 (advanced).
,,	2, ,,	Station IX.,	76 (early to advanced).
,,	4, 1892.	E. of Inchkeith,	4.
,,	8, 1891.	Station I.,	50 (advanced).
,,	9, 1892.	,, VII.,	2.
,,	11, 1891.	,, I.,	100.
,,	11, ,,	Vicinity of Station I.,	80.
,,	12, ,,	Station II.,	A few.
,,	15, 1893.	,, I.,	32 (advanced).
,,	21, ,,	Cross-section III. (N. half),	23.
,,	22, ,,	,, ,, III. (S. half),	23 (dab and flounder, early to later).
,,	22, 1891.	Station I.,	Some.
,,	28, 1893.	,, II.,	57.
,,	30, ,,	,, V.,	10 (various stages).
July	21, 1892.	,, IX.,	3.
,,	22, ,,	,, I.,	2.
,,	23, ,,	,, VII.,	2.
Aug.	29, 1895.	,, V.,	4.

DAB.

The list of hauls in which dab's eggs occurred is a remarkable one. Not only do the extreme limits extend from February 19th in 1891 to August 29th (in 1895), comprising the whole of spring and summer, or a period over six months, but the great number of occurrences, especially in April, May, and June, is marked.

In very few instances do we find the dense masses of eggs which were noticed in the case of the sprat and other species; the only instance of a great number together is on 22nd April 1895, when in Station VII. about 1500 were found. At the same time, it is common to find any number from 100 upwards in each haul, very evenly distributed throughout the stations. Thus, in March, there are found dab's eggs in Largo Bay, Station II., Stations V., VI., VIII., and IX. In April, every station is represented over and over again, including the cross-sections, and the Liston Bank areas; in fact, in April the eggs of the dab are to be found all over the Forth area, pretty evenly distributed. The same remark applies to the month of May, though in the latter part of this month the numbers tail off in the outer stations. Through June, the hauls containing dab's eggs are almost confined to the inner stations, with only one observation on the 2nd in Station IX., and a couple of eggs in Station VIII. Those in July and August are only isolated examples, three hauls in 1892 giving an aggregate of 7 eggs in the former, and one haul in 1895 giving four eggs in the latter.

The spawning-period of the dab may be thus considered in an average year to extend over the months of March, April, May, June, and July. This agrees with Dr Fulton's estimate of 'end of February to July, but ordinarily in April, May, and June.' As regards the spawning-areas, all appearances point to the fact that the dab spawns all over the Firth of Forth area, and that there is very little segregation for the purpose of spawning; the small numbers, at early stages, occurring at every station of the Forth, can indicate nothing but this fact. At the same time, there are clear indications that the dab commences spawning in the outer stations at an earlier period than in the middle, and still earlier than in the inner; and it cannot be doubted that the eggs of the dab, spawned in March and early April in the outer stations, are drifted inwards, under the prevalent east winds, as in the case of the cod, haddock, and plaice. Thus, in 1891, the eggs first occur (in February 19th) in Station VIII., and the next are a month later in Station V. In 1892, the first recorded dab's eggs are as late as April 4th, several miles east of May Island, followed by Cross-section II. (on the 8th) and Cross-section III. (on the 11th). In 1893, no dab's eggs are recorded till April 14th, when a few are found in Station IX. In 1894, there are very few records, and none whatever in Stations VIII. and IX. Lastly, in 1895, the first occurrence is on March 6th in Station VIII., and the next at Stations VIII. and IX., the middle and inner stations not being represented till the 5th of April and the 18th of April respectively. With the exception of the rockling, the egg of the dab is the smallest of the pelagic eggs here dealt with, and its period of incubation is probably very short. We are thus met with a difficulty in that, if the egg of a dab be spawned in the end of March, and in an outer station, alongside that of a cod, then if the drift-currents are of the right force for the cod's egg, and it reaches the shallow water at the assumption of the post-larval period, then the egg of the dab will be too precocious, and the post-larval form will require to seek the bottom long before the shallow water is reached. This difficulty is probably overcome by the fact that the Forth area is, comparatively speaking, shallow water all over, and that, therefore, the young dab can migrate downwards to the bottom as soon as it is able to do so, and find a suitable habitat at the bottom of the Firth.

On account of this conformation of the Firth, the eggs of all the fishes we have referred to have not to guard, to any great extent, against any too early development; the main danger is a 'deferred' development, and 'beaching' as a result. This greatly reduces the mortality amongst the eggs and larvæ, and is probably the main reason why comparatively shallow firths should be used by the food-fishes as nurseries. Were there deep water close inshore we should certainly expect the egg of the dab to be spawned, if contemporaneously, closer inshore than that of *e.g.* the cod.

The eggs continue to be found in small numbers in the outer stations in April and May, and these are probably spawned on the spot. The few occurring in June have most likely been spawned in stations further inshore, and have floated outwards (*cf.* Sprat). In the middle stations, spawning commenced in the middle of March, and the greatest number of dab's eggs in March are found in Stations V. and VI. They are also found in the middle stations in April and May, but tail off in June. In the inner stations, the spawning does not become at all general throughout March or April, and it is well on in May before a large series of occurrences are recorded; they then continue throughout June in plenty, indeed, eleven of the fourteen records in this month are from the inner four stations with their Cross-section. This distribution closely agrees with that for the whting (see Diagram), though the dab does not quite conform to the rule so closely as this fish.

The dab itself is a fish of varied habits, and is found generally distributed at all moderate depths, so that the diffuse spawning-habit is another instance of the tendency to the approximation of the spawning-area to that inhabited by the adult.

(1) The spawning-areas of the dab are commensurate with the whole extent of the Firth of Forth district. (2) The extreme limits of the spawning-season are from February 19th to August 29th; the mean spawning-time being from March 1st to June 30th. Spawning commences in the outer stations, then in the middle, and lastly in the inner stations. Spawning continues latest in the inner stations. (3) The eggs spawned in the outer stations in March, April, and May, are drifted probably shorewards up the Firth, and the same applies to a less extent with those in the middle stations. Those spawned in the inner stations in May, June, and July, seem to develop, *in situ*, whilst floating here and there, and apparently some are drifted seawards to the outer stations.

TABLE VIII.—EGGS OF GURNARD.

FIRTH OF FORTH AREA.

April 5, 1892.	8–12 miles E. of May Island, .	A few.
,, 8, ,,	Cross-section II., . . .	,,
,, 17, 1894.	W. of May Island, . .	1.
,, 17, ,,	Station VIII. and IX., . .	18.
,, 18, 1893.	,, VI., ...	Several (ready to hatch).
,, 18, 1894.	,, VI., ...	4 (early).
,, 20, 1893.	,, I., ...	3 (advanced).
,, 25, 1890.	,, V., ...	1.
,, 25, 1893.	Cross-section I., . . .	9 (advanced).
,, 26, 1892.	Station I., ...	1.
,, 26, ,,	,, VI., ...	1 (advanced).
May 2, ,,	,, VII., ...	2.
,, 6, 1891.	,, V., ...	Eggs of.
,, 6, 1892.	,, IX., ...	10 (advanced).
,, 6, ,,	,, IX., ...	7 ,,
,, 7, ,,	9 miles E. of May Island, .	8.
,, 9, ,,	Station VIII., . . .	41.
,, 9, ,,	,, VIII., . . .	13.
,, 11, ,,	,, I., ...	4 (advanced).
,, 12, ,,	12–17 miles S.E. of May Island,	Gurnard.
,, 12, ,,	6–12 ,, ,, ,,	Eggs of.
,, 14, ,,	Station III., ...	4 (advanced).
,, 17, ,,	,, I., ...	1.
,, 17, ,,	,, VII., ...	4 (advanced, to ready to hatch).
,, 19, 1891.	,, V., ...	Eggs of.
,, 22, ,,	Aberlady Bay, . . .	Large number.
,, 22, 1895.	Station III., ...	88.
,, 23, 1891.	,, I., ...	Eggs of.
,, 25, 1892.	,, IX., ...	77.
,, 25, 1891.	,, VI., ...	A few.
,, 25, ,,	,, II., ...	Eggs of.
,, 26, 1892.	Liston Bank, . . .	29.
,, 26, ,,	Liston Bank and May Island,	117.
,, 26, ,,	W. of Liston Bank, . .	129.

Table VIII.—Eggs of Gurnard—*continued.*

May 26, 1891.	Station IV., ...	A few.
,, 26, ,,	,, V., ...	Eggs of.
,, 27, ,,	,, VII., . . .	Many eggs of.
,, 27, 1892.	Cross-section II. (South), .	9.
,, 27, 1893.	Station I., ...	6 (advanced).
,, 27, 1892.	Cross-section II. (North), .	80.
,, 27, ,,	,, ,, (South), .	8.
,, 28, 1895.	Station VII., . . .	125.
,, 28, ,,	,, VIII., . . .	16.
,, 28, ,,	,, IX., ...	27.
,, 28, 1891.	,, V., ...	Considerable number.
,, 29, ,,	,, IX., ...	Great number.
,, 29, 1895.	,, V., ...	22.
,, 29, ,,	,, VI., ...	2.
,, 30, 1892.	Cross-section I. (North), .	28 (advanced).
,, 30, ,,	,, I., . . .	50 (very advanced).
,, 30, 1893.	Station VIII., . . .	15 (advanced).
,, 30, ,,	,, V., ...	3 (advanced).
,, 31, 1892.	Cross-section III. (North), .	22.
,, 31, ,,	,, III. (South). .	19 (advanced).
,, 31, 1893.	Station II., ...	1 (early).
,, 31, ,,	,, VI., ...	6 (advanced).
,, 31, 1895.	,, II., ...	252.
June 1, 1893.	Cross-section III. (North), .	5 (early).
,, 2, ,,	Station IX., ...	300 (various).
,, 2, 1892.	W. of Eyeborough, . .	2.
,, 4, ,,	E. of Inchkeith, . . .	30 (advanced).
,, 4, ,,	,, (8 fathoms), .	30.
,, 4, ,,	,, (bottom), .	27.
,, 8, 1891.	Station I., ...	29 (fairly advanced).
,, 9, 1892.	,, VIII., . . .	21.
,, 9, 1891.	May Island, ...	45.
,, 9, ,,	Around May Island, . .	Many.
,, 9, ,,	W. of May Island, . .	,,
,, 10, 1892.	Station IX., ...	45.
,, 11, 1891.	,, I., ...	24.
,, 11, ,,	Vicinity of Station I., . .	65 (fairly advanced).
,, 12, ,,	Station II., ...	23.
,, 13, 1892.	,, V., ...	3 (advanced).
,, 13, ,,	,, II., ...	13 (very advanced).
,, 14, 1893.	,, IX., ...	12 (advanced).
,, 15, ,,	,, I., ...	5 (early to later).
,, 15, 1892.	,, VI., ...	8 (advanced).
,, 19, 1893.	,, VI., ...	10 (early to advanced).
,, 22, ,,	Cross-section III. (South). .	2 (early).
,, 22, 1891.	Station I., ...	148 (advanced).
,, 28, 1893.	,, II., ...	73.
July 8, 1891.	Largo Bay, ...	34.
,, 8, ,,	Kirkcaldy Bay, . . .	20 (advanced).
,, 9, ,,	Station V., ...	73 (very advanced).
,, 9, ,,	,, V., ...	11 (very advanced).
,, 9, ,,	,, V., ...	531 (bottom).
,, 9, ,,	Fidra to Cockenzie. . .	48 (advanced).
,, 21, 1892.	Station VIII., . . .	16.
,, 22, ,,	,, IX., ...	8.
,, 22, ,,	,, V., ...	11.
,, 22, ,,	,, VII., . . .	3.
Aug. 29, 1895.	,, V., ...	3.
,, 29, ,,	,, VI., ...	3.

Grey Gurnard.

The record of the eggs of the gurnard extends from April 5th to August 29th, and includes the months of April, May, June, July, and August. We might from this state that the spawning-period is from the first week of April to the second week of August, inclusive.

The main period is during April, May, June, and July, the two middle months containing by far the greatest number of records.

The table in many respects seems to resemble that of the dab (Table VIII.). A great number of occurrences, scattered over all the stations, and moderate numbers in each case, indicate that the gurnard has a diffuse spawning-area, and no very definite migratory aggregation of individuals for the purpose of spawning. As in the case of the dab, the earliest spawning occurs in the offshore stations, the eggs first appearing twelve miles east of May Island. In all the month of April, only two records of eggs in the inner stations are found, and these show only four eggs in an advanced stage of development. It is well on into May before there are any indications of spawning taking place in the inner stations, and the same remarks apply in a lesser degree to the middle stations. Gurnards' eggs, spawned in April, in the inner stations, would inevitably be drifted ashore before they had completed development, and it is only in the later part of the season, May-end, June, and July, when the mean temperature is higher, and the prevalent easterly drift has subsided, that such large eggs can be laid with impunity in the 'near-shore stations.'

During June, spawning still continues in the outer stations, and the eggs make but slow progress landwards (June 2nd, 1893; 300 at various stages). In all the inner stations, the majority of the occurrences are those of eggs in an advanced condition, which strengthens the conclusion that they are mostly spawned in the outer and middle areas, but have been floated in. In July, the outer, middle, and inner stations are all represented by small quantities, so that there is not such a marked falling-off in the outer stations at this period as in the dab. The middle stations are best represented, and it is in these that the two occurrences of August are recorded.

All appearances, therefore, indicate that the gurnard commences to spawn in the outer stations; and, as the season gets later, transfers its main spawning-area to the middle stations. There is no pronounced indication that spawning takes place in the inner stations to any great extent, though what there is, is very late in the season (see Diagram). All these facts of the distribution of the eggs of the gurnard can be explained in a like manner to those of the preceding species, by appealing to the size of the eggs, closely like that of the haddock, and the time of year at which they are spawned. The early eggs are similar in their disposition and behaviour to the later eggs of the haddock (or rather to those of the cod, as they are not so densely aggregated), and the later eggs are disposed, and behave, in a way one might expect haddocks' eggs to do if they spawned on through the summer.

The gurnard is an offshore fish, and hence it probably moves inshore to some extent for spawning, so that there is somewhat of a migration from the adult- to the egg-habitat. An approximation of one to the other would be conceivable by the assumption of an earlier spawning-period, by the assumption of a larger egg (the red gurnard, a smaller fish, but inhabiting deeper water, has a larger egg), or by both of these combined; or lastly, by the change of the very young from adaptation to shallow to that suited to deeper water, or either of these would enable the gurnard to eliminate the necessity for the migration shorewards. (1) The spawning-areas of the gurnard are in the outer stations, with the areas East of the Island of May, and also to some extent the middle areas about Stations V., VI., and VII.: perhaps partly in the inner stations. (2) The spawning-time extends from April to August inclusive, the main time being during April, May, June, and July, with a maximum during the two middle months. The spawning in the outer stations is earlier than that further shorewards. (3) The direction of the drift of the early eggs (in April and May) is probably up the Firth, as in the preceding species, but the movement of the June and July eggs is not so pronounced, and is probably more or less indefinite.

TABLE IX.—EGGS OF TURBOT.

FIRTH OF FORTH.

May 19, 1891.	Station III., . . .	Eggs of.
,, 22, ,,	Aberlady Bay, . . .	Eggs of.
,, 24, 1892.	Station III., . . .	2 (advanced).
,, 25, 1891.	,, VI., ...	A few.
,, 25, ,,	,, II., ...	Eggs of.
,, 27, 1892.	,, I., ...	4 (early).
,, 27, 1891.	,, VII., . . .	Turbot.
,, 28, ,,	,, V., ...	,,
,, 28, 1895.	,, VII., . . .	25.
,, 28, ,,	,, IX., ...	9.
,, 29, 1891.	,, IX., ...	1 or 2.
,, 29, 1895.	,, V., ...	5.
,, 31, 1893.	,, VI., ...	1.
,, 31, 1895.	,, II., ...	56.
June 1, 1893.	Cross-section III. (North), .	1 (early).
,, 2, ,,	Station IX., . . .	15 (early).
,, 4, 1892.	E. of Inchkeith, . . .	1.
,, 14, 1893.	Station IX., ...	1 (early).
,, 15, ,,	,, I., ...	12 (advanced).
,, 19, ,,	,, VI., ...	44 (early to later).
,, 21, ,,	,, III., ...	6 (early).
,, 22, ,,	Cross-section II. (South), .	5 (early).
,, 28, ,,	Station II., ...	6 (early to later).
,, 28, ,,	,, II., ...	61 (early to later).
July 8, 1891,	Largo Bay, ...	Considerable number (turbot-like).
,, 9, ,,	Station V., ...	A few (resembling turbot).
,, 22, ,,	,, V., ...	Eggs of.

The eggs of the turbot occur in small numbers in the Firth of Forth district, and a very few occurrences are recorded. The extreme limits are from May 19th to July 22nd, which probably indicates a spawning period from mid-May to mid-July. Dr Fulton gives from April to July inclusive for the East Coast, so that the time here given is six weeks earlier and shorter than his. No special distribution or movement of the eggs of the turbot can be discerned, and although the turbot is not one of the commonest of the flat fishes it looks as if the Firth of Forth area is not by any means the spawning headquarters of this species. It is probable that the turbot spawns in deeper water further offshore, and that the eggs here recorded must be regarded as more or less due to 'stragglers.' They occur indiscriminately in all stations, and are at all stages.

Nothing more can be said upon this subject, but it is evident that more definite knowledge is desirable with regard to the spawning of this valuable fish.

TABLE X.—EGGS OF BRILL.

FIRTH OF FORTH.

May 6, 1891.	Station V., ...	Eggs of.
,, 7, ,,	,, II., ...	Eggs of.
,, 9, ,,	,, IV., ...	1 or 2.
,, 12, ,,	12 to 17 miles E. of May Island, ...	Brill.
,, 25, ,,	Station II., ...	Probably brill.
,, 27, 1892.	Cross-section II. (North), .	50.
,, 30, ,,	,, I., . . .	Some brill (very advanced).

This meagre list is all that one can glean with regard to the presence of eggs of the brill. Dr Fulton gives the spawning period as mid-March to the end of June, with a maximum in May. That the eggs of the brill should only be found in May, at the height of the spawning-season, and then only in small numbers, indicates that the brill spawns in the Firth of Forth only exceptionally. This species probably spawns far from land, and more knowledge of its spawning-habits is also required.

TABLE XI.—EGGS OF GREEN COD.

FIRTH OF FORTH.

Feb. 21, 1894.	Station VIII.,	16.
,, 21, ,,	,, IX.,	3 (advanced).
,, 22, ,,	,, V.,	2.
,, 26, ,,	,, VI.,	1.
Mar. 6, 1895.	,, VIII.,	72.
,, 7, ,,	May Island to Carr,	2.
,, 7, ,,	Carr to Barbet Ness,	17.
,, 19, ,,	Station VII.,	4.
,, 19, ,,	,, VIII. and IX.,	7.
,, 20, ,,	,, V.,	1.
,, 20, ,,	,, VI.,	1.
April 14, 1893.	,, IX.,	8 (advanced).
,, 25, ,,	Cross-section I.,	164 (green cod and bib), various stages.
May 6, 1892.	Station IX.,	10.
,, 9, ,,	,, VIII.,	43.
,, 9, ,,	,, VIII.,	26.
July 21, 1892.	,, VIII.,	6.
,, 21, ,,	,, IX.,	2.

GREEN COD.

The number of eggs of the green cod is small, but it is likely that in many cases they may have been confused with those of some of the other gadoids. They extend from February 21st to July 21st. On this latter date are recorded a few in each of Stations VIII. and IX., but I would be inclined to doubt the accuracy of the diagnosis in this case. (The observations are my own, and I do not think that they were positive; they are accompanied by a (?).

Thus I think we are justified in saying that the record of the pelagic eggs gives the spawning-period of the green cod as from the third week of February to the end of April, allowing for the period of incubation in May. This compares with Dr Fulton's for the whole East Coast as a more contracted period; he gives practically the first four months of the year. The conclusion is irresistible that (as is indicated by the general principles laid down above) the eggs of the green cod in January would be found further out than the Firth of Forth district. The green cod, in respect of spawning-period, would thus come at the head of the gadoid series (see Diagram), and the distribution of its eggs falls in with this position. The eggs are not found once in the inner stations; partly, perhaps, because by April and May the eggs of the lesser gadoids (*cf.* Ap. 25, 1893) appear in this region, and obscure them; but they are newly spawned in Stations VIII. and IX. Only five records, with an aggregate of 10 eggs, are found in Stations V., VI., and VII., the middle stations, and it is reasonable to conclude that these have been drifted in from the outer stations.

(1) The green cod spawns in the Liston Bank area and outer stations only. (2) The green cod spawns in February, March, and April. (3) The eggs are probably drifted inwards to the middle, and possibly the inner stations, as in the case of the other early-spring gadoids.

TABLE XII.—EGGS OF LING.

FIRTH OF FORTH

April 13, 1891.	Liston Bank, . . .	Large number.
May 6, ,,	Station V., ...	Eggs of.
,, 9, 1892.	,, VIII., . . .	2.
,, 12, 1891.	12 to 17 miles S.E. of May Island, ...	Ling.
,, 12, ,,	6 to 12 miles S.E. of May Island, ...	Ova of.
,, 27, ,,	Station VII., . . .	1.
June 4, 1892.	E. of Inchkeith (bottom),	1.
,, 13, ,,	Station V., ...	1.
,, 13, ,,	,, II., ...	2.

LING.

The list under this head is very meagre. The ling is decidedly our most prolific food-fish, and is also a deep-water fish. The conclusion is warrantable that the Firth of Forth does not form a regular spawning-area for this fish. The occurrence of large numbers at Liston Bank in April is noteworthy. A very few appear to find their way into the upper reaches of the Forth, but it is probable that development is normally outside this system, and, as in the case of the turbot and brill, more knowledge is required. Hitherto ripe ling have only been found in deep water, and far from land.

The species that remain for consideration are the long-rough dab, dragonet, rockling, poor-cod, and bib, all of which spawn in abundance in this area; and the rarer topknot, solenette, and weever, which need not detain us. None of these are important food-fishes, and time has prevented me from dealing with them at length.

We thus find that the Firth of Forth district forms a very important area for the spawning and development of food-fishes. These fall into three groups :—

(1) The *drift* group, which spawn early in the year in extra-territorial waters, and appear to avail themselves of the westerly drift at that time of the year to bear their eggs and fry within the Firth. They consist of the plaice, green cod, haddock, and cod, to which we may add the long-rough dab.

(2) The species which lay their eggs in the upper reaches of the Firth later in the season when the drift-currents seem not to be so pronouncedly westerly. These are the sprat and dragonet, to which we may add, in so far as they spawn in this area, the turbot and brill.

(3) The species which have a spawning habit, partaking in varying proportion of the nature of (1) and (2). These species, in the order of transition from (1) to (2), are :—Whiting (and poor-cod), gurnard, dab, and flounder, to which we may add the rockling.

DIAGRAM SHOWING SPAWNING-PERIODS FOR THE VARIOUS STATIONS.

	Liston Bank and E. of May Island.	Stations IX. and VIII. Cross-section I.	Stations V., VI., VII., and Cross-section II.	Stations I., II., III., IV., and Cross-section III.
1. Plaice .	Feb.-March-(April)	Feb.-Mar.-(April)	—	—
2. Green Cod	Feb.-March	Feb.-Mar.-April-May	—	—
3. Cod and Haddock	March-April	Mar.-April-(May)	—	—
4. Whiting	—	Mar.-April-May	May-June (July)	May-June (July)
5. Gurnard	April-May	April-May	May-June-July	June ?
6. Dab .	(March) April-May	(Feb.)Mar.-April-May	(April)-May-June	May-June (July)
7. Sprat .	—	—	(Mar.)-April-May-June (July)	May-June-July (August)

The species, about which more data should certainly be obtained, are the turbot, brill, and ling; and the districts further from shore than those here dealt with, will have to be investigated for this purpose. A research of this kind would probably throw light on the later stages of these species as well, and might also clear up the ignorance regarding the halibut.

It was intended that this review should also include the areas of St Andrews Bay, Moray Firth, and the Clyde, but the detailed examination of the Firth of Forth has prevented the inclusion of the St Andrews Bay data here. The general spawning-system appears to be much the same in many respects as regards the Moray Firth and the Clyde; the few observations that have been made have revealed some remarkable differences from the Forth system, though the fact of their paucity prevents the issue of statements which could carry any weight. It is thus best to leave them out of consideration for the present.

VII.—REPORT ON THE PELAGIC OVA, LARVÆ, AND YOUNG FISHES PROCURED BY THE s.s. 'GARLAND' DURING THE GREATER PART OF 1896. By Harry M. Kyle, M.A., B.Sc., Berry Scholar, Gatty Marine Laboratory, University of St Andrews.

In this paper will be given a list of the ova, larvæ, and young forms of fishes collected in the Firth of Forth, Moray Firth, Firth of Clyde, and Loch Fyne during the months February, March, April, May, August, September and October 1896. These were taken by the 'Garland,' and forwarded to St Andrews preserved in spirit. The portions of the year during which most hauls were taken, were April (46, from the 10th to the 24th, on the Clyde and Loch Fyne) and in August and September (34 in all, in Moray Firth). The 'Garland' was on the east coast, at Firth of Forth, for a short time only about the beginning of March, and there is therefore very little to show for this period. But in former years, the work had been carried on mostly in the east, and there is a great store of facts in the Scottish Fishery Board Reports from which to draw comparisons between the east and the west.

The preservative fluid for the ova, etc., was an alcoholic solution of camphor. (Formerly it was a 2 per cent. solution of acetic acid in 94 per cent. methylated spirit.) This answered very well for the greater number, but the ova in one or two of the bottles from the Moray Firth were blackened and contracted so much as to be almost unrecognisable. This may have been due, however, to some accident. The same happened to two bottles from the west coast, but this was clearly traceable to bad corks, which had allowed the spirit to evaporate.

In spirit the ova contract considerably, but not all to the same extent, and great difficulty is thus experienced in separating the eggs of some forms from one another. The green cod, whiting, and poor cod are the worst in this respect. The two last indeed, though distinguishable easily enough in the fresh state are almost indistinguishable in spirit. In the fresh state, the whiting ova are larger than those of the poor cod, but in spirit the ova of the poor cod seem to vary greatly in the amount of contraction, and the result is that the ova of the two forms overlap in size. If the embryo is present in the egg, the poor cod is distinguishable from the whiting by having more pigment, but if only the blastodisc is seen it is impossible to separate the two forms completely. Again, the green cod ova come in size between the whiting and poor cod, overlapping both by variations from the average. They appear at an earlier part of the year, however. It must be considered, therefore, that the relative proportions of the poor cod and whiting, when both are present, are only approximate in spirit specimens. As Mr Williamson said, in the Thirteenth Scottish Fishery Board Report:—'The presence of the species recorded is certain; the exact number of the ova of any one species it is impossible to fix.'

Where a very large number of ova were present in a bottle, acting upon the advice of Professor M'Intosh, the following method was taken. Several lots of about a hundred each were counted out until the various ova were considered to be all fairly represented. The proportions were then counted, and also the total number of the eggs, as nearly as possible; then the total number of each species was got by multiplying. If some such method be not taken, the counting of the ova in a bottle containing a few thousands would occupy a whole day, and where a hundred bottles are to be examined there would be a great waste of time over simple enumeration.

The order pursued in this paper will be as follows :—(1) Notes on the collections, beginning with those from the Forth, and going on to those of the Clyde and Loch Fyne ; (2) notes on the larvæ and young fishes from the Forth, Clyde, and Loch Fyne ; (3) the details of the collections taken there ; (4) the Moray Firth collection ; (5) Tables showing the number of ova from the Forth, Clyde, and Loch Fyne. In these Tables are given the day of the month, the station, and the depth of water at which trawl was made, whether at the surface *(s)*, etc.

Notes on Ova from Firth of Forth.

The 'Garland' was in the Forth during the latter part of February and the first part of March. The stations visited were—East of May Island, half a mile, and from the May to two miles east. In 1894, at the same time, the 'Garland' was about the same place, except on 14th March, when it was further up the Forth. A comparison can therefore be made. The predominant forms in both years at this time were haddock, green cod, flounder and *motella.* In 1894 cod, whiting and poor cod were almost entirely absent. In 1896 these three were common. In 1894 the whiting and poor cod were not got in any large quantities until April, when the whiting was the predominant form. For both years, in early March, the haddock was the commonest form—except long rough dab in 1894—and it is very probable, seeing that these eggs were got on the surface and out at sea, they were not far from the spawning ground, which would lie to the north-east, in accordance with the results of the drift-current experiments—more to the north than east. The same applies for the whiting and poor cod, the spawning time of which is somewhat later. At this time the spawning of the green cod is almost over, because the greatest number of eggs is got in the beginning of March and in April 1894, only one egg was found.

From May Island to two miles east trawlings were made at varying depths—surface, 6, 14, 24 fathoms, and bottom. The most eggs were got on the surface, and the number of eggs procured decreased as the depth increased, the bottom net having very few eggs. In the mid-water nets the green cod has a greater proportion of eggs than the other forms, and this would lead to the conclusion—according to Mr A. T. Masterman —that the green cod eggs were spawned further out to sea, and that the embryo was now almost fully developed.

The eggs of the long rough dab were not got in such profusion this year as in 1896 ; the plaice shows about the same numbers ; the flounder also; whilst the dab in both is almost entirely absent. Motella, which was present in every haul, is in greater numbers than in 1894. The dragonet, gurnard, sprat, and turbot are absent from both lists. Their spawning time comes later, because their eggs are present in the list of 1894—the sprat in great numbers in April, the gurnard and turbot towards the end of May, the dragonet at the beginning of June.

Notes on Collection of Eggs from Clyde and Loch Fyne.

This is the first time that eggs have been taken from the Clyde at this period of the year, and a slight glance at the tables will show that this is the spawning period of all the common food fishes. During the first few days of July 1890, eggs of the following species were found (Professor

M'Intosh, Ninth Scottish Fishery Board Report) :—Sprat, gurnard, witch, dragonet, motella, turbot, sole, dab, flounder, ling. From this list the plaice, haddock, cod and other gadoids are absent. From the list for the present year the witch and ling are absent, but all the others of those mentioned are present.

This year the long rough dab, plaice and gurnard are well represented, but far exceeded in numbers by the haddock, cod, whiting, poor cod, flounder and dab ; the cod being present in greatest numbers. If the proportion of the numbers of eggs spawned by different species be considered, it will be found that the plaice, long rough dab and haddock are as abundant as the cod. For example, the cod sheds about three times as many eggs as the haddock ; hence to be equally abundant there should be about three times the number of cod eggs that there are of haddock, which is not always the case.

On several occasions trawlings were made at different depths on 13th, 20th, 21st and 22nd. On the 13th and 21st, however, they were not at the same place, and on the 20th and 22nd they were limited to the surface and two fathoms down. From the results, it is seen that there is no difference between the number of eggs taken on the surface and at two fathoms, and a comparison between the number or kinds of eggs taken at the surface and at the bottom or great depths cannot be made for the same place. But, comparing generally the results given, the proportion of eggs on the surface to those at the bottom is as 100 to 1.

The majority of the eggs of the haddock, cod, whiting, and poor cod had simply the blastodisc, but in a few (chiefly haddock) the embryos were seen. With the exception of the long rough dab, the embryo was not in the same stage for all of the same species in any one bottle of eggs. The greatest numbers of eggs were obtained on 13th, 14th and 15th April, at Stations VI., VII., VIII., and X. ; at Station X. over 20,000 were got. Not having a chart of the Clyde stations at hand, one is restricted to the mere mentioning of stations.

Long rough dab.—This form was got in 23 out of 30 trawls not in any quantity except on the 13th, 14th, and 15th April. The greater proportion of eggs had the embryo well developed ; in some, the larva was hatched. Often, however, where the majority were thus, one or two showed no signs of development, as if they had not been fertilised, or if fertilised, had died at a very early stage.

Plaice.—The plaice is not quite so common as the long rough dab, being present in 21 trawls. These two forms seem to hunt together, as will be seen more strikingly in the list for Loch Fyne. Comparing with the east coast for the same time, we find that the long rough dab has about the same numbers at both places, while the plaice seems to be over in the Forth. No figures are at hand for March on the Clyde, and it cannot be said absolutely that the plaice spawns later in the west than in the east, because its eggs might be got just as early in the year in the west as in the east. Nevertheless, this statement is correct that the spawning period is continued later in the west. Mr Masterman, in Thirteenth Scottish Fishery Board Report, takes the spawning period of the plaice in the east as from January to May, and mentions that Petersen for Danish waters, gives the period as from November to April, with the maximum in the heart of winter. For the Clyde, it seems as if the maximum were in the beginning of April, and thus the spawning period would seem to be later in the warmer waters. The temperature of the water in the Clyde during April (Thirteenth Scottish Fishery Board Report) is about 8° C. on surface and 7° C. at depths greater than 15 fathoms. On the east coast, the temperature of the water at the same period is under

7° C. On the Clyde, therefore, the time taken during incubation will be (Dannevig, Thirteenth Scottish Fishery Board Report) about sixteen days; on the east coast, about eighteen, and longer for Danish water. It may be, then, that the longer period of incubation has pushed the spawning time back towards the winter. The drift currents on the west have not been traced as they have on the east, and it is almost impossible to conjecture how far down the Irish Channel, or how far out in the Atlantic the plaice eggs were spawned, In Loch Fyne, the number of eggs of long rough dab and plaice far exceeds that from Clyde and East Coast. On the 23rd April, from Loch Gair to Quay Ferry, 1470 plaice eggs were got at 6½ fathoms This is near the head of the Loch, and allowing a period of about twelve days' incubation—for the embryo was not fully round the yolk in any—and a drift of about five miles each day, this would give the spawning ground near the Mull of Cantyre, and the time of spawning the first few days in April. To ascertain the truth, however, it would be necessary to have more facts at one's disposal—a knowledge of the direction and rate of drift currents, and the results of trawlings in February and March.

The *haddock* and *cod* are present in the Firth of Clyde and Loch Fyne in enormous numbers. The spawning period of the haddock on the west, like that of plaice, seems to be continued later than in the east, because in the east the numbers are small and cease altogether in April (Thirteenth Scottish Fishery Board Report), whereas on the west they are large and continue so on to the 24th April. If the same line of reasoning that was taken for the plaice be gone through for the haddock and cod, it will be seen that it is doubtful whether the haddock or plaice spawn first, but the cod, as on the east, is later than both.

Whatever applies to the cod applies also to the whiting and poor cod, because the numbers for the three at all places, run almost equal—the cod being in excess. On the east coast, the greatest numbers of the whiting and poor cod eggs were got on the 22nd and 23rd April, those of poor cod, however, continuing to the end of May. The time is almost the same, therefore, for both coasts. If it be inferred, because of more favourable conditions as to climate, temperature, etc., that the spawning time for the Clyde should be earlier than on the east, then the number of eggs of cod, whiting, etc., that ought to be got in March should far exceed those got in April. From present figures it would seem as if spawning season is at same time.

Green cod.—One or two eggs of this form were found on three occasions.

Gurnard.—The eggs of the gurnard are very abundant in the Firth of Clyde. From the 10th to the 20th April they are only found in four out of eleven trawls; after that date they are present everywhere in great numbers. In Loch Fyne, only one egg was found. On the east (1894) gurnards' eggs did not appear until the 22nd of May. This latter fact would point to the conclusion that the spawning period for gurnard is much earlier in the west than in the east. Since the eggs are not got in Loch Fyne, it may be inferred that they were spawned in the Firth and had not had time to drift up the Loch. They should be found in the Loch later.

Sprat.—The eggs of sprat are not common in April either in Firth of Clyde or Loch Fyne. They were found first on 21st April, at Station VII., Firth of Clyde, in bottom net. The greatest number at any time was 54, and this is in striking contrast to the numbers taken on the east coast in April, May and June 1894. In Loch Fyne still fewer were found. It would seem, therefore, that the spawning period has hardly yet begun, and that it is later than in the east.

Turbot.—This form is not abundant, neither in Firth of Clyde nor Loch Fyne. On the east coast it was not found until the end of May.

Flounder and dab.—These may be considered together because they are rarely separate, the flounder being more abundant. Their eggs are as universal as those of the cod, and almost as abundant. On 13th April, at Station II., Clyde, the eggs were almost entirely flounder and dab in the *bottom* net. How this is to be understood is difficult. Station II. may be in partly fresh water; if so, it is curious that no more eggs of cod, etc., were found in this net. On the east coast, the flounder eggs are common from March till the end of May, and the dab reaches a maximum in April.

Motella.—The eggs of motella were very abundant, as on the east coast at the same period. The greatest number was got on April 22nd, at the Station Pladda to Turnberry.

Dragonet.—The eggs of this form, which did not appear on the east coast till June, were present at the beginning of April in Firth of Clyde. They are not so abundant as motella's, and are almost entirely absent from Loch Fyne.

Two other forms occur—the sole and megrim. The sole was got three times, twice in the bottom-net on 13th and 20th April, and once in surface-net on 20th April. Two eggs of megrim were got in the same net as last.

In connection with the trawlings in Loch Fyne:—five places visited. At four of these trawls were made at different depths, and the result is interesting. At $6\frac{1}{2}$ fathoms no whiting, poor cod, sprat, turbot, flounder (twice only), dab, *Motella* (once), or dragonet were found, while the haddock and cod were present in small numbers, but the forms with eggs of large bulk, the long rough dab and plaice were got in greater quantities than anywhere else. This is easily understood for the plaice, because of the greater mass of its eggs as compared with those of other forms, but the long rough dab eggs are specially adapted for floating—owing to perivitelline space—as is to be seen in spirit in the bottles. They float above all the other eggs. The reason for these being found in deep water is, that the larvæ were for the most part hatched,—the embryo having just broken through the egg capsule, or being fully developed within the capsule. In the surface net, the cod eggs, as in Firth of Clyde, were predominant.

LARVÆ AND YOUNG FISHES.

Firth of Forth.—The number and variety of these are not so great as in 1894, owing to the much shorter time that the 'Garland' spent in the Forth.

Clupeoid forms were the commonest, and varied greatly in size. This corresponds to the different months of spawning (Masterman, Fourteenth Scottish Fishery Board Report), one set being from 8 to 9·5 mm., the other from 28 to 31 mm. Sand-eels were fairly common, varying from 5 to 9·5 mm. A single example of the common eel, 6·3 cm. was got at Station II. on the 24th February. Gunnels were almost as common as clupeoids, varying in size from 9 to 13 mm. A few cotti were caught at Station IV. on 20th February.

FIRTH OF CLYDE AND LOCH FYNE.

The most common forms met with were gadoids, sand-eels, and montagu's suckers. The gadoids varied in size from 3·5 to 20 mm., and were present at almost every station. The montagu's suckers, very small in size, with the sucker undeveloped in most, were as numerous as the gadoids. The sand-eels ranged from 8 to 15 mm. Other forms present were pleuronectids, clupeoids, cotti, gobies, and crystallogobies.

FIRTH OF FORTH.

(The numbers in brackets at the end of each trawl refer to the bottles.)

Station IV.—20th February, bottom tow-net. 5 cotti, 4 mm. (97).

Station II.—24th February, surface. 2 sand-eels, 5 mm.; 18 gunnel, 9 to 13 mm.

Station II.—24th February, bottom. Common eel, 6·3; clupeoid, 28 mm.

Half-mile east of May—26th February, surface net. Long rough dab, 2; haddock, 4; poor-cod, 1; *motella*, 3 (102).

Half-mile east of May—26th February. 2 clupeoids, 28 and 31 mm. (98).

From May Island to 2 miles east—4th March, two surface nets. Long rough dab, 2; plaice, 3; haddock, 168; cod, 12; whiting, 100; green-cod, 140; poor-cod, 60; flounders, 37; dab, 9; *motella*, 37 (100).

From May Island to 2 miles east—4th March, bottom. Long rough dab, 2; plaice, 3; haddock, 18; cod, 3; whiting, 3; green-cod, 16; *motella*, 2 (101).

From May Island to 2 miles east—4th March, bottom. 13 clupeoids, 8 to 9·5 mm.; clupeoids, 30 mm.; 2 gunnel, 13 mm. (99).

From May Island to 2 miles east—4th March, 14 fathoms from bottom. Long rough dab, 6; plaice, 1; haddock, 33; cod, 10; whiting, 15; green-cod, 34; flounder, 2; *motella*, 13 (106).

From May Island to 2 miles east—4th March, 14 fathoms from bottom. 5 sand-eels, 8 to 9·5 mm. (103).

From May Island to 2 miles east—4th March, 6 fathoms from bottom. Long rough dab, 5; plaice, 2; haddock, 26; cod, 5; whiting, 10; green-cod, 40; poor-cod, 6; flounder, 4; dab, 2; *motella*, 23 (107).

From May Island to 2 miles east—4th March, 6 fathoms from bottom. 8 clupeoids, 8 to 9 mm. (104).

From May Island to 2 miles east—4th March, 24 fathoms from bottom. Long rough dab, 12; plaice, 2; haddock, 25; cod, 6; whiting, 12. green-cod, 38; poor-cod, 8; *motella*, 21 (108).

East of May Island,—6th March. Long rough dab, 1; haddock, 11; cod, 13; whiting, 6; green-cod, 25; flounder, 2; *motella*, 6 (105).

FIRTH OF CLYDE.

Station III.—10th April, surface. Clupeoid, 17 mm.; sand-eel, 10 mm.; 5 gadoids, 6 to 8·5 mm.: (71).

Station IV.—10th April, surface. Long rough dab, 61; plaice, 6; gurnard, 5; haddock, 322; cod, 276; whiting, 57; green cod, 20; poor cod, 260; flounder, 87; dab, 89; *motella*, 60; dragonet, 84: (30).

Station IV.—10th April, surface. Clupeoid, 11·5 mm.; gadoid, 5 mm.; 4 cotti, 4 to 6 mm.: (72).

Station V.—10th April, bottom. Plaice, 7; flounder, 3; dab, 5: (15).

Station V.—10th April, surface. 3 gadoids, 6, 7, and 7·5 mm.; 2 sand-eels, 9·5 and 12 mm.; cottus, 3 mm.; goby, 2·5 mm.: (74).

Station V.—10th April, bottom. Gadoid, 4 mm.; 2 cotti, 3·5 and 6 mm.; 5 gobies, 2·5 to 3·5 mm.; 5 Montagu's suckers, 2·5 to 3·5. mm.; 2 sand-eels, 8 and 9 mm.: (73).

STATION I.—13th April, bottom. Long rough dab, 5; plaice, 1; haddock, 1; cod, 8; whiting, 9; green cod, 18; poor-cod, 2; turbot, 28; flounder, 15; dab, 13; *motella*, 49; sole, 1: (1).

STATION I.—13th April, bottom. Montagu's sucker, 3 mm.; goby, 3·5 mm.: (70).

STATION I.—13th April, 2 fathoms. Long rough dab, 14; plaice, 4; haddock, 12; cod, 166; whiting, 104; poor cod, 65; turbot, 3; flounder, 220; dab, 45; *motella*, 158: (9).

STATION I.—13th April, surface. 4 gobies, 5 to 7 mm.; cottus, 8·5 mm.; gadoid, 8 mm.; sand-eel, 8 mm.: (69).

STATION II.—13th April, bottom. Cod, 1; whiting, 1; flounder and dab, 605: (12).

STATION VI.—13th April, surface—Long rough dab, 117; plaice, 18; haddock, 165; cod, 600; whiting, 600; poor-cod, 800; flounder, 600; dab, 400; *motella*, 70: (21).

STATION VI.—13th April, surface. 9 gadoids, 6 to 8·5 mm.; clupeoid, 9·5 mm.; *crystallogobius*, 10 mm.: (75).

STATION VI.—13th April, 2 fathoms. Long rough dab, 139; plaice, 19; gurnard, 10; haddock, 400; cod, 700; whiting, 800; poor-cod, 600; flounder, 400; dab, 320; *motella*, 250: (5).

STATION X.—14th April, surface. Over 20,000 ova, consisting of long rough dab, plaice, etc., as in preceding, with larger proportion of cod and *motella* (advanced mostly): (13).

STATION X.—14th April, surface. 9 gadoids, 5 to 9 mm.; 6 sand-eels, 7 to 10 mm.: (80).

STATION X.—14th April, bottom. 8 gadoids, 3 to 7 mm.; 13 Montagu's suckers, 3 to 7 mm.; 2 crystallogobies, 5 and 9·5 mm.: (81).

STATION X.—14th April, bottom. 3 gadoids, 4·5 to 6·5 mm.; 2 Montagu's suckers, 3 and 4 mm.; 2 crystallogobies, 6·5 mm. and 8 mm. (82).

STATION VII.—15th April, surface. Long rough dab, 35; plaice, 100; gurnard, 120; haddock, 800; cod, 850; whiting, 600; green cod, 20; poor-cod, 450; flounder, 200; dab, 900; *motella*, 900; dragonet, 100: (31).

STATION VII.—15th April, surface. 22 gadoids, 3·5 to 8·5 mm.; 3 pleuronectids, 6 to 7·5 mm.: (76).

STATION VII.—15th April, bottom. 4 gadoids, 4 to 7 mm.; goby, 4 mm.; 2 clupeoids, 10 mm.; 4 Montagu's suckers, 3 to 8 mm.; 5 pleuronectids, 4 to 5 mm.: (77).

STATION VIII.—15th April, surface. Long rough dab, 130; plaice, 110; haddock, 200; cod, 1600; whiting, 2000; poor-cod, 400; flounder, 300; dab, 250; *motella*, 300: some of long rough dab were hatched: (7).

STATION VIII.—15th April, surface. 2 gadoids, 6 and 6·5 mm.: (78).

STATION VIII.—15th April, bottom. 2 gadoids, 5 mm.; pleuronectid, 4·5 mm.; cottus, 5 mm.; 7 sand-eels, 8 to 12 mm.; 19 Montagu's suckers, 4 to 7·5 mm.: (79).

STATION XI.—16th April, bottom. Pleuronectid, 5 mm.: (83).

STATION XII.—16th April, bottom. 2 pleuronectid, 6·5 and 8 mm.; 2 gadoids, 6 mm.: (84).

STATION VII.—20th April, bottom (at night). Long rough dab, 6 (hatched); plaice, 13; haddock, 2; cod, 37; whiting, 31; poor-cod, 10; turbot, 1; flounder, 7; dab, 10; *motella*, 53; sole, 6: (?)

SANDA TO BENNAN, 20th April.

Surface, 1st haul. Long rough dab, 1; gurnard, 45; haddock, 82; cod, 191; whiting, 31; poor-cod, 105; sprat, 30; turbot, 5; flounder, 26; dab, 39; *motella*, 8; dragonet, 102; sole, 1; megrim, 2: (27).

2 fathoms, 1st haul (shrimp net). Long rough dab, 3; plaice, 2; gurnard, 84; haddock, 17; cod, 184; whiting, 153; poor-cod, 135; sprat, 54; flounder, 35; dab, 81; *motella*, 18; dragonet, 68; and larval gadoid: (25).

Surface, 2nd haul (shrimp-net). Long rough dab, 1; gurnard, 14; haddock, 8; cod, 52; whiting, 23; poor-cod, 13; sprat, 6; flounder, 15; dab, 31; *motella*, 9; dragonet, 18: (24).

Surface, 3rd haul (shrimp net). Gurnard, 61; haddock, 10; cod, 62; whiting, 83; poor-cod, 33; flounder, 23; dab, 15; *motella*, 3; dragonet, 7 (67).

Surface, 4th haul (shrimp net). Long rough dab, 1; plaice, 4; gurnard, 18; haddock, 9; cod, 675; whiting, 35; poor-cod, 85; sprat, 12; turbot, 15; flounder, 50; dab, 46; *motella*, 25; dragonet, 20 (59).

2 fathoms, 2nd haul. Long rough dab, 6; gurnard, 25; haddock, 8; cod, 48; whiting, 15; poor-cod, 59; sprat, 14; turbot, 1; flounder, 5; dab, 21; *motella*, 5; dragonet, 44 (26).

2 fathoms, 3rd haul. Gurnard, 7; haddock, 112; cod, 24; whiting, 24; poor-cod, 13; flounder, 13; dab, 18; *motella*, 18 (?).

2 fathoms, 4th haul. Long rough dab, 11; plaice, 9; gurnard, 256; haddock, 107; cod, 350; whiting, 170; poor-cod, 200; sprat, 16; flounder, 6; dab, 138; *motella*, 95; dragonet, 98 (34).

Surface. Gurnard, 28; haddock, 58; cod, 99; whiting, 82; poor-cod, 85; flounder, 22; dab, 128; *motella*, 41; dragonet, 20 (64).

Station, VII.—21st April, bottom (night). Plaice, 6; gurnard, 10; haddock, 34; cod, 47; whiting, 29; poor-cod, 50; sprat, 30; turbot, 2; flounder, 6; dab, 3; *motella*, 1; dragonet, 1 (52).

Station VIII.—21st April, surface (night trawl). Plaice, 20; gurnard, 600; haddock, 120; cod, 1000; whiting, 1500; poor-cod, 600; sprat, 20; flounder, 400; dab, 600; *motella*, 500; dragonet, 600 (41).

Station XII.—21st April, surface. Long rough dab, 2; plaice, 3; gurnard, 43; haddock, 20; cod, 114; whiting, 31; poor-cod, 100; sprat, 4; turbot, 4; flounder, 48; dab, 76; *motella*, 60; dragonet, 20 (55).

Station XII.—21st April, 2 fathoms (night trawl). Long rough dab, 3; gurnard, 29; haddock, 119; cod, 131; whiting, 40; poor-cod, 76; sprat, 3; flounder, 42; dab, 74; *motella*, 25; dragonet, 8 (51).

Corsewall to Mull of Cantyre.

21st April, shrimp-net, 2 fathoms, 1st trawl. 7 sand-eels, 11 to 15 mm. (86).

21st April, shrimp-net, 2 fathoms, 2nd trawl. 16 sand-eels, 11 to 15·5 mm.; gadoid, 6·5 mm. (39).

Station XII.—21st April, surface (night). Crystallogobius, 7·5 mm.; 2 Montagu's suckers, 3 mm.; cottus (? damaged), 5 mm.

Pladda to Turnberry.

22nd April, surface, 1st trawl (shrimp-net). Long rough dab, 10 (hatched); plaice, 4; gurnard, 82; haddock, 30; cod, 270; whiting, 100; poor-cod, 250; turbot, 3; flounder, 115; dab, 96; *motella*, 160; dragonet, 24 (48).

22nd April, surface, 2nd trawl. Long rough dab, 4; plaice, 5; gurnard, 96; haddock, 84; cod, 504; whiting, 120; poor-cod, 600; sprat, 4; turbot, 12; flounder, 150; dab, 94; *motella*, 220; dragonet, 50 (44).

22nd April, surface, 3rd trawl. Long rough dab, 3; plaice, 3; gurnard,* 95 ; haddock, 60 ; cod, 450 ; whiting, 90 ; poor-cod, 600 ; sprat, 3 ; turbot, 8 ; flounder, 120 ; dab, 64 ; *motella*, 200 ; dragonet, 22 (45).

22nd April, 2 fathoms, 1st trawl. Long rough dab, 12 ; plaice, 15 ; gurnard, 225 ; haddock, 105 ; cod, 660 ; whiting, 120 ; poor-cod, 400 ; turbot, 20 ; flounder, 460 ; dab, 200 ; *motella*, 750 ; dragonet, 190 (46).

22nd April, 2 fathoms, 2nd trawl. Long rough dab, 11 ; plaice, 6 ; gurnard, 46 ; haddock, 30 ; cod, 125 ; whiting, 35 ; poor-cod, 100 ; sprat, 2 ; flounder, 15 ; dab, 75 ; *motella*, 53 ; dragonet, 25 (38).

22nd April, 2 fathoms, 3rd trawl. Long rough dab, 13 ; gurnard, 42 ; haddock, 22 ; cod, 44 ; whiting, 20 ; poor-cod, 76 ; flounder, 2 ; dab, 11 ; *motella*, 36 (47).

22nd April, surface. 2 gadoids, 6 and 11 mm. (88).

22nd April, 2 fathoms. 3 gadoids, 5 to 10 mm. (89).

LOCH FYNE.

Furnace to Cladich.

23rd April, mid-water net, 6½ fathoms. Long rough dab, 704 ; plaice, 168 ; haddock, 16 ; cod, 15 (49).

23rd April, mid-water net, 6½ fathoms. Long rough dab, 127 ; plaice, 111 ; haddock, 2 ; cod, 6 (50).

23rd April, mid-water net, 6½ fathoms. Long rough dab, 63 ; plaice, 242 ; haddock, 9. In this bottle also 2 young gadoids, 7 mm. (56).

23rd April, mid-water net, 6½ fathoms. Gadoid 7 mm. (91).

23rd April, mid-water net, 6½ fathoms. Long rough dab, 110 ; plaice, 217 ; haddock, 18 ; cod, 10 ; flounder, 2 (58).

23rd April, mid-water net, 2⅓ fathoms. Long rough dab, 41 ; plaice, 40 ; haddock, 7 ; cod, 75 ; whiting, 7 ; poor-cod, 4 ; flounder, 38 ; dab, 7 ; *motella*, 1 (53).

Loch Gair to Quay Ferry.

23rd April, mid-water net, 6½ fathoms. Long rough dab, 160 ; plaice, 1470 ; haddock, 20 ; cod, 15 (54).

23rd April, mid-water net, 6½ fathoms. Sand-eel, 15 mm. ; gadoid, 8 mm. ; 2 eggs of long rough dab (90).

23rd April, mid-water net, 2⅓ fathoms. Long rough dab, 14 ; plaice, 12 ; haddock, 15 ; cod, 63 ; poor-cod, 30 ; flounder, 2 ; dab, 22 ; *motella*, 1 (37).

23rd April, mid-water net, 1 fathom. Long rough dab, 1 ; haddock, 9 ; cod, 9 ; poor-cod, 10 ; sprat, 2 ; flounder, 6 ; dab, 2 (68).

23rd April, mid-water net, 1 fathom. Long rough dab, 4 ; plaice, 4 ; haddock, 340 ; cod, 550 ; whiting, 210 ; poor-cod, 190 ; flounder, 75 ; dab, 373 ; *motella*, 233 (35).

Upper Loch Fyne, Cairndow to Dunderave.

23rd April, 2⅓ fathoms. Long rough dab, 169 ; plaice, 3 ; haddock, 6 ; cod, 430 ; whiting, 10 ; poor-cod, 10 ; sprat, 1 ; flounder, 5 ; dab, 2 ; *motella*, 1 (36).

23rd April, 1 fathom. Long rough dab, 3 ; plaice, 6 ; haddock, 340 ; cod, 1600 ; whiting, 240 ; poor cod, 220 ; flounder, 400 ; *motella*, 35 (57).

* Included in these were 3 eggs similar to those of gurnard, but as large as plaice's.

23rd April, $2\frac{1}{3}$ fathoms. Long rough dab, 20; plaice, 100; haddock, 20; cod, 4000; whiting, 50; poor-cod, 30; sprat, 10; flounder, 100 (32).

TARBERT TO AVIDH ISLAND.

24th April, mid-water net, $6\frac{1}{2}$ fathoms. Long rough dab, 155; plaice, 190; haddock, 11; cod, 3; flounder, 1; *motella*, 1 (40).

24th April, mid-water net, 1 fathom. Long rough dab, 13; plaice, 25; haddock, 28; cod, 600; whiting, 150; poor-cod, 250; turbot, 40; flounder, 1500; dab, 500; *motella*, 680; dragonet, 30 (42).

24th April, mid-water net, $2\frac{1}{3}$ fathoms. Long rough dab, 6; plaice, 11; gurnard, 1; haddock, 12; cod, 146; whiting, 50; poor-cod, 222; turbot, 16; flounder, 177; dab, 138; *motella*, 57; dragonet, 13 (66).

24th April, mid-water net, $2\frac{1}{3}$ fathoms. 6 gadoids, 8 to 20 mm. (92).

OFF KENMORE, LOCH FYNE, 27th April, bottom. Cottus, 14 mm (93).

LOCH SHIRRA, HEAD OF LOCH FYNE.

5th May, 3 fathoms. Long rough dab, 1; cod, 50; whiting, 4; poor-cod, 3; flounder, 21; *motella*, 2; dragonet, 12 (22).

5th May, 3 fathoms. Gadoid, 4 mm.; clupeoid, 11 mm.; 10 gobies, 3 to 4 mm. (94).

HEAD OF LOCH FYNE,

5th May, 3 fathoms. Cottus, 6 mm. (95).

5th May, bottom. 8 gobies, 3·5 to 5 mm.

MORAY FIRTH.

In this region ova were collected between 24th and 26th August 1896, from the Stations I., IV., VI., VII., VIII., IX., and X., and on Sept. 22nd, from Station III. As will be seen, very few eggs were obtained, because of the lateness of the season. By this time the spawning period is over for the common food-fishes; in fact, one might say for all, the eggs obtained being considered to have come from late fish, whose spawning time has been delayed by untoward circumstances. This conclusion receives confirmation from a review of the lists of ova obtained from the Moray Firth for the last three years. In 1893 ova were collected there during the month of May; in 1894, during July; in 1895, during the latter part of July and the first part of August; in 1896, this present year treated of, during the latter part of August. An interesting comparison can therefore be made, and a very superficial glance suffices to show that both in the number of forms represented, and the number of ova obtained, there is a diminution from large quantities in May to the relatively trifling number in the latter part of August. Again, the occurrence of one or two of the forms might seem to be very exceptional, because they occur in one year and not in another. The small numbers cannot be said to arise because few trawlings were made. In 1894 there were thirty-seven trawlings; in 1895, twenty-eight; and in 1896, thirty-four.

During May 1893 the long rough dab, plaice, gurnard, brill, haddock, bib, whiting, witch, lemon-dab, green-cod, poor-cod, cod, ling, turbot, sprat, flounder, dab, and rockling, were represented in the lists. For the most part these are food-fishes. The eggs of the gurnard were the most abundant, the dab coming next, while those of the turbot, sprat, and flounder were plentiful, as well as the gadoid forms mentioned. This is the time when most of the food-fishes are spawning, as April is on the Clyde.

During July 1894 no eggs of long rough dab, plaice, brill, haddock, whiting, witch, green-cod, ling, or sprat, were obtained ; a few new forms occurring, the weever, megrim, lemon dab, Müller's topknot, and sole-nette. The eggs of the gurnard and dab are still the most abundant, though the relative positions of the two are altered. There is a great diminution, however, both in the forms represented and the abundance of ova.

During the latter part of July and first part of August 1895, a still greater diminution is seen, except in the case of the gurnard. This fish is remarkable in that the number of ova got, relative to those of other fish, shows no diminution from April to the first part of August. Its spawning period must, therefore, extend over that time. On the Clyde, its eggs occur most frequently in April ; on the Forth, at the end of May and beginning of June.

The eggs of the megrim, Müller's topknot, lemon-dab, cod, and bib, have disappeared by the end of July, and the numbers of the other fishes' eggs are greatly decreased.

Table showing the number of Ova obtained in Moray Firth during latter part of August 1896.

Month.	August.							Sept.	Total.
Day.	24.	25.	25.	25.	25.	26.	26.	22.	
Station.	IV. S.	VI. S.	VII. S.	VIII S.	IX. S.	I. S.	X. S.	III. S.	
Species—									
Weever, . .	1	3	...	...	...	1	...	...	5
Cod, . . .	...	6	4	2	1	1	2	...	11
Bib, . . .	...	...	2	...	...	...	...	...	2
Megrim, . .	1	...	...	12	1	5	2	3	24
Whiting, . .	...	...	...	...	...	...	...	1	1
Poor-cod, . .	...	...	...	1	...	1	...	8	10
Dab, . . .	4	12	...	...	...	...	2	2	20
Motella, . .	...	1	14	1	...	...	11	6	33
Dragonet, . .	...	...	1	3	...	...	3	...	7
Solenette, . .	...	...	...	...	...	...	...	3	3
Turbot, . .	...	...	2	2	...	...	2	...	6
Gurnard, . .	...	...	11	...	4	...	4	...	19

In the present list for the latter part of August 1896, one or two of these forms again occur, the cod, bib, and megrim, but in very small numbers. *Motella* is the most strongly represented, with thirty-three eggs. The total number of eggs is one hundred and forty-six. Neither the flounder nor the solenette are got in August, but on September 22nd, at Station III., three eggs of the solenette occur. At this place, eight eggs of the poor-cod, and one of the whiting, also appear. The gurnard, turbot, dab, dragonet, and weever, are present, but in very small quantities.

The small numbers, together with the occurrence of forms not found in 1895 in the earlier part of August, leads one to the conclusion given above, viz., that for almost, if not all, these eggs should be considered as coming from fish whose spawning time had been delayed owing to some cause.

Post-Larval and Young Fishes.

These are greater in number, variety, and interest, than the eggs. As in former years, at this season, the most common forms are the clupeoids and gobies. On 25th August, at Station VII., 73 clupeoids were taken, and 33 gobies, while at Station VIII., on same day, 52 gobies. The clupeoids vary in size from 5 to 24 mm. Two sets could be distinguished sometimes—the one ranging from 5 to 12 mm., the other from 13 mm. onward. Similarly, the gobies could be divided into two sets. Pleuronectids were almost as common as the two forms mentioned. Of these, the lemon dab could be distinguished by its markings at all stages, but there were other pleuronectids that could not be detected because the markings were not sufficiently pronounced to enable one to state positively. They were all sinistral pleuronectids—the metamorphosis taking place from left to right—and may have been plaice, witch, pole dab, or long rough dab. The gurnard occurs very frequently, and varies in size from 5 to 10 mm. One might have expected a greater variation, seeing that the spawning period extends over several months. Callionymi, rocklings, Montagu's suckers, and sand-eels, were got in one or two places, as in former years.

In 1894, armed bullheads and weevers were found in October, but neither of these appeared amongst last year's or this year's forms. Five young *Syngnathi aci* were recorded for 1894 ; this year only one occurred at Station III., on 22nd September, and none were got last year. Cattoids are seemingly very scarce. This year only 2, last year 1, and in 1894 only 4 are recorded. A single whiting of 5·4 cm. occurred at Station V. this year. None are recorded for previous years. One or two rare forms occur. *Crystallogobius*, met with on the Clyde, was got at two stations—VI. and IX. This form, being very symmetrical as regards figure and markings, is easily recognisable. The pectoral fins stand out well from the body, the basis of attachment being narrow. The dorsal fin is continuous along the back, with one or two rows of light brown pigment specks on each side. The body is narrowest where it joins on to the head, and there thus seems to be a neck from which the pectoral fins stand out like a ruff, when viewed from above.

Another peculiar form occurs—*Lepadogaster bimaculatus*—the eggs and young of which were described by Professor M'Intosh in Scottish Fishery Board Reports for 1895. Dr M'Intosh says that this fish is rather more characteristic of the southern and western than the eastern shores. It is got at different stages, however, in St Andrews Bay, its eggs being deposited towards the end of June, in July, and August, and the young forms are got in the tow-nets from September onwards. In last year's Report it is mentioned as occurring twice in Moray Firth, and this year it occurs six times, varying in size from 7·5 to 9 mm. Its flat head, prominent eyes, and the three or four irregular rows of brown pigment splotches along the body distinguish it from other forms.

Another peculiar form, not occurring last year or the year before, is the gunnel—got once at Station VII., on 23rd October. This form occurred also on the Clyde, on 29th October.

All the post-larval and young forms, it need hardly be mentioned, were got from the bottom net.

In concluding these notes, I have to thank Professor M'Intosh for his kindly advice and assistance.

MORAY FIRTH.

Station IV.—24th August 1896, surface. Eggs—Weever, 1; dab, 4; megrim, 1.

Station V.—24th August, surface. Whiting, 5·4 cm.

Station V.—24th August, bottom. 3 sand-eels, 20, 24, and 25 mm.; *callionymus*, 7 mm.; 2 cottoids, 4 and 8 mm.; 31 pleuronectids, 7 to 11 mm. (139).

Station VI.—25th August, surface. Eggs—Weever, 3; cod, 6; dab, 12; motella, 1.

Station VI.—25th August 1896. 2 gurnards, 5 and 10 mm.

Station VI.—25th August 1896, bottom. 21 pleuronectids, 6 to 11 mm.; 6 clupeoids, 8 to 12·5 mm.; 5 gobies, 6 to 7 mm., and one 11 mm.; heads of 2 Montagu's suckers; 4 *callionymi*, 5 to 9 mm.; 2 crystallo-gobies, 6 and 8 mm.; 2 gurnards, 6 mm.

Station VII.—25th August, surface. Eggs—Bib, 2; cod, 4; motella, 14; dragonet, 1; turbot, 2; gurnard, 11.

Station VIII.—25th August 1896, bottom. 73 clupeoids, 5 to 15 mm.; 33 gobies, 3·5 to 8 mm.; 8 gurnards, 5 to 8 mm.; 9 *Callionymi*, 3 to 5 mm.; 24 pleuronectids, 3 to 11 mm.; *Lepadogaster bimaculatus*, 8 mm.

Station VIII.—25th August 1896, surface. Eggs—Cod, 2; turbot, 2; megrim, 12; poor-cod, 1; *motella*, 1; dragonet, 3.

