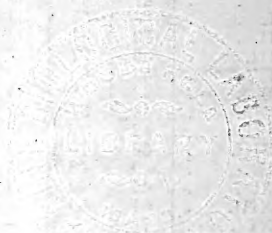




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FISHERY BOARD FOR SCOTLAND.

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SCIENTIFIC INVESTIGATIONS,

1919.

No. I.

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REPORT ON THE MARKING EXPERIMENTS ON  
PLAICE, MADE BY THE S.S. "GOLDSEEKER,"  
IN THE YEARS 1910-1913.

(With Ten Charts.)

BY

DR. T. WEMYSS FULTON, F.R.S.E., Scientific Superintendent.

*This Paper may be referred to as :*

*" Fisheries, Scotland, Scientific Invest., 1919, I. (Feb. 1920)."*



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# REPORT ON THE MARKING EXPERIMENTS ON PLAICE, MADE BY THE S.S. "GOLDSEEKER," IN THE YEARS 1910-1913.

BY DR. T. WEMYSS FULTON, F.R.S.E., SCIENTIFIC SUPERINTENDENT.

(With Ten Charts.)

## I. INTRODUCTION.

In a former Report,\* I described the results of the marking experiments on the food fishes, which were carried on by the research vessel "Goldseeker" during the six years 1904-1909. In the present Report, the results are given of the continuation of these experiments in the four years 1909-1913, so far as concerns the plaice. The experiments with other species of fish, relatively few in numbers, will be dealt with later.

The total number of plaice marked and liberated in the four years was 7166, viz. 2879 males, 4090 females, and 197 whose sexes were not ascertained. The total number recaptured was 3735, or 52·1 per cent., viz. 1530 males (53·1 per cent.), 2163 females (52·9 per cent.), and 42 (21·3 per cent.) of those whose sexes were unknown. The numbers liberated and recaptured in the various years are as follows †:—

Liberated.					Recaptured.				
Year.	Male.	Female.	?Sex.	Total.	Year.	Male.	Female.	?Sex.	Total.
1910	790	1,029	90	1,909	1910	423	557	20	1,000 (52·4%)
1911	725	952	59	1,736	1911	383	496	17	896 (51·6%)
1912	824	1,313	40	2,174	1912	462	733	4	1,199 (55·1%)
1913	540	796	8	1,344	1913	262	377	1	640 (47·6%)
	2,879	4,090	197	7,166		1,530	2,163	42	3,735 (52·1%)

\* "Fishery Board for Scotland, Fifth Report (Northern Area) on Fishery and Hydrographical Investigations in the North Sea and Adjacent Waters, 1908-1911." Cd. 6950, 1913, p. 137.

† The following fish were recaptured after the tables and text were completed. They are not further referred to.

Sc. 4918 A. 10.—Liberated 13th June 1912, at Great Fisher Bank (57° 12' N.; 4° E.); female; length, 41·5 cm. Recaptured 29th November 1919, by the German steam trawler "Hochkamp," at 57° 35' N.; 3° 30' E.; length, 61 cm.; growth, 19·5 cm. in 2714 days; distance travelled, 28 miles N. 22° W.

Sc. 2733 A. 10.—Liberated 5th December 1912, 3 miles N.E. of Fidra Light, Experiment I.; female; length, 40·5 cm. (see p. 79). Recaptured 8th August 1917, 16 miles S.E. of Bell Rock (56° 18' N.; 1° 58' W.); length, 49·1 cm.; growth, 8·6 cm. in 1707 days; distance travelled, 28 miles N. 80° E.

Sc. 5586 A. 10.—Liberated 12th June 1913, 40 miles E. of May, Experiment IV.; female; length, 45 cm. (see p. 157). Recaptured 16th November 1917, 6 miles E. of Cruden Scours (57° 27' N.; 1° 39' W.); length, 48·8 cm.; growth, 3·8 cm. in 1618 days; distance travelled, 65 miles N. 8° E.

Stud No. 1533.—Liberated 12th November 1913, at Nairn Bay; male; length, 29 cm. (see p. 299). Recaptured 10th February 1918, 8 miles S.E. of Dunbeath (58° 11' N.; 3° 12' W.); mark only; 1551 days free; distance travelled, 41 miles N. 49° E.

Stud No. 1402.—Liberated 30th May 1913, off Fidra Light; male; length, 29 cm. (see p. 83). Recaptured 22nd June 1918, off Bell Rock (about 56° 25' N.; 2° 10' W.); length, 39·7 cm.; growth, 10·7 cm. in 1849 days; distance travelled, 23 miles N. 53° E.

Sc. 5127 A. 10.—Liberated 27th March 1913, on Aberdeen Bank; female; length, 39·5 cm. (see p. 204). Recaptured 26th December 1918, 25 miles S.S.E. of Aberdeen (56° 48' N.; 1° 35' W.), in 30 fathoms; length (21"), about 53 cm.; growth, in 2100 days, about 13·5 cm.; distance travelled, 16 miles S. 87° W.

Sc. 5239 A. 10.—Liberated 27th March 1913, E. of Smith Bank; female; length, 39 cm. (see p. 287). Recaptured 29th January 1919, 40 miles N. by W. from Rattray (58° 11' N.; 2° 24' W.); length, 52·9 cm.; growth, 13·9 cm. in 2134 days; distance travelled, 9 miles N. 88° E.

Stud No. 1398.—Liberated 30th May 1913, 3 miles N.E. of Fidra Light, Experiment I.; male; length, 30 cm. (see p. 83). Recaptured 27th February 1919, 20 miles E. of Bell Rock (56° 32' N.; 1° 50' W.); length, 43·9 cm.; growth, 13·9 cm. in 1884 days; distance travelled, 39 miles N. 66° E.

Stud No. 1531.—Liberated 12th November 1913, at Nairn Bay; male; length, 31·5 cm.

The plaice were marked at various stations between the 14th April 1910 and the 12th December 1913. The particulars as to the numbers of the fish marked and liberated at the different stations will be found in the text of the Report. The following table shows the total numbers liberated and recaptured at each of the stations in the course of the four years, with the percentage recaptured for each station :—

TOTAL NUMBER OF PLAICE MARKED AND LIBERATED AND TOTAL NUMBER RECAPTURED, 1910-1913.

Place.	Liberated.				Recaptured.			
	M.	F.	(?)	Total	M.	F.	(?)	Total
Great Fisher Bank . . . .	240	310	49	599	82	109	3	194
Moray Firth . . . . .	249	274	7	530	34·2	35·2	6·1	32·9
Smith Bank . . . . .	296	402	9	707	108	90	3	201
Aberdeen Bank . . . . .	525	674	28	1227	43·4	32·8	42·9	37·9
Fair Isle . . . . .	371	551	18	940	148	184	4	336
Midway between Elie and Fidra	305	469	49	823	50·	45·7	44·4	47·5
20 miles E. of May Isle . . .	352	597	12	961	305	429	7	741
40 miles E. of May Isle . . .	135	240	7	382	58·1	63·6	25·	60·4
50 miles E. of May Isle . . .	84	119	4	207	180	275	6	461
80 miles E. of May Isle . . .	—	1	—	1	48·5	49·9	33·3	49·
100 miles E. of May Isle . . .	81	105	6	192	210	267	12	489
220 miles E. of May Isle . . .	50	55	1	106	68·8	56·9	24·5	59·4
Fidra Light, S. by W. 3 miles .	81	117	2	200	67·9	67·3	16·6	66·9
St. Andrews Bay . . . . .	34	25	—	59	66	139	3	208
5 miles S.E. $\frac{1}{2}$ E. of Tod Head .	1	1	—	2	48·9	57·9	42·9	54·4
Various :—Off Buchanness.					52·4	52·9	—	51·7
Ratray, Tod Head . . . . .	75	147	5	227	—	—	—	—
Kinnaird, etc . . . . .	—	3	—	3	—	—	—	—
Kirkcaldy Bay . . . . .	—	3	—	3	—	—	—	—
Totals . . . . .	2879	4090	197	7166	1530	2163	42	3735
					53·1	52·9	21·3	52·1

(see p. 299). Recaptured 8th March 1919, 4 miles N.W. of Covesea Lighthouse (57° 45' N. ; 3° 28' W.); length, 46·6 cm.; growth, 15·1 cm. in 1942 days; distance travelled, 17 miles N. 77° E.

<sup>107</sup> Stud No. 1408.—Liberated 30th May 1913, 3 miles N.E. of Fidra Light, Experiment I. ♀ female; length, 27·5 cm. (see p. 83). Recaptured 24th March 1919, 1 mile E. of Whitehills (57° 41' N. ; 2° 29' W.). Length, 49·2 cm.; growth, 21·7 cm. in 2124 days; distance travelled, 150 miles N. & E.



6983 plaice were marked with the vulcanite marks, and 3706, or 53·1 per cent., were returned, showing that the latter method was much the more satisfactory. The number marked with the two vulcanite discs was 5637, and the number recaptured was 3086, or 54·7 per cent. The number marked with the vulcanite studs was 1346, and the number recaptured was 620, or 46·1 per cent. The latter method of marking is thus not so satisfactory as that in which two discs are used, connected by a silver wire.

The fish, after being marked, were kept on board the "Goldseeker" in tubs of water until they were liberated, the interval, in some cases, extending over a day or more. The sexes were ascertained by holding the fish up to the light, the ovaries being thus detected in the females. Comparatively few errors were made in determining the sexes by this method.

#### THE INTERVAL BETWEEN LIBERATION AND RECAPTURE.

The duration of the periods of liberty of the marked plaice, before they were recaptured, varied very much. In a few cases, they were taken on the same day on which they were set free; in other instances, some years elapsed before they were caught. In the following table, the recaptures in each period of three months after liberation for all the experiments, have been tabulated, the particulars for the sexes being also shown separately, and percentages given:—

Sex.	1st Year.				2nd Year.				3rd Year.				4th Year.				5th Year.				6th Year.				Total.
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
M.	349	358	234	207	109	80	58	36	26	24	7	11	4	2	5	2	1	1	1	1	1	1	1	1	1,514
%	23·0	23·6	15·4	13·7	7·2	5·3	3·8	2·4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
F.	592	423	298	275	179	111	86	61	40	36	22	10	6	3	3	3	1	2	1	1	1	1	1	1	2,152
%	27·5	19·6	13·8	12·8	8·3	5·1	3·9	2·8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
?	11	9	5	2	2	3	2	5	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	41
%	26·8	21·9	12·2	4·9	4·9	7·3	4·9	12·2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
%	95·2	79·0	53·7	48·4	29·0	19·4	14·6	10·2	6·8	6·0	2·9	2·1	1·0	5	8	5	1	3	1	1	1	1	1	1	3,707 +28 with no date. =3,735
%	25·7	21·3	14·5	13·0	7·8	5·2	3·9	2·7	1·8	1·6	·8	·6	...	...	...	...	...	...	...	...	...	...	...	...	
TOTAL NOS. FOR EACH YEAR:—																									
M.	1,148	75·8%			283	18·7%			68	4·5%			13	·8%			1	·06%			1	·06%			
F.	1,588	73·8%			437	20·3%			108	5·1%			15	·7%			4	·18%			...	...			
?	27	65·8%			12	29·3%			2	4·9%			...	...			...	...			...	...			
	2,763				732				178				28				5				1				
	74·5%				22·4				4·8				·7				·1				·02				

It will be observed that the largest number was recaptured within three months of liberation, and that the number caught in each succeeding quarter was less than in the preceding quarter. Within the first twelve months of liberation, 2763, or 74·5 per cent., were taken; in the second year, the number was 732, or 22·4 per cent.; in the third year, it was 179, or 4·8 per cent.; in the fourth year, 27, or ·7 per cent.; in the fifth year, 5, or ·01 per cent.; while one fish, a male, was taken in the sixth year after liberation, having been at liberty 1821 days.

## PORTS AT WHICH LANDED.

The following table shows the numbers of the marked plaice which were landed at the various ports :—

Port.	No. of Fish.	Port.	No. of Fish.	Port.	No. of Fish.
Aberdeen . . .	1,292	Newhaven . . .	69	Golspie . . .	16
Granton . . .	642	Leith . . .	68	Cockenzie . . .	15
Grimsby . . .	181	London . . .	65	Helmsdale . . .	15
North Shields . . .	171	Buckie . . .	61	Cuxhaven . . .	12
Dundee . . .	147	Hartlepool . . .	47	Pittenweem . . .	11
Ymuiden . . .	111	Geestemünde . . .	46	Montrose . . .	10
Ostend . . .	93	Embo . . .	27	Altona . . .	10
Whitehills . . .	84	Hamburg . . .	25	St. Andrews . . .	10
Lossiemouth . . .	79	Wick . . .	25	Collieston . . .	9
Anstruther . . .	76	Blyth . . .	17	Macduff . . .	8
Hull . . .	72	Peterhead . . .	16	Scarborough . . .	9

Seven each were landed at Largo, Burghead, and Bremerhaven ; six at Cromarty ; five each at Dysart and Nairn ; four each at Kirkcaldy, Sunderland, and Buckhaven ; three each at St. Monans, Port Errol, Elie, Leven, and Vlaardingen ; and two each at Brora, Broughty-ferry, and Gairloch. The following are ports of landing of one fish only each :—Dornoch, Gourdon, Longhaven, Cruden, Roseheart, Goteborg, Newton-by-Sea, Billingsgate Market, Ramsgate, Kinghorn, Scalloway, Rockfield, Portmahomack, Ardersier, Mallaig, Milford Haven, Arbroath, St. Combs, Rattray Head, Fraserburgh, Findhorn, Boston, Holy Island, Oban, and Inverness. Eighteen of the marked plaice recaptured were taken by the "Goldseeker," and no particulars were obtained as to the port of landing of eighty-four of the fish.

## II. THE MIGRATIONS.

Charts have been made showing the results of each of the marking experiments, a straight line (or lines) being drawn between the station where the fish were liberated, and the place where each fish was recaptured. In many cases, also four quarterly charts of the same kind were prepared, showing the results for each three months of the first twelve months following the liberation. Some of these charts are reproduced in this Report. Tables were also prepared, representing, in each case, the number of days the fish was at liberty, the distance travelled, the direction, and the mean rate of movement.

In a few instances, it is clear that a mistake was made as to the exact place where a marked fish was taken, *e.g.* when a fish is represented as having been caught many miles from the place of liberation within a few days after it was set free. But there is no reason to question the general trustworthiness of the records.

In connection with all such experiments on marked fish and the interpretation of the results, certain facts must be borne in mind. Were all the conditions affecting the life of the fish in the sea uniform in all respects, it might be expected that the movements of the marked individuals from any station would show no predominance in any particular direction. One would suppose that the fish would move equally in all directions, so that the lines of migration on the chart would be of a stellate nature, that is to say, radiating from the centre of distribution.

A second point to remember is that the results are dependent upon the distribution of fishing operations and their relative intensity. If, for example, no fishing, or a comparatively small amount of fishing, takes place, say, on the eastern side of a station, one would not expect to get fish in that direction, although, in point of fact, they may have migrated thither. To understand fully the experiments, one would require to know the amount of fishing in all directions in relation to the stations where the fish were liberated. This information does not at present exist.

## 1. THE DISTANCES TRAVELLED.

In each experiment, a summary was made of the distances migrated, irrespective of the time taken, of each of the marked plaice recaptured. In some cases, the fish were recaptured at the place where they were liberated. In the accompanying table are given the numbers of the marked plaice taken at various distances from the place of liberation. It will be seen that the largest proportion were recaptured between 20 and 50 miles, and that this was the case both with the males and the females. The males, on an average, moved farther than the females, 35·1 per cent. being taken at a distance exceeding 50 miles, as compared with 28 per cent. of the females. At distances of from 150 to 200 miles, 5·1 per cent. of the males were recaptured, as compared with 1·8 per cent. of the females, and at distances exceeding 200 miles, 1·9 per cent. of the males, as against ·9 per cent. of the females.

Sex.	Miles.							Total.
	10 and under.	10-20.	20-50.	50-100.	100-150.	150-200.	Over 200.	
M.	236	260	439	267	138	74	28	1,442
%	16·5	18·	30·4	18·5	9·6	5·1	1·9	
F.	404	409	663	361	158	38	18	2,051
%	19·7	19·9	32·3	17·6	7·7	1·8	·9	
(?)	7	6	6	8	5	3	2	37
%	18·9	16·2	16·2	21·6	13·5	8·1	5·4	
Total	647	675	1,108	636	301	115	48	3,530
%	18·3	19·1	31·4	18·	8·5	3·3	1·3	

Forty-eight of the fish, or 1·3 per cent., were recaptured at distances exceeding 200 miles, and 6 at distances over 300 miles, although some of these may be regarded as doubtful. In one case, where the fish was liberated in the Firth of Forth, it was said to have been recaptured near the Goodwin Sands, and landed at Ramsgate, and inquiry confirmed the accuracy of the record. The farthest distance indicated was 472 miles; it refers to a fish liberated off Kinnaird Head, on the east coast of Scotland, and reported as recaptured in Morecambe Bay, Lancashire, but it is open to considerable doubt.

## 2. THE DIRECTION OF THE MIGRATIONS.

## (1) FIRTH OF FORTH REGION.

This region comprises the experiments (1) between Elie and Fidra, (2) 3 miles off Fidra Light, (3) 20 miles east of the Isle of May, (4) 40 miles east of the Isle of May, (5) 50 miles east of the Isle of May, and (6) St. Andrews Bay.

The directions of migration in each of the experiments conducted at these stations are discussed in the body of the Report, and here it will suffice to summarise some of the results. It is best to consider, first of all, the offshore station, 20 miles east of the Isle of May.

## (a) 20 Miles East of the Isle of May.

An examination of the charts showing the lines of migration proves very clearly in this case that the predominant migration is to the north. Thus, of a total of 643 of the marked plaice recaptured, only 9, or 1·4 per cent., were taken to the south of Latitude 56° N., which is only 17 miles south of the station, whereas, no less than 78 were recaptured north of Rattray Head, which lies about 80 miles to the north of the station. In four of the experiments, none of the fish recaptured was taken to the south of 56° N.



For each of the experiments, the following methods have been adopted, in order to determine the general mean direction of the migration, and the distance travelled :—

I. The exact direction of the migration of each fish being ascertained from the nearest compass on the chart, and the distance it had travelled, the sum of the figures for direction and for distance was divided by the number of fish whose lines of migration fell within that quadrant of the circle. Thus, in Experiment II., eight adult females migrated north and east in directions from N. 24° E. to N. 58° E., and for distances which ranged from 5 to 68 miles, the aggregate being 328·5 miles, or an average of 41·1 miles, and the mean direction, as ascertained in this way, was N. 33° E., or parallel to the coast. Four adult females migrated north and west, in directions varying from N. 62° W. to N. 84° W., for distances of from 21 to 23 miles, the aggregate being 89 miles, and the average 22 miles, while the mean direction was N. 77° W.

The other quadrants were treated in the same way for each sex, and the results for this experiment were as follows :—Thirteen plaice moved north and east, in the mean direction N. 32° E., for an aggregate distance of 634·5 miles, the mean being 48·8 miles; 10 migrated north and west, in the direction N. 71° W., the aggregate distance being 220 miles, and the average 22 miles; 9 moved to the south and west, in the mean direction S. 55° W., the aggregate distance being 97·5 miles, and the mean distance travelled 10·8 miles.

Each of the experiments made at this station has been treated in this way, and the results are shown in the accompanying table.

## N. and E.

## N. and W.

Experiment.	Date.	No. of Fish.	Aggregate Distance.	Average Distance.	Mean Direction.	Experiment.	Date.	No. of Fish.	Aggregate Distance.	Average Distance.	Mean Direction.
			Miles.	Miles.					Miles.	Miles.	
I.	28 Nov. 1910	46	3,523	76·6	N. 27° E.	I.	28 Nov. 1910	5	57	11·4	N. 45° W.
II.	21 Mar. 1911	13	634·5	48·8	N. 32° E.	II.	21 Mar. 1911	10	220	22·	N. 71° W.
III.	25 Apr. 1911	9	764	85·	N. 37° E.	III.	25 Apr. 1911	5	91	18·	N. 46° W.
IV.	19 June 1911	13	620	48·	N. 40° E.	IV.	19 June 1911	2	33	16·5	N. 42° W.
V.	11 Sept. 1911	26	1,518	58·4	N. 33° E.	V.	11 Sept. 1911	8	132	16·5	N. 62° W.
VI.	7 Mar. 1912	20	1,018	50·9	N. 33° E.	VI.	7 Mar. 1912	22	350	16·	N. 52° W.
VII.	24 Apr. 1912	27	1,241	45·9	N. 39° E.	VII.	24 Apr. 1912	8	93·5	11·7	N. 39° W.
VIII.	10 May 1912	14	470·5	33·6	N. 45° E.	VIII.	10 May 1912	13	171·5	13·2	N. 41° W.
IX.	6 Dec. 1912	71	4,169	58·7	N. 31° E.	IX.	6 Dec. 1912	28	526·5	18·8	N. 57° W.
X.	26 Mar. 1913	29	1,498	51·7	N. 29° E.	X.	26 Mar. 1913	13	227·5	17·5	N. 61° W.
	Average	268	15,456	57·6	346·		Average	114	1,902·	161·6	516°
		...	1545·6	55·8	N. 34° E.			...	190·2	16·2	N. 52° W.
S. and E.						S. and W.					
I.	28 Nov. 1910	7	83·5	11·9	S. 31° E.	I.	28 Nov. 1910	8	100·5	12·6	S. 58° W.
II.	21 Mar. 1911	...	...	...	...	II.	21 Mar. 1911	9	97·5	10·8	S. 55° W.
III.	25 Apr. 1911	2	11·	5·5	S. 27° E.	III.	25 Apr. 1911	6	45·5	7·6	S. 55° W.
IV.	19 June 1911	2	30·	15·	S. 26° E.	IV.	19 June 1911	19	132·5	7·	S. 53° W.
V.	11 Sept. 1911	2	22·	11·	S. 26° E.	V.	11 Sept. 1911	16	131·5	8·2	S. 53° W.
VI.	7 Mar. 1912	5	151·	30·	S. 65° E.	VI.	7 Mar. 1912	24	215·5	9·	S. 50° W.
VII.	24 Apr. 1912	10	432·5	43·2	S. 31° E.	VII.	24 Apr. 1912	25	187·	7·5	S. 53° W.
VIII.	10 May 1912	6	253·	42·	S. 28° E.	VIII.	10 May 1912	21	177·5	8·4	S. 58° W.
IX.	6 Dec. 1912	7	482·	69·	S. 17° E.	IX.	6 Dec. 1912	14	153·5	11·	S. 61° W.
X.	26 Mar. 1913	6	193·	32·	S. 48° E.	X.	26 Mar. 1913	7	34·	5·	S. 37° W.
	Average	47	1,658	259·6	299°		Average	149	1,275	87·1	533°
		...	184·2	27·9	S. 33° E.			...	127·5	8·7	S. 53° W.

NOTE: In Experiment V., 2 fish went directly N., each for 2 miles.

In Experiment VII., 2 went directly W. for a mean distance of 10 miles; 2 went directly E. for a mean distance of 22·5 miles.

In Experiment IX., 3 went an average of 9 miles directly W., and 3 for an average of 7·7 miles to the east.

In Experiment X., 5 travelled an average of 8·9 miles west, and 2 a mean of 10 miles east.

It will be observed that of the 600 plaice about which particulars exist, 268, or

44·7 per cent., migrated to the north and east, for an average distance of 55·8 miles, the mean direction of all the experiments being N. 34° E., or nearly parallel with the coast; the number which migrated to the north and west was 114, or 19 per cent., the average distance being 16·2 miles, and the mean direction, N. 52° W.; those which travelled south and east numbered 47, or 5·2 per cent., the average distance being 27·9 miles, and the mean direction, S. 33° E.; while 149, or 24·8 per cent., went to the south and west, for a mean distance of 8·7 miles in the mean direction S. 53° W. The mean directions to the north and west in the various experiments ranged from N. 39° W., a line which touches the coast about Arbroath, and N. 71° W., a little north of Fife Ness, while the mean for all experiments in this quadrant, if prolonged, would reach Buddon Ness, at the mouth of the Tay. The mean directions to the south and west ranged from S. 37° W., a line which would touch the coast about Fast Castle, west of St. Abb's Head, to S. 61° W., at Dunbar, and the mean direction of all the experiments, S. 53° W. reaches the coast some miles to the east of Dunbar.

II. It is obvious that the above method, although helpful in showing the direction of the predominant migration, is not strictly accurate. While the general direction is ascertained, the mean direction obtained is not equivalent to the true resultant for the quadrant, since a short distance in one direction is given equal value to a long distance in another direction.

It was desired to ascertain the true resultant of all the varied migrations in each quadrant, *i.e.* the line and distance which would represent the net result of the divergent movements of the individual fish. This was done, according to ordinary mathematical methods, by Miss F. M. Mulholland, and forms the second method adopted. In this case, the adult and immature of each sex were treated separately, and in those fish which went northwards and then westwards, into the Moray Firth, or to the north or west coasts, the initial direction alone was taken into account. The results are shown in the following table:—

## ADULT MALES.

Experiment.	Date.	N. and E.			N. and W.		
		No. of Fish.	Distance.	Mean Direction.	No. of Fish.	Distance.	Mean Direction.
			Miles.			Miles.	
I	28 Nov. 1910	18	1891·2	N 23° E	2	32·1	N. 33° W.
II	21 Mar. 1911.	5	492·2	N 24° E	1	15·	N. 33° W.
III.	25 Apr. 1911.	4	490·7	N. 33° E.	1	23·	N. 65° W.
IV.	19 June 1911.	8	467·5	N. 27° E.	1	17·	N. 46° W.
V.	11 Sept. 1911	14	1208·5	N. 28° E.	4	43·8	N. 42° W.
VI.	7 Mar. 1912.	3	265·9	N. 29° E.	5	64·2	N. 55° W.
VII.	24 Apr. 1912.	12	778·4	N. 33° E.	3	26·3	N. 19° W.
VIII.	10 May 1912.	8	289·8	N. 43° E.	7	85·2	N. 61° W.
IX.	6 Dec. 1912.	28	1975·	N. 28° E.	12	222·9	N. 63° W.
X.	26 Mar. 1913.	13	1136·1	N. 25° E.	3	54·9	N. 68° W.
		113			39		
			S. and E.			S. and W.	
I.	28 Nov. 1910.	2	11·6	S. 23° E.	4	30·2	S. 56° W
II.	21 Mar. 1911.	—	—	—	4	38·2	S. 64° W
III.	25 Apr. 1911.	—	—	—	2	23·7	S. 66° W.
IV.	19 June 1911.	—	—	—	4	24·4	S. 48° W.
V.	11 Sept. 1911.	2	20·4	S. 19° E.	3	19·9	S. 67° W.
VI.	7 Mar. 1912.	1	1·	S. 73° E.	3	17·4	S. 30° W.
VII.	24 Apr. 1912.	1	5·	S. 3° E.	4	30·3	S. 66° W.
VIII.	10 May 1912.	2	225·3	S. 53° E.	4	34·7	S. 64° W.
IX.	6 Dec. 1912.	1	5·	S. 3° E.	6	59·2	S. 66° W.
X.	26 Mar. 1913.	1	102·	S. 10° E.	3	8·2	S. 30° W.
		10			37		

## IMMATURE MALES.

Experiment.	Date.	N. and E.			N. and W.		
		No. of Fish.	Distance.	Mean Direction.	No. of Fish.	Distance.	Mean Direction.
			Miles.			Miles.	
II.	21 Mar. 1911.	—	—	—	1	23·	N. 84° W.
VIII.	10 May 1912.	—	—	—	1	6·	N. 30° W.
IX.	6 Dec. 1912.	3	308·2	N. 26° E.	1	26·	N. 58° W.
X.	26 Mar. 1913.	—	—	—	2	37·8	N. 58° W.
		3			5		
			S. and E.			S. and W.	
II.	21 Mar. 1911.	—	—	—	1	5·	S. 80° W.
IV.	19 June 1911.	—	—	—	3	15·9	S. 51° W.
V.	11 Sept. 1911.	—	—	—	1	13·5	S. 35° W.
VI.	7 Mar. 1912.	—	—	—	1	16·	S. 24° W.
VIII.	10 May 1912.	1	10·	S. 66° E.	1	5·	S. 52° W.
		1			7		

## ADULT FEMALES.

Experiment.	Date.	N. and E.			N. and W.		
		No. of Fish.	Distance.	Mean Direction.	No. of Fish.	Distance.	Mean Direction.
			Miles.			Miles.	
I.	28 Nov. 1910.	26	1968	N. 28° E.	1	4·	N. 39° W.
II.	21 Mar. 1911.	8	322·7	N. 35° E.	4	88·	N. 77° W.
III.	25 Apr. 1911.	4	344·5	N. 53° E.	1	21·	N. 21° W.
IV.	19 June 1911.	3	71·8	N. 61° E.	—	—	—
V.	11 Sept. 1911.	7	364·2	N. 36° E.	—	—	—
VI.	7 Mar. 1912.	16	867·7	N. 30° E.	10	177·5	N. 60° W.
VII.	24 Apr. 1912.	13	610·1	N. 32° E.	5	56·7	N. 50° W.
VIII.	10 May 1912.	2	101·	N. 41° E.	2	33·1	N. 20° W.
IX.	6 Dec. 1912.	30	2165·1	N. 28° E.	6	103·5	N. 64° W.
X.	26 Mar. 1913.	14	661·2	N. 32° E.	5	78·1	N. 74° W.
		123			34		
			S. and E.			S. and W.	
I.	28 Nov. 1910.	3	39·2	S. 33° E.	3	59·8	S. 78° W.
II.	21 Mar. 1911.	—	—	—	3	14·9	S. 54° W.
III.	25 Apr. 1911.	1	4·	S. 18° E.	4	21·5	S. 52° W.
IV.	19 June 1911.	2	29·9	S. 27° E.	1	6·	S. 50° W.
V.	11 Sept. 1911.	—	—	—	5	28·5	S. 45° W.
VI.	7 Mar. 1912.	3	134·1	S. 74° E.	13	110·	S. 63° W.
VII.	24 Apr. 1912.	7	408·	S. 40° E.	16	118·9	S. 62° W.
VIII.	10 May 1912.	2	5·	S. 3° E.	8	56·8	S. 45° W.
IX.	6 Dec. 1912.	3	261·4	S. 41° E.	6	72·7	S. 72° W.
X.	26 Mar. 1913.	4	56·8	S. 53° E.	1	116·7	S. 50° W.
		25			60		

[TABLE.]