Station VIII.—25th August 1896, surface. Gurnard, 10 mm.; sand-eel, 20 mm.; 9 rocklings, 4 to 10 mm.

Station VIII.—25th August 1896, bottom. Lemon dab, 8 mm.; 3 other pleuronectids, 7, 8, and 12 mm.; 14 clupeoids, 7 to 19 mm. (intermediate connecting stages); 52 gobies, 4 to 11 mm.; 4 gurnards, 7·5 to 8·5 mm.; 9 *Callionymi*, 4 to 8 mm.; 4 post-larval lemon dabs, 5 to 7 mm.; *Lepadogaster bimaculatus*, 7·5 mm.

Station IX.—25th August 1896, surface. Eggs—Cod, 1; megrim, 1; gurnard, 4.

Station IX.—25th August 1896. 2 sand-eels, 19 and 24 mm.; 2 rocklings, 4 and 6 mm.

Station IX.—25th August 1896, bottom. Sand-eel, 7 mm.; 2 pleuronectids, 5 and 9 mm.; 12 gobies, 7 to 11 mm.; 3 gurnards, 5 to 7 mm.; 4 Montagu's suckers, 3 mm. (larval) to 6 mm.; *Crystallogobius*, 5 mm.

Station I.—26th August 1896, surface. Eggs—Cod, 1; poor-cod, 1; weever, 1; megrim, 5.

Station I.—26th August, bottom. Pleuronectid, 4·5 mm.; 4 gobies, 5·5 to 12 mm.

Station X.—26th August 1896, surface. Eggs—Cod, 2; megrim, 2; dab, 2; turbot, 2; *motella*, 11; dragonet, 3; gurnard, 4.

Station X.—26th August 1696, bottom. 5 gurnard, 5 to 10 mm.; 4 gobies, 6 to 8·5 mm.; 3 *Callionymi*, 4 mm.; 9 clupeoids, 8 to 14·5 mm., and one 19 mm.; 10 lemon dabs, 4 to 13·5 mm.; 9 other pleuronectids, 6 to 13 mm.

Station II.—21st September 1896, surface. Clupeoid, 18 mm.; gurnard, 4 mm.; 4 gurnards, 10 to 11 mm.

Station II.—21st September 1896, bottom. 6 gobies, 3 to 5 mm.; 5 gobies, 9 to 15 mm.; skulpin, 6 mm.; clupeoid, 10 mm.; pleuronectid, 5 mm.; *Lepadogaster bimaculatus*, 7·5 mm.

Station III.—22nd September 1896, surface. Eggs—Whiting, 1; megrim, 3; poor-cod, 8; dab, 2; *motella*, 6; solenette, 3.

Station III.—22nd September 1896, bottom. *Syngnathus acus*, 33 mm.; 28 gobies, 3 to 11·5 mm.; pleuronectids, 2 mm.; lemon dab, 12 mm.

Station XIII.—14th October 1896, bottom. Goby, 13·5 mm.; *Lepadogaster bimaculatus*, 10·5 mm.

Station XI.—15th October 1896, bottom. Goby, 9·5 mm.

Station XII.—15th October 1896. Lemon dab, 16 mm.; *Lepadogaster*, 8 mm.

Station I.—16th October 1896, surface. Lemon dab, 14·5 mm.

Station II.—16th October 1896, bottom. Goby, 10 mm.; clupeoid, 16 mm.

Station IV.—23rd October 1896, bottom. 3 gobies, 3 to 4·5 mm.

Station V.—23rd October 1866, bottom. 8 gobies, 4·5 to 16 mm.; clupeoid, 14 mm.

Station VI.—23rd October 1896. 4 gobies, 18 to 27·5 mm.; clupeoid, 17 mm.

Station VII.—23rd October 1896, bottom. Gunnel, 20 mm.

Station VIII.—24th October, bottom. 8 gobies, 18 to 38 mm.

Station IX.—24th October 1896. Clupeoid, 24 mm.; lemon dab, 15 mm.; *Lepadogaster bimaculatus*, 9 mm.

FIRTH OF CLYDE.

Station III.—29th October, bottom. 2 gunnel, 19 and 24 mm.

TABLE showing the Number of Ova obtained by the 'Garland' on the Stations of Friths of Forth and Clyde.

Place.	Frith of Forth.							Frith of Clyde.							
Month.	Feb.	March.						April.							
Day.	26	4					6	10	10	13	13	13	13	13	14
Station.	East of May, half-mile S.	From May Island to Two Miles East. 2 S. Nets.	B.	14 F. fr. B.	6 F. fr. B.	24 F. fr. B.	East of May, S.	IV. S.	V. B.	I. B.	I. 2 F.	II. B.	VI. S.	VI. 2 F.	X. S.
Species—															
Long rough Dab,	2	2	2	6	5	12	1	61	..	5	14	..	117	139	*
Plaice,	..	3	3	1	2	2	..	6	7	1	4	..	18	19	
Gurnard,	..	..	..	..	..	..	..	5	..	..	..	..	..	10	
Haddock,	4	168	18	33	26	25	11	322	..	1	12	..	165	400	
Cod,	..	12	3	10	5	6	13	276	..	8	166	1	600	700	
Whiting,	..	100	3	15	10	12	6	57	..	9	104	1	600	800	
Green Cod,	..	140	16	34	40	38	25	20	..	18	..	..	..	..	
Poor Cod,	1	60	..	..	6	8	..	260	..	2	65	..	800	600	
Sprat,	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Turbot,	..	..	..	..	..	..	..	..	..	2	3	..	..	..	
Flounder,	..	37	..	2	4	..	2	87	3	15	220	} 605	600	400	
Dab,	..	9	..	..	2	..	..	89	5	13	45	}	400	320	
Motella,	3	37	2	13	23	21	6	60	..	49	158	..	70	250	
Dragonet,	..	..	..	..	..	..	..	84	..	..	..	..	..	..	
Sole,	..	..	..	..	..	..	..	..	..	1	..	..	..	..	

Place.	Frith of Clyde.															
Month.	April.															
Day.	15	15	20	21	21	21	21	20								
Station.	VII. S.	VIII. S.	VII. B.	VII. B.	VIII. S.	XII. S.	XII. 2 F.	Sanda to Bennan. S.	2 F.	S.	S.	2 F.	2 F.	S.	2 F.	S.
Species—																
Long rough Dab,	35	130	6	..	..	2	3	(a) 1	3	1	..	6	..	1	11	..
Plaice,	100	110	13	6	20	3	..	..	2	..	..	.	..	4	9	..
Gurnard,	120	..	..	10	600	43	29	45	84	14	61	25	7	18	256	28
Haddock,	800	200	2	34	120	20	19	82	17	8	10	8	112	9	107	55
Cod,	850	1600	37	47	1000	114	131	191	184	52	62	48	24	675	350	99
Whiting,	600	2000	31	29	1500	31	40	31	153	23	83	15	24	35	170	82
Green Cod,	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Poor Cod,	450	400	10	50	600	100	76	105	135	13	33	59	13	85	200	85
Sprat,	..	..	..	30	20	4	3	30	54	6	..	14	..	12	16	..
Turbot,	..	..	1	2	..	4	..	5	..	..	..	1	..	15	..	..
Flounder,	200	300	7	6	400	48	42	26	35	15	26	5	13	50	6	22
Dab,	900	250	10	3	600	76	74	39	81	31	15	21	18	46	138	128
Motella,	900	300	53	1	500	60	25	8	18	9	3	5	18	25	95	41
Dragonet,	100	..	..	1	600	20	8	102	68	18	27	44	..	20	98	20
Sole,	..	..	6	..	..	..	..	1	..	..	..	..	..	..	..	..

* In this bottle were over 20,000 ova comprising those of Long rough Dab, Plaice, etc., as in column preceding. Cod and Motella (advanced mostly) were in greater proportion.
S, surface; F, fathoms; B, bottom. (a) Two eggs of Megrim were in this collection.

TABLE showing the Number of Ova obtained on the Stations of the Frith of Clyde and Loch Fyne, April and May 1896.

Place.	Frith of Clyde.						Loch Fyne.																	
Month.	April.						April.						April.				April.			April.			May.
Day.	22.						23.						23.				23.			24.			5.
Station.	Pladda to Turnberry.						Furnace to Cladich.						Loch Gair to Quay Ferry.				Cairndow to Dunderane.			Tarbert to Avidh Island.			Loch Shirra.
	S. 1st.	S. 2nd.	S. 3rd.	2 F. 1st.	2 F. 2nd.	2 F. 3rd.	6½ F. 1st.	6½ F. 2nd.	6½ F. 3rd.	6½ F. 4th.		2⅓ F.	1 F. 1st.	1 F. 2nd.	2⅓ F.	6½ F.	2⅓ F.	2⅓ F.	1 F.	6½ F.	1 F.	2⅓ F.	3 F.
Species— Long rough Dab,	10	4	3	12	11	13	704	127	63	110	2	41	1	4	14	160	20	169	3	155	13	6	1
Plaice,	4	5	3	15	6	..	168	111	242	217	3	40	..	4	12	1470	100	3	6	190	25	11	..
Gurnard,	82	96	95	225	46	42	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..
Haddock,	30	84	60	105	30	22	16	2	9	18	75	7	9	340	15	20	20	6	340	11	28	12	..
Cod,	270	504	450	660	125	44	15	6	..	10	300	75	9	550	63	15	4000	430	1600	3	600	146	50
Whiting,	100	120	90	120	35	20	..	..	..	..	100	7	..	210	10	..	50	10	240	..	150	50	4
Green Cod,	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Poor Cod,	250	600	600	400	100	76	..	..	..	..	60	4	10	190	20	..	30	10	220	..	250	222	3
Sprat,	..	4	3	..	2	..	..	..	..	..	..	..	2	..	..	..	10	1	..	..	..	..	..
Turbot,	3	12	8	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	40	16	..
Flounder,	115	150	120	460	15	2	..	..	..	2	65	38	6	75	2	..	100	5	400	1	1500	177	21
Dab,	96	94	64	200	75	11	..	..	..	..	120	7	2	373	22	..	..	2	..	..	500	138	..
Motella,	160	220	200	750	53	36	..	..	..	..	96	1	..	233	1	..	..	1	35	1	600	57	2
Dragonet.	24	50	22	190	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30	13	12

VIII.—REPORT ON PHYSICAL OBSERVATIONS BEARING ON THE CIRCULATION OF THE WATER IN LOCH FYNE IN APRIL AND SEPTEMBER 1896. By Hugh Robert Mill, D.Sc., F.R.S.E.

The observations published in this report were carried out on board the Fishery Board's cruiser 'Garland' on two occasions, the first from April 2nd to 6th, and the second from September 3rd to 11th, 1896, with the object of farther investigating the circulation of water in Loch Fyne as influenced by tide and wind.

Results of earlier Observations.

Before describing these observations, it is desirable to briefly summarise the results of earlier observations carried out by me for the Scottish Marine Station between 1886 and 1889, which are fully discussed in my paper, on the Clyde Sea Area,* published by the Royal Society of Edinburgh.

Loch Fyne, from the constriction at Otter Ferry to the head, is a branch of the Clyde Sea Area running on the whole northeastward for 26 miles, following the slight curves of its axis. For the first 20 miles the breadth varies between $\frac{3}{4}$ and $1\frac{1}{2}$ mile; then tapering to the head. The total area is $28\frac{1}{2}$ square miles, and it receives drainage from $188\frac{1}{2}$ square miles of land on which the average annual rainfall is estimated to be 70 inches. The total volume of Loch Fyne (as above defined) at low-water is 0·50 cubic sea-miles; and since the average tidal rise over the whole surface is about 8 feet, there is an average increase of 0·029 cubic sea-mile at high-water. The average depth is $22\frac{1}{2}$ fathoms, and the depth along the axis averages $40\frac{1}{2}$ fathoms at low tide.

The outline of Loch Fyne suggests its division into two distinct parts, which are found to correspond with the conditions of depth also. From Otter Spit to Minard Narrows is a distance of $7\frac{1}{2}$ miles, and this section has been termed the Gortans Basin. The depth in the narrows at Otter is only 15 fathoms, at Minard the much narrower channels are scarcely deeper (17 fathoms), but between them the Gortans Basin sinks to a maximum depth of about 35 fathoms, with a depth exceeding 30 fathoms for 3 miles. Speaking generally, Gortans Basin is a shallow and relatively wide hollow, shut off by bars from the deep Arran Basin (frequently called Lower Loch Fyne) on the seaward side, and from the Upper Basin on the landward side. The small shallow recess of Loch Gair opens on the north-west shore in the middle of Gortans Basin. The Upper Basin, although narrower, is much deeper. The depth increases gently from Minard for 3 miles, until off Furnace it begins to increase abruptly, reaching a maximum of 75 fathoms off Strachur, 3 miles farther, and only beginning to shallow off Strone Point, Inveraray, where the shallow Loch Shira joins Loch Fyne. The depth in the centre of the Upper Basin is over 60 fathoms for nearly 6 miles. This is the region the circulation of the water in which is of the greatest interest; and in the Upper Basin the herring fishing is sometimes of great importance,

* *Trans. Roy. Soc. Edin.*, vol. xxxvi. Part iii. No. 23 (1892), pp. 648, 703–707; and vol. xxxviii. Part i. No. 1 (1894) 73–103.

although, in other years, few herring are to be found. The form of the land bordering Loch Fyne has greatly restricted its drainage area, as considerable rivers run parallel to the loch on both sides, draining the country into Loch Crinan and Loch Ridun respectively; thus, the only streams of any importance enter near the head of the loch.

The tidal current, according to the Admiralty publications, enters Loch Fyne at Otter at the rate of $3\frac{1}{2}$ knots, passes through the Gortans Basin at 2 knots, increasing to $2\frac{1}{2}$ at Minard Narrows, but then slackening, until off Dunderawe, near the head of the loch, it is reduced to 1 knot.

From the earlier observations, it was shown that when the water of Loch Fyne was at its saltest, the surface density increased from 1·02420 at the head (Cuill) to 1·02486 at Otter, which was almost equal to that in the open sea. When at its freshest, the surface density varied from 1·0114 at the head to 1·02383 at Otter, the density in the open sea (off Cantyre) at the time being 1·02470. This considerable range of salinity seems to be quite superficial, as the bottom density at the head of Loch Fyne has only been observed to vary from 1·02359 to 1·02463; at Otter from 1·02451 to 1·02507; and in the open sea near Cantyre from 1·02469 to 1·02537. For purposes of comparison, however, it is more convenient to take, as a standard of salinity, the percentage of pure sea-water (*i.e.*, of water with a density of 1·02600 at 60°F.), at each station in the loch, taking the average from surface to bottom. At the entrance to the Clyde Sea Area off Cantyre, this percentage was found practically invariable as 97·6. In Loch Fyne it increased from 88·3 at the head to 95·1 at Otter, *i.e.*, on the average, 0·26 per cent. of sea-water per mile. The extreme range observed at the various stations in Loch Fyne, with Skate Island (off Tarbert) added for comparison, was as follows :—

	Cuill.	Dunder-awe.	Inver-aray.	Strachur.	Furnace.	Gortans.	Otter.	Skate Island.
Max.	94·2	95·4	95·0	95·0	95·1	95·5	96·0	96·9
Min.	80·4	87·7	90·8	90·8	91·6	92·0	93·4	94·2
Range	13·8	7·7	4·2	4·2	3·5	3·5	2·6	2·7

These observations show 'that there is no tendency for the accumula-'tion of fresh water in Loch Fyne; the average salinity appears to come to 'a maximum in June and July, the months of least rainfall and most 'evaporation, and then to diminish steadily to the month of February, at 'the period of maximum rainfall and minimum evaporation. Evaporation 'is probably the most potent factor in carrying away any excess of rainfall 'during the summer months. A great accession of fresh water on the 'surface must necessarily, by raising the level, accelerate the ebb-tide, and 'so run off an excess of fresh water with considerable rapidity. On the 'other hand, after a long dry spell, the tendency of evaporation would 'be to lower the general level, and so accelerate the flood-tide, thus 'increasing the salinity from without.' A brief discussion of the circulation of Loch Fyne, with regard to salinity observations, showed that the tidal effects were by no means superficial, but extended to the bottom in the Gortans Basin, although no evidence could be found of a similar effect in the Upper Basin.

Observations of salinity had given clear indications of the power of wind to produce great changes. When a strong down-loch wind had been blowing for some time, water of high salinity was always found at the head of the loch, proving upwelling from below; and at stations nearer the outlet, the surface salinity was often lowered. These effects were much more clearly brought out by the study of temperature changes. During the years 1886–88, twenty-three series of observations were made along Loch Fyne, which allowed of as many sections being drawn, showing the distribution by means of isotherms on a vertical plane. The direction of these isotherms showed conclusively that a continuous strong wind up or down the loch produced a definite tilt in the layers of water, and the farther study of individual temperature curves made it apparent that the circulation so set up was of a somewhat complicated kind. It appeared, however, that circulation by wind was a phenomenon which occurred irregularly, sometimes giving rise to great disturbances in a short time, at other times leaving the water practically unaffected for long periods. As the observations were rarely repeated at a short interval, and as it was impossible to make them at given phases of the tide, the result was incomplete and unsatisfactory, requiring further observations for confirmation.

One result was, however, quite clear. In the North Channel and on the Plateau at the entrance of the Clyde Sea Area the tidal currents mixed the water so completely that the temperature was always uniform from surface to bottom at any given time, or, in a word, homothermic; while, in the deep water of the Arran Basin beyond, the thermal changes were of a different type, indicative of a much restricted vertical circulation. The bar at Otter was found to act in the same way as the Plateau at the entrance to the Area; and in the deep Upper Basin the temperature at the bottom was found to change very slowly, the lowest temperature for the year being found in summer and the highest in winter, the seasons being opposite to those at the surface. I summed up the temperature observations as follows:—

'The difference between the thermal changes in the Arran Basin and 'Loch Fyne is mainly due to the restricted entrance and the much steeper 'slope within the sill, preventing the free mixture of the water from out- 'side, and also to the low salinity of the surface water in the upper 'reaches. The resemblance of the Channel and Plateau to the Gortans 'Basin is very strong. The upwelling at Otter keeps the Gortans Basin 'supplied with nearly homothermic water of much greater salinity than that 'found at the same depth in the Upper Basin; but on account of the steep 'slope beyond Furnace this water appears to spread over the cold layers of 'Loch Fyne instead of following the ground and gradually mixing with the 'mass down to the bottom. There is, indeed, a certain amount of mixture, 'as is proved by the variations in the salinity of the deep water. How far 'this is due to tidal action we cannot say. Wind is certainly a more power- 'ful agent for setting up vertical circulation in the water than tide is, but 'a steady wind in one direction rarely lasts long enough to produce its full 'effect. The tides, on the other hand, act continuously, and I have been 'led to modify the opinion stated in Part II., p. 706, that tidal influence 'was insignificant as leading to the formation of deep currents in the 'Upper Basin. I do not find, in the temperature observations, enough 'data to found an exact theory upon, and the precise share of steady 'tidal action and spasmodic wind-action in stirring the depths of the 'Upper Basin must remain for the present undetermined.'

Trip of April 1896.

I joined the 'Garland' at Gourock on April 2nd, and made preliminary observations that day in Loch Goil and the Dunoon Basin, remaining for the night at Brodick. On the 3rd observations were made off Brodick, and a careful temperature cross-section at Skate Island through the deepest water of the Clyde Sea Area. The 'Garland' lay for the night off Otter Ferry. On the 4th a complete series of observations was made along Loch Fyne at Otter, Gortans, Minard (*i.e.*, at the entrance, centre, and outlet of the shallow Gortans Basin), and at Furnace, Strachur, Inveraray, Dunderawe, and Cuill in the deep Upper Basin of Loch Fyne. On the 6th observations were repeated at Cuill, Dunderawe, a cross-section at Inveraray, Strachur, Furnace, Minard, Gortans, Otter, and near Kilfinan. That evening the 'Garland' reached Rothesay, and next morning I left at Gourock.

The observations included temperature at close intervals from surface to bottom, and the collection of samples of water for analysis. The instruments employed were those belonging to the Board, including reversing thermometers and slip-water bottles. The samples for analysis were collected in bottles supplied by Mr H. N. Dickson, by whom they were subsequently examined in the University Laboratory, Oxford. The methods of observation, and the stations at which the soundings were made, were the same as those adopted in my earlier work on the Clyde Sea Area, and fully described in the *Transactions of the Royal Society of Edinburgh.* I have not been able to find time for the very laborious task of completely discussing the data of the two trips, but the figures corrected for instrumental errors are published herewith, except the hydrometer-readings, which have not yet been calculated. This omission is of no practical importance, as Mr Dickson's Sprengel-tube determinations of density are of a higher degree of accuracy. Without fully discussing the data, some conclusions may be stated in a few words.

Temperature Observations in April 1896.—A general idea of the condition of temperature in the whole Clyde Sea Area was obtained. It was evident that the water was nearly at its annual minimum of temperature, and consequently nearly homothermic, the small range of temperature making it impossible to localise movements of the mass of the water. The data are all given in Table I., which gives particulars of twenty-four temperature soundings.

On April 2nd, in the deepest part of Loch Goil, the temperature was found to diminish from 45°·4 on the surface to 44°·8 at 12 fathoms, then increase to 45°·8 at 21 fathoms and fall again to 45°·2 at the bottom. In the Dunoon Basin, outside, the temperature fell from 45°·2 on the surface to 44°·3 at 15 fathoms, and then remained practically constant to the bottom.

On April 3rd a series of observations was made in the Arran Basin, as a preliminary to work in Loch Fyne. The water was very nearly homothermic, with an average temperature of 44°·5. Off Brodick, in the East Arran Basin, the surface temperature was 45°·0, falling to 44°·0 at 10 fathoms, and rising again to 44°·6 at the bottom (55 fathoms). This slight intermediate minimum was also found in the deep water (106 fathoms), off Skate Island, where the surface temperature was also 45°; the minimum was probably 44°·2 at 25 fathoms, and at 40 fathoms a temperature of 44°·7 was found, which remained constant to the bottom. Observations midway between the deep sounding and the shore on each side showed that the minimum in the shallow water was at 15 fathoms, and that the water on the west, or Tarbert side, was slightly warmer than that on the east side, but the difference was scarcely half a degree.

On the 4th and on the 6th a complete series of observations was taken at intervals of about 5 miles along the whole length of Loch Fyne; and it was found, as had been anticipated, that the differences in temperature were not sufficient to make tidal observations of any certain value. The two sections may, however, be compared. The average temperature of the whole water in Loch Fyne was close to 45°·1 on the 4th, and about 45°·2, or rather less, on the 6th, showing the progress of seasonal warming. The Gortans Basin was filled with water averaging 44°·8. This colder water seemed to project like a double wedge into the warmer water of the Upper Basin, one tongue of the wedge forming a thin layer traceable right up to Cuill at the depth of about 7 fathoms, the other, a thicker layer, traceable to Inveraray at a depth of about 25 fathoms. The warm layer separating the two tongues was traced as far down the loch as Furnace in 17 fathoms, but the difference in temperature was too slight to serve as a test of the movement of the water.

Chemical Conditions of the Water.—Thirty samples of water were collected on this trip, and analysed by Mr H. N. Dickson in the Laboratory of the University of Oxford, who has furnished Table II., containing the analyses showing density determined by Sprengel-tube weighings, amount of chlorine (χ), and of sulphuric acid (SO_3), as well as the ratios between the various quantities.

The salinity translated into percentages of pure sea-water for the whole depth, at each station, is as follows:—

Cuill,	Dunderawe,	Inveraray,	Strachur,	Furnace,	Gortans,	Otter,	Skate Island.
85·7	89·3	93·4	93·6	93·6	93·9	94·2	96·4

The formula given in my paper on the salinity of the Clyde Sea Area, for the calculation of the average salinity from bottom and surface observations, is erroneous. The above figures are obtained on the basis of the series showing three intermediate samples at Strachur, the bottom density being given eight times as much weight as that at the surface, except in the shallow water, at Cuill, where the bottom density is weighted only five times.

The salinity was well within the range previously observed, and not far from the average.

With regard to the composition of the water, the ratio of sulphuric acid to chlorine appears almost always to be greater at the bottom than in the surface water, but in other cases the contrary holds good. The high ratio of sulphuric acid in Nos. 24 to 29 is difficult to understand. If the figures convey any physical meaning, it would appear that the water at Strachur had undergone some change of composition between the 4th and 6th of April. It certainly seems that some accident had happened to the samples by which sulphates had been introduced, especially as the only sample showing a similarly high ratio was one collected about a week later from the surface off the Mull of Cantyre.

Trip of September 1896.

On September 3rd I joined the 'Garland' at Inveraray, and left on September 12th at Gourock. The following is an abstract of the work done:—

September 3rd.—Observations at Inveraray and Dunderawe, and tidal observations at anchor off Cuill at the head of the loch for six hours (Table III.). Returned to Inveraray at night.

September 4th.—Observations at Inveraray, Strachur, Furnace, Minard, Gortans, Loch Gair, Otter, and Kilfinan, including cross-sections at Inveraray, Furnace, and Minard. Returned to Inveraray at night (see Table VI.).

September 5th.—Made a series of temperature cross-sections off Furnace at high tide, half-ebb, and low-water (see Table IV.). Returned to Inveraray at night.

September 6th.—Sunday.

September 7th.—Observations at Inveraray, Strachur, Furnace, Minard, Gortans, Otter, Kilfinan, and Skate Island in the Arran Basin, staying at Millport for the night (see Table VI.).

September 8th.—Observations at anchor off Otter Spit for nine hours lay for the night in Otter Bay (see Table V.).

September 9th.—Observations at anchor off Otter Spit for six hours (see Table V.), then observations at Gortans, Furnace, Strachur, and Inveraray (see Table VI.). Stayed at Inveraray for night.

September 10th.—Observations at usual stations along the whole length of Loch Fyne, from Cuill to Otter (see Table VI.). Staying at Inveraray.

September 11th.—Observation at Furnace. Spent some time in looking for deep sounding off Pennimore Point (marked 82 fathoms in Admiralty Chart), but could not find more than 75½ fathoms anywhere. Returned to Inveraray at night.

September 12th.—Left the 'Garland' at Gourock.

General Thermal Condition in September.—This trip resulted in the accumulation of a considerable amount of data, which confirms and extends the conclusions arrived at from my earlier work on Loch Fyne. Table VI. gives the readings of 49 temperature soundings taken to determine general distribution. It is useful, in the first instance, as settling the general distribution of temperature throughout the mass of the water, by means of a longitudinal and several cross-sections on two occasions six days apart, and so of allowing the time-changes of temperature to be closely followed at the period of the annual maximum. In the Arran Basin the mass of the water had a temperature varying from about 55° at the surface to 50° at 80 fathoms. On the 4th the Gortans Basin was filled with nearly homothermic water averaging 53°·8 in temperature; but inside the Minard bar the Upper Basin was filled with colder water, sinking from the surface warmth to 50° at 25 fathoms, 49° at 30 fathoms, and 46°·1 on the bottom in the deepest part (75 fathoms). This coldness of the deep water in Loch Fyne in summer is one of its most interesting features, and is always found. The lowest temperature at the bottom of the great hollow of the Arran Basin, off Skate Island (105 fathoms), was only 49°·6, *i.e.*, 3°·5 higher than at the bottom of Loch Fyne. The water on the broad platform, 35 fathoms deep, which stretches between the Minard bar and the sudden dip to deep water off Furnace, was warmer than that at any other point along the Upper Basin; and just off Furnace the warm incoming water was nearest the cold deep layer, and the temperature gradient was steepest. Thus, water at 52° was found at 25 fathoms near Minard, 18 fathoms at Furnace, 10 fathoms at Strachur, 8 fathoms at Inveraray, and 5 fathoms at Cuill, close to the head of the loch. This seaward dip of the isotherms was less marked at lower depths. The surface of the loch from Gortans to Inveraray was covered with a uniformly thick layer of water, 2 fathoms deep, and over 54° in temperature; above Inveraray the warm layer thinned away; below Gortans it deepened considerably.

The distribution of temperature throughout the mass on September 10th was substantially the same, but the differences were of considerable interest, though of small amount. The water in Gortans Basin, still almost homothermic, had warmed by one degree; the surface film of warm water had disappeared from the Upper Basin; but, on the other hand, the lower layers down nearly to the bottom had warmed up perceptibly. On both occasions the convergence of isotherms from above and below at Furnace on the vertical section was well marked, as indeed it was usually found to be in the earlier observations. This seems to indicate a sort of swing or surge in the mass of the water at this point; and one of the principal objects of the cruise was to ascertain whether there was any tidal variation in the temperature near the bottom off Furnace. These temperature observations lose some of their value by not being simultaneous; thus, instead of each longitudinal section being made at the same tidal phase, that of September 4th was begun at the head of Loch Fyne at high-water, and finished off Kilfinan at low-water, passing Furnace at half-ebb. That of the 10th commenced at the head of the loch about half-flood, passed Furnace at high-water, and concluded at Otter about half-ebb. These differences of tidal phase had no great effect on the arrangement of the layers of water, but the full consideration of the observations will possibly show that there is a distinct, though gentle, tidal vibration throughout the mass. The wind on the 4th was easterly, or, in the main, blowing down the loch, and usually very light. On the 10th the wind was south-westerly, *i.e.*, blowing, on the whole, up the loch, and very light. On the 9th an easterly, or, in the main, down-loch breeze had been blowing freshly all day, rising at times to the force of a gale, and this may have been instrumental in mixing the superficial layers of water, as found on the 10th.

Tidal Observations at Cuill. — These observations comprise 19 temperature soundings, recorded in Table III., and taken on September 3rd in mid-channel, opposite Cuill, in the shallow water at the head of Loch Fyne, just on the edge of the abrupt descent to considerable depths. Slightly deeper water is found on both sides of the point of observation, and the river Fyne enters the head of the loch about a mile distant. As the tide ebbed, the warmer and fresher water from the river began to preponderate; and as the tide rose again, the colder water from down the loch mixed from below with the river water, and drove it back, restoring the same conditions as prevailed before. The tidal action of the head of the loch is, in fact, simply that of an estuary receiving a relatively small stream. It was observed that the water did not increase in depth steadily with the rising tide, but, in a series of pulses, the temperature changes corresponding. The weather throughout this series of observations was warm and overcast, with no wind.

Tidal Observations at Otter.—Table V. gives the data of 13 tempera ture soundings made from the 'Garland' anchored in the tideway, off Otter Beacon, in a position indicated by the Beacon on with Ballimore House, and two unnamed headlands on the west shore in line. It was rather to the westward of the deepest part of the channel, and the depth was between 16 and 17 fathoms. Temperature observations were made each hour at the surface, and at 1, 6, 11, and 16 fathoms, five thermometers being used, so that all the temperature observations for each sounding were exactly simultaneous. Samples of water were also taken from surface and bottom, and the densities observed by one of the

Fishery Board direct-reading hydrometers. The readings were reduced to a constant temperature 17°·5 C., by a correction obtained by direct observation, so as to be useful for comparison, *inter se.* These densities, although published, are not supposed to have any absolute value, and should not be compared with densities taken at other times or in other places. They are quite trustworthy, however, as showing the changes of salinity due to tidal phase. An attempt was made to measure the velocity of the current at each observation by timing a chip floating alongside between measured marks on the gunwale. This was successful only while it was calm; and as a strong breeze was blowing most of the time, the vessel did not swing true to the tide, but lay nearly across it, thus making it impossible to carry out the experiments. The strength of the wind also deprived the observations of much of their value as indications of the tidal currents. On September 8th observations were begun shortly before half-flood, and continued to the following low-water. They thus covered half a flood and the whole ebb. Before high-water it was calm, but the ebb was accelerated by a fresh easterly breeze. The strength of the current round the point of Otter Spit was tremendous, two men being unable to row a light boat against it. On the 10th observations were commenced at low-water, and continued until close on high-water, thus covering the whole flood-tide; but the tide was retarded by an easterly wind rising to a gale, which made it difficult to read the instruments accurately on account of the rolling of the vessel as she lay between wind and sea.

On the 9th, at half-tide, the surface temperature was 55°·5, while that at the bottom was 52°·3. As flood-tide proceeded, the surface layers grew cooler, and the deeper grew warmer, indicating mixture of the water, until at high-tide the surface and bottom temperatures were 54°·7 and 53°·4 respectively. As ebb-tide set in, the water became more and more nearly homothermic, until at low-tide the range was only from 54°·3 to 53°·6. The study of the flood-tide next morning showed the first rush of homothermic water inwards past the ship, but this gradually gave place to water warmer above and colder below, until at half-flood the surface temperature was 54°·6, and that at the bottom 52°·3; then mixture began to occur, and the last two hours of flood, like the first two, consisted of nearly homothermic water. Remembering that a temperature of 52°·3 was only found outside Otter bar, at a depth of 30 fathoms, it is demonstrated that the effect of flood-tide is, first, to drive back the mixed and therefore homothermic water which had passed out of Gortans Basin on the ebb, and then to draw up the deep, cool layers, from the Arran Basin, which, at half-tide, are being forced into Gortans Basin; but soon the upwelling water becomes mixed, and the last two hours of flood carry in freshly-mixed water coming from all depths. The commencement of the indraught of deep water from outside seems to correspond with the covering of Otter Spit about half flood, thereby relieving the rush through the Narrows; the subsequent slacking of the surface current before high-water might be considered to relax the upward pull on the lower layers, and so admit only the homothermic surface water. The ebb appears to consist entirely of almost homothermic water, as is necessarily the case when we consider the homothermic character of the Gortans Basin.

The range of salinity being much less than that of temperature, the density observations are much less satisfactory as indexes of circulation; but their indications, as seen by the table below, point in the same direction.

Densities of Water at Otter, 8th September 1896, 17·5 S 17·5.

Hour, .	9.20	10.15	11.15	12.15	13.15	14.15	15.15	16·15	17.15	18.15
Surface,	1·0251	1·0249	1·0250	1·0251	1·0253	1·0250	1·0249	1·0249	1·0251	1·0254
Bottom,	1·0257	1·0256	1·0255	1·0257	1·0256	1·0254	1·0255	1·0255	1·0256	1·0256

Densities as above on 9th September 1896.

Hour, . .	6.20	7.15	8.15
Surface, . .	1·0260	1·0255	1·0255
Bottom, . .	1·0255	1·0254	1·0255

The rates of current, as determined by means of the floating chip on the 8th, were as follows; the wind made such observations quite valueless on the 9th:—

	Flood.			H.W.			Ebb.			L.W.
Hour, . . .	9.20	10.15	11.15	12.15	13.30	14.20	15.15	16.15	17.15	18.15
Miles per hour,	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	1	2	2	$1\frac{1}{2}$	0

Tidal Observations at Furnace.—Nine observations were made in the middle of the channel, off Furnace, but unfortunately only one of these was fairly representative of flood-tide conditions. The others all dealt with the ebb, about which they supply considerable information. Six of the soundings, including two cross-sections, are recorded in Table VI.; the other three, each of them including a section across the loch, are given in a separate table (Table IV.). The three sections were made at high-water, half-ebb, and low-water respectively. The conditions at the time were a uniform thin layer of warm surface water (over 53°) over the whole Gortans and Upper Basins, a homothermic stratum at about 52°·5 filling Gortans Basin and the lower end of the Upper Basin below Furnace to a depth of 20 fathoms; and below that a cold mass filling the deeper part of the Upper Basin. The effect of the ebb-tide was not to disturb the upper warm layer, which evidently flowed unchecked into the Gortans Basin; but there was at half-ebb a very marked upwelling of the cold water from the depths of the Upper Basin, analogous to the upwelling of cool water from the Arran basin at Otter during flood-tide. Thus, the bottom water at the deepest point at Furnace was 1° colder at half-ebb than at high-water, showing an updraught of water from at least 7 fathoms deeper. The possibility of this effect being produced by observing in different positions was guarded against by fixing the position each time by accurate cross-bearings, and checking by the depth. By low-tide the deep temperature had risen half a degree, probably to a large extent by mixture of the water, possibly in part by a backward swing when the outflowing current slackened. The study of the cross-sections amply confirmed these conclusions drawn from the central station observations. They show that at any given depth the water is always slightly colder at the sides than in the centre of the channel, but that the invasion of colder water in the greater depths during ebb-tide takes place throughout the whole breadth of the loch.

It would be extremely desirable to repeat and extend these observations in a way clearly suggested from the above preliminary discussion; but, so far, we may state the general results of the work on Loch Fyne in 1896 as follows:—

The flood-tide brings in water from the upper and deeper layers of the Arran Basin, which is thoroughly mixed in passing Otter Spit before high-water, and fills the Gortans Basin with a nearly homothermic mass, which is passed on through Minard Narrows into the Upper Basin, where it does not sink through the cold deep water in summer, but only mixes with the upper layers above 20 fathoms, becoming more superficial in its effects as the tide passes upwards. In the ebb there is, at the upper end of the loch, only a superficial movement, but at the platform between Furnace and Minard, the rush of the surface current into the Gortans Basin while it is strongest at half-ebb, draws up the deep cold layers to a slight extent, causing a slight mixture with the warmer water. The homothermic mass pours out into the Arran Basin, acting on the ebb probably in the same way as at Furnace on the flood. Thus, there is always in progress a gentle mingling of the deep waters of the two deep basins through the intermediate shallow basin. The rapid surface current of the ebb carries out the excess of fresh water from the Arran Basin, while the small underflow from the Arran Basin passes in water of higher salinity with the flood. This circulation is liable to be accelerated or checked by the influence of wind.

The conclusions thus confirm the general view of the circulation of Loch Fyne which I had previously put forward; but farther observations would be necessary to ascertain the exact process by which this circulation is effected, and in particular to determine the relative parts taken by wind and tide.

TABLE I.—TEMPERATURE OBSERVATIONS IN APRIL 1896.

Date, . .	2nd Apr. 1896	2nd Apr. 1896	2nd Apr. 1896	2nd Apr. 1896	3rd Apr. 1896	3rd Apr. 1896	3rd Apr. 1896	3rd Apr. 1896	4th Apr. 1896	4th Apr. 1896	4th Apr. 1896	4th Apr. 1896
Hour . .	11.40	12.20	13.5	14.0	10.30	16.30	16.45	17.45	6.15	7.0	7.45	8.10
Wind, .	N.N.E. 3	N.N.E. 5	.	.	.	N.N.W. 6	N.N.W. 6	N.N.W. 6	.	.	.	.
Depth, .	41 Fathoms	10 Fathoms	41 Fathoms	20 Fathoms	56 Fathoms	36 Fathoms	105 Fathoms	27 Fathoms	28 Fathoms	29 Fathoms	12 Fathoms	44 Fathoms
Place, .	Dog Rock, Dunoon Basin.	Mouth of Loch Goil.	Stuckbeg, Loch Goil.	Lochgoilhead.	Off Brodick Bay.	Off Skate Is'nd (Cowal side).	Off Skate Is'nd (Centre).	Off Skate Is'nd (Tarbert side).	Otter Beacon.	Gortans.	Minard.	Furnace.
Fathoms, 0	45·2	45·2	45·4	45·4	45·0	45·0	45·1	45·1	45·0	45·5†	46·0	46·0
2	.	. .	45·1	(3) 45·0	44·9	.	.	.	.	(3) 44·8	(1) 45·8	.
5	44·6	(4) 44·5	44·8	45·1	.	44·4	44·7	(6) 45·0	(7) 44·9	.	(6) 45·7	44·9
10	.	(9) 44·3	44·9*	45·0	44·0	44·3	44·5	44·9	.	(8) 44·7	(11) 45·3	44·5
15	44·3	.	45·0	(13) 45·1	.	44·2	.	(16) 44·2	(17) 44·7	.	.	.
20	(21) 44·1	.	(21) 45·8	(19) 45·9	44·2	.	44·3	.	.	(18) 44·7	.	(18) 44·9
25	44·2	.	.	.	.	44·3	.	(26) 44·6	(27) 44·6	.	.	(23) 44·5
30	(31) 44·1	.	(31) 45·5	.	44·2	.	44·3	.	.	(28) 44·6	.	(28) 44·5
35	.	.	.	.	44·5	44·4	.	.	.	.	.	(33) 44·6
40	(39) 44·2		45·2	.	.	.	44·7	.	.	.	.	(38) 44·5
45	.	.	.	.	44·7	.	.	.	.	.	.	(43) 45·0
50	.	.	.	.	.	.	44·7	.	.	.	.	.
55	.	.	.	.	44·6	.	.	.	.	.	.	.
60	.	.	.	.	.	.	44·7	.	.	.	.	.
65	.	.	.	.	.	.	.	.	.	.	.	.
70	.	.	.	.	.	.	44·7	.	.	.	.	.
75	.	.	.	.	.	.	.	.	.	.	.	.
80	.	.	.	.	.	.	.	.	.	.	.	.
85	.	.	.	.	.	.	44·6	.	.	.	.	.
90	.	.	.	.	.	.	.	.	.	.	.	.
95	.	.	.	.	.	.	44·7	.	.	.	.	.
100	.	.	.	.	.	.	.	.	.	.	.	.
105	.	.	.	.	.	.	44·6	.	.	.	.	.

(* At 12 fm. = 44·8). († A few minutes later = 46·5).

TABLE I.—Temperature Observations—*continued.*

Date, . .	4th Apr. 1896	4th Apr. 1896	4th Apr. 1896	4th Apr. 1896	6th Apr. 1896	6th Apr. 1896	6th Apr. 1896	6th Apr. 1896	6th Apr. 1896	6th Apr. 1896	6th Apr. 1896	6th Apr. 1896
Hour, . .	11.45	12.55	13.50	15.35	7.45	8.30	9.15	12.0	12.45	13.30	14.10	14.40
Wind, .	.	S.W. 3	S.W. 3	.	S.W. 2	.	W. 3	.	.	.	.	.
Depth, .	59 Fathoms	17 Fathoms	36 Fathoms	75 Fathoms	16 Fathoms	38 Fathoms	62 Fathoms	37 Fathoms	10½ Fathoms	25 Fathoms	25 Fathoms	58 Fathoms
Place, .	Inveraray.	Off Cuill.	Dunderawe.	Craigans.	Cuill.	Dunderawe.	Inveraray.	Furnace.	Minard.	Loch Gair (centre.)	Otter.	1 mile beyond Otter.
Fathoms, 0	46·7	48·2	47·9	46·0	47·5	47·2	47·2§	46·4	45·2	45·3	45·8	45·3
2	44·6	(3) 46·1*	46·4	.	46·5	.	(3) 45·8	.	.	.	.	.
5	44·7	45·0	44·8	44·6	44·9†	45·3	44·7	45·2	44·7	(4) 45·2	(4) 45·6	44·6
10	45·0	45·2	45·0	45·1	45·3	45·0	44·8	44·9‖	44·9	44·6	41·8	44·4
15	45·0	45·3	45·2	45·1	45·4	45·1‡	44·8	(16) 45·0	.	(14) 44·6	(14) 44·6	44·5
20	45·1	.	.	44·8	.	45·5	45·2	44·5	.	44·7	44·7	44·8
25	45·0	.	45·5	44·8	.	(27) 45·4	45·1	(26) 44·5	.	(24) 44·7	(24) 44·7	44·8
30	45·2	.	.	45·0	.	45·4	45·1	44·7	.	.	.	.
35	.	.	45·6	45·0	.	(37) 45·5	.	(36) 44·7	.	.	.	44·8
40	(38) 45·5	.	.	45·1	.	.	(41) 45·3	.	.	.	.	.
45	.	.	.	.	.	.	.	.	.	.	.	44·7
50	(48) 45·3	.	.	.	.	.	(51) 45·2	.	.	.	.	.
55	.	.	.	(54) 45·0	.	.	.	.	.	.	.	44·7
60	(58) 45·2	.	.	.	.	.	(61) 45·1	.	.	.	.	.
65	.	.	.	(64) 45·2	.	.	.	.	.	.	.	.
70	.	.	.	.	.	.	.	.	.	.	.	.
75	.	.	.	(74) 45·2	.	.	.	.	.	.	.	.

(* 1 fm.=47·2). († 7 fm.=45·2). (‡ 17 fm.=45·2). (§ 1 fm.=47·0). (‖ 8 fm.=45·0).

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TABLE II.—Samples of Water collected on board ss. 'Garland' April 1896.

No. of Sample.	Date.	Hour.	Position.	Depth of sample Fathoms	Temperature.	Density $_4S_{15}$ Sprengel.	χ	Gr. of SO_3 per gram.	$\frac{100SO_3}{\chi}$	$\frac{_4S_{15}-1}{\chi}$	$\frac{_4S_{15}-1}{SO_3}$
	1896.										
1	2 Apr.	11.40	Dog Rock, Loch Long.	0	45·2	1021·60	16·02	·00190	11·86	1·348	11·36
2	,,	,,	,, ,,	41	44·2	24·57	18·27	218	11·92	1·345	11·29
3	,,	13.10	Stuckbeg, Loch Goil.	0	45·4	23·24	17·35	205	11·84	1·339	11·31
4	,,	,,	,, ,,	40	45·2	24·40	18·20	217	11·90	1·341	11·26
5	3 Apr.	10.30	2 miles off Brodick.	0	45·0	23·42	17·47	207	11·83	1·341	11·33
6	,,	,,	,, ,,	56	44·4	25·28	18·66	224	11·98	1·355	11·31
7	,,	17.30	Off Skate Island.	0	45·1	24·51	.	216	.	.	11·36
8	,,	,,	,, ,,	105	44·4	25·15	18·67	221	11·86	1·347	11·36
9	4 Apr.	6.30	Off Otter Beacon,	0	45·0	23·54	17·49	208	11·87	1·346	11·34
10	,,	,,	Loch Fyne.	27	44·4	24·56	18·40	219	11·89	1·335	11·23
11	,,	7.0	Off Gortans, Loch	0	45·5	22·81	17·13	201	11·74	1·332	11·34
12	,,	,,	Fyne,	29	44·4	24·74	18·54	220	11·84	1·334	11·27
13	,,	7.45	Off Minard, Loch	0	46·0	22·13	16·70	197	11·82	1·319	11·21
14	,,	,,	Fyne.	12	45·3	24 21	18·26	214	11·74	1·326	11·29
15	,,	8.10	Off Furnace, Loch	0	46·0	21·54	16·23	191	11·77	1·327	11·28
16	,,	,,	Fyne.	44	44·8	24·56	18·24	215	11·82	1·347	11·40
17	,,	11.45	Off Inveraray,	0	46·7	21·03	15·86	187	11·82	1·326	11·21
18	,,	,,	Loch Fyne.	59	45·0	24·59	18·39	217	11·81	1·337	11·33
19	,,	12.55	Off Cuill, Head of	0	48·2	11·42	8·88	104	11·76	1·286	10·94
20	,,	,,	Loch Fyne.	17	45·1	24·48	18·35	215	11·74	1·334	11·37
21	,,	13.50	Off Dunderawe,	0	47·9	14·96	11·44	136	11·86	1·308	11·02
22	,,	,,	Loch Fyne.	36	45·6	24·18	18·02	213	11·83	1·342	11·35
23	,,	15.40	Between Craigans and	0	46·0	22·05	16·61	196	11·81	1·327	11·24
24	,,	,,	Strachur, Loch Fyne.	74	45·2	24·68	18·43	222	12·06	1·339	11·10
25	6 Apr.	10.50	,, ,,	0	47·0	21·52	16·06	194	12·06	1·340	11·10
26	,,	,,	,, ,,	5	45·0	23·79	17·91	217	12·11	1·328	10·97
27	,,	,,	,, ,,	25	45·2	24·48	18·26	221	12·12	1·341	11·06
28	,,	,,	,, ,,	75	45·2	24·69	18·41	223	12·11	1·341	11·08
29	–	–	Off Mull of Cantyre	0	–	25·17	18·84	226	12·01	1·336	11·12
30	–	–	,, ,,	Bottom	–	25·74	19·14	227	11·86	1·344	11·33

TABLE III.—Observations off Cuill, on Bank in Centre of Channel, 3rd September 1896.

Hour.	10.15	11.0	11.45	12.15	12.45	13.30	14.15	14.45	15.15	15.45	16.20	17.10
Depth—												
0.	.	52·9	52·6	54·3	55·4	55·8	54·1	53·2	53·0	52·8	52·7	52·8
1 foot	.	.	.	52·8	.	.	.	.	.	.	.	.
2 feet	.	.	.	.	53·2	54·6	53·1	52·5	.	52·2	.	.
3 ,,	.	.	52·4	.	.	.	.	.	.	.	.	.
4 ,,	.	.	.	.	52·9	.	.	.	.	.	.	.
5 ,,	.	.	.	52·5	.	52·7	52·3	.	.	.	.	52·5
6 ,,	.	.	52·2	.	.	.	.	52·5	52·2	.	.	.
7 ,,	.	.	.	.	.	.	.	.	.	52·3	52·4	.
8 ,,	.	.	.	.	.	.	.	.	.	.	.	52·6
9 ,,	.	.	.	.	.	.	.	.	.	.	.	.
Depth of water.	9 ft.	.	8½ ft.	7 ft.	6 ft.	7 ft.	7½ ft.	8 ft.	8 ft.	9 ft.	9 ft.	10 ft.

Cross-section through above position (E) from Cairndow (A) to Cuill Side (H).

		A. (Shore.)	B.	C.	D.	E.	F.	G.	H. (Shore.)
	Hour.	16.0	16.5	16.10	16.15	16.20	16.30	16.38	16·45
Observations at stations in cross-section at equal distances be-ween the Cairn-dow and Cuill sides.	Depth—								
	0.	56·7	56·4	53·0	52·5	52·7	52·5	52·5	52·5
	2 ft.	.	53·0	52·5	.	.	.	.	.
	3	.	.	53·0	.	.	.	.	.
	7	.	.	.	.	52·4	.	.	.
	9	.	.	.	.	.	.	52·3	.
	10	.	.	.	52·3	.	52·3	.	.
	22	.	.	.	52·0	.	52·3	.	.
	Depth.	.	4½ ft.	5½ ft.	24 ft.	9 ft.	25 ft.	11 ft.	.

TABLE IV.—Tidal Observations off Furnace.

Date, . .	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896	5 Sept. 1896
Hour . .	10.10	10.20	10.35	11.7	11.20	13.5	13.15	13.30	14.0	14.20	16.15	16.20	16·35	16.55	17·5
Tide, . .	High Water	.	.	.	.	Half ebb	.	.	.	.	Low Water	.	.	.	.
Depth, .	0	$12\frac{3}{4}$ Fms.	40 Fms.	21 Fms.	0	0	$15\frac{1}{2}$ Fms.	$40\frac{1}{2}$ Fms.	18 Fms.	0	0	$15\frac{1}{2}$ Fms.	$40\frac{3}{4}$ Fms.	20 Fms.	0
Position.	Furnace A.	Furnace B.	Furnace C.	Furnace D.	Furnace E.	Furnace A.	Furnace B.	Furnace C.	Furnace D.	Furnace E.	Furnace A.	Furnace B.	Furnace C.	Furnace D.	Furnace E.
Fathoms.															
0	55·2	54·9	56·8	56·0	57·5	56·6	56·6	58·1	55·9	57·2	58·0	56·7	56·4	57·0	57·3
2	.	53·5	.	54·1	.	.	(1) 53·7	(1) 55·3	.	.	.	(1) 54·1	(1) 56·3	(1) 55·8	.
5	.	52·4	(4) 52·8	52·5	.	.	52·4	52·4	(4) 52·3	.	.	52·1	52·7	52·6	.
10	.	52·4	52·6	52·2	.	.	52·0	52·8	52·0	.	.	52·0	52·5	52·3	.
15	.	.	(14) 52·5	52·0	.	.	52·1	52·4	.	.	.	52·1	52·3	52·0	.
20	.	.	51·9	51·0	.	.	.	51·4	(18) 51·2	.	.	.	52·0	51·6	.
25	.	.	(24) 51·1	.	.	.	.	50·0	.	.	.	.	50·6	.	.
30	.	.	49·4	.	.	.	.	48·5	.	.	.	.	48·8	.	.
35	.	.	(34) 48·9	.	.	.	.	47·4	.	.	.	.	47·9	.	.
40	.	.	47·5*	.	.	.	.	46·6	.	.	.	.	47·0	.	.

(* 39=47·7).

Note.—The position marked Furnace A. was on the S.E. shore of Loch Fyne, opposite Furnace Quarry; B. was half-way from the shore to the centre of the Loch, which is marked C.; D. was about three-quarters of the way from the centre to the N.W. shore; and E. was on that shore at the stone-heap in front of the Quarry.

TABLE V.—OBSERVATIONS AT ANCHOR OFF OTTER FERRY, IN THE TIDAL STREAM.—Depth 16 to 17 fathoms.

Date.	8 Sept. 1896	8 Sept. 1896	8 Sept. 1896	8 Sept. 1896	8 Sept. 1896	8 Sept. 1896	8 Sept. 1886	8 Sept. 1896	8 Sept. 1896	8 Sept. 1896	9 Sept. 1896	9 Sept. 1896	9 Sept. 1896	9 Sept. 1896	9 Sept. 1896	9 Sept. 1896	9 Sept. 1896
Hour.	9.20	10.15	11.15	12.15	13.15	14.20	15.15	16.15	17.15	18.15	6.20	7.15	8.15	9.15	10.15	11.10	12.15
Wind.	E.S.E. 0	Calm	-	E. 3	S. 0	E. 3	E. 4	E. 3	E. 3	-	E. 4	E. 4	E. 2	E. 5	E. 6	E. 3	E 6
Tide.	•	•	•	High Water.	•	•	•	•	•	Low Water	Low Water	•	•	•	•	•	Nearly H.W.
Fat hom 0	55·5	55·4	54·9	54·7	55·4	54·9	54·7	54·7	54·3	54·3	54·3	54·4	55·0	54·6	55·0	54·8	55·0
1	54·9	55·0	54·9	54·7	54·9	54·9	54·8	54·8	54·3	54·4	54·3	54·2	55·0	54·7	55·0	54·9	54·9
6	(5) 54·3	54·0	54·1	54·0	54·0	54·4	54·2	54·3	53·7	53·7	54·0	53·9	54·3	54·0	54·4	54·1	54·0
11	(10) 53·8	53·0	53·5	53·8	54·0	54·4	54·0	54·1	53·7	53·6	53·9	53·7	53·7	52·8	54·0	54·0	53·6
16	(15) 52·5	52·6	53·1	53·4	53·4	53·9	53·7	53·4	53·7	54·0	54·0	53·9	53·2	52·4	54·0	54·2	54·0

TABLE VI.—Temperature Observations in Loch Fyne

Date, . . .	3 Sept. 1896	3 Sept. 1896	3 Sept. 1896	3 Sept. 1896	4 Sept. 1896	4 Sept. 1896	4 Sept. 1896	4 Sept. 1896	4 Sept. 1896	4 Sept. 1896	4 Sept. 1896	4 Sept. 1896	4 Sept. 1896	4 Sept. 1896	4 Sept. 1896	4 Sept. 1896
Hour, . . .	10.40	18.0	18.25	18.55	9.10	9.25	9.55	10.15	10.30	11.10	12.0	12.12	12.40	13.45	14.0	14.15
Wind, . .	N.E. 3	Calm.	N.E. 1	N.E. 1	E. 1	E. 1	E. 2	E. 2	E. 1	E. 0	E. 1	E. 1	.	.	.	.
Tide, . . .	3¼ hrs. ebb	4½ hrs. fld.	H. W.	½ hr. ebb	½ hr. ebb	¾ hr. ebb	1¼ hr. ebb	1½ hr. ebb	1¾ hr. ebb	2¼ hrs. ebb	3 hrs. ebb	3¼ hrs. ebb	4 hrs. ebb	5 hrs. ebb	5¼ hrs. ebb	5½ hrs. ebb
Depth, . .	17 Fms.	16½ Fms.	35½ Fms.	44 Fms.	17 Fms.	45 Fms.	63 Fms..	44 Fms.	16 Fms.	72 Fms.	15½ Fms.	43 Fms.	16 Fms.	13 Fms.	24 Fms.	13½ Fms.
Position, .	Cairndow.	Cairndow.	Dunderawe.	Inveraray.	Inveraray anchorage.	Off Inveraray (Dunderawe open).	Off Inveraray (deepest).	Off Inveraray (near St Catherines).	St Catherines.	Strachur.	Furnace B.	Furnace C.	Furnace D.	Minard A.	Minard B.	Minard. C.
Fathoms, 0	53·2	53·4	55·0	55·2	56·8	56·3	55·6	56·2	54·8	58·0	55·0	57·2	58·8	57·2	58·1	58·0
2	(1) 52·9	.	.	.	53·9	.	.	.	.	(1) 54·1*	.	53·5	.	(2½) 53·5	(3) 53·5	(3) 53·0
5	(6) 51·6	52·0	52·2	52·2	(4) 52·0	.	52·4	.	52·3	52·6	52·5	52·6†	52·0	(7½) 53·0	(8) 52·6	(8) 52·2
10	(11) 51·3	51·5	51·9	51·8	(6) 51·9	51·9	51·9	51·9	51·8	52·0	52·0	52·7	52·0	(12½) 52·7	(13) 52·4	(13) 52·1
15	(16) 51·0	51·1	51·5	(13) 51·9	.	51·9	51·4	.	51·4	51·8	52·1	52·2	51·9	.	.	.
20	.	.	50·5	51·1	.	50·9	51·3	51·1	.	51·2	.	51·5	.	.	(23) 51·7	.
25	.	.	49·9	(23) 50·0	.	50·0	49·6	.	.	.	.	.	.	.	.	.
30	.	.	48·9	.	.	48·8	48·8	48·6	.	49·3	.	49·0	.	.	.	.
35	.	.	47·3	(33) 48·0	.	48·0	.	.	.	.	.	48·1	.	.	.	.
40	.	.	.	.	.	47·0	47·0	47·2	.	47·7	.	47·1	.	.	.	.
45	.	.	.	(43) 47·1	.	46·1	.	.	.	.	.	.	.	.	.	.
50	.	.	.	.	.	.	46·3	.	.	46·6	.	.	.	.	.	.
55	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60	.	.	.	.	.	.	46·2	.	.	46·1	.	.	.	.	.	.
65	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
70	.	.	.	.	.	.	.	.	.	46·1	.	.	.	.	.	.
75	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
80	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
85	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
90	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
95	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
105	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

(* 3 fm. = 52·8). († Another reading = 52·2).

TABLE VI.—Temperature Observations in Loch Fyne—*contd.*

Date, . .	4 Sept.1896	4 Sept.1896	4 Sept.1896	4 Sept.1896	7 Sept.1896	7 Sept.1896	7 Sept.1896	7 Sept.1896	7 Sept.1896	7 Sept.1896	7 Sept.1896	9 Sept.1896	9 Sept.1896	9 Sept.1896	9 Sept.1896	9 Sept.1896
Hour, . .	14.50	15.10	15.45	16.15	9.33	10.15	11.15	11.50	12.15	12.47	14.15	12.45	14.0	14.50	15.5	15.25
Wind, . .	.	.	.	E.S.E.4	.	.	.	S.W. squally	.	S.E. 1	S.E. 1	S.E. 3	E. 6	E. 4	.	.
Tide, . . .	5¾ hrs. ebb	L.W.	¾ hr. fld.	1¼ hr. fld.	4 hrs. fld.	4¾ hrs. fld.	H.W.	½ hr. ebb	1 hr. ebb	1½ hr. ebb	3 hrs. ebb	H.W.	1¼ hr. ebb	2 hrs. ebb	2¼ hrs.ebb	2½ hrs. ebb.
Depth, . .	25½ Fms.	3 Fms.	30 Fms.	69 Fms.	72 Fms.	44 Fms.	24½ Fms.	29½ Fms.	24½ Fms.	62½ Fms.	104 Fms.	47 Fms.	24½ Fms.	18½ Fms.	41 Fms.	18½ Fms.
Position, .	Gortans.	Loch Gair.	Otter.	Kilfinan.	Strachur.	Furnace.	Minard B.	Gortans.	Otter.	Kilfinan.	Skate Island.	Outside Otter.	Minard.	Furnace B.	Furnace C.	Furnace D.
Fathoms, 0	57·0	58·3	56·0	56·0	55·0	55·1	55·0	54·9	55·7	56·0	57·0	54·4	53·4	53·8	54·0	54·1
2	.	(1) 55·8	.	.	(1) 54·9	(1) 55·0	.	.	.	.	.	(1) 54·6	(4) 53·6	(3) 53·6	.	(3) 54·0
5	52·9	(2) 53·2	.	54·9	52·8	52·9	(4) 53·5	(4) 54·9	(4) 54·9	55·7	.	54·4	.	.	53·6	..
10	.	(3) 53·2	54·0	54·0	52·0	52·6	(9) 52·4	(9) 54·0	(9) 54·0	56·0	56·2	54·1	(9) 53·3*	(8) 53·2	53·1	(8) 53·4
15	53·1	.	.	53·5	51·6	52·1	(14) 52·5	.	(14) 54·2	.	.	53·8	(14) 53·8†	(13) 52·7	52·0	(13) 52·0
20	.	.	53·3	53·2	51·1	51·5	.	(19) 53·5	53·1	53·5	54·2	.	(19) 52·3	(18) 52·0	51·9	(18) 51·7
25	52·4	.	.	.	.	.	(24) 51·7	.	(24) 52·7	.	.	52·7	(24) 52·0	.	50·9	..
30	.	.	53·4	(28) 53·5	49·1	50·0	.	(29) 52·7	.	52·9	53·0	53·5	.	.	48·7	..
35	.	.	.	.	.	48·9	.	.	.	.	.	51·1	.	.	.	.
40	.	.	.	(38) 52·9	47·7	.	.	.	.	51·3	51·5	.	.	.	47·0	.
45	.	.	.	.	.	(44) 48·1	.	.	.	.	.	{ 53·3 51·0	.	.	.	.
50	.	.	.	(48) 51·0	46·9	.	.	.	.	50·6	51·1	.	.	.	.	.
55	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60	.	.	.	(58) 50·1	46·4	.	.	.	.	50·1	51·0	.	.	.	.	.
65	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
70	.	.	.	(68) 49·4	46·2	.	.	.	.	.	50·4	.	.	.	.	.
75	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
80	.	.	.	.	.	.	.	.	.	.	49·9	.	.	.	.	.
85	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
90	.	.	.	.	.	.	.	.	.	.	49·7	.	.	.	.	.
95	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
100	.	.	.	.	.	.	.	.	.	.	49·6	.	.	.	.	.
105	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

(* Another reading = 53·8). († Another reading = 53·0).

TABLE VI.—Temperature Observations in Loch Fyne—*contd.*

Date,	9 Sept. 1896	9 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	10 Sept. 1896	11 Sept. 1896
Hour,	15.55	16.45	9.10	10.0	10.55	12.10	11.45	11.30	12.50	13.45	14.0	14.25	15.5	15.35	16.5	17.30	15.20
Wind,	.	E. 2	S.W. 2	Calm	S. 1	.	S. 2	.	S.S.W. 2	S. 2	S. 2	.	S.W. 2	S.W. 2	S.W. 1	S.W. 1	S.E. 2
Tide,	3 hrs. ebb.	4 hrs. ebb.	1¾ hr. fld.	2½ hrs. fld.	3¼ hrs. fld.	4¾ hrs. fld.	4¼ hrs. fld.	4 hrs. fld.	5¼ hrs. fld.	H.W.	¼ hr. ebb	¾ hr. ebb	1½ hr. ebb	2 hrs. ebb	2½ hrs. ebb	4 hrs. ebb	1 hr. ebb
Depth,	72 Fms.	62 Fms.	6½ Fms.	12½ Fms.	37 Fms.	32 Fms.	64 Fms.	21 Fms.	73 Fms.	15 Fms.	40 Fms.	18 Fms.	25 Fms.	31 Fms.	25 Fms.	41 Fms.	45 Fms.
Position,	Strachur.	Inveraray.	Inveraray Anchorage	Cuill.	Dunderawe.	Inveraray (near shore)	Inveraray (deep.)	St Catherines.†	Strachur.	Furnace B.	Furnace C.	Furnace D.	Minard.	Gortans.	Otter.	Furnace C.	Furnace C.
Fathoms, 0	53·9	52·7	53·0	52·5*	52·3	53·0	52·8	52·6	53·8	53·9	54·2	54·3	54·0	54·4	54·9	54·0	54·2
2	.	.	.	51·6	.	.	.	.	.	.	.	.	.	.	.	.	.
5	.	52·6	.	(7) 51·1	52·0	.	52·6	52·4	.	53·5	53·3	53·9	(4) 53·7	.	(4) 54·8	53·1	53·9
10	52·6	52·0	52·0	(12) 51·0	51·9	52·3	52·0	52·5	52·3	53·0	53·1	52·6	.	54·2	(9) 54·9	53·0	52·7
15	.	.	.	.	51·9	.	.	52·0	.	52·5	52·2	51·9	(14) 53·3	.	(14) 54·1	.	(14) 52·3
20	51·5	51·0	.	.	51·0	51·3	51·3	51·5	51·7	.	(19) 51·9	.	.	53·6	.	51·8	.
25	.	.	.	.	50·8	.	.	.	50·8	.	51·0	.	(24) 52·1	.	(24) 53·9	.	(24) 51·7
30	49·1	49·5	.	.	50·3	49·4	.	.	49·0	.	(29) 50·1	.	.	53·1	.	48·8	49·5
35	.	.	.	.	49·0	.	(33) 49·0	.	48·0	.	.	.	.	.	.	.	(34) 49·2
40	47·7	47·7	.	.	.	.	.	.	47·6	.	(39) 47·2	.	.	.	.	47·0	.
45	.	.	.	.	.	.	(43) 47·9	.	.	.	.	.	.	.	.	.	(44) 47·9
50	46·9	46·4	.	.	.	.	.	.	47·0	.	.	.	.	.	.	.	.
55	.	.	.	.	.	.	(53) 46·6	.	.	.	.	.	.	.	.	.	.
60	46·2	46·1	.	.	.	.	.	.	46·2	.	.	.	.	.	.	.	.
65	.	.	.	.	.	.	(63) 46·1	.	.	.	.	.	.	.	.	.	.
70	46·1	.	.	.	.	.	.	.	46·1	.	.	.	.	.	.	.	.

(* At head of loch=56·0 ; 50 yards from head=53·6). († At St Catherine's Pier, surf.=53·2 ; 1 fathom=52·9).

IX.—REPORT ON PHYSICAL INVESTIGATIONS CARRIED OUT ON BOARD H.M.S. 'RESEARCH,' DURING AUGUST 1896. By H. N. Dickson, F.R.S.E., F.R.G.S.

The observations made in the Faeroe-Shetland Channel by the officers of H.M.S. 'Research,' during August 1896, were undertaken with the view of forming part of the continued physical survey of the North Sea and the North Atlantic, instituted as an international scheme in 1893. The important share taken by the Fishery Board for Scotland in the first year's work materially assisted in showing the value of the results to be obtained from further and more extended observations, as well as the general accuracy of the methods suggested by Professor Pettersson, and adopted by his colleagues, in conducting the investigation. Since the publication of my paper in the twelfth Report of the Fishery Board, the work of making and collecting observations has been continued as circumstances permitted. The directors of the Swedish and Norwegian work have been specially active in the direction of research carried on by vessels detailed for the purpose, while I have availed myself of opportunities offered by a large number of observers to collect observations of surface temperature, and samples of surface water, from all parts of the Atlantic north of 40° N. lat. Papers have been published from time to time reporting on the progress of the work,* and it may be said that the discussion of the complex relations existing between the physical conditions in the sea area investigated, and the meteorology, or rather climatology, of Western Europe, has passed its preliminary stages, and has brought with it important information, bearing not only on fishery questions, but on the seasonal forecasting of the weather.

While the observations made at the surface and below it in the North Sea and its branches, when taken along with numerous surface observations in the Atlantic, seem to give a fairly adequate general view of the physical changes occurring from season to season, the work of the 'Jackal' in 1893 and 1894 showed clearly that the information gained about these two areas cannot be accurately combined unless we have a detailed knowledge of the process of mixture of waters taking place in the transitional region over the Wyville Thomson Ridge, and round the western and northern border of the Continental shelf. The excellent work done by H.M.S. 'Research' during last summer is accordingly a contribution of the greatest value, not only in itself, but as a factor which immensely increases the importance of the simultaneous observations made elsewhere. It is a matter of regret that the date of publication of this report makes it impossible to compare the observations of the 'Research' fully with those obtainable from other sources, as there has not been sufficient time to collect and properly arrange all the material; but the work shows for itself the extreme interest of the changes constantly taking place in the Faeroe-Shetland Channel, and bears sufficient testimony to the enthusiasm and skill of the officers under whose direction it was carried out.

* See Dr J. Hjort, *Studies of the Norwegian Fisheries*; H. N. Dickson, 'Movements of the Surface Waters of the North Sea,' *Geographical Journal*, March 1896; Prof. Otto Pettersson, Ueber die Beziehungen zwischen hydrographischen und meteorologischen Phänomenen *Meteorologische Zeitschrift*, August 1896.

Stations.

Observations were made at ten stations. The positions of these are given at the head of Table I., and are further described as follows:—

Station	I.,	new station.
„	II.,	same position as 'Jackal' II.*
„	III.,	„ „ 'Jackal' XIII.*
„	IV.,	„ „ 'Knight Errant,' No. 33.†
„	IVa.,	2 to 3 miles south (true) of Station IV.
„	V.,	same position as 'Jackal' XIV.*
„	VI.,	„ „ 'Jackal' XVII.*
„	VII.,	'North of Wyville Thomson Ridge.'
„	VIII.,	same position as 'Knight Errant,' No. 28†.
„	IX.,	'South of Wyville Thomson Ridge.'

In addition to the information included in Table I., there are the following notes:—

Station I., at 10 a.m. and 11 a.m. Current, E. by N., $\frac{3}{4}$ N. $\frac{1}{2}$ knot.

Station II., at 6 p.m. and 7 p.m. No current.

Station III., 10 a.m., 2.30 p.m, 4 p.m., and 5 p.m. No current.

Station IV., Aug. 1, 10.30 a.m. No current. Aug. 2, 11.30 a.m., current, S.E. $2\frac{1}{4}$ knots, 8 p.m., S.E. 1 knot. Aug. 3, 11 a.m. and 2 p.m., no current. Station IVa. is due to the drifting of the vessel southward, bringing it close up to the Wyville Thomson Ridge.

Station V., at 10.30 a.m. and 3.30 p.m., current, E.N.E. $\frac{1}{3}$ knot.

Station VI., at 10.30 a.m., current, S.E. by S. $\frac{1}{2}$ knot.

Station VII., at 10 a.m., current, E. by S., $\frac{1}{2}$ S. 1 knot.

Methods of Observation.

The methods of observation, in so far as the work at sea was concerned, were to all intents and purposes the same as those employed on the 'Jackal' in 1893-94, and it is therefore unnecessary to again describe them in detail. Temperature observations were made with Negretti and Zambra's reversing thermometers, and a copy of the records of the actual readings was supplied to me with the corrected readings appended. The corrections were obtained from Kew certificates, and the work has been carefully revised. Table I. gives the corrected temperatures (T_1) at the depths (d.) in degrees Fahrenheit, and where duplicate observations were made these are added in a second column (T_2). As before, the temperatures of Table I. were reduced to the Centigrade scale and plotted. Table II. gives the temperatures at uniform depths obtained from the curves; the depths are here given in metres as well as fathoms. It may be remarked that the observations, as a rule, give fairly good curves. Station III. suggests a possible alternative curve between 40 and 120 fathoms, giving temperatures about $0°{\cdot}5$ C. higher than the one adopted. Station IVa. should perhaps hardly be treated as a curve at all, as the vessel was apparently drifting southward, and the temperature exhibits very rapid changes close to the Wyville Thomson Ridge, which would form an extremely interesting study in the unlikely event of being on the spot on a day sufficiently calm and clear to make observations of the required accuracy possible. The observations indicate a distinct 'undercurl' of the warm water as it passes over the edge of the ridge.

* *Twelfth Report of the Fishery Board for Scotland*, Pt. III., p. 364 *et seq.*
† *Proc. R.S.E.*, vol. xi., p. 650.

A few extra observations of surface temperature were made, and will be found under water samples 20 to 23, 44 to 48, 69 and 70, 86 to 90, 111 to 115, 139 to 143, 148, 164 to 169, and 174 and 175 of Table III.

Mill's water bottle was again used for the collection of samples, and it seems again necessary to emphasize the fact that this instrument, although extremely useful in smooth water, was not intended by its inventor to be subjected to the conditions under which the observer must, unfortunately, almost always work in these seas. Some of the samples brought home by the 'Research' have obviously been collected at a much less depth than was intended, through the accidental closing of the bottle; these samples I have marked with an asterisk in Table III., but I must confess to doubts about a considerable number of the others. Fortunately, the number of samples collected at each sounding was so great as to remove any serious uncertainty about the real salinities, but with another type of water bottle a much smaller number of samples would have amply sufficed.

The samples were examined in the Chemical Laboratory at the Museum, Oxford, partly by myself and partly by Mr H. E. W. Phillips, to whom I wish to express my indebtedness, but wholly under my direct supervision. They were sent to me in bottles containing about 4 oz. each; all the important samples being supplied at least in duplicate. In the case of the latter, two bottles of the same water were always examined as separate samples, but no noticeable differences were observed.

The examination was restricted in the first place to determinations of salinity by chlorine estimations, controlled by density determinations with Sprengel tubes. Chlorine estimations were made by the ordinary chromate method, using silver nitrate solution of strength about $\frac{1}{5}$ normal. A Geissler's 10 c.c. pipette, with fiducial mark above and below the bulb, stopcock, and very fine point, was used for measuring out the sea water to be titrated. This pipette was calibrated by repeated weighings of its content of distilled water at temperatures from 0° C. to 25° C., which showed no variation exceeding 2 milligrammes, and the factor for reducing its volume to exactly 10 c.c. was accordingly treated as constant. The titration was performed by means of a Geissler burette, with float, reading easily to 0·01 c.c. These instruments have been used in estimating the chlorines of the surface samples from the North Atlantic referred to above (now numbering nearly 3000), and it has been found unnecessary to make the determinations in duplicate, as the burette readings rarely differ by as much as 0·03 c.c. About half of the samples from the 'Research' were nevertheless titrated twice, usually with different silver solutions. In dealing with the surface samples from the Atlantic I hope elsewhere to discuss fully the errors of salinity determinations based on this method, which I believe to be chiefly due to the different appearance of the end reaction with sea water, and with the pure sodium or potassium chloride solutions employed in ascertaining the strength of the silver solutions. A personal equation of some magnitude is thus introduced, which experience has shown to vary in amount from time to time in the same observer, rendering control by some independent method, such as the Sprengel tube determinations, essential.

The ascertained values of $[\chi]$, the chlorine per litre, have been converted to χ, the chlorine per kilogramme, and are given in column 6 of Table III. Column 7 gives the salinity p as calculated from χ by means of Table XI. appended to my report on the 'Jackal' work. Column 8 gives the densities at 15° C. (${}_4S_{15}$.) ascertained by Sprengel tube, and column 9 the salinities calculated from them by Table XII. of the 'Jackal' report. I may state here, pending full discussion elsewhere, that the results of examination of 3000 samples give full confidence in the correctness of these tables, based on Prof. Pettersson's data, for all waters likely to be met with in the North Atlantic. The differences of salinity given in column 10 of Table III., corresponding in magnitude to those obtained by most other observers, have apparently no chemical significance, and must be taken as expressing the accumulated errors in collecting the samples, storing them, and making the two determinations. They are, in any case, well within the point of attaining any geographical meaning.

Column 11 of Table III. gives the densities at 15° C. calculated by working backwards from column 9 with Table XII. of the 'Jackal' report, and from column 11 the specific gravities *in situ* have been computed, using the observed temperatures (T.) and Table X. of the former paper (col. 12).

Notwithstanding the failure of all attempts hitherto made to find chemical differences in the composition of sea-water, now apparently made final by the identical values obtained for salinity from chlorines and densities, I thought it possible * that waters derived largely from sea-water ice might contain some measurable excess of sulphates compared with waters coming from low latitudes, and that at least some indication might thus be given of the place of origin of any given sample. A large number of the surface samples from the Atlantic have been thus examined, with results, mostly negative, which need not be discussed here. Determinations of the sulphates in a number of the 'Research' samples were made along with others, and the values obtained are to be found in column 13 of Table III. Fifty c.c. of the sample were taken in each case, the sulphates precipitated with barium chloride in the usual way, and left to stand overnight. Special care was taken to wash the precipitates with boiling water until the combined filtrates of a whole batch (usually numbering about eight) gave no perceptible turbidity with silver nitrate. About half a dozen samples were done in duplicate, the results agreeing closely in every case. The numbers in column 14, which are those of column 13 multiplied by 100, and divided by those of column 6, show no variation amongst themselves which can be taken to represent actual differences of composition, but as most of them tend towards the superior limit usually assigned to this fraction, it may be well to add that they agree with the values obtained for the great bulk of the surface samples.

It appears from this that we must look to the analysis of dissolved gases for any hope of being able to identify sea-waters by self-borne labels, and one cannot but regret that the 'Research' was not supplied with tubes for collecting gas samples.

Results.

The general distribution of temperature and salinity disclosed by these observations is easily described. At the surface the isothermal of 12° C. passes in a W.N.W. to E.S.E. direction just north of the Ridge, forming an almost straight line to the Orkney Islands. The general map for the same period, not yet quite completed, shows that east of the Orkneys it sweeps northward to the Norwegian coast, which it cuts in about 70° N. lat., just north of the Lofotens. The line of 11° C., according to the same chart, is nearly parallel to that of 12°, passing through the island of Suderö in the Faeroes, and bending north to the east of the group, showing a cold axis close inshore. Below the surface, where observations are

* See K. Rördam, *Meddelelser om Grönland,* xvii. p. 234.

restricted to the Faeroe-Shetland Channel, the distribution shown by parallel straight lines remains practically the same down to 200 fathoms. At 200 fathoms the form of the isotherms changes, and below 300 fathoms, *i.e.*, the level of the summit of the Ridge, they follow the contour lines of the sea-bottom almost exactly, keeping the central axis of lowest temperature very close to the edge of the continental shelf. At all depths, from 300 fathoms to the bottom, this axis probably passes almost directly through Stations III. and VII.

Turning next to the isohalines, we find at the surface the line of 35·4 *pro mille* passing through stations VI., VII., and VIII., and to E.S.E. the lines of 35·3 and 35·2 almost parallel to it, the latter passing through station IV. Below the surface the 35·4 line moves slightly to W.N.W., but otherwise the distribution remains altogether unchanged, the isohalines running almost at right angles to the isothermals till the summit of the Ridge is again reached, when a sudden change to a curved form, the same as the isothermals, takes place, the axis of greatest salinity remaining, however, somewhat to the W.N.W. of the axis of lowest temperature, *i.e.*, more in the centre of the channel. Here the salinity falls to a little less than 34·9 *pro mille*.

Comparing these results with those of former expeditions, the salinity observations show at the upper levels fresher waters near the shore side of the channel west of the Orkney and Shetland Islands, and a steeper gradient towards W.N.W., indicating that water of more than usual salinity was to be found to west and south-west of the Faeroe Islands. This point will be settled by the surface observations in the general map when worked up. The 'Research' observations are practically the first obtained at levels below 300 fathoms, as the 'Jackal' was not fitted with sounding apparatus that could be safely used at those depths.

Subtracting the temperature readings of 'Knight-Errant' from those of the 'Research' we get the following differences between August 1896 and August 1880.

Station IV. 'Knight-Errant, No. 33.'

At surface		$-1^{\circ}\cdot0$ C.	
50 fathoms		$+0\cdot1$	
100	,,	0·0	
150	,,	0·0	
200	,,	?	
			Station IVA.
250	,,	$-4\cdot0$	$+0\cdot1$
300	,,	$-3\cdot3$	$+0\cdot9$
350	,,	$-2\cdot1$	$+2\cdot0$
400	,,	$+0\cdot3$	
450	,,	$+0\cdot6$	
Bottom	,,	$+0\cdot2$	

Station VIII. 'Knight Errant, No. 28.'

At surface $-1^{\circ}\cdot1$ C.
$-0\cdot2$

Station IX. may be compared with 'Knight Errant, No. 5.'

At surface $-1^{\circ}\cdot4$ C.
At bottom $+0\cdot7$

Station IV. is unfortunately too susceptible to great variations of temperature for very slight changes of position to afford any reliable comparison, as is evident from the differences under IVA. It is worth noting that at Station IX. *south* of the Ridge, a distinct difference is observable at a depth of nearly 600 fathoms. The positions do not *exactly* correspond it is true, but the differences of depth, 560 fathoms for the 'Knight Errant,' and 595 fathoms for the 'Research,' are in favour of the different readings being due to a real change in the temperature.

The results of a comparison of these observations with the work of the 'Jackal' in 1893 make it more than ever a matter of regret that we were then prevented by bad weather from sounding in the Faeroe Channel anywhere in the neighbourhood of the Ridge itself. The differences observed in the temperature at the four stations visited in both years are, however, sufficiently striking. The 1893 readings are subtracted from those of 1896.

Station. 'Research' No. / 'Jackal' No.	II. / II.	III. / XIII.	V. / XIV.	VI. / XVII.
Depth Fathoms 0	+0·6	−0·6	+0·1	−0·2
5	+0·5	−0·7	+0·1	−0·2
10	−0·2	−0·6	−0·1	−0·5
15	−0·9	−0·6	−0·2	−0·6
20	−0·7	−0·3	−0·2	−0·7
25	−0·5	−0·3	−0·5	−0·5
30	−0·4	−0·3	−0·8	−0·2
35	−0·4	−0·2	+0·4	+0·4
40	−0·4	−0·2	+0·4	+0·8
45	−0·4	0·0	+0·2	+1·2
50	−0·5	+0·2	+0·1	+1·2
60	−0·4	+0·1	0·0	+1·4
70	−0·3	+0·2	+0·1	+1·6
80	−0·1	+0·5	+0·3	+2·0
90	−0·2	+0·2	+0·3	+2·4
100	−0·4	−0·1	+0·2	+2·4
110	−0·4	−0·1	0·0	+2·2
120	−0·5	+0·1	−0·1	+1·9
130	−0·6	0·0	−0·1	+1·7
140	−0·7	−0·5	−0·1	+1·5
150	−0·9	−0·8	0·0	+1·3
160	−0·9	−0·6	+0·1	+1·0
180	−0·6	−1·8	+0·6	−0·2
200	...	−2·1	−1·0	−1·5
250	...	−3·3	−3·2	+0·1
300	...	−3·0	−2·6	−0·2
350	...	−1·6	−1·8	−0·2
400	...	−0·5	−0·7	0·0
450	...	...	...	...
500	...	...	...	...
550	...	...	...	...
600	...	...	...	...
Bottom.	−1·1	...	...	...

In 1896, as in 1893, Station II. gives more marked indication of a *Sprungschicht* due to land influences, than any of the stations out in the

Channel. Down to a depth of about 8 fathoms the temperature in 1896 is higher than in 1893, but at 15 fathoms it is nearly 1° C. lower, and this quantity diminishes slowly to nearly zero at 80 fathoms, increasing again steadily to 1° at the bottom. Station III. shows a lower temperature of about 0°·5 C. at the surface, diminishing to zero at 45 fathoms, below which point the water was warmer in 1896 than in 1893 by an amount reaching a maximum of 0°·5 C. at 80 fathoms, and diminishing again to zero at about 130 fathoms. At still greater depths the year 1896 shows colder water, the difference being greatest at about 250 fathoms, just above the Ridge level. Station V. shows differences of almost exactly similar type, but the amounts are in general smaller.

Station VI., as before, explains the whole position. Here the temperature in 1896 is lower than in 1893 down to about 30 fathoms, and then warmer water is met with, the difference increasing steadily to as much as 2°·4 C. between 90 and 100 fathoms, then again decreasing to zero at about 180 fathoms, and varying about that point to 400 fathoms.

The general map of surface temperature of the North Atlantic shows that, in 1896, the isothermal of 1896 fails anywhere to cross the parallel of 60° N. lat. Instead of as in 1893 extending northward to the south-west of Iceland,* the line of 17° touches the south of Ireland as before, but immediately to the westward bends southward to below 50° N. lat., instead of northward to beyond 51° N. The line of 10° begins south-east of Iceland, and extends as before to just north of the Faeroe Islands, but apparently recurves in a much wider bend towards the Norwegian coast, and the temperatures east of Iceland are lower, indicating a stronger and more widespread current of cold water moving southwards.

These remarkable differences of distribution become at once intelligible when the meteorology of the period is considered. The pilot chart issued by the United States Hydrographic Office, gives the following information for 1896 :—

May.—'The number of icebergs is unusually large, especially near the south-eastern extremity of Newfoundland.' While this statement refers to a special region with which we are not immediately concerned, it may be taken as indicating temperature above the normal in high latitudes during early summer.

June.—'The weather over the North Atlantic has been generally fine. The winds in the northern part of the ocean (north of 45° N.) were fresh to strong from the north or east during the first week, due to an area of high pressure over that region. On the 8th they commenced to blow from the westerly quadrants, and continued so with the exception of a few days for the two weeks following.

'The barometric pressure in the vicinity of the Azores was irregular and below the normal for the first two weeks. During that time the winds between those islands and Europe were principally from the west or south-west.

July.—'The weather over the North Atlantic during most of the month has been moderate. . . . . North of the 45th parallel there were gales, principally from the south-west, from the 3rd to the 5th, and from the 8th to the 12th of the month, due to two storm areas, whose centres are shown on the chart between the 50th and 60th parallels.

'The barometric pressure has been generally below the normal north of 50° N. Over the west coasts of Europe, and the British Isles, and the ocean adjacent, anti-cyclones have predominated. This arrangement of conditions caused south-west to westerly winds, principally over the

* *Geographical Journal,* March 1896, Plate 7.

northern central part of the ocean, with variable winds of not much force between the Azores and Western Europe.

'In the vicinity of the Azores the pressure has been about normal, but the centre of the high area has been to northward and eastward of its average position.

August.—'The weather over the North Atlantic during the month has been remarkably fine. South of the 50th parallel the weather has been continually good, excepting a few reports of moderate gales received from vessels east of Newfoundland, due to areas of low pressure passing over far to the northward.

'East of the 40th meridian anti-cyclones have prevailed over the steamer routes nearly the entire month, causing northerly or easterly winds over the British Isles and coast of Western Europe. The centre of the high area being so far to the northward of its usual position caused the paths of the lows to be deflected much further to the northward than usual.'

The *Bulletin Mensuel du Bureau Central Meteorologique de France*, and the Daily Weather Reports of the British Meteorological Office, tell the same story of unusually high pressure west and south-west of the British Isles during July, giving light westerly winds, and keeping such depressions as appeared far to the northward. These publications give the additional information that depressions tended to move south eastwards from the direction of Iceland into the North Sea, and we accordingly get as a general result for the whole period that south of the entrance to the Faeroe-Shetland Channel, as far as to the Azores, the usual southerly component of the winds was either absent or abnormally weak, while north and west of the channel the prevailing winds were northerly, often north-westerly, sometimes north-easterly.

It thus appears that the usual drift coming up the Faeroe-Shetland Channel from the Atlantic was, as a current, abnormally weak, owing to the absence of southerly winds over the areas to south and west of the Wyville Thomson Ridge. At the surface, and for some 30 to 50 fathoms below it, the movement was not only arrested but reversed; and the colder surface water from the Norwegian Sea made its way as a surface layer apparently some distance south of Station VI. This water, be it noted, probably passed up the Faeroe Channel in the spring, and may have received but a slight admixture of surface water from further north.

The southward movement of water in the upper strata would naturally tend to cause a slight descending motion along the borders of the continental shelf where that shelf extends in an east to west direction, and to this the lowering of temperature below the 100 fathom line at Station II. may possibly be ascribed. At the northern end of the channel, however, it would produce a relief of pressure at the greater depth, and check the slow southward movement of the ice-cold water below the level of the Wyville Thomson Ridge. This check, and the great weakening of the warm current moving northward over it, would greatly lessen the 'undertow' just at the Ridge, and the consequent mixture of hot and cold water occurring along the Faeroe-Shetland Channel. Hence we find temperatures below 200 fathoms lower than those observed in 1893, especially at Stations III. and V., where the effect of mixing was then most marked; and between the motionless bottom layer and the southward drift at the surface the feeble stream of unmixed Atlantic water shows itself as a warm wedge extending between 35 fathoms and 160 fathoms at Station VI., and tapering away to somewhere between 50 and 100 fathoms at Stations III. and V.

Averaging the differences of temperature between the surface and the

100 fathoms in 1893 and 1896, we find Station II. 0°·4 C. colder in the latter year, Stations III. and IV. practically the same, and Station VI. 0°·9 warmer. Notwithstanding the widely different characteristics of the two summers, it appears that near the north-western edge of the plateau the mean temperature of the water within 100 fathoms of the surface was nearly the same, and in the southern part of the Faeroe Channel it was actually higher in the colder season. It would be premature to discuss the meteorological significance of these facts before the data from all sources have been compared with them; but it seems only fair, in order to place the work of the 'Research' in the position it deserves, to point out that a low surface temperature over the Norwegian Sea has been followed by persistent northerly winds over western Europe throughout the last quarter of 1896, and therefore presumably by abnormally high pressures over the former region. These northerly winds have almost certainly kept the North Sea full of oceanic water, water which we know to have had a fairly high temperature, and the autumn and early winter has been unusually open and rainy in the British Isles.

The extensive system of observations organised during 1896 will, it is expected, continue in operation till the end of 1897, and it is to be hoped that the connecting link supplied by H.M.S. 'Research' during the first year will not be wanting in the second.

Note.—The following analysis of samples collected by H.M.S. 'Research,' made by Mr W. S. Anderson at the Marine Station, Granton, have been sent to me by Mr Irvine. The CO_2 determinations were made with Pettersson's apparatus, but the samples were not collected in exhausted tubes. Numbers of samples correspond to those in Table III.

	Depth in fms.	χ in grms. per Kilogrm.	Total CO_2 per litre in milli-grms.	Alkalimity CO_2 per litre in millligrms.	Probable Density as ${}_4S_{15}$ calculated from χ.
Surf. Faeroe Channel,	0	19·567 (?)	104·8	—	1026·30 (?)
No. 127	360	19·287	102·6	52·6	1025·92
,, 117	380	19·295	104·7	52·5	1025·93
,, 105	500	19·190	101·1	52·5	1025·78
,, 172	550	19·521	105·7	52·6	1026·24
,, 170	595	19·525	104·2	52·6	1026·25
,, 145	600	19·335	101·5	52·2	1025·98
,, 146	640	19·306	97·2	52·5	1025·94

TABLE I.—Temperature Observations.

No. of Station.	I.			II.		III.			IV.			IVa.		IV.		
Position, Lat.,	61° 49½′ N.			61° 45′ N.		61° 1′ N.			60° 3′ N.			2 to 3m. S.		60° 3′ N.		
Position, Long.,	0° 43′ W.			0° 59′ W.		3° 12′ W.			5° 51′ W.			of IV.		5° 51′ W.		
Date,	30th July.			30th July		31st July.			1st August.			1st August.		2nd August.		
Hour,	10 a.m.			6 p.m.		10 a.m. to 7 p m.			10.30 a.m. to 2.30 p.m.			6 p.m.		11.30 a.m. and 8 p.m.		
Depth—Fathoms,	203			218		502			575			502		548		
Wind, Direction,	N.E. by N.			N. E.		N.E.			N.E. by N.			N.N.E.		N.W.		
Wind, Force,	3-4.			3		3-4			3			3		3		
Weather,	o.c.			b.c.		o.c.			o.c.m.d.			o.c.		b.c.		
Sea,	Moderate.			Moderate.		Swell.			Moderate.			Moderate.		Moderate.		
Barometer—Inches,	30·12			30·14		30·13			30·14			30·14		30·07		
Air Temperature, F.	2°.			53°.		52°.			51°.			52°.		53°.		
	d.	T_1.	T_2.	d.	T.	d.	T_1.	T_2.	d.	T_1.	T_2.	d.	T.	d.	T_1.	T_2.
	0	54·0	53·8	0	54·0	0	53·5	53·0	0	54·0	52·4	0	54·0	0	53·7	52·0
	5	53·6	53·9	5	53·7	5	53·6	..	5	54·2	51·8	210	47·9	200	47·6	..
	10	53·6	53·2	10	52·6	10	53·2	52·1	10	54·1	53·3	220	47·6	210	48·3	..
	15	52·9	..	20	49·8	20	51·6	51·2	15	52·3	..	230	47·2	220	47·4	..
	20	52·2	50·7	30	49·1	30	49·6	48·4	20	50·7	52·3	240	48·2	230	49·6	..
	25	..	49·5	40	49·0	40	48·4	47·6	30	50·7	50·6	250	46·9	240	45·6	..
	30	49·7	..	50	48·5	50	48·0	47·2	40	49·7	50·0	260	47·2	300	40·7	..
	35	48·9	..	60	48·7	60	48·5	47·0	50	49·8	49·8	270	46·2	350	41·0	33·2
	40	48·6	..	70	48·7	70	46·7	47·0	60	49·0	49·8	300	43·5	400	32·0	..
	50	48·2	47·9	80	48·7	80	47·8	46·8	70	48·5	49·2	350	39·8	450	31·4	..
	60	47·8	..	90	48·3	90	47·6	46·3	80	48·0	48·5	400	33·1	550	31·0	..
	70	47·9	..	100	48·0	100	45·7	46·1	90	..	48·4	..	..	..	..	..
	75	47·0	..	110	47·0	110	47·0	45·5	100	47·8	48·1	..	..	..	..	..
	80	..	47·6	120	47·4	120	45·7	..	110	47·7	47·4	..	..	..	..	..
	90	..	47·5	130	47·2	150	42·8	43·3	120	47·3	..	..	..	..	..	..
	100	46·9	45·9	140	46·8	170	43·4	..	130	47·7	..	..	..	..	..	..
	110	..	46·6	150	46·3	200	38·9	..	140	47·4	..	..	..	..	..	..
	120	..	45·8	160	46·1	250	33·2	34·7	150	47·4	47·5	..	..	..	..	..
	130	..	45·6	170	45·5	270	34·0	..	160	47·3	..	..	..	..	..	..
	140	..	45·6	180	45·8	300	32·0	..	170	47·3	47·4	..	..	..	..	..
	150	45·2	44·9	190	45·4	350	31·2	..	180	47·2	..	..	..	..	..	..
	160	..	45·0	200	45·0	400	30·5	30·1	190	47·0	..	..	..	..	..	..
	170	..	44·1	210	44·9	490	29·8	30·0	200	46·9	..	..	..	..	..	..
	180	45·1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	185	44·8	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	190	44·5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

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TABLE I.—TEMPERATURE OBSERVATIONS—*continued.*

No. of Station.	IV.			V.			VI.			VII.		VIII.			IX.	
Position, Lat.,	60° 3′ N.			61° 20′ N.			60° 37′ N.			60° 7¼′ N.		60° 2′ N.			59° 42′ N.	
Position, Long.,	5° 51′ W.			4° 22′ W.			5° 37′ W.			6° 40′ W.		7° 4′ W.			7° 7′ W.	
Date,	3rd August.			4th August.			5th August.			6th August.		6th August.			7th August.	
Hour,	11 a.m. and 2 p.m.			10·30 a.m. to 9 p.m.			10.30 a.m. to 9 p.m.			10 a.m.		3.30 p.m. to 9.30 p.m.			10 a.m.	
Depth—Fathoms,	582			610			398			650		262			595	
Wind, Direction,	N.E.			N.			W.N.W.			N.W. by W.		N.W.			N.E. by N.	
Wind, Force,	2–3			3			2			2		2			3 to 5	
Weather,	b.c.			b.c.			o.c.m.d.			o.c.m.d.		o.c.			b.c.q.	
Sea,	Moderate.			Moderate.			Moderate.			Steep & lumpy.		Steep and lumpy.			Lumpy.	
Barometer—Inches,	30·08			30·15.			30·18			30·13		30·12			30·17	
Air Temperature, F.,	51°.			53°.			52°.			52°.		54°.			53°.	
	d.	T_1.	T_2.	d.	T_1.	T_2.	d	T_1.	T_2.	d.	T.	d.	T_1.	T_2.	d.	T.
	0	54·0	54·0	0	53·0	..	0	53·9	..	0	53·0	0	54·5	54·2	0	55·0
	20	53·3	..	5	53·0	..	5	53·7	53·2	600	31·0	5	54·1	53·0	550	46·8
	60	48·9	..	10	52·1	50·9	10	52·8	..	640	31·0	10	54·0	..	595	46·7
	80	49·0	..	15	51·7	..	20	51·5	51·8	..	..	15	54·0	53·9	..	..
	100	48·8	..	20	51·3	..	30	50·8	..	..	..	20	53·8	..	..	..
	140	48·7	..	30	48·8	..	50	48·9	49·5	..	..	25	53·7	..	..	..
	160	48·5	..	40	47·8	..	60	49·3	..	..	..	30	53·6	52·9	..	..
	200	46·6	46·8	50	47·2	48·2	70	48·4	..	..	..	40	51·9	..	..	..
	240	44·8	43·5	60	47·0	..	80	47·6	..	..	..	60	49·5	49·0	..	..
	260	40·2	..	80	46·5	..	90	47·9	..	..	..	70	48·6	..	..	..
	280	35·0	..	90	46·1	..	100	45·7	47·0	..	..	80	48·5	..	..	..
	300	34·6	35·6	100	46·2	46·8	120	46·1	..	..	..	90	48·4	..	..	..
	320	33·5	..	120	45·9	45·9	140	45·1	45·9	..	..	100	48·0	48·7	..	..
	340	32·9	..	140	45·4	45·8	150	46·5	..	..	..	110	48·2	48·1	..	..
	360	33·0	..	180	44·7	..	160	44·7	..	..	..	120	48·5	..	..	..
	400	31·1	..	200	40·6	..	180	42·4	43·9	..	..	130	48·3	..	..	..
	420	31·1	..	240	34·8	34·5	200	39·5	43·4	..	..	140	47·6	..	..	..
	540	30·8	..	260	34·4	34·0	220	37·4	..	..	..	150	48·2	..	..	..
	..	..	..	280	33·8	..	240	35·0	..	..	..	160	48·0	..	..	..
	..	..	..	300	..	..	260	34·4	..	..	..	180	47·5	..	..	..
	..	..	..	310	..	..	280	33·0	..	..	..	200	47·5	48·2	..	..
	..	..	..	0	..	..	300	33·1	32·5	..	..	220	47·8	..	..	..
	..	..	..	360	..	..	320	31·9	..	..	..	230	47·4	..	..	..
	..	..	..	400	..	..	340	31·7	..	..	..	240	47·8	..	..	..
	..	..	..	420	..	..	360	31·4	..	..	..	250	47·6	..	..	..
	..	..	..	440	..	..	380	30·9	..	..	..	..	..	..	..	..
	..	..	..	480	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	500	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	550	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	560	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	580	..	..	..	..	..	..	..	..	..	..	..	..

TABLE II.—Temperatures from Curves. Degrees Centigrade.

Depth. Fathoms.	Depth. Metres.	I.	II.	III.	IV.	IVA.	V.	VI.	VIII.
0	0	12·2	12·2	11·5	12·4	...	11·7	12·2	12·3
5	9	12·1	12·1	11·4	12·3	...	11·7	12·1	12·3
10	18	12·0	11·4	11·3	11·9	...	11·3	11·6	12·3
15	27	11·6	10·5	11·0	11·5	...	11·0	11·2	12·3
20	37	10·4	9·9	10·7	11·0	...	10·7	10·8	12·3
25	46	9·8	9·6	10·1	10·6	...	10·2	10·5	12·0
30	55	9·6	9·5	9·5	10·4	...	9·4	10·2	11·7
35	64	9·4	9·4	9·1	10·2	...	9·1	10·0	11·4
40	73	9·3	9·4	8·8	9·9	...	8·9	9·8	11·0
45	82	9·1	9·4	8·7	9·8	...	8·6	9·7	10·6
50	91	9·0	9·3	8·6	9·7	...	8·5	9·5	10·3
60	110	8·8	9·3	8·4	9·5	...	8·3	9·4	9·6
70	128	8·8	9·3	8·3	9·3	...	8·2	9·1	9·3
80	146	8·7	9·3	8·1	9·2	...	8·1	8·8	9·2
90	165	8·6	9·2	7·9	9·1	...	8·0	8·6	9·1
100	183	8·3	8·9	7·6	9·0	...	7·9	8·4	9·1
110	201	8·1	8·8	7·5	8·7	...	7·7	8·2	9·1
120	220	7·7	8·6	7·5	8·6	...	7·6	7·9	9·1
130	238	7·6	8·4	7·3	8·6	...	7·5	7·7	9·1
140	256	7·6	8·2	6·6	8·6	...	7·5	7·5	9·1
150	274	7·3	7·9	6·2	8·6	...	7·5	7·3	9·0
160	293	7·2	7·8	6·2	8·6	...	7·5	7·0	8·9
180	329	7·1	7·8	4·6	8·6	...	7·1	5·8	8·6
200	366	...	7·2	3·8	8·5	...	4·8	4·2	8·6
250	457	...	...	1·4	5·6	8·4	1·4	1·5	8·6
300	549	...	...	0·0	1·4	5·6	0·7	0·2	...
350	640	...	...	−0·4	0·6	4·7	0·2	−0·2	...
400	732	...	...	−0·8	0·0	...	0·0	...	...
450	823	...	...	−1·0	−0·2	...	−0·3	...	...
500	914	...	...	...	−0·4	...	−0·5	...	...
550	1006	...	...	...	−0·6	...	−0·6	...	...
600	1097	...	...	...	...	...	...	...	...
Bottom, . . .		6·9	7·2	−1·1	−0·6	4·6	−0·7	−0·4	8·6

TABLE III.—DENSITIES AND SALINITIES, ETC.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
No. of Sample.	Date.	Position.	Depth. Fathoms.	T.	χ.	p from χ.	$_4S_{15}$ from Sprengel.	p from $_4S_{15}$.	Diff. from p χ.	$_4S_{15}$ from χ.	$_4S_T$.	SO_3.	$\frac{100\ SO_3}{Cl}$.
	1896.												
1	July 30	Station I.	15	11·6	19·45	35·14	...	...	...	26·17	26·85	...	...
2	„	„	190	6·9	19·50	35·23	...	...	...	26·24	27·66	231	11·83
3	„	„	35	9·4	19·45	35·14	...	...	...	26·17	27·22	...	...
4	„	„	75	8·8	19·51	35·27	26·31	35·33	−0·06	26·27	27·41	...	...
5	„	„	120	7·7	19·47	35·17	...	...	...	26·19	27·49	...	...
6	„	„	170	7·2	19·48	35·19	...	...	...	26·20	27·57	...	...
7	„	„	0	12·2	19·49	35·21	...	...	...	26·22	26·79	231	11·85
8	„	„	5	12·1	19·50	35·23	26·15	35·12	+0·11	26·24	26·84	...	...
9	„	„	10	12·0	19·46	35·15	...	...	...	26·17	26·78	...	...
10	„	„	20	10·4	19·49	35·21	...	...	...	26·22	27·10	...	...
11	„	„	25	9·8	19·49	35·21	...	...	...	26·22	27·20	...	...
12	„	„	50	9·0	19·50	35·23	26·16	35·13	+0·10	26·24	27·35	...	...
13	„	„	100	8·3	19·49	35·21	...	...	...	26·22	27·42	...	...
14	„	„	150	7·3	19·47	35·17	...	...	...	26·19	27·55	...	...
15	„	Station II.	50	9·3	19·46	35·15	...	...	...	26·17	27·23	...	...
16	„	„	110	8·8	19·52	35·27	26·24	35·23	+0·04	26·27	27·35	...	...
17	„	„	170	7·8	19·46	35·15	...	...	...	26·17	27·39	230	11·82
18	„	„	0	12·2	19·46	35·15	...	...	...	26·17	26·74	231	11·87
19	„	„	210	7·2	19·45	35·14	...	...	...	26·17	27·54	230	11·82
20	„	Lat. 61° 35′ N., Long. 1° 32′ W.	0	11·9	19·45	35·14	...	...	...	26·17	26·80	...	...
21	July 31	„ 61° 27½′ N., „ 1° 55′ W.	0	12·1	19·45	35·14	...	...	...	26·17	26·77	...	...
22	„	„ 61° 20′ N., „ 2° 15′ W.	0	12·2	19·47	35·17	...	...	...	26·19	26·77	...	...
23	„	„ 61° 12′ N., „ 2° 38′ W.	0	12·2	19·40	35·05	...	...	...	26·10	26·67	...	...
24	„	Station III.	0	11·5	19·45	35·14	26·17	35·14	0·00	26·17	26·87	...	...
25	„	„	190	4·5	19·26	34·84	...	...	...	25·95	27·65	227	11·79
26*	„	„	490	−1·1	...	35·10	26·31	35·33	...	...	...	...	...
27	„	„	0	11·5	19·47	35·17	26·22	35·21	−0·04	26·19	26·88	...	...
28	„	„	125	7·5	19·48	35·16	...	...	...	26·18	27·50	...	...
29	„	„	400	−0·8	19·33	34·93	26·03	34·96	−0·03	26·01	28·16	228	11·81
30	„	„	5	11·4	19·45	35·14	26·10	35·05	+0·09	26·17	26·88	...	...
31	„	„	10	11·3	19·43	35·10	...	...	...	26·14	26·87	...	...

32	,,	,,	20	10·7	19·43	35·12	...	...	...	26·15	26·98	...	...
33	,,	,,	30	9·5	19·43	35·10	...	...	...	26·14	27·17	...	...
34	,,	,,	40	8·8	19·45	35·14	...	...	...	26·17	27·31	...	...
35	,,	,,	50	8·6	19·43	35·10	...	...	...	26·14	27·31	...	...
36	,,	,,	60	8·4	19·47	35·17	...	...	...	26·19	27·40	...	...
37	,,	,,	70	8·2	19·46	35·15	...	...	...	26·17	27·39	...	...
38	,,	,,	80	8·2	19·46	35·15	...	...	...	26·17	27·39	...	...
39	,,	,,	90	7·9	19·45	35·14	...	...	...	26·17	27·44	...	...
40	,,	,,	100	7·6	19·45	35·14	...	...	...	26·17	27·48	231	11·86
41	,,	,,	110	7·5	19·43	35·10	...	...	...	26·14	27·46	...	...
42	,,	,,	150	6·2	19·48	35·20	26·27	35·27	−0·07	26·21	27·71	...	...
43	,,	,,	250	1·4	19·46	35·15	26·21	35·20	−0·05	26·17	28·15	231	11·90
44	,,	Lat. 60° 52′ N., Long. 3° 31′ W.	0	12·3	19·48	35·19	...	...	...	26·20	26·76	...	...
45	,,	,, 60° 46′ N., ,, 3° 53′ W.	0	11·4	19·43	35·10	...	...	...	26·14	26·85	...	...
46	Aug. 1	,, 60° 33′ N., ,, 4° 25′ W.	0	11·9	19·49	35·21	...	...	...	26·22	26·85	...	...
47	,,	,, 60° 22′ N., ,, 4° 58′ W.	0	11·2	19·53	35·29	...	...	...	26·28	27·03	...	...
48	,,	,, 60° 13′ N., ,, 5° 22′ W.	0	10·4	19·46	35·15	26·18	35·16	−0·01	26·17	27·05	...	...
49	,,	Station IV.	0	11·9	19·45	35·14	26·27	35·27	−0·13	26·17	26·79	...	...
50	,,	,,	120	8·6	19·49	35·21	...	...	...	26·22	27·39	...	...
51	,,	,,	110	8·7	19·49	35·21	...	...	...	26·22	27·37	...	...
52	,,	,,	200	8·5	19·49	35·17	26·31	35·33	−0·16	26·19	27·37	231	11·86
53	,,	,,	190	8·5	19·47	35·17	...	...	...	26·19	27·37	231	11·86
54	,,	,,	5	12·3	19·46	35·15	...	...	...	26·17	26·72	...	...
55	,,	,,	10	11·9	19·48	35·19	...	...	...	26·20	27·11	...	...
56	,,	,,	20	11·0	19·49	35·21	...	...	...	26·22	27·00	...	...
57	,,	,,	30	10·4	19·49	35·21	...	...	...	26·22	27·10	...	...
58	,,	,,	40	9·9	19·46	35·15	...	...	...	26·17	27·14	...	...
59	,,	,,	50	9·7	19·48	35·19	...	...	...	26·20	27·20	...	...
60	,,	,,	60	9·5	19·50	35·23	26·13	35·09	+0·14	26·24	27·27	...	...
61	,,	,,	70	9·3	19·46	35·15	...	...	...	26·17	27·23	...	...
62	,,	,,	80	9·2	19·51	35·25	...	...	...	26·25	27·33	...	...
63	,,	,,	90	9·1	19·46	35·15	...	...	...	26·17	27·26	...	...
64	,,	,,	100	9·0	19·48	35·19	...	...	...	26·20	27·31	...	...
65	,,	,,	130	8·6	19·53	35·28	...	...	...	26·27	27·34	...	...
66	,,	,,	150	8·6	19·53	35·28	26·22	35·21	+0·07	26·27	27·34	...	...
67	,,	,,	170	8·6	19·52	35·27	...	...	...	26·27	27·34	...	...
68	,,	,,	0	12·2	19·62	35·45	26·33	35·35	+0·10	26·40	26·97	...	...
69	Aug. 2	Lat. 60° 2⅓′ N., Long. 5° 30⅓′ W.	0	?	19·63	35·47	...	...	...	26·42	?	...	...
70	,,	,, 60° 2½′ N., ,, 5° 59½′ W.	0		19·51	35·25	...	...	...	26·25	?	...	...

TABLE III.—DENSITIES AND SALINITIES, ETC.—*continued.*

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
No. of Sample.	Date.	Position.	Depth. Fathoms.	T.	χ.	p from χ.	${}_4S_{15}$ from Sprengel.	p from ${}_4S_{15}$.	Diff. from $p\ \chi$.	${}_4S_{15}$ from χ.	${}_4S_T$.	SO_3.	$\frac{100\ SO_3}{Cl}$.
	1896.												
71	Aug. 2	Station IV.	0	12·1	19·60	35·41	...	...	...	26·37	26·96	.	...
72	"	"	0	13·6?	19·53	35·29	...	...	...	26·28	26·58?	...	...
73*	"	"	550	−0·5	19·56	35·34	26·32	35·34	0·00	26·32	28·46	...	...
74	Aug. 3	"	0	12·2	19·62	35·45	26·35	35·38	+0·07	26·40	26·97	...	...
75	"	"	400	0·0	19·37	34·99	...	...	...	26·05	28·14	228	11·77
76	"	"	0	12·2	19·61	35·44	26·27	35·27	+0·17	26·40	26·97	...	...
77*	"	"	420	−0·1	19·51	35·25	26·18	35·16	+0·09	26·25	28·36	230	11·78
78	"	"	320	0·8	19·37	35·00	26·05	34·99	+0·01	26·06	28·09	228	11·77
79	"	"	0	12·2	19·55	35·32	...	...	...	26·30	26·87	...	...
80	"	"	260	4·5	19·54	35·31	26·28	35·29	+0·02	26·30	28·00	...	...
81	"	"	540	−0·5	19·35	34·96	...	...	...	26·03	28·16	227	11·74
82	"	"	0	12·7	19·53	35·28	...	...	...	26·27	26·75	...	...
83	"	"	300	1·4	19·57	35·36	...	...	...	26·34	28·26	...	...
84	"	"	0	12·2	19·59	35·41	26·34	35·36	+0·05	26·37	26·94	...	...
85	"	"	360	0·6	19·33	34·93	...	...	...	26·01	28·05	...	...
86	"	Lat. 60° 20′ N., Long. 5° 30′ W.		12·2	19·56	35·34	...	...	...	26·32	26·89	...	...
87	"	" 60° 30½′ N., " 5° 19′ W.	0	12·3	19·59	35·40	...	...	...	26·36	26·91	...	...
88	Aug. 4	" 60° 58½′ N., " 4° 49½′ W.	0	11·6	19·52	35·26	...	...	...	26·26	26·94	...	...
89	"	" 61° 14′ N., " 4° 27′ W.	0	11·6	19·47	35·17	...	...	...	26·19	26·87	...	...
90	"	" 61° 20′ N., " 4° 18′ W.	0	11·7	19·55	35·32	26·22	35·21	+0·11	26·30	26·96	...	...
91*	"	Station V.	440	−0·2	19·50	35·24	...	...	...	26·24	28·35	...	...
92	"	"	320	0·4	19·31	34·90	...	...	...	25·99	28·05	...	...
93	"	"	0	12·2	19·48	35·19	...	...	...	26·20	26·77	229	11·78
94	"	"	360	0·1	19·28	34·84	...	...	...	25·94	28·04	226	11·72
95	"	"	0	12·1	19·54	35·30	...	...	...	26·29	26·88	...	...
96*	"	"	300	0·7	19·39	35·02	25·98	34·89	+0·13	26·07	28·10	...	...
97	"	"	0	11·6	19·51	35·25	...	...	...	26·25	26·93	...	...
98	"	"	580	−0·7	19·27	34·82	...	...	...	25·93	28·08	...	...
99	"	"	560	−0·6	19·34	34·94	...	...	...	26·01	28·15	226	11·71
100	"	"	240	1·7	19·37	35·00	...	...	...	26·06	28·02	228	11·79
101	"	"	260	1·2	19·28	34·85	...	...	...	25·94	27·95	229	11·87
102	"	"	0	11·6	19·51	35·26	26·21	35·20	+0·06	26·26	26·94	...	...
103*	"	"	310	0·5	19·42	35·08	...	...	...	26·12	28·17	...	...

104	,,	,,	0	11·3	19·48	35·19	...	...	...	26·20	26·93	...	...
105	,,	,,	500	−0·5	19·29	34·86	...	...	...	25·96	28·09	228	11·83
106	,,	,,	180	7·1	19·51	35·25	...	...	...	26·25	27·64	...	...
107	,,	,,	100	7·9	19·51	35·25	...	...	...	26·25	27·51	228	11·70
108	,,	,,	0	11·7	19·51	35·25	26·29	35·30	−0·05	26·25	26·91	...	...
109	,,	,,	10	11·3	19·47	35·21	...	...	...	26·22	26·95	...	...
110	,,	,,	50	8·5	19·54	35·30	...	...	...	26·29	27·47	...	...
111	,,	Lat. 61° 15′ N., Long. 4° 30′ W.	0	11·7	19·54	35·30	...	...	...	26·29	26·95	...	...
112	Aug. 5	,, 61° 5′ N., ,, 4° 48′ W.	0	11·6	19·55	35·31	...	...	...	26·30	26·98	...	...
113	,,	,, 60° 55′ N., ,, 5° 9′ W.	0	11·7	19·54	35·30	...	...	...	26·29	26·95	...	...
114	,,	,, 60° 45′ N., ,, 5° 23′ W.	0	11·7	19·56	35·34	...	...	...	26·32	26·98	...	...
115	,,	,, 60° 37′ N., ,, 5° 37′ W.	0	11·9	19·54	35·31	...	...	...	26·30	26·93	...	...
116	,,	Station VI.	0	12·2	19·52	35·26	26·17	35·14	+0·12	26·26	26·83	...	...
117	,,	,,	380	−0·6	19·32	34·91	...	...	...	26·00	28·14	228	11·80
118	,,	,,	0	12·2	19·54	35·30	...	...	...	26·29	26·86	231	11·81
119	,,	,,	340	−0·2	19·33	34·93	...	...	...	26·01	28·12	228	11·82
120	,,	,,	0	12·2	19·54	35·29	...	...	...	26·28	26·85	...	...
121	,,	,,	320	−0·1	19·35	34·96	...	...	...	26·03	28·13	...	...
122*	,,	,,	300	0·3	19·48	35·19	...	...	...	26·20	28·27	...	...
123*	,,	,,	280	0·6	19·45	35·14	...	...	...	26·17	28·21	...	...
124	,,	,,	260	1·3	19·35	34·96	25·92	34·81	+0·15	26·03	28·02	...	...
125	,,	,,	0	12·1	19·61	35·43	...	...	...	26·39	26·98	...	...
126	,,	,,	220	3·0	19·50	35·23	...	...	...	26·24	28·09	...	...
127	,,	,,	360	−0·3	19·34	34·94	...	...	...	26·01	28·12	229	11·83
128	,,	,,	0	12·8	19·62	35·45	...	...	...	26·40	26·86	...	...
129	,,	,,	100	8·3	19·55	35·32	...	...	...	26·30	27·51	...	...
130	,,	,,	90	8·8	19·57	35·36	...	...	...	26·34	27·48	...	...
131	,,	,,	0	12·2	19·63	35·47	...	...	...	26·42	26·99	...	...
132	,,	,,	200	6·3	19·44	35·11	...	...	...	26·14	27·63	...	...
133	,,	,,	5	11·8	19·59	35·40	...	...	...	26·36	27·00	...	...
134	,,	,,	10	11·6	19·56	35·34	...	...	...	26·32	27·00	...	...
135	,,	,,	20	11·0	19·57	35·36	...	...	...	26·34	27·12	...	...
136	,,	,,	50	9·7	19·56	35·33	...	...	...	26·31	27·31	...	...
137	,,	,,	150	8·1	19·56	35·34	...	...	...	26·32	27·56	...	...
138	,,	,,	0	12·1	19·59	35·40	26·27	35·27	+0·13	26·36	26·95	...	...
139	,,	Lat. 60° 34½′ N., Long. 5° 40′ W.	0	12·2	19·62	35·45	...	...	...	26·40	26·97	...	...
140	Aug. 6	,, 60° 27½′ N., ,, 6° 1′ W.	0	11·6	19·50	35·22	...	...	...	26·23	26·89	...	...
141	,,	,, 60° 20¾′ N., ,, 6° 22½′ W.	0	11·7	19·49	35·21	26·28	35·29	−0·08	26·22	26·88	...	...
142	,,	,, 60° 14′ N., ,, 6° 43′ W.	0	11·6	19·50	35·23	...	...	...	26·24	26·92	...	...

TABLE III.—DENSITIES AND SALINITIES, ETC.—*continued.*

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
No. of Sample.	Date.	Position.	Depth. Fathoms.	T.	χ.	p from χ.	${}_4S_{15}$ from Sprengel.	p from ${}_4S_{15}$.	Diff. from $p\ \chi$.	${}_4S_{15}$ from χ.	${}_4S_T$.	SO_3.	$\frac{100\ SO_3}{Cl}$.
	1896.												
143	Aug. 6	Lat. 60° 8′ N., Long. 7° 2′ W.	0	11·7	19·60	35·41	...	...	...	26·37	27·03	...	...
144	,,	Station VII.	0	11·7	19·62	35·45	...	...	...	26·40	27·06	...	...
145	,,	,,	600	−0·6	19·26	34·81	...	...	...	25·92	28·06	227	11·80
146	,,	Lat. 60° 7¼′ N., Long. 6° 39½′ W.	640	−0·6	19·27	34·82	...	...	...	25·93	28·07	228	11·82
147	,,	,,	0	11·7	19·56	35·34	...	...	...	26·32	26·98	...	...
148	,,	,, 60° 5½′ N., ,, 6° 56½′ W.	0	12·5	19·58	35·38	...	...	...	26·35	26·87	...	...
149	,,	Station VIII.	250	8·7	19·60	35·41	...	...	...	26·37	27·52	...	...
150	,,	,,	220	8·8	19·56	35·34	...	...	...	26·32	27·46	...	...
151	,,	,,	240	8·8	19·60	35·41	...	...	...	26·37	27·51	231	11·77
152	,,	,,	0	12·5	19·61	35·44	...	...	...	26·40	26·92	231	11·78
153	,,	,,	200	9·0	19·59	35·40	...	...	...	26·36	27·47	...	...
154	,,	,,	0	12·3	19·60	35·41	...	...	...	26·37	26·92	...	...
155	,,	,,	130	9·1	19·56	35·34	...	...	...	26·32	27·51	...	...
156	,,	,,	150	9·0	19·59	35·40	26·26	35·26	+0·14	26·36	27·47	...	...
157	,,	,,	0	12·3	19·59	35·40	...	...	...	26·36	26·91	...	...
158	,,	,,	5	12·0	19·59	35·40	...	...	...	26·36	26·97	...	...
159	,,	,,	15	12·2	19·59	35·40	...	...	...	26·36	26·93	...	...
160	,,	,,	30	12·0	19·57	35·36	...	...	...	26·34	26·95	...	...
161	,,	,,	40	11·1	19·57	35·36	...	...	...	26·34	27·10	...	...
162	,,	,,	60	9·7	19·57	35·36	...	...	...	26·34	27·34	...	...
163	,,	,,	100	9·3	19·55	35·32	26·18	35·16	+0·16	26·30	27·36	...	...
164	,,	Lat. 60° 0′ N., Long. 7° 6′ W.	0	12·3	19·59	35·40	...	...	...	26·36	26·91	...	...
165	,,	,, 59° 50′ N., ,, 7° 20′ W.	0	12·5	19·62	35·45	...	...	...	26·40	26·92	...	...
166	Aug. 7	,, 59° 49¾′ N., ,, 7° 22′ W.	0	11·6	19·66	35·54	...	...	...	26·48	27·15	...	...
167	,,	,, 59° 49½′ N., ,, 7° 22′ W.	0	12·7	19·57	35·36	...	...	...	26·34	26·82	...	...
168	,,	,, 59° 49′ N., ,, 7° 24′ W.	0	12·7	19·59	35·40	...	...	...	26·36	26·84	...	...
169	,,	,, 59° 49′ N., ,, 7° 25′ W.	0	12·6	19·59	35·40	...	...	...	26·36	26·85	...	...
170	,,	Station IX.	595	8·2	19·53	35·28	...	...	...	26·27	27·49	231	11·85
171	,,	,,	0	12·8	19·56	35·34	...	...	...	26·32	26·80	...	...
172	,,	,,	550	8·2	19·56	35·35	...	...	...	26·33	27·55	231	11·81
173	,,	,,	0	12·8	19·55	35·32	...	...	...	26·30	26·77	...	...
174	,,	Lat. 59° 38½′ N., Long. 6° 31½′ W.	0	12·8	19·66	35·52	...	...	...	26·46	26·92	232	11·82
175	,,	,, 59° 35′ N., ,, 5° 55′ W.	0	12·8	19·64	35·48	...	...	...	26·43	26·89	232	11·83

X.—REPORT ON THE PHYTO-PLANKTON COLLECTED ON THE EXPEDITION OF H.M.S. 'RESEARCH,' 1896. By Professor P. T. CLEVE, LL.D., of the University of Upsala, Sweden. (Pl. VIII.)

From the Fishery Board for Scotland I received for examination a series of samples collected last summer around the Shetland Islands. Some of the samples were so poor in diatoms and cilioflagellates that they are omitted in the following account.

The samples examined were the following:—

1. Station Jackal II., lat. 61° 45′ N., long. 0° 59′ W., 30th July, 10 a.m.
2. „ „ „ „ 1 p.m.
3. „ „ „ „ 3 p.m.
4. Station Jackal XIII., lat. 61° 1′ N., long. 3° 12′ W., 31st July, 10 a.m.
5. „ „ „ „ 11.30 a.m.
6. „ „ „ „ 2 p.m.
7. Station Jackal XIV., lat. 61° 20′ N., long. 4° 22′ W., 4th Aug., 11 a.m.
8. „ „ „ „ 2 p.m.
9. Station Jackal XVII., lat. 60° 34·5′, long. 5° 37·5′, 5th Aug., 2 p.m.
10. „ „ „ „ 3.30 p.m.
11. Station Knight Errant 28, lat. 60° 2′ N., long. 7° 11′ W., 6th Aug., 11.30 a.m.
12. „ „ „ „ 6 p.m.
13. „ „ „ „ 8 p.m.
14. Station Knight Errant 33, lat. 60° 3′ N., long. 5° 51′ W., 1st Aug., 10 a.m.
15. „ „ „ „ 2 to 4 p.m.
16. „ „ „ „ 3rd Aug., 11 a.m.
17. „ „ „ „ 2 p.m.

The more important forms are named in the following table (p. 298), where *r* signifies rare and *c* common, *cc* very common, + neither rare or common.

A complete enumeration of the forms, with remarks, will be found later on. In order to get as complete a list as possible, I treated a mixture of all the samples with acids, and examined the cleaned forms. This sample is in the following pages named 'mixed sample.'

LIST OF SPECIES.

A. DIATOMS.

Asteromphalus heptactis (Bréb.), Ralfs. (Pritch., Pl. VIII. fig. 21; *Spatangidium Ralfsianum*, Norm. M.J. VII. (1859), Pl. VII. figs. 7, 8; *Asteromphalus Ralfs.*, A. Schm., Atl., Pl. XXXVIII. figs. 5–8) occurs rarely in some samples, and has been observed by M. Grove in samples from Färö (Knight Errant Exp.) and by various observers in guano from California and Peru. It belongs to the warmer Atlantic. Another species, *A. atlanticus*, Cl., occurs also in the Atlantic, but in company with *Chœtoceros-species*, and seems to characterise the chœtoceros-plankton as *A. heptactis* does the east atlantic plankton. *A. atlanticus* is found in Davis Strait, and this summer near Spitsbergen always in chœtoceros-plankton.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
DIATOMS.	*r*	*r*	*r*	*r*	+	+	+	*cc*	*cc*	*cc*	*c*	+	*c*	*c*	*cc*	*c*	*c*
Asteromphalus heptactis, Ralfs.,	.	.	.	.	.	.	*r*	.	.	.	*r*	.	.	.	.	.	*r*
Bacteriastrum delicatulum, Cl.,	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.	.	.	*r*
Cerataulina Bergonii, H. P., .	.	.	.	.	.	.	.	.	.	.	*r*	.	.	*r*	.	.	*r*
Chætoceros atlanticus, Cl., .	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.	.	.	*r*
C. borealis, Btw., . . .	.	*r*	*r*	*r*	*r*	*r*	*r*	.	.	*r*	*r*	.	.	*r*	.	.	.
C. currens, Cl., ...	.	.	.	.	.	*r*	+	.	.	*r*	*r*	*rr*	.	.	.	.	.
C. decipiens, Cl., . . .	.	.	.	.	.	.	*r*	.	.	*r*	.	.	.	*r*	.	.	*r*
C. peruvianus, Btw., . .	.	.	.	.	*r*	.	*r*	.	.	.	.	.	.	.	.	.	.
Corethron hysrtix, Hensen., .	.	.	.	.	.	.	*r*	.	.	*r*	*r*	.	.	.	.	.	*r*
Dactyliosolen antarcticus, Castr.,	*r*	.	.	.	.	.	*r*	.	.	*r*	*r*	*r*	.	.	.	.	*r*
D. mediterraneus var. *tenuis*, Cl.,	.	.	.	.	.	.	*r*	.	.	.	*r*	.	.	.	.	.	*r*
Nitzschia seriata, Cl., . .	.	.	.	.	.	.	.	.	.	*r*	*r*	.	.	.	.	.	*r*
Rhizosolenia alata, Btw., . .	+	.	.	.	.	.	+	*cc*	*c*	*cc*	.	+	*c*	*cc*	*cc*	*c*	*c*
R. al. var. *gracillima*, Cl., . .	.	.	.	*r*	.	.	*r*	.	*c*	*c*	.	*r*	.	.	.	*c*	.
R. styliformis, Btw., . .	+	+	+	+	+	+	+	+	*c*	*cc*	*c*	+	*cc*	*c*	+	+	*c*
CILIOFLAGELLATES.	*cc*	*cc*	*cc*	*cc*	*cc*	*cc*	+	*r*	*r*	*r*	*r*	*c*	+	+	.	*r*	+
Ceratium furca, Duj., . .	+	+	*r*	+	+	+	+	*r*	.	*r*	.	.	*r*	*r*	.	.	*r*
C. fusus, Duj., ...	+	+	*r*	+	+	+	.	*r*	.	.	*r*	.	.	.	.	.	*r*
C. tripos, Ehb. type, . . .	*c*	*c*	*c*	*c*	*c*	*c*	+	*r*	*r*	+	+	*c*	*c*	*c*	.	*r*	*c*
C. tripos var. *horrida*, Cl., .	+	+	+	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	.	.	.	*r*
C. tripos var. *longipes*, Baile, .	*r*	.	.	*r*	.	.	.	.	.	.	.	*r*	+	*r*	.	*r*	*r*
Peridinium divergens, Ehb., .	*r*	*r*	.	*r*	*r*	*r*	*r*	.	*r*	*r*	*r*	.	*r*	*r*	.	.	
Pyrophacus horologium, Stein.,	.	.	.	.	.	.	.	.	.	.	.	*rr*	.	*r*	.	.	*r*
CHLOROPHYLLACEAN.																	
Halosphora viridis, Schmitz, .	.	.	.	*r*	*r*	.	.	.	.	.	.	.	.	*r*	.	.	.

Bacteriastrum delicatulum, Cl., n. sp. (Pl. fig. 15). Slightly silicious. Frustule cylindrical. Long. axis, 0·015; diam., 0·012 mm. Awns arising inside the margin of the valve, furcate, with distinct basal part (in length 0·002 mm.), about eight in the circle.—This species was found very rarely in some samples. It is distinguished from *B. varians* by its delicate membrane and the long basal parts of the awns. The cell-contents were heaped at the valves, but my specimens were perhaps not healthy when killed by the alcohol. In *B. varians*, the cell-contents consist of a number of small chromatophores scattered along the wall of the frustule.

Cerataulina Bergonii, H. P. (Monogr. du Rhizosol., Pl. I. figs. 15, 16), rare in some samples.

Chœtoceros atlanticus, Cl. (D. f. the Arct. Sea, Pl. II. fig. 8), rare in some few samples.

Chœtoceros borealis, Btw., rare.

var. *Brightwellii*, Cl. (D. f. the Arct. Sea, Pl. II. fig. 7*a*), rare (Nos. 2, 9, 17).

var. *solitaria*, Cl., n. var. Cells isolated, or in pairs. Not very rare. (Nos. 2, 7, 9, 10, 11, 12, 17.)

Chœtoceros criophilus, Castr. (Challenger D., p. 78), rare (Nos. 11, 17).