## IMMATURE FEMALES.

Experiment.	Date.	N. and E.			N. and W.		
		No. of Fish.	Distance.	Mean Direction.	No. of Fish.	Distance.	Mean Direction.
			Miles.			Miles.	
I.	28 Nov. 1910.	2	76·8	N. 21° E.	2	13·9	N. 40° W.
II.	21 Mar. 1911.	—	—	—	4	89·8	N. 75° W.
III.	25 Apr. 1911.	1	34·	N. 12° E.	3	39·1	N. 60° W.
IV.	19 June 1911.	1	45·	N. 62° E.	1	16·	N. 38° W.
V.	11 Sept. 1911.	5	287·5	N. 24° E.	4	80·8	N. 76° W.
VI.	7 Mar. 1912.	1	20·	N. 15° E.	7	82·	N. 56° W.
VII.	24 Apr. 1912.	1	8·	N. 77° E.	—	—	—
VIII.	10 May 1912.	4	69·7	N. 49° E.	3	36·8	N. 24° W.
IX.	6 Dec. 1912.	10	759·8	N. 27° E.	9	139·2	N. 62° W.
X.	26 Mar. 1913.	2	54·9	N. 31° E.	3	46·5	N. 47° W.
		27			36		
			S. and E.			S. and W.	
I.	28 Nov. 1910.	2	18·1	S. 60° E.	1	5·	S. 50° W.
II.	21 Mar. 1911.	—	—	—	1	49·	S. 2° W.
III.	25 Apr. 1911.	1	7·	S. 36° E.	—	—	—
IV.	19 June 1911.	—	—	—	11	79·2	S. 54° W.
V.	11 Sept. 1911.	—	—	—	7	65·	S. 65° W.
VI.	7 Mar. 1912.	1	9·	S. 64° E.	7	62·9	S. 33° W.
VII.	24 Apr. 1912.	2	9·8	S. 37° E.	5	27·	S. 38° W.
VIII.	10 May 1912.	1	6·	S. 25° E.	8	77·4	S. 67° W.
IX.	6 Dec. 1912.	3	200·8	S. 14° E.	2	18·9	S. 59° W.
X.	26 Mar. 1913.	1	24·	S. 30° E.	3	18·9	S. 48° W.
		11			45		

Owing to the labour involved, collective results for all the fish in each quadrant, male and female, adult and immature, were calculated only for one experiment, viz. No. 9. The total number of plaice recaptured, about which the necessary particulars were obtained, was 120. The results were as follows:—

71, or 59·1 per cent., migrated in the mean direction N. 28° E., the aggregate miles being 5207·6, and the average 73·3.

28, or 23·3 per cent., migrated in the mean direction N. 63° W., the aggregate miles being 491·6, and the average 17·6.

7, or 5·8 per cent., migrated in the mean direction S. 29° E., the aggregate miles being 456·4, and the average 65·2.

14, or 11·6 per cent., migrated in the mean direction S. 68° W., the aggregate miles being 151·3, and the average 10·8.

III. A third method was adopted for the experiments at 20 miles east of the Isle of May, by calculating the resultant not for each of the quadrants separately but for all directions together, so that the net result of the migrations of all the recaptured plaice might be represented by a single line. These calculations were kindly made by Dr. Tocher, Lecturer on Statistics, University of Aberdeen. In this case also, the sexes were considered separately, adults being distinguished from immatures, and the direction taken by each fish throughout the whole of its migration was taken into account, and not merely, as in the above methods, the initial direction of those which went northwards and then passed westwards. The distinction affects only those which turned westwards into the Moray Firth, or farther, and not those found to the south of the Moray Firth. For example, one of the marked plaice from Experiment No. 5 was taken south of Cape Wrath, and the directions and distance drawn on the chart from the station where it was liberated to the place at which it was recaptured are as follows:—N. 24° E. 85 miles;

N. 17° W. 77 miles ; N. 76° W. 62 miles ; S. 66° W. 14½ miles. By the first two methods described above, the direction taken was the initial direction alone. N. 24° E. Owing to this westerly factor in such instances, and the initial westerly direction of many of the fish in other cases, the net resultant passes to the land, or over it. The results are given in the following table :—

No. of Expt.	Males.				Females.			
	Adult.		Immature.		Adult.		Immature.	
	Mean Dist. (Miles).	Mean Direction.	Mean Dist. (Miles).	Mean Direction.	Mean Dist. (Miles).	Mean Direction.	Mean Dist. (Miles).	Mean Direction.
I.	62·04	N. 15° W.	...	...	55·41	N. 6° E.	16·78	W.
II.	41·35	N. 36° W.	14·	S. 88° W.	28·23	N. 27° W.	28·4	S. 86° W.
III.	58·	N. 28° W.	...	...	40·85	N. 53° W.	14·67	N. 43° W.
IV.	34·1	N. 24° W.	5·33	S. 51° W.	13·2	N. 84° W.	12·36	S. 88° W.
V.	41·52	N. 33° W.	13·5	N. 40° E.	33·58	N. 21° W.	26·84	N. 68° W.
VI.	27·73	N. 60° W.	16·	S. 24° W.	27·84	N. 54° W.	12·63	S. 84° W.
VII.	34·95	N. 6° W.	...	...	27·65	N. 69° W.	6·44	S. 75° W.
VIII.	20·16	N. 33° W.	7·	S. 45° W.	14·03	S. 82° W.	12·04	N. 61° W.
IX.	40·67	N. 23° W.	56·	N. 6° W.	46·82	N. 17° W.	41·29	N. 46° W.
X.	45·89	N. 32° W.	20·	N. 63° W.	26·83	N. 36° W.	12·75	N. 79° W.
Mean.	40·641	N. 29° W.	18·83	N. 77° W.	31·444	N. 45° W.	18·42	N. 77° W.

In the case of the adult males, the resultant mean direction ranged from N. 6° W. to N. 60° W. in the different experiments, the former being a line cutting the coast at Milton Ness, a little north of Montrose, and the latter a line running into St. Andrew's Bay to the north of St. Andrews. The mean direction for the adult males in all the experiments was N. 29° W., a line which cuts the coast between Arbroath and Red Head. The mean direction for the adult females varied in the different experiments from N. 6° E., a line which cuts the coast a little south of Stonehaven, to S. 82° W., which runs to the mouth of the Firth of Forth ; and the mean for all the experiments was N. 45° W., a line which touches the coast of Forfarshire between Buddon Ness and Arbroath. The mean line of migration for the immature of both sexes was N. 77° W., which touches the coast of Fife a little south of Fife Ness.

(b) *Between Elie and Fidra.*

A glance at the migration charts shows that here also the predominant migration was to the northwards, and that comparatively few of the marked plaice were recaptured within the Firth of Forth itself. As is shown in the following table, of 480 of the marked plaice recaptured, about which the necessary particulars were obtained, 102, or 21·2 per cent., were taken within the Firth of Forth, and 378, or 78·7 per cent., outside the Firth. Of the latter, 294, or 61·3 per cent. of all recaptures, were found south of Kinnaird Head, that is, south of the Moray Firth ; 51, or 10·6 per cent., were obtained in the Moray Firth, while 33, or 6·9 per cent., were recaptured still farther to the north or west ; only 18, or 3·7 per cent., were recovered to the south of the Firth of Forth (Lat. 56° N.).

Expt.	Recaptured.		Inside Forth.		Outside Forth.		South of Kinnaird.		In Moray Firth.		Farther North and West.		South of Forth (56° N.).	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
I.	66	67·7	4	6·1	62	93·9	44	66·7	9	13·6	9	13·6	2	3·
II.	55	55·	13	23·6	42	76·3	31	56·3	8	14·5	3	5·4	3	5·5
III.	28	60·	12	42·8	16	57·1	12	42·8	3	10·7	1	3·5	...	...
IV.	21	46·2	4	19·	17	80·9	13	61·9	2	9·5	2	9·5	...	...
V.	27	54·	5	18·5	22	81·5	18	66·7	2	7·4	2	7·4	...	...
VI.	35	52·8	14	40·	21	60·	20	57·1	..	...	1	2·9	3	8·6
VII.	66	66·	14	21·2	52	78·8	41	62·1	7	10·6	4	6·1	1	1·5
VIII.	71	69·6	10	14·1	61	85·9	46	64·8	8	11·3	7	9·8	3	4·2
IX.	56	56·	16	28·6	40	71·4	37	66·1	2	3·6	1	1·7	4	7·1
X.	55	56·	10	18·2	45	81·8	32	58·2	10	18·2	3	5·4	2	3·6
(with particulars).	480		102	21·2	378	78·7	294	61·3	51	10·6	33	6·9	18	3·7

Since trawling, the method of fishing by which most of the marked plaice were taken, is prohibited in the Firth of Forth, the facts may be stated in another way. Of the total of 823 plaice which were marked and liberated, the percentage recaptured in the Firth of Forth was 12·4, and outside the Firth, 45·9; 35·7 per cent. were taken south of Kinnaird, 6·2 per cent. in the Moray Firth, 4 per cent. farther north and west, and only 2·2 per cent. south of the Firth of Forth.

Two experiments were also made 3 miles north-east of Fidra Light, with results very similar to those above described, the majority of the fish going to the northwards. In the first experiment, where 100 plaice were marked and liberated, 67 were recaptured. Of these, 8, or 11·9 per cent., were taken within the Firth of Forth, and 59, or 88·1 per cent., outside it. Seven, or 10·4 per cent., were got in the Moray Firth, and only 2, or 3 per cent., were recaptured south of the Firth of Forth. In the other experiment, of 100 fish liberated, 50 were captured, 10, or 20 per cent., in the Firth of Forth, and 40, or 80 per cent., outside the Firth. In this case, 3, or 6 per cent., were got in the Moray Firth, and 5, or 10 per cent., south of the Firth of Forth. The particulars are given in the following table:—

Expt.	Re-captured.		Inside Forth.		Outside Forth.		South of Kinnaird.		In Moray Firth.		Farther North & West.		South of Forth (56° N.).	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
I.	67	67·	8	11·9	59	88·1	46	68·7	7	10·4	6	9·	2	3·
II.	50	50·	10	20·	40	80·	36	72·	3	6·	1	2·	5	10·
(with particulars).	117	58·5	18	15·4	99	84·6	82	70·1	10	8·5	7	5·9	7	6·

## (2) ABERDEEN BANK.

The results at the station at Aberdeen Bank were somewhat different from those in the area of the Firth of Forth, a larger proportion of the marked plaice being got to the south of the station. This station lies at a considerable distance from shore, about 33½ miles S.E. by E. ½ S. from Aberdeen, the nearest land, and has a depth of 34–37 fathoms of water. The great majority of the fish moved shorewards towards the west, and about as many to the south as to the north. This was especially marked in the experiments made in the summer months. The following table shows the numbers, so far as the particulars serve, which were

found farther north than the latitude of the station ( $56^{\circ} 55' N.$ ) and farther south. Of a total of 720 recaptured, 380, or 52.8 per cent., were found to the north, and 319, or 44.3 per cent., to the south; 21 were recaptured in the same latitude. It will be observed that the proportion which went north was, as a rule, least in the experiments made in summer, and largest in those made in autumn.

Experi- ment.	Date.	To North.	To South.	Same Latitude.	Total.
I.	10 June 1910	102	86	5	193
II.	21 Oct. 1910	143	40	3	186
III.	19 July 1911	23	32	3	58
IV.	6 July 1912	23	36	—	59
V.	21 Sept. 1912	20	16	1	37
VI.	27 Mar. 1913	34	35	8	77
VII.	21 May 1913	14	52	1	67
VIII.	13 Nov. 1913	21	22	—	43
		380	319	21	720
		52.8	44.3	2.9	

As is shown in the section dealing with the migration of spawning fish, this seems to be due to the more marked northerly migration of the fish with ripening reproductive organs in autumn.

All the recaptured plaice from this station have been dealt with according to the first method referred to above for the experiments at 20 miles east of May. It will be seen from the following table that 84 fish were recaptured in the "north-and-east" quadrant, the mean direction being  $N. 33^{\circ} E.$ , the aggregate mileage 3661, and the average distance travelled 43.6 miles; when this line is placed on the chart, it passes north-east, parallel to the coast, to the latitude of Rattray Point. No less than 366 went to the "north-and-west," the mean direction in this case being  $N. 45^{\circ} W.$ , the aggregate mileage 15,143, and the average distance migrated 41.4 miles; this line, when placed on a chart, passes into Aberdeen Bay. To the "south-and-east" 36 fish were recaptured, the mean direction being  $S. 24^{\circ} E.$ , the aggregate mileage 1049, and the average distance migrated 29 miles; this line passes offshore to the south-east. To the "south-and-west" 229 fishes were recaptured, the mean direction of migration being  $S. 52^{\circ} W.$ , the aggregate mileage 7319, and the average distance migrated 32 miles; this line runs almost parallel to the coast, but a little more to the west, to nearly opposite the mouth of the Tay. It will be seen that the general westerly movement of the migrations above referred to is conspicuous, 595 of the fish being taken to the westward of the station, and 120 to the eastward.

Ex- peri- ment.	Date.	N. and E.				N. and W.				S. and E.				S. and W.			
		No. of Fish.	Aggre- gate Dis- tance.	Average Dis- tance.	Mean Direction.	No. of Fish.	Aggre- gate Dis- tance.	Average Dis- tance.	Mean Direction.	No. of Fish.	Aggre- gate Dis- tance.	Average Dis- tance.	Mean Direction.	No. of Fish.	Aggre- gate Dis- tance.	Average Dis- tance.	Mean Direction.
I.	10 June 1910	24	Miles. 530	Miles. 22	N. 35° E.	95	Miles. 3,324	Miles. 35	N. 35° W.	17	Miles. 427	Miles. 25	S. 48° E.	54	Miles. 1,495	Miles. 28	S. 54° W.
II.	21 Oct. 1910	32	1,987	62	N. 25° E.	128	7,418	58	N. 85° W.	3	82	27	S. 11° E.	30	714	24	S. 28° W.
III.	19 July 1911	6	390	65	N. 31° E.	26	447	17	N. 52° W.	2	43	21	S. 14° E.	22	813	37	S. 57° W.
IV.	6 July 1912	5	202	40	N. 34° E.	24	1,204	50	N. 31° W.	6	320	53	S. 21° E.	25	1,167	47	S. 59° W.
V.	21 Sept. 1912	5	175	35	N. 29° E.	18	265	15	N. 29° W.	1	4	4	S. 3° E.	11	293	27	S. 46° W.
VI.	27 Mar. 1913	7	323	46	N. 34° E.	38	1,216	32	N. 46° W.	4	72	18	S. 34° E.	24	761	32	S. 58° W.
VII.	21 May 1913	4	50	12	N. 25° E.	14	322	23	N. 50° W.	3	101	34	S. 38° E.	44	1,385	31	S. 56° W.
VIII.	13 Nov. 1913	1	4	4	N. 50° E.	23	947	41	N. 35° W.	...	...	...	..	19	691	36	S. 55° W.
		84	3,661	43.6	N. 33° E.	366	15,143	41.4	N. 45° W.	36	1,049	29	S. 24° E.	229	7,319	32	S. 52° W.

In Experiment I., 1 fish went 73° directly N., and 3 an aggregate of 67°, the mean being 22°, directly W.

In Experiment V., 2 went an aggregate of 20°, mean 10°, directly W., and 1 5° S.

In Experiment VI., 2 travelled an aggregate of 22°, mean 11° N., and 1 15° S.



## (3) FAIR ISLE.

Eight experiments were made in the neighbourhood of Fair Isle. The number of plaice marked and liberated was 940, of which 461, or 49 per cent., were recaptured. The fish were set free at five different localities, as detailed later on when dealing with the experiments (p. 217). The depths of water in these cases were very considerable, ranging from about 60 to 74 fathoms, that is to say, water much deeper than the plaice normally inhabits. As was to be expected in such circumstances, the movement of the fish was from the deeper to the shallower water near the coast, and the great majority were recaptured to the east of the Orkneys, or farther south, in the Moray Firth. Comparatively few were found to the north, but some were taken even to the north of Shetland, and a fair number at the little island of Foula, to the north and west. In the following table, the number of fish which have gone in the various directions, north-and-east, north-and-west, etc., have been tabulated according to the first method formerly described. It will be seen that, of 435 of the marked plaice which were recaptured, about which particulars exist, 283, or 65·1 per cent., moved to the south and west, the mean direction being S. 56° W., the aggregate mileage, 21,126, and the average distance, 75 miles; only 27, or 6·2 per cent., were taken to the south and east, the mean direction being S. 32° E., the aggregate mileage, 2666, and the mean distance, 99 miles; to the north and west, the number recaptured was 100, or 23 per cent., the mean direction being N. 39° W., the aggregate mileage, 3593, and the average distance, 36 miles; only 19, or 11·6 per cent., were taken to the north and east, the mean direction being N. 26° E., the total mileage, 900, and the average distance, 44 miles. Thus, 383 of the fish were found to the westward of the station.

Ex-periment.	Date.	N. and E.				N. and W.				S. and E.				S. and W.			
		No. of Fish.	Aggre-gate Dis-tance.	Average Dis-tance.	Mean Direction.	No. of Fish.	Aggre-gate Dis-tance.	Average Dis-tance.	Mean Direction.	No. of Fish.	Aggre-gate Dis-tance.	Average Dis-tance.	Mean Direction.	No. of Fish.	Aggre-gate Dis-tance.	Average Dis-tance.	Mean Direction.
I.	4 Nov. 1910	3	132	44	N. 8° E.	41	1,991	48	N. 55° W.	1	187	187	S. 33° E.	91	6,423	70	S. 67° W.
II.	15 Sept. 1910	1	8	8	N. 53° E.	...	...	...	...	4	252	63	S. 39° E.	7	314	45	S. 48° W.
III.	15 Sept. 1910	9	478	53	N. 39° E.	21	599	28	N. 37° W.	7	443	63	S. 39° E.	85	6,132	72	S. 60° W.
IV.	15 Sept. 1910	2	33	16	N. 45° E.	4	98	24	N. 28° W.	...	...	...	...	11	899	82	S. 55° W.
V.	11 Apr. 1911	2	163	81	N. 26° E.	11	130	12	N. 29° W.	2	306	153	S. 3° E.	15	1,053	70	S. 55° W.
VI.	12 Oct. 1911	1	63	63	N. 12° E.	4	191	48	N. 56° W.	4	656	164	S. 26° E.	31	3,106	100	S. 58° W.
VII.	19 June 1912	1	12	12	N. 7° E.	12	431	36	N. 45° W.	4	377	94	S. 45° E.	26	1,886	72	S. 54° W.
VIII.	22 Nov. 1912	1	11	11	N. 19° E.	7	153	22	N. 25° W.	5	445	89	S. 39° E.	17	1,313	78	S. 53° W.
		20	900	44	N. 26° E.	100	3,593	36	N. 39° W.	27	2,666	99	S. 32° E.	283	21,126	75	S. 56° W.

In Experiment II., 1 fish went 47' directly N., and 1 133' S.

In Experiment III., 1 fish went 14' directly W.

In Experiment IV., 1 fish went 5-5' W.

In Experiment VI., 1 fish went 83' W.

In determining the mean direction of migration of the experiments at Fair Isle, the second method previously referred to was also adopted, with results set forth in the following table :—

## ADULT MALES.

Experiment.	Date.	N. and E.			N. and W.		
		No. of Fish.	Distance.	Mean Direction.	No. of Fish.	Distance.	Mean Direction.
			Miles.			Miles.	
I.	4 Nov. 1910.	—	—	—	14	842·6	N. 72° W.
II.	15 Sept. 1910	1	8·	N. 53° E.	—	—	—
III.	Do.	3	115·5	N. 27° E.	4	135·5	N. 38° W.
IV.	Do.	1	1·	N. 29° E.	1	46·	N. 7° W.
V.	11 Apr. 1911.	1	79·	N. 27° E.	1	13·	N. 11° W.
VI.	12 Oct. 1911.	—	—	—	3	109·	N. 53° W.
VII.	19 June 1912.	—	—	—	3	152·2	N. 76° W.
VIII.	22 Nov. 1912.	—	—	—	2	23·9	N. 26° W.
		6			28		
			S. and E.			S. and W.	
I.	4 Nov. 1910.	—	—	—	47	3358·1	S. 63° W.
II.	15 Sept. 1910.	1	236·	S. 28° E.	3	107·9	S. 48° W.
III.	Do.	4	378·2	S. 7° E.	38	3046·1	S. 57° W.
IV.	Do.	—	—	—	3	325·3	S. 57° W.
V.	11 Apr. 1911.	—	—	—	7	482·7	S. 50° W.
VI.	12 Oct. 1911.	1	397·	S. 3° E.	9	929·8	S. 58° W.
VII.	19 June 1912.	—	—	—	5	379·7	S. 60° W.
VIII.	22 Nov. 1912.	2	293·6	S. 53° E.	10	799·7	S. 40° W.
		8			122		

## IMMATURE MALES.

Experiment.	Date.	N. and E.			N. and W.		
		No. of Fish.	Distance.	Mean Direction.	No. of Fish.	Distance.	Mean Direction.
			Miles.			Miles.	
V.	11 Apr. 1911.	—	—	—	1	16·	N. 59° W.
					1		
			S. and E.			S. and W.	
II.	15 Sept. 1910.	—	—	—	1	6·	S. 4° W.
III.	Do.	1	20·	S. 73° E.	—	—	—
IV.	Do.	—	—	—	1	106·5	S. 47° W.
VII.	19 June 1912.	—	—	—	1	190·	S. 27° W.
VIII.	22 Nov. 1912.	—	—	—	1	41·	S. 63° W.
		1			4		

## ADULT FEMALES.

Experiment.	Date.	N. and E.			N. and W.		
		No. of Fish.	Distance.	Mean Direction.	No. of Fish.	Distance.	Mean Direction.
			Miles.			Miles.	
I.	4 Nov. 1910.	2	45·9	N. 8° E.	22	828·7	N. 66° W.
III.	15 Sept. 1910.	2	148·6	N. 63° E.	12	300·6	N. 34° W.
IV.	Do.	—	—	—	3	51·3	N. 45° W.
V.	11 Apr. 1911.	1	84·	N. 25° E.	9	96·9	N. 29° W.
VI.	12 Oct. 1911.	—	—	—	1	81·	N. 56° W.
VII.	19 June 1912.	1	12·	N. 7° E.	8	198·8	N. 28° W.
VIII.	22 Nov. 1912.	—	—	—	4	82·6	N. 18° W.
		6			59		
			S. and E.			S. and W.	
I.	4 Nov. 1910.	—	—	—	31	1845·2	S. 74° W.
II.	15 Sept. 1910.	2	10·9	S. 42° E.	2	169·1	S. 84° W.
III.	Do.	—	—	—	37	2177·9	S. 55° W.
IV.	Do.	—	—	—	7	404·9	S. 52° W.
V.	11 Apr. 1911.	1	188·	S. 6° E.	6	368·5	S. 41° W.
VI.	12 Oct. 1911.	1	90·	S. 36° E.	19	1513·6	S. 54° W.
VII.	19 June 1912.	3	308·1	S. 41° E.	14	840·2	S. 55° W.
VIII.	22 Nov. 1912.	3	121·3	S. 42° E.	5	347·7	S. 53° W.
		10			121		

## IMMATURE FEMALES.

Experiment.	Date.	N. and E.			N. and W.		
		No. of Fish.	Distance.	Mean Direction.	No. of Fish.	Distance.	Mean Direction.
			Miles.			Miles.	
I.	4 Nov. 1910.	1	86·	N. 7° E.	5	104·3	N. 59° W.
III.	15 Sept. 1910.	4	182·4	N. 35° E.	3	56·7	N. 30° W.
IV.	Do.	1	32·	N. 62° E.	—	—	—
VI.	12 Oct. 1911.	1	63·	N. 12° E.	—	—	—
VII.	19 June 1912.	—	—	—	1	44·	N. 82° W.
VIII.	22 Nov. 1912.	1	11·	N. 19° E.	1	41·	N. 4° W.
		8			10		
			S. and E.			S. and W.	
I.	4 Nov. 1910.	1	187·	S. 33° E.	12	736·3	S. 40° W.
II.	15 Sept. 1910.	1	5·	S. 43° E.	1	30·	S. 24° W.
III.	Do.	2	35·3	S. 50° E.	9	442·4	S. 55° W.
V.	11 Apr. 1911.	1	118·	S. 1° E.	2	123·4	S. 39° W.
VI.	12 Oct. 1911.	2	168·5	S. 20° E.	2	225·7	S. 40° W.
VII.	19 June 1912.	1	56·	S. 57° E.	6	391·9	S. 28° W.
VIII.	22 Nov. 1912.	—	—	—	1	46·	S. 82° W.
		8			33		

It will be seen that, of the 164 adult males about which particulars exist, only 6 went to the north and east, 8 to the south and east, while 28 moved to the north and west. and no fewer than 122 to the south and west; in the last case the mean direction varied from S. 40° W. to S. 63° W. Of the 196 adult females about which

particulars exist, 6 moved to the north and east, 10 to the south and east, 59 to the north and west, and 121 to the south and west; the mean direction taken to the north and west in the different experiments ranged from N. 18° W. to N. 66° W., and the mean direction of those which migrated to the south and west was from S. 41° W. to S. 84° W. When drawn on a chart, these lines run as follows:— S. 63° W. passes into the Moray Firth, in a line with Tarbet Ness; S. 40° W. passes to Troup Head on the south coast of the Moray Firth, so that the mean direction, in this quadrant, of the experiments as a whole lies between Tarbet Ness and Troup Head, that is, on the south shore of the Moray Firth. In the north-and-west quadrant, the line N. 18° W. passes close to Foula, off the south-west coast of the Shetland Isles, and the line N. 66° W. passes close to the north of the Orkneys.

An interesting feature of the experiments at Fair Isle is the number of plaice which moved south, not only into the Moray Firth and its southern part, but travelled on, south of Rattray Head, to the east coast of Scotland. For instance, 26 were found to the south of Buchanness, a few of them near the Bell Rock or off the mouth of the Firth of Forth, others off the coast of Aberdeen. Thus, these fish migrated in a direction contrary to that of the majority which were marked on the east coast, that is to say, in the direction of the current instead of against it. It would appear that these fish, in moving from the deeper to the shallower water, continued their movement in the direction in which they began it. It is questionable whether the movement of the current in the depths at Fair Isle is anything like as strong as in the shallower water, and it is probable that it is this movement which is the important factor in directing the migration of the fish. Of the total number recaptured, 49 were taken to the west of the Orkneys, mostly on the north coast of Scotland, but 17 of them west and south-west of Cape Wrath.

### 3. THE SPAWNING MIGRATION.

Special attention has been given to the migratory movements of fish which were found to be "spawning" or "ripe," when captured, and charts have been prepared showing the migration of each "ripe" and "spawning" fish. The number of marked plaice recaptured, which were described as "spawning," was 216, viz. 146 males, 67 females, and 3 whose sex was not stated.

#### I. FISH DESCRIBED AS "SPAWNING."

##### (1) FIRTH OF FORTH.

From the experiments made at 20 miles east of the Isle of May, 21 of the plaice recaptured were "spawning," 14 males and 7 females. One of these fish was found in London, and the place where it was captured is unknown. Of the other 20, 18 were recovered to the north and east, at distances of from 16 to 238 miles, a male being taken 16 miles to the east of the Bell Rock; 11, 8 males and 3 females, were recaptured at Aberdeen Bank, or in its vicinity, at distances of from 37 to 55 miles; 3 were recaptured in the Moray Firth, 2 in the neighbourhood of Banff, and 1 off Dunrobin Castle; 2 were got to the east of the Orkneys, at distances of 164 and 173 miles; and 1 was recaptured 14 miles W.S.W. of Cape Wrath, at a distance of 238 miles. The mean rates of movement of these fish ranged from 1.1 to 17 miles per 10 days. One fish was recaptured 15 miles to the westward, near Carr Light, and another 3½ miles to the south-west of the station.

The number of "spawning" plaice recaptured from the experiments in the Firth of Forth between Elie and Fidra was 50, 30 males, 18 females, and 2 of unknown sex. The place of capture of all but 1 of the females was ascertained. Of the total, 46 had migrated to the north-and-east, and 3 to the south-and-east. Of those which were found to the north and east, 1 was taken within the limits of the Firth of Forth, ¾ of a mile off Pittenweem, Fife, at a distance of 5 miles; 2 north-east of Fife Ness, at distances of 17 and 28 miles; 3 east and south of the Bell Rock, at distances of 29 and 39 miles; 2 north-east of May Isle; 11 westward of Aberdeen Bank, at distances of from 58 to 75 miles; 1 off Aberdeen Bay, at 72 miles distant; 4 off Buchanness, at distances of from 81 to 90 miles; 15 in the Moray Firth; 12 on the south shore of it, at distances of from 127 to 174 miles, most of them near Banff;

and 3 on the north coast of the Firth, at 153 to 168 miles distant; 1 between the Orkney Islands, at 192 miles; 1 to the east of the Orkneys and south of Fair Isle, at 195 miles; 2 on the north coast of Scotland, at distances of 208 and 225 miles; and 1 at Loch Inchard, on the west coast of Scotland, at a distance of 256 miles. The 3 fish which were taken to the south and east had also travelled long distances. The first was caught 32 miles E.S.E. of Longstone Light, at a distance of 75 miles; the second 24 miles E. by S. of Hartlepool, at 122 miles distant; and the third 21 miles E. of Flamborough Head, at 161 miles distant. Of these, the sex of the first-mentioned was unknown, the second was a female, and the third a male.