Chœtoceros curvisetus, Cl. (Bih. K. Sv. Vet. Ak. Handl., XX. 32, Pl. I. fig. 5), very rare (Nos. 11, 17).

Chœtoceros currens, Cl., n. sp. (Pl. fig. 8). Cells isolated. Valves dissimilar. Upper valve usually the largest, convex, with the awns arising near the centre. Lower valve flat, with awns arising between the centre and the margin. Valves nearly orbicular. Awns of the upper valve directed in the direction of the sagittal axis, not distinctly striate, with a spire of conspicuous spines. Awns of the lower valve somewhat diverging. Cell-contents: scattered chromatophores, also in the awns. Long. axis, 0·02; sag. axis, 0·015; trans. axis, 0·012 mm.

This species may be the same as *C. volans*, Schütt (Ber. D. Bot. Ges., 1895, Bd. XIII. fig. 20), but in the fig. of Schütt the awns of the upper valve arise near the margin, and, besides, there is no description of the awns, so I cannot, without original specimens, identify them. *C. currens* was met with this summer in the seas around Spitsbergen and Beeren Eiland.

Chœtoceros decipiens, Cl. (D. f. Arct. S., Pl. I. fig. 5). Of this species, so abundant in the middle Atlantic, some few specimens only were found.

Chœtoceros peruvianus, Btw. (Pl. fig. 7) (M.J. IV., Pl. VII. figs. 16–18; and VI., Pl. VIII. figs. 9, 10). This species is nearly related to *C. currens*, but much coarser, and differs especially by the awns, which are coarsely transversely striate (striæ 21 in 0·01 mm.), and carry a spiral of coarse spines.

C. peruvianus belongs to the warmer seas. I know this form from Ascension, the Mediterranean, and Java.

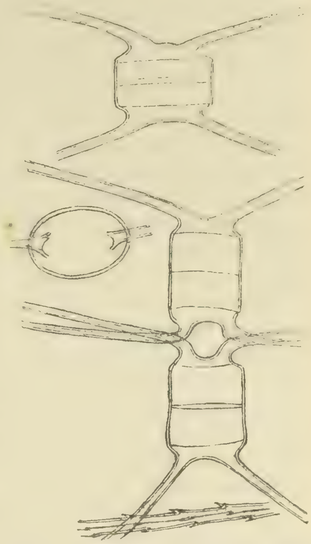


FIG. 1.—*Chœtoceros borealis*, var. *solitaria*, 500 tm.

Corethron hystrix, Hensen (Pl. fig. 15). Frustule very thin and membranaceous, cylindrical, short, with very convex valves. Long. axis, 0·04 to 0·07; diam., 0·02 to 0·03 mm. Both valves at their basis with a circlet of straight, simple awns, all in the same direction, or about 45° from the longitudinal axis; upper valve besides with a number of exceedingly delicate hairs, thickened at their ends. Cell-contents: numerous linear chromatophores, which radiate from the nucleus along the inside of the frustule. Nucleus near the connecting zone.

This species is nearly related with a form from the Antarctic Ocean, of which Mr Comber sent me specimens; also that form has, as Mr Comber pointed out, between the awns, hyaline hairs, which end in hooks, but they are much stronger than in *C. hystrix.*

C. hystrix was found only in a small number of specimens. I have also observed it this summer in samples from Beeren Eiland, and in the end of October in the middle of the North Sea. It seems to be a characteristic, but rare, form of the Atlantic plankton.

Coscinodiscus anguste-lineatus, A. Schm. (Atl., Pl. LIX. fig. 34) var. Some few valves were found in the mixed sample. Diam., 0·01 to 0·03 mm. Margin with a row of apiculi (5 in 0·01 mm.). Rows of cellules, 12 to 18 in 0·01 mm.

Coscinodiscus curvatulus, Gran. var. Some few valves in the mixed sample. Diam., 0·035 to 0·055 mm. Margin with a row of apiculi (2–3 in 0·01 mm.) and a pseudonodule. Rows of cellules almost straight, 6 to 7 in each bundle, and about 6 in 0·01 mm.

Coscinodiscus minor, Ehb. var. In the mixed sample some few valves were found of a form resembling A. S. Atl., CXIII. fig. 10, and LIX. fig. 8, but of extremely small size, 0·01 mm. only in diameter. Cellules about 12 in 0·01 mm., larger in the middle and smaller at the margin, which is striate (striæ about 20 in 0·01 mm.).

Coscinodiscus oculus iridis, Ehb. A single specimen only was found in the mixed sample.

Dactyliosolen antarcticus, Castr. (Challenger D., p. 75, Pl. IX. fig. 7), occurs in several samples, but nowhere abundant. Hitherto observed in the Antarctic Ocean only.

Dactyliosolen mediterraneus, H. P. var. *tenuis*, Cl. (Pl. fig. 14). Frustules slightly silicious, in diameter 0·01 to 0·025 mm. Annuli, 2 to 4 in 0·01 mm. Valve flat, with delicate puncta arranged in rows, which radiate from the centre, where are some scattered puncta. Connective zone, with fine, elongate puncta arranged in lines parallel to the longitudinal axis, about 24 in 0·01 mm.

This form agrees with *D. medit*, H. P. (Monogr. d. Rhizosol, Pl. I. figs. 8, 9), in most respects, but not in the strength of the membrane, which is described as being strongly silicious.

Hemidiscus cuneiformis, Wallich (Janisch. Gazelle Exp., Pl. I. fig. 7). Some few valves in the mixed sample.

Navicula fusiformis, Grun. var. A very small, exceedingly delicate, form, in length 0·035 mm. only, was found in the mixed sample.

Nitzschia closterium, W. Sm. A delicate variety, with straight beaks, was rarely found in Nos. 5, 8, 12, 16, 17.

Nitzschia lineola, Cl., n. sp. (Pl. fig. 10). Valve narrow, acute. L., 0·1 to 0·11 mm.; B., 0·002 mm. Keel eccentric, its puncta 14 in 0·01 mm. Striæ, 24 in 0·01 mm. This exceedingly delicate form was observed rarely in No. 14.

Nitzschia (*Tryblionella*) *migrans*, Cl., n. sp. (Pl. fig. 9). Valve flat, with parallel margins and subcuneate somewhat obtuse ends. L., 0·035 mm.; B., 0·007 mm. Keel-puncta indistinct. Striæ coarse, 11 in 0·01 mm.

This species was found in isolated specimens, rarely in Nos. 12 and 13. It is related to *N. seriata*, Cl.

Nitzschia seriata, Cl. (Vega Exp. D., Pl. XXXVIII. fig. 75). This species, which occurs in the Arctic Sea, and occasionally in the North Sea the Irish Channel, was met with in some few samples only. It is the only arctic form observed in the 'Research' samples.

This species may easily be mistaken for another form, which I name *N. fraudulenta*, n. sp. The latter (Pl. fig. 11) occurs in chains as *N. seriata*, but is much more delicate, and has finer striæ (23 in 0·01 mm.), which are seen only with difficulty, whilst *N. seriata* is coarsely striate.

N. fraudulenta was found last summer in the harbour of Plymouth, and at the end of October in the middle of the North Sea. It is a southern, and *N. seriata* a northern, form, perhaps of the same species.

Rhizosolenia alata, Btw. (M.J. VI., Pl. V. fig. 8). This species was exceedingly common in several samples, especially from the western stations. The form found there was the typical one, but variable in size, so that several specimens must be considered as belonging to *R. alata* var. *gracillima*, Cl. The latter form, but not the typical, occurs in summer-time in large masses in the Kattegatt and Skagerak. This variety was also found as the principal constituent of the plankton near Beeren Eiland in September this year. At both places I have sometimes met with specimens, of which one-half belongs to *R. alata* and the other to *R. gracillima* (see the fig. in Van Heurck Synopsis, Pl. LXXIX. fig. 8). I am very much inclined to consider *R. alata* as an Atlantic form, which, in water of less salinity, becomes changed into *R. gracillima*.

Rhizosolenia semispina, Hensen (Pl. fig. 13). Under the name *R. setigera*, two well distinct species have been confounded, viz., the original form figured by Brightwell in M.J. VI., 1858, Pl. V. fig. 7, and the form figured in Van Heurck's Synopsis, Pl. LXXVIII. fig. 7, and in Peragallo, Monogr. du g. Rhizosol., Pl. IV. figs. 12 and 14. The original *R. setigera* is very delicate, has no markings on the calyptra. There are no rings to be seen on the connecting zone. This form has not been found in the 'Research' samples, but occurs in the winter and early spring in the Kattegatt and Skagerak, where it forms interior cells, which are identical with *Pyxilla baltica*, Grun. The figures (Pl. fig. 12) show the formation of *Pyxilla baltica* inside *R. setigera.*

The other form, named *R. semispina* by Hensen was formerly (Bih. t. K. Sv. Vet. Akad. Handl., Bd. XXII. 3, No. 5) named by me *R. setigera forma gracilis.* It is very rare in the 'Research' samples, some few specimens only having been observed in Nos. 10 and 11. On the other hand, it is of very frequent occurrence in the west Atlantic plankton, which I call *tricho-plankton.*

Rhizosolenia Stolterfothii, H. P. (Monogr. d. Rhiz., Pl. I. figs. 17, 18). A few specimens only were found in No. 11.

Rhizosolenia styliformis, Btw. This characteristic Atlantic form was found more or less abundant in most of the 'Research' samples. It seems to belong especially to the eastern parts of the Gulf-stream.

Thalassiothrix longissima, Cl. and Grun. Of this species, which occurs in the western Atlantic (south west of Iceland) in enormous masses, some few specimens only were found in Nos. 7, 11, 14, 17.

B. Cilioflagellates.

Ceratium furca, Duj.

Ceratium fusus, Duj.

Ceratium tripos, Ehb. This widely distributed species occurs in different varieties, which it is of importance to distinguish. Ehrenberg named a variety *macroceros* and another *arctica*, but did not give any figures of them. In the Infusionsthierschen, Pl. XXII. fig. 18, he figures two forms, of which the left is the most common, and may be considered as *the type*, and is as such figured by Claparède and Lachman. It corresponds with the var. *baltica*, Schütt (Beschr. d. Plankton-Exp. von Krümmel, pp. 266 and 302). The right figure corresponds in outline with the variety *arctica*, figured by Claparède and Lachman, Etudes sur les infusoires, Pl. XIX. fig. 3. This is evidently the same as Schütt's var. *labradorica*, *l.c.* The other variety, *macroceros*, is figured by Claparède and Lachman, fig. 1. This easily recognised form has been named *scotica* by Schütt.

Schütt adds two other varieties, viz., *parvula*, the figure of which is insufficient for indentification, and *tergestina.* The latter has in my paper (in Bih. K. Sv. Vet. Akad. Handl., XXII. 3, No. 5) been named *arctica* Aur, but was figured by Bailey, already 1854, as *Peridinium longipes* (Smithsonian contr., Vol. vii. f. 35). To these varieties I will add two, viz., *C. tripos* var. *bucephalus* and *C. tripos* var. *horrida.*

I give on Plate figures of all these varieties.

1. *C. tripos type* = *C. tripos* var. *baltica*, Schütt, fig. 1, is very common in the North Sea and in the 'Research' samples. In the Kattegatt and Skagerak it belongs to the summer plankton or the tripos-plankton.

2. *C. tripos* var. *macroceros*, Ehb. = *C. tripos* var. *scotica*, Schütt, fig. 6, very common in the English Channel and the south part of the North Sea. It was found very rarely in the 'Research' samples No. 10. In the Kattegatt and Skagerak it appears in the summer and autumn,

always in company with southern forms, and it belongs to tripos- and didymus-plankton.

3. *C. tripos* var. *arctica*, Ehb. = *C. tripos* var. *labradorica*, Schütt, fig. 3, is abundant in Baffin's Bay and the Labrador current. The form figured by Claparède and Lachman is remarkable for the coarse apiculi on the horns and the tail. It has not yet been found with certainty in the Kattegatt and Skagerak.

4. *C. tripos* var. *longipes*, Bail = *tergestina*, Schütt, *arctica*, Aur, fig. 2, was rarely found in the 'Research' samples; it occurs in the winter abundantly in the Kattegatt and Skagerak.

5. *C. tripos* var. *horrida*, Cl., fig. 4, resembles the var. *longipes*, but is remarkable for the spines on the horns and the tail. Occurs, although rarely, in most of the 'Research' samples.

6. *C. tripos* var. *bucephalus*, Cl., fig. 5, was not found in the 'Research' samples, but this summer in the collections of the Swedish expedition to Spitsbergen, as well as in a sample taken at the end of October in the middle of the North Sea.

Peridinium divergens, Ehb. (Stein, *Inf.*, Pl. X. figs. 1–5).

Pyrophacus horologium, Stein (*Inf.*, Pl. XXIV.).

C. Silicoflagellates.

Dictyocha fibula, Ehb., extremely rare in the mixed sample.

Dictyocha speculum, Ehb., rarely in No. 11.

D. Chlorophyllacean.

Halosphæra viridis, Schmitz, rare in several of the samples.

Results.

In a paper published this 1896 (in Bih. K. Sv. Vet. Akad. Handl., Bd. XXII. 3, No. 5), I have distinguished in the Skagerak and Kattegatt four different types of plankton, viz. :—

I. *Tripos-plankton*, characterised by abundance of crustaceans and cilioflagellates, but usually a scarcity of diatoms, among which *Coscinodiscus concinnus* and *Rhizosolenia gracillima* are the most important. This kind of plankton rules at the west coast of Sweden in the summer, and there are reasons for believing it to be derived from the northern or southern North Sea.

II. *Didymus-plankton* (Sign N), characterised by *Chætoceros didymus*, *C. Schüttii*, *C. curvisetus*, *C. laciniosus*, *Ditylum Brightwellii*, *Leptocylindrus danicus*, *Skeletonema costatum*, *Eucampia Zoodiacus*, &c., all species belonging to the coast-plankton of the English Channel, west Scotland, and continental coasts of the North Sea. It appears in the Skagerak and Kattegatt in the autumn, and comes no doubt along the west coast of Jütland and from Norway.

III. *Tricho-plankton* (Sign T), characterised by abundance of diatoms, the most important being *Thalassiothrix longissima*, *Rhizosolenia semispina*, *Chætoceros atlanticus*, *C. borealis*, *C. decipiens*, &c., species abundant in the western part of the Atlantic, south of Iceland. It arrives to Sweden in January and February, usually mixed with the following kind : —

IV. *Sira-plankton* (Sign Si), characterised by an abundance of diatoms, the following being the most remarkable: *Thalassiosira Nordenskiöldii*, *T. gravida*, *Nitzschia seriata*, *Coscinodiscus excentricus* var. *Chœtoceros socialis*, *C. teres*, *C. scolopendra*, *C. similis*, *C. diadema*, &c. This plankton belongs to the Arctic Sea, and arrives some years (as in 1895 and 1896, but not in 1894) at the coasts of Sweden in the end of January or in February. It disappears in the spring almost completely.

The plankton collected in the 'Research' expedition has no resemblance to 2, 3, and 4, but it has to 1, or tripos-plankton, and may be considered as its Atlantic facies. A glance at the table shows that the samples belong to two types, one characterised by the scarcity of diatoms and abundance of cilioflagellates. The other shows the contrary. Now, the samples rich in diatoms have been collected at the *western* and the samples poor in diatoms at the *eastern* stations. They belong evidently to *two different* kinds of water. There is thus reason for distinguishing the two kinds of plankton as *Styli* (Sign S) and *Tripos*-plankton (Sign Tp). The former comes no doubt from the warmer Atlantic, and continues probably to Finmark and Beeren Eiland, where it seems to arrive in September. The examination of samples collected by the Swedish expedition to Spitsbergen, not yet finished, has convinced me that there ruled at Beeren Eiland, in the month of August, tricho-plankton, but in September styli-plankton of nearly the same facies as at the coast of Sweden in summer, that is, with *Rhizosolenia gracillima*. Dr Fulton informs me that the drift-bottles thrown out at the most westerly station, Knight Errant 28, have not yet been returned. There ruled S plankton. On the other hand, drift-bottles from the station Jackal II., where the plankton was Tp, landed at Scotland. Bottles from Jackal XIII. (pl. Tp) did, on the other hand, not land, but those from Jackal XVII. (pl. S) drifted ashore in Scotland. This discrepancy might be explained by the situation of the last-named stations at the boundaries between the two kinds of water, but this explanation cannot be accepted without being strengthened by the analysis of the water. That the drift-bottles from the eastern stations landed on the coast of Scotland proves that the water with Tp drifted to the south. The water with Tp had, the last summer, a very wide extension in the north-eastern Atlantic as well as in the North Sea.

EXPLANATION OF PLATE.

Fig. 1. *Ceratium tripos*, Ehb., typical (Sweden, summer-plankton), 150 t.m.

Fig. 2. *Ceratium tripos* var. *longipes*, Bail (Sweden, winter-plankton), 150 t.m.

Fig. 3. *Ceratium tripos* var. *arctica*, Ehb. (Baffins Bay), 150 t.m.

Fig. 4. *Ceratium tripos* var. *horrida*, Cl. (Shetland Islands), 150 t.m.

Fig. 5. *Ceratium tripos* var. *bucephalus*, Cl. (North Sea, Oct. 1896), 150 t.m.

Fig. 6. *Ceratium tripos* var. *macroceros*, Ehb. (the English Channel, July 1896), 150 t.m.

Fig. 7. *Chætoceros peruvianus*, Btw., 500 t.m.; *b*, piece of the awn, 1000 t.m.

Fig. 8. *Chætoceros currens*, Cl.; *a* and *b*, specimens from Spitsbergen; *c*, valve; all 500 t.m.; *d*, piece of the awn, 1000 t.m.

Fig. 9. *Nitzschia migrans*, Cl., n. sp., 1000 t.m.

Fig. 10. *Nitzschia lineola*, Cl., n. sp., 500 t.m.; *b*, piece of the valve, 1000 t.m.

Fig. 11. *Nitzschia* (*seriata* var.?) *fraudulenta*, Cl., n. sp., 500 t.m.; *b*, piece of the valve, 1000 t.m.

Fig. 12. *Rhizosolenia setigera*, Btw.; first *b* second, and *c* third, state in the formation of interior cells (*Pyxilla baltica*, Grun.); all from Sweden (March 1896); 200 t.m.

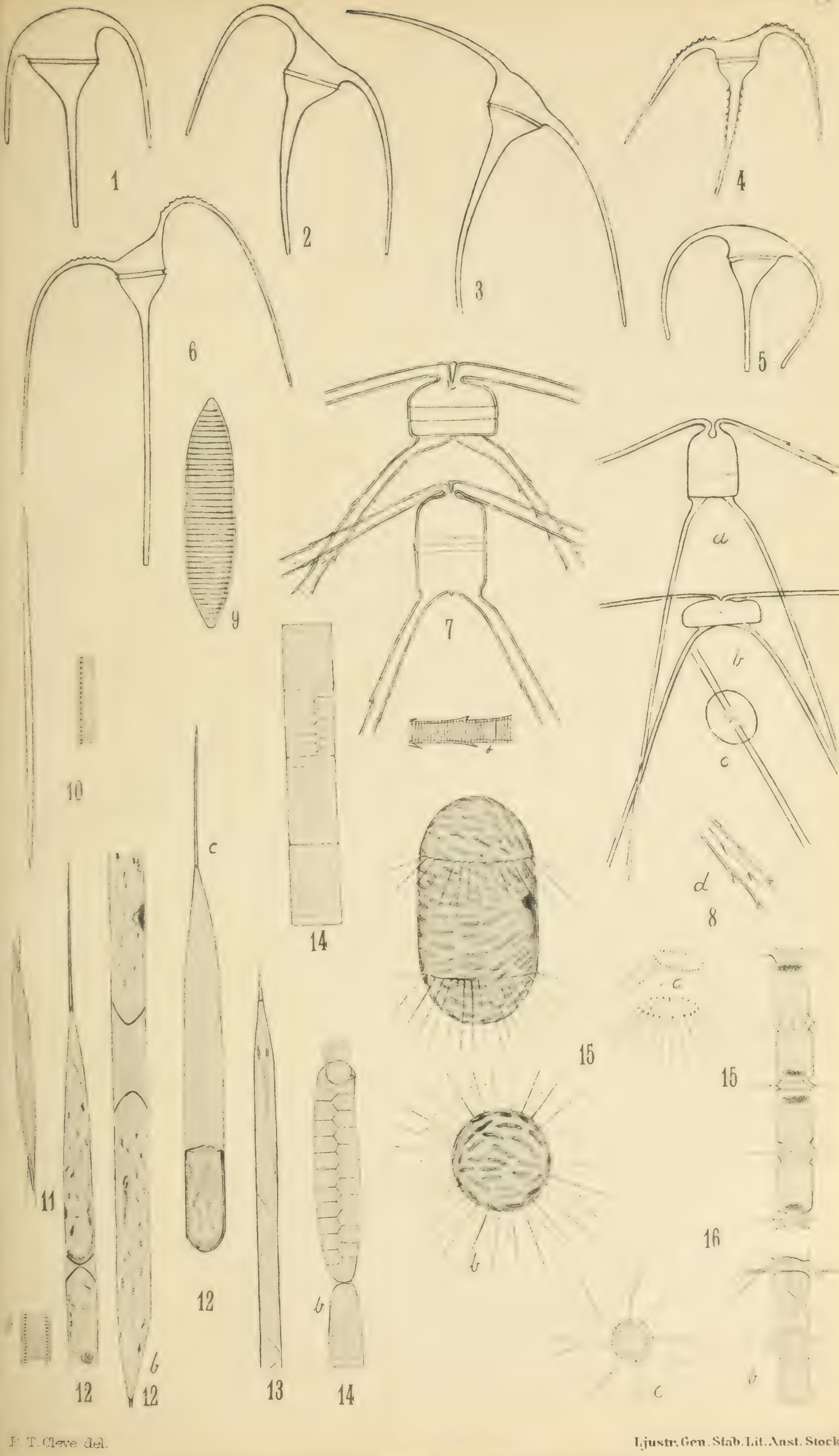
Fig. 13. *Rhizosolenia semispina*, Hensen, 500 t.m. (Sweden).

Fig. 14. *Dactyliosolen mediterraneus* var. *tenuis*, Cl.; *b*, ignited; both 500 t.m.

Fig. 15. *Corethron hystrix*, Hensen; entire frustule in zonal view; *b*, in valvular view, from the North Sea (Oct. 1896); *c*, ignited specimen from Shetland Islands; all 500 t.m.

Fig. 16. *Bacteriastrum delicatulum*, Cl., n. sp.; *b* ignited specimen; *c*, valve; all 500 t.m.

Plate. 8



F. T. Cleve del.

Ljustr. Gen. Stab. Lit. Anst. Stockh.

XI.—NOTES ON THE ANIMAL PLANKTON FROM H.M.S. 'RESEARCH.' By Thomas Scott, F.L.S.

This collection, which consisted of twenty-four tow-net gatherings, was contained in twenty-two small bottles: all the gatherings (with one exception) were collected at the surface of the water, in the Shetland-Faröe Channel, at the end of July and the beginning of August last year, by H.M.S. 'Research.' The collections were made by a tow-net made of fine silk bolting-cloth.

Detailed Description of the Collection.

1. This gathering consisted of the contents of one haul of the tow-net, collected at the surface at 'Jackal Station No. II.,' lat. 61°45'N. long. 0°59'W., on July 30th, 1896, at 10 a.m. (net down 15 minutes). The total contents were equal to about 9 c.c., of which 0·75 c.c. consisted of flocculent matter (Diatoms, Infusoria, *Ceratium*, etc.), the remainder being composed of larger organisms, chiefly Entomostraca. The plant plankton has been described by Professor Cleve (p. 297). The following organisms were observed by me :—

Calanus finmarchicus (Gunner).
Pseudocalanus elongatus, Boeck.
Temora longicornis (Müller).
Acartia Clausii, Giesbrecht.
Oithona (?) *similis*, Claus.
Podon intermedius, Lilljeborg.

The number of Entomostraca in this gathering was, approximately, about 3500, and for every 26 *Calani* there were about 6 *Pseudocalani*, 32 *Temoræ*, and 200 *Acartiæ*, while *Oithona* and *Podon* were very rare.

2. This gathering consisted of the contents of one haul of the tow-net, collected at the surface, at the same station as above, and on the same date, at 1 p.m. (net down 15 minutes). The total contents measured 8·75 c.c , of which about ·75 c.c. consisted of flocculent matter. The following organisms were observed :—

Calanus finmarchicus (Gunner).
Pseudocalanus elongatus, Boeck.
Centropages typicus, Kröyer.
Temora longicornis (Müller).
Eucalanus elongatus (Dana).
Acartia Clausii, Giesbrecht.
Oithona (?) *similis*, Claus.
Podon intermedius, Lilljeborg.
Parathemisto (?) *gracilipes*, Norman.
Limacina retroversa (Fleming).

The number of Entomostraca in this gathering was about the same as the last, and the proportion of the species was also similar. There were only one or two specimens of *Parathemisto* and of *Centropages*, and one specimen of *Eucalanus*. *Limacina* was very rare.

3. This gathering consisted of the contents of one haul of the tow-net, collected at the surface, at the same station as the other two, and on the same date, at 3 p.m. (net down 15 minutes).

The total contents of this haul measured 10 c.c., about 1 c.c. consisting of flocculent matter. The following organisms were observed in this gathering :—

Calanus finmarchicus (Gunner).
Pseudocalanus elongatus, Boeck.
Euchæta norvegica, Boeck.
Temora longicornis (Müller).
Acartia Clausii, Giesbrecht.
Oithona (?) *similis*, Claus.
Podon intermedius, Lilljeborg.
Parathemisto (?) *gracilipes*, Norman.

The number of Entomostraca was, approximately, about 4000, and the proportions of the species, the one to the other, nearly as in the formula—

Calanus,	*Pseudocalanus,*	*Temora,*	*Acartia,*	*Oithona,*	*Podon.*
50	7	24	180	12	2

There were two specimens of *Euchæta* and one of *Parathemisto*. Besides the usual Diatomacea, Infusoria, and Radiolaria, there were a few specimens of *Globigerina* in this gathering.

4. This gathering consisted of one haul of the tow-net, collected at the surface, at 'Jackal Station No. XIII.,' lat. 61°1′ N. long. 3°12′ W., on July 31st, 1896, at 10 a.m. (net down 15 minutes).

The total contents of this haul measured about 10·5 c.c., including about ·5 c.c. of flocculent matter. The following organisms were observed in this gathering:—

Calanus finmarchicus (Gunner).
Pseudocalanus elongatus, Boeck.
Temora longicornis (Müller).
Acartia Clausii, Giesbrecht.
Oithona (?) *similis*, Claus.
Podon intermedius, Lilljeborg.
Parathemisto gracilipes, Norman.
Limacina retroversa (Fleming).

The number of the Entomostraca was about 4500, and the proportional numbers of the species nearly as in the last gathering. *Limacina* was very rare.

5. This gathering consisted of one haul of the tow-net, collected at the same station, and on the same date as the last, at 11.30 a.m. (net down 15 minutes).

The total contents of this haul measured about 11·5 c.c., including about 0·5 c.c. of flocculent matter. The following were the organisms observed:—

Calanus finmarchicus (Gunner).
Pseudocalanus elongatus, Boeck.
Temora longicornis (Müller).
Centropages typicus, Kröyer.
Acartia Clausii, Giesbrecht.
Oithona (?) *similis*, Claus.
Podon intermedius, Lilljeborg.
Parathemisto (?) *gracilipes*, Norman.

The total number of Entomostraca was about 5000, the proportional numbers of the species being somewhat similar to those of previous gatherings.

6. This gathering consisted of one haul of the tow-net, collected at the surface, at the same station as Nos. 4 and 5, and at the same date, at 2 p.m. (net down 15 minutes).

The total contents of this haul measured about 12·5 c.c., 1·5 c.c. of which consisted of flocculent matter. The following are the organisms observed in this gathering:—

Calanus finmarchicus (Gunner).
Pseudocalanus elongatus, Boeck.
Temora longicornis (Müller).
Acartia Clausii, Giesbrecht.
Oithona (?) *similis*, Claus.
Podon intermedius, Lilljeborg.
Evadne Nordmanni, Lovén.
Parathemisto (?) *gracilipes*, Norman.
Limacina retroversa (Fleming).
Sagitta.
Globigerina.

The total number of Entomostraca and the proportional numbers of the different species were similar to the last.

7, 8. These two small gatherings were put together in the same bottle: they consisted of the contents of two hauls of the tow-net, collected at the surface, at 'Knight Errant Station No. 33,' lat. 60°3′ N. long. 5°51′ W. at 10 a.m. and noon on August 1st, 1896 (net down 15 minutes each time).

The total contents of the two hauls measured about 13 c.c., but about half of this quantity consisted of flocculent matter, the other half being made up of Entomostraca and *Salpæ.* The following are the organisms observed :—

Calanus finmarchicus (Gunner).
Eucalanus crassus, Giesbrecht.
Pseudocalanus elongatus, Boeck.
Temora longicornis (Müller).
Metridia hibernica (Brady and Robertson).
Acartia Clausii, Giesbrecht.
Oithona (?) *similis*, Claus.
Ectinosoma atlanticum (Brady and Robertson).
Podon intermedius, Lilljeborg.
Salpa (?) *vulgaris.*
Paracalanus parvus, Claus.

Calanus and *Pseudocalanus* were scarce, *Acartia* was frequent, *Salpa* was also frequent, but all the others were more or less rare.

9, 10. These two gatherings were put together in the same bottle: they consisted of the contents of two hauls with the tow-net, at the surface of the water, at the same station as the last, and collected on the same date, at 2 p.m. and 4 p.m. (the net being down for 15 minutes each haul).

The total contents of the two hauls measured only about 5 c.c., and consisted chiefly of *Salpa* and some flocculent matter. Entomostraca were scarce, only five species being observed, of which the following are the names :—

Calanus finmarchicus (Gunner), rare.
Pseudocalanus elongatus, Boeck, few.
Acartia Clausii, Giesbrecht, few.
Oithona (?) *similis*, Claus, few.
Podon intermedius, Lilljeborg, few.
Salpa (?) *vulgaris*, frequent.
(?) *Arachnactis*, sp., rare.
Ctenophora, rare.

11, 12. These two gatherings were put together in the same bottle: they consisted of the contents of two hauls with the tow-net, at the surface of the water, at the same station as the last; they were collected at 2 p.m. and 3.30 p.m. on August 2nd, 1896 (the net being down 15 minutes each haul).

The total contents of these two hauls measured about 11 c.c., including about 1 c.c. of flocculent matter. The Entomostraca numbered, approximately, about 4000. The following are the names of the organisms observed :—

Calanus finmarchicus (Gunner).
Eucalanus elongatus (Dana).
Aëtidius armatus, Brady.
Euchæta norvegica, Boeck.
Metridia hibernica (Brady and Robertson).
Podon intermedius, Lilljeborg.
Limacina retroversa (Fleming).
Sagitta.
Tomopteris.
Ctenophora.

The formula shows the proportional numbers nearly—

Calanus,	*Pseudocalanus*,	*Metridia*,	*Podon.*
90	6	50	40

The others were more or less rare.

13. This gathering consisted of one haul of the tow-net, at the same 'Knight Errant Station' as the last, collected at the surface at 10 a.m. on August 3rd, 1896 (the net being towed for 15 minutes).

The total contents of the haul measured about 9 c.c., and consisted mostly of flocculent matter: several species of Entomostraca were observed, but individuals were few or rare. *Acartia Clausii* was of more frequent occurrence than any of the others.

The following are the species that have been observed :—

Calanus finmarchicus (Gunner), rare.	*Acartia Clausii*, Giesbrecht, frequent.
Pseudocalanus elongatus, Boeck, one.	*Evadne Nordmanni*, Lovén, few.
Paracalanus parvus (Claus), two.	Ctenophora, frequent.
Centropages typicus, Kröyer, one.	(?) *Arachnactis.*

14. This gathering consisted of one haul of the tow-net, at the same station, and on the same date, as No. 13 : it was collected at the surface at 2 p.m. (the net being towed for 15 minutes).

This gathering only measured about 5 c.c., including 1 c.c. of flocculent matter.

Calanus finmarchicus (Gunner), few.	*Acartia Clausii*, Giesbrecht, frequent.
Pseudocalanus elongatus, Boeck, rare.	*Oithona* (?) *similis*, Claus, rare.
Centropages typicus, Kröyer, one.	*Podon intermedius*, Lilljeborg, rare.
Temora longicornis (Müller), rare.	*Evadne Nordmanni*, Lovén, rare.

Globigerina.
(?) *Arachnactis.*

There were also a few Ctenophora and larval Crustacea, as well as one or two young Gasteropod molluscs.

15. This gathering consisted of one haul with the tow-net at 'Jackal Station No. XIV.,' lat. 61°20′N. long. 4°22′W., taken at 11 a.m. on the 4th of August 1896, at the surface of the water (the net being towed for 15 minutes).

The gathering measured about 16·5 c.c., 1·5 c.c. of which consisted of flocculent matter, the remaining 15 c.c. being mostly Copepoda. The number of Copepods in the gathering would be approximately about 5000, the greater part consisting of *Calanus finmarchicus*. Other species (the names of which are given below) were rare :—

Calanus finmarchicus (Gunner).	*Euchæta norvegicus*, Boeck.
Paracalanus parvus (Claus).	*Acartia Clausii*, Giesbrecht.
Temora longicornis (Müller).	*Oithona* (?) *similis*, Claus.

Globigerina, rare.

16. This gathering consisted of one haul with the tow-net at the same station as No. 15 : it was collected at the surface at 2 p.m. on the 4th August (the net being towed for 15 minutes).

This was comparatively a small gathering : it measured about 5 c.c., including 2·5 of flocculent matter. The number of Copepoda in the gathering was about 1500. *Calanus finmarchicus* was more common than any of the others, as shown by the formula—

Calanus,	*Pseudocalanus,*	*Acartia,*	*Oithona,*	*Podon.*
160	4	60	9	17

Names of the species :—

Calanus finmarchicus (Gunner).	*Acartia Clausii*, Giesbrecht.
Pseudocalanus elongatus, Boeck.	*Oithona* (?) *similis*, Claus.
Metridia hibernica (Brady and Robertson), two.	*Podon intermedius*, Lilljeborg.
	Evadne Nordmanni, Lovén, one.

17. This gathering, which was contained in two bottles, consisted of one haul with the tow-net at the same station, and on the same date, as Nos. 15 and 16 : it was collected at 8 to 12 feet below the surface of the water, at 4 p.m. (the net, in this experiment, was only towed for 10 minutes).

This gathering, which was considerably larger than any of the others, measured about 96 c.c., nearly 89 c.c. of this consisting entirely of *Calanus finmarchicus*, which was the only Entomostracan observed in this gathering. The number of *Calanus* would be, approximately, about 30,000. The remaining portion of the gathering consisted of *Ctenophora* (rare), Diatomacea, Infusoria, and Radiolaria.

18. This gathering consisted of one haul of the tow-net at the same station as No. 17, and on the same date: it was collected at 9 p.m., at the surface of the water (the net being towed for 15 minutes).

The total contents of this gathering measured 65 c.c., and consisted chiefly of *Calanus*. A few other species were observed, but these were of more or less rare occurrence. The number of Copepoda in this gathering would be, approximately, about 22,000. The following are the names of all the species observed:—

Calanus finmarchicus (Gunner).
Pseudocalanus elongatus, Boeck.
Temora longicornis (Müller).
Euchæta norvegica, Boeck.
Acartia Clausii, Giesbrecht.
Parathemisto (?) *gracilipes*, Norman.
Sagitta.
Ctenophora.
Larval decapod Crustacea, rare.

19. This gathering consisted of one haul of the tow-net at 'Jackal Station No. XVII.': it was collected at the surface of the water at 10 a.m. the 5th of August 1896 (the net being towed for 15 minutes).

This gathering measured about 10·5 c.c., the larger portion of which consisted of *Calanus*. The only other species observed were *Pseudocalanus elongatus* and *Acartia Clausii*, both of which were rare. The number of Copepoda in this gathering was, approximately, 3500.

20. This gathering consisted of one haul of the tow-net at the same station as No. 19, and at the same date: it was collected at the surface at 2 p.m. (the net being towed for 15 minutes).

The contents of the tow-net measured about 14·5 c.c., about a fourth part consisting of Radiolaria, Infusoria, and Diatomacea. The Entomostraca, which numbered about 3600, consisted chiefly of *Calanus*; the other species that were observed were all of more or less rare occurrence. Their names are as follows:—

Calanus finmarchicus (Gunner).
Pseudocalanus elongatus, Boeck.
Temora longicornis (Müller).
Metridia hibernica (Brady and Robertson).
Acartia Clausii, Giesbrecht.
Parathemisto (?) *gracilipes*, Norman.

also a few Ctenophora and larval Crustacea.

21. This gathering consisted of one haul of the tow-net at the same station, and on the same date, as the last: it was collected at 3.30 p.m., and was a surface gathering (the net was towed 15 minutes).

The contents of the tow-net measured 23 c.c., including about 1·5 c.c. of diatomaceous matter. The remaining 21·5 c.c. consisted almost entirely of Entomostraca, chiefly *Calanus*. The following are the names of the species observed, all of which, with the exception of *Calanus*, were more or less rare:—

Calanus finmarchicus (Gunner).
Eucalanus elongatus (Dana), one.
Pseudocalanus elongatus, Boeck, very rare.
Temora longicornis (Müller), very rare.
Acartia Clausii, Giesbrecht, rare.
Oithona (?) *similis*, Claus, very rare.
Evadne Nordmanni, Lovén, rare.
Microniscus calani, G.O. Sars, three.
(?) *Clavelina*, one small group.

22. This gathering consisted of one haul of the tow-net at 'Knight Errant Station No. 28,' lat. 60°2′ N. long. 7°11′ W., taken on August 6th, at 11.30 a.m. It was a surface gathering, and the time the net was towed was 15 minutes.

The gathering measured about 10·5 c.c., 3 c.c. of which consisted of flocculent matter: the remainder consisted chiefly of Entomostraca, and numbered, approximately, about 3000. The names of the species observed are:—

Calanus finmarchicus (Gunner).
Paracalanus parvus (Claus).
Temora longicornis (Müller).
Acartia Clausii, Giesbrecht.
Oithona (?) *similis*, Claus
Podon intermedius, Lilljeborg.
Parathemisto (?) *gracilipes*, Norman.
Limacina retroversa (Fleming).
Globigerina, Ctenophora, *Evadne Nordmanni*, Lovén.

In 626 specimens, the following proportions were found:—

Calanus,	*Paracalanus*,	*Temora*,	*Acartia*,	*Oithona*,	*Podon*,	*Evadne*.
310	1	46	146	7	15	1

23. This gathering consisted of one haul of the tow-net at the same station, and on the same date, as the last: it was a surface gathering, and was collected at 6 p.m. (the net being towed for 15 minutes).

The contents of this gathering measured about 7·5 c.c., and contained a considerable number of *Salpæ*. Though several species of Entomostraca were observed, individuals were few in number. *Acartia Clausii* was more frequent than any of the others. The following are the names of the species observed:—

Eucalanus elongatus (Dana) one.
Paracalanus parvus (Claus), one.
Pseudocalanus elongatus, Boeck, three.
Metridia hibernica (Brady and Robertson), several.
Scolocithrix abyssalis, Giesbrecht, one or two.
Euchæta norvegica, Boeck, five or six.
Acartia Clausii, Giesbrecht, frequent.
Podon intermedius, Lilljeborg, frequent.
Salpa (?) *vulgaris*, frequent.
Diphys (?) *campanulifera*, rare.
Ctenophora, rare.

24. This gathering consisted of one haul of the tow-net at the same station, and on the same date, as Nos. 22 and 23: like the others it was a surface gathering, and was collected at 8 p.m. (the net being towed 15 minutes).

This gathering, which consisted chiefly of Ctenophora and *Salpa*, measured about 7·5 c.c. Entomostraca were comparatively few in number. The following are the names of the species observed:—

Calanus finmarchicus (Gunner), frequent.
Eucalanus elongatus (Dana), one.
Paracalanus parvus (Claus), one or two.
Pseudocalanus elongatus, Boeck, rare.
Temora longicornis (Müller), one.
Metridia hibernica (Brady and Robertson), two.
Acartia Clausii, Giesbrecht, frequent.
Oithona (?) *similis*, Claus, few.
Podon intermedius, Lilljeborg, frequent.
Evadne Nordmanni, Lovén, rare.
Sergestes (?) *atlanticus*, M. Edw., one (jun.).

Salpa, several. (?) *Arachnactis*. (?) *Diphys*.

LIST OF THE SPECIES NAMED IN THE PRECEDING DESCRIPTION.

Macrura.

Sergestes (?) *atlanticus*, M. Edwards.

Copepoda.

Calanus finmarchicus (Gunner).
Eucalanus elongatus (Dana).
Paracalanus parvus (Claus).
Pseudocalanus elongatus, Boeck.
Aëtidius armatus, Brady.
Scolocithrix abyssalis, Giesbrecht.
Temora longicornis (Müller).
Mitridia hibernica (Brady and Robertson).
Euchæta norvegica, Boeck.
Centropages typicus, Kröyer.
Acartia Clausii, Giesbrecht.
Oithona (?) *similis*, Claus.
Ectinosoma atlanticum (Brady and Robertson).

Cladocera.

Podon intermedius, Lilljeborg.
Evadne Nordmanni, Lovén.

Amphipoda.

Parathemisto (?) *gracilipes*, Norman.

Epicaridæ.

Microniscus calani, G.O. Sars.

Pteropoda.

Limacina retroversa (Fleming)

Tunicata.

Salpa (?) *vulgaris*.
(?) *Clavelina*.

Vermes.

Sagitta bipunctata, G. and G.
Tomopterus onisciformis, Esch.

Cœlenterata.

Diphys, sp., and one or two others not identified.

NOTES ON SOME OF THE SPECIES.*

Sergestes (?) *atlanticus*, M. Edwards.—A single immature specimen of *Sergestes*, which the Rev. Mr Stebbing (who examined the specimen for me) thinks may probably belong to *S. atlanticus*, was obtained in the last of the tow-net gatherings collected by H.M.S. 'Research'; the specimen measured about 18 mm. ($\frac{3}{4}$ inch) in length. The distribution of *Sergestes atlanticus*, according to Spence Bate—see his work on the *Macrura* of the 'Challenger' Expedition—is almost world-wide; the 'Challenger' specimens were obtained in such widely divergent locali-

* I am largely indebted to Dr Giesbrecht's valuable work, *Der Pelagischen Copepoden des Golfes von Neapal*, for information concerning the distribution of the Copepoda. Dr Brady's *Monograph of British Copepoda*, and various other works, have also been consulted.

ties as off Japan; off Matuka, Fiji Islands; south of Australia; off Monte Video; near Teneriffe; and at 300 miles off the Chesapeake. Moreover, it was taken at the surface and also at the depth of 2425 fathoms. *Sergestes arcticus*, Kröyer, which Spence Bate considers to be identical with *S. atlanticus*, was obtained off the coast of Greenland. The length of the 'Challenger' specimens varied from 20 to 50 mm.; while, according to S. Smith, a specimen of *Sergestes arcticus*, obtained off the east coast of the United States of America, measured 90 mm. in length.

Calanus finmarchicus (Gunner).—The distribution of this species is also nearly world-wide, as the following other records will show:—Arctic Ocean, North Atlantic, and European Seas (Brady); Mediterranean, West Coast of South America, Hongkong (Giesbrecht); Australasia and South Pacific (Brady); Sulu Sea (Dana).

Eucalanus elongatus (Dana).—This is clearly Dana's species; it agrees perfectly with the description and figures of it in Dr Giesbrecht's monograph on the *Copepoda of the Gulf of Naples.* This also is an apparently widely-distributed species: Dana records it from the Sulu Sea, and T. Street from north of the Celebes; Dr Claus obtained it in the Mediterranean, and Dr Giesbrecht notes its occurrence westward of Gibraltar; on the West Coast of South America, from Valparaiso northwards; and in the Pacific between lat. 3° S. and 14° N., westward to long. 132° W. But, though the species is of wide distribution, its occurrence in the Shetland-Faröe Channel is of interest, as there seems to be no previous record of its being found so far north in the Atlantic (unless perhaps, some of the North Atlantic records of *Eucalanus attenuatus*: Dana may, owing to an oversight, really refer not to that species, but to *Eucalanus elongatus*). *Eucalanus elongatus* does not yet appear to have been recorded from the North Sea, at least within the British area.

Eucalanus crassus, Giesbrecht.—Only a single specimen (a female) of this species was obtained, and it was captured at 'Knight-Errant Station No. 33.' *Eucalanus crassus* is a more robust species than either *Eu. elongatus* or *Eu. attenuatus.* The abdomen has the same number of segments as in that of the last-named species, but the genital segment is considerably shorter, and is laterally more dilated and broadly rounded: the second abdominal segment is very short. The occurrence of *Eucalanus crassus* in the Shetland-Faröe Channel is somewhat interesting, as bearing on the distribution of the species. Dr Giesbrecht records the occurrence of the species off Rio de Janeiro and north-east thereof; to the west of South America between lat. 14° and 26° S., and further between long. 175° W. and 138° E., and lat. 19° to 20 N. Moreover, while re-examining some specimens of *Eucalanus* from the Gulf of Guinea, for the purpose of comparing them with that from the Shetland-Faröe Channel, I found one of this species: this specimen was taken at a depth of 50 fathoms, lat. 70° 54′ N., long. 17° 25′ W., and the temperature of the water at the 50 fathoms was 56°·58 Fahr. The above is all that I know as regards the distribution of this *Eucalanus.* It is just possible, however, that some of the records of *Eucalanus attenuatus* may, as with *Eu. elongatus*, really refer to *Eucalanus crassus.*

Paracalanus parvus (Claus).—This is a small and widely distributed species, and readily distinguished by the structure of the fifth pair of thoracic feet in ♂ and ♀. The following is a brief summary of what is known as to its distribution :—Heligoland (Claus), North Sea (Mobins), Trieste (Claus ; Car.), Teneriffe (I. C. Thompson), West Coast of South America, Hongkong (Giesbrecht), Plymouth (Bourne), Irish Sea (I. C. Thompson), Firth of Forth (Mihi).

Pseudocalanus elongatus, Boeck.—This Copepod is usually more or less common all round the British coasts. According to Dr Giesbrecht, the known distribution of this species extends approximately from lat. 50° to 60° N., and from the Baltic to about long. 10° W.

Aëtidius armatus, Brady.—Several specimens (all female) of this species were obtained on the same date and also at the same station ('Knight-Errant Station No. 33') as *Eucalanus crassus*, but at a somewhat later hour of the day. The occurrence of *Aëtidius armatus* in the Shetland-Faröe Channel is, like that of *Eucalanus crassus*, of considerable interest as bearing on the distribution of the species. *Aëtidius armatus* was first described by Prof. G. S. Brady in his work on the 'Challenger' Copepoda, where he records its occurrence in gatherings from the following places :—Indian Ocean (lat. 46° 46′ S., long. 45° 31′ E.), Torres Straits, off Port Jackson, Australia ; Chinese Sea (lat. 17° 54′ N., long. 1·7° 14′ E.) ; in lat. 32° 24′ S., long. 13° 5′ W. ; and in lat. 3° 10′ N., long. 14° 51′ W. Dr Giesbrecht, in his work on the *Copepoda of the Gulf of Naples*, records it as follows :—Gibraltar, 99°–124° W., 3° S.–11° N. Mr I. C. Thompson records it from Malta, and in my report on 'Some Entomostraca from the Gulf of Guinea, West Coast of Africa,' there are a few records of the species for that district. It may also be stated that the specimens recorded by Dr Giesbrecht were obtained at a depth of 2300 metres ; those from the Gulf of Guinea were obtained at depths varying from 5 to 460 fathoms (fully 1400 metres). The capture of *Aëtidius armatus* at this northern station is therefore of interest, as it extends greatly the limits of its distribution, and indicates that its distribution is almost world-wide. The presence of the *Aëtidius armatus* at this 'Knight-Errant' station might of course be due to the action of oceanic currents transporting the specimen beyond the normal limits of the distribution of the species.

Scolocithrix abyssalis, Giesbrecht.—The occurrence of this species in the 'Research' collection is of interest. In my report on some Entomostraca from the Gulf of Guinea (pub. 1894), a Copepod is described as *Scolocithrix tumida*, which appears to be identical with *Scolocithrix abyssalis*, Giesbrecht. The 'Research' specimen agrees perfectly with the form described as *S. tumida*. The specimens from the North Pacific and the Gulf of Guinea were obtained in moderately deep water, the former from 1000 to 4000 metres, the latter from 85 to 460 fathoms; but the 'Research' specimen is from a surface gathering. The known distribution of this *Scolocithrix* appears to be very limited ; the only record given by Dr Giesbrecht, and referred to above, is as follows :—'124°–132° W., 11°–14° N. ; in 1000–4000 metres, Tiefe,' and it was obtained at only two stations in the Gulf of Guinea, viz. : at about 100 miles to the west of Lonago (lat. 4° 27′ 7″ S., long. 10° 1′ 8″ E.), in 85 and 235 fathoms ; and at about the same distance west of Princes Island (1° 55′ 5″ N., 5° 55′ 5″ E.), in 460 fathoms. Its occurrence at the surface of the water at the Shetland-Faröe Channel is therefore interesting from its bearing on the distribution of the species, both horizontally and bathymetrically.

Temora longicornis (Müller).—The known distribution of this species appears to be confined to a comparatively limited area of the North Atlantic—viz., from lat. 50° to 60° N., westward to about 10° W. long. It has no doubt been recorded from the Adriatic Sea by Dr Claus, and from Marseilles by Dr Gouret; but Dr Giesbrecht, the eminent authority on the Copepoda, seems to be of the opinion that these records may not refer to this, but to some closely allied form. In my report on 'Some Entomostraca from the Gulf of Guinea, West Coast of Africa,' *Temora longicornis* is included in the list of Copepoda obtained in the collections from that district, but attention is directed to the fact that the fifth pair of thoracic feet in the male differ somewhat from the same appendages of the males of that species from the British Seas, and a figure is given on Plate IX. (fig. 13) showing the nature of the difference. I am now inclined to consider the *Temora* recorded under this name from the Gulf of Guinea to belong, not to *T. longicornis*, but to *T.* (*Calanus*) *turbinatus* (Dana)—a form closely related to the other.

Metridia hibernica (Brady and Robertson).—This species was described in 1873, in the *Annals and Magazine of Natural History*, as *Paracalanus hibernicus* by Dr Brady and Mr (afterwards Dr) Robertson; it was subsequently ascribed to *Metridia armata* of Boeck, and also to the genus *Pleuromma* of Claus. Dr Giesbrecht, in his valuable monograph on the *Copepoda of the Gulf of Naples*, has shown that, while the form discovered by Brady and Robertson is a true Metridia, it belongs to no previously described species; he therefore restores the specific name first given to it by Drs Brady and Robertson. The following is a brief summary of what is known regarding the distribution of this species, viz.: North Atlantic, from lat. 51° 22′ N., and long. 12° 25′ W. to Rockall Bank, Scilly Isles (Dr Brady). Arctic examples, apparently belonging to this species, but twice the size of British specimens, were obtained by the 'Alert' and 'Discovery' Expeditions (Dr Brady). Firth of Forth, Firth of Clyde, and Moray Firth (Mihi). Irish Sea (I. C. Thompson).

Euchæta norvegica, Boeck.—It will be noted that this Copepod has been obtained in a few of the surface tow-net gatherings; it appears, however, to be found in the greatest abundance in deep water. The distribution of *Euchæta norvegica* appears to be restricted to a somewhat limited area. Dr Mobius has obtained it off the south-west coast of Norway. Professor Sars reports it as occurring generally in the North Atlantic and Arctic Sea, between Norway, Greenland, and Iceland. It occurs abundantly in Loch Fyne, but sparingly in other parts of the Clyde estuary. The Clyde appears to be near the southern limit of its distribution. It is only within comparatively recent years that *Euchæta norvegica* has been observed in the British seas.

Centropages typicus, Kröyer.—This species is of more or less general occurrence all round the British Islands, but is somewhat restricted in its distribution. It appears to be confined to the North Atlantic, the North Sea, and the Mediterranean. The following are some of the localities from which *Centropages typicus* has been recorded, viz.: Canary Islands (I. C. Thompson); this seems to be near the southern limit of the species. Mediterranean—[Malta (I. C. Thompson); Trieste (Car), Gulf of Naples (Giesbrecht), off Nice (Claus)]. Cape Finisterre (Kröyer), West of Ireland (Brady and Robertson), Shetland Islands (Norman), Faröe Channel (Brady), south-west and south of Norway (Boeck), Heligoland (Claus), Wimereux (Canu).

Acartia Clausii, Giesbrecht.—All the specimens of *Acartia* observed belonged to the one species, viz., *A. Clausii.* This is quite a distinct form, especially as regards the structure and armature of the fifth feet, and in this respect it differs very markedly from *Acartia longiremis*, Lilljeborg. So far as known, the distribution of *Acartia Clausii* appears to be even more extensive than, though probably not so general as, *Centropages typicus.* The area of its known distribution includes the Mediterranean (Giesbrecht, Claus, Gourret, I. C. Thompson), Libreville, Gaboon River, West Africa (Mihi), Canary Islands (I. C. Thompson, Wimereux (Canu), Plymouth (Bourne), Loch Fyne, Scotland (Norman), Firth of Forth, Scotland (Mihi). The present seems to be one of the most northerly records hitherto reported for this species.

Oithona (?) *similis*, Claus.—All the 'Research' specimens of *Oithona* appear to belong to the species described by Dr Giesbrecht as *Oithona similis*, Claus. Dr Giesbrecht seems to consider that most of the British records of *Oithona spinifrons* are referable to this species, and he is satisfied that *Oithona spinirostris*, Giesbrecht, is also identical with it. The authentic distribution of *Oithona similis* is limited to a comparatively few places ; as, for example, Nice, Trieste, and Gulf of Naples in the Mediterranean (Claus, Car, Giesbrecht), Kieler Fohrde (Giesbrecht), Bay of Wismar, Baltic (Braun), West Baltic (Hensen), the Indian and Pacific Oceans (Giesbrecht).

Ectinosoma atlantica (Brady and Robertson).—This minute species has to all appearance a world-wide distribution. Besides the various records of its occurrence around the British Islands, it has also been reported from the North and South Atlantic and the Pacific Oceans (the Gulf of Guinea, West Coast of Africa, near Ascension Island ; and near the Galapagos Island). *Ectinosoma atlantica* is so minute that it has doubtless often escaped observation : it is sometimes a moderately common species in Loch Fyne.

Podon intermedius, Lilljeborg.—All the specimens of *Podon* observed belonged to this species, which is readily distinguished from *P. polyphemoides* by the number of hairs of the second antenna—one branch having seven and the other six hairs.

Parathemisto (?) *gracilipes*, Norman.—None of the specimens of *Parathemisto* obtained appeared to be mature, but, as far as could be made out, they all belonged to *P. gracilipes*, which is a smaller species than *P. oblivia.*

XII.—THE INVERTEBRATE FAUNA OF THE INLAND WATERS OF SCOTLAND.—PART VII. By THOMAS SCOTT, F.L.S., Mem. Soc. Zool. de France. (Plate IX.); INCLUDING AN ACCOUNT OF THE EXAMINATION OF SOME OF THE LOCHS OF SHETLAND. By THOMAS SCOTT, and ROBERT DUTHIE, Fishery Officer.

CONTENTS.

PRELIMINARY REMARKS.

This paper, as indicated by the title, is in two divisions: in the first, an account is given of all the lochs (except those of Shetland) that have been examined during the past year; while a description of some of the Shetland lochs is contained in the second division.

The lochs, exclusive of those of Shetland, examined during 1896, were the following:—(1) Black Loch, (2) Achy-Lochy, and (3) Loch Ruan, in the neighbourhood of Campbeltown (Cantyre), which were visited in April. (4) Loch Greenan, and (5) Loch Fad, in the vicinity of Rothesay, Island of Bute, also visited in April. (6) Loch Rescobie, and (7) Loch Balgavie, near Forfar, which were examined in September; and (8) Linlithgow Loch, in the neighbourhood of Linlithgow, examined in October. A somewhat interesting tow-net gathering from Loch Frissa, Island of Mull, was also sent to me by Dr John Murray; *Diaptomus Wierzejskii*, Richard, and *Daphnia Jardinii*, Baird, were both obtained in this gathering. The known distribution of *Diaptomus Wierzejskii* in Britain is as follows:—In lochs in the Shetland Islands, where it is not only of frequent occurrence, but is the only member of the genus hitherto observed. In the lochs of Barra and North Uist, Outer Hebrides, where it is also frequent, and in a small loch in the district of Assynt, West Sutherlandshire; its discovery in Loch Frissa, therefore, extends the distribution of the species considerably.

By the examination of these lochs a few important additions have been made to the fresh-water fauna of Scotland during the past year: these additions include a species of *Canthocamptus*, believed to be new to science; a species of *Canthocamptus*, new to Britain; a species of *Moraria*, new to Britain; and a species of *Cyclops*, that also does not appear to have hitherto been recorded for the British Islands. A species of *Cyclops*, new to the Scottish fauna, is also recorded. The discovery of these things is the more interesting when it is remembered how much has already been done in the investigation of the fresh-water fauna of the British Islands.

Notes on some Brackish-Water Species.

But while advantage is being taken of the opportunities that from time to time occur for continuing and extending the investigation of the fresh-water fauna of Scotland—an investigation that is becoming of some importance in view of the increasing interest in the Inland Fisheries of our country—some attention has also been given to those aquatic forms that occupy the 'borderland' between what are truly fresh-water and truly marine conditions. The fauna of this 'borderland' is, especially in some of its aspects, peculiarly interesting to the biologist, as it is there, if anywhere, he is likely to meet with transition forms of life.

The marshy brackish-water shores of the Clyde, to the west of Langbank on the south side, and Dumbarton on the north side, have recently been partially examined, and also some marshy ground in the vicinity of Clachland Point, Arran. The names of the organisms obtained at these three localities are not included in the Table of distribution, as that Table is restricted to the fauna of the fresh-water lochs, but these names are given here instead. Only the names of the Crustacea, however, are given, which are as follows :—

Gammarus locusta (Linné).—Very common in pools at the roots of the dense vegetation on the shore to the west of Dumbarton.

Jæra albifrons (Montagu).—In the same locality with the *Gammarus*, but not common.

Sphæroma (?) rugicauda, Leach.—Also occasionally observed with the *Gammarus.*

Eurytemora lacinulata (Fischer).—Near Langbank, in brackish water.

Cyclops bisetosus, Rehberg.—Near Langbank, in the same localities as the last.

Cyclops bicuspidatus, Claus ; var. *Lubbockii*, Brady.—In brackish water at Langbank, and near Dumbarton ; frequent.

Cyclops equoreus, Fischer.—Near Langbank ; not common.

Tachidius littoralis, Poppe.—Near Dumbarton ; not common.

Delavalia palustris, Brady.—In brackish water on the shore near Dumbarton.

Canthocamptus palustris, Brady.—In brackish water near Langbank, and also near Dumbarton.

Canthocamptus hirticornis, T. Scott.—Near Langbank ; not common.

Laophonte Mohammed,* Richard.—In brackish water near Langbank ; frequent.

Platychelipus littoralis, Brady.—Near Dumbarton ; not common.

Cyclocypris serena, Koch.—Near Langbank, in brackish water.

* *Laophonte Mohammed*, Richard.—This species was described by Dr Richard of Paris, in 1891 (*Mem. Soc. Zool. France*, vol. iv. p. 526, pl. vi. figs. 1–15 (separate copy)) ; it had been obtained in salt lakes in Algeria. In November 1895, Mr D. J. Scourfield of London recorded its discovery in a marsh at Barmouth Junction, North Wales (*Jour. Quekett Microscop. Club*, vol. vi. s. ii. p. 136, pl. viii. figs. 3–9 (separate copy)), and these two records and the present one seem to be all the information we at present have concerning the distribution of the species. I may mention that, though the Clyde specimens are identical with those from North Wales, as figured by Mr Scourfield, they differ somewhat, especially in the structure of the first swimming feet, from Dr Richard's description and drawings. I therefore sent a few of the Clyde specimens to Dr Richard, and he, in a very friendly note to me concerning them, says that in his opinion they are of the same species as that described by him, and that the difference observed in the Clyde specimen may be accounted for by the difference in the habitat—that they are simply a northern form of the species described by him.

Cyprinotus prasinus (Fischer).—Frequent near Langbank; Clachland Point, Arran.

Herpetocypris reptans (Baird).—Clachland Point, Arran; scarce.

Cypridopsis aculeata (G. O. Sars).—Near Langbank; frequent.

Candona candida (Müller).—Clachland Point, Arran, and near Langbank.

Candona lactea, Baird.—Near Langbank, in the brackish pools.

Cythere pellucida, Baird.—Near Langbank, and near Dumbarton.

Cythere gibbosa, Brady and Robertson.—Near Langbank; not common.

Limnicythere inopinata (Baird).—Near Lachland Point, Lamlash; scarce.

Cytheridea torosa (Jones).—Brackish water, Dumbarton; Langbank; Arran.

DIVISION I.

Description of the Lochs examined during the past year (exclusive of those of Shetland).

(1) *Black Loch, near Campbeltown.*

This is a small loch among the hills to the south of the town; it is surrounded on all sides by bogland, and the water is consequently dark coloured. There appeared to be an abundance of micro-organisms in the water. Several interesting Crustaceans were obtained in the gathering from this loch, and included such forms as *Moraria Anderson-Smithi; Canthocamptus minutus*, Claus; *Candona hyalina;* and *Alona rustica*, *Alona rustica* was first described in Part iii. of the *Thirteenth Annual Report of the Fishery Board*, from specimens obtained in the Outer Hebrides and in Shetland, and this is the only other record of its occurrence in Scotland. Specimens of the pretty *Sida crystallina* were also observed here. The total number of species of Crustacea from this loch is twenty-seven. Mollusca appeared to be very scarce.

(2) *Achy-Lochy, and* (3) *Loch Ruan, near Campbeltown.*

These two small lochs are situated on the uplands, a short distance to the north of Campbeltown; they are comparatively near each other, but the first occupies a slightly lower elevation. Part of the town of Campbeltown is supplied with water from Loch Ruan. The surroundings of these lochs are in somewhat marked contrast to those of Black Loch. There is a considerable extent of pasture land in the vicinity of Achy-Lochy and Loch Ruan, and the prospect is consequently much more pleasing. It is quite possible that the difference of the environment may react on the fauna of the lochs. Twenty-five species of Crustacea were observed in the gathering from Achy-Lochy, but only twelve in that from Loch Ruan. *Gammarus Duebeni* was obtained in Loch Ruan; the statoblasts of *Cristatella muceda* and of *Plumatella* sp. were also found in that loch, and *Diatoms* were numerous. *Nephelis octoculata* was obtained in Achy-Lochy.

(4) *Loch Greenan, and* (5) *Loch Fad, Island of Bute.*

Both these lochs are interesting hunting-grounds for the naturalist. Many rare species are to be found not only in the lochs but also around their shores. Unfortunately, when visiting the lochs in April, I was able to make only a partial examination of them, and, consequently, could not expect to be so successful as I might otherwise have been. In the gathering from Loch Greenan collected during the visit referred to, twenty-two species of Crustacea were obtained, and nineteen species in the gathering from Loch Fad. Two of the species from Loch Fad are new to Britain—viz., *Canthocamptus cuspidatus*, Schmeil, and *Moraria Poppei* (Mrazek).

(6) *Loch Rescobie, and* (7) *Loch Balgavie, near Forfar.*

The overflow water from Loch Rescobie runs into Loch Balgavie, and this probably may account, partly at least, for the similarity of the fauna of the two lochs. The gatherings collected in these two lochs were found to be exceedingly rich, both in the number and variety of the organisms captured; over fifty species of Crustacea were obtained in the two lochs, besides fourteen species of Mollusca. The number of species of Crustacea observed in each of the two lochs is practically the same. Thus :—

	Rescobie.	Balgavie.
Amphipoda, ...	1	1
Copepoda, ...	15	12
Ostracoda, ...	12	13
Cladocera, ...	16	17
Total, . .	44	43

The difference in the number of Mollusca was very marked, eleven species having been obtained in Loch Rescobie but only three in Loch Balgavie : this difference, however, may be merely accidental. *Cyclops varicans*, G. O. Sars, one of the species of Copepoda found in these lochs, is new to Britain, while *Canthocamptus inornatus* is new to science; leeches, water-mites, hydra, ' water-boatmen,' Infusoria, and Diatomacea of various kinds, were also more or less common. Mention may also be made of *Darwinula Stevensoni*—a rare Ostracod—which was obtained in both lochs.

(8) *Linlithgow Loch, in the neighbourhood of Linlithgow.*

Twenty-five species of Crustacea were obtained in this loch. *Canthocamptus inornatus*, the species already referred to as new to science and first discovered in the two lochs just described, was also found in Linlithgow Loch, where it appeared to be more frequent than in the Forfarshire lochs. This was the only loch among those examined during the past year where *Cypris reticulata* was obtained.

Loch Frissa, Island of Mull.

Though the number of species observed in the tow-net gathering from this loch was small, the occurrence in it of *Diaptomus Wierzejskei* is, as already indicated, of considerable interest as regards the distribution of the species.

The following table contains the names of all the species of Mollusca and Crustacea that have been observed and identified; it also shows the distribution of the species in the various lochs referred to. The total number of species recorded in the table is ninety-three—fifteen of which are Mollusca, and seventy-eight Crustacea. The Crustacea include two species of Amphipoda, twenty-five species of Copepoda, twenty-one species of Ostracoda, and thirty species of Cladocera. It will be understood that only those species obtained in connection with the present investigation are recorded here.

TABLE containing the Names of the Different Species of Mollusca and Crustacea observed in the various Lochs of Scotland referred to in the preceding Notes; and showing also the Distribution of the Species in each of the Lochs.

Names of the Species.	Lochs in the vicinity of Campbeltown (Cantyre).			Lochs in the Island of Bute.		Lochs in Forfarshire.		Linlithgow Loch.	Loch Frissa, Mull.
	Black Loch.	Achy-Lochy.	Loch Ruan.	Loch Fad.	Loch Greenan.	Loch Rescobie.	Loch Balgavie.		
MOLLUSCA.									
Sphærium corneum (Linné),	.	.	.	.	.	×	.	.	.
Pisidium roseum, Scholtz,	.	.	.	.	.	×	.	.	.
Pisidium pusillum (Gmelin),	×	×	.	.	.	(?)	.	.	.
Valvata piscinalis (Müller),	.	.	.	.	.	×	.	.	.
Valvata cristata (Müller),	.	.	.	.	.	×	.	.	.
Planorbis nitidus, Müller,	.	.	.	.	.	×	.	.	.
Planorbis nautileus (Linné),	.	.	.	.	.	.	×	.	.
Planorbis albus, Müller,	.	×	.	.	.	×	.	.	.
Planorbis contortus (Linné),	.	.	.	.	.	×	.	.	.
Physa fontinalis (Linné),	.	.	.	.	.	×	.	×	.
Limnæa peregra (Müller),	.	.	.	.	.	×	.	×	.
Limnæa palustris (Müller),	.	.	.	.	.	.	×	.	.
Limnæa truncatula (Müller),	.	×	.	.	.	×	.	.	.
Ancylus lacustris (Linné),	.	.	.	.	.	.	×	.	.
CRUSTACEA.									
AMPHIPODA.									
Gammarus pulex (Linné),	.	.	.	.	.	×	.	×	.
Gammarus Duebeni, Lilljeborg,	.	.	×	.	.	.	.	.	.
COPEPODA.									
Diaptomus gracilis, G. O. Sars,	.	.	.	×	.	×	×	.	.
Diaptomus Wierzejskii, Richard,	.	.	.	.	.	.	.	.	×
Cyclops viridis (Jurine),	×	×	×	×	×	×	.	×	.
Cyclops albidus (Jurine),	.	×	×	.	×	×	.	×	.
Cyclops strenuus, Fischer,	.	.	×	.	×	.	.	×	×
Cyclops bicuspidatus, Claus,	.	×	.	.	.	.	.	.	.
Cyclops vernalis, Fischer,	.	.	.	×	.	.	.	×	.
Cyclops bisetosus, Rehberg,	.	.	.	.	.	×	.	.	.
Cyclops Leucharti, Claus,	.	.	.	.	.	×	.	.	.
Cyclops serrulatus, Fischer,	×	×	.	.	×	×	.	.	.
**Cyclops varicans*, G. O. Sars,	.	.	.	.	.	×	×	.	.
Cyclops macrurus, G. O. Sars,	.	.	.	.	.	×	×	.	.
Cyclops affinis, G. O. Sars,	.	×	.	.	.	×	×	.	.
Cyclops phaleratus, Koch,	.	.	.	.	.	×	.	.	.
Cyclops fimbriatus, Fischer,	×	×	×	×	×	×	.	×	.
Canthocamptus staphylinus (Jurine),	×	×	.	×	×	×	.	×	.
Canthocamptus minutus, Claus,	×	×	.	×	×	×	.	×	.
Canthocamptus inornatus, sp. n.,	.	.	.	.	.	×	.	×	.
**Canthocamptus cuspidatus*, Schmeil,	.	.	.	×	.	.	.	.	.
Attheyella crassa, G. O. Sars,	×	×	.	×	×	×	.	×	.
Attheyella pygmæa, G. O. Sars,	×	×	×	×	×	.	.	×	.
Attheyella Zschokkei (Schmeil),	×	.	.	×	.	.	×	.	.
Moraria Anderson-Smithi, T. and A. Scott,	×	.	.	.	.	.	.	.	.
Moraria brevipes, G. O. Sars,	.	.	.	.	.	×	×	.	.
**Moraria Poppei* (Mrazek),	.	.	.	×	.	.	.	.	.

* Species new to Britain.

Names of the Species.	Lochs in the vicinity of Campbeltown (Cantyre).			Lochs in the Island of Bute.		Lochs in Forfarshire.		Linlithgow Loch.	Loch Frissa, Mull.
	Black Loch.	Achy-Lochy.	Loch Ruan.	Loch Fad.	Loch Greenan.	Loch Rescobie.	Loch Balgavie.		
OSTRACODA.									
Cypria ophthalmica (Jurine), . .	×	×	.	.	×	×	.	×	.
Cypria exsculpta (Fischer), . .	.	.	.	.	.	×	.	.	.
Cyclocypris lævis (Müller), . .	.	.	.	.	.	×	.	.	.
Cyclocypris serena (Koch), . .	×	×	.	.	×	×	.	×	.
Cyclocypris globosa (G. O. Sars), .	×	.	.	.	.	.	×	.	.
Cypris reticulata, Zaddach, . .	.	.	.	.	.	.	.	×	.
Herpetocypris reptans (Baird) . .	×	×	.	.	×	×	.	.	.
Herpetocypris strigata (O. F. Müller),	.	.	.	×	.	×	.	.	.
Ilyodromus Robertsoni (Brady and Norman), ...	×	.	.	×	.	.	.	×	.
Cypridopsis villosa (Jurine), . .	.	.	.	×	.	×	.	.	.
Pionocypris vidua (Müller), . .	.	.	.	.	×	.	×	.	.
Potamocypris fulva, Brady, . .	.	.	.	×	.	.	.	.	.
Candona candida (Müller), . .	×	×	.	×	×	×	.	×	.
Candona lactea, Baird, . . .	.	×	.	.	.	×	.	×	.
Candona (?) *compressa* (Koch), . .	.	.	.	×	.	×	.	.	.
Candona Kingsleii, B. & R. . .	×	×	.	.	×	.	.	.	.
Candona hyalina, B. & R., . .	×	.	.	.	.	.	.	.	.
Ilyocypris biplicata (Koch), . .	.	.	.	.	.	.	.	×	.
Darwinula Stevensoni, B. and R., .	.	.	.	.	.	×	×	.	.
Limnicythere inopinata (Baird) .	.	.	.	.	.	×	×	×	.
Limnicythere sancti-patricii, B. and R., ...	.	.	.	.	.	×	×	.	.
CLADOCERA.									
Sida crystallina (Müller), . .	×	.	×	.	.	.	×	.	.
Daphnella brachyura (Liévin), .	.	.	.	.	.	.	×	.	.
Ceriodaphnia laticaudata, . .	.	.	.	.	.	×	.	×	.
Ceriodaphnia rotunda, . . .	×	.	.	.	.		.	.	×
Scapholeberis mucronata (Müller), .	.	.	.	.	.	×	.	.	.
Simocephalus vetulus (Müller), .	.	×	.	.	×	×	.	×	.
Daphnia pulex (Linné), . . .	.	.	.	.	.		.	×	.
Daphnia longispina, Müller, . .	.	.	.	×	.	×	.	.	.
Daphnia Jardinii, Baird, . .	.	.	.	.	.	.	.	.	×
Bosmina longirostris (Müller), . .	.	×	×	.	.	.	.	.	.
Bosmina (?) *longispina*, . .	.	.	.	.	.	.	.	.	×
Ilyocryptus sordidus (Liévin), . .	×	.	.	.	.	×	.	×	.
Eurycercus lamellatus (Müller), .	.	.	.	.	×	×	.	.	.
Acroperus harpæ, Baird, . . .	.	×		.	×	×	.	.	.
Alonopsis elongatus, G. O. Sars, .	.	.	.	.	.	×	.	.	.
Alona guttata, G. O. Sars, . .	×	×	×	.	×	.	×	.	.
Alona costata, G. O. Sars, . .	.	.	.	.	.	(?)	(?)	(?)	.
Alona rustica, T. Scott, . . .	×	.	.	.	.	.	.	.	.
Alona affinis, Leydig, . . .	.	×	×	.	×	×	.	.	.
Alona quadrangularis (Müller), .	×	×	.	.	×	.	×	.	.
Alonella exigua (Lilljeborg), . .	×	.	.	.	.	×	.	.	.
Alonella nana (Baird), . . .	.	×	.	.	.	.	.	.	.
Peracantha truncata (Müller), . .	×	.	.	.	×	×	.	.	.
Pleuroxus lævis, G. O. Sars, . .	.	.	.	.	.	.	×	.	.
Pleuroxus trigonellus (Müller), .	.	.	.	.	.	×	.	.	.
Pleuroxus uncinatus, Baird, . .	.	×	.	.	.	×	.	.	.
Chydorus sphæricus (Müller), .	×	×	×	×	.	×	.	×	.
Chydorus barbatus (Brady), . .	×	.	.	.	.	.	×	.	.
Chydorus (?) *ovalis*, Kurz, . .	.	.	×	.	.	.	.	×	.
Leptodora hyalina, Lillejeborg . .	.	.	.	.	.	×	.	.	.

NOTES ON SOME OF THE SPECIES RECORDED IN THE PRECEDING TABLE.

Crustacea.

Gammarus Duebeni, Lilljeborg.

As has been already stated, this species was obtained in Loch Ruan, near Campbeltown. Loch Ruan is situated several hundred feet above sea-level, and part of the town of Campbeltown obtains its supply of water from this loch; the occurrence of *Gammarus Duebeni* in it is therefore of interest, as it tends to show that this amphipod, though sometimes observed in brackish water, is not limited to such conditions.

Cyclops Leucharti, Claus, Pl. IX., figs. 23–25.

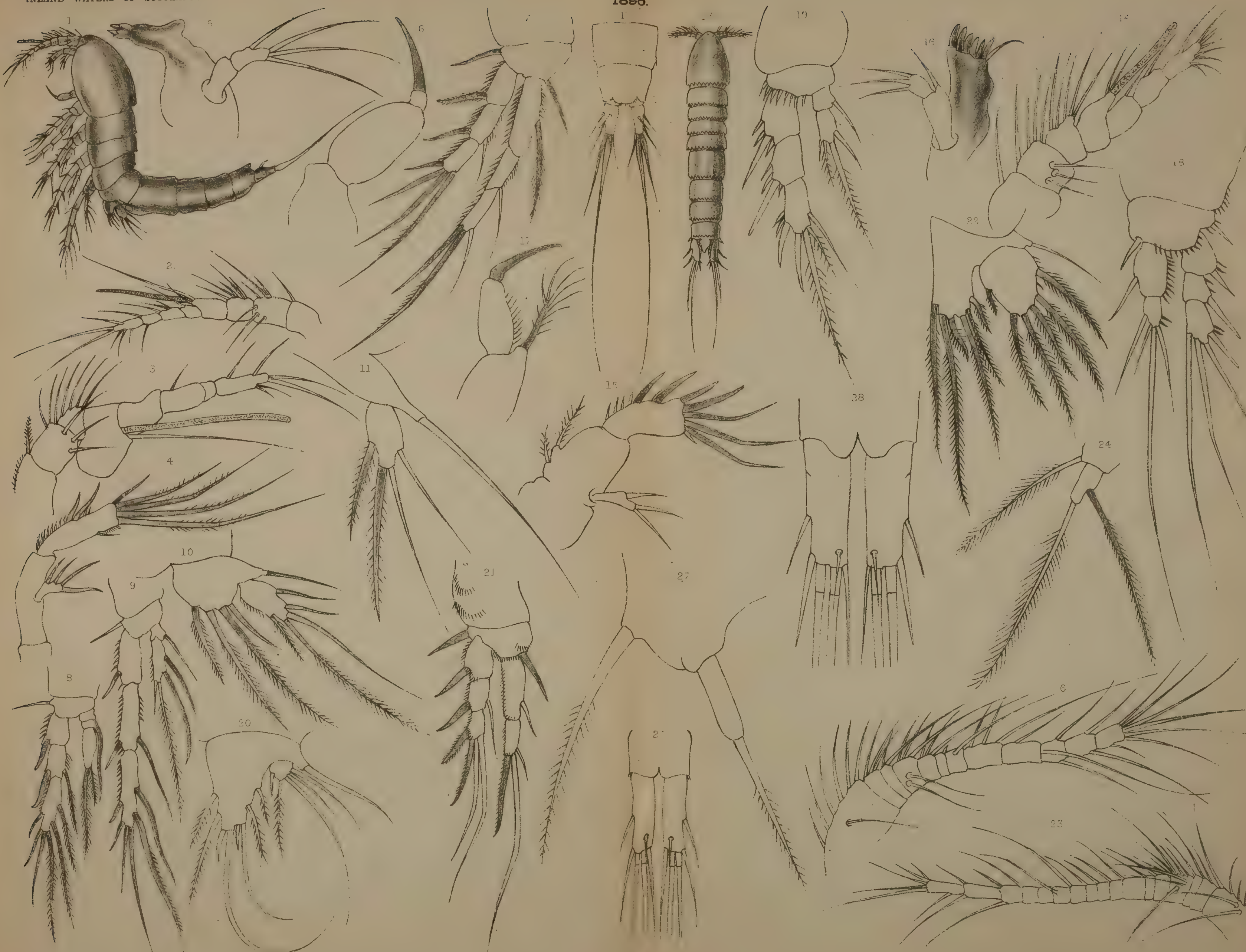
So far as known to me, this species, which is comparatively a small one, has not before been recorded for Scotland. It belongs to the group of *Cyclops* that are provided with seventeen-jointed antennules, and is readily distinguished from any other British species by the structure and armature of the fifth pair of thoracic feet. This pair of feet, which are of medium size, are each furnished with three moderately long setæ, of nearly equal length: one seta is on the basal joint, and two are on the secondary joint; one of those on the secondary joint springs from a lateral notch, while the other is situated at the apex (fig. 24). This arrangement of the setæ of the secondary joint is one of the characters that distinguishes *Cyclops Leucharti* from *Cyclops oithonoides*, G. O. Sars. In this species, which, along with the other, has been obtained in England by Mr Scourfield, both setæ spring from the truncate end of the secondary joint. In living or in well-preserved adult specimens of *Cyclops Leucharti*, there is a peculiar hiatus or notch near the end of the hyaline marginal membrane of the last joint of the antennules: this is not shown in our figure, but Dr Schmeil * gives an enlarged drawing of it. It was also distinctly seen in one or two of the specimens from Rescobie Loch. A few of the specimens from Rescobie also carried ovisacs.

Cyclops varicans, G. O. Sars (Pl. IX., figs. 26–28).

There are two species of *Cyclops* that a have somewhat similar appearance, and require careful examination to distinguish the one from the other—viz., *Cyclops varicans*, G. O. Sars, and *Cyclops bicolor*, G. O. Sars. Adult female specimens of *Cyclops varicans* may, however, be distinguished by the antennules having twelve instead of eleven joints (fig. 26); and by observing, in the fifth pair of feet, that that part of the basal joint intermediate between the seta on that joint and the secondary branch is not so prominently produced in *Cyclops varicans* as it is in *Cyclops bicolor*. The secondary joint of the fifth pair in *Cyclops varicans* is small, and bears only one seta; this seta springs from the apex of the joint, which is so small that it looks as if it were merely the basal part of the seta (fig. 27).

Habitat.—Loch Rescobie and Loch Balgavie; rare. One or two of the specimens carried ova. I do not know of any previous British record for this species.

* *Deutschlands freileb. Sussw.-Copep.*, Part I., Pl. III., fig. 3.



A. S. *del.*

FIGS. 1-12.—*Canthocamptus inornatus*, sp.n. FIGS. 13-20.—*Moraria Poppei* (Urazek). FIGS. 21 and 22.—*Canthocamptus Cuspidatus*, Schmeil.

FIGS. 23-25.—*Cyclops Leucharti*, Claus. FIGS. 26-28.—*Cyclops varicans*, G.O. Sars.

Canthocamptus cuspidatus, Schmeil (Pl. IX., figs. 21 and 22).

1893. *Canthocamptus cuspidatus*, Schmeil, 'Copepodes des Rhätikon-Gebirges' (*Abhandl. d. Naturf. Gesellschaft zu Halle*, Bd. xix.), p. 36, taf. iv. (separate copy).

Habitat.—Loch Fad, Bute; Loch Vennachar, Perthshire; Loch of Tingwall (Scalloway); and Loch of Brough (Bressay), Shetland.

Remarks.—During the past year a fresh-water Harpactid was obtained at Loch Fad in Bute; sometime afterwards this was identified as similar to a copepod that had been observed in Loch Vennachar, and which, in my paper on the 'Inland Waters of Scotland,' published in Part III. of the *Fourteenth Annual Report of the Fishery Board*, had been ascribed to *Attheyella Macandrewæ*, T. and A. Scott. At the time the Loch Vennachar specimens were examined certain differences were noticed between them and the typical *Attheyella Macandrewæ* from Loch na Chaite on Ben Lawers; but it was considered that these differences might be due to the difference in habitat, and that the Loch Vennachar copepod might be only a variety of that from Ben Lawers. The recent discovery, however, of the species at Loch Fad, has led to its re-examination; and I have also recently had an opportunity of consulting a work by Dr Otto Schmeil on some Copepoda collected by Dr F. Zschokke in the Rhætian Alps between Austria and Switzerland; and from the additional information thus obtained, I am now satisfied that the Loch Fad species is identical with that described by Dr Schmeil as *Canthocamptus cuspidatus*, from the collections of Dr F. Zschokke referred to above.

It may also be mentioned that, so far as I can judge, the Ben Lawers *Attheyella Macandrewæ* seems to be identical with *Canthocamptus rhæticus*, another of the species found by Dr Schmeil in the collections from the Rhætian Alps, and described by him in the same work with the others.*

The disparity between *Canthocamptus rhæticus* and *Canthocamptus cuspidatus* is not at first sight very apparent, and the two are evidently closely allied species. When, however, they are dissected and examined by the aid of the microscope, several quite distinct, though minute, differences become visible, of which the following seem to be the most important. The mandible-palp in *Canthocamptus rhæticus* is only about half the size of that of *Canthocamptus cuspidatus*. The proximal joint of the inner branches of the first thoracic feet is proportionally considerably shorter than the same joint in *Canthocamptus cuspidatus*, and the entire inner and outer branches are also proportionally shorter. In the fifth pair the produced inner portion of the basal joint is narrower in *Canthocamptus rhæticus*, and the secondary joint is sub-quadrate in form; in *Canthocamptus cuspidatus* the form of the secondary joint is broadly sub-ovate; the difference in the armature of both basal and secondary joints is also very marked

Several of the Loch Fad specimens of *Canthocamptus cuspidatus* carried ova, and the ovisacs were in every case small, and contained very few but comparatively large ova: so different was the appearance of the ovisacs, that those of the Loch Fad specimen which carried ova could be distinguished by that character alone. Figures of the first and fifth thoracic feet (female) are given on Pl. IV., figs. 21 and 22.

Canthocamptus inornatus, sp. n. (Pl. IX., figs. 1–12).

Description of the Female.—Length about ·85 ($\frac{1}{30}$th of an inch).

* *Copepodes des Rhätikon-Gebirges*, p. 23, taf. ii. (As *Canthocamptus rhæticus*, Schmeil, was published in 1893, and *Attheyella Macandrewæ* was not published till the following year, this name must give place to the other.)

Body moderately stout and elongate; the various segments are apparently devoid of the usual fringes of cilia (fig. 1). Antennules somewhat slender, eight-jointed; the first four and the last joints are sub-equal and of moderate length; the fifth joint is smaller than the others; the formula shows, approximately, the proportional length of the joints:—

Proportional lengths of the joints,	10 · 11 · 9 · 10 · 5 · 8 · 7 · 10 .
Number of the joints, . .	1 · 2 · 3 · 4 · 5 · 6 · 7 · 8 .

Antennæ elongate; secondary joint small, one-jointed, and armed with four spines (fig. 4). The biting part of the mandibles is attenuated and somewhat feeble; the palp is two-jointed and furnished with a few setæ (fig. 5). The first pair of feet are elongate and slender; both branches are three-jointed; the inner branches are somewhat longer than the outer, and the first joint is equal to about one and a half times the length of the second; the second and third are sub-equal; a moderately stout seta springs from near the middle of the inner edge of the first joint; the second joint bears a seta on the inner distal angle; and the end joint has at the apex a small hair and two spiniform setæ—one being considerably longer than the other; the joints of the outer branches are sub-equal; the marginal spines are elongate; and the middle joint is provided interiorly with a few marginal cilia, and has also a small hair near the distal end (fig. 7). The inner branches of the second, third, and fourth pairs are short and two-jointed,—the first joint being very small; the outer branches are elongate and three-jointed. In the fourth pair the inner branches scarcely reach beyond the end of the first joint of the outer branches; the proximal joint of the inner branches is very small, and bears one seta on the inner margin; while the elongate end joint is armed on the inner margin with two moderately long spines, and also bears one long and one very short terminal seta (fig. 9). The fifth pair are small; the basal joint is somewhat broadly foliaceous, and scarcely produced interiorly, and resembles in this respect the basal joint of the fifth pair in *Canthocamptus staphylinus*; on the posterior margin of the basal joint are four moderately stout setæ,—the two middle setæ being considerably longer than the others; the secondary joint is of an oblong form, the length being equal to about twice the breadth; its armature consists of one small seta near the distal end of the inner margin, two small setæ on the outer margin, and two elongate apical setæ (fig. 10). Caudal stylets are nearly as long as the last abdominal segment, and the principal seta are very long and slender (fig.).

Description of the Male.—The male is similar to the female, except in the following particulars: the antennules, which are modified for grasping, have the fourth joint delated exteriorly into a lobe-like projection; the penultimate joint is also very small (fig. 3). The inner branches of the third pair of swimming feet are three-jointed; the second joint, which, like the first, is very small, is produced interiorly into a long spine-like process that extends beyond the extremity of the third joint; the third joint, which is equal to fully twice the combined lengths of the first and second, bears one short and one elongate apical seta; the marginal spines of the first and second joints of the outer branches are strong and slightly curved at the end (fig. 8). The fifth pair are very small, the basal joint being almost rudimentary; the secondary joint is ovate, and provided with two spiniform and two slender setæ, as shown in the drawing (fig. 11).

Habitat.—Rescobie Loch, near Forfar, and Linlithgow Loch; not very rare.

Remarks.—The species now described may be distinguished by the structure of the elongate swimming feet and by the form of the fifth pair. Since the discovery of this species in Scotland it has been obtained also in Lancashire by my son, Mr A. Scott.

Moraria brevipes (G. O. Sars).

This species, which, under the name of *Ophiocamptus brevipes*, was recorded for the first time in Part III. of the *Thirteenth Annual Report of the Fishery Board for Scotland*, from specimens obtained in Loch Lubnaig, Perthshire, was discovered last year in Rescobie Loch and Loch Balgavie, near Forfar. It appeared to be more frequent in these two lochs than it was in Loch Lubnaig. These are yet, so far as I know, the only British habitats for this Copepod. The form and armature of the fifth pair of feet, taken together with its other characters, clearly distinguish this from other British fresh-water Harpactids.

Moraria Poppei (Marazek). (Pl. IX. figs. 13–20).

1893. *Ophiocamptus Poppei*, Mrazek, 'Beitrag zur Kenntniss der Harpacticiden Fauna des Süsswassers' (*Zool. Jahrb.*, Siebenter Band), p. 114, taf. 5, figs. 54–59.

Description of the Female.—Length, ·59 ($\frac{1}{42}$ of an inch). Dorsal aspect of body narrow, cyclindrical (fig. 13). Antennules short, seven-jointed, joints sub-equal. The formula shows the different lengths of the joints of the specimen figured :—

Proportional lengths of the joints, .	10	7	5	6	6	6	8
Number of the joints, . . .	1	2	3	4	5	6	7

Antennæ short and stout, secondary branch one-jointed and furnished with three setæ (fig. 15). Mandibles well developed, palp comparatively large and two-jointed (fig. 16). Posterior foot-jaws strongly clawed. The first joint is also armed with a setiferous spine on the inner distal angle (fig. 17). First four pairs of swimming feet short, inner branches, two outer branches three-jointed. In the first pair the inner branches are nearly as long as the outer branches, and the first joint is stouter than, and nearly twice the length of, the last joint (fig. 18). In the next three pairs the inner branches, which are shorter than the outer branches, have the joints sub-equal. The outer branches of the fourth pair are proportionally rather longer than those of the first, and are fully twice the length of the inner branches (fig. 19). The basal joint of the fifth pair is comparatively large and sub-triangular in form, and bears several small setæ round the distal end. The secondary joint is very small (fig. 20). Caudal stylets stout, about as long as the last abdominal segment.

Habitat.—Side of Loch Fad, Bute ; rare.

Remarks.—The above description and drawings had been prepared before I happened to observe the close resemblance between this Copepod from Loch Fad and *Ophiocamptus Poppei* described by Herr. Ald. Mrazek, who discovered that species in a brook in the forest at St Ivan, Pribram, Bohemia. Further study of the characters of the two forms leaves no doubt in my mind as to their identity. The similarity of the form and armature of the fifth feet is remarkably close ; even the curved setæ at the apex of the basal joint are similar in the specimens from Loch Fad and in those from St Ivan.

Cyclocypris serena and *Cyclocypris lævis.*

In the Appendix to the Second Part of the 'Monograph of the Marine and Fresh-Water Ostracoda of the North Atlantic and North-Western Europe,' by Drs Brady and Norman, various changes in the nomenclature of the Ostracod-fauna have been introduced, in order to bring the Monograph more into line with the results of recent investigations. One of the effects of this has been the removal of the two species referred to above from the genus *Cypria*, Zenker, to *Cyclocypris*, Brady and Norman.

Among other changes introduced in the Appendix to the Monograph, the following have reference to species recorded in the present paper: *Ilyodromas Robertsoni* (Brady and Norman) = *Herpetocypris Robertsoni*, Brady and Norman.

The genus *Ilyodromas* was instituted by Prof. Sars in 1894, to include one or two aberrant species of *Herpetocypris*, and *Herpetocypris Robertsoni* was one of these.

Pionocypris vidua (O. F. Müller).

This is recorded in previous papers as *Cypridopsis vidua.* But Drs Brady and Norman have now instituted the new genus *Pionocypris* for this and one or two similar forms.

Candona compressa (Koch).

This was previously recorded as a form of *Candona pubescens*, but it is now considered to be distinct.

Ilyocypris biplicata (Koch).

Two Ostracod forms have been described under the name of *Cypris* (afterwards *Ilyocypris*) *gibba*,—a distinctly tuberculated form, and one only bisulcated. Prof. Sars, in separating these two forms, retains that which is tuberculated under the old name, and gives to the simply bisulcated form the name of *Ilyocypris Bradii.* Drs Brady and Norman, in their Appendix, state, in referring to this, that if the simply bisculated form is to be recognised as distinct, it should bear the name of *Ilyocypris biplicata*, as it appears to be identical with Koch's specimens of that name. The specimens from Linlithgow Loch recorded in this paper are all simply bisulcated, and I have for the reasons stated recorded them under Koch's specific name. The only locality where I have obtained typical tuberculated specimens was in the Union Canal near Edinburgh.

Darwinula Stevensoni, Brady and Robertson. This, which is comparatively a rare species in Scotland, was obtained sparingly in both of the Forfarshire Lochs referred to in this paper.

Alona rustica, T. Scott.

This distinct Cladoceran, which has hitherto been obtained only in lochs in the Outer Hebrides and in Shetland, was one of the species found in the gathering from Black Loch near Campbeltown.

Leptodora hyalina, Lilljeborg.

Leptodora occurred in the gathering from Loch Rescobie, but appeared to be very rare. It is probable, however, that if a boat and tow-net were employed in the examination of the loch it might be found to be more frequent.

EXPLANATION OF THE PLATE.

Plate IX.

Canthocamptus inornatus, sp. n.

Fig. 1.	Female, side view,	× 80
Fig. 2.	Antennule, female,	× 250
Fig. 3.	Antennule, male,	× 380
Fig. 4.	Antennæ,	× 380
Fig. 5.	Mandible and palp,	× 760
Fig. 6.	Posterior footjaw,	× 760
Fig. 7.	Foot of first pair of swimming feet,	× 380
Fig. 8.	Foot of third pair of swimming feet, male,	× 253
Fig. 9.	Foot of fourth pair of swimming feet, female,	× 253
Fig. 10.	Foot of fifth pair, female,	× 380
Fig. 11.	Foot of fifth pair, male,	× 760
Fig. 12.	Last abdominal segment, and caudal stylets,	× 126

Moraria Poppei (Mrazek).

Fig. 13.	Female, dorsal view,	× 90
Fig. 14.	Antennule,	× 760
Fig. 15.	Antennæ,	× 760
Fig. 16.	Mandible and palp,	× 760
Fig. 17.	Posterior footjaw,	× 760
Fig. 18.	Foot of first pair of swimming feet,	× 760
Fig. 19.	Foot of fourth pair of swimming feet,	× 760
Fig. 20.	Foot of fifth pair,	× 760

Canthocamptus cuspidatus, Schmeil.

Fig. 21.	Foot of first pair of swimming feet,	× 253
Fig. 22.	Foot of fifth pair, female,	× 380

Cyclops Leucharti, Claus.

Fig. 23.	Antennule of female,	× 126
Fig. 24.	Foot of fifth pair of thoracic feet,	× 380
Fig. 25.	Caudal stylets,	× 190

Cyclops varicans, G. O. Sars.

Fig. 26.	Antennule of female,	× 253
Fig. 27.	Foot of fifth pair,	× 760
Fig. 28.	Caudal stylets,	× 380

DIVISION II.

An Account of the Examination of some of the Lochs of Shetland. By Thomas Scott and Robert Duthie.

Some additional work has been done during the past year in continuation of our inquiry into the fresh-water fauna of the Shetland Islands, and some important additional information concerning the distribution of the Mollusca and Crustacea has been obtained. Owing, however, to pressure of other work, fewer lochs were visited last year than formerly. Those examined were all in the vicinity of Lerwick, and are described in the following order :—

I. Lochs on the Mainland.

(1) Loch of Wick, (2) Gossa Water, (3) Neugles Water, (4) Lochs of Tingwall and Asta, (5) Long Lochs and Flossie Loch, (6) Loch of Fladdabister.

II. Lochs of Bressay.

(1) Aith Loch, (2) Setter Loch, (3) Brough Loch.

I. Lochs on the Mainland.

(1) *Loch of Wick, Shurton Hill, Lerwick.*

Examined, 3rd August 1896.

This is a small loch, with very little vegetation of any kind. It appears to be subject to partial evaporation in warm weather. When visited, the water had subsided and left a wide margin of white mossy sediment, which rendered the work of examination rather difficult. Fauna were not very plentiful. The loch is about 350 feet above sea-level.

(2) *Gossa Water, Shurton Hill.*

Examined, 3rd August 1896.

This loch, like the above, which it adjoins, has also a high altitude—some 400 feet above sea-level. The shores, like the surrounding hills, are covered with deep moss ; but algæ were growing freely in some places, and fauna were fairly plentiful. The water seemed to be much deeper than in the neighbouring and smaller loch, and the area did not appear to vary much from evaporation or overflow.

(3) *Neugles Water, near Scalloway.*

Examined, 3rd August 1896.

This loch, like the others visited the same day, was examined under favourable atmospheric conditions. It nestles in a rather pretty situation on the top of the hill of Steinswall, between the valleys of Fitch and Tingwall, and has an altitude of 220 feet—in marked contrast to the neighbouring lochs of Asta and Tingwall, which are only 26 and 28 feet respectively above sea-level.

(4) *Lochs of Asta and Tingwall.*

Examined, 16th October 1896.

These lochs, of which the latter is over a mile long, are well known to sportsmen as affording excellent trout-fishing, and on this account they are much frequented by anglers during the fishing season. The Loch of Tingwall is also interesting to students of ancient history as being the seat of the ancient Law Ting or Parliament, which met on a small holm or island near the centre. The lochs are quite near each other, connected by a fair-sized burn, and they have many points of resemblance. The water is clear and transparent, and free from the mossy sediment usually prevalent in Shetland lochs. The shores are gravelly, with occasional stretches of rock, and there were few aquatic plants to be seen. The hand-net was used along the whole length of the northern shores of both lochs, wherever the water was deep enough to admit of it. Free swimming animalculæ were very scarce; the specimens obtained were mostly shell-fish and insect larvæ. The collections from the two lochs appeared to be similar in many respects. As the season was far advanced, the day cold, and the lochs and burn flooded, the examination could hardly be considered satisfactory. A visit under more favourable conditions might yield better results.

(5) *Long Lochs and Flossie Loch, Gulberwick.*

Examined, 10th September 1896.

These are three small tarns lying in a marsh among the hills west of Gulberwick, some four miles from Lerwick. Though rather inaccessible, they are well worth a visit, and they are a favourite resort of trout-fishers. None of the Shetland lochs yet visited showed such a profusion of aquatic plants, and the fauna appeared to be both abundant and varied. The lochs are about 300 feet above sea-level.

(6) *Loch of Fladdabister* (7 or 8 miles S. of Lerwick).

Examined, 10th September 1896.

This loch is not far from the sea, and at a much lower elevation than the Flossie Lochs. It looks best at a distance : a closer examination is disappointing. Its shores have a desolate appearance, entirely devoid of plant life, and fauna seemed extremely scarce, though a long and careful search was made with the hand-net all round the loch. The adjacent ground and the bottom of the loch are covered with deep moss; the shores are rocky, without a trace of vegetation.

II. Lochs of Bressay.

All the lochs in the north part of Bressay were examined last year, and described, along with the general features of the island, in the Board's report for 1895. This year three lochs in the centre of the island were visited and examined.

Aith Loch.

Examined, 15th October 1896.

The Loch of Aith lies about half a mile inland from the voe of the same name, and at an altitude of 70 or 80 feet above sea-level. Like the other lochs in Bressay, it is comparatively small. It was freer from moss and mud than most of the neighbouring lochs. Algæ were growing freely in some parts, and animalculæ seemed well distributed all round the margin. The loch was examined about noon, the day being fine, with a bright sun.

Loch of Setter.

Examined, 15th October 1896.

The Loch of Setter is 43 feet above the level of the sea, to which a burn flows through it from the Loch of Brough. It is about the same size as Aith Loch, but shallower about the margin and destitute of vegetation.

Loch of Brough.

Examined, 15th October 1896.

Brough Loch lies near the middle of Bressay, at an elevation of 77 feet. With the exception of the Loch of Setter, through which fish must pass to it, it is said to be the only loch in Bressay that affords good trout-fishing. It appeared to be deeper than the Loch of Setter, and was less barren in appearance, owing to the presence of some algæ round the shores.

FAUNISTIC NOTES.

A detailed list of the species of Mollusca and Crustacea obtained in the lochs examined during the past year is contained in the annexed table of distribution, but the following short description of the contents of the gatherings from the various lochs may also be of interest.

Loch of Wick.

Although the number of species obtained in the gathering from this loch was not very great, it included several comparatively rare forms, such as *Moraria Anderson-Smithi* and *Acantholeberis curvirostris.* In this gathering the pretty *Graptoleberis testudinarius* was moderately common.

Gossa Water.

Four species of Copepoda, three of Ostracoda, and nine of Cladocera, were observed in the gathering from this loch. *Gammarus pulex* and a single species of Mollusca were also obtained.

Neugles Water.

Several interesting species were obtained in the gathering from this loch, especially among the Cladocera,—viz.: *Latona setifera*, *Drepanothrix dentata*, *Ilyocryptus sordidus*, *Alona intermedia*, and *Chydorus globosus. Cytheridea lacustris* (one of the Ostracoda) was also obtained.

Lochs of Asta and Tingwall.

In some respects the gatherings from these two lochs were more than usually interesting. Among the Mollusca in the gathering from Loch of Asta, *Planorbis contortus* and *Planorbis glaber* were obtained for the first time during the investigations that are now being carried on. They have both, however, been recorded for the Shetland Islands in Dr Jeffrey's *British Conchology*. *Camptocercus macrurus*, one of the Cladocera obtained in this loch, is one of the species now recorded for the first time for Shetland. Other interesting forms, such as *Canthocamptus hirticornis* and *Chydorus globosus*, were also observed.

In this gathering from Loch of Tingwall were *Gammarus Duebeni*, *Canthocamptus hirticornis*, *Canthocamptus cuspidatus* (this is an interesting addition to the fauna of Shetland), *Chydorus globosus*, *Ilyocypris biplicata*, and *Potamocypris fulva.* A few specimens of *Jæra Nordmanni* were observed in this gathering, which probably had been accidentally introduced.

Long Lochs and Flossie Loch.

The three lochs being small and near to each other, the gatherings from them were not kept separate. These combined gatherings yielded over thirty species—sixteen species of Cladocera, nine of Copepoda, four of Ostracoda, and two of Mollusca. One of the species of Mollusca—*Planorbis albus*—is an addition to our previous lists, so also is *Pleuroxus trigonellus*, one of the Cladocera. *Canthocamptus hirticornis*, *Latrona setifera*, and *Drepanothrix dentata* were also observed.

Loch of Fladdabister.

Fewer species were obtained in the gathering from this loch than in any of the others. Ten species in all were obtained, comprising five species of Copepoda, four of Cladocera, and the Amphipod *Gammarus Duebeni*.

Aith Loch, Bressay.

Thirteen species (all Crustacea) were obtained from the gathering from this loch, but though there was not such a variety of forms as in some of the other lochs, some, at least, of the species were more or less uncommon. *Gammarus Duebeni*, *Attheyella pygmæa*, *Diaptomus Wierzejskii*, and *Chydorus globosus* are the names of some of the species found in Aith Loch.

Loch of Setter, Bressay.

In this gathering twenty-two species were obtained, including two species of Mollusca, *Gammarus (?) pulex*, nine species of Copepoda, and ten species of Cladocera. *Canthocamptus cuspidatus* was one of the Copepods obtained here.

Loch of Brough, Bressay.

Twenty-three species of Crustacea were obtained in this loch, including the two somewhat rare forms, *Canthocamptus cuspidatus* and *Camptocercus macrurus*. No Mollusca were observed.

Insect larvæ, water mites, beetles, Rhizopods, Diatoms, etc., were observed in several of the gatherings, but have not yet been identified.

TABLE containing the names and showing the distribution of all the species from the Shetland lochs, described in the preceding pages.

Names of the species.	Lochs on the Mainland.							Lochs of Bressay.		
	Loch of Wick.	Gossa Water.	Neugles Water.	Loch of Tingwall.	Loch of Asta.	Long Lochs and Flossie Loch.	Loch of Fladdabister.	Aith Loch.	Setter Loch.	Brough Loch.
MOLLUSCA.										
Pisidium pusillum, Jenyns, . . .	.	×	.	.	.	.	.	.	.	.
Planorbis nautileus (Linné), . . .	.	.	.	×	×	.	.	.	×	.
**Planorbis albus*, Müller .	.	.	.	.	.	×	.	.	.	.
**Planorbis glaber*, Jeffreys, ...	.	.	.	.	×	.	.	.	.	.
**Planorbis contortus*, Linné, ...	.	.	.	×	×	.	.	.	.	.
Limnea peregra (Müller)	.	.	.	×	.	×	.	.	×	.
**Limnea truncatula* (Müller), . . .	.	.	.	×	(?)	.	.	.	.	.
CRUSTACEA.										
AMPHIPODA.										
Gammarus Duebeni, Lilljeborg, . . .	.	.	.	×	.	.	×	×	.	×
Gammarus pulex (Linné)	.	×	×	.	.	.	.	.	(?)	.
COPEPODA.										
Diaptomus Wierzejskii, Richard, . . .	.	×	.	×	×	.	.	×	×	×
Cyclops viridis (Jurine),	×	.	.	.	×	.	.	.	.	.
Cyclops albidus (Jurine),	.	×	×	×	×	×	.	×	.	×
Cyclops strenuus, Fischer	.	×	.	.	.	×	×	×	.	×
Cyclops serrulatus Fischer, . .	×	×	×	×	×	×	×	×	×	×
**Cyclops affinis*, G. O. Sars	.	.	.	.	.	×	.	.	.	.
Cyclops fimbriatus, Fischer, . . .	.	.	.	.	.	.	×	.	.	.
Canthocamptus staphylinus [Jurine), . .	.	.	.	×	×	×	.	×	×	×
Canthocamptus hirticornis, T. Scott, .	.	.	.	×	×	×	.	.	×	×
**Canthocamptus cuspidatus*, Schmeil, . .	.	.	.	×	.	.	.	.	×	×
Attheyella crassa (G. O. Sars, ...	×	.	×	.	×	×	×	.	×	
Attheyella pygmæa (G. O. Sars, ...	×	.	.	×	×	×	×	×	×	×
Attheyella Zchokkei (Schmeil), ...	×	.	×	(?)	.	×	.	.	(?) ×	×
Moraria Anderson-Smithi, T. & A. Scott,	×	.	.	.	.	.	.	.	.	.

* The species so marked have not been recorded in previous lists.

Names of the Species.	Lochs on the Mainland.							Lochs of Bressay.		
	Loch of Wick.	Gossa Water.	Neugles Water.	Loch of Tingwall.	Loch of Asta.	Long Lochs and Flossie Loch.	Loch of Fladdabister.	Aith Loch.	Setter Loch.	Brough Loch.
Ostracoda.										
Cyclocypris serena (Koch)	.	.	×	×	×	×	.	.	.	.
Cyclocypris lævis Müller)	.	×	.	.	.	.	.	.	.	.
Cypria ophthalmica (Jurine), . . .	.	×	×	.	.	×	.	.	.	×
Herpetocypris reptans (Baird), . . .	.	.	.	.	.	×	.	.	.	.
Cypridopsis villosa (Jurine), ...	.	.	.	.	×	.	.	.	.	.
**Ilyocypris gibba* (Ramdohr), . . .	.	.	.	×	.	.	.	.	.	.
**Potamocypris fulva*, Brady, ...	.	.	.	×	.	.	.	.	.	.
Candona candida (Müller), ...	.	×	.	×	×	×	.	.	.	×
Cytheridea lacustris (G. O. Sars), . . .	.	.	×	.	.	.	.	.	.	.
Cladocera.										
Latona setifera (Müller),	.	.	×	.	.	×	.	.	.	.
Bosmina longirostris (Müller), . . .	×	×	×	.	.	×	.	.	×	×
Drepanothrix dentata (Euren), . . .	.	.	×	.	.	×	.	.	×	.
Acantholeberis curvirostris (Müller), . .	×	.	.	.	.	.	.	.	.	.
Ilyocryptus sordidus (Lievin), . . .	.	.	×	.	.	×	.	.	.	.
Ceriodaphnia quadrangula, ...	×	.	.	.	.	.	.	.	.	.
Daphnia longispina (Müller), . . .	.	.	.	×	.	.	×	.	.	×
Eurycercus lamellatus (Müller), . . .	×	×	×	.	×	×	.	×	×	×
**Camptocircus macrurus*,	.	.	.	.	×	.	.	.	.	×
Acroperus harpæ (Baird),	.	×	×	×	×	×	.	×	×	.
**Pleuroxus trigonellus*, .	.	.	.	.	.	×	.	.	.	.
Alonopsis elongata, G. O. Sars, . . .	×	×	×	×	×	.	.	.	×	×
Graptoleberis testudinarius (Fischer), . .	×	×	×	.	×	×	.	.	×	×
Alona affinis, . .	.	×	.	.	×	×	.	×	.	×
Alona quadrangularis (Müller), . . .	.	×	.	(?)	.	×	×	.	(?)	.
Alona intermedia, G. O. Sars, . . .	.	.	×	.	.	.	.	.	.	.
Alona rusticata, T. Scott	.	.	.	.	.	.	×	.	.	.
Alona guttata, G. O. Sars	.	.	.	.	.	(?)	.	×	(?)	.
Alonella exigua (Lilljeborg), ...	.	.	×	.	.	×	.	.	.	.
Alonella nana (Baird), .	.	.	.	.	.	×	.	.	.	.
Harporhynchus falcatus, G. O. Sars, . .	×	.	.	.	.	×	.	.	.	×
Chydorus globosus, Baird,	.	.	×	×	×	×	.	×	.	.
Chydorus sphæricus (O. F. Müller), . . .	×	.	×	×	.	.	.	×	×	×
Chydorus barbatus Brady, ...	×	×	×	×	×	×	.	.	×	×
Polyphemus pediculus (De Geer), . . .	.	×	.	.	.	.	.	.	.	.

XIII.—THE CURRENTS OF THE NORTH SEA, AND THEIR RELATION TO FISHERIES. By Dr T. Wemyss Fulton, F.R.S.E., Scientific Superintendent (Plates X., XI.).

CONTENTS.

I. INTRODUCTION.

In recent years the attention of a number of investigators has been directed to the hydrography of the North Sea, and several inquiries and series of observations have been made with the object of determining its principal physical conditions at different seasons and in successive years, with especial relation to the movements of its waters. The most important investigations on the subject have been made by the eminent Swedish scientists, Professor Otto Pettersson and Dr Ekman, who have succeeded in throwing a great deal of light on the physical changes which take place in the Kattegat, Skagerrak, and adjoining areas; and apparently in correlating them with the herring and mackerel fisheries. At their initiative approximately simultaneous observations were carried on in 1893 and 1894 by Danish and Swedish vessels in the Kattegat and Skagerak by H.M.S. 'Jackal' in the Faroe-Shetland Channel, and in other parts of the North Sea by Norwegian and German vessels; and several preliminary reports embodying and discussing the observations have been published.

The method adopted in these hydrographic researches consists essentially in the determination of the salinity and temperature of the water at various depths in different localities, and, as far as possible, at the same time, so as to obtain a simultaneous record of the conditions over the whole area. The waters which enter the North Sea and may circulate within it come from two great sources, the ocean on the one hand and the Baltic and fresh-water rivers on the other; and, since these waters differ in salinity and temperature according to their source, it is possible, by comparing the temperature and salinity observations, to trace the course and extent of their movements. For this purpose it is obviously necessary to have both simultaneous observations over a wide area, and a series of such observations in different seasons and in successive years. The final results of the work already accomplished have not yet been published, but Mr H. N. Dickson is now engaged in preparing synoptic charts.

Another method of tracing the movement of the water is by a study of the organisms which are suspended in it, and carried by it, especially the diatoms and minute plant life. If, for instance, a series of floating forms which are usually absent from one region and normally abundant in another region, suddenly make their appearance in numbers in the former, it offers very strong evidence that there has been a movement of the water from one to the other. This branch of inquiry is being pursued by Professor Cleve of Upsala, in connection with the investigation of the currents in the North Sea.

A third method, somewhat akin to the last mentioned, consists in the employment of floating bodies, usually bottles, whose place and time of immersion are known, and which can be subsequently identified when they are recovered. It is a method regularly used in the Atlantic by the United States Hydrographic Office, and by the *Deutsche Seewarte* of Hamburg. It was also employed by the Prince of Monaco in connection with the movement of the Gulf Stream* and by various others.† It is the system which has been adopted in the experiments made by the Fishery Board, the results of which are given in the present paper. This mode of ascertaining the direction and rate of surface currents appears at first sight to be simple, and it is comparatively inexpensive, but it may be open to objection on several grounds. In the first place, if the floating body is not completely submerged it will be directly acted on by the wind, which may drive it in a direction different from that of the moving water; and the extent of the wind-action will largely depend upon the proportion of the surfaces exposed and submerged. In the second place, even although completely submerged, one cannot always be certain of the exact route taken by an individual float between the point where it was put into the water and the point where it was picked up, or as to the time it may have lain upon the beach before being observed. The course may have been irregular or zig-zag, and the lapse of time between the stranding and recovery of the float may be considerable. But the force of these objections may be greatly diminished by due care and by a study of the winds during the period of flotation, and by a multiplication and comparison of the observations. Conclusions based upon isolated experiments may be erroneous, but when the same results are obtained in dozens or hundreds of experiments, extending over a long time, the conclusions to be drawn from them become much more certain.

Two kinds of floats were employed in the experiments, namely, bottles and slips of wood; the former gave by far the best results, judged by the percentage of those recovered. The bottles (fig. 1) were made of coarse glass, they were wide-mouthed, and of ounce size, and in each was placed a card bearing a number, and printed directions in three languages—English, Danish, and German—requesting that it should be returned to the writer, with a statement of the place and date of recovery. The card and the cork were dipped in melted paraffin-wax, and the buoyancy of each bottle was tested in a pail of sea water. Soft lead wire was then wound round the neck, sufficient to submerge the bottle flush with the surface; in a few cases where it was exceptionally heavy, cork was tightly tied to it by silk cord (which has been proved to resist the action of sea water for years) until the same degree of buoyancy was obtained. The slips of wood (fig. 2) were six inches long, one inch broad, and $\frac{3}{8}$ of an inch thick. They were immersed in melted paraffin, the printed card, also coated with paraffin, and a small square piece of

* Sur le Gulf Stream, Recherches pour établir ses rapports avec la côte de France, 1885; and various subsequent papers in the *Comptes rendus de l'Académie des Science.*
† M. J. Thoulet, Océanographic, première partie, 1896.

sheet-lead, sufficient to all but submerge the wood, were then securely tacked on to one side, and another card to the other side; and the whole was again dipped in paraffin. The object was to render it impervious to water while allowing the print to be read through the translucent layer. So long as they were floating, the drift-slips, as a rule, answered well, as was shown both by direct experiments and by many of the results. But when they lay on the beach for any length of time, subjected to the tossing action of the waves and friction and abrasion on stones and sand,

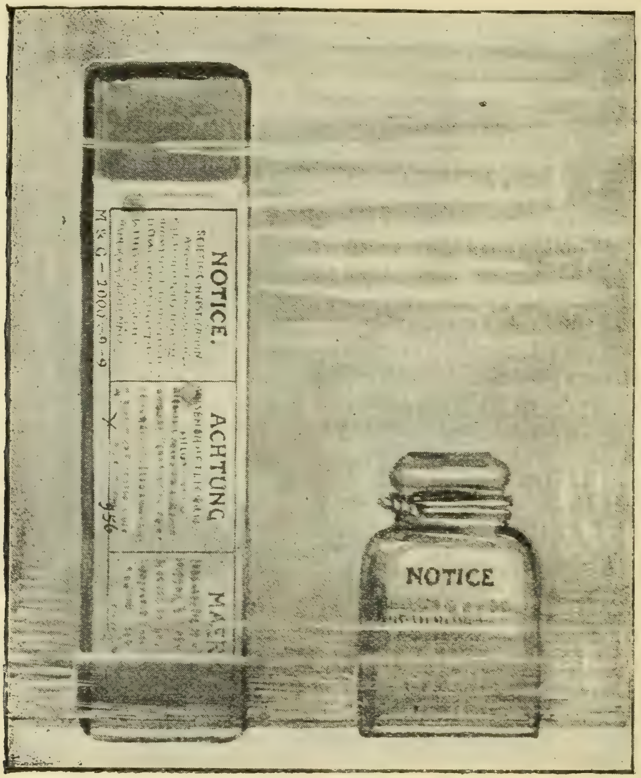


FIG. 1.—Showing the two forms of float adopted in the experiments.

the paraffin was apt to be more or less worn off and the print partially obliterated. At first, too, another difficulty was encountered. The paraffin and paper proved attractive to minute animals on the shore—probably crustacea, such as *Talitrus*, which abounds in most places—and they were eaten off, leaving curious patterns; mixture of creosote and carbolic acid with the paraffin obviated this difficulty. As has been said, however, the wooden slips did not give such good results as the bottles.

These floats were meant to ascertain the movement of the surface water. Latterly, it was deemed expedient to discover, if possible, whether the bottom water and the intermediate layers moved in the same direction as the surface. A number of wooden slips were accordingly weighted so as to sink gently to the bottom, but none have been recovered; probably owing to the influences above alluded to. Bottles, carefully arranged to resist pressure, and tested first, were also loaded with the same object, and two have been recovered. The few experiments made to ascertain the drift of the intermediate layers were also unsuccessful.

The object of the experiments was to ascertain the direction and rate of the currents, especially on the east coast of Scotland, in connection with certain fishery questions. The most important of these concern the transport or carriage of the floating eggs and larvæ of the food fishes from the areas where they are shed to the areas where the young fishes begin their independent life. It is now well known that the eggs of all the food fishes, with the exception of the herring, skates, and rays, are pelagic, and after being emitted into the water float, separate and isolated, in the upper layers. This is so, for instance, with the eggs of the cod, haddock, whiting, coalfish, and all the flat-fishes. It has also been proved by the researches of the 'Garland' that almost all these fishes, and all the important ones, do not shed their eggs within the three-mile limit on the east coast, but that they do so beyond that limit, and probably in many cases up to a considerable distance from the shore.* It has further been shown by the researches of the 'Garland' that, in many cases, the habitat of the very young fishes, when they are assuming, or have just assumed, the character of the adult, is in the shallow inshore waters. While the great spawning grounds are, therefore, in the offshore waters the 'nurseries' are, in many cases, in the shallow water along the shores, and the floating eggs and the larvæ may be obtained by the tow-net within the three-mile limit, whither they have been carried by the currents from areas further out. A study of the course of the currents along the coast is thus of importance to enable us to trace this connection. It has been frequently proposed to protect during the spawning time parts of the areas where the important food fishes spawn, mainly with the view of increasing the abundance of the fishes in inshore waters. In such a case it is obviously desirable to be able to establish the relationship between the offshore area and the inshore grounds. It will be seen later that owing to the course of the prevalent current the spawning area which stands in relation to any part of the territorial waters on the east coast, is not, as a rule, *ex adverso* of the latter, but lies to the northward of it, and may be a considerable distance off. In connection with this part of the subject it is necessary besides considering the rate of the current to consider also the natural rate of development of the floating eggs of different species. If a current goes in a definite direction at the rate of, say, three miles a day, and a pelagic egg transported by it takes twenty days to hatch, the egg will be carried in the interval sixty miles from the place where it was shed into the water to the place where the larval fish emerges. The larval fish, which, for some time, is practically inert and helpless after issuing from the egg, may be carried a considerable distance farther before it is able to make its way against the current. The duration of the development within the egg varies in different species, principally in accordance with the size of the egg, and it also varies directly with the temperature. These factors were explained in the author's preliminary paper on the subject,† and they will be more fully dealt with later in the present one.

The determination of the currents in the sea may also be of importance, from the fishery point of view, in other directions. They are, for example, effective in carrying the smaller organisms suspended in the water, and

* T. Wemyss Fulton, "The Spawning and Spawning Places of Marine Food Fishes," Part iii., *Eighth Annual Report*, p. 257.

† "The Relation of Marine Currents to Offshore Spawning Areas and Inshore Nurseries," *Thirteenth Annual Report, Fishery Board for Scotland*, Part III., pp. 153, 157 (1895).

which form a principal source of the food of pelagic fishes, as the herring and mackerel, as well as of the larval and post-larval stages of many other forms. They appear also to be correlated with the distribution of certain species, which are not in their adult condition subjected to their drift-action. It is not improbable that the successive appearance of the shoals of herrings, whose presence gives rise to the spring fishing on the western and northern coasts of Scotland, the summer fishing on the east coast of Scotland, and the autumn fishing off the Norfolk coast, is connected with the existence of the current which will be shown to exist parallel to these coasts, and which moves in the same direction. Moreover, a knowledge of the currents referred to may help to explain the formation of banks, especially in the southern and eastern parts of the North Sea, which are frequented by great numbers of the food fishes.

This paper will therefore deal, in the first place, with the movements of the surface water in the North Sea, as shown by the drift-bottles and drift-slips, and their relation to tides and winds; and, in the second place, with the effect of these movements so far as concerns the sea fisheries.

II. THE DIRECTION AND RATE OF THE CURRENTS.

(1) *The Course of the Drifters.*

The experiments were begun in September 1894, and have been continued up to February of the present year (1897), thus embracing a period of about two years and a half. During this time the number of bottles set adrift in the North Sea, or to the north and west of it, was 2074, and the number of wooden slips set adrift was 1479; about 14 per cent. have up to the present been recovered, the great majority being bottles. There is evidence, which need not be particularised, that all the drifters which were found were not returned. Most of them were put overboard from the fishery steamer 'Garland,' others by H.M.S. 'Jackal' and H.M.S. 'Research,' others by fishing-boats engaged in the deep-sea fishery; many by the steamers belonging to Messrs Currie & Co., Leith, while on their passage to Christiansund and Hamburg; by the steamers belonging to Messrs Geo. Gibson & Co., Leith, on their voyage to Rotterdam, and by steamers belonging to the North of Scotland Steam Shipping Company.

The courteous assistance thus rendered by the firms and gentlemen named materially aided the work

In almost all cases a number of drifters, from three or four to over twenty, were thrown overboard at the same place; and in the Tables appended to this paper (p. 377) the dates and places of immersion and recovery are given. The area where they were put into the sea extends from between the Shetland and Faroe Isles on the north to a line running from a point off Flamborough Head to the Hook of Holland on the south. The great majority were put away on the east coast, but a considerable number also at intervals along lines between the Isle of May on the one hand and Christiansund and Hamburg on the other. The following shows the numbers put away in the various months of the period:—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1894,	.	.	.	.	.	.	.	.	24	180	114	59
1895,	38	127	224	70	26	.	50	105	.	.	.	.
1896,	.	.	204	4	98	175	310	540	.	553	267	292
1897,	110											

The number set adrift on the east coast of Scotland, within 20 miles of the shore, south of Duncansby Head, Caithness, was 1864; the number set adrift in the neighbourhood of the Shetland and Orkney Isles was 369; the number on the route to Christiansund was 630; on the route to Hamburg 520; and between a point 12 miles off Flamborough Head and the Hook of Holland 200. Some others were put into the sea off the east coast at a distance greater than 20 miles.

The drifters which were recovered were found principally along the east coasts of Scotland and England, as far south as Norfolk, and on the Continent between North Holland in the south and north of the Loffoden Islands, within the Arctic Circle, in the north; between the parallels of 53 and 69 north latitude. They were scattered over a stretch of about 1700 miles of coast. The numbers found up to the end of March 1897, on the various coasts are as follows:—

East coast of Scotland, 155; England, 95; Holland, 5; Germany (west coast), 4; Denmark, 57; Sweden, 6; Norway, 46. On the Scotch coast, south of the Moray Firth, the numbers found in the different counties were:—Banff, 36; north coast of Aberdeen, 16; east coast of Aberdeen, 16; Kincardine, *nil*; Forfar, 2; Fife, 43; East Lothian, 36; and Berwick, 6. On the English coast the numbers found were:—Northumberland, 25; Durham, 11; Yorkshire, 34; Lincoln, 2; Norfolk, 23. The number found on the Orkney and Shetland Isles was 11 and 21 respectively; the remainder of the drifters were found in the inner parts of the Moray Firth and Firth of Forth, with the exception of 6, which were picked up at sea while still floating in the water.

In order to study the movement of the drifters, a line was drawn on a large chart between the place where each was set adrift and the place where it was found. It was soon proved, however, that, in many cases, such a line did not represent the real route taken. This was especially true of those stranded on the Continental coasts, particularly Denmark, Holland, Germany, and Sweden, which, in nearly all cases, must have first passed down off the east coast of this country and then crossed over to the other side. Before proceeding to consider the movements in detail, it may be well to state here the principal conclusions derived from the experiments with respect to the course of the currents. The most important are as follows:—

(1) The surface Atlantic water passes southwards and eastwards from the neighbourhood of the Shetlands, and eastwards from the area west of the Orkneys; it then moves southward along the east coast of Scotland and England to the neighbourhood of the Wash, impinging more or less on the coasts that run at an angle to it, namely, Banff and Aberdeen, Fife, East Lothian, Berwick, and the east coast of England, as far as the neighbourhood of Spurn Point in Yorkshire.

(2) The movement of the surface water is then eastwards towards the coast of the Continent, the main body impinging on the coast of Denmark, north of the Horn.

(3) The course is then northward to the Skagerrak, and along the west coast of Norway, as far at least as the Loffodens. Sometimes the water passes into the Skagerrak, to the coast of Sweden and the Christiania Fjord.

(4) While the above movement down the western and up the eastern parts of the North Sea is the regular and predominating one, it may be modified by the prevalence of strong winds or gales blowing in certain directions. These may cause the current to swerve; or, as happened at one period, to be reversed.

(5) In the western part of the Moray Firth and in the Firth of Forth the movements are much less regular, and depend directly upon the winds and tides.

In describing the course taken by the drifters it will be convenient, in the first place, to consider the area over which their movements occurred, in sections; namely, (1) the region of the Shetland and Orkney Isles; (2) the Moray Firth; (3) the east coast of Scotland; (4) the east coast of England; (5) the eastern part of the North Sea, south of the Skagerrak; (6) the Skagerrak, Christiania Fjord, and coast of Norway.

Shetland—Orkney Area.

In the first named region drifters were put into the sea in the Faroe-Shetland Channel, between Shetland and Orkney, and at various places in the neighbourhood of these islands. The places and the apparent course of the floats are indicated in the adjoining chart (fig. 2), and it will be observed that, in the great majority of cases, the course of the bottles was eastward or southward. At the end of July and the beginning of August 1896, a number of drift-bottles and slips were thrown overboard from H.M.S. 'Research' at seven stations west and north of the Shetlands, as shown in the chart; and some from every station were recovered with the exception of the station known as 'Jackal No. XIV' (lat. 61° 18½′ N. long. 4° 21¼′ W.), which lies midway between the Faroe Isles and the Shetlands. Of the twenty-two 'Research' drifters recovered, sixteen were found on one or other of the Shetland Isles, two on the Orkney Isles, one on the coast of Aberdeenshire, and three on the west coast of Norway. The details of each are given in the Table (p. 388), but some of the chief facts may be described. Three of those set adrift on the 30th July, about 65 miles to the north of the Shetlands (lat. 61° 49½′ N. long. 0° 43′ W.), were picked up on the beach at Fetlar and Yell, more than ninety miles to the south, one on the 12th September and the other two on the 14th September, or 44 and 46 days after they were put into the water. One of those set adrift on 31st July at lat. 61° 1′ N. and long. 3° 13′ W. was picked up near Lerwick, over 100 miles to the south-east, on 4th December. Six of those from a point about 125 miles west of the Shetlands (lat. 60° 38¼′ N. long. 5° 35½′ W.), put adrift on the 5th August, were picked up at various places in the north of Shetland between 27th August and 7th September, the distances travelled in that time ranging from 116 to about 150 miles. One was found on 24th February 1897, at Sorsmolen, near Christiansund N., in the province of Romsdal, Norway, having travelled about 430 miles in the 204 days.

The one first found, on 27th August, was carried at least 138 miles in the 22 days it was afloat; and all these drifters had travelled eastward and a little southward.

Of those put away, on the 1st August, about 135 miles west of the southern part of the Shetlands (lat. 60° 3′ N. long. 5° 48′ W.), two were picked up on the Shetlands, two on Orkney, and one at Cruden Bay, Aberdeenshire. The first recovered was found, forty days after it had been put into the water, on the east side of the Mainland, Orkney, about 118 miles distant; the first one found on Shetland was picked up on the 28th September on the west side, about 124 miles distant. The drifter found on the coast of Aberdeen, over 200 miles from the place where it was thrown into the water, was not picked up until the 22nd December, 144 days afterwards. Two of those set adrift on 7th August in lat. 59° 42′ N. long. 7° 7′ W. were found on the *east* side of the Shetlands on 6th

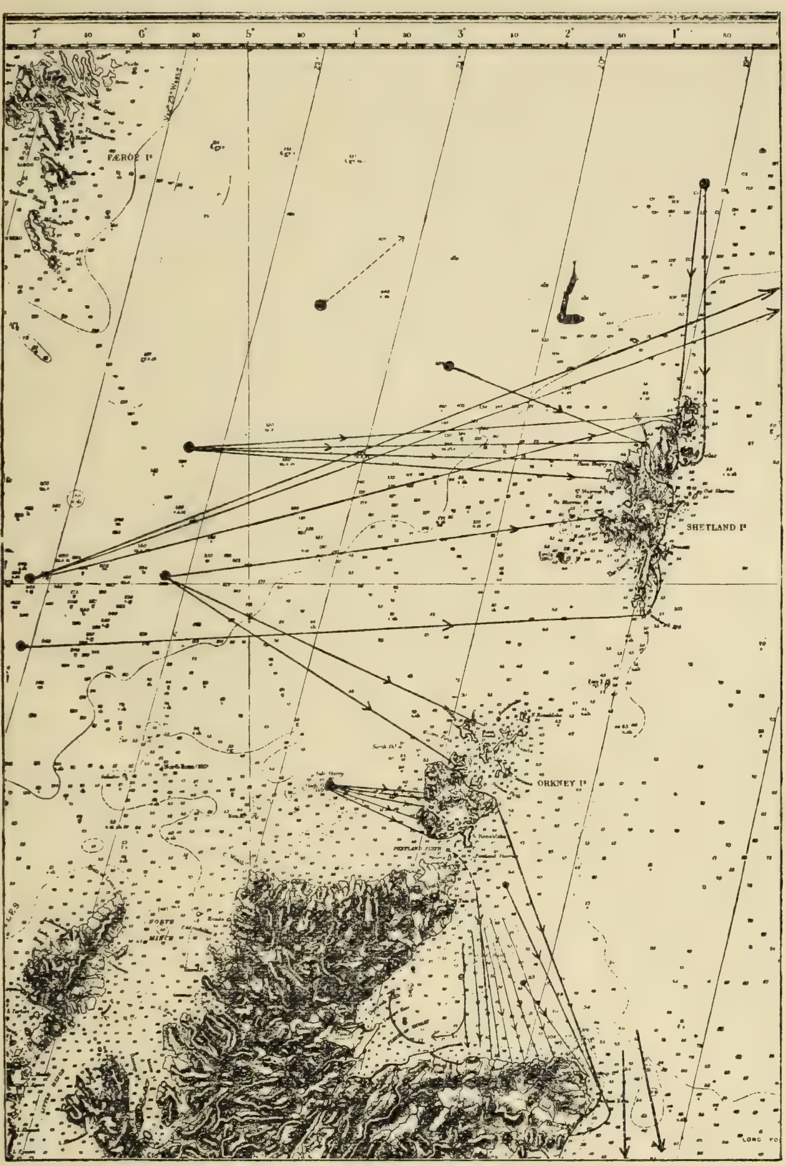


FIG. 2.—Chart of Faroes, Shetland, and N. of Scotland, showing the course taken by the drift-bottles.

and 11th December; a note from the person who found one of them stating—what is confirmed by the meteorological records—that it had been blowing a gale from the south-east for several days before.