It is of interest to note that plaice from the Firth of Forth migrated to the Moray Firth to spawn, and some of them did so with considerable speed. Thus, 2 liberated in November 1910, between Elie and Fidra, were recaptured, 1 off Banff, in January 1911, after 55 days, and the other off Lossiemouth, in March 1911, after 104 days, the rates of movement being respectively 24.7 and 15.6 miles per 10 days. The fish recovered at Loch Inchard was taken in March, after 114 days, the rate of speed being 22.4 miles, and 1 of those recaptured on the north coast was taken also in March, after 106 days, the rate of travel being 21.2 miles.

From the station, 3 miles from Fidra Light, 11 "spawning" plaice were recaptured, all to the north and east. Ten of these were from the first experiment on 5th December 1912, and of these 1 was taken off Fife Ness, at a distance of 11 miles; 2 were recaptured north-east of the Bell Rock, at distances of 33 and 40 miles; 2 south-east of Aberdeen, at distances of 68 and 69 miles; 1 south-east of Buchanness, at a distance of 99 miles; and 2 near Buchanness, at distances of 84 and 91 miles; the remaining 2 fish were found in the Moray Firth, 1 off Banff, at a distance of 145 miles, the other off Dunbeath, on the north coast, at a distance of 166 miles. A fish, liberated on 30th May 1913, at this station, was recaptured to the south-east of Aberdeen, at a distance of 67 miles, in January of the next year.

From the experiment in St. Andrew's Bay (3rd December 1913), two "spawning" males were recaptured, at 17 and 20 miles eastwards, south of the Bell Rock.

From the experiments at 40 miles east of the Isle of May, 12 "spawning" plaice were recaptured, 8 to the north and east, at distances of from 31 to 194 miles; 3 were recaptured in the neighbourhood of Aberdeen Bank, at distances of 31, 36, and 37 miles, 4 in the Moray Firth, 2 of them off Banff, at 108 and 109 miles distant, a third in the Dornoch Firth, at a distance of 139 miles, and the fourth off the Ord of Caithness, at 151 miles, 1, 30 miles E.N.E. of Sule Skerry, to the west of the Orkneys, at a distance of 194 miles. Four were taken to the north and west, 1 at Aberdeen Bay, 52 miles distant, another 5 miles E.N.E. of Stonehaven, 45 miles to the westward, and 2 E.N.E. of May Isle, at distances of 18 and 24 miles.

From the experiments at 50 miles east of the Isle of May, 7 "spawning" plaice were recaptured. One was taken 20 miles eastwards of the Isle of May, at a distance of 32 miles from the station; 3 were recaptured south-east of Aberdeen, near Aberdeen Bank, at 25 and 37 miles to the north and east, and 38 miles north; 1 was found 8 miles south-east of the Bell Rock, 36 miles to the west and north; another, in Eddrachilles Bay, Sutherland, on the west coast of Scotland, at a distance of 236 miles; and the last, 27 miles E. by S. of Hartlepool, 103 miles to the south and west.

Only one "spawning" plaice, a male, was recaptured from the experiments at 100 miles east of the Isle of May (Experiment II.); it was taken on Aberdeen Bank, 50 miles to the north and west of the station.

## (2) GREAT FISHER BANK.

One "spawning" female was recaptured from the experiment at Great Fisher Bank in July 1911; it was taken 99 miles to the north and west.

## (3) TOD HEAD.

One "spawning" fish, a male, was recovered from the experiment made off Tod Head in July 1912; it was taken 38 miles to the north and east, offshore, eastwards of Aberdeen.

## (4) ABERDEEN BANK.

Forty-two "spawning" plaice were recaptured from the experiments at Aberdeen Bank, 24 males, 17 females, and 1 whose sex was not recorded. Thirty-eight of these fish had migrated to the north and west, towards the coast of Aberdeen and the Moray Firth; 11 were recaptured at short distances to the north and west, off the coast of Aberdeen, at from 8 to 15 miles; 2 were taken off Buchan Ness, 1 at a distance of 26 miles, and the other at 35 miles; 1, 7 miles south-east of Aberdeen, at a distance of 26 miles, and 1 off Aberdeen Bay, at a distance of 30 miles; no less than 16 were got in the Moray Firth, 10 at or near Banff, at a distance of 77 miles, 4 on the north coast at from 104 to 110 miles, 1 in the Dornoch Firth, at a distance of 119 miles, and 1 off Burghead (on the south shore) at 106 miles distant; 3 were recaptured at the mouth of the Moray Firth, at 71, 88, and 103 miles distant; 2 on the north coast of Scotland, at 148 and 150 miles; 1 to the north-east of the Orkneys, at a distance of 140 miles; and 1 on the west coast of Scotland, 11½ miles W.S.W. of Cape Wrath, at a distance of 197 miles. Four were recovered to the south and west, at distances of from 20 to 45 miles.

## (5) ABERDEENSHIRE COAST.

We may include under this heading 6 "spawning" fish, 3 males and 3 females, recaptured from the experiment at Cruden Scaurs, off the coast of Aberdeen. Of these, 1 was taken 49 miles to the south and west, off the Bell Rock, a distance of 49 miles; 2 in the Moray Firth, 1 near Banff, at 61 miles distant, and the other in the Dornoch Firth, at a distance of 104 miles; 1 was found south-west from Rackwick Bay, on the west of the Orkneys, at a distance of 129 miles; 1, off Aukerry, to the east of the Orkneys, at a distance of 117 miles; and the sixth, 14 miles S.S.E. of Fair Isle, at a distance of 133 miles to the north and east.

One "spawning" male was recaptured from the experiment off Rattray Head; it was taken 6 miles off Clythness, in the Moray Firth, at a distance of 64 miles.

A "spawning" male was also recaptured from the experiment off Kinnaird Head: it was taken near Smith Bank, in the Moray Firth, at a distance of 33 miles.

## (6) MORAY FIRTH.

Nineteen fish, namely, 16 males and 3 females, were taken in a "spawning" condition from the experiments made at Smith Bank. Of these, 15 were recaptured within the Moray Firth itself; 9 were taken in the Dornoch Firth and near Tarbet Ness, at distances of from 27 to 44 miles; 7 were found on the north coast of the Firth, at distances of from 9 to 24 miles; of the remaining 3 fish, 2 were taken on the north coast of Scotland, at distances of 57 and 69 miles respectively, and the third 18 miles N.N.E. of Kinnaird Head, at a distance of 24 miles from the place of liberation.

From the experiment at Burghead Bay, on 12th December 1913, 9 "spawning" plaice, 7 males and 2 females, were recaptured; one of these was taken on the north coast of Scotland, at a distance of 105 miles, and all the others in the Moray Firth, 5 near Tarbet Ness, at distances of from 11 to 16 miles, 3 on the north coast, at 6, 17, and 28 miles.

From the experiment at Dornoch Firth, on 23rd April 1910, a male and a female in the "spawning" condition were recovered, both at a distance of 8 miles to the south-east of Tarbet Ness.

From the experiment off Covesea Light, on 27th July 1910, 1 "spawning" fish, a male, was recaptured, on the west coast, in the North Minch, at a distance of 152 miles.

From the experiments off Tarbet Ness, in April and September 1911, 5 "spawning" fish, 3 males and 2 females, were got; 3 were taken in the Moray Firth, 2 off Tarbet Ness, at 7 and 15 miles, and 1 off Clyth Ness, at a distance of 17 miles; of the other 2, 1 was recaptured on the north coast of Scotland, at a distance of 66 miles, and the other on the west coast, 16 miles W.S.W. of Cape Wrath, at a distance of 124 miles.

From the experiment at Nairn Bay, in November 1913, 3 "spawning" males were recaptured, 2 of them in the Dornoch Firth, at distances of 22 and 23 miles to the north and east, and 1 off Lybster, Caithness, 46 miles in the same direction.

#### (7) FAIR ISLE.

The number of "spawning" plaice recaptured from the experiments made at Fair Isle was 21, 16 males and 5 females. Of these, 18 were recaptured to the south and west; 4 to the east of the Orkneys, at 35 to 45 miles distant; 3 in the Moray Firth; 1 off Whitehills, Banff, at a distance of 109 miles, another 3 miles south of Clyth Ness, at a distance of 93 miles, the third 6 miles off Berriedale Ness, at a distance of 103 miles; 4 on the north coast of Scotland, at distances of from 100 to 112 miles to the south and west; 2 on the west coast, 1 at Scourie Bank, Eddrachilles Bay, and the other near Ru Stoer, North Minch, at distances of 131 and 178 miles; 2, 24 miles north-east of Kinnaird Head; 1, 7 miles S.S.E. of Buchanness, at a distance of 119 miles; 1, 9 miles E.S.E. of Buchanness, at a distance of 113 miles; and 1, 13 miles E.N.E. of Aberdeen, 126 miles to the south and west. One was recaptured near Foula, 117 miles to the north; 1, 9 miles N. by W. from Ronasvoe, Shetland, 81 miles to the north and west; and 1 at Scalloway, 46 miles to the north and west.

From what is stated above, the general northward movement of the "spawning" fish along the east coast is evident. Only 4 were recaptured to the south of the Firth of Forth (56° N. Lat.), namely, 3 from the experiments at the station between Elie and Fidra, and 1 from the experiments at 50 miles E. of the Isle of May. A large number were taken south-east of Aberdeen, in the neighbourhood of Aberdeen Bank, and in the Moray Firth, no fewer than 78, mostly in the Dornoch Firth or neighbourhood, off the Caithness coast, and in the vicinity of Banff, where 22 were recaptured. The great majority of the lines of migration are consistent with the relation to the prevailing current, that is to say, in the opposite direction to the movement of the water, the chief anomaly being a few fish which moved south towards the coast of Aberdeen from the neighbourhood of Fair Isle.

A special chart has been made showing, by a dot, the position where each "spawning" fish was recaptured. From south to north, the main localities are as follows:—(1) to the south-east of the Bell Rock; (2) at Aberdeen Bank; (3) Closer to the shore between Aberdeen and Buchanness; (4) In the Moray Firth, (a) off Banff, (b) the Dornoch Firth, and (c) the coast of Caithness. In connection with this distribution of "spawning" fish, however, it must not be forgotten that a very considerable amount of trawling takes place at Aberdeen Bank, and also cod-net and plaice-net fishing in the Moray Firth. The information is not, however, sufficient to make close analysis useful.

## II. FISH DESCRIBED AS "RIPE."

All the fish which were described as "ripe" on recapture were also tabulated and charts made showing their movements and places of recapture. The number so described was 203, viz. 154 males, 48 females, and 1 whose sex was not recorded.

#### (1) FIRTH OF FORTH.

Thirty fish, said to be "ripe," were recovered from the experiments made at 20 miles east of the Isle of May, 23 males and 7 females. Twenty-five of these were recaptured to the north and east, 2 to the north and west, 1 to the south and west, and 2 to the south and east. Three were got at 1½, 13, and 23 miles to the north and east; 7 were found near Aberdeen Bank, or on the coast of Aberdeen, at distances of from 36 to 57 miles; 1 was taken near Buchanness at a distance of 74 miles, and another 40 miles north-east of Buchanness, at 109 miles distant; 8 were recaptured in the Moray Firth, 6 on the south shore, of which 3 were taken off Banff, and 2 on the north coast, at 144 and 132 miles distant; 1 was recovered 25 miles to the north-east of Kinnaird Head, at a distance of 106 miles, and another 15 miles north of Kinnaird Head, at 106 miles distant; 1. 15 miles from Auskerry, east of the Orkneys, at a distance of 160 miles, and 1 on the north coast of Scotland,



at a distance of 215 miles. Of those which went south-east, 1 was got 35 miles E.S.E. of North Shields, at a distance of 97 miles, and 1, 158 miles E. by S. of North Shields, at 176 miles distant; 1 was taken 4 miles north of St. Andrews, 28 miles to the north and west; and another 8 miles to the north and west; 1 was recaptured 6 miles to the south and west.

Thirty-two "ripe" plaice, 22 males, 9 females and 1 of unknown sex, were got from the experiments between Elie and Fidra, in the Firth of Forth. The place of capture of 1 of the males was not ascertained, and another male was described as having been taken "183 miles north-east of Caithness" and cannot, therefore, be localised. None of the fish was recaptured within the Firth of Forth. Nine were taken at distances between 18 and 31 miles to the north and east, off May Isle and the Bell Rock, and 6 were found off the coast of Aberdeenshire, in the vicinity of Aberdeen, at distances of from 62 to 78 miles, and farther north 1 was got at 71 miles distant, 3 near Buchanness, at a distance of from 85 to 88 miles. Five were recaptured in the Moray Firth, at distances varying from 126 to 174 miles, and 2 on the north coast, at 211 and 214 miles distant. Four were recaptured to the south and east, at 25, 36, 45, and 122 miles, the latter, a male, on the Whitby grounds.

From the experiments at 3 miles from Fidra Light, 6 "ripe" plaice were recaptured, 3 males and 3 females. One was taken between the Carr Light and the Bell Rock, at a distance of 18 miles to the north and east; another, at 23 miles in the same direction; 1 near Aberdeen Bank, at a distance of 71 miles; 1 far off-shore, off the Aberdeenshire coast, at a distance of 106 miles to the north and east; and another to the east of the Orkneys, at a distance of 191 miles; the sixth, a female, was recaptured 26 miles to the south and west, opposite the mouth of the Firth of Forth.

Only 1, a male, was recaptured from the experiment in St. Andrew's Bay. It was taken to the east of the Isle of May, at a distance of 20 miles to the south and east.

Six "ripe" plaice were recovered from the experiment at 40 miles east of the Isle of May, 3 males and 3 females. Four were taken to the north and east, 1 off Tod Head, at a distance of 33 miles; another near Buchanness, at 60 miles; and 2 in the Moray Firth, 1 at Whitehills, Banff, at a distance of 110 miles, and the other near Clyth Ness, Caithness, at a distance of 135 miles. Two, both males, were got to the south and west, 1 at a distance of 8 miles, and the other at 25 miles, the latter to the east of St. Abb's Head.

Five, all males, were taken from the experiments at 50 miles east of the Isle of May, 1, 39 miles to the south and west, E.S.E. of the Isle of May; another south-east of the Bell Rock, at a distance of 30 miles to the north and west; a third, on the Whitby Grounds, 104 miles to the south and west; the fourth at Aberdeen Bank, 37 miles to the north and east; and the last in the Moray Firth, off Whitehills, Banff, at a distance of 110 miles.

## (2) GREAT FISHER BANK.

Eight were recaptured from the experiments at the Great Fisher Bank, 5 males and 3 females, 2 at 11 and 37 miles to the south and east, 1, 43 miles to the north and east, 3 to the south and west, at  $1\frac{1}{2}$ , 62, and 69 miles, and 2 to the north and west, at 137 and 156 miles, 1 of them on Aberdeen Bank.

## (3) ABERDEEN BANK.

The number of "ripe" plaice recovered from the experiments at Aberdeen Bank was 41, 33 males and 8 females. The place of capture of 1, a male, was not determined. Of the remaining 40, 28 had migrated to the north and west, 6 to the south and west, 3 to the north and east, 2 to the south and east, and 1 to the west. Nine were found to the north and west of the station, towards the coast of Aberdeen, at distances of from 4 to  $16\frac{1}{2}$  miles; 4 near Buchanness, at 32 and 35 miles; 12 in the Moray Firth, 6 of them on the south coast, 3 at Banff, 1 at the Dornoch Firth, and 5 off the coast of Caithness; 1 was recaptured on the north coast and 2 on the west coast, to the south-west of Cape Wrath; 1 was got 7 miles from Rackwick, west of the Orkneys, at a distance of 146 miles; 1 on the east of the Orkneys, at 127

miles to the north and east ; 1, 13 miles to the north and east of the station ; and another at a distance of 51 miles north and east. Of the 2 which migrated south and east, 1 was taken at a distance of 17 miles, and the other at 28 miles, both off shore. Of the 6 which went south-west, 1 was got at a distance of 21 miles, off Tod Head ; 1 off Fife Ness, at 52 miles distant ; and another E.S.E. of May Isle, at a distance also of 52 miles ; the fourth was got off Bell Rock, at a distance of 42 miles ; the fifth was recaptured 59 miles distant, 10 miles off the Isle of May ; and the sixth, 8 miles E.  $\frac{1}{2}$  S. of Tynemouth, at a distance of 114 miles.

#### (4) ABERDEENSHIRE COAST.

From the experiments south-east of Cruden Scaurs, 5 recaptured plaice were "ripe," 4 males and a female. They were all taken in the Moray Firth, 2 at Banff, at distances of 61 and 62 miles, 1 off Buckie, at 74 miles, and the other 2 on the coast of Caithness, at distances of 91 and 95 miles.

#### (5) MORAY FIRTH.

From the experiments at Smith Bank, 21 "ripe" fish, viz. 17 males and 4 females, were recaptured. Fifteen of these were taken in the Moray Firth, 10 to the north and west, at distances of from 5 to 42 miles, several in the neighbourhood of the Dornoch Firth, and the others on the Caithness coast ; 1, 23 miles to the west ; 2, 10, and 39 miles to the south and west ; 1, 14 miles to the north and east ; another, 12 miles to the north and east ; 1, off the mouth of the Pentland Firth, at a distance of 31 miles to the north and east ; and 4 on the north coast of Scotland, off Dunnet Head and Strathie Point, at distances of from 48 to 67 miles.

Ten, 6 males and 4 females, were recaptured from the experiment at Burghead Bay ; the position of 1 of the females was not ascertained ; of the others, 7 were taken in the Moray Firth, 1 at a position unspecified, and 5 of the others on the south coast, and 1 on the coast of Caithness, at distances of from 2 $\frac{1}{2}$  to 38 miles ; the other 2 were recaptured near Sule Skerry, off the north coast of Scotland, at distances of 106 and 110 miles.

From the experiments off Tarbet Ness, 8 were recaptured, viz. 6 males and 2 females. Six were taken at the mouth of the Dornoch Firth, at from 11 to 15 $\frac{1}{2}$  miles to the westwards, and the other 2 on the north coast of Scotland, near Strathie Point, at distances of 80 and 85 miles.

One "ripe" fish, a male, was recaptured from the experiment in Nairn Bay, in November 1913 ; it was taken near Tarbet Ness, 22 miles to the north and east.

#### (6) FAIR ISLE.

Twenty-nine "ripe" fish were recovered from the experiments near Fair Isle, 25 males and 4 females. Of these, 24 were found to the south and west, 3 at short distances, 15, 18, and 21 miles, towards the Orkneys ; 6 to the east and south-east of Auskerry, on the east side of the Orkneys, at distances of from 32 to 50 miles ; and 1 farther to the south-west, towards the Pentland Firth, at a distance of 57 miles ; 1 was recaptured off the Moray Firth, east of Noss Head, at a distance of 56 miles ; and other 3 south-east of Noss Head, at distances of 73, 76, and 105 miles ; 2 were recaptured near Banff, on the south coast, at distances of 116 and 117 miles ; 6 were taken on the north coast of Scotland, at distances of from 100 to 145 miles, and 1, 10 miles W.S.W. of Cape Wrath ; another was caught 6 miles S.E. of Tod Head, on the east coast, at a distance of 153 miles ; 1, 8 miles to the north and east ; 3 near Foula, Shetland, at 45 to 49 miles to the north and west ; and 1, 7 miles E.S.E. of Fetlar, at the north of the Shetlands, at a distance of 65 miles to the north and east.

### 4. RELATION OF THE MIGRATION TO THE PREVAILING CURRENT.

A considerable number of years ago, in papers published in the Annual Reports of the Fishery Board for Scotland, I showed that an important relation existed between the prevailing surface current in the North Sea, and the life-history of

food fishes.\* Since that time, many investigations have confirmed the close relationship that exists between the movements of the sea-water and the life-histories of edible fish. In this country, the investigations in particular of Professor Meek on the coast of Northumberland may be specially mentioned,† and among those on the Continent perhaps the most remarkable are those of Dr. Johan Hjort on the migratory movements of the cod on the north and west coasts of Norway. Although full information in regard to all species of fish has not yet been obtained, the results so far appear to justify the statement that, in the case of fishes with pelagic eggs, when the prevailing current carries these floating eggs in one direction—whether that be towards the south on the east coast of this country, or towards the north as on the west coast of Norway—there is a migration of the adult or adolescent fish in the opposite direction. The Norwegian experiments have shown that codfish may migrate from Finmarken to the Lofoten Isles, and even farther south to the coast of Romsdal, in connection with spawning, and return north again, a journey of many hundreds of miles, after spawning is over.

The experiments described in the present Report show that the great majority of the "spawning" plaice move northward and westward against the prevailing current. This fact is shown very clearly on the charts appended. It is evident, however, that this habit, in the case of the plaice, is not without exceptions, for a few of the "spawning" plaice were found to the south of the locality where they were liberated. As elsewhere stated, a striking feature of the experiments is the large number of adult plaice which pass from the Firth of Forth area northwards into the Moray Firth and there spawn. In several cases, the fish which were marked in the Firth of Forth, or off the Isle of May, in the late months of the year, were recaptured in a "spawning" or "ripe" condition in the Moray Firth in the early months of the following year, having in the interval made a rapid journey between the two firths. On the other hand, there are some instances, referred to in the text of this Report, which show that an adult plaice may remain a long time in the same locality in which it was liberated, and spawn there; this seems to be true more particularly of the very large fish. It is evident, therefore, that, while there is a general migration, for spawning purposes, of the plaice in the contrary direction to the current, it cannot be said that the habit is a rigid one.

### III. GROWTH.

The rate of growth of the plaice has now been tolerably well established by the numerous researches which have been made on the subject, particularly in connection with the International Fishery Investigations. The matter will, therefore, be only briefly considered here. In the case of recaptured fish, which were sent on to the laboratory and came into my possession, it was customary to keep them covered for a day, or longer, in a wet cloth, until the tail fin was quite soft, and the measurement of length was then made. In the case of fish landed at English or foreign ports, however, only the records were available to me, and it is evident from them that the fish, in many cases, when measured, were more or less dry, so that the length was not the true length. This was especially noteworthy in records from German ports, the measurement in some instances being less than the length of the fish when it was liberated, even although several months had elapsed before it was recaptured.

In these experiments, as in those described in my former Report, it was noticeable that the marked plaice, recaptured within a short period after their liberation, usually showed no increase in length, and often a measurable decrease. This was most noticeable in the experiments which were made in the winter months, when growth is naturally slow, or arrested altogether, but it was by no means confined to these months. In experiments in spring and in summer, the same thing was

\* (1) "The Relation of Marine Currents to Offshore Spawning Areas and Inshore Nurseries." 13th S.F.B. Report, Part III., pp. 153-164 (1894).

(2) "The Currents of the North Sea and their Relation to Fisheries." 15th S.F.B. Report, Part III., pp. 334-395 (1896).

(3) "An Additional Note on the Surface Currents of the North Sea." 18th S.F.B. Report, Part III., pp. 370-381 (1891).

† Northumberland Sea Fisheries Committee. Reports on the Scientific Investigations.

observed, and the probable explanation is that the handling and marking of the fish interferes with feeding and growth for some time.

### 1. FISH RECAPTURED AFTER ONE YEAR OR MORE.

The results have been tabulated for some of the experiments. In the ten experiments made between Elie and Fidra (p. 36), the number of marked plaice recaptured after an interval of from one to two years of freedom was 127, viz. 58 males and 69 females. The particulars are shown in the following table :—

Date Liberated.	No. of Fish.	Days Free.	Date Caught.	Place Recaptured.	Sizes.		Growth.	Rate per 10 Days.
					Lib.	Recap.		

#### EXPERIMENT I.

##### MALES.

25th Nov. 1910.	A. 1650	455	Feb. 1912.	4' N. of Tarbet Ness	31·5	37·4	5·9	·13
	1669	453	Do.	18' E.S.E. of Aberdeen.	35·	38·4	3·4	·07
	1610	475	Mar. 1912.	7' S.S.E. of Buchanness.	39·	39·7	·7	·01
	1696	480	Do.	2' off Banff.	33·	36·1	3·1	·06
	1658	546	May 1912.	Stormy Bank.	40·5	46·3	5·8	·1
	1646	670	Sept. 1912.	28' E. of May.	36·5	38·2	1·7	·02
	1659	721	Nov. 1912.	30' E. of Aberdeen.	31·5	41·2	9·7	·13

##### FEMALES.

	1670	397	Dec. 1911.	7' S.E. of Buchanness.	37·	41·6	4·6	·11
	1651	487	Mar. 1912.	16' E.N.E. of Aberdeen.	41·5	47·1	5·6	·11
	1676	469	Do.	10' E.N.E. of May.	40·5	46·6	6·1	·13
	1683	464	Do.	18' E.S.E. of Aberdeen.	36·	39·6	3·6	·08
	1667	586	July 1912.	14' E. $\frac{1}{2}$ S. of Auskerry.	36·5	45·7	9·2	·16
	1685	597	Do.	30' E./S. $\frac{1}{2}$ S. of Aberdeen.	37·	46·1	9·1	·15
	1671	668	Sept. 1912.	30' S.E./E. $\frac{1}{4}$ S. of Buchanness	36·5	47·8	11·3	·17

#### EXPERIMENT II.

##### MALES.

8th Feb. 1911.	1820	383	Feb. 1912.	1' off Largo.	29·	33·3	4·3	·1
	1850	376	Do.	26' S.E./E. of Aberdeen.	34·5	38·2	3·7	·09
	1835	391	Mar. 1912.	4' off Pennan Head.	35·	40·5	5·5	·14
	1848	387	Do.	7' N.N.E. $\frac{1}{2}$ E. of Troup Head.	32·5	37·	4·5	·12
	S. 217	391	Do.	$\frac{1}{2}$ ' off Pittenweem.	29·	35·8	6·8	·17
	244	400	Do.	6' off Brora.	32·5	37·	4·5	·14
	251	413	Do.	4' S.S.E. of Collieston.	33·	37·8	4·8	·12
	207	444	Apr. 1912.	63' E./S. of Girdleness.	37·	41·2	4·2	·09
	227	545	Aug. 1912.	28' E.S.E. of Bass Rock.	30·	35·5	5·5	·1
	245	663	Dec. 1912.	4' E.S.E. of Cruden Scours.	34·5	40·	5·5	·08

Date Liberated.	No. of Fish.	Days Free.	Date Caught.	Place Recaptured.	Sizes.		Growth.	Rate per 10 Days.
					Lib.	Recap.		

EXPERIMENT II.—*continued.*

## FEMALES.

A. 1830	400	Mar. 1912.	Moray Firth.	33·5	45·	11·5	·28
S. 209	421	Apr. 1912.	17' E.N.E. of Aberdeen	38·	44·9	6·9	·16
214	421	Do.	29' E. $\frac{1}{4}$ N. of St. Abbs.	37·5	44·	6·5	·15
A. 1811	465	May 1912.	8' S.S.E. $\frac{3}{4}$ S. of Clyth Ness.	43·	47·	4·	·08
S. 219	505	June 1912.	27' E.S.E. of Aberdeen.	35·5	43·6	8·1	·16
220	532	July 1912.	35' E.N.E. of May.	41·5	47·9	6·4	·12
233	559	Aug. 1912.	10' E.N.E. of Rattray.	31·5	43·3	11·8	·21
A. 1841	575	Sept. 1912.	22' N.E./E. of Buchanness.	37·	45·	8·	·13
1846	663	Dec. 1912.	30' E.S.E. of Bell Rock.	34·	45·2	11·2	·16

## EXPERIMENT III.

## MALE.

21st Mar. 1911.	S. 349	714	Mar. 1913.	4' off Occumster.	29·5	37·2	7·7	·11
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## FEMALES.

A. 1933	407	May 1912.	40' E.S.E. of Bass Rock.	32·5	39·5	7·	·17
S. 351	458	June 1912.	12' E./N. of May Island.	32·5	40·1	7·6	·16
A. 1938	450	Do.	25' E./N. of May.	30·	40·6	10·6	·23
S. 341	472	July 1912.	10' N.E. of Bell Rock.	30·	37·4	7·4	·16

## EXPERIMENT IV.

## MALES.

25th Apr. 1911.	S. 485	415	June 1912.	35' N.E./E. of May.	32·	38·8	6·8	·16
	478	437	July 1912.	10' E./S. of May.	32·	37·1	5·1	·12
	496	482	Aug. 1912.	20' E./S. of May.	31·	38·7	7·7	·16
	487	711	Apr. 1913.	5' N. $\frac{1}{4}$ E. of Buckie.	32·	41·4	9·4	·13

## FEMALES.

	484	394	May 1912.	30' E. $\frac{1}{2}$ N. of May.	30·	37·9	7·9	·2
	475	666	Feb. 1913.	15' S.E. of Bell Rock.	36·5	44·9	8·4	·13
	497	668	Do.	22' S.E. of Aberdeen.	34·	47·2	13·2	·2

## EXPERIMENT V.

## MALES.

19th June 1911.	A. 3025	380	July 1912.	50' N./W. of Rattray.	33·	36·6	3·6	·09
	S. 535	730	June 1913.	13 $\frac{1}{2}$ ' N.N.E. $\frac{1}{2}$ E. of Banff.	31·	34·	3·	·04

## FEMALES.

	A. 3013	387	July 1912.	Moray Firth.	40·5	47·	6·5	·17
	3020	517	Nov. 1912.	60' E./N. of Bell Rock.	37·	41·3	4·3	·08

Date Liberated.	No. of Fish.	Days Free.	Date Caught.	Place Recaptured.	Sizes.		Growth.	Rate per 10 Days.
					Lib.	Recap.		
EXPERIMENT VI.								
MALES.								
7th Sept. 1911.	A. 3422	371	Sept. 1912.	12' E. of May.	35·	39·5	4·5	·12
	3392	508	Jan. 1913.	26' S.E./E. of Aberdeen.	34·	40·7	6·7	·13
	3410	527	Feb. 1913.	24' S.E. of Aberdeen.	34·	36·2	2·2	·04
	3428	567	Mar. 1913.	29' E./S. $\frac{1}{2}$ S. of Tod Head.	32·5	36·4	3·9	·07
	S. 687	592	Apr. 1913.	2' S.S.W. of Largo.	31·	36·8	5·8	·09
FEMALES.								
	A. 3394	370	Sept. 1912.	16' E. of May Island.	30·5	37·5	7·	·19
	S. 695	393	Oct. 1912.	$\frac{3}{4}$ ' off shore between Craill and Anstruther.	29·	36·5	7·5	·19
	A. 3377	571	Mar. 1913.	24' S.E./S. of Aberdeen.	33·5	39·9	6·4	·11
	3409	551	Do.	16' E./S. of May.	37·5	44·1	6·6	·12
	3378	637	June 1913.	10' E.S.E. of Bass Rock.	35·	39·7	4·7	·07
? SEX.								
	3391	527	Feb. 1913.	20' S.E. of Aberdeen.	33·5	37·9	4·4	·08
	3384	623	May 1913.	$\frac{3}{4}$ ' off River Ugie.	33·5	41·2	7·7	·12
	3396	658	June 1913.	..	30·5	39·5	9·	·14

## EXPERIMENT VII.

## MALES.

6th Mar. 1912.	A. 4119	374	Mar. 1913.	26 $\frac{1}{2}$ ' E.S.E. of Copinshay.	35·5	42·	6·6	·17
	4135	385	Do.	30' E.S.E. of Start Point	36·5	39·3	2·8	·07
	4145	433	May 1913.	26' E.N.E. of May.	38·5	43·8	5·3	·12
	S. 794	498	July 1913.	Moray Firth.	29·5	35·	5·5	·11
	A. 4117	562	Sept. 1913.	47' N. $\frac{1}{2}$ W. of Rattray Head.	36·	42·4	6·4	·11
	4163	579	Oct. 1931.	14' E.N.E. of May.	33·5	40·2	6·7	·11
	S. 791	659	Dec. 1913.	16' S. of Bell Rock.	31·5	39·9	8·4	·13

## FEMALES.

	A. 3998	392	Apr. 1913.	2 $\frac{1}{2}$ ' E./N. of Tarbet Ness.	41·	44·2	3·2	·08
	4154	442	May 1913.	7' S.E./E. of Buchanness.	33·	39·7	6·7	·15
	4160	444	Do.	20' E./S. $\frac{1}{4}$ S. of Buchanness.	40·	45·6	5·6	·13
	4171	435	Do.	12' E.N.E. of Aberdeen.	36·	42·6	6·6	·15
	4129	471	June 1913.	2 $\frac{1}{2}$ ' E./N. $\frac{1}{4}$ N. of Noss Head.	39·5	45·	5·5	·11
	4161	463	Do.	3' E. of Bell Rock.	36·	41·2	5·2	·11
	S. 804	489	July 1913.	10' E. of Bass Rock.	30·	38·3	8·3	·17
	4162	532	Aug. 1913.	50' E. $\frac{1}{2}$ S. of Aberdeen.	44·	48·2	4·2	·08
	4121	618	Nov. 1913.	16' E./N. of Aberdeen.	39·	46·4	7·4	·12
	4143	721	Feb. 1914.	Moray Firth.	36·	44·	8·	·1

Date Liberated.	No. of Fish.	Days Free.	Date Captured.	Place Recaptured.	Sizes.		Growth.	Rate per 10 days.
					Lib.	Recap.		

## EXPERIMENT VIII.

## MALES.

24th Apr. 1912.	4418	366	Apr. 1913.	7' N.N.E. of St. Abb's Head	38·5	40·9	2·4	06
	4452	366	Do.	40' E.S.E. of Bass Rock.	32·	37·5	5·5	·15
	4447	376	May 1913.	8' S.E. of May.	34·	38·6	4·6	·12
	4432	418	June 1913.	7' S.E. of Pentland Skerries.	33·	37·6	4·6	·11
	4443	409	Do.	30' S.E./S. of Aberdeen.	35·5	39·1	3·6	·09
	A. 4384	695	Mar. 1914.	7' N.E. of Bell Rock.	35·5	43·2	7·7	·11
	S. 830	680	Do.	5' of S. Buchanness.	30·	37·	7·	·10
	A. 4428	724	Apr. 1914.	183' N.E. of Caithness.	39·	42·5	3·5	·05

## FEMALES.

	A. 4392	344	Apr. 1913.	7' S.S.E. of Aberdeen.	34·	38·8	4·8	·14
	4414	351	Do.	4' E./N. of Tarbet Ness.	35·	39·3	4·3	·12
	4383	375	May 1913.	47' E. $\frac{1}{2}$ S. of Aberdeen.	34·5	39·6	5·1	·14
	4435	386	Do.	Largo Bay.	45·	51·	6·	·16
	4444	393	Do.	18' N.E. of Buchanness.	35·	41·5	6·5	·16
	4454	428	June 1913.	30' E. $\frac{1}{2}$ S. of Aberdeen.	40·5	45·8	5·3	·12
	4424	462	July 1913.	26' S.E./E. $\frac{1}{2}$ E. of Aberdeen.	41·5	46·4	4·9	·11
	S. 812	435	Do.	5' E. $\frac{1}{2}$ N. of Bell Rock.	32·5	41·1	8·6	·2
	816	484	Aug. 1913.	16' E. $\frac{1}{2}$ S. of May.	31·5	42·2	10·7	·22
	4460	559	Nov. 1913.	7-8' E.S.E. of Tod Head.	35·5	48·5	13·	·05
	S. 829	584	Do.	16' E.S.E. of Bell Rock.	33·5	41·1	7·6	·13
	A. 4411	638	Jan. 1914.	1 $\frac{1}{2}$ ' off Whitehills.	47·	49·5	2·5	·04
	4398	672	Feb. 1914.	5-6' N.E. $\frac{1}{2}$ E. of Strathie Point.	40·	49·	9·	·13
	4455	656	Do.	4' off Pennan.	44·	49·2	5·2	·08
	S. 811	707	Apr. 1914.	26' E.S.E. of Aberdeen.	33·	40·	7·	·8

## ? SEX.

	A. 4450	688	Mar. 1914.	16' E.N.E. of May.	38·5	44·7	6·2	·09
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## EXPERIMENT IX.

## MALES.

9th May 1912.	A. 4638	381	May 1913.	9' S.E. of Buchanness.	33·5	35·9	2·4	·06
	4613	515	Oct. 1913.	14' E.N.E. of May.	37·	40·2	3·2	·06
	4618	594	Dec. 1913.	12' E.N.E. of North Shields.	38·	41·	3·	·05
	4593	617	Jan. 1914.	20' S.E. of Aberdeen.	30·	37·4	7·4	·12
	4595	625	Do.	2' W. of May.	33·	39·8	6·8	·11
	4642	610	Do.	3' S.E. of Bell Rock.	42·	42·4	4·	·01
	4611	675	Mar. 1914.	Off Flamboro' Head.	34·	40·	6·	·09
	4646	683	Do.	16' E.N.E. of May.	31·5	36·8	5·3	·08
	4654	690	Do.	20' E.N.E. of May.	34·5	37·5	3·	·04

Date Liberated.	No. of Fish.	Days Free.	Date Captured.	Place Recaptured.	Sizes.		Growth.	Rate per 10 days.
					Lib.	Recap.		

EXPERIMENT IX.—*continued.*

## FEMALES.

4591	418	July 1913.	10' E.S.E. of Bass Rock.	43·	47·4	4·4	·1
4570	495	Sept. 1913.	28' E./N. of May.	53·5	42·8	10·7	—
4621	482	Do.	30' S.S.E. of Aberdeen.	38·5	44·1	5·6	·12
4619	616	Jan. 1914.	20' E.S.E. of Bass Rock.	42·5	49·2	6·7	·11
4627	623	Do.	1½' off Whitehills.	36·	41·	5·	·08
4584	621	Do.	90' N.E./N. of Longstone Light.	31·	37·3	6·3	·10
4641	659	Feb. 1914.	½' off Pittenweem.	33·	34·3	1·3	·02
4574	663	Mar. 1914.	6' E. of Blyth.	51·5	53·9	2·4	·04
4600	678	Do.	17' S.E. ½ E. of Berriedale Head.	38·5	43·5	5·	·07
4650	698	Apr. 1914.	7' S.E./E. of Buchanness.	27·5	38·1	10·6	·15

## EXPERIMENT X.

## MALES.

26th Mar. 1913.	S. 1296	379	Apr. 1914.	25' N. of Kin-naid.	33·	40·	7·	·18
	A. 5037	474	July 1914.	40' S. E. of Aberdeen.	35·	39·5	4·5	·09

## FEMALES.

5001	365	Mar. 1914.	1' off Pittenweem.	43·5	48·	4·5	·12
S. 1295	399	Apr. 1914.	7' S.S.E. of Buchanness.	31·	42·	11·	·27
A. 5004	429	May 1914.	7' S.E. of Aberdeen.	39·	44·8	5·8	·13
S. 1302	401	Do.	8' S.E. of Aukerry.	32·5	42·3	9·8	·24
A. 2962	464	July 1914.	20' E. of Buchanness.	38·5	47·5	9·	·19
S. 1304	519	Aug. 1914.	8' S.E. of Buchanness.	34·5	40·8	6·3	·12
5015	634	Dec. 1914.	7' N.E./E. ½ E. of Aberdeen.	41·5	43·2	6·7	·10

It will be seen that the amount of growth, and the calculated rate of growth per 10 days, varied very considerably in different cases. In considering the measurements, various things have to be taken into account. Thus, the smaller fish (under adult size) grow more rapidly than the older and larger fish of the same sex; secondly, growth is well known to take place chiefly in the summer months, and may be almost or completely arrested in winter, and some of the fish in the table had the growth of two summers; thirdly, as the table shows, many of the fish were got at a great distance from the place of liberation, and it is known that in certain localities, as, for example, the Moray Firth, growth is more rapid than it is in other localities, as in the Firth of Forth and neighbourhood. It does not appear, therefore, to be necessary to discuss these measurements in detail.

Similar tables have been made for the fish which were at liberty for longer periods than that referred to above. Thus, 30, viz. 12 males and 18 females, were recaptured after having been between 2 and 3 years at liberty.



Date Liberated.	No. of Fish.	Days Free.	Date Caught.	Place Caught.	Sizes.		Growth.	Rate per 10 Days.
					Lib.	Recap.		

## EXPERIMENT I.

## MALE.

25th Nov. 1910. | A. 1627 | 820 | Feb. 1913. | 26' N. of Buckie. | 36·5 | 42·1 | 5·6 | ·06

## FEMALES.

1655	759	Dec. 1912.	40' E. of May.	36·5	43·	6·5	·08
1625	837	Mar. 1913.	16' E./S. of May.	36·	45·5	9·5	·11
1697	857	Do.	1½' off Banff.	41·5	45·8	4·3	·05
1641	1074	Nov. 1913.	39' S.E./E. ¼ S. of Tod Head.	33·	44·5	11·5	·11

## EXPERIMENT II.

## MALES.

8th Feb. 1911. | S. 236 | 748 | Feb. 1913. | 1½' off Banff. | 35·5 | 40· | 4·5 | ·06  
 221 | 892 | July 1913. | 5' S.S.W. of Co-pinshay. | 32·5 | 43·9 | 11·4 | ·13

## FEMALES.

A. 1828	861	June 1913.	4' E./N. ¼ N. of Lossiemouth.	33·	41·	8·	·09
1809	889	July 1913.	1' off Kirkcaldy.	45·5	51·9	6·4	·07

## EXPERIMENT III.

## MALES.

21st Mar. 1911. | S. 343 | 742 | Apr. 1913. | 1½' off Whitehills. | 28·5 | 36·5 | 8· | ·11  
 346 | 1082 | Mar. 1914. | 5' E. of Berriedale Head. | 31·5 | 39·2 | 7·7 | ·07

## EXPERIMENT IV.

## FEMALE.

25th Apr. 1911. | S. 499 | 837 | Aug. 1913. | 30' E. of Bell Rock. | 35· | 47·1 | 12·1 | ·14

## EXPERIMENT V.

## MALES.

19th June 1911.	S. 545	892	Nov. 1913.	6' E./N. ½ N. of Aberdeen.	33·	39·8	6·8	·08
	550	1002	Mar. 1914.	10' E.S.E. of Bell Rock.	30·5	42·9	12·4	·12

## FEMALE.

A. 3003	915	Dec. 1913.	10' E.N.E. of May.	39·	48·4	9·4	·1
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Date Liberatéd.	No. of Fish.	Days Free.	Date Caught.	Place Caught.	Sizes.		Growth.	Rate per 10 days.
					Lib.	Recap.		

## EXPERIMENT VI.

## MALE.

7th Sept. 1911. | A. 3411 | 883 | Feb. 1914. | Whitby Grounds. | 34· | 39· | 5· | ·06

## ? SEX.

| S. 686 | 764 | Oct. 1913. | 50' off Bell Rock. | 31· | 37·9 | 6·9 | ·09

## EXPERIMENT VII.

## MALE.

6th Mar. 1912. | S. 805 | 743 | Mar. 1914. | 24' S.S.E. of Aberdeen. | 30·5 | 36·4 | 5·9 | ·08

## FEMALES.

A. 4127	751	Mar. 1914.	25' E.N.E. of	37·5	48·7	11·2	·15
			May.				
4130	728	Do.	1' off Whitehills.	39·	45·4	6·4	·09
S. 799	748	Do.	26' S.E./E. $\frac{1}{2}$ E. of Aberdeen.	31·	37·8	6·8	·09
A. 4174	776	Apr. 1914.	24' S.S.E. of Aberdeen.	37·	45·2	8·2	·1
4024	822	June 1914.	40' N.N.E. of Longstone.	39·5	43·	3·5	·04
4133	982	Nov. 1914.	8' E.S.E. of Aberdeen.	41·5	54·1	12·6	·13

## EXPERIMENT VIII.

## MALES.

24th Apr. 1912. | S. 823 | 818 | July 1914. | 50' E.S.E. of Aberdeen. | 32·5 | 41·7 | 9·2 | ·1

| 820 | 1074 | Apr. 1915. | 8' E.S.E. of May. | 31· | 38·3 | 7·3 | ·07

## FEMALE.

| A. 4438 | 757 | May 1914. | 24' S.E. of Noss. | 37· | 46·5 | 9·5 | ·12

## EXPERIMENT IX.

## MALE.

9th May 1912. | A. 4596 | 1054 | Mar. 1915. | 25' S.E./E. of Aberdeen. | 35· | 44·1 | 9·1 | ·09

## FEMALES.

4624	813	Aug. 1914.	5' E./N. of Bell Rock.	30·	43·1	13·1	·29
4658	957	Dec. 1914.	24' S.E./E. of Aberdeen.	33·5	46·	12·5	·13
4578	1031	Mar. 1915.	20' E./S. of Bell Rock.	35·5	43·7	8·2	·08

## EXPERIMENT X.

## NIL.

One male and 3 females were recaptured between 3 and 4 years after they were liberated. The male (Stud No. 235) was recovered in September 1914, near Fair Isle, that is, after 1306 days, and had increased in length from 34 to 43·1 cm., a total increase of 9·1 cm., or ·07 cm., per 10 days, over the whole period. The 3 females were all of small size when liberated; 1 (Stud No. 242) was recovered in April 1914, after 1148 days, off North Shields; it measured 32·5 cm. when liberated and 47·5 cm. when recaptured, an increase of 15 cm., or at the rate of ·13 cm. per 10 days. The second female (No. 855) was recaptured in August 1914, after 1220 days, at Aberdeen Bank; it had increased from 32 to 44·2 cm., a growth of 12·2 cm. in the period, or at the rate of ·1 cm. per 10 days. The third female (No. 543) had increased from 30·5 to 43·5 cm., or 13 cm. in the period, which is at the rate of ·1 cm. per 10 days.

A male and 2 females were recaptured after 4 years of freedom. The male (Stud No 692) was taken in January 1916, after 1604 days, 21 miles off Flamborough Head; it had grown from 22·5 to 37·7 cm., a total increase of 15·2 cm., or at the mean rate of ·09 cm. per 10 days. One of the females (A. 1617) was taken in December 1914, after 1476 days, near Aberdeen Bank; it had increased from 42·5 to 55·3 cm., a total of 12·8 cm., or at the rate of ·08 cm. per 10 days; this was a large fish when it was liberated. The other female (Stud No. 696) was got in April 1916, after 1682 days, E.S.E. of the Bell Rock; it had grown from 28 to 44·2 cm., a total increase of 16·2 cm., or at the rate of ·09 cm.

The marked fish which were recaptured after an interval of years in other experiments were also tabulated. The number taken between 2 and 4 years after liberation was 21, 11 males and 10 females. In the case of 1 male and of 1 female, the measurements were not ascertained. Moreover, the measurements of one of the females were obviously wrong, since, in 1197 days, it had grown, according to the record, only from 39 to 39·9 cm., an increase of less than one centimetre after three summers' freedom. The true length of this fish was probably 49·9 cm. on recapture, showing a growth of 10·9 cm., but, as there is doubt about it, it is omitted. The particulars of the other fish are given in the following table :—

[TABLE.

## FISH AT LIBERTY FOR 3 TO 4 YEARS.

Place of Liberation.	Date.	No. of Mark.	Days Free.	Date of Recapture.	Place of Recapture.	Size.		Growth.	Rate of Growth per 10 days
						Liberated.	Recap.		
MALES.									
40' E. of May	12th June 1912	S. 836	1377	March 1916	8' N.N.E. of Sarclet	29.5 cm.	38.4 cm.	8.9 cm.	.06 cm.
Aberdeen Bank	10th June 1910	S. 27	1398	April 1914	6' E./N. of Clyth Ness	36.5 "	44.4 "	7.9 "	.05 "
Do.	21st Oct. 1910	A. 1294	1180	Jan. 1914	25' S.E. ½ E. of Aberdeen	34. "	36.2 "	2.2 "	.02 "
Do.	21st Oct. 1910	A. 1094	1326	June 1914	10' S.E. of Fair Isle	36.5 "	49.2 "	12.7 "	.09 "
Fair Isle	4th Nov. 1910	A. 1449	1175	Jan. 1914	14' off Whitehills	34. "	44.5 "	10.5 "	.09 "
Do.	11th April 1911	S. 395	1132	May 1914	14' E./S. ½ S. of Aukery	36. "	47.5 "	11.5 "	.1 "
Do.	11th April 1911	S. 399	1349	Dec. 1914	9' E.S.E. of Buchanness	29. "	45. "	16. "	.11 "
Great Fisher Bank	14th July 1911	A. 3139	1117	August 1914	174' E./S. of Aberdeen	34.5 "	44.2 "	9.7 "	.08 "
Do.	16th June 1910	A. 339	1314	Jan. 1914	30' S.E./E. of Aberdeen	33. "	45.6 "	12.6 "	.09 "
Nairn Bay	12th Nov. 1913	A. 6079	1155	Feb. 1917	5' N.N.E. of Tarbet Ness	43. "	47.8 "	4.8 "	.04 "
FEMALES.									
Aberdeen Bank	10th June 1910	A. 32	1447	May 1914	18' S.S.E. of Aberdeen	36.5 "	48. "	11.5 "	.07 "
Do.	6th July 1912	A. 2206	1188	Oct. 1915	23' S.E./E. of Aberdeen	34.5 "	52. "	17.5 "	.15 "
Do.	27th Mar. 1913	A. 5144	1457	March 1917	Lossiemouth	36. "	45.9 "	9.9 "	.07 "
Fair Isle	4th Nov. 1910	A. 1428	1301	May 1914	8-9' S.S.E. of Fair Isle	40. "	54.5 "	14.5 "	.1 "
Do.	4th Nov. 1910	A. 1466	1313	June 1914	8' S.E. of N. Lighthouse	37.5 "	52.3 "	14.8 "	.1 "
Smith Bank	27th Mar. 1913	A. 5257	1098	Dec. 1916	2' off Lybster	35. "	50.8 "	15.8 "	.14 "
St. Andrews' Bay	3rd Dec. 1913	A. 6199	1105	Dec. 1916	30' E.S.E. of Aberdeen	35. "	48.9 "	13.9 "	.12 "
Rattray Head	7th July 1912	S. 999	1397	May 1916	8' S.S.E. of Buchanness	32. "	46.2 "	14.2 "	.10 "
FISH AT LIBERTY FOR 4 TO 5 YEARS.									
FEMALES.									
20' E. of May	28th Nov. 1910	A. 1705	1566	Mar. 1915	25' E.S.E. of May	38.5 "	53.1 "	14.6 "	.1 "
Do.	19th June 1911	A. 3032	1821	June 1916	70' N.E./N. of Longstone	37. "	50.8 "	13.8 "	.07 "
FISH AT LIBERTY FOR 5 TO 6 YEARS.									
MALE.									
20' E. of May	28th Nov. 1910	A. 1716	1892	Feb. 1916	—	36.5 "	45. "	8.5 "	.04 "

It will be seen that the average rate of increase in growth per 10 days varied considerably according to the sex and size of the fish. Taking the whole period, the mean rate, in the case of males, ranged from  $\cdot 02$  to  $\cdot 11$  cm., the average being about  $\cdot 07$  cm., which is equivalent to an annual increment of about  $2\cdot 5$  cm., but it will be noticed that, with two exceptions, all the males, when liberated, were of adult size. The average rate of increase per 10 days among the females ranged from  $\cdot 07$  to  $\cdot 15$  cm., the mean for the 8 cases being  $\cdot 106$  cm., or at the rate of  $3\cdot 7$  cm. per annum. The majority of the females were under the adult size when liberated.

Two females, both liberated at 20 miles east of the Isle of May, were recovered after an interval of between 4 and 5 years. The former (No. 1705) was taken in March 1915, after 1566 days, not far from where it had been liberated, namely 25 miles E.S.E. of the Isle of May; on liberation it measured  $38\cdot 5$  cm., and on recapture,  $53\cdot 1$  cm., an increase of  $14\cdot 6$  cm., or at the rate of  $\cdot 1$  cm. per 10 days. The other female (No. 3032) was recaptured in June 1916, after 1821 days, 70 miles N.E./N. of Longstone, Northumberland; it had grown from 37 to  $50\cdot 8$  cm., an increment of  $13\cdot 8$  cm., or at the rate of  $\cdot 07$  cm. per 10 days.

One fish was recaptured after more than 5 years of freedom. It was a male (No. 1716) liberated at 20 miles east of the Isle of May on 28th November 1910, and recaptured in February 1916, after 1892 days. This fish was got in London in the market, and the place of the recapture was not ascertained.

#### IV. THE INTENSITY OF FISHING.

One important result of the marking experiments is the light they throw upon the destruction of the fish by fishing operations. There is no reason to suppose that the marked plaice are captured in greater numbers, or in less, than the unmarked plaice which live around them on the fishing-grounds. The proportion of the marked fish which were recaptured by fishing operations thus furnishes a clue to the intensity of fishing, and gives an indication of the proportion of the plaice which may ultimately be captured by commercial fishing. As already mentioned, in order thoroughly to understand such questions, one would require to possess detailed information as to fishing operations, both in regard to the amount or quantity of fishing, and in regard to the fishing-grounds, and this is especially desirable when the number of fish marked and liberated and the proportion recaptured are small. In these experiments on the east coast of Scotland, however, the number of plaice marked was large, viz. 7166, and the number recaptured was also large, viz. 3735, or  $52\cdot 1$  per cent. The number actually recaptured must have been still greater, for, in the first place, there is evidence that the mark is sometimes lost and the fish recaptured with the signs of having been marked, though the mark is absent; in the second place, all the marked plaice which are recaptured are not returned, or their capture made known. It is probable also that a certain number died after having been returned to the sea, owing to injury received in the process of capture, or in the process of marking. One feels justified in saying that fully a half of the adolescent and adult plaice living on the fishing-grounds along the east coast of Scotland are ultimately caught in commercial fishing.

In some cases, however, the proportion recaptured was much more than 52 per cent. The experiments which give the highest percentage of recapture were those made at the station 20 miles east of the Isle of May. In the 10 experiments at this station, 961 plaice were marked, and 643, or  $66\cdot 9$  per cent., recaptured, the percentage of recaptured in different experiments ranging from  $54\cdot 9$  to  $77\cdot 3$  per cent. At the neighbouring station in the Firth of Forth, between Elie and Fidra, 823 plaice were marked and liberated, and 489, or  $59\cdot 4$  per cent., recaptured, although trawling, the method of fishing by which plaice are usually taken, is prohibited in the Firth of Forth. Here the percentage of recaptures varied from  $46\cdot 2$  to  $69\cdot 6$  per cent. Of 200 liberated 3 miles from Fidra Light, at the entrance to the Firth of Forth, 122, or 61 per cent., were recovered. In the experiments at Aberdeen Bank, 1227 plaice were marked and liberated, and 741, or  $60\cdot 4$  per cent., were recaptured, the percentage in the different experiments ranging from 40 to 70 per cent. In the neighbourhood of Fair Isle, 940 were marked and liberated, and 461, or 49 per cent., were recaptured, the percentage or recapture in the eight experi-

ments varying from 31 to 63·3 per cent. The percentage of recaptures in the Moray Firth were not so high; in this firth, as in the Firth of Forth, trawling is prohibited. In the experiments in the neighbourhood of Smith Bank, 707 plaice were marked and liberated, and 336, or 47·5 per cent., were recovered, the percentage in different experiments being as low as 28 and as high as 56. In the experiments made in other parts of the Moray Firth, 530 plaice were liberated, and 201, or 37·9 per cent., recaptured. In the neighbourhood of the Great Fisher Bank, 599 were liberated, and 194, or 32·9 per cent., recaptured, many of the fish being landed at foreign ports. In the experiments to the east of the Isle of May, the percentage of recaptures steadily diminished the farther and farther to sea the experiments were made. At 20 miles, as above mentioned, 66·9 per cent. were recaptured; at 40 miles, 54·4 per cent. of the 382 liberated were taken; at 50 miles, 51·7 per cent. of 207; at 100 miles, 28·1 per cent. of 192; and at 220 miles (to the north of the Great Fisher Bank), of 106 liberated only 17, or 16 per cent., were recaptured. In some cases, the actual numbers were not very large. In the six experiments with the largest number of plaice marked and liberated, the following results were obtained:—Aberdeen Bank, 10th June 1910: of 336 liberated, 201, or 59·8 per cent., were recaptured; at the same place, on 21st October 1910, of 282 liberated, 195, or 69·1 per cent., were recaptured; at Great Fisher Bank, on 16th June 1910, of 287 liberated, 116, or 40·4 per cent., were subsequently captured; at Fair Isle, of 262 liberated on 15th September 1910, 131, or 50 per cent., were recaptured and of 246 liberated on 4th November 1910, 147, or 59·3 per cent., were recaptured; at 20 miles east of the Isle of May, on 6th December 1912, of 202 liberated, 132, or 65·3 per cent., were again caught.

From the table printed on page 4 it will be seen that 74·5 per cent. of the marked plaice which were recaptured were taken within a year of liberation; in the second year, the percentage was 22·4; in the third year, 4·8; and in the fourth year, only ·7.

## V. DESCRIPTION OF THE VARIOUS EXPERIMENTS.

### 1. EXPERIMENTS MIDWAY BETWEEN ELIE AND FIDRA, FIRTH OF FORTH.

At this station, which lies in the middle of the Firth of Forth, midway between Elie and Fidra (Lat. 56° 8' N.; Long. 2° 48' W.), with a depth of about 27 fathoms, marked plaice were liberated on ten occasions, from November 1910 to March 1913. The total number liberated was 823, viz., 305 males, 469 females, and 49 whose sex was not ascertained. The number of the fish recaptured was 489, or 59·4 per cent., namely, 210 males, or 68·9 per cent., 267 females, or 56·8 per cent., and 12 of undetermined sex, or 25 per cent. The particulars relating to the experiments are as follows:—

No. of Experiment.	Date.	No. of Fish.								Percentages Recaptured.			
		Marked.				Recaptured.				♂	♀	(?)	Total.
		♂	♀	(?)	Total.	♂	♀	(?)	Total.				
I.	25 Nov. 1910.	37	54	8	99	25	39	3	67	67·6	72·2	37·5	67·7
II.	8 Feb. 1911.	35	56	9	100	24	29	2	55	68·6	51·8	22·2	55·
III.	21 Mar. 1911.	29	19	2	50	19	11	—	30	65·5	57·9	—	60·
IV.	25 Apr. 1911.	16	35	1	52	9	15	—	24	56·2	42·9	—	46·2
V.	19 June 1911.	21	29	—	50	12	15	—	27	57·1	51·7	—	54·
VI.	7 Sep. 1911.	27	23	20	70	17	14	6	37	62·9	60·9	30·	52·8
VII.	6 Mar. 1912.	27	70	3	100	21	45	—	66	77·8	64·3	—	66·
VIII.	24 Apr. 1912.	44	55	3	102	33	37	1	71	75·	67·3	33·3	69·6
IX.	9 May 1912.	41	57	2	100	30	26	—	56	73·2	45·6	—	56·
X.	26 Mar. 1913.	28	71	1	100	20	36	—	56	71·4	50·7	—	56·
		305	469	49	823	210	267	12	489	68·8	56·9	24·5	59·4

The percentages of recaptures varied from 56·2 to 77·8 for the males, and from 24·9 to 72·3 for the females.