Some of the bottles from the other station, about 165 miles west of the Shetlands, in lat. 60° 2′ N. long. 7° 4′ W., were found in Norway. They were set adrift on the 6th of August; two were picked up on 11th and 21st December on the east side of the northern part of Shetland. Before this three were found on the coast of Norway, two on the 30th November, 116 days after they had been set adrift, and one a little later, on 3rd December. One of the former was found on the Island of Hitteren, S. Trondhjem, about 510 miles distant, and the other, still further north, on the Island of Gjoring, near Kolvreid, N. Trondhjem, over 700 miles from the point where it was thrown into the sea. The third was found on the south-west side of Haramsoen Island, S. Søndmær, near Aalesund, Romsdal, and, therefore, to the south of the others.

The results of the 'Research' drifters agree with the results derived from a study of the others. The general course taken was eastward, with a tendency southward in the region of the Orkneys, and northward in the region of the northern part of the Shetlands; but deviations obviously occurred, owing in all probability to variations in wind influence. The case where three bottles were carried directly south from about ninety miles north of the Shetlands is the most anomalous. The meteorological observations taken twice daily at the nearest station (Flugga, North Unst, at the north of Shetland) show that during August northerly winds prevailed. At the hours when the observations were made (9 a.m. and 9 p.m.) the wind blew from the north on twenty-one occasions and from between N. and N.E. and N.W. on twelve occasions; from the south it blew once, from the west on four occasions, and from between S.W. and S.E. on nineteen occasions. It is probable that the bottles thrown into the sea at the most north-westerly station, on 4th August, have been carried towards the north of Norway; none have yet been returned to me.

The particulars respecting other bottles set adrift in the area being dealt with give general results of the same kind. Of five thrown overboard from a fishing-boat on 30th April 1895, 20 miles south-east of Lerwick, one was found on the 31st August, that is, after 123 days, two miles north of Aalesund, Romsdal, Norway, a distance of 250 miles from the point where it was set adrift. Its course had, therefore, been north-east.

Another put away on 22nd April 1896, twenty-six miles east of Lerwick, was found on 23rd August, after exactly the same interval of 123 days, three miles south of Hanstholm in Denmark, 357 miles distant, and in a south-easterly direction. Three of ten set adrift on 31st October 1896, at Suleskerry, about 32 miles to the west of the Orkneys, were found on the 6th, 9th, and 14th November on the west coast of the Orkney Isles, and a fourth was picked up on 4th January 1897 on South Ronaldshay. The former had travelled at the rate of about 5 geographical miles a day in a south-east direction; the wind during the time they were afloat, as shown by the observations at Wick and Fair Isle, being mostly from the north and from the west. Other two drifters put away on the 3rd November 1896, eight miles south-east of Start Point, Orkney, were found on the east coast of Shetland, two on the 14th, and the third on the 22nd December; they had, therefore, travelled between sixty and eighty miles in a N.N.E. direction in a little over forty days. The wind records at Fair Isle show that during the period they were afloat, there were strong winds in November from the south and south-west, while in December, from the 1st to the 14th, there were almost continuous strong winds from the south-east and gales from S.S.E. and E.S.E., which lasted for four days.

The Moray Firth Area.

In the second area, that of the Moray Firth, a large number of bottles and wooden drifters were put into the sea. They divide themselves pretty sharply into two groups, according to whether they were set adrift to the westward or to the eastward of a line running in a southerly direction from Duncansby Head to the mouth of the river Spey—that is to say, a little to the westward of the third degree of longitude west of Greenwich. Those set adrift to the west of this line, especially if near the shore, took various courses within the area as they did in the confined waters of the Firth of Forth. As a rule they moved westwards, and up along the coast in a north-west direction. Their course was just what might be expected from the influence of an eddy setting westwards from the neighbourhood of the mouth of the Spey, and subject to the action of the winds and tides. The other group put away to the east of the imaginary line referred to belong to quite a different class. The great majority (50) travelled southward, and were stranded on the coast of Banff and Aberdeen, which runs from the west to the east. Two were found on the east coast of Aberdeen, and one on the Orkney Isles, to the north, which occurred in connection with the exceptional movement of the water in December 1896 and January 1897, to be referred to later. Ten were found on the south-west coast of Norway; and only two to the west of the imaginary line parallel to the 3° of west longitude; but there is some doubt in the latter cases. The particulars are summed up in the following Table, which shows, of course, only the drifters which were recovered :—

I. *Set Adrift to the West of the Line—*		II. *Set Adrift to the East of the Line—*	
1. Found within the area, .	54	1. Found to the westward, .	2
2. ,, to the eastward,*	4	2. ,, on the south coast of Moray Firth, .	50
3. ,, in Shetland, .	1	3. ,, on east coast of Scotland, . . .	5
		4. ,, in Orkney, .	1
		5. ,, off the east coast of England, . .	1
		6. ,, in S.W. Norway,	10
		7. ,, in Sweden, .	2
		8. ,, in Denmark, .	0
	59		71

It is clear from this tabulation that the general movement of the water from Duncansby Head and the south part of the Orkneys is southward. It impinges on the coasts of Banff and Aberdeen, and the great mass is then deflected to some extent eastwards, but a part goes westwards along the coast. It will be noticed that only five drifters were picked up on the east coast of Scotland, all on the east coast of Aberdeen. Three of these were set adrift on 22nd July 1896, 8 miles N.N.E. of Troup Head, Banffshire, therefore not very far within the Firth. They were carried in a south-east direction round Kinnaird Head; one was found, 4 days later, on Rattray Head, 24 miles distant, another on the sixth day 7 miles farther south, and the third, a month later, between the other two; it had, no doubt, been lying most of the time among the rocks. The wind during the period of flotation was not very marked;

* These were put in very near the line.

it blew variably and not very strong, mostly from the north-west and north-east, until the 25th when it blew strong from the east, and the next day from the south east, which would tend to drive the drifters ashore where they were found.

The other two are of special interest. They were put into the water on 29th December 1896, one about 14 miles S.E. by E. of Duncansby Head, and the other nearly midway between Duncansby Head and Rattray Head. They were found on the 3rd and 6th February 1897, on the coast of Aberdeen, and on the 21st February, it is important to notice, another drifter thrown into the sea with the first named (off Duncansby Head) was picked up on Sanda, one of the northern of the Orkney Isles. There is little doubt that all three drifters had at first gone south and east, and were off the east coast of Scotland when they were overtaken by the movement following the violent E.N.E. gales towards the latter part of January 1897, which drove the surface water northwards along the coast; two of them were stranded on the corner of the coast of Aberdeen, while the third continued its course northward, and was caught on Start Point, Orkney, fifteen or sixteen days later. This reversal of the usual course of the surface water puzzled me in some other cases also, as it was the first time it had been observed since the experiments were begun in September 1894, and I thought at first some error had been made in the numbering of the bottles, or in recording the place where they had been put into the sea; but I soon obtained satisfactory evidence that the unusual northward movement extended along the whole east coast of England and Scotland, from Norfolk to Shetland, and that it was a rapid movement. The fact that it was largely caused by strong gales blowing from the E.N.E., is apparently due to the physical configuration of the coasts and bottom of the North Sea, and will be dealt with later.

The circumstance that no bottles put into the Moray Firth were found on any other part of the east coast of Scotland, or on the coasts of England or Denmark, while they were found on the south-west coast of Norway and on the west coast of Sweden, points at first sight to the deflection of the current eastwards and not southwards, by the barrier opposed to it by the coast of Banff and Aberdeen. But that it also goes south as well as east is shown (1) by the evidence given below as to the course taken by the drifters put into the sea off the east coast of Aberdeen and further south; (2) by the fact that one of the Moray Firth drifters was picked up at sea by a fishing-smack far to the south, between Flamborough Head and the Dogger Bank, about sixty miles off the Yorkshire coast; and (3) by the time taken for the floats to reach the Continent. The marked retrocession of the stretch of coast between the Moray Firth and Fife is also of importance in this connection. The drifter referred to as having been picked up by a fishing-smack was a wooden one, which was set adrift with others on the 22nd July 1896, near the dividing line previously described, and, therefore, well within the Firth. Two others of the same lot were picked up on the south coast of the Moray Firth, oneon the 24th, near Macduff, Banffshire, and the other on the 28th, about ten miles further east. The third cleared the point and then moved in a *mean* S. by E. ½ E. direction for a distance of about 220 miles; and, as it was floating for 104 days and travelled altogether nearly 250 miles, its mean rate was rather under 2½ miles per day. It was picked up on 3rd December in lat. 54° 35′ N. long. 1° 20′ E. about 65 miles N.E. by E. from Spurn Point, and was no doubt on its way to the Continent. During the period of flotation the effective winds blew in August on the Scotch coast from W. by N. and W.N.W.; on the

English coast at Shields from W. by S.; in September, at Buchan Ness from S.W. by S., at the Bell Rock from W. ¼ S., at Shields from S.S.W., at Yarmouth from S.W. ½ W. In October, at the Bell Rock from N. by W., at Shields from N. ¾ W., and at Yarmouth from E.S.E. In November, at the Bell Rock from W. by N., at Shields from S.S.W., and at Yarmouth and Helder from N.E. It will, therefore, be seen that the direction of the winds were usually opposed to the southward movement.

Of the twelve Moray Firth drifters which were found on the south-west coast of Norway and on the west coast of Sweden, one was set adrift on the 9th February 1895, two on the 12th and 13th March, and all the others at the beginning of August of the same year. The three first mentioned were put away off the coast of Caithness; one was found on 3rd October, 237 days afterwards, at Farsund, near the Naze of Norway, 317 miles distant; another was found, near Stavanger, after 181 days, on 9th September, a direct distance of 270 miles; the third was found two miles south of Lysekil, near Marstrand, Sweden, on 6th September, after 179 days, at a distance of 464 miles. That the first moved south is shown by the fact that other drifters put away a little further north next day and two days later were found in Banffshire and on the north-east corner of Aberdeenshire. The wind that prevailed in the Moray Firth during February was from N.N.W.; in March, from N.N.E. at Buchan Ness, N.N.W. at Bell Rock, and S.W. at Yarmouth; in April, at Buchan Ness from S.W.,at Bell Rock from W., at Shields from N.E., and at Yarmouth from E. by N. The mean course of the floats was probably in the form of a curve bending south-east and then north-east, one at least being carried into the Skagerak.

The other nine were set adrift on the 2nd and 8th August 1895; eight were recovered on the south and south-west coast of Norway, and one near Hällo, on the west coast of Sweden, after intervals of from 67 to 178 days, the direct distances varying from 282 to 490 miles. During the time they were afloat the prevailing direction of the winds was as follows:—*August*, Buchan Ness S. by W., Bell Rock W. by S., Helder and Yarmouth W.S.W.; *September*, Buchan Ness S.W. ¾ S., Bell Rock W.S.W., Shields S.W., Yarmouth W., Helder W.N.W.; *October*, N.W. or near it at most places; *November*, strong from S. and S.W.

In these cases there is little doubt the surface water was driven in large part directly across in an easterly direction from the Moray Firth.

It is noteworthy that other drifters put away a little earlier, on the 24th and 25th July, off the east coast of Aberdeen, Kincardine, and Forfarshire, were found partly further south on the east coast of Scotland and partly on the coasts of Denmark and Norway. Thus, of three set adrift on 24th July, eleven miles south-east of Scurdy Ness, near Montrose, one was found 34 miles to the south in the Firth of Forth, in seventeen days; one after ninety days at Nymindegab, near the Horn, Denmark, a direct distance of 344 miles; and the third, after an interval of 162 days, near Stavanger, in Norway, a direct distance of 300 miles. Another set adrift on the same day a little further north (eleven miles S.E. of Bervie) was found in 21 days on the coast of Fife. Of other two set adrift also on 24th July, one was found in 22 days forty miles to the south, and the other near Kragerö, in South Norway, within the Skagerak, a direct distance of 400 miles, in 196 days. These examples show, what will be proved later, that the general course of the surface water on the west side of the North Sea is to the south and south-east, and to the north on the east side, even when, and, indeed, probably, because the prevailing wind is from the south-west.

The East Coast of Scotland.

The course taken by the other drifters put away on the east coast of Scotland, south of the Moray Firth, was almost invariably to the south or south-east. A considerable number were set adrift in the Firth of Forth. These took an irregular course, according to the wind and tide, like those in the inner part of the Moray Firth. A few of them, however, were carried out of the Forth, and then, as a rule, took the usual route southward. Omitting those put away in the Forth and recovered there, the tabulated results are as follows:—

I. *Found to the South*—		II. *Found on Continent*—	
1. On Scotch coast, . .	58	1. In Norway, . . .	15
2. At sea off Scotch coast, .	2	2. In Sweden, . . .	1
3. On English coast, . .	0	3. In Denmark, . . .	35
Northumberland, .	20	4. In Germany, . .	4
Durham, . . .	10	5. In Holland, . . .	5
Yorkshire, . . .	26		—
Lincolnshire, . .	2		60
Norfolk, . . .	0		
	—	III. Found to the north, .	21
	58		
4. At sea off English coast,	1		
	—		
	119		

All those found to the north fall into two groups:—(1) Those set adrift at or near the mouth of the Firth of Forth, a few miles from land, and which were stranded in the neighbourhood; (2) those (nine in number) which were carried north by the reversal of the movement of the water in January 1897, which has been previously referred to. The former group may be for the present passed over, as the results were due to local causes alone; so that, with the exception of the latter at the beginning of the present year, none of the drifters travelled northward up the coast.

Two things stand out conspicuously in the above Table. The first is that the drifters stranded on the English coasts were stranded on the northern part. Only two were found in Lincolnshire, and none at all (of those set adrift on the east coast) on the coast of Norfolk. Thus, none were stranded south of the Wash, only two between the Wash and the Humber, and the great majority to the north of Flamborough Head. The second point is that, compared with the Moray Firth drifters, a great number were stranded on the coast of Denmark, and comparatively few in Norway, while some were found on the coast of Holland and Germany.

The Table shows that 119 of the drifters had travelled southward along the east coast, of which 58 were stranded on the coast of Scotland, and exactly the same number on the English coast, while two were picked up at sea off the Scotch coast, and one off the English coast. The great majority of those stranded on the coast of Scotland were found in Fife and East Lothian; some were found on the Isle of May, at the mouth of the Firth of Forth, and some in Berwickshire. Only two were picked up on the coast of Forfarshire, and none in Kincardineshire or Aberdeenshire. They were, therefore, stranded, just as in the Moray Firth, on the coasts which front the north. A considerable number were set adrift in the vicinity of the Bell Rock Lighthouse, which lies about 10 miles south of the coast of Forfarshire, and east of the mouth of the river Tay; and also at distances of from five to thirteen miles off Scurdy Ness, near Montrose. The former drifters, in nearly every case, travelled south and somewhat west, striking the eastern part of the coast of Fife and the coast of East Lothian. This was also the course of the majority which were put into the sea off Scurdy Ness. In both cases, however, and especially in the latter, some were stranded on the English coast.

Taking the groups put in at various parts of the east coast, we find their destination was as follows:—Of twenty-three set adrift at distances ranging from about four to twenty miles off Buchan Ness, Aberdeenshire, three (put in four miles off) were found on the coast of Aberdeen, two were picked up at sea by fishing-boats 24 and 26 miles further south, eight and ten days afterwards, six were found on the coast of Northumberland, one in Yorkshire, one on the west coast of Germany, five in Denmark, and five in Norway. Of eleven set adrift, about twenty miles further south, namely, from ten to twelve miles off Girdle Ness, one was recovered on the coast of Forfarshire, two in East Lothian, one in Yorkshire, one in Holland, one in Denmark, and four in Norway. Of seven set adrift further south, at from four to eighteen miles off Stonehaven, three were found in Northumberland, one in Durham, and three in Denmark.

Of five put away off Bervie, Kincardineshire, one was found in Fife, one in Northumberland, and three in Norway. Of ten set adrift off Scurdy Ness, near Montrose, Forfarshire, three were recovered in Fife one in East Lothian, two in Yorkshire, two in Holland, one in Denmark, and one in Norway. Still further south, in the vicinity of the Bell Rock Lighthouse, forty-two of those set adrift were recovered; namely, seven in Fife, twenty-three in East Lothian, four in Berwickshire, three in Northumberland, one in Durham, two in Yorkshire, one in Lincolnshire, and one in Holland.

Of thirty-five of those recovered, which were set adrift at from about three to twenty miles east and south-east of the Isle of May, three were found in East Lothian, one in Northumberland, four in Durham, nine on the coast of Yorkshire, one was picked up at sea off the Yorkshire coast, and two were found on the west coast of Germany, twelve in Denmark, one in Sweden, and two in Norway.

By drawing lines on a chart between the points where the bottles were set adrift and where they were found, the general and preponderating movement southward is clearly revealed. In some of the cases where the drifters were found on the Norwegian coast there is evidence that they were driven rapidly with the surface waters north-eastwards by strong *south-west* winds blowing almost continuously while they were afloat as in November 1894 (see Pl. XI. figs. 1, 2, 3). But, in the majority of cases, the drifters which reached the Continent were first carried southwards along the Scotch and English coast. This is shown by a large number of cases in which some of the bottles of one and the same lot were stranded on the English coast, while others were picked up later on the coast of Denmark, and later still on the Swedish or Norwegian coast. Some of these may be referred to.

The English Coast and the Continent.

Three bottles were set adrift in the Firth of Forth on 23rd November 1894; one was found on 17th February 1895, on the Yorkshire coast; and another on the 20th July, near Ording in Schleswig, Germany. A few days later—on 28th November 1894—five were set adrift three miles

S.S.E. of the Isle of May; on the 17th of February 1895, one was found on the coast of Durham; on 18th July another was found on Heligoland; and four days later a third at Hallig, Oland, Germany. On 30th November, five were set adrift six miles west of the Isle of May; three of them were found on the Yorkshire coast, 79, 81, and 85 days later; and, in August, 259 days from the time of setting adrift, a fourth was found at Egmont-on-Sea, N. Holland. On 20th March 1895, ten bottles were set adrift near the mouth of the Firth of Forth; on the 2nd April, thirteen days later, two were found on the coast of Northumberland, about 67 miles distant; two days afterwards, on the 4th April, another was found 82 miles distant, also on the coast of Northumberland; on the 20th May (after 61 days), a fourth was found near Spurn Point, Yorkshire, a distance of 202 miles; on 1st August, after an interval of 134 days, a fifth was picked up three miles north of Blokhus, Denmark; and on 14th September, a sixth two miles north of Ringkjöbing, Denmark.

Of five bottles set adrift on 16th April 1895, 18 miles E.S.E. of Stonehaven, Kincardineshire, one was found on 6th June, after 51 days, on the coast of Northumberland, 129 miles to the south; another was found on 10th September (after 147 days) half-a-mile west from the Old Skaw, Denmark; and a third on 18th September at Blokhus, Denmark. Of five set adrift 25 miles E. by N. of the Isle of May, on 27th April 1895, one was found on 13th July, after an interval of 77 days, near Scarborough, Yorkshire, a distance of 142 miles; and on 27th September (after 135 days), another was picked up two miles east of Hanstholm, Denmark. Three of ten put away on 24th July 1895, ten miles S.E. of Scurdy Ness, Forfarshire, were recovered; one after seventeen days on the coast of Fife; another on the 22nd October, after ninety days, at Nymindegab, Denmark; and a third on 2nd January 1896, after 162 days, near Stavanger in Norway. Of ten set adrift on the same day, 11½ miles S.E. of Girdleness, Aberdeenshire, one was found forty miles to the south, in Forfarshire, twenty-two days later; and another in Norway, near Kragerö, within the Skagerrak, on the 5th February 1896, after an interval of 196 days. Other drifters, as has been previously mentioned, put away about the same time in the Moray Firth and off the north part of Aberdeenshire, were found on the south and south-west coast of Norway and in Sweden from October 1895 to March 1896. On 28th August 1895, twenty bottles were set adrift south-east of the Isle of May; one was found on 18th November, after 82 days, near Hunnebostrand, 95 kilometres north of Gothenburg, Sweden; a second on the 1st December, near Arendal, Norway; and a third on 4th December at Karmoen, near Stavanger, Norway. From the account given later (p. 356) of the effective winds during the period of flotation, it will be seen that they blew in August and September on the English coast from W., S.W., and W.S.W.; in October from N.W.; and in November from S.W. and S.E.; at the Skaw they blew from W.N.W. and N.W. in August and September; from W. by N. in October; and from S.W. in November.

On the 22nd July 1896, a large number of drifters were thrown overboard from the 'Garland' while she was passing up the east coast of Scotland. Ten set adrift near the Bell Rock were found on the coast of Fife, the May Isle, and East Lothian; eight within a week or two, and the other two at the beginning of September within the Firth of Forth. Some of those set adrift off Scurdy Ness, further to the north, were also picked up in Fife about twelve days later. One put away off Bervie, Kincardineshire, was found thirty-one days later on Holy Island, Northumberland, 63 miles to the south. Another put away six miles south-east of Girdle Ness, Aberdeenshire, was picked up at Hillerslev, near Thisted, Denmark, on the 7th November, after immersion for ninety-eight days; and five of those set adrift still further to the north, four miles south-east of Buchan Ness, were subsequently recovered. Two of them were picked up at sea by fishing-boats 24 and 26 miles to the southward, seven and nine days after they had been put into the water; and other three were found in the early part of September on the coast of Northumberland, from forty-eight to fifty-six days after immersion, and at distances ranging from 134 to 142 miles. There can be no doubt that the one found in Denmark, although the only one of that particular group recovered, first passed down off the east coast of Scotland, and probably the north-east coast of England. Reference has already been made to the wooden drifter put away on the same day within the Moray Firth, about 80 miles further to the north and west, which was found on the 3rd December (134 days afterwards), at the Dogger Bank, about 60 miles off Flamborough Head.

On the 22nd April 1896, four bottles were set adrift 26 miles east of Lerwick, Shetland; on the 23rd August, 123 days later, one was found at Klitmoeller, three miles south of Hanstholm, Denmark; and thirty-seven days after that, on the 29th September, another was picked out of the water in the Christiania Fjord, near Bolæren Island, about 12 miles within Færder Lighthouse. These drifters must also have come south.

It is evident from what has been said that the general movement of the water in the western part of the North Sea is southward along the east coast of Scotland and the northern part of the east coast of England, and that it then passes to the Continent. Before discussing the relations of this movement to the seasons, and the speed of the current, it will be well to consider the course of the drifters put away in other parts of the North Sea. While the results on the western side showed the movement referred to, I was desirious of ascertaining, as far as possible, the area of demarcation where this southward movement gave place to the northward movement on the eastern side, as well as some other points. Drifters were, therefore, dropped into the sea at intervals along lines stretching from the Firth of Forth to the Naze of Norway on the one hand, and to Hamburg on the other; and also along a line passing from off Flamborough Head to the Hook of Holland. The lines along which the floats were set adrift are represented on Plate X.

Between the Isle of May and the Naze of Norway.

The drifters put away between the Firth of Forth and the Naze of Norway were as follows:—

Date.	Distance in Nautical Miles E. ½ S. of May Isle.																
	10	15	20	25	30	35	50	70	75	80	100	130	150	180	200	250	300
24th Feb. 1895,	.	10	.	10	.	10	10	.	.	.	.	10	.	10	.	.	.
16th Mar. 1895,	.	10	.	10	.	10	.	.	.	10	.	10	.	10	.	.	.
* 21st Aug. 1896,	30	.	25	.	20	.	20	10	.	.	10	10	20	.	10	20	.
* 23rd Oct. 1896,	.	.	.	.	.	.	50	.	20	.	35	15	.	.	.	.	.
* 6th Nov. 1896,	30	.	.	.	.	.	.	.	.	.	.	15	20	.	15	20	15
25th and 26th Dec. 1896, . .	.	.	.	.	20	.	.	.	.	.	20	.	20	.	20	20	20

* Most of these were wooden drifters.

Some of the drifters have been recovered from each voyage. Eighteen of those set adrift on the first occasion (24th February 1895) were found later—sixteen on the coast of Denmark, one in Sweden, and one in Norway. Of ten put adrift fifteen miles east of the Isle of May, one was found at Klegod, near Ringkjöbing, Denmark, on the 8th August, 165 days after immersion; another on the 6th September, further up the coast near the Skaw, at Hirtshals; and a third half-a-mile west from the Old Skaw, four days later. Four of the ten set adrift 25 miles east of May Isle were also found on the Danish coast; one on 27th August, 184 days after immersion, near Fjaltring, on the west coast; the second on the 28th August at Haurvig, Holmslandsklitte, Ringkjöbing; the third on 31st August, at Lokken, south of Hirtshals; and the fourth on 16th September at Harboore, near Lemvig. One of those put away 35 miles from the Isle of May was picked up on 23rd September near the Old Skaw after 211 days. Of those set adrift at 50 miles, one was recovered on 21st August, after 178 days, at Haurvig, Ringkjöbing; another the next day at Aargab in the same locality; and a third on the 14th September, two miles north of Ringköjbing. Of those put away 130 miles from the May, one was found on 7th August at Havstokken, near Nymindegab; another on 11th August, eight miles north of Ringkjöbing; and a third on 15th August at Aargab. Of those set adrift 180 miles east of the Isle of May, and, therefore, about half-way to Norway, one was found on the 14th July, after 140 days, and another on 3rd August, both near Nymindegab, north of the Horn, Denmark; a third was found on the 4th August at the Buskar Rock, Marstrand, Sweden; and a fourth on 6th February 1896, nearly a year later, on the Island of Smolen, near Christiansund, N., in the province of Romsdal, Norway. These cases show that the bottles travelled first to the south of the place where they were put in, and then in a north-east direction along the Danish coast and into the Skagerak, and then in the opposite direction along the coast of Norway.

Thirteen of the bottles set adrift on the same route on 16th March 1895 were found later, all on the Danish coast, in August and September. With the exception of one set adrift 15 miles east of May Isle, and which was found at Ringkjöbing, near the Horn, 186 days later, they were all picked up on the coast of North Jutland, between Hanstholm and the Skaw, and mostly near the latter place. The details are given on p. 382.

Three of those put away at 130 miles from the Isle of May, and two put away at 180 miles, were found south of the line, in the same area as most of the others, namely, on North Jutland.

In both the above cases no drifters were put away further east than 180 miles from the Isle of May, that is to say, about midway between that island and the Naze of Norway, and they all moved southward in the first instance, and then northwards and eastwards along the Danish coast. From the analysis of the effective winds (p. 356) it will be seen that at the Bell Rock they blew in March from the west-north-west; and further south, at Yarmouth, from the south-west, at the Skaw from the north-west, and at Helder from the W.S.W. In April, off the Scotch coast they blew from the south-west and west, off the English coast and at Skagen rather from the east-wards; in May from the northwards; in June and July from the west or W.N.W.

The third series were set adrift on the 21st August 1896, and five were recovered (of fifty-five bottles and 125 wooden drifters), three on the English coast and two in Norway. Of the former, two were put away ten miles from the Isle of May; one was found twenty-one days afterwards, 67 miles to the south, and the other 42 miles to the south after twenty-three days. The third was set adrift fifty miles from the Isle of May, and was found on 29th January 1897, six miles south of Holy Island, Northumberland, that is to say, further north than the others. There is little doubt, that, after going a long way in the usual course, it was driven back in a N.W. direction by the reversed movement that took place at this time, referred to below. One of the two found on the coast of Norway was put away 250 miles from the Isle of May (and, therefore, about eighty miles west of the Naze of Norway), and it was picked up on the 15th October, fifty-five days afterwards, on the island of Bommell, south of Bergen, 143 miles N. by E. of the point where it was set adrift. The other was put away 130 miles from the Isle of May, or a little over 200 miles west of the Naze, and it was found on 18th January 1897 (150 days afterwards) at Yelmesöen, West Lofoten, about 800 miles to the north. It is evident that at this time there was, in addition to the southerly movement on the east coast, a strong and rapid northerly movement of the water to the west of the Norwegian coast. This is also shown by the results on the Hamburg route described below.

The fourth series were set adrift on 23rd October 1896. They comprised only twenty-five bottles and seventy-five drifters, and only three have been recovered, two of which were put off fifty miles east of the Isle of May, and picked up on the 24th January 1897, one at Monkwearmouth, Sunderland, and the other at South Shields, both, therefore, on the coast of Durham. The third was found in an unexpected position, namely, at Sandwick Bay, Shetland, on the 24th March 1897. It is very probable that these bottles were driven back by the reversal of the movement of the water in December and January, from a position much further east and south.

The fifth series were set adrift on 6th November 1896, at the distances stated in the above table. Only one has as yet been returned. It was put away 150 miles from the Isle of May, and picked up on 4th March 1897 at Sulen, eleven miles north of Bergen, Norway.

The sixth series were put away on the 25th and 26th December 1896, and a large number have been already returned. Of those set adrift at 30, 100, and 150 miles east of the Isle of May none have up to the present been recovered; but nine of the twenty at 200 miles, eight of the twenty at 250 miles, and seven of the twenty at 300 miles have been found on the coast of Norway. The details are given in the Table (p. 394). The earliest found were those set adrift at 250 miles—that is about 80 miles west of the Naze of Norway. On 1st and 2nd January, six and seven days later, four were picked up near Stavanger, at from 85 to 87 miles distant, in a N.E. by N. direction; on 2nd January one was also found, 73 miles distant, at Fjorve, near Farsund. In February three others were picked up, two near Stavanger, and one near the Naze. Six of the seven recovered from the lot set adrift 300 miles from the Isle of May (or about 32 miles west of the Naze) were found between 19th and 26th February, in the vicinity of Bergen, and at Obristad Lighthouse, Jœderen. One was found on 4th March near Molde.

About the same dates (20th–28th February) members of the lot put away at 200 miles east of May Isle—or about 125 miles west of the Naze—began to be found, some near Bergan, and some near Stavanger, at distances of from about 120 to 185 miles from the point where they were immersed. This lot therefore travelled much faster, in a north-east direction, than the lot at 300 miles did, in a northerly course; but not nearly so fast as the intermediate lot, which travelled N.E. by N. at the rate of over fourteen miles a day. The prevailing winds at the Scaw during October and November were S. by W. and S.W.; in December S.; and in January 1897 N.N.E.

Thus we see that the bottles set adrift in February and March 1895, at 138 and 180 miles east of May Isle, were found south of the line, on the coasts of Denmark and Sweden, with the exception of one, found nearly a year afterwards far up the west coast of Norway; in August 1896 those put away at 130 and 250 miles were found in Norway; and in December all those east of 200 miles were also found in the west and south-west coast of Norway. None were recovered on the south coast of Norway, and the only one found within the Skagerak was the one picked up near Marstrand in Sweden on 4th August.

Between the Isle of May and Hamburg.

Let us now compare the course of the drifters put away along the line between the Isle of May and Hamburg. They were set adrift on three occasions, as follows:—

Date.	Distance in Nautical Miles S.E. by E. of May Isle.												
	13	20	30	50	60	70	100	130	150	200	250	300	350
*15th, 16th August 1896, . .	30	25	20	20	...	10	10	10	20	10	20	10	...
*18th October 1896	...	30	30	20	...	20	30	15	20	15	20	15	...
23rd, 24th December 1896, .	...	...	...	...	20	...	20	...	...	20	20	20	20

Eight of the first series put away in August have been returned. One, set adrift 30 miles from May Isle, was found at Blyth, Northumberland, 72 miles to the south, on 11th September, 27 days afterwards. None of those from 50, 70, and 100 miles have yet been returned, but members of the lots put away at 130, 150, 200, 250, and 300 mles have been recovered. The earliest found was one set adrift on 16th August, 300 miles from May Isle, or about 65 miles from Heligoland. It was picked up on one of the Whale Islands (Hvaloerne), on the south-east side of Christiania Fjord, near the coast of Sweden, on the 29th September, 44 days after immersion, having travelled during that time 325 miles in a north-easterly direction, up the Danish coast and across the Skagerrak. The next to be found was set adrift 200 miles from May Isle, or about 170 miles from Heligoland, in the middle of the North Sea. It was picked up ten miles east of Arendal, on the south coast of Norway, within the Skagerrak, on the 21st October, having travelled about 296 miles N.E. by E. in the 66 days. Another of the same lot was found in November (date not stated) on Malmo Isle, Lysekil, Göteborg, Sweden. A third—a wooden slip—was found floating on 4th March 1897 in a small harbour on the Island Ramer, about nine miles east of Christiansand, S. Norway. One of those put away further west, at 130 miles from May Isle, and, therefore, in the western part of the North Sea, was found on 6th November at Algeröen, west of Bergen, Norway,

* Mostly wooden drifters.

having drifted 330 miles in a N.E. direction in 82 days. Another of those put in at 250 miles from May Isle was also picked up near Bergen, at Lyngöen, on 15th November, 91 days afterwards; and one set adrift at 150 miles from May Isle was found on 1st December, 107 days later, near Aalesund, Romsdal, Norway, 480 miles distant.

These results agree with those derived from consideration of the course of the drifters put away along the line between the Isle of May and the Naze of Norway on 21st August. They show a movement southwards along the English coast, and a simultaneous, but more extended and rapid movement in a northerly or north-easterly direction in the middle and eastern parts of the North Sea.

The results in October are somewhat different. Twelve of this series were recovered, eleven to the south, on the English coast, and one which was brought up in a trawl-net from the Dogger Bank; while none have as yet been returned from the Continent. Four of the five bottles put away twenty miles from the Isle of May were picked up on the northern part of the coast of Northumberland, 19 to 25 miles to the south, three on the fourth and one on the sixth day after immersion. One put in at thirty miles was found on 3rd November, sixteen days later, on the coast of Yorkshire, 84 miles to the south; and four of those put away at fifty miles from the Isle of May were found on the southern part of the Yorkshire coast, from 83 to 93 miles distant, on the fourteenth and fifteenth day. The other two found on the English coast belong to another category. One of them was set adrift at 70 miles and the other at 130 miles from May Isle, and they were both found on the coast of Northumberland 97 and 98 days later, on 23rd and 24th January. They were almost certainly well on their way to the Continent when they were driven back by the reversed movement of the water in January; and this circumstance probably explains why none of this series, nor of the series put in on the Norwegian route in October and November, have yet been returned from the Continent. They would be carried back again, and were most likely still off the English coast at the end of January.

Only one of the series set adrift on 23rd and 24th December has as yet been recovered. It was put in 350 miles from May Isle (about 24 miles from Heligoland) on 24th December, and found eighty miles to the north at the Horn, Denmark, on 5th January, sixteen days afterwards. The prevailing wind in December was at Helder W.S.W., at the Scaw S.; in January 1897, at Helder E. by S. strong, and at the Scaw N.N.E.

Between the English and Dutch Coasts.

The third line along which drifters were put away extended from a point twelve miles N.E. by E. of Flamborough Head to the Hook of Holland, and they were set adrift on the 1st November 1896, and the 3rd January 1897. The details are given in the Table on pages 392, 395. Altogether 143 bottles and 70 wooden slips were thrown over on this line, and although many of them were put away near the Dutch coast, and almost all the others about midway between Holland and Norfolk, none were recovered on the Continent until April, 1897, when some were picked up on the coast of Jutland, Denmark.

The principal objects in selecting this area for experiment were to ascertain (1) whether the current that proceeds northwards along the coast of Denmark was associated with a northerly movement from the Channel; (2) whether the southerly movement of water on the east coast penetrated to the Channel. So far as the experiments have gone, they indicate that neither of these movements takes place, and that the circulation in the North Sea (which we have seen at this period to have been very marked) appears to be confined to water derived from the north. This conclusion must, however, be looked upon as tentative, because the experiments here were limited to November and January, and sufficient time has, perhaps, scarcely yet elapsed to show the ultimate course of all the bottles. It has also to be borne in mind that in January the usual course of the water was for a time reversed; although this circumstance might have been expected to favour the escape of surface water to the south by the Channel.

Of those put away on 1st November, nine were recovered, in a bunch, so to speak, all on the 29th of the same month, in the neighbourhood of Yarmouth, Norfolk. Eight of these were set adrift 47½ miles E. ½ S. of Grimsby; they had therefore moved directly southwards distances ranging from about 59 to 67 miles in the twenty-nine days. The other was put away 46 miles N.E. by E. ½ E. of Cromer, Norfolk; it had therefore moved in a south-westerly direction about 50 miles. The effective wind at Yarmouth during November blew strong from the N.E. ¾ E; and at Helder from N.E. ¼ E. It is of interest to note that another drifter of this lot was picked up on 6th April 1897, at Thorupstrand, Thisted, Denmark. It indicates that the surface water, driven back by the exceptional wind conditions, resumed its usual course later. This is also shown by the fact that one of the lot put away on the same day, not far distant, namely, 57 miles E. ½ S. of Cromer, was found on 2nd April 1897, thirty miles east of Hantsholm, Denmark.

Seventeen have been up to the present recovered of the second series set adrift on 3rd January, all but one on the English coast; two on the 15th January, and all the others between the 20th and 26th January. The two found on the 15th were put away 52 miles E. ½ S. of Grimsby, and were picked up on the coast of Yorkshire between Flamborough Head and Filey. They had therefore drifted in a north-west direction, contrary to the usual course, for over 60 miles in twelve days. Four others, set adrift 43 miles N.E. by E. of Cromer, Norfolk, were found on 23rd, 24th, and 26th January, west of Cromer, Norfolk, 45 to 48 miles from where they were immersed; these had been carried west by south. Three put away 57 miles E. ¼ S. from Cromer were found on 22nd and 24th January a little south-east of Cromer; they had therefore been carried westwards for about sixty miles. Two, put in 51 miles E. by N. ¾ N. of Lowestoft, were found still further to the south of Cromer, on 22nd January, having drifted westwards for about 65 miles; and five, set adrift 32 miles N. by W. of the Hook of Holland, were found on 20th and 21st January in the neighbourhood of Great Yarmouth, having been carried in the seventeen days about 90 miles in a north-west direction. But on 5th April 1897, one of those set adrift 32 miles off the Hook of Holland was picked up seven miles west from the Skaw, Denmark; showing as in the previous cases a northerly movement of the surface water.

The person who returned one of the bottles on the 24th January informed me that "a terrific E.N.E. gale had been raging from the 21st," and this helps to account for the unusual course taken by the drifters in the above cases. On referring to the Daily Weather Report issued by the Meteorological Office, it will be found that at Helder in the Netherlands, at Yarmouth, and at Spurn Head, Yorkshire, the winds from the 3rd to the 7th January were blowing from the S.W., S., S.E., and E.S.E., gentle and moderate; on the 8th and 9th they blew strong from the east, and they continued almost always from the east, north-east, and east-north-east, moderate or fresh, until the 21st, when they blew strong from N.E. and E.N.E. On the 23rd a heavy N.N.E. gale sprang up over the North Sea, and continued the following day. It has also to be noted that during the preceding months the effective winds in the southern part of the North Sea blew, as a rule, from an easterly direction; for example, at Yarmouth they blew from E.S.E. $\frac{1}{2}$ S. in October; from N.E. $\frac{3}{4}$ E., strong, in November; from S.E. $\frac{1}{2}$ E., strong, in December; in January they blew from E.N.E. The existence of the strong winds and gales from the N.E., E., and E.N.E. no doubt explains the westward movement of the bottles, and it is noteworthy that they also went northwards along the east coast, some, as we have seen, being got in Yorkshire. Strong north-east and easterly winds appear to heap up the water on this part of the east coast, and owing to the configuration of the coast and the bottom it escapes in a north-westerly direction along the coast.

2. Seasonal Variations.

It is evident from the description given of the course of the drifters throughout the period covered by the experiments that the surface water in the North Sea has a general movement southwards along the western side and northwards along the eastern side. Before considering how this movement is related to the effective winds it will be well to consider whether any variation is apparent at different seasons. In the Moray Firth, east of the third degree of west longitude, the drifters put away in October (1894 and 1896) were found on the south coast of the Firth in the same month and in November; those put away at the end of February (1895) were found in March; those put away in March (1895, 1896) were picked up in the same month and in April; and those set adrift in July were found in July and August. The drifters put away on the east coast in February, March, April, May, June, July, August, September, October, November, December, in the various years, were found to the south in the same month or later, with the exception of those at the end of December 1896, when the reversed movement began. None were set adrift on the east coast in the month of January. In all the months, then, during which the drifters were thrown in on the east coast (except December 1896), they moved southwards, which seems to prove that the southward movement of the surface waters on the western side of the North Sea is practically continuous and does not vary with the seasons.

There is not the same regularity or continuity shown in the times when the drifters were found on the coasts of Holland, Germany, and Denmark. This is clear from the following table; and for comparison the months during which drifters were stranded on the English coast, south of Durham, where the coast line begins to project markedly eastwards, are included.

From this table it will be seen that while bottles were recovered on the coast of Yorkshire in January, February, May, June, July, August, November, and December, they were found in Holland in February, June, July, and August, and in Germany only in July. On the coast of Denmark they were found in January, April, July, August, September, October, and November, but in very different proportions. Thus, only one was found in January, July, October, and November respectively; while twenty-one were recovered in August and twenty-nine in September. It will also be noticed that it was only in 1895 that they were stranded in August and September on the Danish coast; in 1896 only one was found in August and none were found in September. Further, it will be seen that those found in August 1895 in Denmark were set adrift in the previous November, February, and March, and those found in September, in February, March, April, and May. These facts point to the conclusion that

Set Adrift on East Coast of Scotland.	Found in				
	Yorkshire.	Lincolnshire.	Holland.	Germany.	Denmark.
Nov. 1894, .	Feb. 1895, 5	.	Aug. 1895, 1	July 1895, 3	Aug. 1895, 2 *
Dec. 1894, .	Feb. 1895, 9	Feb. 1895, 2	.	.	.
Feb. 1895, .	.	.	.	.	Aug. 1895, 9
,, ,, .	.	.	.	.	Sept. 1895, 6
† ,, ,, .	.	.	.	.	July 1895, 1
† ,, ,, .	.	.	.	.	Aug. 1895, 2
‡March 1895,	May 1895, 1 June 1895, 1	. .	. .	. .	Aug. 1895, 2 Sept. 1895, 15
† ,, ,, .	.	.	.	.	Aug. 1895, 5
April 1895, .	June 1895, 1 July 1895, 1	. .	. .	. .	Sept. 1895, 4
May 1895, .	.	.	.	.	Sept. 1895, 4
July 1895, .	.	.	.	.	Oct. 1895, 1
August 1895, .	.	.	Feb. 1897 §	.	Jan. 1886, 1
March 1896,	.	.	June 1896, 1 July ,, 2 Aug. ,, 1	July, 1	.
April ,, .	.	.	.	.	Aug. 1896, 1
May ,, .	Aug. 1896, 1	.	.	.	.
June ,, .	,, ,, 4	.	.	.	.
July ,, .	Dec. 1896, 1	.	.	.	Nov. 1896, 1
Oct. ,,	Nov. 1896, 5 Jan. 1897, 1	. .	. .	. .	. .

* These were probably at first carried northwards.
† 130 and 180 miles east of May Isle.
‡ A number of these were got on Northumberland and Durham also.
§ This drifter was put away in the very north of Scotland, off the coast of Caithness.

there was an exceptional concentration of the surface water towards the Danish coast in August and September 1895; and on referring to the wind chart I find that in June, July, August, and September the effective winds blew from a westerly direction, inclining sometimes towards the north and sometimes towards the south (see Table, p. 358). In the corresponding period of 1896 the effective winds were less strong, although much in the same direction.

3. The Cause of the Movement of the Surface Waters.

The full discussion of the causes that produce the movement of the surface water in the North Sea will be best dealt with by Professor Pettersson when he is dealing with the subject generally. But some points may be here referred to. The factors that appear to bear upon the question are:—(1) The movement of the Atlantic water, or Gulf Stream, across the north-western and northern boundary of the North Sea; (2) the action of the Baltic current passing out of the Skagerrak during the greater part of the year in a westerly direction along the south coast of Norway, and then in a northerly direction along the west coast; (3) the minor influence of the rivers that flow into the North Sea, and whose waters pass for the most part in the direction taken by the surface water as above described; (4) the earth's rotation; (5) the direction of the tidal streams; (6) the action of the wind.

The Prevailing or Effective Winds.

The wind appears to be the most important influence in determining the movement of the surface water in the North Sea, and I was anxious to ascertain, as precisely as possible, the relation between this movement and the prevailing winds. For this purpose the direction and force of the winds each day from 1st September 1894 to 31st January 1897 at the following stations were tabulated, comprising over 12,000 observations:—

In Scotland, at North Unst, Shetland, Fair Isle, Wick, Buchan Ness, Girdle Ness, Bell Rock, St Abbs; in England, at Shields, Spurn Head, and Yarmouth; on the Continent, at Helder, Cuxhaven, the Scaw, and Skudesnaes. The information for the English and Continental stations was obtained from the Daily Weather Reports published by the Meteorological Office; that for the Scottish stations from the daily records in the possession of the Scottish Meteorological Society, which were kindly lent to me by Dr Alexander Buchan, the secretary, who has also given me the benefit of his great experience on this part of the subject. In the English and Continental returns the observations taken at 8 a.m., and in the Scottish returns the record of the prevailing wind during the previous twenty-four hours were selected. As might have been anticipated, the latter records were much more satisfactory than the former, which gave the direction and force of the wind only at one point in the twenty-four hours. A better result would doubtless have been obtained by combining the 8 p.m. observations, but the labour was too great. The tabulated observations in both cases were of direct use in tracing the action of the wind over a short period; but it was necessary for my purpose to obtain a resultant showing the direction and force of the wind for each month, and this resultant I have termed the *effective* wind. The method by which this was accomplished was as follows:—The observations at North Unst, Shetland, Buchan Ness, the Bell Rock Lighthouse, Shields, Yarmouth, Helder and the Skaw were selected. Gentle breezes were omitted from consideration, but fresh breezes, strong breezes and gales were included, their force being indicated according to the Beaufort scale; and such winds in each month at each station were represented according to their direction by a line whose length corresponded to the force of the wind, $\frac{1}{8}$ of an inch being taken as = 1. By combining the lines into a polygon of forces, the *resultant* or *effective* wind for the month at the stations was obtained; and by combining the twelve monthly resultants in the same way the resultant or effective wind for the whole year was determined.

The results are given in the following Table, and shown in the polygons on pl. XI. Comparison can therefore be made between the effective winds in each month and the course of the drift-bottles as detailed in the Tables .

It will be noticed that although the direction of the effective wind in the same month at a particular station usually varied considerably in the two years, the resultant direction for the whole year is practically the same at the Scotch stations in 1895 and 1896. At these stations the results are founded, as has been said, on the prevailing direction for each twenty-four hours, and not merely on a single daily observation, as with the English and Continental results. For example, the effective wind at North Unst blew from W.S.W. $\frac{1}{2}$ S. in 1895, and from W.S.W. in 1896; at Buchan Ness it blew from W. by S. $\frac{1}{4}$ S. in 1895, and from S.W. by W. in 1896; at the Bell Rock it blew from W. by N. $\frac{1}{4}$ W. in 1895, and from W. by N. in 1896. These stations are considerably distant from one another, at points from the extreme north to the southern part of the east coast of Scotland; and by combining the resultants in the two years I find the mean direction of the effective wind to have been W. by S. $\frac{1}{4}$ W. in 1895 and W. by S. $\frac{1}{8}$ W.—practically the same—in 1896. In the four months of 1894 during which the experiments were carried on—September to December—the resultant for the period was:—Unst, W.N.W. $\frac{1}{4}$ W., Buchan Ness, W.S.W., Bell Rock, W. by N., and the mean for the three stations was W. $\frac{1}{8}$ S. It is therefore clear that over the whole

TABLE I.—*Showing the Direction and Force of the Resultant or Effective Wind in Each Month during the Experiments.*

1894.	September.	October.	November.	December.	Mean for Four Months.	
North Unst, .	N.N.W. 34	N.E. 11	S.W. by S.¼W. 41	W.N.W. 33	W.N.W. ½ W. 63	W. ¼ S. 53
Buchan Ness,	N.N.W. ½ W. 36	N.W. by N.½W. 5·5	S.S.W. 50·5	S.W. ¾ W. 31·5	W.S.W. 71·5	
Bell Rock, .	N.N.E. 29	N.E. by E. 21·5	S.W. ½ W. 48	W. ¼ S. 28	W. by N. 33	
Shields, . .	N. ½ W. 8	N.E. by N. 11	S. 5	W.S.W. ¾ W. 5	N. ¾ E. 12	N.W. ½ W. 17·3

1894.	September.	October.	November.	December.	Mean for Four Months.	
Yarmouth, .	N. by E. ¾ E. 21·5	N.E. by E. ¾ E. 14·5	S. ¾ W. 6·5	W. by S. ¼ W. 19	N. ½ E. 18	N.W. ½ W. 17·3
Helder, . .	N.N.W. 10·5	N.N.E. ½ E. 7	W.S.W. 17	W. by S. ¼ W. 25·5	W. ½ N. 42·5	
The Scaw, .	N.E. by E. ½ E. 3	N.E. by N. ½ E. 5·9	S.W. by S. ½ W. 12	S.W. ¾ W. 6·5	S.W. 9	

1895.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean for Year.	
North Unst, .	N.E. ½ E. 13·5	N. by E. 10	S.W. by W. 6·5	W.N.W. 5·5	S. by E. 9	W. 14	W.N.W. ½ W. 18·5	W.S.W. ¾ S. 8·5	S.W. by W. 19	N. ¾ W. 21·5	S. ¾ E. 35·5	S.S.W. ¼ W. 7·5	W.S.W. ½ S. 67	W. by S. ¼ W. 74·3
Buchan Ness,	N.N.W. ½ N. 12·6	N.N.W. ¼ W. 14	N.N.E. 4·5	S.W. ¾ W. 8·5	N.W. by W. 8·5	N.W. ½ W. 15·5	W. by N. ¼ N. 18·5	S. by W. 11·5	S.W. ¾ S. 15·5	N.W. ¾ S. 14	S. ½ W. 37·3	S.W. ¾ S. 18	W. by S. ¼ S. 92	
Bell Rock, .	N.N.E. ½ E. 20·6	N.E. 11	N.N.W. 10·6	W. 5·5	N.E. by E. 15	W. by N. 7·5	W. by N. ¼ N. 9	W. by S. 14	W.S.W. 19	N.W. 35	S. by W. ¼ W. 31·5	S.W. by S. ¼ W.	W. by N. ½ N. 73	
Shields, . .	N. by E. ½ E. 9	E.N.E. 4	W. ¼ S. 7·5	N.E. 8	N. by W. ¼ W. 10	...	W. by N. 9	N.E. 2	S.W. 5·5	N.W. 6	S.W. ½ S. 3·9	E. by S. ½ S. 4	N.N.W. ½ N. 29	
Yarmouth, .	N.E. by E. ¼ E. 9	E. by N. 28·3	S.W. ½ S. 17	E. by N. 4	N. by E. ¾ E. 15	N. ¾ E. 4·5	W. by S. 12	W.S.W. 11·3	W. 4	N.W. by N. 3	S.E. ¾ E. 17	E. by S. ½ S. 9	E. ½ S. 30	N.W. by W ½ W 3·3
Helder, . .	E.N.E. 9·5	N.E. 12·5	W.S.W. 20·6	S.W. by W. 10	N. ¼ E. 11	N.W. by N. 12	W. ½ N. 27	W.S.W. 25	W.N.W. 11·3	W. by N. 20	S.E. by S. ½ S. 7·3	W. ½ S. 14	W. ½ N. 105	
The Scaw, .	E. ½ N. 3·5	E. by N. 21·5	N.W. ¾ W. 3·3	E. ½ N. 12	E.S.E. 2	N.W. by W. ¼ W. 7·5	W. ¾ S. 7·5	W.N.W. ½ N. 13·3	N.W. ½ N. 7	W. by N. ½ N. 9·5	S.W. ½ S. 12	S.E. ½ E. 13·5	N. 7·5	

1896.														
North Unst, .	W. ½ N. 38	S.W. ½ W. 37·5	W.S.W. 18·5	W. ¼ S. 18·5	N.W. by W. ½ W. 16·5	E.N.E. ¾ E. 16	S. by E. 6·75	N.W. 11·5	S. ¾ E. 10	N.E. by N. 25·5	W.S.W. 14	S. ¾ E. 36	W.S.W. 110	W. by S. ¼ W. 100
Buchan Ness,	S.S.W. 14·5	S. ¾ E. 34	W. b S. ½ W. 22·6	N.W. by W 18·5	N.N.W. 17	W. by S. 2	S.E. 3	W. by N. ½ W. 20·5	S.W. by S. 7·3	N. ½ W. 21	S.S.W. ¾ W. 6·5	S.E. by S. ¼ E. 29	S.W. by W. 65	
Bell Rock, .	W.S.W. ¾ W. 32·5	S.W. ¾ W. 27·75	W. by S. 23	W.N.W. ¼ N. 26	N.W. by W. 4	N.N.E. ¾ E. 8	N.W. 3·5	W.N.W. 13·5	W. ¼ S. 6·3	N. by W. 34·5	W. by N. ¼. 19·5	S. by W. 8·3	W. by N. 149·5	
Shields, . .	S.W. ¼ W. 6·3	S. ¼ E. 9	S.S.W. 10	W. 8	N.W. by N.½W. 6·5	W.S.W. ¾ W. 8	N. by W. 8·5	W. by S. ¼ W. 7	S.S.W. 4	N. ¾ W. 5	S.S.W. 4	S.E. by E. ½ S. 9·3	S.W. by W.½W. 40	N.W. by W. ¼ W. 50·6
Yarmouth, .	N.W. by N.½W. 4	E. 10	W. by N. ½ W. 11·5	N.W. 21	N. ½ E. 25	N.W. 5·5	N.W. ½ W. 13	N.W. by N. 9·3	S.W. ¼ W. 8·3	E.S.E. ½ S. 2·5	N.E. ¾ E. 23·5	S.E. ½ E. 19·5	N. ½ W. 57	
Helder, . .	W.S.W. ½ W. 13·5	S.E. 2·5	W.S.W. 24	N.W. by N.¾W. 14	N. 23·5	W.N.W. 7	N.W. ¼ W. 12	N.W. by W.½W. 18	W. by S. 12	S.W. by S. 5·3	N.E. ½ E. 5·5	W.S.W. ¼ W. 4	W.N.W. ¼W. 97	
The Scaw, .	N.W. by W.½W. 9	W. by N. 8·5	S.W. by W. 2·9	N.W. by W. 3	S.W. 4	N.W. by N.¾W. 6·5	N.W. by W.¼W. 7·3	N.W. by W.¼W. 8	S. by E. ½ E. 12	S. by W. ½ W. 16	S.W. ¼ W. 4·5	S. 2	W.S.W. ½ W. 48	

1897—January.	North Unst.	Buchan Ness.	Bell Rock.	Shields.	Yarmouth.	Helder.	The Scaw.
	S.E. ½ E. 12	E.N.E. 19·75	E. 13·5	N.E. by N. ½ E. 22	E.N.E. 10·5	E. by S. ½ E. 20·75	N.N.E. ½ E. 9·75

time from September 1894 to December 1896, the prevailing winds on the east coast of Scotland blew from between the two points W. and W. by S. If the direction of the prevailing winds at each of the three Scotch stations be marked on a chart (see pl. x.), it will be found that at North Unst, in both years, it points towards the north of Norway parallel to the coast; at Buchan Ness, Aberdeenshire, it points in both years to the southern part of the west coast of Norway; in 1895 to the vicinity of Skudesnaes; in 1896 to the neighbourhood of the Sogne Fjord (with Bergen midway between); at the Bell Rock it points in both years to the coast of Jutland, in the vicinity of the Limfjord. And Dr Buchan informs me that the prevailing wind in Scotland, as a whole, is, as a general rule, W.S.W.

It is, I think, evident from these facts that the movement of the floats on the east coast of Scotland is not directly and immediately due to the action of the prevailing winds; it is also clear that the drifters are not, as has been sometimes contended, driven by the wind independently of the movement of the water in which they are suspended. If they, or the surface water, were merely driven before the wind from the east coast of Scotland, the general course would be north-east and easterly, whereas we have seen that the almost invariable course is southerly, at right angles to the direction of the prevailing wind. That is, I think, an important point to establish.

The resultant wind at the English and Continental stations does not show the same agreement in the two years, a circumstance probably due to the fact that the calculation was based only on the 8 a.m. observations. At Shields, the prevailing wind, on the basis stated, blew, in 1895, from N.N.W. $\frac{1}{2}$ N., and, in 1896, from S.W. by W. $\frac{1}{2}$ W.; at Yarmouth, in 1895, it blew from E. $\frac{1}{8}$ S., and, in 1896, from N. $\frac{1}{2}$ W.; at Helder, in 1895, it blew from W. $\frac{1}{2}$ N., and, in 1896, from W.N.W. $\frac{1}{4}$ W.; at the Scaw it blew, in 1895, from N., and, in 1896, from W.S.W. $\frac{1}{2}$ W. The variation is therefore considerable. By grouping together the three southern stations, Shields, Yarmouth, and Helder, the resultant for 1895 is N.W. by W. $\frac{1}{2}$ W. (3·3), and for 1896 N.W. by W. $\frac{1}{4}$ W. (50·6), practically the same direction, but much stronger; and the four months, September to December 1894, give for the group N.W. $\frac{1}{2}$ W.

If the two English stations, Shields and Yarmouth, be taken together, the combined resultants are:—In 1895, N.E. by N. $\frac{1}{2}$ E. (3·3), and, in 1896, N.W. $\frac{1}{4}$ W. (5·6). The two Continental stations, Helder and the Scaw combined, give for 1895 W. by N. $\frac{1}{4}$ W. (111), and for 1896 W. by N. $\frac{1}{2}$ W. (139). In the four months of 1894, September to December, the resultant for the two English stations is N. $\frac{1}{2}$ E. (30), and for the two Continental stations W. $\frac{1}{8}$ S. (48). We thus see that while the yearly resultant at the different stations—each founded on a possible maximum of 365 observations—varies somewhat in the two years, this variation is reduced when the stations are combined, and the number of observations thereby doubled or trebled. It must be remembered that the observations exclude light airs and gentle breezes; and an examination of the daily weather reports shows that when a fresh or strong breeze is blowing it usually blows from about the same quarter at the stations in the same areas. While the combination of the observations at two stations reduces the variation shown in the two years, it also approximates the resultants to those obtained from the more extensive observations at the Scottish stations. Thus, while in each of the years the prevailing wind is westerly, the southerly element is also well marked at the most northern station (North Unst, Shetland) and at Buchan Ness, Aberdeenshire, and a northerly element comes in at the Bell Rock. The resultants at the English stations show a still greater increase in the northerly element; at the two Continental stations it is less marked and resembles the condition at the Bell Rock.

It seems, therefore, to be tolerably certain that during the time the experiments were in progress the prevailing wind in the southern part of the North Sea was somewhere about north-west, a direction which would, in this case, rather favour the south-eastward movement of the water from the Yorkshire coast towards the coast of Holland, where, however, very few drifters were obtained. At Helder, the prevailing wind for the last four months of 1894 was W. ½ N. (42·5), for 1895 it was also W. ½ N. (105), and for 1896 W.N.W. ¼ W. (97), more westerly and stronger than on the English coast (see figs. 6,13, 20, pl. xi.). Winds blowing in this direction off the north coast of Holland would tend to drive the surface water towards the coast of Schleswig, where very few drifters were found. At the Scaw the resultant is only well marked in 1896, and indicates a W.S.W. ½ W. wind, with a force or duration of 48. In 1895, it was N. (7·5), and for the four months of 1894 S.W. (9). If south-west winds prevailed along the west coast of Denmark, as appears likely, they would tend to move the surface water approximately in the direction the drifters took at this part of the North Sea.

From the above discussion of the effective winds during the period the experiments were being made, it is, I think, evident that the direction of the wind was approximately coincident with the general direction of the movement of the surface water only at a limited portion of the southern part of the east coast of England, on the west coast of Norway, and, probably, at the northern part of the coast of Denmark. But the most constant and outstanding feature in the experiments, the movement of the water down the whole east coast of Scotland and the northern part of the east coast of England, in a S. by W., S. and S. by E. direction, is a movement at right angles to the prevailing winds, and cannot, therefore, be due to their direct action. In the northern part of the east coast of Scotland, the movement of the water is rather opposed to the prevailing winds.

The Tidal Streams.

Before going further I may allude to another factor that may bear upon this southerly movement of the water on our east coast, namely, the tidal stream, which appeared to me at one time to be the most important. The tidal wave which causes high water on the east coast travels in the same direction as the movement of the surface water as shown by the drifters; southwards from Shetland in the north to Flamborough Head, Yorkshire, in the south, at the rate of about 55 miles an hour; and it then passes to the east and northwards along the coasts of Holland and Germany and Denmark. From the similarity of the direction taken by the drifters, I assumed that the south-going tidal stream was probably the efficient cause of their movement; but I have seen reason to modify this view. In the first place, a high authority on the subject of the tides around our coasts, to whom I wrote, assured me that the north-going ebb-stream, which moves in the opposite direction, is stronger than the flood-tide; and that he would expect the majority of the drifters to be found to the north of the place where they were thrown into the sea. From the gradual rise of the bottom of the North Sea from north to south, one would expect this to be the case, the inclination (as well as the prevailing wind off the Scottish east coast) favouring a more rapid run to the north. I endeavoured to learn the opinions of the coastguard at some parts of the coast on this subject, but only ascertained that the current off the coast runs north and south. In the second place, I think a study of the action of the winds over the North Sea, during the period of the experiments, shows that the prevailing winds will largely account for the movement of the water. The circumstance that the course of the tidal movement of flood and ebb has the same range as the movement of the drift bottles appears to be due to the configuration of the coasts, and of the bottom; the North Sea is practically a basin or bay, and the communication with the Channel seems to have very little connection with the movement of the water. The cross-section at the Straits of Dover is very much less than that of the northern opening between Duncansby Head and the nearest point on the Norwegian coast. As was previously stated, none of the thousands of drifters put away on the east coast have been got south of a line between the Wash and Helder; and none of those put off between Norfolk and Holland, south of a line between Lowestoft and Helder, although the tidal stream from the east coast penetrates to the Thames.

Let us now consider the influence of the prevailing winds as above described. At North Unst, Shetland, the direction of the wind coincides generally with the direction of the Gulf Stream, or Atlantic current, which impinges on and passes up the western coast of Norway. At Buchan Ness, about 190 geographical miles further south, it blows in much the same direction, and will tend to heap up the water on the south-west coast of Norway. At the Bell Rock, 65 miles (geog.) further south, it blows from the W. by N.; and along the east coast of England from a point somewhat more to the north. The general action of the wind then in the North Sea tends to drive and heap up the surface water on the eastern side, which is very shallow south of the Skagerak. It cannot escape to the south owing to the narrow orifice of the Channel and the shallows, and it, therefore, passes northwards along the coast of Schleswig and Denmark, and joins the current passing up the Norwegian coast and that issuing from the Baltic, sometimes penetrating into the Skagerrak. Pettersson has shown that the strong current that usually flows westwards from the Baltic passes along the south coast of Norway and thence northwards along the west coast,* and the north-going current along the west coast of Norway is well known.

It is, I think, chiefly in consequence of this tendency for the heaping up of water on the eastern side of the North Sea and its passage northwards that water, flowing in from the Atlantic around the North of Scotland, passes down the east coast of Scotland and England, as previously explained, to take its place. That the wind is a potent factor in producing this movement is shown by the conditions attending the exceptional reversal of the movement of the water to which reference has been frequently made, and which may now be more fully described. The rotation of the earth is no doubt also of importance.