## EXPERIMENT I.

25th November 1910.

In this experiment, 99 fishes were marked and liberated, 37 being males, 54 females, and 8 whose sexes were not ascertained. The sizes of the males ranged from 30·5 to 42 cm., and of the females from 29 to 58 cm.

The numbers liberated and recaptured are shown, in groups of 5 cm., in the accompanying table :—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	cm. 56-60·5	Total.
F. Lib. . . .	4	8	24	9	2	6	1	54
F. Recap. . .	3	5	21	7	1	2	—	39
M. Lib. . . .	1	16	17	3	—	—	—	37
M. Recap.. .	—	10	13	2	—	—	—	25
? Lib. . . . .	—	3	3	1	1	—	—	8
? Recap. . . .	—	1	2	—	—	—	—	3

Of the 37 males liberated, no less than 30 were of adult size, namely, of 33 cm. and over, while 7 were under that size.

Of the 54 females, 31 were adults (38 cm. and over), while the remaining 23 were under that size.

The fish were taken at the usual place, Station VI., Firth of Forth, on the afternoon of 25th November 1910, and were liberated within an hour of their capture, being in the interval kept in tanks of running water.

The number recaptured was 67, or 67·7 per cent. of those liberated, viz. 25 males (67·6 per cent. of the total males liberated), 39 females (72·2 per cent. of the total females), and 3 of undistinguished sex (37·5 per cent.).

Of the 25 males, 24 were of adult size. Their periods of liberty ranged from 55 to 820 days, and averaged 293 days. Their mean size on liberation was 36·5 cm., and on recapture 38·6 cm. They migrated distances of from 5 to 256 miles, the average being 113 miles, and the mean rate of travel per 10 days, 3·9 miles.

One male was under the adult size, being 31 cm. on liberation and 31·8 cm. on recapture. It had moved 7 miles in 123 days, thus going at the rate of ·6 mile per 10 days.

Thirty-three of the 39 females taken were 38 cm. and over on recapture, and they were at liberty for from 6 to 1476 days, the mean period being 402·4 days. The mean size on liberation was 39·7 cm., and on recapture 43·9 cm. They went distances of from 18 to 189 miles, the average being 78 miles, and the mean rate of travel per 10 days was 1·98 miles.

The remaining 6 females were immature, the range of sizes on liberation being from 29 to 34 cm., and on recapture from 29·8 to 36·8 cm., averaging respectively 31·1 cm. and 32·6 cm. The periods of freedom varied from 29 to 326 days, the mean being 151 days. The distances travelled were from 8 to 147 miles, averaging 42·7 miles, and the mean rate of movement was 2·8 miles per 10 days.

## THE EXTENT AND DIRECTION OF MIGRATION.

The first fish to be recaptured in this experiment was taken in the following month, namely, on the 1st of December 1910, after a period of 6 days. It was an adult female, and was caught 27 miles to the north and east, off the Bell Rock. Other 2 fish were got in this month, both females. Their movement was also north-east, 1 going round Fife Ness to St. Andrews Bay, and the other to within a few miles of Aberdeen. The rates of movement of these 3 fishes were respectively 45, 7·6, and 18·3 miles per 10 days.

In January 1911, 4 fishes were got, 2 females, 1 male, and 1 of undistinguished sex. One of the females went easterly for a distance of 39 miles in 63 days, the second made a long journey to the northwards, being recaptured in Ham Sound, Orkney Isles, a distance of 165 miles in only 39 days, thus moving at the rate of 42·3 miles per 10 days. Both the male and the fish of undetermined sex had entered the Moray Firth, and were taken off Whitehills, at a distance of 136 miles in periods of, respectively, 45 and 55 days, the mean rates of movement being 30·2 and 24·7 miles per 10 days.

Six fish were got in the third month after liberation, February, 4 of them being females, and 2 males. Four were taken to the north-east, off the Aberdeenshire coast, namely, 3 females and 1 male. They travelled, respectively, 71, 72, 89, and 92 miles in 74, 86, 70, and 87 days. The remaining male and female were found to the east of the station, at distances of 18·5 and 23·5 miles, after 91 and 77 days.

*First Quarter.*—Thus, during the first 3 months after liberation, 13 of the marked plaice, or 19·4 per cent. of the total number recaptured, were taken, 3 males, 9 females, and 1 of unknown sex. All had gone in an easterly or north-easterly direction, for distances of from 18 to 165 miles. Of the 3 males recovered in this quarter, 1 was found 23 miles to the eastward; it measured 38·5 cm., and was "ripe."

*Second Quarter.*—Thirteen were recaptured in March, 9 males, 3 females, and 1 of unknown sex. Most of the males migrated long distances, but 2 were taken within the Firth of Forth, 1, of 34·5–36·1 cm., and "spawning" ("partly spent") near Pittenweem, at a distance of 5 miles, after 120 days; the other, of 31–31·8 cm., and "immature" farther to the westwards, off Anstruther, at a distance of 7 miles, after 123 days. All the other males migrated rapidly to the northwards; 1, of 33·5–35 cm., and "spent," was taken at Aberdeen Bank, at a distance of 72 miles, after 126 days; another, of 35·5–35·7 cm., and described as "immature," was caught near Buchanness, at a distance of 85 miles, after 108 days; 2 were recaptured in the Moray Firth, 1 of 37·5–37·6 cm., to the north and east of Tarbet Ness, at a distance of 162 miles, after 104 days, and the other, which was taken by a foreign trawler, and landed at Ostend, at an unspecified locality; it measured 37–37 cm., and the condition of the testes was not recorded. Another, measuring 37–36·9 cm., and "spawning" ("partly spent") was recaptured after 106 days off Whiten Head, on the north coast of Scotland, at a distance of 225 miles. Two others were taken together at Loch Inchard, Ross-shire, on the west coast of Scotland, at a distance of 256 miles, after only 114 days, and both were "spawning." These fish travelled with great rapidity, the 2 taken at Loch Inchard having moved at a mean rate of 22·4 miles per 10 days, the 1 captured off Whiten Head, at the rate of 21·2 miles, and the 1 caught off Tarbet Ness, at 15·6 miles. One of the three females was recaptured in the Firth of Forth, at a distance of 8 miles to the westward, near Inchkeith, after 105 days; it measured 30·5–31 cm. and was "immature"; the second female, which measured 54–53·6 cm., and was "ripe," was taken after 112 days 29 miles to the north and east; the third female, the condition of whose ovaries was not recorded, measured "32–31 cm.," and was taken by a German trawler 52 miles north-east of Rattray Point (Lat. 58° 20' N.; Long. 1° E.) at a distance of 147 miles, after 121 days. The fish, whose sex was not ascertained, measured 39–39 cm., and was recaptured in the Moray Firth, after 99 days, by a foreign trawler, and landed at Ostend.

In April, a male, of 34–35 cm., and "immature" was captured 12 miles to the westward, near Inchkeith, after 139 days.

One male and 2 females were taken in May, all to the north-east, the male, measuring 33·5–33·8 cm., and "immature," after 161 days, at a distance of 44 miles. One of the females, which measured 38·5–41·8 cm., was taken after 173 days at a distance of 38 miles. The other female, which measured 39–41 cm., and was "spent," was recaptured, after 174 days, at a distance of 35 miles.

In the second quarter, then, 17 fish, or 22·4 per cent., were taken, viz., 11 males, 5 females, and 1 of undetermined sex. Fourteen (82·3 per cent.) went north and east, 1 (6·7 per cent.) north and west, and 2 (13·3 per cent.) south and west. Particulars as to the position of the recapture of 1 taken in the Moray Firth were not given. Of those moving north and east, 9 were males, 4 were females, and 1 was of unknown sex.



*Third Quarter.*—Three fish were recaptured in June, 2 females and 1 whose sex was not determined. One of the females, which measured 39·5–41·4 cm., and was “spent,” was taken after 188 days south-east of Aberdeen, at a distance of 58 miles. The other female, measuring 40·5–42·9 cm., and “immature,” was got 30 miles N.N.E. of Rattray Point, at a distance of 130 miles, after 197 days. The fish whose sex was not recorded measured 32·5 cm. on liberation, and was taken 38 miles east and a little south of the station.

Four females and 1 male were recaptured in July. The male, which measured 39–43·7 cm., and “had been ripe,” was recaptured, after 235 days, off Whiten Head, on the north coast of Scotland, at a distance of 226 miles. One of the females, which measured 34–36·8 cm., was taken after 234 days in St. Andrew’s Bay at a distance of 22 miles. The second female, measuring 33·5–38·2 cm., and “immature,” was recaptured after 219 days near the Bell Rock, at a distance of 23 miles. The third female, which measured 37–40·2 cm., and was “apparently immature,” was recaptured to the north-east of Aberdeen, at a distance of 76 miles, after 221 days. The fourth female, measuring 36–40·6 cm., and “immature,” was taken after 223 days, offshore, to the south-east of Aberdeen, at a distance of 74 miles.

In August, 2 females were recaptured, both to the north and east; 1, measuring 41·5–44·2 cm., and “half-ripe,” was taken, after 271 days, near Tod Head, at a distance of 47 miles. The other, measuring 37·5–42 cm., and “immature,” was recaptured far offshore, eastward from Aberdeen, at a distance of 124 miles, after 259 days.

In this quarter, therefore, 10 fishes, or 15 per cent., were taken, of which 9 (90 per cent.) went north and east for an average distance of 87 miles, and 1 went east and a little south for a distance of 38 miles.

*Fourth Quarter.*—In September, a female, of 41–43·5 cm., was taken, after 280 days, 50 miles E.N.E. of Whitby, at a distance of 105 miles, to the south and east.

In October a female, of 29–36·6 cm., was taken, after 326 days, 39 miles to the eastwards of the Isle of May.

Two were taken in November, a male, of 42–44 cm., and “nearly ripe,” after 357 days, 28 miles to the north-east, near the Bell Rock, and a female, 40–46·2 cm., and “immature,” after 347 days, 142 miles to the north and east.

Thus, in the fourth quarter, only 4 fishes, or 5·9 per cent., were recaptured, 2 to the north and east, 1 to the east, and 1 to the south and east.

In the twelve months after liberation, 44 plaice, or 65·7 per cent. of the total recaptured, were taken, of which only four were got in the Firth of Forth; omitting these, 37, or 84·1 per cent., went to the northwards, and north and east; two, or 4·8 per cent., migrated to the south and east, and one directly east. Of the remaining fish, 2 were taken in 1911, 14 in 1912, 4 in 1913, and 2 in 1914.

In December 1911 a female, of 37–41·6 cm., and “nearly ripe,” was recovered after 397 days, near Buchanness, at a distance of 87 miles, and a male of 36 cm. on liberation, but of unknown size on recapture, after 399 days, 17 miles to the south and east, off Dunbar.

In February 1912, 2 males were recaptured, both “nearly ripe” and to the northwards, 1, of 35–38·4 cm., after 453 days, off Aberdeen, at a distance of 72 miles, and the other, of 31·5–37·4 cm., after 455 days, in the Dornoch Firth, Moray Firth, at a distance of 167 miles.

Two males and 3 females were taken in March 1912, all to the north and east, and ripe or nearly so. One of the females, measuring 40·5–46·6 cm., and “nearly ripe,” was caught after 469 days, off Fife Ness, at a distance of 18 miles; another, of 36–39·6 cm., and also “nearly ripe,” was found off Aberdeen, at a distance of 73 miles, after 464 days; the third female, measuring 41·5–47·1 cm., and “spawning,” was caught, after 487 days, near Buchanness, at a distance of 81 miles. One of the males, which measured 39–39·7 cm., and was “ripe,” was taken, after 475 days, in the same locality, at a distance of 86 miles; the other male, of 33–36·1 cm., and “ripe,” was recaptured off Whitehills, Banff, in the Moray Firth, at a distance of 137 miles, after 480 days.

One male, of 40·5–46·3 cm., and “ripe,” was got in May, after 546 days, on the north coast of Scotland, off Dunnet Head, at a distance of 214 miles.

In July, 2 females were recaptured, 1 measuring 37–46·1 cm., and “spent,”

after 597 days, offshore, to the east of Aberdeen, at a distance of 82 miles, and the other, of 36·5–45·7 cm., and also “spent,” to the east of the Orkney Isles, at a distance of 189 miles.

In September, a male, of 36·5–38·2 cm., was, caught, after 670 days, 36 miles distant, to the east of the Isle of May, and the female, of 36·5–47·8 cm., after 668 days, offshore, to the south-east of Buchanness, at a distance of 93 miles.

A male, of 31·5–41·2 cm., and “nearly ripe,” was got in November, after 721 days, south-east of Buchanness, at a distance of 87 miles.

In December, after 759 days, a female, measuring 36·5–43 cm., and “nearly ripe,” was recaptured 49 miles to the north and east, east of the Isle of May.

In February 1913, a male of 36·5–42·1 cm., and “spawning” (“partly spent”), was recaptured, after 820 days, off Berriedale Ness, in the Moray Firth, at a distance of 164 miles.

In March 1913, 2 females were taken, 1 after 837 days, measuring 36–45·5 cm., and “nearly ripe” 25 miles distant, to the east of the Isle of May; the other, measuring 41·5–45·8 cm., and “spawning” was recaptured in the Moray Firth off Whitehills, at a distance of 136 miles, after 857 days.

A female was recovered in November 1913, after 1074 days, in the offshore waters, off Tod Head, at a distance of 65 miles to the north and east; it measured 33–44·5 cm., but the condition of the ovaries was not recorded.

Of the two fish recaptured in 1914, both females, 1, which measured 52–54·5 cm., was taken in February, after 1169 days, off Hartlepool, at a distance of 122 miles to the south and east; it was “spawning.” The other female, measuring 42·5–55·3 cm., and “about three-quarters ripe,” was recovered in December, offshore, to the south-east of Aberdeen, at a distance of 69 miles.

*Distances travelled, 10 miles and under.*—Three of the marked plaice, or 4·5 per cent., were recovered within 10 miles of the station, 2 males, 1 taken off Pittenweem at a distance of 5 miles, and the other off Anstruther at a distance of 7 miles, and a female, which was got to the westward, near Inchkeith, at a distance of 8 miles.

*10 to 20 miles.*—Four fish, or 6·1 per cent., were recaptured, 2 males and 2 females. One of the males travelled westwards for 12 miles, to the neighbourhood of Inchkeith, and the other, 17 miles to the south-east, outside the Forth. The two females were found at a distance of 18 miles to the north-east.

*Under 20 miles.*—Thus, 7 fish, or 10·6 per cent., 4 males (16 per cent.) and 3 females (7·9 per cent.) were found within a distance of 20 miles from the place of liberation.

*20 to 50 miles.*—Seventeen of the plaice, or 25·8 per cent., migrated distances of between 20 and 50 miles. Four (16 per cent.) were males, all of which were found to the north and east, the average distance being 33 miles. Twelve (31·6 per cent.) were females, which had also moved an average distance of 33 miles, all but two to the north and east; one of the other fishes was found 25 miles to the south and east, and 1, 39 miles directly east. One, whose sex was not determined, was got 38 miles to the south-east.

*50 to 100 miles.*—Twenty of the fish (30·3 per cent.) migrated distances between 50 and 100 miles. Of these, 6 (24 per cent.) were males, all of which had gone to the north and east, from 72 to 92 miles, the mean being 82·3 miles. Fourteen (36·8 per cent.) were females, which had migrated distances of from 58 to 93 miles, also to the north and east, the average distance being 75·3 miles.

*Over 100 miles.*—Twenty-two fish (33·3 per cent.) moved distances exceeding 100 miles. Eleven (44 per cent.) were males, all of which had gone to the north and east for an average distance of 194 miles, 6 being taken in the Moray Firth, and 5 farther north, 3 of them at distances of 214, 225, and 226 miles, on the north coast of Scotland, while 2 had travelled to the west coast and were caught at Loch Inchard, a distance of 256 miles from the station. Nine (23·7 per cent.) were females, which had moved an average distance of 140 miles. Seven of these were taken to the north and east, 1 in the Moray Firth, at a distance of 136 miles and the others at distances of from 130 to 189 miles, off the Moray Firth, and the Orkneys. Two of the females had taken an unusual direction to the south and east, 1 being captured 105 miles distant, 50 miles off Whitby, and the other, 122 miles, 24 miles off Hartlepool. Two whose sexes were not known were taken in the Moray Firth.

In this experiment, 5 males, or 20 per cent., migrated distances over 200 miles,

the average being 235·4 miles, while the farthest distance reached by a female was 189 miles.

The following table shows the number and percentage of each sex which were found (1) within the Firth of Forth, (2) south of Kinnaird Head, Aberdeenshire, (3) within the Moray Firth, (4) farther to the north or north and west :—

Sex.	Inside Forth.		Outside Forth.		South of Kinnaird.		Moray Firth.		Farther North and West.	
	No.	%	No.	%	No.	%	No.	%	No.	%
M.	3	12·	22	88·	11	44·	6	24·	5	20·
F.	1	2·6	37	97·4	32	84·2	1	2·6	4	10·5
(?)	—	—	3	100·	1	33·3	2	66·6	—	—
Total	4	6·1	62	93·9	44	66·7	9	13·6	9	13·6

Only 4, or 6·1 per cent. of the marked plaice, were found within the Firth of Forth, 62, or 93·9 per cent., being recaptured outside the Forth. It is to be noted, however, that trawling, by which the vast majority of the recaptured plaice are taken, is prohibited within the Firth of Forth ; of the four fishes recaptured within the Firth, 3 were caught with hooks, and 1 in a crab-net. The majority were recaptured south of Kinnaird Head, but 18, or more than a fourth of the number recaptured (27·2 per cent.) were taken to the north of Kinnaird Head, 9 in the Moray Firth and 9 outside the limits of the Firth, or farther to the north or north-west. Only a single female (2·6 per cent.) was recaptured in the Moray Firth, where 6 males were taken ; and it is noteworthy that many of the females, both those which had gone farther north than Kinnaird Head, and those which were taken to the south of it, were captured more offshore, towards the east, in deeper water, than the males.

#### MATURITY.

The condition of the testes was ascertained in 22 of the 25 males captured. Seven were " spawning " and " partly spent " ; all were recaptured to the northwards, except 1 which was taken off Pittenweem, in the Firth of Forth, on 25th March 1911, after 120 days, at a distance of 5 miles from the station ; it measured 34·5–36·1 cm. Four of the others were also caught in March 1911, 2 being remarkable, as being caught at Loch Inchard, on the west coast of Sutherland, after 114 days, at a distance of 256 miles, showing a mean rate per 10 days of 22·4 miles ; they measured respectively 36·5–36·3 cm., and 42–41·8 cm., and thus had apparently diminished in length ; they were caught by a Grimsby trawler and landed at that port. One of the others, taken in March, was got in the same direction 8 miles north-east from Whiten Head, on the north coast of Sutherland, at the entrance to Loch Erriboll, at a distance of 225 miles, after 106 days, the rate of travel being 21·2 miles per 10 days ; it was caught by an Aberdeen trawler, and landed at Aberdeen, and measured 37–36·9 cm. The other fish caught in March, after 104 days, was taken in the Moray Firth, 17 miles N.N.E. from Lossiemouth, at a distance of 162 miles ; it was captured in a cod-net and measured 37·5–37·6 cm. ; the rate of travel in this case was 15·6 miles per 10 days. Another " spawning " male, measuring 38–37·9 cm., was recaptured in a cod-net on 19th January 1911, after only 55 days of freedom, a mile off Banff, in the Moray Firth, a distance of 136 miles ; the rate of travel in this case was 24·7 miles per 10 days, or nearly 2½ miles a day. The seventh " spawning " male was caught, also by cod-net, in February 1913, after 820 days, in the Moray Firth, off Berriedale Ness, at a distance of 164 miles ; it measured 36·5–42·1 cm., and the mean rate of travel was 2 miles per 10 days.

Two males are described as " spent " ; 1 was caught in March 1911, after

126 days, off Aberdeen, at a distance of 72 miles ; it measured 33·5–35 cm. ; the other, measuring 39–43·7 cm., was taken off Whiten Head, on the north coast of Scotland, in July 1911, after 235 days, at a distance of 226 miles.

Four males were "ripe," all taken to the northwards. One, measuring 38·5–38·7 cm., was caught in February 1911, after 77 days, 24 miles distant, to the east of the Isle of May ; the second, of 39–39·7 cm., was caught in March 1912, after 475 days, near Buchanness, at a distance of 86 miles ; the third, measuring 33–36·1 cm., was taken, also in March 1912, by cod-nets, at Whitehills, Moray Firth, at a distance of 137 miles ; the fourth had migrated farther, being taken in May 1912, after 546 days, off the north coast of Scotland, 26 miles N.W. by N. from Dunnet Head, a distance of 214 miles ; it measured 40·5–46·3 cm. The mean rates of movement per 10 days in the cases of these fish were, respectively, 3·1, 1·8, 2·8, and 3·9 miles.

Four males were described as "nearly ripe" ; they were all recaptured to the northwards. One, measuring 42–44 cm., was taken in November 1911, after 357 days, at a distance of 28 miles, north and east of the Bell Rock ; another, of 35–38·4 cm., was taken in February 1912, after 453 days, off Aberdeen, at a distance of 72 miles ; the third, measuring 31·5–37·4 cm., was captured, by a cod-net, also in February 1912, after 455 days, in the Moray Firth, at the entrance to the Dornoch Firth, a distance of 167 miles ; and the fourth, measuring 31·5–41·2 cm., was caught in November 1912, after 721 days, off Aberdeenshire, at a distance of 87 miles. The mean rates of movement in these cases were, respectively, ·8, 1·6, 3·7 and 1·2 miles.

Of the 4 males of adult size, whose testes were "immature," one was taken in March 1911, after 108 days, off Buchanness, at a distance of 85 miles ; another, of 34–35 cm., was caught in April 1911, after 139 days, 12 miles to the west, near Inchkeith ; the third was found on 5th May, after 161 days, 44 miles to the north and east ; it measured 33·5–33·8 cm. ; the fourth, of 36·5–38·2 cm., was taken in September 1912, after 670 days, 36 miles to the north and east ; a male, measuring 31–31·8 cm., was caught in March 1911, 7 miles to the north and west, off Anstruther, Firth of Forth.

Of the 33 adult females recaptured, the condition of the ovaries was determined in 31 cases.

Five were "spawning," but the position of capture, and the date, were not ascertained for one of them. Three of the other 4 were got to the north and east, 1, of 41·5–45·8 cm., in March 1913, after 857 days, in the Moray Firth, off Whitehills, at a distance of 136 miles ; it was taken in a cod-net. Another, measuring 47·5–47·6 cm., was caught off Aberdeen Bay in February 1911, after 86 days, a distance of 72 miles ; the third was taken a little farther north, in March 1912, after 487 days, the distance being 81 miles ; it measured 41·5–47·1 cm. The fifth fish was captured in February 1914, after 1169 days, 24 miles E. by S. of Hartlepool, having migrated a distance of 122 miles to the south and east ; it measured 52–54·5 cm. The mean rates of migration of those four fish were as follows :—1·64, 8·4, 1·7, 1·04 miles per 10 days.

One adult female is described as "ripe" ; it measured 54–53·6 cm., and was caught in March 1911, after 112 days, 29 miles to the north and east, off the Bell Rock.

Four were described as "spent," all captured to the north and east. One, of 39–41 cm., was taken in May 1911, after 174 days, 35 miles distant, east of the Bell Rock ; the second, measuring 39·5–41·4 cm., was caught in June 1911, after 188 days, off Tod Head, 58 miles distant ; the third, measuring 36·5–45·7 cm., was taken in July 1912, after 586 days, east of Auskerry, Orkney Islands, 189 miles distant ; and the fourth, of 37–46·1 cm., was also caught in July 1912, after 597 days, off the Aberdeenshire coast, at a distance of 82 miles. The mean rates of travel, per 10 days, were respectively 2, 3·1, 3·2, and 1·4 miles.

Six were "nearly ripe." One was caught 25 miles to the south and east in March 1913, after 837 days ; it measured 36–45·5 cm. All the others were taken to the north and east ; 1, in December 1912, after 759 days, 49 miles distant ; it measured 36·5–43 cm. ; another, of 37–41·6 cm., in December 1911, after 397 days, off Buchanness, at a distance of 87 miles ; the fourth, of 36–39·6 cm., in March 1912, after 464 days, 73 miles distant, off Aberdeen ; the fifth, of 40·5–46·6 cm.,

also in March 1912, after 469 days, at a distance of 18 miles; and the sixth, in February 1911, after 74 days, also off Aberdeen, at a distance of 71 miles; it measured 44-44.3 cm.

One female was "about three-quarters ripe," in December 1914, when it was caught off Aberdeen, at a distance of 69 miles, after 1476 days; it measured 42.5-55.3 cm.

Two females were "half-ripe," both recaptured to the north and east; one was taken in February 1911, after 70 days, off Buchanness, 89 miles distant; it measured 39-39.4 cm.; the other was caught in August 1911, after 271 days, off Bervie, 47 miles to the north and east; it measured 41.5-44.2 cm.

Three were described as "a quarter ripe," and were all recaptured to the north and east; 1 was taken in December 1910, after only 6 days, 27 miles to the north and east, north of the Bell Rock, and measuring 39-38.8 cm.; the second, also caught in December 1910, after 35 days, near Aberdeen, at a distance of 64 miles; it measured 39.5-39.7 cm.; the third, which measured 38.5-38.7 cm., was recovered on 3rd January 1911, after 39 days, east of the Pentland Skerries, at a distance of 165 miles. All these three fish showed rapid movement, the respective mean rates, per 10 days, being 45, 18.3, and 42.3 miles. They were obviously females reaching first-maturity, and they would probably spawn in the ensuing season.

Of the 9 females described as "immature" 1 was caught in January, 1 in May, 1 in June, 3 in July, 1 in August, 1 in September, and 1 in November. They were all taken to the north and east, at distances of from 23 to 142 miles, after intervals of from 63 to 668 days. The one caught in January 1911, after 63 days, measured 40-39.9 cm., and was recaptured 39 miles eastwards; the one taken in May 1911, after 173 days, measured 38.5-41.8 cm., and was caught 38 miles distant. Three had gone long distances; 1, of 40.5-42.9 cm., was taken in June 1911, after 197 days, off Rattray Head, 130 miles to the north-east; another, of 37.5-42 cm., was caught in August 1911, after 259 days, far offshore, east of Aberdeenshire, at a distance of 124 miles; the third, measuring 40-46.2 cm., was taken in November 1911, after 347 days, off the middle of the entrance to the Moray Firth, at a distance of 142 miles.

#### EXPERIMENT II.

8th February 1911.

The number of plaice marked and liberated in this experiment was 100, viz. 35 males, 56 females, and 9 of which the sex was not determined. The sizes of the males ranged from 29 to 39 cm., and of the females from 29.5 to 51.5 cm.; the sizes of the 9 fish of undistinguished sex varied from 31 to 40.5 cm. The numbers liberated and recaptured are shown in the subjoined table in groups of 5 cm. :—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	Total.
F. Lib.	4	23	18	6	3	2	56
F. Recap.	—	12	12	4	1	—	29
M. Lib.	4	25	6	—	—	—	35
M. Recap.	4	16	4	—	—	—	24
? Lib.	—	6	3	—	—	—	9
? Recap.	—	2	—	—	—	—	2

Seventeen of the males and 39 of the females were under adult size (33 cm. and 38 cm.) when liberated. The plaice for the experiment were trawled by the "Goldseeker" at Station VI. in the Firth of Forth, off Pittenweem, on the 8th February, and the fish were marked and liberated at the station which is only a few miles from Station VI., in the course of a few hours.

The number of the marked plaice subsequently recaptured was 55, or 55 per cent., which is a relatively small proportion; of the total, 24, or 68.6 per cent., were males, 29, or 51.8 per cent., were females, and 2, or 22.2 per cent., were of unknown sex.

Nineteen of the 24 males recaptured were of adult size on recapture, the sizes ranging from 33.3 to 43.8 cm., the mean being 38.6 cm., as compared with 29 to 39 cm., with a mean of 33.9 cm., on liberation; the periods of freedom varied from 121 to 1306 days, the average being 453 days; the distances migrated varied from 4 to 212 miles, with a mean of 93.1 miles, and the average rate of movement, per 10 days, was 2 miles.

Five of the males were under adult size, the average being 32.2 cm., compared with 31.4 cm. on liberation; the mean period of freedom was 148 days, and the distances migrated were from 4 to 28 miles, the average being 15.6 miles, and the mean rate of travel, per 10 days, 1.1 miles.

Of the 29 females, 22 were of adult size on recapture, the sizes ranging from 40.1 to 51.9 cm., the mean being 44.3 cm., while on liberation the sizes were from 31.5 to 49.5 cm., the average being 38.1 cm.; the average period of freedom was 395 days, the range being 14 to 1148 days, and the distances migrated varied from 11 to 161 miles, the mean being 68.2 miles, and the mean rate of movement 1.7 miles per 10 days.

Seven of the females were under adult size, the average size being 34.1 cm., as compared with 34.2 cm., on liberation; the periods of freedom averaged 59 days, and the distances migrated, 12½ miles, ranging from 3 to 59.5 miles; the mean rate of movement, per 10 days, was 2.1 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Only 1 of the marked plaice was recaptured in February, viz. a female, which measured 44–44 cm., and was caught after 14 days 18 miles to the north and east, “spent.”

In March 1911, 9 were recaptured, 2 males, 6 females, and 1 of unknown sex. Five of these, viz. 2 males and 3 of the females, were taken within the Firth of Forth, at distances of from 3 to 5 miles, in from 22 to 41 days, all towards the north shore of the Firth. All these fish were under the adult size, and the reproductive organs were “immature,” in the 4 cases in which the condition was known. Three of the other females were found to the north and east, outside the Firth; 1, of 39.5–39.6 cm., 28 miles distant, north-east of the Bell Rock; it was “spent”; another, of 49.5–50.2 cm., was taken off the coast of Aberdeen, at a distance of 62 miles, after 50 days, “spawning”; the third was also taken near Aberdeen, at a distance of 59 miles, after 45 days; it measured 33–32.1 cm., and was “immature.” The remaining fish was of undistinguished sex, and had gone to the south and east; it was captured, after 51 days, 32 miles off Longstone Light, at a distance of 78 miles, and was “partly spent.”

In April, 4 of the marked plaice were recaptured, 1 male and 3 females. The 3 females were all taken within the Firth of Forth, 1 off Kirkcaldy, at a distance of 11 miles, after 63 days; it measured 37.5 cm. on liberation, but the size on recapture was not ascertained, nor the condition of the reproductive organ. Another, under adult size, was found on Station VI., where it was originally caught, at a distance of 4 miles, after 76 days. The third, of 36.5 cm., and thus under adult size, was taken in Largo Bay, 4½ miles distant, after 55 days. The male had moved out of the Firth, and was taken to the east of the Isle of May, at a distance of 24 miles, after 79 days; it measured 31–31.9 cm., and was “immature.”

In the first quarter, then (the month of February included), 14 of the marked plaice, or 25.4 per cent., were recaptured; 8 (57.1 per cent.) had moved north and east for an average distance of 26 miles (4 of them into the Firth of Forth); 4 (28.6 per cent.) had moved north and west, an average distance of 6.2 miles (all within the Firth of Forth); and 2 had moved to the south and east for an average distance of 51 miles. Eight of the 14 fish had remained within the Firth of Forth, or 57.1 per cent., and 2 of them were recaptured at Station VI., where they had been originally caught. Of the 6 fish which left the Firth of Forth, 4 went to the north and east for distances of from 18 to 59 miles; 1 travelled east and a little south for 24 miles, and another south and east for 78 miles.

*Second Quarter.*—Only 1 of the marked plaice was caught in May 1911; it was of undistinguished sex, measuring 33.5–34.5 cm., and was recaptured within the Firth of Forth, near Methil, 7½ miles distant, after 99 days.

Three were taken in June, 1 male and 2 females, all "immature." The male which measured 34.5-36.5 cm., had migrated to the Moray Firth, and was taken off Noss Head, near Wick, at a distance of 169 miles, after 121 days, the mean rate of movement being 13.9 miles per 10 days. One of the females, measuring 37.5-41.2 cm., was also taken to the south-east of Noss Head, at a distance of 154 miles, after 130 days, the mean rate of movement being 11.3 miles per 10 days. The third female, of 39.5-40.9 cm., was caught off Aberdeen, at a distance of 72 miles, after 118 days, the mean rate of travel being 6.1 miles per 10 days.

Four were recaptured in July, 1 male and 3 females; they were all "immature." One, a female of 36.5-36.5 cm., and therefore under the adult size, was taken in the Firth of Forth, at Station VI, where it was originally caught, a distance of  $4\frac{1}{2}$  miles, after 155 days; another female, measuring 37-40.5 cm., was taken, after 166 days, off Montrose, to the north and east, a distance of  $37\frac{1}{2}$  miles; the third female, measuring 40-43.9 cm., was caught, after 172 days,  $43\frac{1}{2}$  miles to the north-east; the male, of 34.5-36.2 cm., was got off Buchanness,  $85\frac{1}{2}$  miles distant, after 155 days.

In the second quarter, then, the total number of marked plaice recaptured was 8, or 14.5 per cent., of which 7, or 87.5 per cent., were taken to the north and east, the average distance being 81 miles, and the mean rate of travel 5.9 miles per 10 days; one of these fish was caught within the Firth of Forth. Another, also caught in the Firth of Forth, had moved  $7\frac{1}{2}$  miles to the north and west.

*Third Quarter.*—In August 1911, 2 fish were recaptured, a male of 34-36 cm., off the Isle of May, 19 miles to the north and east, after 188 days, and a female measuring 36-40.1 cm., 26 miles distant in the same direction.

None was taken in September, but 2 were got in October, 1 of 37-40.2 cm.,  $22\frac{1}{2}$  miles to the south and east, off St. Abb's Head, after 240 days, and the other of 37-38 cm., to the north-east, off Aberdeen, at a distance of 57 miles. The latter is described as "nearly ripe," and the former as "half-ripe."

In this quarter, therefore, only 4 fish, or 7.3 per cent., were recaptured.

*Fourth Quarter.*—Two males were taken in November, both to the north and east; 1, of 39-43.8 cm., was caught after 294 days near Aberdeen, at a distance of 70 miles; the other, of 30-31.7 cm., was taken, after 269 days, near the Bell Rock, at a distance of 28 miles.

In December, a male and a female were recaptured; the male measuring 31 cm. on liberation, but of unknown size on recovery, was caught off the mouth of the Forth, to the south and east, at a distance of 17 miles; the female, of 34-43.7 cm., was taken, after 296 days, to the south and east, off the coast of Northumberland, at a distance of  $85\frac{1}{2}$  miles.

None was taken in January 1912.

Thus, in this quarter, only 4 fishes were recaptured, or 7.3 per cent., 2 to the north and east, and 2 to the south and east.

Within 12 months of liberation, the total number of the marked plaice recaptured was 30, or 54.5 per cent., Twenty (66.6 per cent.) had migrated to the north and east, and 5 (16.6 per cent.) to the north and west, and to the south and east respectively. Of these, 10 were taken within the Firth of Forth, 5 to the north and east, and 5 to the north and west.

Of the remaining fish recaptured in this experiment, 19 were taken in 1912, 4 in 1913, and 2 in 1914.

Two were got in February 1912, 1 within the Firth of Forth, off Largo, at a distance of 5 miles, after 383 days, measuring 29-33.3 cm., and "immature"; the other had migrated 72 miles to the north and east, and was caught off Aberdeen, after 376 days; it measured 34.5-38.2 cm., and was "about ripe."

Six were caught in March 1912, 5 males and 1 female, and all to the north and east. One of the males had gone only a short distance of 4 miles in 391 days, and was taken off Pittenweem, in the Firth of Forth; it measured 29-35.8 cm., and the testes were "immature." Three males were taken in the Moray Firth, 1, measuring 35-40.5 cm., and "ripe," off Kinmuir Head, at a distance of 126 miles, after 391 days; the second, of 32.5-37 cm., in the same region, at a distance of 127 miles, after 387 days, the condition of the testes not being ascertained; the third, measuring 32.5-37 cm., was taken off Brora, at a distance of 174 miles, after 400 days, and it was "ripe." The remaining male was caught off Collieston, Aberdeen-

shire, at a distance of 81 miles, after 413 days; it measured 33-37.8 cm., and was "spent." The female was also caught in the Moray Firth, after 400 days, but the exact locality of capture and the condition of the ovaries are unknown; it measured 35.5-45 cm.

Two females and 1 male were recaptured in April 1912, 2 to the north and east, and 1 to the eastward. The male, measuring 37-41.2 cm., was caught far offshore, east of Aberdeenshire (57° 15' N.; 0° 10' W.), in 44 fathoms, after 444 days, the condition of the testes not being ascertained. One of the females, of 38-44.9 cm., and "spent," was caught near Buchanness, at a distance of 81 miles, after 421 days. The other female, measuring 37.5-44 cm., was taken 29 miles E.  $\frac{1}{4}$  N. of St. Abb's Head, a distance of 48 miles, after 421 days; the condition of the ovaries was not determined.

A female, of 43-47 cm., and "spent," was captured in May 1912, after 465 days, in the Moray Firth, off Clyth Ness, a distance of 161 miles. Another female, measuring 35.5-43.6 cm., was taken in June, after 505 days, to the south-east of Aberdeen, at a distance of 77 miles, and 1 of 41.5-47.9 cm., and "spent," in July, after 532 days, 43 miles to the north and east. In August, a male and a female were captured, the male to the north-east of St. Abb's Head, 34 miles distant, after 545 days, and the female, measuring 31.5-43.3 cm., after 559 days, off Rattray Head, at a distance of 105 miles. Another female, of 37-45 cm., "three-quarters ripe," was also caught off Rattray Head in September, after 575 days, a distance of 110 miles. The other 2 fish taken in 1912 were got in December, a male and a female, both to the north and east. The male, measuring 34.5-40 cm., and "nearly ripe," was caught after 663 days, off the coast of Aberdeen, at a distance of 84 miles, and the female, of 34-45.2 cm., and "immature," also after 663 days, eastwards of the Bell Rock, at a distance of 45 miles.

The next fish recaptured was in February 1913; it was a male, of 35.5-40 cm., and "spent," taken  $1\frac{1}{2}$  miles off Banff, in the Moray Firth, at a distance of 134 miles, after 748 days. A female, of 33-41 cm., was caught off Lossiemouth, in the Moray Firth, in June 1913, after 861 days, at a distance of 156 miles.

Two were captured in July; a female of 45.5-51.9 cm., and described as "spent," after 889 days, within the Firth of Forth, off Kirkealdy,  $10\frac{1}{2}$  miles to the westwards; and a male of 32.5-43.9 cm., after 892 days, 5 miles S.S.W. of Copinshay, Orkney Isles, at a distance of 181 miles.

The next marked fish captured was a female, which was found in April 1914, after 1148 days, to the east of Holy Island, Northumberland, at a distance of 53 miles from the place of liberation; it measured 32.5-47.5 cm., and was described as "spent."

The last fish to be taken was a male, measuring 34-43.1 cm., which was recaptured in September 1914, after 1306 days, 7 miles S.E. of Fair Isle, at a distance of 212 miles.

*Distances travelled—Under 10 miles.*—Eleven of the recaptured fish, or 20.4 per cent., were taken at distances not exceeding 10 miles, viz. 4 males (16.6 per cent.), with an average of 4.5 miles, and 6 females (21.4 per cent.), with an average of 4.3 miles, and 1, whose sex was not known, had migrated  $7\frac{1}{2}$  miles. All these fish were taken on the north side of the Firth of Forth, off the coast of Fife, 5 off Largo, 1 off Elie, 1 off Methil, and the remainder off Pittenweem, at Station VI., where they were originally caught for the marking experiment. While some of these fish, which had remained in the Firth were caught within a short time after liberation, in from 22 to 41 days, 2 of them had been for a year and more, both males, one of 29-33.3 cm., and therefore under the adult size, for 383 days; it was "immature" when taken in February, and the other, measuring 29-35.8 cm., taken in March, and also "immature," for 391 days. None of the fish was of adult size when recaptured.

*10 to 20 miles.*—Five (9.4 per cent.) were recaptured between 10 and 20 miles, viz. 2 males (8.3 per cent.), with an average distance of 18 miles, and 3 females (10.7 per cent.), with an average distance of 13 miles. The 2 males were caught to the eastwards, outside the Firth, at distances of 17 and 19 miles. One of the females was also taken to the north-east, off Fife Ness, at a distance of 18 miles, after 14 days. Both the other females were caught in the Firth of Forth, off Kirkealdy, at distances of between 10 and 11 miles, 1, measuring 37.5 cm. on liberation, but of unknown



size on recapture, after 63 days, and the other, measuring 45·5–51·9 cm., in July 1913, after 889 days.

*Under 20 miles.*—Thus, 16 of the fish, or 29·6 per cent., were recaptured at distances of under 20 miles, viz. 6 males (25 per cent.), with an average distance of 9 miles, 9 females (32·1 per cent.), with an average distance of 7½ miles, and 1 of undistinguishable sex, which went 7½ miles.

*20 to 50 miles.*—Eleven plaice, or 20·4 per cent., migrated distances between 20 and 50 miles, viz. 7 females (25 per cent.), with an average of 39 miles, and 4 males (16·6 per cent.), with an average of 27·2 miles. One of the females went to the south and east for 48½ miles, and all the others to the north-east, for distances of from 26 to 45½ miles. Three of the males had moved to the east and south, off the mouth of the Firth, for 23, 24, and 34 miles, and 1 to the north and east for 28 miles.

*50 to 100 miles.*—Fourteen, or 25·9 per cent., were found at distances of from 52 to 85½ miles, viz. 6 males (25 per cent.), with an average of 74 miles, 7 females (25 per cent.), with an average of 68·8 miles, and 1 of undistinguished sex, at 78½ miles. All the males had migrated to the north and east, and were taken off the coast of Aberdeenshire. Five of the 7 females had gone in the same direction, to the north and east, and were taken off the coast of Aberdeenshire; 2 went to the south and east for distances of 53 and 85½ miles.

*Over 100 miles.*—Thirteen, or 24·1 per cent., were recovered at distances of from 105 to 212 miles, viz. 8 males (33·3 per cent.), with a range of from 110 to 212 miles, and a mean of 154·4 miles, and 5 females (17·8 per cent.), with a range of from 105 to 161 miles, and an average of 137½ miles. All the fish were found to the northwards, 8 of them in the Moray Firth, 1 at Orkney, 1 at Fair Isle, 2 off Rattray Head, and 1 far offshore, east from Aberdeenshire. With two exceptions, all the fish had been at liberty for periods exceeding a year, and up to 748, 861, 892, and 1306 days. None of the fish from this experiment was recaptured on the north or the west coast of Scotland.

The number recaptured within the Firth of Forth was 13, or 23·6 per cent., 4 (16·6 per cent.) being males, 8 (27·6 per cent.) females, and 1 of undistinguished sex. Forty-two, or 76·3 per cent., were recaptured outside the Firth, 31, or 56·3 per cent., to the south of Kinnaird Head, 8, or 14·5 per cent., in the Moray Firth, and 3, or 5·4 per cent., farther north. The particulars are given in the following table:—

Sex.	Inside Forth.	Per cent.	Outside Forth.	Per cent.	South of Kinnaird.	Per cent.	Moray Firth.	Per cent.	Farther N. and W.	Per cent.
M.	4	16·6	19	79·1	13	54·1	5	20·8	2	8·3
F.	8	27·6	21	72·4	17	58·6	3	10·3	1	3·4
(?)	1	50·	1	50·	1	50·	—	—	—	—
Total.	13	23·6	42	76·3	31	56·3	8	14·5	3	5·4

#### MATURITY.

*Males.*—Of the 24 males recaptured, the condition of the testes was ascertained in 19 cases.

None was described as “spawning,” but 2 were “ripe,” both caught in March 1912, after 391 and 400 days, both in the Moray Firth, 1 to the west of Kinnaird Head, at a distance of 126 miles, and the other off the Dornoch Firth, at a distance of 174 miles; the fish measured respectively 35–40·5 cm., and 32·5–37 cm., and the mean rate of movement per 10 days was 3·2 and 4·3 miles.

One male, of 35·5–40 cm. was described as “spent”; it was taken off Banff in the Moray Firth, at a distance of 136 miles, in February 1913, after 748 days, the mean rate of movement being 1·78 miles per 10 days. Another male, of 33–37·8 cm., caught in March 1912, after 413 days, off the Aberdeenshire coast, was described as “spent” or “immature.”

Three males were “nearly ripe,” all caught to the north-east, off the coast of Aberdeen, at distances of from 57 to 84 miles, in the months of February, October, and December, after 376, 263, and 663 days; all were above the adult size on liberation.

Two males were described as “fully half-ripe”; 1 was caught off the coast of

Aberdeen, at a distance of 70 miles in November 1911, and the other, north of St. Abb's Head, in October 1911. One male was said to be "about half-ripe"; it was caught in August 1912, after 545 days, 34 miles distant, to the north-east of St. Abb's Head. All these fish were over the adult size on liberation.

Six males were "immature." Four were over the adult size when liberated, and they were caught in June, July, August, and September—months well without the limits of the spawning season; 1 was caught near Fair Isle, 1 in the Moray Firth, 1 off Buchanness, and 1 north-east of May Isle; the other 2 were under adult size when liberated, and were both taken in the Firth of Forth, at a distance of 5 miles from the Station, in February and March 1912, after 383 and 391 days; they measured respectively 29-33.3 cm., and 29-35.8 cm., so that the latter was above the average adult size during the spawning season, and was yet "immature."

*Females.*—The condition of the ovaries was determined in 23 of the 29 females recaptured. One, measuring 49.5-50.2 cm., was "beginning to spawn"; it was caught off Aberdeen, at a distance of 62½ miles, in March 1911, after 50 days, the mean rate of movement being 12.5 miles per 10 days.

None of the females was described as "ripe."

Seven were "spent"; 6 were above adult size on liberation. The largest of all, measuring 45.5-51.9 cm., was taken in July 1913, after 889 days, off Kirkcaldy, in the Firth of Forth, about 10 miles distant; 1 was caught in the Moray Firth, off Clyth Ness, in May 1912, and another off Aberdeen, at a distance of 81½ miles, in April 1912; 3 were taken off the Isle of May, at 18, 28½, and 43½ miles, in March 1911, February 1911, and July 1912; the seventh spent female was found in April 1914, after 1148 days, 53 miles to the south and east, off Holy Isle; it measured 32.5 cm., when liberated and 47.5 cm. on recapture.

One female, measuring 37-45 cm., was described as "three-quarters ripe"; it was caught in September 1912, off Rattray Head, 110 miles to the northwards. Two were "half ripe," 1 taken in August 1912, off the coast of Aberdeen, 77½ miles distant, and the other off Rattray Head, in August 1912, at a distance of 105 miles; they measured respectively 35.5-43.6 cm., and 31.5-43.3 cm.

Seven females above adult size on recapture were described as "immature"; 3 were taken in the month of June, 2 in the month of July, 1 in August, and 1 in December, all to the north and east. Five females, which were under the adult size on recapture, were caught in March and April 1911, 4 of them in the Firth of Forth, at distances of from 3 to 5 miles, and 1 off the coast of Aberdeen, at a distance of 59½ miles, after 45 days.

One fish, whose sex is not recorded, but which from its size was probably a male, is described as "spawning"; it was caught in March 1911, after 51 days, at a distance of 78½ miles to the south-east, off the coast of Northumberland; it measured 35-35.2 cm.

### EXPERIMENT III.

21st March 1911.

In this experiment, only 50 fishes were marked and liberated, viz. 29 males, 19 females, and 2 whose sex was not determined. The sizes of the males ranged from 27.5-38 cm., and of the females, from 26.5-37 cm., while the 2 of undistinguished sex each measured 34 cm. Nineteen of the males and 19 of the females were under the adult size when liberated. The numbers liberated and recaptured, arranged in 5-cm. groups, are shown on the accompanying table:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	Total.
F. Lib. . . . .	4	13	2	19
F. Recap. . . . .	3	6	2	11
M. Lib. . . . .	12	14	3	29
M. Recap. . . . .	7	12	—	19
? Lib. . . . .	—	2	—	2
? Recap. . . . .	—	—	—	—

All the plaice used in this experiment were trawled by the "Goldseeker" at Station VI., Firth of Forth, on the same day as they were marked and liberated.

The number recaptured was 30, or 60 per cent., 19 (65·5 per cent.) being males, and 11 (57·9 per cent.) females.

Of the 19 males, 14 were of adult size, when recaptured, the sizes ranging from 35·4–39·2 cm., and averaging 37·1 cm., whereas, on liberation, the average size was 31·7 cm., and the range, from 28·5–35 cm.; their periods of liberty ranged from 90 to 1247 days, the mean being 445 days; they migrated distances of from 4½ to 168 miles, the average distance being 67·6 miles, and the mean rate of movement 1·4 miles per 10 days.

The average size of the 5 males under adult size on recapture was 28 cm., and on liberation 29 cm.; the mean period of freedom was 29 days, and the distances migrated, from 4½ to 13½ miles, the average being 7·4 miles, and the mean rate of movement 2·5 miles per 10 days.

Of the 11 females, 6 were of adult size on recapture, the sizes ranging from 38·3 to 41 cm., and averaging 40·1 cm., while on liberation the range was 30–37 cm., and the mean 33·9 cm.; the periods of freedom varied from 184 to 458 days, averaging 361 days; the distances migrated were from 5 to 46 miles, the mean being 25·9 miles, and the mean rate, per 10 days, ·7 mile. The average size of the other 5 females was 33·7 cm., on recapture, and 31·6 cm. on liberation; the periods of freedom varied from 22 to 472 days, and the average was 151 days; the distances migrated ranged from 5 to 33½ miles, the mean being 14 miles, and the average rate of movement, per 10 days, ·9 mile.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—One fish, a male, of 28–27·6 cm., was recaptured in March 1911, after 7 days, off Anstruther, in the Firth of Forth, at a distance of 6 miles.

In April, 3 were taken, 2 males and a female, all within the Firth of Forth, and all under the adult size. One of the males was got after 20 days, off Buckhaven, at a distance of 7 miles; the other male was caught, after 35 days, off St. Monans, at a distance of 4 miles; while the female was taken, after 22 days, off Pittenweem, at a distance of 5 miles.

In May, 2 males and 1 female were recaptured, all within the Firth of Forth, and all under adult size. One of the males was found, after 41 days, off Anstruther, at a distance of 6 miles; the other was caught, after 44 days, 13 miles to the westwards, near Pettycur (east of Burntisland); while the female was got, after 45 days, off Largo, at a distance of 6 miles.

Two were recaptured in June, a male and a female, both under adult size. The male was caught off St. Monans, at a distance of 4 miles, after 90 days, and the female, off Pettycur, 13 miles to the westwards, after 73 days.

Thus, all the fish recaptured to the end of June 1911, 9 in number, or 30 per cent. of the total recaptured, were taken within the Firth of Forth, and all were considerably under adult size, both on liberation and recapture. They were all taken on the north coast of the Forth (Fifeshire).

*Second Quarter.*—None was recaptured in July, but 2 were taken in August. One of these, a female, which measured 33–35·5 cm., was caught, after 146 days, within the Firth of Forth, in the South Bay, near Cockenzie, at a distance of 11 miles; the other, a male, which measured on liberation 35 cm., but whose size on recapture was not recorded, had moved out of the Forth, and was taken to the eastwards, at a distance of 17 miles, after 145 days.

Two were recovered in September. A female, of 35–38·3 cm., was found, after 184 days, eastwards of the Isle of May, at a distance of 26 miles; the other was a male, of 32·5–36·5 cm., which was caught, after 176 days, in the same locality 26 miles distant; both were "immature."

*Third Quarter.*—Two were taken in October 1911, both males; 1, of 31–35·9 cm., was caught off Montrose, at a distance of 43 miles to the north-east, after 222 days; and the other, measuring 32–35·6 cm., was caught, after 224 days, in the same locality, but a little farther north, at a distance of 50 miles; both were described as "nearly ripe."

None was caught in November, but in December, a male, measuring 35-38.9 cm., was taken, after 259 days, off St. Andrews Bay, at a distance of 22 miles; it was described as "nearly ripe."

Only 3 fish (10.7 per cent.) were taken in this quarter.

*Fourth Quarter.*—In January 1912, after 310 days, a male, of 33.5-38.3 cm., was caught in the Moray Firth, to the east of Noss Head, at a distance of 154 miles; the condition of the testes was not ascertained.

Three of the fishes were recaptured in February, but the place of capture of 1 of them, a male, was not recorded. The other 2 were females; 1, of 36-41 cm., was taken, after 337 days, off Pittenweem, in the Firth of Forth, at a distance of 5 miles; it was described as "rather immature"; the second female was caught, after 332 days, to the east of May Isle, at a distance of 24 miles; it was "ripe," and measured 37-40.9 cm.

In March 1912, 2 males were recaptured, but the place of capture of 1 was not ascertained; the other, measuring 31.5-36.9 cm., was caught, after 352 days, near Pittenweem, at a distance of 5 miles; it was "immature."

In this quarter, then, 6 fish were taken, or 20 per cent. of those recovered, but the positions of 2 of them were not ascertained.

In the 12 months after liberation, 22 marked plaice, or 73.3 per cent. of the total, were recaptured, and the position of recapture was ascertained for 20 of them. Seven of the males (41.2 per cent.), and 5 of the females (45.5 per cent.), or 12 fish in all (42.9 per cent. of those whose position was ascertained) were found within the Firth of Forth; 1 was recaptured in the Moray Firth, 2 off the coasts of Forfar and Kincardine, and 4 to the east of the Isle of May.

Of the remaining fish, 4 were recaptured in the remainder of 1912, 2 in 1913, and 2 in 1914.

A female, caught in May 1912, after 407 days, was taken 46 miles distant, to the east of St. Abb's Head; it measured 32.5-39.5 cm.

In June, 2 females were recovered, 1 north-east of the Isle of May, at a distance of 20½ miles, after 458 days, and the other, of 30-40.6 cm., farther in the same direction, at a distance of 33½ miles.

The fourth fish taken in 1912 was a female, captured in July, after 472 days, to the south-east of Montrose; it measured 30-37 cm.

In March 1913, after 714 days, a male, of 29.5-37.2 cm., and "partly spent," was captured in the Moray Firth, off Clyth Ness, at a distance of 164 miles.

In April, after 742 days, another male was taken, also in the Moray Firth, off Whitehills, at a distance of 139½ miles; it measured 28.5-36.5 cm., and was "nearly spent."

In March 1914, after 1082 days, another male was taken in the Moray Firth, to the south of Clyth Ness, at a distance of 168 miles; it measured 31.5-39.2 cm., and was "spawning."

The last fish recaptured from this experiment was also a male, which measured 34 cm. on liberation, but the size on recapture was not recorded, nor the condition of the testes; it was taken in August 1914, after 1247 days, off St. Andrews Bay, 18½ miles to the north and east.

*Distances Travelled*—*Under 10 miles.*—Nine of the plaice (32.1 per cent.) were found at distances not exceeding 10 miles, viz. 6 males (35.3 per cent.), with an average of 5.5 miles, and 3 females (27.2 per cent.) with an average of 5.3 miles. All were found within the Firth of Forth. Three were taken near Pittenweem, at a distance of 5 miles, 2 near St. Monans, at a distance of 4½ miles, 2 off Anstruther, at a distance of 6 miles, 1 off Largo, at a distance of 6 miles, and 1 off Buckhaven, at a distance of 7 miles.

*10 to 20 miles.*—Five fishes (17.8 per cent.) were recaptured between 10 and 20 miles, 3 males (17.6 per cent.), with an average of 16.3 miles, and 2 females (18.2 per cent.), with an average of 12 miles. Three of these were within the Firth of Forth, a male and a female taken at Pettycur, to the westward, at a distance of 13½ miles, and a female, in the South Bay, off Cockenzie, at a distance of 12 miles. Two of the fish, both males, were caught off the mouth of the Firth, at 17 and 18½ miles.

*Under 20 miles.*—Thus, 14 fish, or 50 per cent., were taken at distances under 20 miles, 9 males (52.9 per cent.), with an average of 9.1 miles, and 5 females (45.4 per

cent.) with an average of 8.3 miles, and 12 of them were found within the Firth of Forth.

20 to 50 miles.—Nine, or 32.1 per cent., were recaptured between 20 and 50 miles, 3 males (17.6 per cent.), with an average distance of 30.8 miles, and 6 females (54.5 per cent.) with an average of 30.7 miles. Two of the males and 4 of the females were found to the north and east, and 1 of the males and 2 of the females to the south and east.

50 to 100 miles.—Only 1 fish was got between these limits, a male, which went to the north and east, a distance of 50½ miles.

Over 100 miles.—Four fish (14.3 per cent.), all males (23.5 per cent.), were recaptured at distances of from 137½ to 168 miles, the average being 156 miles. They all migrated to the northwards, 3 being taken in the Moray Firth, and 1 just outside the limit, east of Noss Head.

The following table shows the numbers and percentages of those which were caught in the Firth of Forth, and outside the Firth :—

Sex.	Inside Forth.	Per cent.	Outside Forth.	Per cent.	South of Kinnaird.	Per cent.	Moray Firth.	Per cent.	Farther N. and W.	Per cent.
M.	7	41.2	10	58.8	6	35.3	3	17.6	1	5.9
F.	5	45.4	6	54.5	6	54.5	—	—	—	—
Total.	12	42.8	16	57.1	12	42.8	3	10.7	1	3.5

#### MATURITY.

*Males.*—The condition of the testes was determined in 11 of the 19 males recaptured. Three were “spawning,” and all were recaptured in the Moray Firth, 1 measuring 29.5–37.2 cm., in March 1913, after 714 days, at a distance of 164 miles, the mean rate of movement per 10 days being 2.3 miles; another, measuring 28.5–36 cm., in April 1913, after 742 days, at a distance of 137½ miles, the mean rate being 1.8 miles per 10 days; and the third, of 31.5–39.2 cm., in March 1914, after 1082 days, at a distance of 168 miles, the mean rate being 1.5 miles per 10 days.

One male was “ripe”; it measured 30.5–35.4 cm., and was caught in March 1912, after 348 days, at a position unknown.

Three are described as “nearly ripe,” 1, of 35–38.9 cm., taken in December 1911, 22½ miles to the north and east; another, of 32–35.6 cm., taken in October 1911, 50½ miles to the north and east; the third, measuring 31–35.9 cm., also taken in October 1911, 43½ miles to the north and east.

*Females.*—No female was “spawning,” but 1, of 37–40.9 cm., captured in February 1912, after 332 days, 24½ miles to the north and east, eastwards of the Firth, was “ripe.”

None was described as “nearly ripe,” or “spent.”

Four females, of adult size on recapture, were said to be “immature”; 1 was got in the month of June, and another in September; the third, taken in February 1912, was “rather immature”; it measured 36–41 cm., and was caught in the Firth of Forth; the fourth, taken in May 1912, west of St. Abb’s Head, measured 32.5–39.5 cm.