4. Reversal of the Normal Current.

In December 1896, and especially January 1897, a number of drifters were picked up on the east coast, to the north of the place where they were thrown into the water. Some of these belonged to groups which had been put in a considerable time before, and members of which had been previously found to the south, as usual. Others were set adrift in December and January, and rapidly moved northwards. Further, some thrown

* *Journ. Scot. Geogr. Soc.*, July 1894.

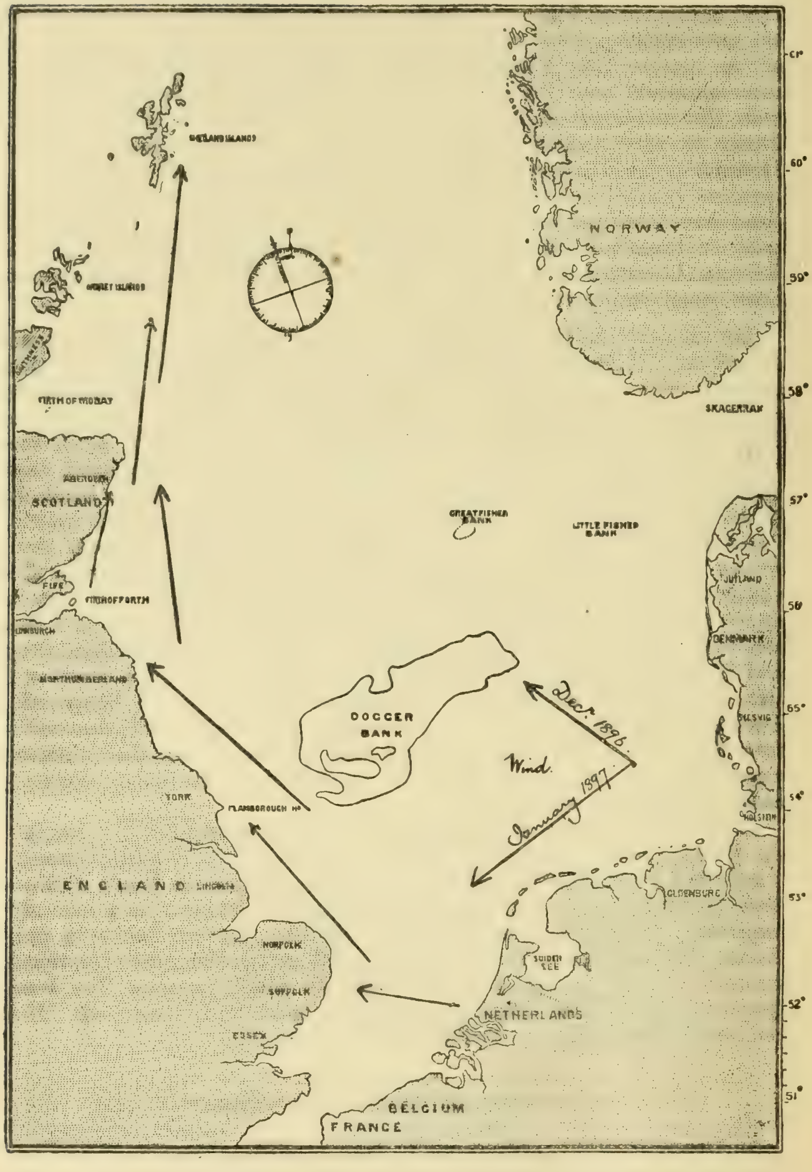


FIG. 3.—Chart of North Sea, showing the reversed movement of the surface water in December 1896 and January 1897.

in 24 miles from the Hook of Holland on 3rd January, travelled rapidly westwards, and were found on the Norfolk coast twenty-one days later.

For example of a lot set adrift in the Moray Firth on 22nd July 1896, three were recovered within a few days, on the Banffshire coast, to the south, and one was picked up on 7th December in Shetland. At the time they were put away we have already seen that the current was, as usual, running to the south (p. 343 and table p. 387). The one picked up in Shetland had probably passed round Rattray Head, and was well on its way southward when it was carried by the reversed movement northward as far as Shetland. Others, put away in August and October east of the Isle of May, were found in January, about the same date, on the coast fo Northumberland and Durham (pp. 390, 391). Three set adrift at Orkney on 3rd November were found at Shetland on the 14th and 22nd December. The "Garland," coming down the coast on December 28th and 29th, set adrift a number of bottles at various places, and all those recovered were found to the north, as far north as Orkney. One, for instance, put away on 28th December, off Bervie, Kincardineshire, was found in Orkney, 135 miles to the north, sixteen days later. From off Buchan Ness one was also found in Orkney ; from the Bell Rock and the Isle of May they were found in Aberdeenshire, travelling about 65 miles in ten days. Further down the coast some were stranded on the coast of Durham and Northumberland, which ought, in the usual course, to have been far away to the south and east. Others put away off the coast of Lincoln on 3rd January 1897 were found on the Yorkshire coast, over sixty miles to the north-west within twelve days; those put away north-east and east of Norfolk at the same time, were found on the coast of Norfolk, and it is noteworthy they travelled much slower at this part of the North Sea than those further north. Finally, the drifters put away near the Hook of Holland moved westwards to Norfolk. There is therefore no question that at this time the movement of the water was reversed.

Now, it will be seen from the table (p. 358) and the chart (Pl. XI.) that the winds during December and January were blowing from the south and east, as follows :—

	N. Unst.	Buchan Ness.	Bell Rock.	Shields.	Yarmouth.	Helder.	Scaw.
Dec. 1896,	S. ¾ E. 36	S.E. by S. ¼ E. 29	S. by W. 8·3	S.E. by E. ½ S. 9·3	S.E. ½ E. 19·5	W.S.W. ¼ W. 4	S. 2
Jan. 1897,	S.E. ¼ E. 12	E.N.E. 19·7	E. 13·5	N.E. by N. ½ E. 22	E.N.E. 10·5	E. by S. ½ E. 20·75	N.N.E. ½ E. 9·75

An examination of the daily records shows that strong winds and gales from S., S.E., E.S.E., and S.S.E. prevailed on the east coast of Scotland during the first ten days of December, and on the east coast of England, but less strong during the first six days. On the 14th it blew strongly from the east, rising in some places to a gale; from the 17th to the 21st it blew on the east coast of Scotland fresh or strong from N.E., E., N.N.E., or N. The strong winds and gales from the southward and south-east at the beginning of the month would tend to drive the water northwards along the coast, and this appears to account for the northward movement of the drifters picked up in Shetland in December. From the 24th to the 31st December the prevailing winds were from the S.W. and towards west, rising at some places to a gale on the 26th and 27th. From the 2nd to the 4th January the winds blew strong from the south and S.S.W.; and from the 6th to the 9th there were strong winds and gales from E., S.E., and E.S.E. on the Scotch coast; on the English coast they were mainly easterly from the 8th to the 11th. From the 12th to the 25th, a northerly element comes in, the wind blowing usually from the N., N.E., and N.N.E., and rising to gales. The effective wind at all the stations in January was from the east and north, the mean direction being E.N.E. E.

The prevailing winds therefore seem to account for the reversal of the current in December and January, the south and south-east winds driving the water directly northwards parallel to the coast, and the east and north-east winds keeping it up on the east coast of England, whence, as it cannot escape to the south, it passes northwards. None of the drifters were found south of Norfolk, although the strong winds from E.N.E. in January would tend to drive part of the surface water towards the Channel.

The direct influence of continuous winds, blowing strongly in a uniform direction for a period, in driving the surface water before it, is shown in a number of other cases, as, for example, in November 1894. During almost the whole of that month the wind blew between west and south, and principally from S.W. on the east coast of Scotland (see Table I. p. 358 and figs. 1, 2, 3 on Pl. XI.), and drifters put in at the beginning of the month 8 and 10 miles off the coast of Aberdeen, were found in December on the west coast of Norway, near Bergen, and to the north of it; the first found had travelled 270 miles in 29 days. These drifters, and the surface water, were, no doubt, blown in a north-westerly direction from the Scottish coast, until they entered the strong northerly drift racing up off the west coast of Norway.

There are two points upon which something must be said:—(1) The rate of the current; (2) the depth to which the movement described extends.

5. The Rate and Depth of the Current.

With respect to the rate of movement, the same observations that apply to the direction deduced from a few experiments apply also here. It would be wrong to infer the rate from isolated cases, where the drifters may have lain on the beach for some time before being discovered. But this source of error is greatly diminished by repeated instances, and by—what was a very common occurrence—a large proportion of one lot being found on the same day, or on dates close together. In some cases, too, the drifters were picked up by fishing-boats while they were afloat.

Beginning at the north, with the drifters put away by H.M.S. 'Research' to the north and west of the Shetlands, we find that those set adrift on 5th August in lat. 60° 38½′ N. long. 5° 35½′ W. moved in an easterly direction to the Shetlands, distances ranging from 116 to 147 miles in 22 to 26 days, or at a rate of about 5 miles a day. The prevailing winds during the period of flotation were from the north-west and north at North Unst, Fair Isle, and Wick. Those set adrift on 30th July to the north of the Shetlands (lat. 61° 49½′ N. long. 0° 43′ W.) were found about 90 miles to the south in 44 and 46 days, but during the latter part of the period, the winds were blowing strongly from an easterly direction, sometimes veering towards north and sometimes towards south. Those set adrift on 6th August (lat. 60° 2′ N. long. 7° 4′ W.) and found in Norway travelled about 500 miles in 116 days, or at a rate of between 4 and 5 miles a day. Some put in at Suleskerry, to the west of the Orkneys, travelled eastwards to the Orkneys at a rate rather over 5 miles a day.

In the Moray Firth the drifters put away at Smith Bank were carried southwards at rates varying from about 13 to 5 or 6 miles a day. At the beginning of March 1895, they travelled 40 miles in 3 days, the wind blowing the whole time strongly from the north; and, it may be noticed, the water impinged on the coast at this time much more to the eastwards than usual. In October 1894, the rate was about 5 or 6 miles an hour, and at the time the wind blew partly from S.W., but chiefly from N.E. In October 1896, the rate was much the same, the wind blowing chiefly from the N.E., N.N.E., and E. On the east coast of Scotland and England the rate was not, as a rule, so rapid. Thus, off the Scotch coast, the southward movement in September 1894 was between 4 and 5 miles per day, the wind blowing from the north-east; in April and May 1895, with mostly light breezes from the south, west and east, with a few days of strong wind from N.N.E., the rate was considerably under a mile a day. At the end of July and beginning of August 1895, with the winds chiefly variable, and light from the south-west and west, the rate off the coast of Aberdeen was about 2 miles a day. In the latter half of May 1896 and early part of June, with the winds variable and light, but chiefly from E. and E.N.E., the rate was between 2 and 3 miles a day. In July two were picked up at sea off the coast of Aberdeen; they had travelled in a southerly direction at the rate of about 3 miles a day, the wind being light and variable, chiefly from the east and north. Others of the same group were picked up on the Northumberland coast, about 50 days afterwards, having travelled 142 miles, a rate rather under 3 miles a day, the winds blowing from various points. In October, with northerly and N.E. breezes, the rate was increased to between 5 and 7 miles an hour.

Those found on the English coast moved at about the same speed, and as the distance traversed was greater, and the period of flotation longer (and the direction of the wind therefore more variable), the results are perhaps of more value. In September–October 1894, the southward rate was exactly 3 miles a day. In December–January, from the Firth of Forth to Yorkshire, the rate was from under 2 miles to over 4 miles a day in different cases; the prevailing wind in December 1894 was W. by N. at Bell Rock (33) and N. ¾ E. (12) at Shields; in January 1895 it was N. by E. (9) at Shields. The most rapid was 208 miles in 48 days (from Fifeness to Lincolnshire), or about 4·3 miles per day. In March–April–May the rate in different cases, varied from a little over a mile a day to over 5 miles, the quicker movement being due to north-easterly winds. In May–June–July 1896, the speed ranged from between 2 and 3 to about 4 miles per day, the winds blowing chiefly from N.W. A drifter put in to the water on 11th June, 12 miles E.S.E. of the Isle of May, was picked up by a fishing-smack 32 miles E.S.E. of Flamborough Head, on 26th August, having travelled 156 miles in 76 days, or at a mean rate of slightly over 2 miles a day. In June–July, the speed was about 3 miles per day; during the period the wind blew chiefly in June from W., S.W., and W.S.W., and in July from N.N.W. A bottle set adrift in the Moray Firth on 22nd July was picked up on 3rd December about 65 miles N.E. from Spurn Head, Yorkshire, having travelled about 248 miles southward in 134 days, or rather under 2 miles per day. In August–September, the rate was from about 2 to a little over 3 miles per day. In October, the mean speed was, in some cases, as high as over 6 miles per day (93 to 133 miles), and, in other cases, over 4 miles, the effective wind being N. by W. and strong.

As a general rule, it may be said that the surface movement southwards along the east coast, ranges about 2 or 3 miles a day; that its speed may be greatly increased by northerly winds, and, no doubt, diminished by winds from the opposite quarter. It also appears that the speed is, as a rule, greatest at some distance from the coast of Scotland and the north of England; that it diminishes quite near the coast, and likewise at a considerable distance, say 50 or 60 miles, from it. The rate at which the reversed movement took place in December 1896 and January 1897 was much the same as the southerly movement under northerly winds. The meteorological conditions as we have seen were strong southerly and south-easterly winds in December, and north-easterly winds in January. One bottle travelled very rapidly from off Kincardineshire to Orkney, a distance of 135 miles in 16 days, or over 8 miles a day. Further south the rate was about 4 to 6 miles, off the Yorkshire coast (in January with east and north-east winds) it was about 5 miles a day, and between the Dutch coast and Norfolk the same.

The rate at which the movement of the surface water takes place across the southern part of the North Sea is not so easy to define owing to the uncertainty of the curve taken by the drifter. But from an examination of the cases where some members of the same group or of allied groups were stranded on the English coast and others on the Continent, it would appear that the rate, as a rule, is a little over 2 miles per day. The northerly movement on the eastern side of the North Sea appears to be somewhat faster, especially on the west coast of Norway. The particulars given in the tables shows this to be the case.

With respect to the depth to which the movement extends, the experiments do not give much information, but such as it is it supports the view that the bottom layers, at least in the southern part of the North Sea, move in the same direction. One of the bottom drifters put away on the Dogger Bank in October was found 50 days later 35 miles to the southward, having been brought up in a trawl-net. The temperature observations made by Dr Murray on some of the west coast lochs and by Dr H. R. Mill in the Firth of Clyde, show that a strong wind blowing for a day or two may affect the water down to very considerable depths; and it can scarcely be doubted that a fairly constant circulation of the surface water in the North Sea, as described in this paper, is associated with movement in the same direction of the intermediate or bottom layers, at all events where the depth is not great. For the special purpose I had in view in beginning these experiments, namely, the transport of floating fish eggs, it is sufficient if the surface layers—down say to 6 or 7 fathoms—move in the direction indicated. At the same time it appears to me that experiments made with floats of a special and superior kind, designed to remain suspended at different depths, would throw a great deal of light on the movement of the deeper strata. The method of tracing such movements by differences of physical property in the water (salinity and temperature) is comparatively simple where these differences are strongly marked, as in the areas so systematically investigated by Professor Pettersson. But in the greater part of the North Sea the differences are comparatively slight, and it will be a matter of difficulty to satisfactorily elucidate the movement of the deeper layers by the method named. It will, at all events, involve a very great number of simultaneous observations over a wide area, and their frequent repetition for a number of years. On the other hand, very large floats, arranged so as to sink very slowly, and connected by silk cord with a small surface float just large enough to buoy the large float at a given depth, would, I think, furnish valuable information at comparatively small expense.

The hydrographical results of the experiments may be summed up as follows :—

1. That there is at all seasons a fairly constant slow circulation of the surface water in the North Sea, Atlantic water entering round the north of Scotland and between the Orkneys and Shetlands, and passing southwards along the east coasts of Scotland and England, as far as the neighbourhood of the Wash, then in an E.N.E. direction towards the coast of Denmark, and then northerly along the Danish coast. The surface water may or may not enter the Skagerrak and penetrate to the west coast of Sweden and Norway, according to the prevailing wind. The main body passes up the west coast of Norway and joins the Atlantic stream. The limit between the north-going eastern stream and the south-going western stream varies greatly, probably according to the prevailing winds; as a rule, the extent of the former is greater.
2. The movement of the surface water in confined areas, like the western part of the Moray Firth and the Firth of Forth, is irregular, and depends upon variations in the winds and the tides.
3. That, while the general circulation of the surface water in the North Sea is as above described, the current may be deflected by the wind, or even, under exceptional meteorological conditions, reversed.
4. That the speed of the movement is usually about two or three geographical miles a day, but may be much accelerated or retarded by the action of the wind.
5. That the principal cause of the circulation is probably the influence of the prevailing winds, driving the water towards the eastern side and tending to heap it up there.

III.—Relation of the Movement of the Surface Waters to Fisheries.

The most important object of the experiments from the practical point of view was, as has been already said, to ascertain the carriage by currents of the floating eggs and larvæ of the marine food-fishes. With the exception of the herring, of skates and rays, and the catfish, the eggs of the food-fishes are buoyant, and float as tiny, isolated crystalline spheres. The eggs may therefore be wafted considerable distances during the time the embryonic fish is developing within them; and the distance will depend upon the rate and constancy of the current and the duration of the period of development. Further, when the eggs hatch, the tiny young fishes which escape from them are ill-developed and but poorly endowed with the power of independent movement. They wriggle about by fits and starts, and remain quiescent in the intervals. On emerging from the egg each little fish carries attached to its under surface the remains of the yolk, from which it derives its nourishment for a period varying from a few days to upwards of a week, and during this larval stage, at least, it may be said that it is as much subject to be carried by the general movement of the water around it as it was when still within the egg. When the yolk is used up, or a little before it, it begins to feed on the minute organisms in the water, and has then the power of darting for an inch or two hither and thither; but it is still practically inert so far as its carriage by the current is concerned. It is not, indeed, until some weeks later, when it begins to assume the form of the adult, that it may be regarded as anything like independent of the movement of the water; in the case of flat-fishes, the young then settle on the bottom, and have completed their pelagic life.

The period during which the young fish is subject to the movement of the current must vary considerably in different species, but, except in a few cases, we do not yet possess exact information as to the duration of the post-larval stage. It has, however, to be noted in this connection that, while the pelagic eggs are almost always confined to the surface waters, the larval and post-larval fishes become more abundant in the intermediate layers and towards the bottom. As a rule, the surface tow-net takes eggs and the bottom tow-net takes larval and post-larval fishes. Owing, therefore, to the sinking of the young fishes from the surface layers, they will not be so liable to be carried by the current, unless the latter also equally involves the bottom layers.

Both the pelagic eggs and the larvæ that issue from them are very small, as may be seen from the following table comprising some of the chief forms, and which gives measurements in fractions of an inch:—

	Cod.	Haddock.	Whiting.	Saithe.	Ling.	Turbot.	Brill.	Sole.	Plaice.	Lemon Sole.	Flounder.	Dab.
Diameter of egg.	$\frac{1}{16}$	$\frac{1}{17}$	$\frac{1}{21}$	$\frac{1}{22}$	$\frac{1}{23}$	$\frac{1}{26}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{13}$	$\frac{1}{18}$	$\frac{1}{27}$	$\frac{1}{30}$
Length of larvæ.	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{8}$	...	$\frac{1}{8}$	$\frac{1}{11}$	$\frac{1}{9}$	$\frac{1}{7}$	$\frac{1}{6}$	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{10}$

It will be evident that these tiny fishes, the longest of which on emerging from the egg is only about $\frac{1}{6}$th of an inch in length, could in any case have but a feeble power of contending with the current.

It is of great importance, in dealing with the question of the transport of pelagic eggs and larvæ, to consider the position of the places where the various species spawn—the location of their breeding-grounds—and also the time during which the spawning occurs, or the spawning season. The importance of the latter point chiefly relates to the duration of the period of development within the egg, for in summer, when the temperature of the water is higher, the pelagic eggs hatch much more rapidly than in the winter or spring. The investigations made by the 'Garland' have thrown a great deal of light on both these questions. It has been shown that the important food-fishes, such as cod, plaice, haddock, ling, saithe, turbot, halibut, sole, lemon sole, do not spawn within the territorial waters on the East Coast; and this has been subsequently confirmed in other places where the physical conditions are similar, and especially when the depth of the water is not great.* There is little doubt that around the whole of the North Sea, with the exception of the deep waters off the Norwegian coast, the fishes named do not spawn within the three-mile limit, but further out from shore. On the West Coast, on the other hand, where the physical conditions are different and deep water extends close to the shore, spawning fishes may be found within the territorial zone. Fishes that do spawn within the three-mile limit on the East Coast, as well as further off, are the dabs, the flounder, the sprat, and the gurnard; and while the great majority of whiting spawn beyond the limit, a few spawn on the borders or within the limits. The dabs also spawn chiefly offshore, and the only species which appear to shed their eggs rather more within than without the limit are the flounder and the sprat.

The fact just stated, that the valuable food-fishes do not spawn within the territorial waters in the North Sea, is one of great importance. The

* See my papers, 'The Spawning and Spawning Places of Marine Food Fishes,' *Eighth Ann. Report*, Part III. p. 257 (1890); 'Observations on the Reproduction, Maturity, and Sexual Relations of the Food Fishes,' *Tenth Ann. Report*, Part III. p. 235 (1892).

inshore waters abound with young fish. Small flat-fishes, such as plaice, dabs, and turbot, exist in great numbers on sandy beaches and shallows, and young round-fishes, as cod, saithe, and ling, frequent the more rocky regions. It is therefore evident that these young post-larval forms, which were spawned offshore, must be carried to the inshore grounds principally by the movement of the water; and by the use of tow-nets their progress shorewards may be traced. For example, eggs of plaice, ling, haddock, and cod, advanced in development, as well as the larval fishes with the yolk-sac still attached, and the older post-larval forms, may be found close inshore, as in the Firth of Forth and St Andrews Bay. They are in process of being swept in by the currents;

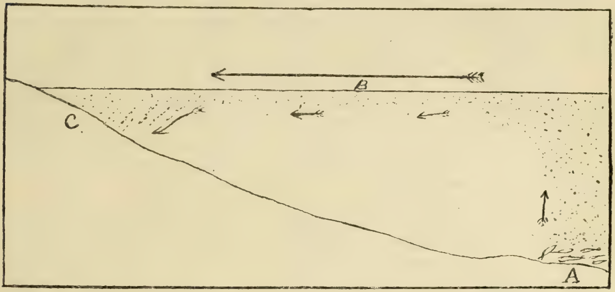


Fig. 4.—Diagram representing the carriage of pelagic eggs from offshore spawning grounds, A, to inshore waters, C, by the surface current B.

and it is largely in this way that the inshore grounds are recruited from the spawning areas further out (Fig. 4). Young fishes are not, however, limited to the grounds near the shore. Some kinds, such as the long rough dab and the haddock, are more common at a distance from shore in deeper water; but our knowledge respecting the distant grounds is at present very imperfect, owing to the fact that no vessel is available capable of making the investigation. For the same reason we do not know the limits or extent of the great spawning areas. All that can be said is that such species as cod, haddock, ling, plaice, and turbot spawn from five or six miles up to great distances from shore, and also on the offshore banks and their neighbourhood, such as the Dogger Bank, the Great Fisher Bank, Smith Bank, etc. During the greater part of the year the adults are more or less scattered about the North Sea and within territorial waters, searching for food, but towards the approach of the spawning season they congregate in shoals in particular localities.

The nature of the bottom does not appear to have any influence in the determination of the spawning area of fishes producing pelagic eggs; it may be muddy, or sandy, or rocky. There is thus a great difference from the case of fishes producing demersal eggs, such as the herring, where the eggs are attached, as a rule, to objects in the bottom, and where the presence of mud might prove extremely injurious. At the same time it cannot be held that the selection of spawning places by fishes producing pelagic eggs is fortuitous, for adults with ripening reproductive organs move out from the inshore waters at the approach of the spawning season, and may return to them after their spawn is shed. As pointed out by the author some years ago,* the selection of areas

* *Eighth Annual Report for* 1889, Part iii., "The Spawning and Spawning Place of Marine Food-Fishes," p. 258.

offshore for spawning appears to be determined chiefly by the physical conditions in relation to the safety of the floating eggs and their transport to the places most suitable for the welfare of the young fishes derived from them. If, for example, plaice were to spawn close to the shore on the east coast, a very large proportion of the eggs would inevitably suffer destruction by being stranded on the beaches before the embryonic fishes inside them were far developed, or by being carried into water of insufficient density, as at the mouths of estuaries, when they would sink to the bottom; and yet the habitat of the young of no fish is more characteristically restricted to the shallow inshore waters than in the case of the plaice. The plaice spawns early in the year when the water is cold, and it possesses a relatively large egg, both conditions being associated with a prolonged period of development and therefore a prolonged flotation. On the other hand, the dab or the sprat, which spawn later, when the water is warmer, and which possess a relatively small egg, shed their eggs to a considerable extent within the territorial waters, the period of development being comparatively brief. Since the two factors mentioned are so important in connection with the carriage of floating eggs by currents, namely, the size of the egg and the temperature of the water during the period of flotation, it is necessary to consider them in some detail.

The spawning period or season for all the more important species of the food-fishes is now well determined. In the following table I give the limits of the spawning season, the diameter of the egg, the mean number of eggs produced by one female, and the duration of the period of development within the egg of a number of species, as stated by different observers:—

Species.	Spawning Season.	Mean Diameter of Egg in Millimetres.	Mean Number produced by one Female.	Duration of Period of Development within the Egg.
Plaice . .	Middle of Jan.–middle of May. .	1·93	300,000	20 days at 41° F.
Common Dab .	End of Feb.–middle of July . .	0·85	106,000	3 days at 45°–60° F.
Flounder . .	Beginning of Feb.–end of June .	0·92	1,411,000	$3\frac{2}{3}$ days at 54° C.
Long Rough Dab	End of Jan.–middle of May . .	1·1	44,000	14 days in March.
Lemon Dab .	End of April–end of Aug. . .	1·3	411,000	6 days at 53° F.
Turbot . .	Beginning of April–end of July .	1·02	8,500,000	6–7 days in June.
Brill . . .	Middle of March–end of June .	1·3	825,000	8–9 days in May
Cod . . .	End of Jan.–beginning of June .	1·38	4,530,000	15 days at 43° F.
Haddock . .	Middle of Jan.–end of May . .	1·45	450,000	15 days at 43° F.
Whiting . .	Beginning of March–end of Aug.	1·2	250,000	10 days at 46° F.
Saithe . .	January–end of April . . .	1·16	6,500,000	12 days in Feb.
Ling . . .	End of Mar.–end of Aug. . .	1·08	18,500,000	9 days
Gurnard . .	Middle of April–end of Aug. .	1·45	256,000	6–7 days
Sprat . . .	Middle of Mar.–middle of Aug. .	1·0	...	...

The observations made by several investigators, and specially by Mr Dannevig at Dunbar, have shown that, at the same temperature, pelagic eggs with small yolks hatch more rapidly than those whose yolks are large, and that the development or hatching of the eggs of a given species is accelerated by an increase of temperature and retarded by a decrease of temperature. It is obvious from the variations in the period of development of the eggs of different species, as shown in the above table, that they will be in very different degrees subject to the transporting power of sea currents; and that, other things being equal, they will be carried very different distances before hatching occurs. Exact observations are wanting as to the duration of the period of development of the eggs of many species under different temperatures, but sufficient is known to enable some conclusions of importance to be drawn. From the daily observations made at the Bell Rock Lighthouse and the North Carr Lightship in 1891, 1892, and 1893, on the temperature of the sea, I have compiled the following table of the mean temperature of the surface water on the east coast of Scotland in the various months throughout the spawning season. The temperature varies to some extent in different years, but there are good reasons for believing that such variation retards or accelerates the spawning season, and that each species in a given region only begins to spawn when the temperature has reached a certain point, normal for that species :—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.
40·5	39·2	39·4	41·9	45·5	50·2	53·6	54·3	53·8

From these mean temperatures it will be seen that the surface water is coldest in February and March, and warmest in August and September, and that the range from the minimum to the maximum is close upon 15° F.

The maximum and minimum temperatures of the bottom water on the east coast, off the Firth of Forth, in from 25 to 30 fathoms of water, is not contemporaneous with the maximum and minimum at the surface. The bottom water is colder than the surface water from February or March to October, and warmer in October, November, December, and January ; in March the surface and bottom temperatures are usually subequal. In January the difference rarely exceeds 1° F., and is usually much less ; in February it is still smaller ; in April the bottom water may be nearly 2° F. colder, but is usually less ; in May the difference is a little greater ; in June the surface water may be about 5° F. warmer, and after that the difference diminishes until, in September, they are subequal. But, while this variation in the temperature between bottom and surface should be kept in view, it can scarcely affect the conclusions respecting the period of development of pelagic eggs, for they usually float within a few fathoms of the surface in water of good density, *i.e.*, in the open sea, and in the season during which most pelagic eggs are shed, namely March and April, the difference is comparatively small.

From the experimental observations made by Mr Dannevig at Dunbar in 1895, and which were instituted principally in connection with the present investigation,* it was found that at the temperature of 39·2°—which is the mean natural temperature for the surface water in February—the eggs of the cod and of the haddock took 20½ days to hatch. At a temperature of 41°, which is nearly one degree colder than the mean surface temperature in April, the eggs of the cod took 17½ days to hatch, those of the haddock 17¾ days, and the eggs of the whiting 15½ days. At a temperature of 42·8°, which corresponds with the mean temperature of the sea about the beginning of May, the eggs of the cod and haddock took 15½ days to hatch, those of the whiting 13½ days, those of the plaice 18¼ days, and those of the flounder 6½ days. At a temperature of 46·4°F., which represents the mean temperature of the surface water, about the end of May and beginning of June, the eggs of the haddock hatched in 13 days, those of the cod in 12¾ days those of the whiting in 10¼ days, those of the plaice in 14½ days, and the eggs of the flounder in 5½ days. At 50°, which corresponds to the mean June temperature of the water, haddock and cod eggs hatched in about 10½ days, whiting eggs in 8 days, those of the plaice in 12 days, and those of the flounder in 4½ days. At a temperature of 53°·6, which is the mean temperature for July, the eggs of the cod and haddock took

* *Thirteenth Annual Report*, Part iii., p. 147.

$9\frac{2}{3}$ days to hatch, those of the whiting $6\frac{1}{2}$ days, the eggs of the plaice $10\frac{1}{2}$ days, and the eggs of the flounder $3\frac{2}{3}$ days.

From a comparison of these facts with the months during which the spawning of the various species goes on, the generalisation made above becomes clear, namely (1) that the eggs of those species which spawn early in the year will be subjected to the action of the current for a considerably longer time than those which spawn later; (2) that the eggs of any given species which are shed at the commencement of the spawning season of that species will be subjected to the action of the current for a longer period than those which are shed towards the end of the spawning period.

Thus, under natural conditions in the sea, the eggs of the plaice, a fish which spawns early, will take about twenty-three or twenty-four days to hatch in February and March, while those shed at the end of the spawning season, in May, will hatch in about sixteen days. The eggs of the cod and haddock shed at the beginning of the spawning season, and up to nearly the end of March, will take about twenty days, and towards the end of the spawning time, about twelve or thirteen days before hatching occurs. The hatching period of the eggs of the whiting will vary from about sixteen days at the beginning of the spawning season to about six at its close; that of the saithe will vary from fifteen or sixteen days to eleven or twelve. Among species which spawn in the summer the period is much shorter. Turbot eggs, which are shed from April to July inclusive, probably take from about eleven or twelve days at the beginning of the season to about five days towards its close; and the same remarks apply to the eggs of the ling. The fact discovered by Holt, and confirmed by Canu and M'Intosh, that the eggs of the turbot sink during development in water of ordinary specific gravity, will probably cause the period of hatching to be rather more prolonged in this case, because the lower layers of water are colder during the spawning season of this fish. Dannevig has, however, shown that the specific gravity of the turbot's egg during development does not exceed 1028, in which case in the open sea it will not sink very far. The eggs of the gurnard, which are shed from April to August inclusive, require about fourteen or fifteen days to hatch at the commencement of the spawning season, and about eight or nine days towards the close of the season. The eggs of the sprat, which are small, are shed from the middle of March to the middle of August, and the period of hatching will range from about eight or nine days to about four days at the end of the season. The eggs of the common dab, the smallest of all the pelagic eggs belonging to a food fish, will require about seven or eight days at the end of February, when spawning commences, to between two and three days at the close of the season in July. The eggs of the flounder, which are also small, will hatch in about eight days at the beginning of the spawning season in February, and in five or six days towards its close in June. The hatching period of the eggs of the halibut is unknown, for living eggs have never yet been under observation, but judging from the size of the eggs, and assuming (what is not yet satisfactorily proved) that they are shed in the spring, they would probably require four or five weeks to hatch.

From the facts stated it is evident that the dispersion of the individuals of different species in the egg state by the movement of currents must vary to a considerable degree, and that in some cases the extent of the movement is great. The eggs of the plaice, for example, in the twenty-three or twenty-four days they are floating during development, may travel southwards more than 50 miles—sometimes much more—

from the spawning area where they were shed; and the eggs of cod and haddock may travel in a similar direction from 20 to 40 miles before they hatch. On the other hand, the floating eggs of the summer spawning fishes will be carried much shorter distances, in some cases only a few miles; for, besides the higher temperature of the water at that season, the eggs of such species are frequently small, and therefore prone to hatch rapidly. In agreement with these conditions it is also found that the summer spawning species, and notably the flounder and the sprat, shed their eggs much closer to the shore, and within the territorial waters, than those which spawn earlier in the year, for owing to the fact that hatching occurs rapidly, they are not exposed to the same risks of being stranded and destroyed. The gurnard at first sight appears to be, in one respect an exception, inasmuch as its egg is relatively large, and it spawns in the Firth of Forth as well as outside in the offshore waters. But it does not spawn in the inshore area until comparatively late, when the temperature of the surface water is over 50° F., and the egg would then hatch in about a week. This fish, indeed, reverses the procedure of most sea fishes by migrating in summer to the inshore waters in considerable numbers to spawn, leáving them again in the autumn. Looking over the 'Garland's' trawling records for a series of years it will be found that gurnards are not taken in the trawl in any year, even at the stations east of the Isle of May, until April, and then in small numbers, and with very rare exceptions after October; they are most numerous from the end of May to the end of August.

It has been already explained that the larval fish, after it has issued from the egg, is almost or quite as inert as it was while still within it, so far as its transport by currents is concerned. But the available information respecting the duration of this period and the earlier part of the post-larval stage, when the yolk sac has been absorbed, is imperfect. It is probably in all cases, and in some cases certainly, much longer than the period spent within the egg. Dannevig (see page 187) has shown that the larvæ of plaice from eggs which hatched in thirteen days at the beginning of May, had absorbed the yolk, and entered the post-larval stage eight days after hatching; while other thirty-four days, or forty-two days from the date of hatching, elapsed before their transformation was sufficiently advanced to enable them to remain permanently on the bottom. During at least half of this period the post-larval plaice in the sea would be subjected to a considerable extent to the movement of the water around them, and combining this with the movement of the egg, and making allowance for the probably diminished rate of the current in the bottom layers to which the larvæ descend, it is a moderate estimate to assume that the young plaice which abound on the sandy beaches, say, in St Andrews Bay, may be from 60 to 100 miles south of the place where the eggs from which they were derived were spawned. The duration of the larval stages of other species has been somewhat variously stated by different observers, or not stated at all. It appears to vary from three or four days to ten or twelve days according to the species and the temperature. It is known that an increasing temperature accelerates, and a decrease of temperature retards the absorption of the yolk and the growth of the young fish, just as it hastens or delays the development of the embryo within the eggs. Hence the duration of the larval and post-larval stages of summer-spawning species—and consequently the length of exposure to the influence of currents—is comparatively brief. Very little definite information exists respecting the length of the post-larval stage except in the plaice.

From a consideration of the movement of the surface water off our eastern coast as explained in the first part of this paper, and the facts reviewed above, it may be concluded that the great spawning areas lying off that coast stand in normal relationship, not to the inshore waters opposite to them, but to those situated further to the south. The millions and billions of eggs which are annually shed into the waters above these spawning areas—each with its potential marketable fish within it—are normally carried by the surface waters southwards to a more or less distant area where they hatch, and the larval fishes continue to be borne in the same direction. Thus the spawning grounds in the northern part of the Moray Firth, at Smith Bank, and neighbourhood, and which are known to be frequented by great shoals of the food fishes, must be looked upon as the main source of supply of larval and post-larval fishes to the areas off the north coast of Aberdeen, the coast of Banff, and by the normally deflected current passing westwards, to the inner reaches of the Moray Firth, perhaps also partly to the east coast of Aberdeen. The spawning grounds lying off the latter coast and the coast of Kincardineshire can only exceptionally supply the territorial waters of these coasts; normally the floating eggs will be borne southwards, and may reach the coast of Fife or even Berwickshire. So also the offshore spawning areas situated to the eastwards of the Isle of May can only exceptionally furnish larval and post-larval fishes to the Firth of Forth and St Andrews Bay. They must be regarded as standing in relationship rather to the coasts of Berwickshire and Northumberland. Similar generalisations may be made in connection with the spawning areas off the east coast of England.

The importance of these conclusions with respect to proposals for protecting spawning fishes is obvious. If, for example, it was deemed to be desirable (as in my opinion it is desirable, as a corollary to the experiments already made, and described in last year's Report), to protect, for part of the spawning season, the offshore grounds which stand in relation to the Firth of Forth and St Andrews Bay, then it would be necessary to deal with the areas lying to the north-east. Owing, however, to the want of investigations of the offshore spawning grounds, it is not possible at present to define their exact extent or position.

If the movement of the surface water and of the pelagic eggs floating in it is normally in the direction indicated, to the south, one would expect a corresponding migratory movement of the growing or adult fish in the opposite direction, or otherwise there would tend to be, so to speak, an aggregation of fish in the southern parts of the North Sea. This would especially tend to happen with forms whose eggs and larvæ float for long periods, as those of the plaice, cod, and haddock. With the summer-spawning species, the distance between the place where the eggs are shed and the nurseries of the young fishes derived from them is comparatively small, and the reversed migratory movements of the growing or adult fishes would accordingly not require to be great. Now, it is an interesting fact that the experiments on the migration of fishes show that a definite movement of plaice occurs northwards along the east coast of Scotland. In the Eleventh Annual Report (Part iii. p. 185) I described the movement of marked plaice in the Firth of Forth and St Andrews Bay, and showed that this movement was in a westerly direction along the southern shore of the Firth of Forth, then easterly along the northern shore, and then northerly towards St Andrews Bay and towards the coast of Forfarshire, as shown in a diagram, here reproduced (Fig. 5). Since that account was published I have received a number of marked plaice caught in the Moray Firth, which were liberated a year or more before in the Firth of Forth, and which must have travelled at least 150 miles to the north. One, indeed, was retaken off Dunnet Head, Caithness, to the west of the Orkney Isles, more than 200 miles from the place where it was liberated. It must not be supposed that because these plaice moved so far north from the Firth of Forth that the spawning areas of the plaice, which stand in relation to the Firth of Forth, are situated there. I have shown by many experimental observations that the irritation caused by the presence of a small metallic disc

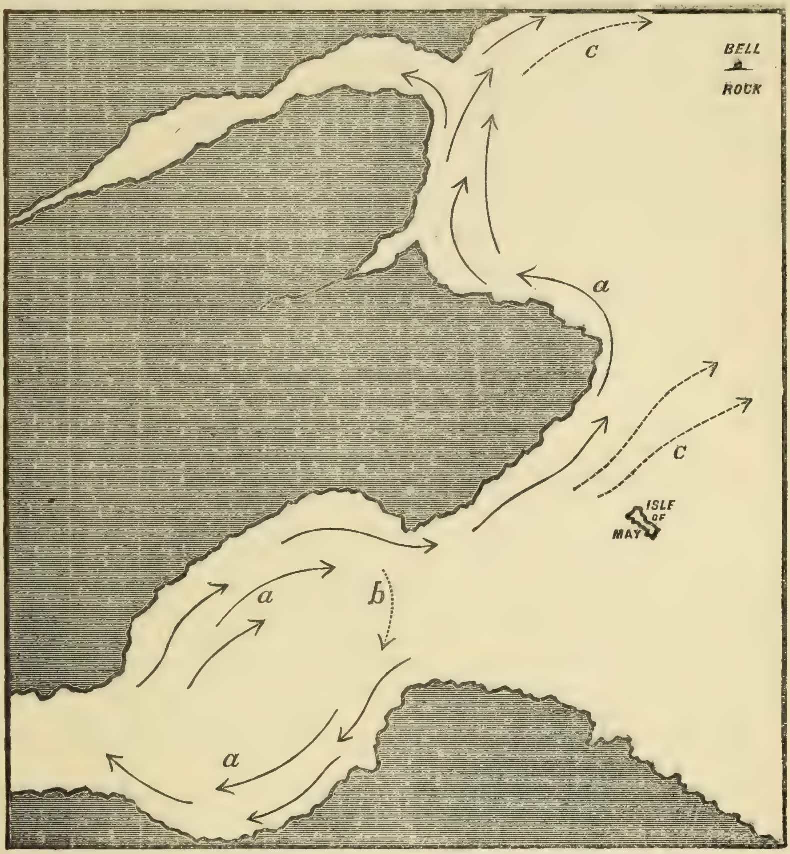


Fig. 5.—Showing the northward movement of marked plaice in the Firth of Forth and St Andrews Bay.

on the skin interferes with the rate of growth and with the development of the reproductive organs. Had the reproductive organs of the plaice mentioned developed normally they would have become ripe, and the fish would have moved outwards to the offshore waters probably before reaching the Moray Firth. But as development did not occur, and the impulse to the offshore migration was therefore absent, they continued their northward movement. The irritation of the skin referred to cannot be a factor in determining the movement, because *all* the marked plaice were got to the north, and none to the south; and while one might argue (but erroneously) that the irritation caused the migratory movement, it is impossible that it should cause it to be invariably in a definite direction. More than 10 per cent. of the marked plaice—over 1000—have been recovered.

The experiments with cod and haddock were not so successful. No marked haddock was recovered, but about 5 per cent. of the cod were re-caught; the total number is too small for generalisation. One liberated in the Firth of Forth was got off Stonehaven, 52 miles to the north, in sixty-nine days. But it is clear that if the plaice, a comparatively slow moving flat-fish, travels so far northwards, there is no difficulty in assuming that the more rapid round-fish may do likewise. The experiments with the dabs show that they may move considerable distances (as far at least as 39 miles), and that their movement is irregular, and may be to the south as well as to the north. As previously explained, this fish spawns within the territorial waters as well as offshore, and has a small egg, which hatches rapidly.

While the normal movement of the surface water off the East Coast, and therefore the normal movement of the eggs and larvæ floating in it, is towards the south, it must be borne in mind that it is subjected to temporary deviations from the prevalence of continuous strong winds or gales blowing over a period. Instances of this will be found in the first part of the paper. A northerly gale drives the south-going water with greater rapidity in the same direction; a gale from the south-east will retard it or temporarily reverse it according to its force and duration. Strong easterly gales tend to drive the surface water in to the coast; westerly gales drive the offshore water further away towards the east. There is therefore what may be termed a disturbing factor frequently in operation, the effect of which may be to disperse the floating eggs and larvæ more or less temporarily in various directions. Sometimes this factor will bring towards the inshore grounds large supplies of eggs and larvæ from spawning areas, *ex adverso*, possibly even from the southward (as in January of this year). At other times it will carry them rapidly seawards, when large numbers of certain kinds will perish. The liability to loss in this way must be regarded as the principal reason why the fecundity of species producing floating pelagic eggs is so much greater than the fecundity of those producing demersal, attached, eggs; the *mean* number of eggs shed by each female of twenty-three species producing pelagic eggs is 2,388,000, while the *mean* number shed by each female of twelve species producing demersal eggs is only 24,700, or very nearly a hundred times less.

But notwithstanding such temporary deviations, due to gales, the normal movement is to the south.

It is evident that the circulation of the surface waters of the North Sea, as shown by the experiments described in this paper, may be of importance in other directions, and opens up other aspects of fishery inquiry. It is not improbable that it is associated with the succession in time of the summer and autumn herring fishing along the East Coast, which begins in Shetland in June, and ends off the Norfolk coast in November. It explains also the frequent appearance of Atlantic forms in the waters off the East Coast; and perhaps also the occasional anomalous distribution of certain fishes, as the anchovy, which appeared a few years ago on the west, north, and then on the north-east coast of Scotland. But these points require further consideration before definite statements can be made.

TABLE II.—SHOWING PARTICULARS OF DRIFTERS.

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Minimum distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1894. 21 Sept.	12	.	¼ mile E. by N. of Bell Rock,	1	28 Sept. '94	Tyninghame, Haddingtonshire,	27½	7
.	.	.	. . .	2	,, ,,	½ mile W. of North Berwick,	25	7
.	.	.	. . .	3	,, ,,	,, ,,	,,	7
.	.	.	. . .	4	29 ,,	3 miles E. of North Berwick,	24½	8
.	.	.	. . .	5	4 Oct.	Fifeness, . . .	11	13
21 Sept.	12	.	11 miles off Scurdy Ness, Forfarshire,	6	29 Sept.	Dunbar, . . .	41	8
.	.	.	. . .	7	,, ,,	Belhaven, Dunbar, .	41½	8
.	.	.	. . .	8	30 ,,	Belhaven Sands, Dunbar,	41½	9
.	.	.	. . .	9	9 Oct.	1½ miles E. of Dunbar, .	41½	18
.	.	.	. . .	10	15 ,,	Holy Island, Northumberland,	72	24
.	.	.	. . .	11	16 ,,	3 miles E. of Tantallon Castle,	40½	25
.	.	.	. . .	12	,, ,,	,, ,,	,,	25
.	.	.	. . .	13	15 Nov.	3 miles W. of Dunbar, .	41½	55
4 Oct.	10	.	5 miles N.E. by E. of Nairn,	14	7 Oct.	Cromarty, . . .	8	3
.	.	.	. . .	15	14 Mar. '95	Old Bar, Nairn, . .	1½	161
5 Oct.	10	.	1½ miles N.W. ½ W. of Burghhead,	16	29 Oct. '94	Lothbeg, 5 miles N. of Brora,	22	24
,, ,,	10	.	5 miles N.E. ¾ N. of Lossiemouth,	17	15 ,,	Covesea Lighthouse, near Lossiemouth,	5¼	10
.	.	.	. . .	18	,, ,,	,, ,,	,,	10
.	.	.	. . .	19	16 ,,	,, ,,	,,	11
.	.	.	. . .	20	18 ,,	,, ,,	,,	13
.	.	.	. . .	21	,, ,,	,, ,,	,,	13
.	.	.	. . .	22	26 ,,	,, ,,	,,	21
.	.	.	. . .	23	27 ,,	3 miles E. of Lossiemouth,	6¼	22
.	.	.	. . .	24	27 ,,	4 ,, ,,	7	22
.	.	.	. . .	25	1 Nov.	2 ,, ,,	6	27
6 Oct.	10	.	1 mile N.W. by W. of Cromarty,	26	11 Oct.	N. side of Cromarty Ferry,	2	5
.	.	.	. . .	27	16 ,,	Nairn, ...	9	10
.	.	.	. . .	28	21 ,,	Nigg Sands, . . .	3	15
.	.	.	. . .	29	28 ,,	N. side Nigg Bay, .	3½	22
.	.	.	. . .	30	18 Oct.	Nigg Sands, . . .	.	.
9 Oct.	10	.	7 miles E. ¾ S. of Tarbet Ness,	31	15 ,,	E. Bay, Hopeman, .	11½	6
.	.	.	. . .	32	,, ,,	Hopeman Harbour, .	,,	6
.	.	.	. . .	33	3 Jan. '95	½ mile E. of Burghead,	,,	86
11 Oct.	40	.	Smith Bank (middle), .	34	16 Oct. '94	¼ ,, ,, Portknockie, Banffshire,	29	5
.	.	.	. . .	35	21 ,,	East side of Cullen, Banffshire,	29¼	10
.	.	.	. . .	36	24 ,,	2 miles E. of Cullen, Banffshire,	29¾	13
.	.	.	. . .	37	16 ,,	Findochty, Banffshire, .	29	5
.	.	.	. . .	38	17 ,,	W. of Portknockie, Banffshire,	29¼	6
.	.	.	. . .	39	19 ,,	¼ mile E. of Cullen, Banffshire,	29½	8
.	.	.	. . .	40	23 ,,	¼ mile E. of Cullen, Banffshire,	29½	12
11 Oct.	10	.	20 miles E. by S. ½ S. of Dunbeath,	41	17 ,,	Macduff, Banffshire, .	37	6
.	.	.	. . .	42	,, ,,	Banff, Banffshire, .	37	6

* That is along a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Minimum distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1894. 11 Oct.	10	.	13 miles E.S.E. of Dunbeath,	43	17 Oct. '94	Ianstown, Buckie, Banffshire,	33½	6
.	.	.	. . .	44	,, ,,	Findochty, Banffshire, .	33	6
12 Oct.	10	.	16 miles N.N.E. ½ E. of Cullen,	45	29 ,,	1½ mile E. of Cullen, Banffshire,	16	17
.	.	.	. . .	46	1 Dec.	Cullen Beach, . .	16	50
12 Oct.	10	.	15 miles S.E. of Ord of Caithness,	.	.	. . .	.	.
22 ,,	10	.	2¾ miles E.S.E. ½ S. of Embo,	47	25 Oct. '94	Embo, Sutherlandshire,	2¾	3
.	.	.	. . .	48	26 ,,	,, ,,	,,	4
.	.	.	. . .	49	,, ,,	,, ,,	,,	4
.	.	.	. . .	50	,, ,,	,, ,,	,,	4
.	.	.	. . .	51	,, ,,	,, ,,	,,	4
.	.	.	. . .	52	,, ,,	,, ,,	,,	4
.	.	.	. . .	53	,, ,,	,, ,,	,,	4
22 Oct.	10	.	2¾ miles S. of Brora, .	.	.	. . .	.	.
,, ,,	10	.	3 miles N.N.E. of Tarbet Ness,	54	21 Nov. '94	Golspie, Sutherlandshire,	7	30
23 ,,	10	.	8½ miles N. ¾ E. of Lossiemouth,	55	28 Oct.	3 miles E. of Tain, .	20	5
.	.	.	. . .	56	29 ,,	3½ miles W. of Tarbet Lighthouse,	17	6
.	.	.	. . .	57	12 Nov.	Tain, ...	23	20
.	.	.	. . .	58	28 ,,	Embo, Sutherlandshire,	21	36
.	.	.	. . .	59	15 Jan. '95	½ mile W. of Tarbet Ness,	14½	84
.	.	.	. . .	60	21 ,,	2 miles E. of Tain, .	21	90
Oct.	10	.	16 miles E. ¾ S. of Tarbet Ness,	61	29 ,,	Rockfield, near Tarbet Ness,	19	98
.	.	.	. . .	62	1 Nov. '94	Near Ballone Castle, Tarbet Ness,	17	9
.	.	.	. . .	63	3 ,,	Near Ballone Castle, Tarbet Ness,	17	11
.	.	.	. . .	64	14 ,,	Near Ballone Castle, Tarbet Ness,	,,	22
.	.	.	. . .	65	28 Jan. '95	Tarbet Ness Point, .	16	97
5 Nov.	20	.	8 miles S.E. of Buchan Ness,	66	4 Dec. '94	Brandesund, near Bergen, Norway,	270	29
.	.	.	. . .	67	18 ,,	Kjarvaagsund, near Trondhjemsfjord,	490	43
.	.	.	. . .	68	27 ,,	15 miles N. of Trondhjem, Norway,	494	52
.	.	.	. . .	69	5 ,, '95	Fro Islands, off Trondhjem, Norway,	500	395
6 Nov.	20	.	10 miles S.E. of Girdleness,	70	28 ,, '94	Smolen, Christiansund, Norway,	470	52
.	.	.	. . .	71	7 Oct. '95	Northfolden Fjord, near Loffoden Isles, Norway,	780	334
.	.	.	. . .	72	15 May '96	6 miles N. of Christiansund, N. Norway,	536	555
6 Nov.	20	.	10 miles S.E. of Bervie,	73	1 Jan. '95	Kirm, N. of Bergen, Norway,	340	56
.	.	.	. . .	74	8 Aug.	6 miles N. of Marstenes, near Bergen,	330	275
.	.	.	. . .	75	16 Feb. '96	Skralenæs, Sandö, near Christiansund, N. Norway,	490	467
20 Nov.	3	.	Firth of Forth, 2 miles E. of Inchkeith,	76	28 Nov. '94	Arbroath, . . .	41	8

* That is along a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Minimum distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1894. 20 Nov.	.	.	. . .	77	8 Aug. '95	Houvig, near Ringkjöbing, Denmark,	.	.
23 Nov.	3	.	Firth of Forth, 2 miles N. of Musselburgh,	78	17 Feb.	Near Redcar, Yorkshire,	113	86
.	.	.	. . .	79	20 July	Near Ording, Schleswig, Germany,	430	239
23 Nov.	3	.	Firth of Forth, 1 mile W.N.W. of Gullane Ness,	.	.	. . .	.	.
28 Nov.	5	.	Off Firth of Forth, 3 miles S.S.E. of May Isle,	80	17 Feb. '95	Seaton Carew, West Hartlepool,	106	81
.	.	.	. . .	81	18 July	Heligoland, Germany, .	360	237
.	.	.	. . .	82	22 ,,	Hallig, Oland, Prussia,	.	.
28 Nov.	10	.	Off Firth of Forth, 8 miles S.E. of May Isle,	83	14 Aug.	8 miles N. of the Horn, Denmark,	343	259
30 ,,	6	.	Firth of Forth, 3 miles S. of Fifeness,	.	.	. . .	.	.
,, ,,	5	.	Firth of Forth, 1 mile W. of May Isle,	84	16 Feb. '95	3½ miles S.W. from Bridlington Pier, Yorks, .	162	78
,, ,,	5	.	Firth of Forth, 6 miles W. of May Isle,	85	17 ,,	Near Redcar, Yorkshire,	118	79
.	.	.	. . .	86	19 ,,	Filey, Yorkshire, . .	140	81
.	.	.	. . .	87	23 ,,	1½ miles W. of Whitby, Yorkshire,	122	85
.	.	.	. . .	88	16 Aug.	2½ miles W. of Egmont-on-Sea, N. Holland,	335	259
30 Nov.	4	.	Firth of Forth, 1¼ miles S. of Pittenweem,	89	1 Dec. '94	West side of Isle of May,	5	1
.	.	.	. . .	90	5 Feb.	4 miles S. of Withernsea, Yorkshire,	190	67
30 Nov.	4	.	Firth of Forth, 1¼ miles S. of St Monance,	91	1 Dec.	West side Isle of May, .	5	1
,, ,,	3	.	Firth of Forth, ½ mile N. of Bass Rock,	92	15 Feb.	Atwick, near Hornsea, Yorkshire, . .	178	77
,, ,,	,,	.	Firth of Forth, ½ mile N. of Bass Rock,	93	19 ,,	Seaton Carew, Durham,	121	81
,, ,,	3	.	Firth of Forth, ½ mile N. by E. of Fidra,	.	.	. . .	.	.
1 Dec.	5	.	Firth of Forth, midway between Largo and Cockenzie,	94	8 Dec.	Elie, Fife, . . .	7½	7
.	.	.	. . .	95	10 ,,	St Monance, Fife, . .	9½	9
1 Dec.	5	.	Firth of Forth, 1½ miles E. of Inchkeith,	96	,, ,,	Elie, Fife, . . .	12	9
6 ,,	3	.	Firth of Forth, 2 miles S. by E. of West Wemyss,	97	,, ,,	Wemyss Castle, Fife, .	2	4
.	.	.	. . .	98	,, ,,	West Wemyss Harbour, Fife,	2	4
6 Dec.	3	.	Firth of Forth, 2 miles S. by E. of Leven,	99	14 ,,	Kincraig, Elie, Fife, .	3	8
7 ,,	10	.	18 miles E. by S. from May Isle,	100	5 Feb.	Withernsea, near Hull,	178	60
.	.	.	. . .	101	24 ,,	Gristhorpe, Filey, Yorkshire, . . .	149	79
7 Dec.	10	.	22 miles E. by S. from May Isle,	102	4 ,,	Withernsea, near Hull,	180	59

* That is along a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Minimum distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1894.								
.	.	.	. . .	103	15 Feb. '95	Hornsea Sands, Yorkshire,	163	70
10 Dec.	3	.	Firth of Forth, 1 mile N. E. of Gullane Ness,	.	.	. . .	.	.
12 ,,	10	.	$3\frac{1}{2}$ miles S. S. W. of Bell Rock Lighthouse,	104	5 Feb.	Withernsea, near Hull.	192	55
.	.	.	. . .	105	6 ,,	2 miles S. of Donna Nook, Lincolnshire,	207	56
17 Dec.	3	.	3 miles E. of Barbert Ness, Fife,	106	2 ,,	Filey Beach, near Scarboro',	161	47
.	.	.	. . .	107	3 ,,	1 mile N. of Withernsea, near Hull,	192	48
.	.	.	. . .	108	,, ,,	Donna Nook, Lincolnshire,	208	48
17 Dec.	3	.	$5\frac{1}{2}$ miles S.E. by S. of Buddon Ness,	.	.	. . .	.	.
19 ,,	3	.	2 miles S.S.E. of Buddon Ness,	.	.	. . .	.	.
20 ,,	6	.	8 miles S.E. of Scurdy Ness, Forfarshire,	109	20 Feb. '95	Coatham, Redcar, Yorkshire,	143	62
.	.	.	. . .	110	22 Feb.	Hinderwell, near Whitby, Yorkshire,	154	64
1895.								
11 Jan.	5	.	22 miles N. by W. of Kinnaird Head.	.	.	. . .	.	.
,, ,,	5	.	$18\frac{1}{2}$ miles N by $\frac{3}{4}$ mile W. of Kinnaird Head,	111	25 Feb. '95	Knockinnon, near Dunbeath,	44	45
,, ,,	5	.	$13\frac{1}{2}$ miles N.N.E. of Peterhead,	112	27 ,,	Burghead Harbour, .	57	47
,, ,,	5	.	N.E. by N. of Peterhead,	.	.	. . .	.	.
29 ,,	2	.	Firth of Forth, 2 miles S. by E. of West Wemyss,	.	.	. . .	.	.
,, ,,	2	.	Firth of Forth, 2 miles S. by E. of Leven,	113	4 Feb. '95	Salmon Stake Nets, Dalmeny Park, .	$16\frac{1}{2}$	6
,, ,,	4	.	Firth of Forth, midway between Largo and Cockenzie,	114	,, ,,	Barnbogle Castle, Dalmeny Park,	16	4
.	.	.	. . .	115	2 Feb.	Barnbogle Castle, .	6	4
.	.	.	. . .	116	5 ,,	,, ,, .	6	7
.	.	.	. . .	117	15 ,,	East Wemyss, Fife, .	4	17
29 Jan.	4	.	Firth of Forth, $1\frac{1}{2}$ miles E. of Inchkeith,	118	3 ,,	Granton Harbour, .	$5\frac{3}{4}$	5
30 ,,	3	.	Firth of Forth, 1 mile W.N.W. of Gullane Ness,	119	,, ,,	Wardie Burn, Granton,	$5\frac{1}{2}$	3
30 ,,	3	.	Firth of Forth, 2 miles N. of Musselburgh,	.	.	. . .	.	.
8 Feb.	3	.	Firth of Forth, $1\frac{1}{2}$ miles E. of Bass Rock,	.	.	. . .	.	.
8 ,,	3	.	Firth of Forth. 3 miles S.S.E. of May Isle,	120	11 Aug. '95	8 miles N. of the Horn, Denmark,	365	184
9 ,,	5	.	Ord. of Caithness, N. 60, W. 11 Min.,	121	3 Oct.	Kviljo, near Farsund, Norway,	317	236
10 ,,	5	.	Noss Head, N. 37, W. 11 Min.,	.	.	. . .	.	.