None of the fish recaptured in the Forth showed signs of maturity, and all the recaptured fish which were under the adult size on recapture (5 males and 5 females) were taken in the Firth of Forth. A male, recaptured in the Firth in March, and thus in the spawning season, was “immature,” though it measured 36.9 cm.; and a female, taken in February, in the Firth, in the spawning season, was also “immature,” though it measured 41 cm.

#### EXPERIMENT IV.

25th April 1911.

In this experiment, 52 fish were marked and liberated, viz., 16 males, 35 females, and 1 whose sex was not determined. The sizes of the males ranged from 29 cm. to 39 cm., and of the females from 29.5 to 55 cm. Nine of the males, and 17 females

were under adult size when they were liberated. The numbers liberated and recaptured, arranged in 5 cm. groups, are as follows :—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	cm. Total.
F. Lib. . . . .	2	13	9	6	2	3	35
F. Recap. . . . .	1	8	3	2	1	—	15
M. Lib. . . . .	4	9	3	—	—	—	16
M. Recap. . . . .	3	6	—	—	—	—	9
? Lib. . . . .	—	—	1	—	—	—	1
? Recap. . . . .	—	—	—	—	—	—	—

The fish used were trawled by the "Goldseeker" at Station VI. (the "Fluke Hole") off St. Monans, Firth of Forth, on the same day as they were marked and liberated.

The number recaptured was only 24, or 46·2 per cent., viz. 9 males (56·2 per cent.) and 15 females (42·9 per cent.). All the 9 males were of adult size, when recaptured, the range being from 36·4 to 41·4 cm., and the average 37·9 cm., as compared with a range of 29 to 34·5 cm., and an average of 31·2 cm., when they were liberated; the periods of freedom varied from 241 to 711 days, the mean being 467 days; the distances migrated were from 18½ to 218 miles, averaging 87·6 miles, and the mean rate of movement per 10 days was 1·8 miles. Eleven of the females were of adult size on recapture, the average length being 43·9 cm., and the range from 38·4 to 48·4 cm.; on liberation, the sizes were from 32 to 47·5 cm., with an average of 37·9 cm.; the periods of liberty varied from 108 to 1220 days, and averaged 466 days; the distances migrated were from 5 to 153 miles, the mean being 60·5 miles, and the average rate of travel, per 10 days, 1·2 miles. The four females, under the adult size, had an average length of 32 cm. on liberation and 36·3 cm. on recapture; the periods of freedom were from 42 to 394 days, and averaged 251 days, and the distances migrated varied from 6 to 38½ miles, and averaged 23·6 miles, while the mean rate of movement was ·89 mile.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Only 1 fish was taken in the 3 months following liberation, a female in June, after 42 days, got near Largo, in Fife, Firth of Forth, 6 miles distant; its size on recapture is not recorded, but it measured 35·5 cm. on liberation.

*Second Quarter.*—Only 2 fish were taken in this quarter, both females. The position of recapture of 1 is unknown; the other was taken within the Firth, near Burntisland, 16 miles to the westward, in August, after 125 days; it was an adult, measuring 38-42 cm. and is described as "half-ripe."

*Third Quarter.*—Two fishes only were recaptured in this quarter, a female in November, which measured 34-37·1 cm., the position of recovery being unknown, and a male, of 29·5-36·8 cm., which was taken in December, after 241 days, off Tod Head, to the north and east, at a distance of 50 miles; it was described as "three-quarters-ripe."

*Fourth Quarter.*—The number recaptured in this quarter, which embraces the spawning period, was larger, viz. 8 fishes. Five were caught in February 1912, 4 males and a female. The male, measuring 32·5-36·5, was caught, after 296 days, 7 miles west from Strathie Point, on the north coast of Scotland, at a distance of 218 miles, the mean rate of movement being 7·4 miles per 10 days; it was "nearly ripe." One of the females, of 39·5-40·8 cm., was captured, after 288 days, in the Moray Firth, 18 miles south-east of Noss Head, a distance of 153 miles; it was "spawning" ("partly spent"). Another female, measuring 44·5-46 cm., was caught north-east of Rattray Point, at a distance of 115 miles. The other 2 females were taken in the Firth of Forth, north-east of Pittenweem, at distances of 4 and 5 miles, after 304 and 301 days; they measured 35-38·4 cm. and 34-40·6 cm., and both were "immature."

In March 1912, a female, of 41·5–44 cm., and “partly spent,” was taken, after 325 days, off Buchanness, at a distance of 85 miles.

In April, a male was captured, “nearly ripe,” and measuring 29·5–36·4 cm., but the place of capture was not recorded; and a female, of 32–34 cm.; and thus under adult size, was taken, after 355 days, off St. Abb’s Head, 26 miles from the Station, “immature.”

In the 12 months after liberation, therefore, 13 fishes, or 54·2 per cent. of the total, were recaptured, the positions of capture being recorded for 10 of them. Four were caught within the Firth of Forth, and the others outside the Firth.

Of the remainder, 5 were recovered in 1912. A female, of 30–37·9 cm., and “immature,” was taken in May, after 394 days, 38 miles to the north and east; in June, a male, of 32–38·8 cm., and “half ripe,” was caught, after 415 days, 43 miles to the north and east; in July, another male, of 32–37·1 cm., was taken, after 437 days, off the mouth of the Forth, 18 miles distant; in August, after 482 days, another male was recaptured, farther in the same direction, at a distance of 28½ miles; in November, after 576 days, a male, whose size on liberation was 34 cm., the size on recapture being unknown, was taken to the north-east, off Stonehaven, at a distance of 58 miles.

Five fishes were caught in 1913, 3 females and 2 males. In February, 2 females were taken, 1, of 36·5–44·9 c.m., and “spawning,” was got, after 666 days, 29 miles to the eastwards; the other, of 34–47·2 cm., and “ripe,” was found, after 668 days, to the south-east of Aberdeen, at a distance of 67½ miles. A male, of 29 cm., when liberated, the size on recapture being unknown, was caught, after 686 days, 1½ miles off Banff, in the Moray Firth, at a distance of 134½ miles, but the condition of the testes was not ascertained. In April, after 711 days, another male, measuring 32–41·4 cm., was caught in the Moray Firth, farther to the west, off Buckie, the condition of the testes not being recorded. In August, after 837 days, a female, of 35–47·1 cm., was caught 51 miles to the north and east, to the eastwards of the Bell Rock.

The last fish to be recaptured was a female, which was taken in August 1914, after 1220 days, far offshore, to the south-east of Aberdeen, at a distance of 77 miles; it measured 32–44·2 cm., and was “immature.”

*Distances travelled—Under 10 miles.*—Three fish, or 14·3 per cent., were taken within 10 miles of the Station, and all were females (23·1 per cent.), the average distance being 5·1 miles; 2 were caught off Pittenweem, and 1 off Largo, in the Firth of Forth, the former after 301 and 304 days, and the latter after 42 days.

*10 to 20 miles.*—Two were recaptured between 10 and 20 miles, or 9·5 per cent. One was a male, which was taken 18 miles distant, east of the Isle of May, and the other, a female, which was got farther west, in the Firth of Forth, near Burnt-island. Thus, 5 fishes, or 23·8 per cent., were taken at distances under 20 miles, 1 male and 4 females, only the male being got outside the Firth.

*20 to 50 miles.*—Six (28·6 per cent.) were taken at distances of from 26½ to 50 miles, 3 males (37·5 per cent.) and 3 females (23·1 per cent.); 2 of the males and 2 of the females went north and east, and 1 male and 1 female east and slightly south; the mean distance for the males was 40·5 miles, and for the females, 31·3 miles.

*50 to 100 miles.*—Five fish, or 23·8 per cent., were recaptured at distances of from 51 to 85 miles, viz. 1 male and 4 females (30·8 per cent.), the average distance for the latter being 70·3 miles. All migrated northwards, 4 being caught off the Aberdeenshire coast, and 1 far east of the Bell Rock.

*Over 100 miles.*—Five of the fish, or 23·8 per cent., 3 males (37·5 per cent.) and 2 females (15·4 per cent.) were taken at distances of from 115 to 218 miles, the average for the males being 167·6 miles, and for the females 134·5 miles. Two were got in the Moray Firth, 1 just outside its boundaries, and 1 off Rattray Point, at the entrance to the Moray Firth, and 1 on the north coast of Scotland. The rates of travel of these distant fish ranged from 1·9 to 7·4 miles per 10 days, as contrasted with ·6 to 2·6 for the fish caught between 50 and 100 miles.

Four fish, or 19 per cent., were recovered within the Firth of Forth, and 17, or

80·9 per cent., outside the Firth, 2, or 9·5 per cent., in the Moray Firth, as shown in the adjoining table :—

Sex.	Inside Forth.	Per cent.	Outside Forth.	Per cent.	South of Kinnaird.	Per cent.	Moray Firth.	Per cent.	Farther N. and W.	Per cent.
M.	—	—	8	100	5	62·5	2	25	1	12·5
F.	4	30·8	9	69·2	8	61·5	—	—	1	7·7
Total.	4	19	17	80·9	13	61·9	2	9·5	2	9·5

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 6 cases. None was “spawning” or “ripe.” The one taken in February 1912, on the north coast of Scotland, west of Strathie Point, was “nearly ripe,” as was also a male caught in April 1912, in an unspecified locality, east of the Isle of May; another male, taken in December 1911, off Tod Head, was “three-quarters-ripe,” and 1 caught in June 1912, 43 miles to the north-east, was described as “half-ripe.”

*Females.*—The condition of the ovaries was determined in 13 of the 15 fish recovered.

Three were “spawning,” or “partly spent,” all got to the north and east, 1 off Noss Head, in the Moray Firth, in February 1912, another in March 1912, near Buchanness, and the third 29 miles to the north and east, east of Fife Ness, in February 1913, after 666 days.

One female was said to be “ripe”; it was caught in February 1913, after 668 days, 67 miles to the north and east, south-east of Aberdeen.

A female, taken in August 1911, near Burntisland, was described as “half-ripe.”

Five females above the adult size when recaptured were described as “immature.” The position of capture of 1 taken in August 1911 was unknown, other 2 were got in August 1913 and August 1914 respectively, to the north-east, and 2 were recovered in February 1912, and thus in the spawning season, both near Pittenweem, in the Firth of Forth, 1 measuring 34–40·6 cm., and the other 35–38·4 cm.

#### EXPERIMENT V.

19th June 1911.

Only 50 plaice were marked in this experiment, 21 males and 29 females. The males ranged in size from 28·5 cm. to 40 cm., and 9 of them were under the adult size (33 cm.); the females ranged from 29 cm. to 47 cm., and 16 were under the adult size (38 cm.). The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows :—

	cm. 25–30·5	cm. 31–35·5	cm. 36–40·5	cm. 41–45·5	cm. 46–50·5	Total.
F. Lib. . . . .	3	7	13	5	1	29
F. Recap. . . . .	1	5	7	2	—	15
M. Lib. . . . .	4	12	5	—	—	21
M. Recap. . . . .	3	6	3	—	—	12

The fish were trawled by the “Goldseeker” at Station VI., Firth of Forth (“Fluke Hole”), on the same day as they were marked and liberated.

The number recaptured was 27, or 54 per cent., viz. 12 males (57·1 per cent.) and 15 females (51·7 per cent.). Eleven of the males were of adult size on recapture, their lengths varying from 34·5 cm. to 44·1 cm., and averaging 38·5 cm., as compared with a range of 30·5–40 cm., and an average of 33·8 cm., on liberation; their periods of freedom varied from 177 to 1002 days, the average being 431 days; the distances migrated were from 5 to 211 miles, the mean being 87·2 miles, and the average rate of travel, 2·02 miles per 10 days. One male was under 33 cm., when recaptured, and it had moved 15 miles in 136 days.

Of the females, 11 were of adult size, viz. from 38·7 to 48·4 cm., with an average of 42·7 cm., while the sizes on liberation were from 30·5 to 45 cm., the mean being 37·4 cm.; they were at liberty for from 34 to 1250 days, the average being 43 days;



the distances migrated were from  $4\frac{1}{2}$  to 90 miles, the average being 44·3 miles, and the mean rate of movement 1·04 miles per 10 days.

Four of the females were under the adult size, the average being 36·1 cm., compared with 33·6 cm. on liberation; the average period of freedom was 166 days; the distances migrated ranged from  $4\frac{1}{2}$  to 113 miles, the mean being 46·3 miles, and the mean rate of movement, 2·8 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—A female, of 38–37·8 cm., was caught in June 1911, after 8 days, at a distance of 18 miles to the east, off the Isle of May; another female, of 32·5–33 cm., was taken in July, off St. Monans, in the Firth of Forth, a distance of 4 miles, after 24 days; in September, after 84 days, a third female, measuring 40 cm. on liberation, and of unrecorded size on recapture, was caught by the “Goldseeker” on Station VI. (where it was originally taken). This fish was again liberated 40 miles east of May Isle on 12th September (see page ).

Only 3 fish, all females, were thus got in the first quarter, 2 within the Firth of Forth.

*Second Quarter.*—In November, after 136 days, a male, of 28·5–28·4 cm., was taken, near Newhaven, in the Firth of Forth, at a distance of 15 miles. Two males were recaptured in December, 1, measuring 32·5–35·5 cm., and “half-ripe,” after 177 days, 26 miles to the north and east, north-west of the Bell Rock; the second, of 37–40·9 cm., and “nearly ripe,” near Buchanness, 87 miles distant, after 185 days.

Thus, only 3 fish were recaptured in this quarter, 1 within the Firth of Forth.

*Third Quarter.*—In this quarter, which includes most of the spawning season, 9 marked plaice were recaptured. In January 1912, 2 females were taken, 1, of 34–38·9 cm., and “rather immature,” at Aberdeen Bank, 63 miles distant, after 219 days; the other, of 35·5–38·7 cm., was “spawning” (“partly spent”), and was caught, after 225 days, near Buchanness, at a distance of 90 miles.

Two females were also recaptured in February, 1 of 40·5–42·3 cm., and “partly spent,” to the east of the Isle of May, at a distance of 18 miles; the other, measuring 45 cm. on liberation, somewhat farther to the north, at a distance of 25 miles, after 245 days; its size on recapture and the condition of the ovaries were not recorded.

Five were taken in March, a male and a female, off Pittenweem, 5 miles distant, after 274 days and 260 days, respectively; the male, measuring 34·5–38·2 cm., is described as “immature”; the female measured 37·5–41·2 cm., and was also “immature.” Two males were recaptured near Buchanness, at distances of 88 and 85 miles, after 257 and 265 days; they measured 31·5–37·4 cm., and 40–44·1 cm. respectively, and both were “ripe.” Another male was taken, after 272 days, at a distance of 211 miles, off Strathie Point, on the north coast of Scotland; it also was “ripe.”

In this quarter, all the 9 fish went to the north and east, for an average distance of 66 miles, but 2 of them were taken in the Firth of Forth.

*Fourth Quarter.*—Three were recovered in April, all to the north and east. A female, of 32·5–37·2 cm., and “immature,” was found, after 301 days, off Tod Head, at a distance of 50 miles; another female, of 42–43·6 cm., and “ripe,” was taken, after 302 days, to the north of Aberdeen Bank, at a distance of 78 miles; a male, of 36–38·4 cm., and “spent,” was got, after 305 days, at a distance of 67 miles, in the same direction.

In May 1912, after 331 days, a female, of 31·5–36·3 cm., and “immature,” was taken to the north-east of Rattray Point, at a distance of 113 miles. None was taken in June.

Four fish, therefore, were recovered in this quarter, and all had gone to the north and east, for an average distance of 77 miles.

In the 12 months following liberation, 19 of the fishes, or 70·4 per cent., were recaptured, viz. 8 males (66·7 per cent.) and 11 females (73·3 per cent.). Seventeen (89·5 per cent.) travelled to the north and east, and 1 each (5·2 per cent.) to the south and east, and south and west.

Of the remainder, 3 were taken in 1912, 3 in 1913, and 2 in 1914. Two were found in July 1912, a male and a female, and both in the Moray Firth; the male,

which measured 33-36.6 cm., and is described as "immature," was got off Clyth Ness, at a distance of 154 miles, after 380 days, the mean rate of travel being 4.06 miles per 10 days; the female, of 40.5-47 cm., was captured, after 387 days, by a foreign trawler, and landed at Ostend; the condition of the ovaries, and the exact locality where it was taken, were not recorded.

A male was got in June 1913; it measured 31-34 cm., was described as "immature," and was recaptured, after 730 days, off Banff, in the Moray Firth. In November, after 892 days, a male, measuring 33-39.8 cm., was taken off Aberdeen, at a distance of 72 miles to the north and east; it was "nearly ripe." In December, a female was recaptured 18 miles away, near Bell Rock; it measured 39-48.4 cm., was "ripe," and had gone at a mean rate per 10 days of .2 mile.

In March 1914, a male, of 30.5-42.9 cm., and "spawning," was recaptured near the Bell Rock, a distance of 29 miles, after 1002 days, the mean rate of migration being .3 mile. The last fish, from this experiment, to be taken was a female, 30.5-43.5 cm.; it was got, after 1250 days, off Aberdeen, at a distance of 60 miles from the station; it was described as "fully half-ripe," and had moved at an average rate of .5 mile per 10 days.

*Distances travelled—Under 10 miles.*—Four of the marked plaice, or 15.4 per cent., were found within a distance of 10 miles from the station, viz. 1 male, and 3 females (21.4 per cent.). They were all taken within the Firth of Forth, 2 off Pittenweem, and 2 off St. Monans.

*10 to 20 miles.*—Four were recaptured at distances of from 15 to 18.5 miles, the average being 17.4 miles, viz. 1 male and 3 females (21.4 per cent.). The male was taken within the Firth, on the south shore, near Newhaven; the females were all got to the eastwards, off the Isle of May. Eight of the fish, or 30.8 per cent., were thus recaptured within 20 miles of the station, 2 males, with an average distance of 10 miles, and 6 females, with an average distance of 11.4 miles.

*20 to 50 miles.*—Four fish, or 15.4 per cent., were recovered at distances of from 25 to 50 miles, with an average of 33 miles, all to the north and east. A male, after 177 days, was found 26 miles off, near the Bell Rock, and another, after 1002 days, in the same direction, a little farther to the east, at a distance of 29 miles. Of 2 females, 1 was found near the same position as the last, at a distance of 25 miles, after 245 days, and the other, after 301 days, near Tod Head, at a distance of 50 miles.

*50 to 100 miles.*—Ten of the fish, or 38.5 per cent., were got at distances of from 60 to 90 miles, viz. 5 males, with an average of 80 miles, and 5 females, with an average of 74.5 miles. All were taken to the north and east. Three of the males were found close together, off Buchanness, at distances of 85 and 88 miles; the other 2 males went a little farther south, being taken at distances of 67 and 72 miles. One of the females was recaptured off Buchanness, in the same locality as the males, at a distance of 90 miles; 3 were taken off the coast of Aberdeen, farther south, at distances of 60, 63, and 78 miles, and the remaining female was caught far offshore, to the south-east of Aberdeen, at a distance of 80 miles.

*Over 100 miles.*—Four fish, or 15.4 per cent., were got at distances of from 113 to 211 miles, all to the northwards, viz. 3 males and 1 female. The female was taken north-east of Buchanness, in deepish water, at a distance of 113 miles. Two of the males were taken in the Moray Firth, at distances of 134 and 154 miles; the other was recaptured off Strathie Point, on the north coast of Scotland, at a distance of 211 miles.

Of all the fish recaptured, 5, or 18.5 per cent., were got in the Firth of Forth, 3 females and 2 males, and 22, or 81.5 per cent., outside the Firth, 10 males and 12 females. Two were caught in the Moray Firth, and 2 farther to the north or north and west.

#### MATURITY.

*Males.*—The condition of the reproductive organs was ascertained in all the 12 males and in 11 of the 15 females recaptured. One male, of 30.5-42.9 cm., was found to be "spawning"; it was taken in March 1914, after 1002 days, 29 miles to the north and east.

Three were "ripe," all taken to the north and east, in March 1912, 1, of 30.5-36.1 cm., off the north coast of Scotland, at a distance of 211 miles; 1, of 31.5-37.4

cm., near Buchanness, at a distance of 88 miles ; and the third, in the same locality, at a distance of 85 miles.

Two were "nearly ripe," 1 of 37-40.9 cm., taken in December 1911, after 185 days, near Buchanness, where those above referred to were caught, at a distance of 87 miles ; and the other, in November 1913, after 892 days, a little farther to the south, at a distance of 72 miles.

One male, of 36-38.4 cm., recaptured in April 1912, after 305 days, to the north and east, off Stonehaven, was described as "spent."

Another, of 32.5-35.5 cm., taken in December 1911, 26 miles to the north and east, near the Bell Rock, was "fully half-ripe."

Three of the adult males were "immature" ; 1 was taken in June and another in July, in the Moray Firth, but the third was caught in March 1912, and thus within the spawning season, within the Firth of Forth, at Pittenweem ; it measured 34.5-38.2 cm.

*Females*.—Two of the females were "spawning" ; 1 was caught in January 1912, after 225 days, near Buchanness, at a distance of 90 miles ; it measured 35.5-38.7 cm. ; the other was taken in February 1912, after 235 days, east of the Isle of May, at a distance of 18 miles ; it measured 40.5-42.3 cm.

Two were described as "ripe," one taken east of Aberdeen, offshore, at a distance of 78 miles, in April 1912, after 302 days ; it measured 42-43.6 cm. ; the other was found to the north and east of May Isle, at a distance of 18 miles, in December 1913, after 915 days, and it measured 39-48.5 cm. A female, measuring 30.5-43.5 cm., and taken in November 1914, after 1250 days, south-east of Aberdeen, at a distance of 60 miles, was described as "half-ripe."

Among the "immature" females was 1, of 37.5-41.2 cm., taken in March 1912, after 260 days, near Pittenweem, in the Firth of Forth, and 1, of 34-38.9 cm., caught in January 1912, after 219 days, 63 miles to the north and east, south-east of Aberdeen.

Of the females under the adult size on recapture was 1 of 32.5-37.2 cm., taken 50 miles distant, off Tod Head, to the north and east, in April 1912, and 1, of 31.5-36.3 cm., caught in May 1912, north and east of Buchanness, at a distance of 113 miles.

#### EXPERIMENT VI.

*7th September 1911.*

In this experiment, 70 fish were marked and liberated, consisting of 27 males, 23 females, and 20 whose sexes were not determined. The males ranged in size from 22.5 to 37.5 cm., and 9 were under the adult size ; the sizes of the females were from 24.5 to 65.5 cm., and 21 were under the adult size ; the sizes of those whose sexes were not determined on liberation ranged from 25 to 44.5 cm. ; of this lot, 16 were recaptured, and the sex was found recorded for 10 of them, 3 being males and 7 females.

The total number of fishes recaptured was 37, or 52.8 per cent. ; of the males recorded on liberation, 17, or 62.9 per cent., were recaptured ; of the females recorded on liberation, 14, or 58.3 per cent., were recaptured ; and the number recaptured of those whose sexes were not determined on liberation was 6, or 31.6 per cent. In this experiment, therefore, the information in regard to the sexes is limited.

The fish were taken by trawl by the "Goldseeker" in Kirkcaldy Bay, Firth of Forth, at 1.40 p.m. on the 6th September ; they were marked and placed in tanks of running water until 8.30 a.m. on the 7th, when they were set free.

Of the 17 males recaptured 14 were of adult size, viz. from 33.6 to 40.7 cm., the average being 37.4 cm., compared with a range of from 22.5 to 37 cm., and an average of 33.1 cm. on liberation ; their periods of freedom varied from 110 to 1604 days, the mean being 457 days ; they travelled distances of from  $2\frac{1}{2}$  to 213 miles, the average being 70 miles, and the mean rate of movement, 1.4 miles per 10 days. Three of the males were under adult size, the average being 27.2 cm., which was also the average on liberation ; they had been at liberty for from 7 to 181 days, and migrated an average distance of 10 miles, with a mean rate of .86 mile per 10 days. Eight of the 14 females were of adult size, ranging from 39 to 44.2 cm., the mean being 40.9 cm., compared with 28 to 40 cm. and an average of 35.3 cm. on

liberation; the periods of freedom were from 167 to 1682 days, the average being 555 days; the distances migrated were from 5 to 137 miles, the average being 49·7 miles, and the mean rate of movement per 10 days ·89 mile. Six were immature, the sizes ranging from 25·6 to 37·7 cm., the average being 31·9 cm., compared with 24·5 to 37 cm., and a mean of 29·2 cm. on liberation; the average period of freedom was 239 days., the distances travelled being from 5 to 29 miles, averaging 13 miles, and the mean rate of travel per 10 days was ·56 mile.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In September, after 7 days, a male, of 28·5 to 28 cm., was taken near Kirkcaldy, in the Firth of Forth, at a distance of  $11\frac{1}{2}$  miles, and in October, after 34 days, 1 of undetermined sex, measuring 29·5 to 28 cm., was caught in the same neighbourhood, off Dysart, at a distance of  $9\frac{1}{2}$  miles. These were the only fish recovered within the first three months after liberation, and they were found near where they were originally caught.

*Second Quarter.*—Two were recaptured in December 1911, a female of 28·5–28·2 cm., off Largo, in the Firth of Forth, at a distance of  $6\frac{1}{2}$  miles, after 92 days, and a male, measuring 35–36 cm., after 110 days, to the north-east of Tod Head, at a distance of 56 miles; it is described as “very immature.” Two were caught in February 1912, a female of 37–39 cm., and “immature,” off Pittenweem, at a distance of 5 miles, after 167 days, and the male, of 35–35·3 cm., and “fully half-ripe,” after 158 days, near Buchanness, at a distance, to the northwards, of 78 miles.

Only 4 fishes were, therefore, recaptured in the second quarter, 2 in the Firth of Forth, and 2 at a considerable distance northwards, along the coast.

*Third Quarter.*—In March 1912, 2 females were taken, 1, of 37–37·7 cm., and “immature,” after 179 days, near Largo, in the Firth of Forth, at a distance of  $5\frac{1}{2}$  miles, and the other, of 25·5–26 cm., a little farther to the west, off Leven, at a distance of 9 miles, after 191 days. Three males were also got in March, all within the Firth of Forth, 1, of 26–26·5 cm., after 179 days, in Largo Bay, a distance of  $5\frac{1}{2}$  miles; another, of 23 cm. on liberation, but of unknown size on recapture, after 181 days, on the south shore of the Firth, at a distance of 14 miles; the third, after 183 days, was taken near Elie,  $2\frac{1}{2}$  miles distant; it measured 34–35·3 cm., and was “immature.” Another fish of undetermined sex, measuring 25–28 cm., was recaptured, after 190 days, near Kirkcaldy, at a distance of 11 miles. In April, a female was found, after 214 days, far up the Firth of Forth, at Bo’ness, a distance of 29 miles; it measured 24·5–25·6 cm., and was “immature”; a male, of 32·5–33·6 cm., also “immature,” was caught, after 212 days, near Bell Rock, at a distance of 27 miles. In May, a female, of 36·5–39·9 cm., and “immature,” was recaptured after 256 days, 43 miles to the north and east.

In this quarter, 9 fishes, or 24·3 per cent., were found, 7 within the Firth of Forth.

*Fourth Quarter.*—Two females were taken in June, 1 after 281 days, off Tod Head, to the north and east, at a distance of 58 miles; it measured 35–39·8 cm. The other was caught to the south and east, 35 miles N.E. by E. of Scarborough (Lat.  $54^{\circ} 43' N.$ , Long.  $0^{\circ} 15' E.$ ), 137 miles distant, after 295 days; it measured 40–40·7 cm.; the condition of the ovaries was not ascertained; the mean rate of movement in this case was 4·6 miles per 10 days. Two males were recovered in August 1912, 1, 24 miles to the south and east, off the Isle of May, after 330 days; it measured 34·5–39·2 cm., and was “immature.” The other, measuring 37–40·5 cm., was caught, after 356 days, 4 miles north-east from Noup Head, Orkney Isles, at a distance of 213 miles.

Within 12 months after liberation, 19 fishes, or 51·3 per cent., were recaptured, of which the unusually high number of 12, or 63·1 per cent. of them, were taken within the Firth of Forth.

Three fish were found in the remainder of 1912, 2 in September, and 1 in October. A female, of 30·5–37·5 cm., was caught in September, after 370 days, 24 miles to the north and east, and a male in the same locality, after 371 days, at a distance of 21 miles; it measured 35–39·5 cm. In October, after 393 days, a female, measuring 29–36·5 cm., was got near Crail, in the Firth of Forth, at a distance of 8 miles.

Of the remaining 14 fish, 11 were taken in 1913, 1 in 1914, and 2 in 1916. A male, of 34–40·7 cm., and “nearly ripe,” was caught in January, after 508 days, at Aberdeen Bank, south-east of Aberdeen, at a distance of 72 miles. Two were caught close together in February, after 527 days, at Aberdeen Bank, at distances of 66 and 67 miles. One was a male, measuring 34–36·2 cm., and it was “ripe.” In the other, the sex was not determined, but, as it measured 33·5–37·9 cm., and was “spawning,” it was probably a female. Three were recaptured in March, a female of 37·5–44·1 cm., and “immature,” after 551 days, to the east of May Isle, at a distance of 24 miles; another female, of 33·5–39·9 cm., and also “immature,” was taken, after 571 days, at Aberdeen Bank, at a distance of 62 miles; and a male, of 32·5–36·4 cm., not far from it, at a distance of 65 miles, after 567 days; the condition of the testes was not recorded. A male, measuring 31–36·8 cm., was caught in April 1913, after 592 days, off Largo, in the Firth of Forth; it was “immature.” One of unknown sex was recaptured in May 1913, after 623 days, close to Buchanness, at a distance of 92 miles; it measured 33·5–41·2 cm., and was “immature.” In June, a female, of 35–39·7 cm., and “spent,” was taken, after 637 days, 15 miles to the east of the Bass Rock, and another, whose sex was unknown, of 30·5–39·5 cm., was taken by the “Goldseeker,” after 658 days, in the Firth of Forth. In October, after 764 days, one of unknown sex was got almost directly east, offshore, at a distance of 67 miles; it was “immature.”