* That is along a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.					Date and Position where Recovered.			
Date.	Number of Bottles.	Number of Wooden Slips.	Position.	No.	Date.	Position.	Minimum distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
1895. 10 Feb.	10	.	Noss Head, N. 10 Min.,	122	27 Feb. '95	Aberdour, near Fraserburgh,	47	17
11 ,,	4	.	Firth of Forth, ½ mile N. of Bass Rock,	123	25 Aug.	Klitmoeller, 6 miles S. of Hanstholm, Denmark,	373	193
.	.	.	. . .	124	8 Sept.	Hanstead, Hanstholm, Denmark,	375	2 9
11 Feb.	4	.	Firth of Forth, ½ mile N. by E. of Fidra,	125	18 Feb.	St Monance, Fife, . .	7½	7
,, ,,	3	.	Firth of Forth, 1¼ miles S. of St Monance,	126	16 ,,	East Sands, St Andrews,	17	5
.	.	.	. . .	127	24 ,,	Tentsmuir Sands, ,, .	20	13
11 Feb.	3	.	Firth of Forth, 1¼ miles S. of Pittenweem,	128	18 ,,	Kingsbarns, Fife, .	10	7
12 ,,	6	.	10½ miles S.E. of May Isle,	129	18 ,,	3 miles N.W. of Fifeness,	16½	6
.	.	.	. . .	130	22 ,,	Kingsbarns, Fife, . .	16	10
12 Feb.	6	.	5 miles S.E. of May Isle,	131	23 ,,	¼ mile E. of Crail, .	9½	11
.	.	.	. . .	132	31 Aug.	Hirtshals near the Scaw, Denmark,	455	201
23 Feb.	5	. .	Kinnaird Head, S. 24 Min., E. 28 Min.,	.	.	. . . .	.	.
24 ,,	10	.	Smith Bank, Moray Firth,	133	12 Mar.	Philorth River, Fraserburgh,	45	18
			Between May Isle and the Naze of Norway.					
24 ,,	10	.	15 miles E. ½ S. of May Isle,	134	8 Aug. '95	Klegod, near Rinkjöbing, Denmark,	338	165
.	.	.	. . .	135	6 Sept.	8 miles S. of Hirtshals, Denmark,	395	194
.	.	.	. . .	136	10 ,,	½ mile W. of Old Skaw, Denmark,	410	198
.	.	.	. . .	137	27 Aug.	4 miles S. of *Borbjerg Lighthouse, near Fjaltring, Denmark,	323	184
.	.	.	. . .	138	28 ,,	Haurvig, Holmslandsklitte, Ringkjöbing, Denmark,	325	185
.	.	.	. . .	139	31 ,,	Lökken, near Hirtshals,	385	188
24 Feb.	10	.	25 miles E. of May Isle,	140	16 Sept.	Harboore, near Lemvig, Denmark,	320	204
,, ,,	10	.	35 miles E. of May Isle,	141	23 ,,	1 mile W. of Old Skaw,	400	211
,, ,,	10	.	50 miles E. of May Isle,	142	21 Aug.	Haurvig, Ringkjöbing, Denmark,	300	178
.	.	.	. . .	143	22 ,,	Aargab, Ringkjöbing, Denmark,	303	179
.	.	.	. . .	144	14 Sept.	2 miles N. of Ringkjöbing, Denmark,	300	202
24 Feb.	10	.	130 miles E. of May Isle,	145	7 Aug.	Havstokken, near Nymindegab, Denmark,	238	164
.	.	.	. . .	146	11 ,,	Husby, 8 miles N. of Ringkjöbing, Denmark,	235	168
.	.	.	. . .	147	15 ,,	Aargab, Ringkjöbing,	234	172
24 Feb.	10	.	180 miles E. of May Isle,	148	14 July	Nymindegab, 15 miles N. of the Horn, Denmark,	202	140
.	.	.	. . .	149	3 Aug.	Near Nymindegab, 11 miles N. of the Horn,	200	160

* That is along a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Minimum distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1895.								
.	.	.	. . .	150	4 Aug. '95	Buskar Rock, Marstrand, Sweden,	308	161
.	.	.	. . .	151	6 Feb. '96	Smolen Island, near Christiansund, N. Norway,	436	347
1 Mar.	45	.	Smith Bank, . .	152	4 Mar. '95	New Aberdour, Fraserburgh,	40	3
.	.	.	. . .	153	4 ,,	New Aberdour, Fraserburgh,	40	3
.	.	.	. . .	154	4 ,,	Dindarg Castle, near Rosehearty,	40	3
.	.	.	. . .	155	5 ,,	Pennan Harbour, Aberdeenshire,	38½	4
.	.	.	. . .	156	5 ,,	Pennan Harbour, Aberdeenshire,	38½	4
7 Mar.	5	.	18 miles E.N.E. of Fifeness,	157	24 June	Scarborough, Yorkshire,	140	109
12 ,,	5	.	12 miles S.E. of Wick, .	158	9 Sept.	Liknoes, Karmo Island, near Stavanger, Norway,	270	181
13 ,,	5	.	25 miles E. of Wick, .	159	6 ,,	2 miles S. of Lysekil, Marstrand, Sweden,	464	177
,, ,,	5	.	35 miles N.E. of Fraserburgh,	.	.	. . .	.	.
,, ,,	5	.	St Andrews Bay, Fife, 3 miles E. of Barbert Ness,	160	15 Sept.	2½ miles S. of the Lighthouse of Bovlejerg (Fjaltring), Denmark,	350	186
,, ,,	5	.	St Andrews Bay, 5½ miles S.E. by S. of Buddon Ness,	161	23 ,,	Lökken, Denmark, .	408	194
14 ,,	5	.	7 miles E. of St Andrews,	.	.	. . .	.	.
,, ,,	5	.	6 miles E. of St Andrews,	162	20 Sept.	1½ miles S. from Hirtshals, Denmark,	417	190
,, ,,	5	.	8 miles E.S.E. from Stonehaven,	163	9 ,,	Blokhus, 30 miles E. of Hanstholm, Denmark,	378	179
15 ,,	5	.	12 miles E. of Wick, .	164	16 June	Portsoy, Banffshire, .	52	93
,, ,,	5	.	24 miles E.N.E. of Wick,	165	23 April	So. Pharay, by Longhope, Orkney,	25	39
,, ,,	5	.	17 miles E. by ½ S. of Dunbar,	166	9 Sept.	Blokhus, Denmark, .	378	178
16 ,,	10	.	15 miles E. of May Isle,	167	17 ,,	Ruberg, S. of Hirtshals, Denmark,	395	185
.	.	.	. . .	168	18 ,,	Harboore, near Lemvig, Ringköbing, Denmark,	334	186
			Between May Isle and the Naze of Norway.					
16 Mar.	10	.	25 miles E. ½ S. of May Isle,	169	,, ,,	Skallerup, S. of Hirtshals, Denmark,	385	186
,, ,,	10	.	35 ,, ,,	170	10 ,,	Blokhus, 26 miles E. of Hanstholm Light, Denmark,	373	178
,, ,,	.	10	35 ,, ,,	171	27 Aug.	Skiveren, Raabjerg, near the Scaw, Denmark,	350	164
,, ,,	.	10	35 ,, ,,	172	1 Sept.	4 miles E. of Hirtshals, N. Jutland, Denmark,	338	169

* That is along a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Minimum distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1895. 16 Mar.	.	10	35 miles E. of May Isle,	173	2 Sept. '95	Hirtshals, N. Jutland, Denmark,	336	170
,, ,,	10	.	80 ,, ,,	174	13 ,,	Hirtshals, N. Jutland, Denmark,	336	181
,, ,,	10	.	130 ,, ,,	175	8 Aug.	Blokhus, N. Jutland, .	265	145
.	.	.	. . .	176	10 ,,	,, ,, .	265	147
.	.	.	. . .	177	22 ,,	Lökken, Hjorring, N. Jutland,	271	159
16 Mar.	10	.	180 miles E. of May Isle,	178	1 ,,	Blokhus, N. Jutland, .	226	138
.	.	.	. . .	179	3 ,,	,, ,, .	226	140
18 Mar.	5	.	10 miles E. of Buchan Ness,	180	28 Sept.	At the Scaw, Denmark,	397	196
,, ,,	5	.	15 miles E. of Buchan Ness,	181	11 ,,	4 miles W. of Old Scaw, Denmark,	390	179
,, ,,	5	.	55 miles N.E. of Fraserburgh,	.	.	. . .	.	.
19 ,,	5	.	10 miles S.E. of Lerwick,	.	.	. . .	.	.
20 ,,	5	.	Firth of Forth, ½ mile N. of Bass Rock,	.	.	. . .	.	.
,, ,,	5	.	Firth of Forth, 6 miles W. of May Isle,	182	20 May '95	Near Spurn Point, Yorkshire,	202	61
.	.	.	. . .	183	14 Sept.	2 miles N. of Ringkjöbing, Denmark,	348	179
20 Mar.	5	.	Firth of Forth, 1 mile W. of May Isle,	184	4 April	1 mile N.E. of Warkworth, Northumberland,	64	15
,, ,,	5	.	Firth of Forth, 1¼ miles S. of St Monance,	185	2 ,,	Amble Pier, Acklington, Northumberland,	64	13
.	.	.	. . .	186	,, ,,	Warkworth Harbour, Northumberland,	67	13
.	.	.	. . .	187	4 ,,	3 miles S. of Blyth, Northumberland,	82	15
.	.	.	. . .	188	1 Aug.	3 miles N. of Blokhus, Denmark,	408	134
20 Mar.	4	.	Firth of Forth, 1½ miles S. of Pittenweem,	.	.	. . .	.	.
22 ,,	5	.	75 miles E. by N. of May Isle,	189	12 Sept. '95	Malmon's Stenhuggeri, Bohuslan, Sweden,	430	176
29 ,,	5	.	32 miles N.E. by E. of Fraserburgh,	190	7 April	½ mile W. of Rosehearty, Aberdeenshire,	34½	9
,, ,,	5	.	55 miles N.E. by E. of Fraserburgh,	.	.	. . .	.	.
8 April	10	.	3½ miles S.S.W. of Bell Rock,	191	18 May '95	½ mile E. of Dunbar, .	22½	40
.	.	.	. . .	192	22 ,,	Largo, Fife, . . .	24½	44
.	.	.	. . .	193	5 June	East Hartlepool, Durham,	121	59
.	.	.	. . .	194	12 ,,	Whitby, Yorkshire, .	139	65
15 April	5	.	20 miles S.E. of Unst, Shetland,	.	.	. . .	.	.
,, ,,	4	.	10 miles S.E. of Flugga Lighthouse,	.	.	. . .	.	.
16 ,,	5	.	18 miles E.S.E. of Stonehaven,	195	6 June '95	St Mary's Isle, near Cullercoats,	129	51
.	.	.	. . .	196	10 Sept.	½ mile W. from the Old Scaw, Denmark,	402	147

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TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Minimum distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1895.								
.	.	.	. . .	197	18 Sept. '95	Gronhöj, ½ mile from Blokhus, Denmark,	366	155
16 April	5	.	35 miles E.S.E. of Stonehaven,	.	.	. . .	.	.
17 ,,	5	.	Firth of Forth, 2 miles E. of Inchkeith,	198	25 April	1 mile E. of Largo, Fife,	13½	8
.	.	.	. . .	199	3 May	Earlsferry, Fife, . .	12	16
17 April	5	.	Firth of Forth, midway between Largo and Cockenzie,	200	25 April	Elie, Fife, . . .	7½	8
.	.	.	. . .	201	26 ,,	Cove, Haddingtonshire,	23	9
.	.	.	. . .	202	28 ,,	Step Rock, St Andrews,	26½	11
22 April	5	.	3 miles S.S.E. of May Isle,	203	26 ,,	Kingsbarns, Fife, . .	12	4
.	.	.	. . .	204	28 ,,	Boarhill, Fife, . .	13¼	6
.	.	.	. . .	205	5 May	Ruddon Point, Largo, Fife,	13½	13
.	.	.	. . .	206	28 July	4 miles E. of St Andrews,	.	.
22 April	5	.	5 miles S.E. of May Isle,	207	7 May	Belhaven, Dunbar, .	10	15
.	.	.	. . .	208	9 ,,	5 miles W. of Dunbar, .	9½	17
22 April	6	.	10½ miles S.E. of May Isle,	209	29 April	Belhaven, Dunbar, .	11½	7
.	.	.	. . .	210	1 May	5 miles E. of Dunbar, .	10	9
.	.	.	. . .	211	14 ,,	3 miles W. of Dunbar, .	12¼	22
.	.	.	. . .	212	22 ,,	Blackhall Rocks, Hartlepool,	100	30
22 April	5	.	67 miles E. ½ S. of May Isle,	213	14 Sept.	Skallerup, S. of Hirtshals, Denmark,	318	142
27 ,,	5	.	25 miles E. by N. of May Isle,	214	13 July	Cloughton Wyke, 5 miles N. of Scarborough,	142	77
.	.	.	. . .	215	27 Sept.	2 miles E. of Hanstholm, Denmark,	350	135
30 April	5	.	20 miles S.E. of Lerwick, Shetland,	216	31 Aug.	Outside Harhamsö, Sondmör, 2 miles N. of Aalesund, Norway,	250	124
1 May	5	.	10 miles E. by N. from Buchan Ness,	217	10 Sept.	10 miles S. of Hirtshals, Denmark,	365	134
,, ,,	4	.	20 miles E. by N. from Buchan Ness,	218	.	Raabjærg, W. of Old Scaw, Denmark,	382	.
.	.	.	. . .	219	21 Sept.	2 miles W. of Old Scaw, Denmark,	384	145
20 May	5	.	Firth of Forth, 4½ miles E. by N. of Inchkeith,	220	30 May	1½ miles W. of Craig Royston, near Granton,	9½	10
,, ,,	5	.	4½ miles N.N.W. of Fiddra,	221	26 ,,	Burntisland, Fife, .	13	6
.	.	.	. . .	222	29 ,,	Point Garry, No. Berwick,	7½	9
24 May	7	.	Firth of Forth, 4 miles W. of May Isle,	223	5 June	Pathhead, Kirkcaldy, Fife,	15¾	12
.	.	.	. . .	224	9 Sept.	Lyngby, near Hjörring, Denmark,	428	108
24 July	10	.	11 miles S.E. of Scurdy Ness, Forfarshire,	.	.	. . .	.	.
24 ,,	10	.	11 miles S.E. of Scurdy Ness,	225	11 Aug. '95	½ mile E. of Elie, Fife, .	34	17
.	.	.	. . .	226	22 Oct.	Ngmindegab, near N. Nebel, Denmark,	344	90

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TABLE SHOWING PARTICULARS OF DRIFTERS—*continued*.

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Distance travelled in Geog.* Miles.	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1895. .	.	.	. . .	227	2 Jan. '96	Kolnas, 2 miles S. of Tananger, near Stavanger,	300	162
24 July	10	.	11 miles S.E. of Bervie,	228	15 Aug. '95	Kingsbarns, Fife, . .	34	21
,, ,,	10	.	11½ miles S.E. of Girdleness,	229	16 ,,	Arbroath, Forfarshire, .	40	22
.	.	.	. . .	230	5 Feb. '96	Bay at Skaado, near Kragerö, S. Norway,	420	196
25 July	10	.	10½ miles off Rattray Head,	231	11 Dec. '95	Rauane, near Kragerö, S. Norway,	400	139
2 Aug.	10	.	12 miles E. by S. of Tarbet Ness,	.	.	. . . .	.	.
,, ,,	10	.	10¾ miles N.N.E. of Lossiemouth,	232	15 Nov. '95	Most southerly point of Skudesnaes, Norway,	286	105
.	.	.	. . .	233	18 ,,	9 miles N. from Skudesnaeshavn, Norway, .	288	108
8 Aug.	10	.	(Smith Bank) 19 miles S.E. by E. of Helmsdale,	234	14 Oct.	On the island Gjuting, Bommelöen, W. side Haugesund (near Bergen),	283	67
.	.	.	. . .	235	13 Dec.	Blomvaag, Lat. N. 60° 32′, Long. E. 4° 53′,	300	127
8 Aug.	10	.	Smith Bank, Moray Firth,	236	6 ,,	Jederens rev, S.-W. Norway, about 15 kilometres from Stavanger,	282	120
,, ,,	10	.	Smith Bank, Moray Firth,	237	18 ,,	Skogsö, 10 kilom. E. of Mandal,	344	133
.	.	.	. . .	238	5 Mar. '96	Smögen, near Hållo lighthouse, W. coast of Sweden,	490	210
8 Aug.	10	.	18¼ miles N. of Banff, .	239	21 Nov.	Indrevœr, Sulen, in Sogn, Norway,	310	105
.	.	.	. . .	240	2 Feb.	Nœrland, Norbo, near Stavanger,	270	178
9 Aug.	10	.	9 miles S.E. of Lybster,	241	18 Aug. '95	Lybster Bay, Caithness,	10	9
.	.	.	. . .	242	17 ,,	,, ,, ,,	10	8
.	.	.	. . .	243	13 Feb. '97	Nes Ameland, Holland,	404	553
9 Aug	10	.	17¾ miles S.E. of Clyth Ness,	244	27 Aug. '95	Dunnet Sands, 1 mile from Castletown, Caithness,	.	18
.	.	.	. . .	245	27 Feb. '97	Sulen Island, N. Bergenhus, Norway,	313	567
27 Aug.	5	.	Firth of Forth, E. of May Isle,	246	27 Jan. '96	7 miles E. of Hirtshals, Denmark,	450	153
28 ,,	10	.	3 miles S.S.E. of May Isle,	247	18 Nov. '95	Near Hunnebostrand, 95 kilometres N. of Gothenburg, Sweden,	473	82
,, ,,	10	.	10½ miles S.E. of May Isle,	248	4 ,,	Vigsnæs, Karmöen, near Stavanger, Norway,	308	98
.	.	.	. . .	249	1 Dec.	Outside Sandöen, near Tvedestran, Norway,	400	95
1896. 26 Mar.	10	15	5 miles N.E. of May Isle,	.	.	. . . .	.	.
,, ,,	10	15	½ mile N. of Bell Rock,	250	25 Aug. '96	Between Falga and Kirkduin, near Helder, N. Holland,	300	152

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TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Distance travelled in Geog.* Miles.	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1896. 26 Mar.	10	25	9 miles S.E. of Montrose,	251	26 June '96	N. side of Terschelling Island, Holland,	308	91
,, ,,	10	20	10 miles S.E. of Stonehaven,	252	End of July '96	On Texel Island, Holland,	305	.
,, ,,	5	25	10 miles S.E. of Girdleness,	253	21 July '96	E. end of Ameland Island, Holland,	322	117
,, ,,	5	20	10 miles E. by S. of Buchanness, Aberdeenshire,	254	20 ,,	Between the Frisian Islands Juist and Borkum, Germany,	353	116
27 ,,	5	29	Moray Firth, 10 miles N. of Scar Nose,	255	30 Mar.	Pennan Harbour, Aberdeenshire,	16	4
.	.	.	. . .	256	5 April	Broadsea, Fraserburgh,	21	9
.	.	.	. . .	257	6 ,,	300 yards W. of Broadsea, Fraserburgh,	21	10
.	.	.	. . .	258	6 Sept.	300 yards W. of Gardenstown,	20	162
22 April	4	.	26 miles E. of Lerwick, Shetland,	259	23 Aug.	Klitmoeller, 3 miles S. of Hanstholm, Denmark,	357	123
.	.	.	. . .	260	29 Sept.	Drifting near Bolæren Island, Christiania-fjord, about 12 miles within Faerder lighthouse,	455	160
1 May	.	4	12 miles S.E. of Lerwick,	.	.	. . .	.	.
16 ,,	.	15	12 miles N.N.E. of Troup Head,	.	.	. . .	.	.
,, ,,	.	14	12½ miles N.E. of Kinnaird Head,	261	9 Aug. '96	3 miles S. of Seaham Harbour, Durham,	188	85
,, ,,	.	14	13 miles S.E. of Buchanness,	262	8 ,,	Speeton, near Flamborough Head, Yorks,	193	84
,, ,,	.	14	11 miles S.E. of Girdleness, Aberdeenshire,	263	13 June	Dunbar, Haddingtonshire,	67	28
.	.	.	. . .	264	26 ,,	Belhaven Bay, near Dunbar,	68	41
,, ,,	.	14	11 miles S.E. of Scurdy Ness, Forfarshire,	.	.	. . .	.	.
,, ,,	.	14	3 miles S.E. of Bell Rock,	265	3 June '96	Sand Bay, Coldingham, Berwickshire,	38	18
.	.	.	. . .	266	8 ,,	Dunstanborough Castle, Northumberland,	64	23
.	.	.	. . .	267	11 ,,	Newton-by-the-Sea, Chathill, Northumberland,	62	26
.	.	.	. . .	268	26 ,,	3 miles N. of Berwick-on-Tweed,	45	41
.	.	.	. . .	269	5 July	Burnmouth, Ayton, Berwickshire,	43	50
.	.	.	. . .	270	15 ,,	4 miles S. of Berwick-on-Tweed,	47	60
16 May	.	9	4½ miles N.E. of May Isle,	271	5 June	¼ mile S. of Holy Island, Northumberland,	39	20
.	.	.	. . .	272	8 ,,	½ mile N. of River Wear, Sunderland,	87	23
.	.	.	. . .	273	10 ,,	North Sands, Hartlepool,	99	25
.	.	.	. . .	274	21 ,,	Blackhall Rocks, Quarrington Hill, Durham,	.	36
11 June	.	25	20 miles E.S.E. of May Isle,	275	16 Aug.	Robin Hood Bay, near Whitby,	113	66

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TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Distance travelled in Geog.* Miles.	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
Date. 11 June	.	30	18 miles E.S.E. of May Isle,	.	.	. . .	.	.
,, ,,	.	20	16 miles E.S.E. of May Isle,	276	25 June '96	Anstruther, Fife, . .	22	14
.	.	.	. . .	277	10 Aug.	Thornwick Bay, Flamborough, Yorks,	133	60
.	.	.	. . .	278	11 ,,	Runswick Bay, Yorks,	.	62
,, ,,	.	20	14 miles E.S.E. of May Isle,	.	.	. . .	.	.
,, ,,	.	20	12 miles E.S.E. of May Isle,	279	26 Aug. '96	Picked up at sea, about 32 miles E.S.E. of Flamborough Head, Yorks,	156	76
,, ,,	.	20	10 miles E.S.E. of May Isle,	.	.	. . .	.	.
,, ,,	.	20	8 miles E.S.E. of May Isle,	280	17 June '96	Elie Harbour, Fife, .	16½	6
,, ,,	.	20	6 miles E.S.E. of May Isle,	281	17 July	2 miles from Saltburn, near Middlesborough,	108	36
.	.	.	. . .	282	22 ,,	3 miles S.E. of Redcar, Yorks,	109	39
22 July	10	15	2 miles N.E. of May Isle,	283	30 ,,	Near Kingsbarns, Fife,	6½	8
.	.	.	. . .	284	,, ,,	Adrift in sea, 1 mile E.N.E. of Cellardyke, Fife,	4	8
.	.	.	. . .	285	2 Aug.	Leven, Fife, . . .	16	11
.	.	.	. . .	286	3 ,,	Scoughall, Prestonkirk, Haddingtonshire,	12	12
.	.	.	. . .	287	8 ,,	Cambo, near Kingsbarns, Fife,	7	17
.	.	.	. . .	288	,, ,,	E. of N. Berwick, .	11½	17
.	.	.	. . .	289	9 ,,	Cambo, near Kingsbarns, Fife,	7	18
.	.	.	. . .	290	,, ,,	E. side of N. Berwick, .	11½	18
.	.	.	. . .	291	10 ,,	1½ miles E. of N. Berwick,	11	19
.	.	.	. . .	292	12 ,,	Fifeness, . . .	4	21
.	.	.	. . .	293	15 ,,	St Andrews, Fife, .	11½	24
22 July	10	16	½ S.E. of Bell Rock, .	294	2 ,,	Carplie, near Anstruther, Fife,	17	11
.	.	.	. . .	295	3 ,,	Between Elie and St Monance, Fife,	19	12
.	.	.	. . .	296	9 ,,	Tantallon Castle, near N. Berwick,	24½	18
.	.	.	. . .	297	,, ,,	1 mile N. of Kingsbarns, Fife,	11¾	18
.	.	.	. . .	298	10 ,,	North Berwick, . .	25	19
.	.	.	. . .	299	11 ,,	Aberlady Bay, . .	30	20
.	.	.	. . .	300	12 ,,	W. side of May Isle, .	15¾	21
.	.	.	. . .	301	13 ,,	Castleton Farm, North Berwick,	25	22
.	.	.	. . .	302	1 Sept.	Kilrenny, Anstruther, .	17	40
.	.	.	. . .	303	3 ,,	1 mile E. of Crail, .	19	42
22 July	10	15	10 miles S.E. of Scurdy Ness, Forfarshire,	304	2 Aug.	Carplie, near Anstruther,	32	11
.	.	.	. . .	305	4 ,,	Kingsbarns, Fife, .	25	13
22 July	10	15	10½ miles S.E. from Bervie, Kincardineshire,	306	17 ,,	Holy Island, Northumberland,	63	26
,, ,,	10	15	6 miles S.E. of Girdleness, Aberdeenshire,	307	7 Nov.	Vangsaa, Hillerslev, near Thisted, Denmark,	350	109

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TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1896. 22 July	10	15	4 miles S.E. of Buchan Ness, Aberdeenshire,	308	29 July '96	Picked up at sea, 24 miles S.E. by E. of Aberdeen,	26	7
.	.	.	. . .	309	1 Aug.	Picked up at sea, 15 miles S.E. of Aberdeen,	24	9
.	.	.	. . .	310	8 Sept.	King Edward's Bay, Tynemouth, Northumberland,	142	49
.	.	.	. . .	311	10 ,,	Whitley-by-the-Sea, Northumberland.	141	51
.	.	.	. . .	312	16 ,,	Newsham, by Blyth, Northumberland,	134	57
22 July	10	15	8 miles N.N.E. of Troup Head, Banffshire,	313	26 July	Rattray Head, Aberdeenshire,	19	4
.	.	.	. . .	314	28 ,,	Peterhead Harbour, .	26	6
.	.	.	. . .	315	23 Aug.	4 miles N. of Peterhead,	22	32
22 July	10	18	8 miles N.N.E. of Scarnose Point, Banffshire,	316	24 July	Near Macduff, Banffshire,	14	2
.	.	.	. . .	317	28 ,,	Pennan, Aberdeenshire,	18	6
.	.	.	. . .	318	3 Dec.	Picked up at sea, Lat. 54° 35′ N., long. 1° 20′ E.—about 65 miles N.E. by E. from Spurn Light, Yorkshire,	248	134
22 July	10	6	7 miles N.N.E of Lossiemouth, Elginshire,	319	26 July	Between Portessie and Findochty, Banffshire,	11	4
.	.	.	. . .	320	28 ,,	Cullen, Banffshire, .	18	6
.	.	.	. . .	321	,, ,,	1 mile W. of Whitehills,	18	6
.	.	.	. . .	322	22 Oct.	2 miles ,, ,,	17	92
.	.	.	. . .	323	7 Dec.	Head of Basta Voe, in Yell, Shetland,	.	138
22 July	10	20	3 miles E.S.E. of Tarbet Ness, Cromarty,	324	27 July	W. of Burghead, Elginshire,	13	5
.	.	.	. . .	325	,, ,,	At Covesea Lighthouse, Elginshire,	14	5
.	.	.	. . .	326	,, ,,	,, ,, ,,	14	5
.	.	.	. . .	327	,, ,,	E. side of Burghead, .	13	5
.	.	.	. . .	328	28 ,,	Near Covesea Lighthouse, Elginshire,	14	6
.	.	.	. . .	329	,, ,,	At Covesea Lighthouse, Elginshire,	14	6
.	.	.	. . .	330	29 ,,	,, ,, ,,	14	7
.	.	.	. . .	331	,, ,,	,, ,, ,,	14	7
.	.	.	. . .	332	,, ,,	2 miles E. of Covesea Lighthouse, Elginshire,	13	7
.	.	.	. . .	333	6 Aug.	Between Port Gordon and Buckie, Banffshire,	21	15
.	.	.	. . .	334	17 ,,	Bearshead, near Lossiemouth, Elginshire,	15	26
.	.	.	. . .	335	16 Aug.	1 mile S.W. of Burghhead,	13	25
.	.	.	. . .	336	26 Sept.	E. of Covesea Lighthouse, Elginshire,	14	66
30 July	15	15	Lat. 61° 49½′ N., long. 0° 43′ W.,	337	12 ,,	Ayrwick, East Yell, Shetland,	.	44
.	.	.	. . .	338	14 ,,	Tresta Bay, Fetlar, Shetland,	91	46
.	.	.	Lat. 61° 45′ N., long. 0° 59′ W.,	339	14 ,,	,, ,, ,,	91	46
30 July	5	5	. . .	.	.	. . .	.	.
30 ,,	10	10	Lat. 61° 1′ N., long. 3° 13′ W.,	340	4 Dec. '96	East Quarff, 5 miles S. of Shetland, Lerwick,	103	126

* That is a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*.

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1896. 1 Aug.	10	10	Lat. 60° 3′ N., long. 5° 48′ W.,	341	9 Sept. '96	Stembister Beach, St Andrews Castle, Orkney,	118	40
.	.	.	. . .	342	28 ,,	West Burra Firth, Voe, Aithstring, Shetland,	124	59
.	.	.	. . .	343	24 Nov.	Aikerness, Westray, Orkney,	94	116
.	.	.	. . .	344	22 Dec.	Cruden Bay, Aberdeenshire,	204	144
.	.	.	. . .	345	2 Feb. '97	Houss, Burra Isle, Shetland,	206	144
4 Aug.	15	15	Lat. 61° 18½′ N., long. 4° 21¼′ W.,	346	25 Aug. '96	Stenness, near Hillswick, Northmavine,, Shetland.	116	21
5 Aug.	20	20	Lat. 60° 38¼′ N., long. 5° 35½′ W.,	347	27 ,,	Collister, Westing, Unst,	138	22
.	.	.	. . .	348	29 ,,	Kirk Goe, West Yell, Shetland,	134	25
.	.	.	. . .	349	31 ,,	Near Brough Lodge, Fetlar, Shetland,	147	26
.	.	.	. . .	350	4 Sept.	Ness of Sound, West Yell, Shetland,	147	30
.	.	.	. . .	351	7 ,,	Ronasvoe, Heylor, under Lerwick,	124	33
.	.	.	. . .	352	24 Feb. '97	Sorsmolen, Romsdal, Norway,	.	203
6 Aug.	20	20	Lat. 60° 2′ N., long. 7° 4′ W.,	353	30 Nov. '96	Kvænvær, Hitteren, S. Trondheim, Norway,	510	116
.	.	.	. . .	354	,, ,,	N. side of Gjoring Island, near Kolvreid, Namdallen, Norway,		116
.	.	.	. . .	355	11 Dec.	Aiths Bank Beach, Fetlar, Shetland,	202	127
.	.	.	. . .	356	21 ,,	Otterswick, East Yell, Shetland	199	137
.	.	.	. . .	357	3 ,,	Kramsöen, S. Sondmâre, Norway,	.	111
7 Aug.	20	20	Lat. 59° 42′ N., long. 7° 7′ W.,	358	11 ,,	Boddam Voe, Dunrossness, Shetland,		126
.	.	.	. . .	359	6 ,,	Gulberwick, near Lerwick, Shetland,	195	121
			Between May Isle and Hamburg.					
15 Aug.	5	25	13 miles S.E. by E. of May Isle,		.	. . .	.	.
,, ,,	5	20	20 miles ,, ,,		.	. . .	.	.
,, ,,	5	15	30 miles ,, ,,	360	11 Sept. '6	Blyth, Northumberland,	72	27
,, ,,	5	15	50 miles ,, ,,	.	.	. . .	.	.
16 ,,	5	5	70 miles ,, ,,	.	.	. . .	.	.
,, ,,	5	5	100 miles ,, ,,	.	.	. . .	.	.
,, ,,	5	5	130 miles ,, ,,	361	6 Nov. '96	Algeröen, west of Bergen, Norway,	330	82
,, ,,	5	15	150 miles ,, ,,	362	1 Dec.	Rorvikvaag, Vigra, Aalesund, Norway,	480	107
,, ,,	5	5	200 miles ,, ,,	363	21 Oct.	10 miles E. of Arendal, Norway,	296	66
.	.	.	. . .	64	Nov.	Malmon Isle, Lysekil, Sweden,	.	.

* That is a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1896, .	.	.	. . .	365	4 Mar. '97	Ramer Island, 9 miles E. of Christiansand, Norway,	.	200
16 Aug.	5	15	250 miles S.E. by E. of May Isle,	366	15 Nov. '96	Lyngöen, near Bergen, Norway,	358	91
,, ,,	5	5	300 miles ,, ,,	367	29 Sept.	S.E. side of Christiania Fjord, on the Island Spjœr Hvaler,	325	44
			Between May Isle and the Naze of Norway.					
21 ,,	5	25	10 miles E. ½ S. of May Isle,	368	11 ,,	Druridge Bay, Northumberland,	67	21
.	.	.	. . .	369	13 ,,	Bamborough Castle, Northumberland,	42	23
,, ,,	5	20	20 miles ,, ,,	.	.	. . .	.	.
,, ,,	5	15	30 miles ,, ,,	.	.	. . .	.	.
,, ,,	5	15	50 miles ,, ,,	370	29 Jan. '97	6 miles S. of Holy Island, Northumberland,	52	161
,, ,,	5	5	70 miles ,, ,,	.	.	. . .	.	.
,, ,,	5	5	100 miles ,, ,,	.	.	. . .	.	.
,, ,,	5	5	130 miles ,, ,,	371	18 Jan. '97	Yelmesöen, W. Lofoten, Norway,	740	150
,, ,,	5	15	150 miles ,, ,,	.	.	. . .	.	.
,, ,,	5	5	200 miles ,, ,,	.	.	. . .	.	.
,, ,,	5	15	250 miles ,, ,,	372	15 Oct. '96	Bömmelöen, S. Bergenhus, Norway,	143	55
22 ,,	5	5	300 miles ,, ,,	.	.	. . .	.	.
13 Oct.	10	15	2 miles N.E. of Bell Rock,	373	17 Oct. '96	Broad Sands, near N. Berwick,	27	4
.	.	.	. . .	374	20 ,,	2 miles E. of Dunbar, .	28	7
.	.	.	. . .	375	,, ,,	,, ,, .	28	7
.	.	.	. . .	376	21 ,,	Belhaven, Dunbar, .	28	8
.	.	.	. . .	377	11 Nov.	East Links, Dunbar, .	27	29
.	.	.	. . .	378	16 ,,	E. side of May Isle, .	18	34
.	.	.	. . .	379	15 Dec.	Gullane Bay, Firth of Forth,	32	64
13 Oct.	10	15	5 miles S.E. of Scurdy Ness, Forfarshire,	380	20 Oct.	North Berwick, . .	39	7
,, ,,	10	15	4 miles S.E. of Stonehaven,	381	30 ,,	Between Goswick and Holy Island, Northumberland,	72	17
.	.	.	. . .	382	3 Nov.	Hartlepool, Durham,	133	21
.	.	.	. . .	383	6 Feb. '97	Seaham Harbour, Durham,	127	116
13 Oct.	10	15	5 miles S.E. of Girdleness, Aberdeenshire,	384	22 Jan.	Whitby, Yorkshire,	172	100
14 ,,	10	15	4 miles S.E. of Buchan Ness, Aberdeenshire,	385	18 Oct. '96	Sands of Cruden, Aberdeenshire,	5	4
.	.	.	. . .	386	20 ,,	Sands of Cruden, Aberdeenshire,	5	6
.	.	.	. . .	387	,, ,,	Sands of Cruden, Aberdeenshire,	5	6

* That is a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1896.								
.	.	.	. . .	388	20 Oct. '96	Sands of Cruden, Aberdeenshire,	5	6
.	.	.	. . .	389	24 Jan. '97	Marskie-by-the-Sea, Northumberland,	125	102
.	.	.	. . .	390	7 Feb.	Blyth, Northumberland,	134	116
14 Oct.	10	15	Smith Bank, . .	391	20 Oct. '96	Sandend, near Portsoy, Banffshire,	28	6
.	.	.	. . .	392	21 ,,	Whitehills, near Banff,	32	7
.	.	.	. . .	393	22 ,,	,, ,,	32	8
.	.	.	. . .	394	22 Nov.	¼ mile E. of Portsoy, Banffshire,	29	8
14 Oct.	10	10	Smith Bank, . .	395	20 Oct.	1 mile W. of Gardenstown, Banffshire,	30	6
.	.	.	. . .	396	22 ,,	Troup Head, Gamrie, .	31	8
14 Oct.	8	10	Smith Bank, . .	397	20 ,,	W. side of Buckie, Banffshire,	29	6
.	.	.	. . .	398	11 Nov.	½ mile E. of Findochty, Banffshire,	29	28
.	.	.	. . .	399	22 Jan. '97	Findochty, Banffshire,	29	99
15 Oct.	.	.	Smith Bank, . .	400	26 Oct. '96	Whitehills, near Banff,	32	11
.	.	.	. . .	401	28 ,,	1 mile W. of Banff, .	32	13
.	.	.	. . .	402	1 Nov.	¼ mile W. of Kinnaird Head,	37	16
.	.	.	. . .	403	7 Dec.	Macduff, Banffshire, .	33	53
.	.	.	. . .	404	12 ,,	Banff, ...	34	58
15 Oct.	10	10	Smith Bank, . .	405	20 Oct.	W. end of Buckie, Banffshire,	29	5
.	.	.	. . .	406	22 ,,	Cullen, Banffshire, .	30	7
.	.	.	. . .	407	20 ,,	Findochty, ,, .	29	5
			Between May Island and Hamburg.					
18 Oct.	5	25	20 miles S.E. by S. of May Isle,	408	21 Oct. '96	Ross Sands, near Old Law, Northumberland,	23	4
.	.	.	. . .	409	,, ,,	7 miles S. of Berwick-on-Tweed,	19	4
.	.	.	. . .	410	,, ,,	7 miles S. of Berwick-on-Tweed,	19	4
.	.	.	. . .	411	24 ,,	Sands at Bamburgh Castle, Northumberland,	25	6
18 Oct.	5	25	30 miles S.E. by E. of May Isle,	412	3 Nov.	½ mile N. of Staithes, Yorkshire,	84	16
,, ,,	5	15	50 miles S.E. by E. of May Isle,	413	1 ,,	South Bay, Scarborough, Yorks,	93	14
.	.	.	. . .	414	,, ,,	South Bay, Scarborough, Yorks,	93	14
.	.	.	. . .	415	2 ,,	North Bay, Scarborough, Yorks,	92	15
.	.	.	. . .	416	,, ,,	Whitby, Yorkshire, .	83	15
18 Oct.	5	15	70 miles S.E. by E. of May Isle,	417	24 Jan. '97	Cresswell, Morpeth, Northumberland,	.	99
,, ,,	10	20	100 miles S.E. by E. of May Isle,	.	.	. . .	.	.
,, ,,	5	10	130 miles S.E. by E. of May Isle,	418	23 Jan. '97	Newton-by-the Sea, Chathill, Northumberland,	.	98
,, ,,	5	15	150 miles S.E. by E. of May Isle,	.	.	. . .	.	.

* That is a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1896. 18 Oct.	5	10	200 miles S.E. by E. of May Isle,	419	7 Dec. '96	Brought up in trawl-net, in Lat. 54° 30′ N., 100 miles E. by N. of Spurn Point, Yorkshire,	35	50
,, ,,	5	15	250 miles S.E. by E. of May Isle,	.	.	. . .	.	.
,, ,,	5	10	300 miles S.E. by E. of May Isle,	.	.	. . .	.	.
			Between Isle of May and the Naze of Norway.					
23 Oct.	5	25	50 miles E. ½ S. of May Isle,	420	24 Jan. '97	Roker, Monkwearmouth, Sunderland,	.	.
.	.	.	. . .	421	,, ,,	South Shields,	87	93
,, ,,	5	15	75 miles E. ½ S. of May Isle,	.	.	. . .	.	.
,, ,,	10	25	100 miles E. ½ S. of May Isle,	.	.	. . .	.	.
,, ,,	5	10	130 miles E. ½ S. of May Isle,	.	.	. . .	.	.
29 ,,	.	20	Orkney, midway between Copinsay Isle and Holm Sound,	422	19 Nov. '96	E. end of Burray Isle (on the N. side of the Point of the Ness), Orkney,	4	21
.	.	.	. . .	423	28 ,,	E. end of Burray Isle (on the N. side of the Point of the Ness), Orkney,	4	30
31 Oct.	.	10	4 miles E.S.E. of Sule Skerry, west of Orkney,	424	6 ,,	¼ mile S. of Black Craig, Hoy Sound, Orkney,	33	6
.	.	.	. . .	. .	.	. . . .	.	.
3 Nov.	.	.	. . .	425	9 Nov. '96	Rackwick, Hoy, Orkney,	34	6
.	.	.	. . .	426	14 ,,	Jerland Shore, Stenness, Orkney,	32	11
.	.	.	. . .	427	4 Jan. '97	Hoxay Head, S. Ronaldshay, Orkney,	48	63
.	.	.	. . .	428	4 Mar.	Stenness, Orkney,	32	124
3 Nov.	.	10	8 miles S.E. of Start Point, Orkney,	429	14 Dec. '96	N. end Whalsey Island, Shetland.	80	41
.	.	.	. . .	430	,, ,,	Air of Clickimin, near Lerwick, Shetland,	66	41
.	.	.	. . .	431	22 ,,	Neap, North Nesting, Shetland,	.	49
3 Nov.	.	10	4 miles S.W of Fair Isle,	.	.	. . .	.	.
			Between Leith and the Hook of Holland,					
1 Nov.	9	10	47 miles E. ½ S. of Grimsby,	432	29 Nov. '96	100 yards S. of Winterton Lighthouse, near Great Yarmouth,	59	28
.	.	.	. . .	433	,, ,,	Hemsby Beach, near Gt. Yarmouth,	64	28
.	.	.	. . .	434	,, ,,	Winterton, near Great Yarmouth,	59	28
.	.	.	. . .	435	,, ,,	Winterton, near Great Yarmouth,	59	28
.	.	.	. . .	436	,, ,,	Newport, near Great Yarmouth.	63	28

* That is a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
1896.								
.	.	.	. . .	437	29 Nov. 96	Between Yarmouth and Lowestoft,	67	29
.	.	.	. . .	438	,, ,,	Hasbro beach, E. Coast Norfolk,	70	29
.	.	.	. . .	439	,, ,,	Waxham, Sea Palling, Stalham, Norfolk,	71	29
1 Nov.	7	10	46 miles N.E. by E. ½ E. of Cromer, Norfolk,	440	,, ,,	¾ mile S. of Winterton Lighthouse,	50	29
,, ,,	8	10	57 miles E. ½ S. of Cromer,	.	.	. . .	.	.
,, ,,	8	10	57 miles E. by N. ½ E. of Lowestoft,	.	.	. . .	.	.
,, ,,	8	10	37 miles N. by W. of Scheveningen, Holland,	.	.	. . .	.	.
,, ,,	.	20	24 miles N. by W. of Scheveningen,	.	.	. . .	.	.
2 ,,	.	6	5 miles N.E. by E. of Sumburgh Head, Shetland,	441	9 Nov. '96	St Ninians Sand, Bigton by Levenwick, Dunrossness, Shetland,	.	7
,, ,,	.	6	8 miles N.E. by N. of Fair Isle,	442	6 Mar. '97	Morkenæs, Lofotens, Norway, Lat. 68° 8′ 15″ N.,	715	124
12 ,,	.	5	7 miles N E. of Noss Head, Bressay,	.	.	. . .	.	.
14 ,,	.	5	2 miles N.N.E. of Noss Head,	.	.	. . .	.	.
			Between May Isle and the Naze of Norway.					
6 ,,	5	25	10 miles E. ½ S. of May Isle,	.	.	. . .	.	.
,, ,,	5	10	130 miles E. ½ S. of May Isle,	.	.	. . .	.	.
,, ,,	5	15	150 miles E. ½ S. of May Isle,	443	4 Mar. '97	Kalgvag, Sulen, Sogne Fjord, Norway,	275	118
,, ,,	5	10	200 miles E. ½ S. of May Isle,	.	.	. . .	.	.
7 ,,	5	15	250 miles E. ½ S. of May Isle,	444	22 Feb.	Trœnen, Nordland, Norway,	620	108
,, ,,	5	10	300 miles E. ½ S. o May Isle,	.	.	. . .	.	.
			Between the Isle of May and Hamburg.					
23 Dec.	20	.	60 miles from May Isle,	.	.	. . .	.	.
24 ,,	20	.	100 ,, ,, ,,	.	.	. . .	.	.
,, ,,	20	.	200 ,, ,, ,,	.	.	. . .	.	.
,, ,,	20	.	250 ,, ,, ,,	.	.	. . .	.	.
,, ,,	20	.	300 ,, ,, ,,	.	.	. . .	.	.
,, ,,	20	.	350 ,, ,, ,, (about 24 miles W. of Heligoland)	445	5 Jan.	The Horn, Denmark,	80	16

* That is a straight line between the two points.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Poition where Recovered.		Distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
			Between the Isle of May and the Naze of Norway.					
1896. 25 Dec.	20	.	30 miles E. of May Isle,	.	.	. . .	.	.
,, ,,	20	.	100 ,, ,, ,,	.	.	. . .	.	.
,, ,,	20	.	150 ,, ,, ,,	.	.	. . .	.	.
26 ,,	20	.	200 ,, ,, ,,	446	20 Feb. '97	Sulen Island, N. Bergenhus, Norway,	350	56
.	.	.	. . .	447	,, ,,	Blomvaag, near Bergen, Norway,	187	56
.	.	.	. . .	448	,, ,,	Skudenæs, Norway, .	126	56
.	.	.	. . .	449	25 ,,	Wesnœs Lighthouse, near Stavanger, Norway,	140	61
.	.	.	. . .	450	26 ,,	4 miles N. from Stavanger, Norway,	146	62
.	.	.	. . .	451	,, ,,	Jœderen, near Stavanger, Norway,	138	62
.	.	.	. . .	452	27 ,,	1 mile S.S.E. from Tananger, Stavanger, Norway,	139	63
.	.	.	. . .	453	28 ,,	Golten, 6 miles S.W. of Bergen, Norway,	182	64
.	.	.	. . .	454	3 Mar.	Sundervig, near Egersund, Norway,	115	67
26 Dec.	20	.	250 miles E. of May Isle,	455	1 Jan.	Sele, near Stavanger, Norway,	85	6
.	.	.	. . .	456	,, ,,	,, ,,	87	6
.	.	.	. . .	457	,, ,,	,, ,,	87	6
.	.	.	. . .	458	2 ,,	,, ,,	85	7
.	.	.	. . .	459	,, ,,	Fjörve, Lister, near Farsund, Norway,	73	7
.	.	.	. . .	460	15 Feb.	Hvidingsöe, near Stavanger, Norway,	106	51
.	.	.	. . .	461	11 ,,	2 miles W. of Korshavn, near the Naze, Norway,	86	47
.	.	.	. . .	462	13 ,,	Roth Island, near Tananger, Stavanger, Norway,	102	49
.	.	.	. . .	463	19 ,,	Stolmöe Isle, 20 miles S. of Bergen, Norway,	.	55
27 Dec.	20	.	300 miles E. of May Isle (about 32 miles W. of the Naze of Norway),	464	20 ,,	near Bremnos, 10 miles S. of Bergen, Norway,	.	56
.	.	.	. . .	465	22 ,,	2 miles S. of Obristad Lighthouse, Jæderen, Norway,	64	58
.	.	.	. . .	466	24 ,,	Rong, Herlö parish, near Bergen, Norway,	83	60
.	.	.	. . .	467	26 ,,	2 miles S. of Obristad, Jæderen, Norway,	64	62
.	.	.	. . .	468	,, ,,	Rong, Herlö parish, near Bergen, Norway,	83	62
.	.	.	. . .	469	3 Mar.	Ona Lighthouse, near Molde, Norway,	.	67
28 Dec.	10	.	Off Buchan Ness, Aberdeenshire,	470	24 Jan.	Sandwick Bay, So. Ronaldshay, Orkney,	.	27
.	.	.	. . .	471	18 Mar.	Cunningsburgh, Shetland,	.	87
28 Dec.	10	.	Off Girdleness, Aberdeenshire,	472	9 Feb.	Fraserburgh, Aberdeenshire,	17	43
.	.	.	. . .	473	17 Mar.	$1\frac{1}{2}$ miles west of ,,	17	79
28 Dec.	10	.	Off Bervie, Kincardinshire,	474	13 Jan.	Grutha Point, Grimness, South Ronaldshay, Orkney,	135	16

* That is a straight line between the two points.

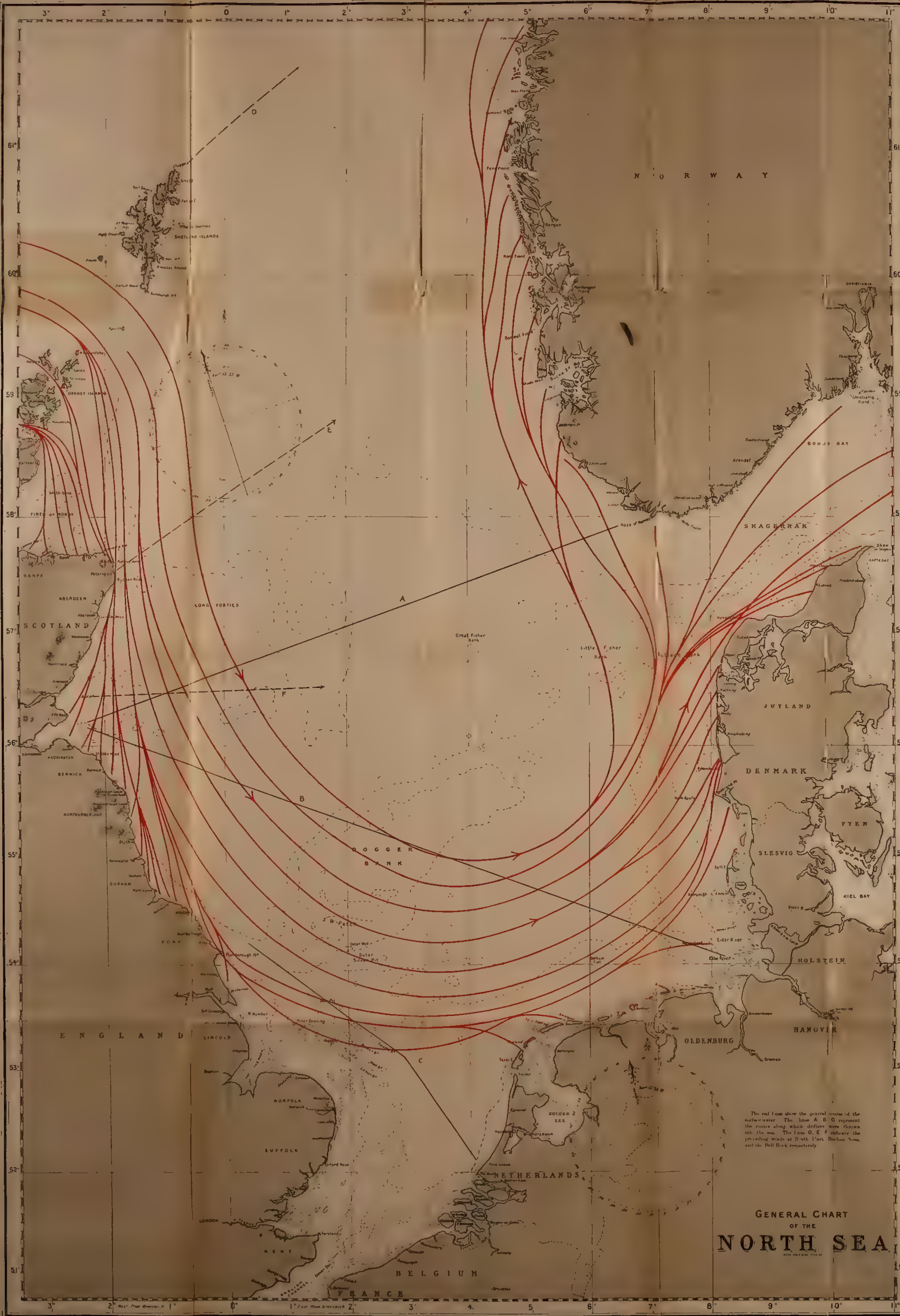
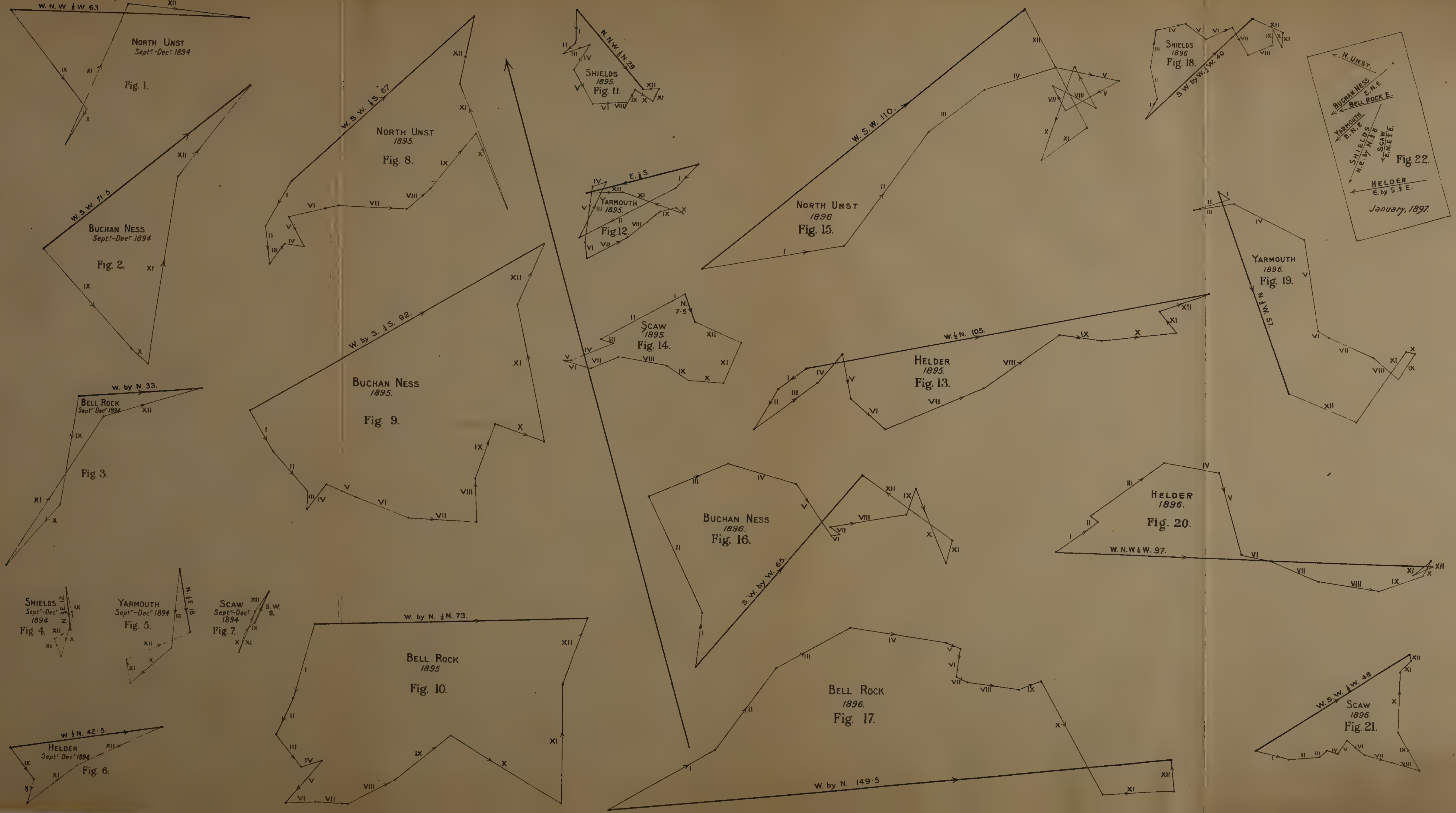

GENERAL CHART
OF THE
NORTH SEA
The red lines show the general course of the surface-water. The lines A B C represent the routes along which drifters were thrown into the sea. The lines D, E F indicate the prevailing winds at North Unst, Buchan Ness, and the Bell Rock respectively.
NORWAY
SHETLAND ISLANDS
ORKNEY ISLANDS
FIRTH OF MORAY
BANFF
ABERDEEN
SCOTLAND
LONG FORTIES
Great Fisher Bank
Little Fisher Bank
SKAGERRAK
BOHUS BAY
Bergen
Arendal
JUTLAND
DENMARK
FYEN
SLESVIG
KIEL BAY
HOLSTEIN
HANOVER
OLDENBURG
Bremen
Elbe River
Eider River
Sylt
HADDINGTON
BERWICK
NORTHUMBERLAND
DURHAM
YORK
Flamborough Hd
R. Humber
LINCOLN
ENGLAND
NORFOLK
SUFFOLK
LONDON
KENT
DOGGER BANK
Outer Silver Pit
NETHERLANDS
ZUIDER ZEE
BELGIUM
FRANCE
A
B
C
D
E
F
3°
2°
1°
0°
1°
2°
3°
4°
5°
6°
7°
8°
9°
10°
11°
61°
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°

PLATE XI.



W. N. W. ½ W. 63
North Unst
Sept^r-Dec^r 1894
Fig. 1.
W. S. W. 71·5
Buchan Ness
Sept^r-Dec^r 1894
Fig. 2.
W. by N. 33.
Bell Rock
Sept^r Dec^r 1894
Fig. 3.
Shields
Sept^r-Dec^r
1894
Fig. 4.
N ½ E 12
Yarmouth
Sept^r-Dec^r 1894
Fig. 5.
N ½ E 18
Scaw
Sept^r-Dec^r
1894
Fig. 7.
S.W. 8.
W ½ N. 42·5.
Helder
Sept^r Dec^r 1894
Fig. 6.
W. S. W. ½ S. 67
North Unst
1895.
Fig. 8.
W. by S. ½ S. 92.
Buchan Ness
1895.
Fig. 9.
W. by N. ½ N. 73.
Bell Rock
1895
Fig. 10.
N. N. W. ½ N. 29
Shields
1895.
Fig. 11.
E. ½ S.
Yarmouth
1895.
Fig. 12.
N.
7·5
Scaw
1895.
Fig. 14.
W. S. W. 110.
North Unst
1896
Fig. 15.
W. ½ N. 105.
Helder
1895.
Fig. 13.
S. W. by W. 65.
Buchan Ness
1896.
Fig. 16.
Bell Rock
1896.
Fig. 17.
W. by N. 149·5
S. W. by W. ¼ W. 40
Shields
1896
Fig. 18.
N. Unst.
Buchan Ness
E. N. E
Bell Rock E.
Yarmouth
E. N. E
Shields
N. E. by N. ½ E
Scaw
E. N. E ½ E.
Fig. 22.
Helder
E. by S. ½ E.
January, 1897.
N ½ W. 57.
Yarmouth
1896.
Fig. 19.
Helder
1896.
Fig. 20.
W. N. W ½ W. 97.
W. S. W. ½ W. 48
Scaw
1896.
Fig. 21.

TABLE SHOWING PARTICULARS OF DRIFTERS—*continued.*

Date and Position where set Adrift.				No.	Date and Position where Recovered.		Distance travelled in Geog. Miles.*	Time between setting away and Recovery in Days.
Date.	Number of Bottles.	Number of Wooden Slips.	Position.		Date.	Position.		
29 Dec.	10	.	Off the Bell Rock Lighthouse,	475	7 Jan. '97	2 miles N. of Peterhead,	45	10
.	.	.	. . .	476	10	4 ,, ,,	47	11
29 Dec.	12	.	Off the Isle of May, .	477	8 ,,	Blackdog Rocks, Aberdeenshire,	65	11
.	.	.	. . .	478	,, ,,	,, ,,	65	11
.	.	.	. . .	479	9 ,,	2 miles N. of River Don, Aberdeenshire,	64	12
.	.	.	. . .	480	9 ,,	Mouth of Ythan, ,,	68	12
.	.	.	. . .	481	18 ,,	Bethelvie, ,,	66	20
28 Dec.	10	.	8 miles N.E. by N. of Fair Isle,	482	26 Feb.	Sulen island, Sognfjord, Norway,	.	60
.	.	.	. . .	483	,, ,,	Hasselviken Trondhjemsfjord (about 45 Kilom. from Trondhjem), Norway,	.	60
28 Dec.	10	.	10 miles E.S.E. of N. Ronaldshay, Orkney,	.	.	. . .	.	.
29 ,,	,,	.	20 miles S. by W. of Copinsha Isle, Orkney,	484	6 Feb.	1½ miles S. of Collieston, Ellon, Aberdeenshire,	.	39
.	.	.	. . .	485	21 ,,	Start Point, Sanday, Orkney,	.	55
29 Dec.	10	.	50 miles S. by W. of Copinsha Isle, Orkney,	486	3 ,,	Rattray Head, Aberdeenshire,	.	36
			Between Isle of May and Hook of Holland.					
1897. 3 Jan.	20	.	52 miles E. ½ S. of Grimsby,	487	15 Jan.	3½ miles S. of Filey, Yorkshire,	63	12
.	.	.	. . .	488	,, ,,	2 miles N. of Flamborough Head,	62	12
3 Jan.	20	.	43 miles N.E. by E. of Cromer,	489	,, ,,	Sheringham, near Cromer, Norfolk,	45	12
.	.	.	. . .		24 ,,	12 miles W. of ,,	48	21
.	.	.	. . .		,, ,,	,, ,,	48	21
.	.	.	. . .	492	26 ,,	,, ,,	48	23
3 Jan.	20	.	57 miles E. ¼ S. from Cromer, Norfolk,	493	22 ,,	Trimingham, 5 miles S.E. of Cromer, Norfolk,	54	19
.	.	.	. . .	494	,, ,,	,, ,, ,,	54	19
.	.	.	. . .	495	24 ,,	Cromer, Norfolk,	57	21
3 Jan.	20	.	51 miles E. by N. ¾ N. of Lowestoft,	496	22 ,,	Bacton, N. Walsham, Norfolk	61	19
.	.	.	. . .	497	,, ,,	Hasbro, near Stratham, Norfolk,	60	19
3 Jan.	20	.	32 miles N. by W. of Hook of Holland,	498	20 ,,	California, near Great Yarmouth, Norfolk,	80	17
.	.	.	. . .	499	,, ,,	Gorleston, near Great Yarmouth, Norfolk,	81	17
.	.	.	. . .	500	21 ,,	Caister-on-Sea, near Gt. Yarmouth, Norfolk,	80	18
.	.	.	. . .	501	,, ,,	Newport, near Great Yarmouth, Norfolk,	80	18
.	.	.	. . .	502	,, ,,	3 miles N. of Winterton, near Great Yarmouth, Norfolk,	82	18
17 Jan.	10	.	50 miles S.S.W. of Bressay Light,	.	. .	. . .	.	.
,, ,,	,,	.	100 miles S.S.W. of Bressay Light,	.	. .	. . .	.	.

* That is a straight line between the two points.

XIV.—NOTE ON THE REPRODUCTIVE ORGANS OF A HERMAPHRODITE LING. By H. M. Kyle, M.A., B.Sc.

Another form has to be added to the list of fishes in which hermaphroditism is known to occur, viz., the ling (*Molva vulgaris*). As this form is grouped under the same family, and closely allied to the common cod, which presents numerous instances of hermaphroditism, it is hardly to be wondered at that the same phenomenon should occur in it. This is but another example which shows the truth of the dictum—that the most abundant and most widespread orders are the most liable to show variations. Professor Howes points out, in his paper on the 'Hermaphrodite Genitalia,' etc. in the *Linnæan Soc. Jour.*, vol. xxiii., that this phenomenon is known in six orders, four of which contain the most widespread forms: one of them, indeed, including a larger number of fish than is included under all the other orders put together.

A specimen of the hermaphrodite ling (the first that has been found and recorded up to this time, I believe) was taken off Lerwick, in Shetland, on the 14th May of this year. The reproductive organs were forwarded by the courtesy of Mr Duthie, assistant fishery officer, and Professor M'Intosh has kindly handed them to me to describe. Certain particulars with regard to the appearance of the fish were sent to Professor M'Intosh, from which one could gather that it looked like a young female ling, about one-third the full size, with a head rather smaller than is usual. From this description it might be inferred that the female reproductive organs were more developed than the male, but in reality, as will be shown, both were equally developed.

The reproductive organs are most remarkable, a good-sized ovary on each side being connected with a well-developed testis, which is at least five times as large as the ovary.

On the one side, the right, the full length of the organ is 15·4 cm., the ovary situated at the posterior end being 4·8 cm. long by 3·2 in diameter. The ovary is barrel-shaped, of a yellow colour, and full of ova, most of them almost ripe, the largest being ·71 mm. The external coat is strong, thick, and fibrous, giving rise internally to the leaf-like folds on which the ova are borne. These folds, as is usual in the group, project into a central cavity which posteriorly opens into a short, wide duct. This duct, which is common to the ovaries on both sides, opens to the exterior. Close to the posterior end is a small piece of testis, springing from the coat of the ovary. This peculiar position, at a distance from the remaining parts of the testis, may be compared with a similar phenomenon found in the cod, and described by Mr Masterman in the *Thirteenth Report of the Fishery Board* (1894).

Anteriorly, the fibrous covering of the ovary is continued over the connection to the multi-lobed testis. Over this it extends also, but changes its colour from yellow to white. On the dorsal surface of the ovary, and running along the duct that leads from the testis into the ovary, is the genital artery. The lobes of the testis (about sixteen in number) are much folded and convoluted, and are arranged round the duct and blood-vessel in a spiral manner.

The organ on the left side is even more complicated than that of the right.

The ovary is situated between two portions of the testis, and the ovary itself is not all in one piece. The length of the whole organ is 14·4 cm., the principal portion of the ovary, which has the same shape and appearance as that on the right side, being 3·4 cm. by 2·0.

The other portion of the ovary is small, and separated from the first by connective tissue and a small piece of testis. The difference in size of the ovaries may be due to the ova having partially escaped from the left.

Posterior to the ovary are two large lobes of the testis with smaller detached portions. The duct leading from these opens into the oviduct close behind the ovary, and near to the external opening. When the organs were in position, this posterior testis would lie in the middle line behind the ovaries. The fibrous coat of the ovary is continued over the testis, as on the other side.

Anteriorly from this coat, but still on the ovary, two small portions of the testis arise : the one simple, the other having several lobules. In front are seven large lobes, with numerous lobules, arranged about the genital blood-vessel, and the connective tissue round it.

The left organ is neither so long nor so broad as the right, nor are the lobes of the testis so large. The blood-vessels in each run from the anterior end of testis to the dorsal surface of the ovary.

The duct leading from the testis into the ovary shows the honeycombed appearance on its upper and inner surface mentioned by Professor Howes, and the longitudinal ridges on its lower surface mentioned by Mr Masterman, for the cod. Across the opening is a small fold of the wall of the ovary. This fold is ·5 cm. long, and springs from within the ovary. Opening into the duct are the smaller ducts from the side lobes of the testis. There is thus a close relation between the testis and the ovary. Whether these portions of the testes attached to the ovary itself are functional and shed their contents directly into the cavity of the ovary is not quite clear from the specimen. There was no trace of any duct. But there is no reason why this should not be so, seeing that the sperms from the large lobes must pass through the ovary in any case. The position and structure of the valve in the duct show that its function is to keep the ova from passing forward to the testis, which otherwise they might easily do,—not to keep the sperms from getting into the ovary.

The structure of the valve is very much the same as that described by Howes in the cod, but there is no longitudinal median ridge running back into the duct. This fold or valve can be easily pushed into the cavity of the ovary, and thus the sperms would get through the opening in it. But if compressed into the mouth of the duct, the sides of the opening will be pressed together, and no ova or sperms will get through, certainly no ova.

Masterman, in his paper on 'Hermaphroditism in the Cod,' gives a synopsis of the chief features of eleven examples. Comparing the ling with these, the principal feature is the comparatively large size of the testes. In only one specimen, mentioned by Howes, was there a large testis : in it the testis was on the left side, and as large as the two ovaries together. In the ling the testes were five times as large as the ovaries. Again, the testes were in three main portions: two anterior and one posterior. This variation, though striking, is not peculiar to the ling, because, in the specimens of the cod, the testes were as often posterior as anterior, and in two specimens there were three portions. In none of these was there any division of an ovary into two portions, as in the ling. None of these examples, therefore, seem to have been so complex. With regard to the ducts—the two leading from the anterior portions into the ovaries were exactly alike, and answered to the description given by Masterman for the ducts of the cod. The duct from the posterior portion was simple, without any appearance of a valve or longitudinal ridges.

Mr H. C. Williamson, M.A., B.Sc., Science Scholar of this University, has recently sent a specimen of the reproductive organs of *Chrysophrys aurita* from the Mediterranean. It is very well preserved, showing the ovaries (5·7 cm. in length) with the plate-like testes (3·2 cm.) attached along their ventral surface, and the duct opening to the exterior.

EXPLANATION OF LETTERS USED IN DESCRIPTION OF FIGURES 3–5. PLATE VII.

r. o. Right ovary, with small portion of testis attached.
o. Oviduct: the two portions of the reproductive organs were joined round *o.*
r. t. Right testis.
b. v. Blood-vessel.
l. o. Left ovary, with small portions of testis attached.
l. t. Left testis.
p. o. Small ovary, posterior to oviduct.
p. t. Posterior portion of testis.
d. Duct, from right testis leading into right ovary, showing longitudinal ridges on its lower, and honeycombed appearance on its upper surface.
v. Fold or valve across the duct, with small opening.

INDEX.