In February 1914, a male measuring 34–39 cm., was taken 122½ miles to the south-east of Whitby after 883 days; it was described as “mature.”

The two remaining fishes were recovered in 1916, 1, a male, in January, measuring 22·5–37·7 cm., and “spawning,” was recaptured 21 miles off Flamborough Head, at a distance of 161 miles, after 1604 days. In April, a female, measuring 28–44·2 cm., and described as “spent,” was taken, after 1682 days, 51 miles to the eastward, offshore.

*Distances travelled*—10 miles and under.—Nine fish, or 25·7 per cent., were recaptured at distances of from 2½ to 9½ miles, the average being 6·8 miles, viz. 3 males (18·7 per cent.), with a mean distance of 4½ miles, 5 females (35·7 per cent.), with an average of 6·8 miles, and 1 of unknown sex, which travelled 9½ miles. They were all found within the Firth of Forth, 4 off Largo, 1 off Elie, 1 off Leven, 1 off Pittenweem, and 1 off Crail, and 1 off Dysart.

10 to 20 miles.—Four, or 11·4 per cent., were recaptured at distances between 11 and 15½ miles, viz. 2 males (12·5 per cent.), with an average of 13 miles, 1 female, 15½ miles, and 1 of undetermined sex, 11 miles. Three were taken within the Firth of Forth, 2 near Kirkcaldy, and 1 off Portobello. The female had moved to the south and east, east of the Bass Rock.

The number recaptured at distances under 20 miles was, therefore, 13, or 37·1 per cent., viz. 5 males (39·5 per cent.), with an average of 8 miles, 6 females (42·8 per cent.), with a mean of 7·9 miles, and 2 of undistinguished sex, with an average of 10 miles. Ten were got within the Firth of Forth, and 3 outside it.

20 to 50 miles.—Seven of the plaice, or 20 per cent., were recovered at distances of from 24·5 to 43·5 miles, viz. 3 males (18·7 per cent.), with an average of 24·1 miles, and 4 females (28·6 per cent.), with an average of 30·3 miles. One of the females was taken 29 miles to the westwards, at Bo'ness, in the Firth of Forth; another female was recaptured 24½ miles to the south and east; 1 of the males was got also 24 miles to the south and east; all the other fish were caught to the north and east.

50 to 100 miles.—Eleven, or 31·4 per cent., were taken at distances of from 51 to 92 miles, viz. 5 males (31·25 per cent.), with an average of 68 miles, 3 females (21·4 per cent.), with an average of 57·3 miles, and 3 of unknown sex, with an average distance of 75 miles. One female had gone directly east, a distance of 51 miles; all the others were got to the north and east, 5 at Aberdeen Bank and vicinity, at distances of from 58 to 72 miles; 1 was taken to the north of Tod Head, and 2—a male and 1 of unknown sex—close to Buchanness, at distances of 78 and 92 miles respectively. One of unknown sex was taken at Aberdeen Bank, at a distance of 66 miles, and another almost directly east (N. 88° E.) offshore, at a distance of 67 miles.

Over 100 miles.—Four fish, or 11·4 per cent., were got at distances of from 122 to 213 miles, namely, 3 males (18·7 per cent.), with an average of 165·6 miles, and

1 female. One of the males was got on the north coast of Scotland, at a distance of 213 miles. The other three fishes, 2 males and a female, were all got to the south and east, the female off Scarborough, 137 miles distant, 1 of the males off Whitby, at a distance of 122 miles, and the other male 21 miles east of Flamborough Head. The mean rates of movement of the 3 males were respectively 6, 1.38, and 1 mile per 10 days. Fourteen of the fishes, or 40 per cent., were taken within the Firth of Forth, namely, 5 males (31.25 per cent.), 7 females (50 per cent.), and 2 of unknown sex (40 per cent.). All the other fish were got to the south of Kinnaird Head, except the male, which was taken on the north coast of Scotland.

#### MATURITY.

*Males*.—The only male, which was “spawning” on recapture, was the one taken in January 1916, off Flamborough Head.

Two were described as “ripe,” the one found off Whitby in February 1914, at a distance of 122 miles, and the other in February 1913, on Aberdeen Bank.

One was “nearly ripe”; it also was captured on Aberdeen Bank in January 1913.

A male, caught in February 1912, near Buchanness, and measuring 35–35.3 cm., was described as “fully half ripe.”

Among those of adult size whose testes were “immature,” 3 were taken within the spawning season, 1 in March 1912, and measuring 34–35.3 cm., at Elie, in the Firth of Forth; another, measuring 31–36.8 cm., in April 1913, at Largo, in the Firth of Forth; the third, caught in April 1912, to the north-east, off the Bell Rock, measured 32.5–33.6 cm.

*Females*.—No female was “spawning” or “ripe,” or “nearly ripe.” Two were described as “spent,” 1, of 35–39.7 cm., taken in June 1913, to the east of the Bass Rock, at a distance of 15 miles; the other, of 28–44.2 cm., in April 1916, at 51 miles almost directly east, in the offshore waters. Among those described as “immature,” was 1 of 37–39 cm., taken in February 1912, off Pittenweem, in the Firth of Forth; it was “rather immature”; 1, of 37.5–44.1 cm., caught in March 1913, 24 miles to the north and east; 1, of 35.5–39.9 cm., taken in March 1913, at Aberdeen Bank, and 1, of 36.5–39.9 cm., caught in May 1912, 43 miles to the north and east. Among those under adult size on recapture, 3 were taken within the limits of the spawning season, 1, of 37–37.7 cm., in March 1912, near Largo, in the Firth of Forth; another, of 25.5–26 cm., also in March 1912, off Leven, in the Firth of Forth; 1 in April 1912, to the westwards, near Bo’ness, in the Firth of Forth. One fish whose sex is not recorded, measuring 33.5–37.9 cm., was taken in February 1913 on Aberdeen Bank.

#### EXPERIMENT VII.

##### 6th March 1912.

In this experiment, 100 fishes were liberated, 27 males, 70 females, and 3 whose sexes were not ascertained. The sizes of the males ranged from 26 to 38.5 cm., and of the females, from 29 to 59.5 cm. Eleven of the males and 36 of the females were under the adult size when they were liberated.

The numbers liberated and recaptured are shown on the table below, arranged in 5-cm. groups:—

	cm. 25–30.5	cm. 31–35.5	cm. 36–40.5	cm. 41–45.5	cm. 46–50.5	cm. 51–55.5	cm. 56–60.5	Total.
F. Lib. . . . .	6	17	30	12	1	1	3	70
F. Recap. . . . .	4	10	22	7	—	—	2	45
M. Lib. . . . .	6	15	6	—	—	—	—	27
M. Recap. . . . .	6	10	5	—	—	—	—	21
? Lib. . . . .	—	1	2	—	—	—	—	3
? Recap. . . . .	—	—	—	—	—	—	—	—

The fish were trawled by the “Goldseeker,” at Station VI., in the Firth of

Forth (off St. Monans), on the 6th March; they were marked between 3.25 and 4.15 p.m., and liberated at 6 p.m. on the same day, all being in good condition.

The number recaptured was 66, or 66 per cent., viz. 21 males, or 77.8 per cent., and 45 females, or 64.3 per cent.

Twenty of the males were of adult size when recaptured, the sizes ranging from 34 to 43.8 cm., and averaging 37.7 cm., as compared with a range of 29.5 to 38.5 cm., and an average of 33.4 cm. on liberation; the periods of freedom varied from 39 to 743 days, the mean being 343 days; the distances migrated were from 4 to 195 miles, the mean being 69.9 miles, and the average rate of movement, 2.1 miles per 10 days.

Of the females, 34 were of adult size, viz. from 38.3 to 54.1 cm., the mean being 43.4 cm., compared with a range of from 30 to 59.5 cm. on liberation (but the size of the largest fish was not recorded on recapture); the periods of liberty were from 12 to 1120 days, the average being 405 days; the distances migrated varied from  $4\frac{1}{2}$  to 174 miles, and averaged 63.9 miles, and the mean rate of travel, per 10 days, was 1.7 miles. Eleven of the females were under adult size on recapture, viz. from 30.1 to 37.8 cm., averaging 34.6 cm., while, on liberation, the range was from 30 to 37.5 cm., averaging 33.2 cm.; they were at liberty for from 2 to 748 days, the mean being 148 days; the distances migrated were from  $2\frac{1}{2}$  to 85 miles, the average being 24.4 miles, and the mean rate of movement, per 10 days, 1.6 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Six of the fishes, 5 females and a male, were recaptured in March. Four were taken in the Firth of Forth, all on the north coast, the male, after 7 days, off Methil, a distance of 7 miles; it measured 26–25.5 cm., and was “immature”; a female, of 30–30.1 cm., was taken, after 9 days, off Buckhaven, at a distance of  $8\frac{1}{2}$  miles; another, of 33.5–33.8 cm., after 8 days, off Pittenweem, a distance of 5 miles; another, of 37.5–37.5 cm., after 2 days, off St. Monans; a distance of  $4\frac{1}{2}$  miles. A female, of 37–36.7 cm., was taken north-east of the Isle of May, at a distance of 18 miles, after 9 days, “immature.” Another female, of 38.5–38.6 cm., and described as “spent,” was recaptured, after 12 days, by a steam-trawler, the position being given as “outside Granton Harbour”; as trawling is prohibited in the Firth of Forth, there is little doubt that this fish was caught outside the Isle of May.

In April, 6 fishes were recaptured, 5 females, and a male. All the females were taken within the Firth of Forth. One, measuring 43.5 cm. when liberated, but of unknown size when taken, was caught, after 48 days, off St. Monans, a distance of  $4\frac{1}{2}$  miles; the condition of the ovaries was not ascertained; another female, of 33.5–34.3 cm., and “immature,” was taken off Pittenweem, at a distance of 5 miles, after 28 days; a third, of 56 cm. when liberated, was captured after 34 days, off Buckhaven, at a distance of 5 miles, the size on recapture and the condition of the ovaries not being recorded; the fourth female, measuring 39.5–39.8 cm., and “immature,” was caught, after 28 days, off Pittenweem, at a distance of 5 miles; the fifth, of 35–35.7 cm., and “immature,” was recovered 45 days later off Elie, at a distance of  $2\frac{1}{2}$  miles; the male, which measured 36–36.5 cm., and is described as “immature,” was taken, after 39 days, offshore, to the south-east of Aberdeen, at a distance of 71 miles.

Four fishes were recaptured in May, 2 females and 2 males. One of the males, measuring 34.5–35.6 cm., and “immature,” was taken, after 83 days, near Tod Head, at a distance of 52 miles; the other, measuring 35–34.7 cm., and described as “spent,” was got, after 62 days, north and east of the Isle of May, at a distance of  $16\frac{1}{2}$  miles. One of the females, measuring 38–40 cm., and said to be “spent,” was recaptured, after 68 days, to the east of the Isle of May, at a distance of 24 miles. The other female, of 33–33.6 cm., and “immature,” was caught, after 70 days, near Kinghorn, 12 miles to the westward.

Thus, in this quarter, 16 fishes, or 24.2 per cent., were recaptured, the position of capture being ascertained for all but one, namely, the one referred to above as being caught “outside Granton Harbour.” Of the 16, 10 were taken within the Firth of Forth.

*Second Quarter.*—In June, 2 females and 1 male were taken, the male, measuring

34-37.5 cm., after 107 days, at Aberdeen Bank, a distance of 72 miles. One of the females, of 31-32.7 cm., was taken, after 106 days, to the north of the Bell Rock, at a distance of 29 miles; the other, measuring 36.5-39.5 cm., was recaptured, after 107 days, to the east of the Isle of May, at a distance of 19 miles.

Three females and 1 male were recovered in July. The male, measuring 34-37.8 cm., was taken, after 138 days, to the north-east of the Isle of May, at a distance of 16 miles. One of the females, measuring 38.5-40 cm., was caught, after 119 days, 19 miles to the north-east. Another female, of 37-39.3 cm., was got, after 120 days, to the north of the Bell Rock, at a distance of 31 miles. A third female, of 42.5-44.3 cm., was taken, after 145 days, nearly at the same place, 29 miles distant.

None was recaptured in August, and therefore, in the second quarter, only 7 fishes, or 10.6 per cent., were got, of which none was taken in the Firth of Forth, all being recaptured to the north and east.

*Third Quarter.*—In September, a female, of 37.5-43.6 cm., was found, after 194 days, 51 miles to the north-east, in the offshore waters.

In October, another female, of 30.5-34.5 cm., was taken near the Bell Rock, at a distance of 23 miles, after 237 days.

In November, a male, of 34.5-36.7 cm., was recaptured, after 241 days, near Aberdeen Bay, at a distance of 71 miles.

Only 3 fishes were thus recaptured in the third quarter, all to the north and east.

*Fourth Quarter.*—In December 1912, 3 males and 1 female were caught. The female, measuring 59.5 cm. on liberation, was recaptured in the Moray Firth off Whitehills, near Banff, at a distance of 137 miles, after 292 days; its size on recapture and the condition of its ovaries were not recorded. One of the males, of 29.5-34 cm., was taken, after 274 days, at Station VI., Firth of Forth, the place where it was originally captured; another male, of 29.5-35.5 cm., was got, after 299 days, to the east of the Isle of May, at a distance of 24 miles; the third male, whose size on liberation was 32.5 cm., but the size on recapture and the condition of the testes were not recorded, was recaptured, after 274 days, in the offshore waters, at a distance of 56 miles to the south and east.

In January 1913, 2 females were recaptured; 1, measuring 41.5-44.3 cm., and described as "spent," after 327 days, was taken off Buchanness, at a distance of 91 miles; the other female, of 35.5-41.3 cm., was recaptured, after 307 days, in the Moray Firth, off Noss Head, at a distance of 166 miles; it was described as "immature."

Seven were got in February, 2 males and 5 females. One of the males, measuring 32.5-35 cm., and "spawning," was recaptured, after 357 days, at Aberdeen Bank, at a distance of 72 miles; the other male, of 30.5-36.6 cm., and "spawning" ("partly spent") was taken, after 352 days, in the same direction, at a distance of 62 miles. One female was taken in the Firth of Forth, off St. Monans, at a distance of 4½ miles, after 357 days; it measured 41.5-45.6 cm., and was "spent." The other 4 females were caught off the coast of Aberdeen, 1 measuring 34-39.9 cm., and "immature," after 358 days, near Buchanness, at a distance of 89 miles; the other 3 were got close together, at Aberdeen Bank, at distances of 72, 73, and 72 miles after respectively 353, 359, and 357 days; they measured 40.5-46.2 cm., 39.5-47.7 cm., and 36-42.3 cm.; the last-named fish was "spawning," and the first 2 were "spent."

Thirteen fishes, or 19.7 per cent., were, therefore, recaptured in the fourth quarter; 2 were got in the Firth of Forth, and all the others to the north and east, except 1 which was found to the south and east.

Thus, in the first 12 months after liberation, 39 of the fishes were recaptured, or 59.1 per cent., the position of recapture of 37 being known; twelve were taken in the Firth of Forth.

Of the remainder, 18 were got in the remaining months of 1913. In March, 2 males and a female were taken, all to the north; the female, which measured 30.5 cm. on liberation, the size on recapture not being recorded, was "immature"; it was caught, after 363 days, off Buchanness, at a distance of 85 miles; one of the males, of 35.5-42 cm., was taken, after 374 days, to the east of the Orkney Isles, at a distance of 173 miles; the condition of the testes was not recorded; the other male, measuring 36.5-39.3 cm., and "spawning," was recaptured, after 385 days, farther to the northwards, off Start Point, Orkney Isles, at a distance of 195 miles



In April, a male and a female were recaptured, both in the Moray Firth. The male, which measured 36 cm. on liberation, but whose size on recapture and the condition of the testes were not recorded, was caught, after 393 days, off Noss Head, at a distance of 156 miles; the female, of 41-44.2 cm., and "spawning," was recaptured, after 392 days, off Tarbet Ness, at a distance of 174 miles; the mean rates of movement in these cases were respectively 3.9 and 4.43 miles per 10 days.

In May, 3 females and 1 male were recaptured, the male, after 433 days, E.N.E. of May Isle, at a distance of 35 miles; it measured 38.5-43.8 cm., and was "spent." The females were taken in the vicinity of Buchanness, after intervals of 435, 442, and 444 days, at distances of 77, 90, and 99 miles; they measured respectively 36-42.6 cm., and "immature," 33-39.7 cm., and "spent," and 40-45.6 cm., the condition of the ovaries not being recorded for this last-named fish.

Two females were got in June. One, measuring 36-41.2 cm., and "immature," was caught, after 463 days, near the Bell Rock, at a distance of 26 miles; the other, which measured 39.5-45 cm., was recaptured, after 471 days, close to Noss Head, in the Moray Firth, at a distance of 171 miles, its state of maturity not being recorded.

A male and a female were recaptured in July; the male was caught in the Moray Firth, but the precise locality was not stated, while the female, which measured 30-38.3 cm., and was "immature," was taken, after 489 days, to the east of the Bass Rock, at a distance of 15 miles.

In August, a female, which measured 44-48.2 cm., was taken, after 532 days, offshore, to the south-east of Buchanness, at a distance of 101 miles.

In September, a male, of 36-42.4 cm., was recaptured, after 562 days, to the east of Clyth Ness, in the Moray Firth, at a distance of 150 miles.

Another male was taken in October, after 579 days, to the east of the Isle of May, at a distance of 23 miles; it measured 33.5-40.2 cm.

A female was caught in November, after 618 days, near Buchanness, at a distance of 80 miles; it measured 39-46.4 cm., and was "three-quarters ripe."

The last fish to be taken in 1913 was a male, of 31.5-39.9 cm., and "nearly ripe"; it was recaptured in December, after 659 days, in the neighbourhood of the Bell Rock, at a distance of 18 miles.

Eight of the marked plaice were taken in 1914. A female was taken in February after 721 days, in the Moray Firth, in an unspecified position; it measured 36-44 cm., and the condition of the ovaries was not recorded.

Three females and 1 male were recaptured in March. One of the females, which measured 37.5-48.7 cm., and was "spent," was taken, after 751 days, to the east of the Isle of May, at a distance of 33 miles; another female, of 31-37.8 cm., and said to be "spent," was caught, after 748 days, at Aberdeen Bank, at a distance of 76 miles; the third female, of 39-45.5 cm., and "spawning," was taken, after 728 days, off Whitehills, Banff, in the Moray Firth, at a distance of 137 miles; the male, which measured 30.5-36.4 cm., and was "spawning," was captured to the south-east of Aberdeen, at a distance of 58 miles.

In April, a female, of 37-45.2 cm., and "spent," was taken at the same place as the last, at a distance of 58 miles, after 776 days; another female, of 39.5-43 cm., and described as "immature," was recovered, after 822 days, to the east of the Isle of May, at a distance of 45 miles.

In November, a female, of 41.5-54.1 cm., and "three quarters ripe," was recaptured, after 982 days, near Aberdeen, at a distance of 69 miles.

The last fish of the experiment to be recaptured was got in March 1915, after 1120 days, to the east of the Isle of May, at a distance of 25 miles; its size on liberation was 33.5 cm., but neither its size on recapture nor the condition of the ovaries was recorded.

Of the 66 fish taken, 14, or 21.2 per cent., were got in the Firth of Forth, namely, 2 males (9.5 per cent.) and twelve females (26.7 per cent.); 52, or 78.8 per cent., were got outside the Firth, 90.5 per cent. of the males and 73.3 per cent. of the females. Seven, or 10.6 per cent., were recaptured in the Moray Firth, and 4, or 6.1 per cent., all males, were taken still farther to the north.

*Distances travelled.*—Eleven fish, or 17.2 per cent., were recaptured at distances of from  $2\frac{1}{2}$  to  $8\frac{1}{2}$  miles, namely, 2 males (10 per cent.), with an average of 5.5 miles, and 9 females (20.4 per cent.), with an average of 4.9 miles. They were all taken in

the Firth of Forth. One of the males (No. 803) was recaptured by the "Gold-seeker" at Station VI., off St. Monans, on the 5th December 1912, and again liberated on the following day, at the Station 20 miles east of the Isle of May.

*10 to 20 miles.*—Nine fish, or 14·1 per cent., migrated distances of from 12 to 19 miles, namely, 3 males (15 per cent.), with an average of 17·1 miles, and 6 females (13·6 per cent.), with an average of 16·5 miles.

Thus, 20 fish, or 31·2 per cent., were recovered at distances under 20 miles. Five males, or 25 per cent., with a mean of 12·5 miles, and 15 females, or 34 per cent., with an average of 9·6 miles. Twelve of them were got within the Firth of Forth.

*20 to 50 miles.*—Twelve fish, or 18·7 per cent., were taken at distances of from 23 to 45 miles, namely, 3 males (15 per cent.), with an average of 27·3 miles, and 9 females (20·4 per cent.), with an average of 29·7 miles. All the males and 6 of the females were recaptured to the north and east, and 3 of the females to the east and partly to the south.

*50 to 100 miles.*—Twenty-three fishes, or 36 per cent., went journeys of from 51 to 99 miles, namely, 9 males (45 per cent.), with an average of 69 miles, and 14 females (31·8 per cent.), with an average distance of 77·3 miles. Eight of the males and all the females were recaptured to the north and east; 1 of the males was taken to the south and east, at a distance of 56 miles.

*Over 100 miles.*—Ten of the plaice, or 15·6 per cent., were recaptured at distances of from 101 to 195 miles, viz. 4 males (20 per cent.), with an average of 168·6 miles, and 6 females (13·6 per cent.), with an average of 147 miles. All these fish were taken to the northwards, 5 of the females within the Moray Firth, and 1 offshore, south-east from Buchanness, 2 of the males to the east of Noss, in the Moray Firth, and 2 off the Orkneys.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 17 of the 21 males recaptured. Four were "spawning," all recaptured to the north and east, 2 in February 1913, after 352 and 357 days, at Aberdeen Bank, at distances of 62 and 72 miles; another, of 36·5–39·3 cm., is described as taken in March 1913, after 385 days, in 50 fathoms, 20 miles E.S.E. of Start Point, in the Orkneys, at a distance of 195 miles; the fourth was caught in March 1914, after 743 days, to the south-east of Aberdeen, at a distance of 58 miles.

One male, of 31·5–39·9 cm., was "nearly ripe"; it was caught in December 1913, after 659 days, to the south of the Bell Rock, east of the Isle of May, at a distance of 18 miles.

Two males were described as "spent"; 1, of 35–34·7 cm., was taken in May 1912, after 62 days, 16 miles to the north and east; the other, measuring 38·5–43·8 cm., was caught in May 1913, after 433 days, 35 miles to the north and east.

Among the males of adult size on recapture, whose testes were "immature," 1 was recaptured in the spawning season; it measured 36–36·5 cm., and was taken to the south-east of Aberdeen Bank, in April 1912, after 39 days, at a distance of 71 miles.

*Females.*—Of the 45 females recaptured, the condition of the reproductive organs was ascertained in 38. Three were "spawning," 1 of 36–42·3 cm., caught in February 1913, after 357 days, at Aberdeen Bank, a distance of 72 miles; the other 2 were caught in the Moray Firth, one of 41–44·2 cm., in April 1913, after 392 days, off Tarbet Ness, at a distance of 174 miles, and the other, of 39–45·4 cm., in March 1914, after 728 days, off Whitehills, Banff, at a distance of 137 miles.

One female was "mature"; it measured 39·5–43 cm., and was taken in June 1914, to the east and a little south of the Isle of May, at a distance of 45 miles.

Nine females were described as "spent"; 1, of 38·5–38·6 cm., was taken in March 1912, after 12 days, probably outside the Isle of May; another, of 38–40 cm., was caught in May, after 68 days, 24 miles east and partly south of the Isle of May; and a third, of 37·5–48·7 cm., was taken in March 1914, after 751 days, to the north and east of the Isle of May, at a distance of 33 miles; all the others, except 1, were found to the northwards, off the coast of Aberdeen, viz. 1, of 41·5–44·3 cm., in January 1913, at a distance of 91 miles; another, of 40·5–46·2 cm., in February 1913, at a distance of 72 miles; another, of 39·5–47·7 cm., also in February 1913, at a distance of 73 miles; another, of 33–39·7 cm., in May 1913, at a distance of 90

miles, and another, measuring 37-45.2 cm., in April 1914, after 776 days, at a distance of 58 miles; the remaining "spent" female was recaptured in the Firth of Forth in February 1913, near St. Monans, at a distance of  $4\frac{1}{2}$  miles; it measured 41.5-45.6 cm. A female, which was 31-37.8 cm., and was therefore under the adult size, was taken in March 1914, after 748 days, at Aberdeen Bank, at a distance of 76 miles, and was described as "spent."

Two females were described as "three-quarters ripe"; 1 was caught in November 1913, after 618 days, south-east of Buchanness, at a distance of 80 miles, and it measured 39-46.4 cm.; the other, of 41.5-54.1 cm., was caught in November 1914, after 982 days, not far from the same place, at a distance of 69 miles.

Among the adult females, 12 were described as "immature." Three were recaptured in the spawning season, 1, measuring 35.5-41.3 cm., in January 1913, off Noss Head, in the Moray Firth, at a distance of 166 miles; another, of 34-39.9 cm., was taken in February 1913, off Buchanness, at a distance of 89 miles; and the third, of 39.5-39.8 cm., was got in April 1912, after 28 days, near Pittenweem, in the Firth of Forth, at a distance of 5 miles.

Of 9 females, which were under adult size on recapture, and which were "immature," 6 were taken in the Firth of Forth. Of the other 3, 1 measuring 37-36.7 cm., was taken in March 1912, after 9 days, 18 miles to the north and east; another, of 31-32.7 cm., was found in June 1912, after 106 days, near the Bell Rock, 29 miles to the north and east; and the third was caught in October 1912, 23 miles distant, in the same direction.

#### EXPERIMENT VIII.

24th April 1912.

The number of plaice marked and liberated in this experiment was 102, viz. 44 males, 55 females, and 3 of undetermined sex. The sizes of the males ranged from 27 cm. to 40.5 cm., and of the females, from 30 to 55 cm.; the sizes of those of undetermined sex were from 33.5 to 42 cm. Of the males, 12 were under the adult size on liberation, and of the females, 35 were under the adult size.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	Total.
F. Lib.	1	30	14	7	1	2	55
F. Recap.	1	21	7	7	1	—	37
M. Lib.	3	29	12	—	—	—	44
M. Recap.	2	21	10	—	—	—	33
? Lib.	—	1	1	1	—	—	3
? Recap.	—	—	1	—	—	—	1

All the plaice used were taken by the "Goldseeker" at Station VI., Firth of Forth (Fluke Hole), on the 23rd April; they were marked between 3.10 and 4.5 p.m., and kept in tanks with a good circulation of water until 10 a.m. on the 24th, when they were liberated in good condition. Only 1 of the plaice died while in the tanks.

The number recaptured was 71, or 69.6 per cent., viz. 33 males, or 75 per cent., 37 females, or 67.3 per cent., and 1 of unknown sex.

Of the males, 32 were of adult size on recapture, namely, from 33.4 to 43.2 cm., the average being 38.4 cm., compared with from 27 to 40.5 cm., and an average of 34.6 cm. on liberation; the periods of freedom ranged from 10 to 1074 days, averaging 351 days; the distances migrated were from  $2\frac{1}{2}$  to 192 miles, averaging 77.8 miles, and the mean rate of movement was 2.29 miles per 10 days. Of the females, 28 were of adult size, when recaptured, ranging from 38 to 51 cm., and averaging 43.1 cm., compared with 31.5 to 47 cm., and an average of 38 cm. on liberation; they were at liberty for from 35 to 757 days, the average being 366 days; the distances migrated ranged from  $2\frac{1}{2}$  to 356 miles, the average being 73.8 miles, and the mean rate of movement 2 miles per 10 days. Nine of the

females were under the adult size on recapture, ranging from 32.2 to 37.1 cm., the mean being 35.5 cm., compared with from 30 to 34.5 cm., and an average of 32.4 cm. on liberation; the fish were at liberty from 9 to 492 days, the average being 212 days; the distances migrated ranged from  $2\frac{1}{2}$  to 136 miles, averaging 28.4 miles, and the mean rate of movement per 10 days was 1.34 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In May 1912, 4 plaice were recaptured, 1 male and 3 females, all within the Firth of Forth, 3 near Elie, about 2 miles distant, and 1 off Pittenweem, at a distance of 4 miles. One of the females, measuring 44–44.3 cm., got off Pittenweem, was “spent”; all the others were “immature.” In June a female, of 39.5–39.4 cm., was taken 24 miles distant, to the east of the Isle of May. In July 4 females were caught, all eastwards of the Firth of Forth, at distances from the station of 11, 12, 17, and 24 miles; 1, measuring 42.5–44.1 cm., was “half-ripe,” and all the others “immature.” The number recaptured in the first 3 months after liberation was, therefore, 9, or 12.7 per cent., 4 within the limits of the Forth, and 5 off the mouth of the Forth.

*Second Quarter.*—In August 1912, 2 fishes were recaptured, a male, of 33.5–36.5 cm., to the north-east of the Isle of May, at a distance of 16 miles, after 114 days, and a female, of 40.5 cm., when liberated, but of unknown size when recaptured, which was taken to the south-east of St. Abb’s Head, at a distance of 54 miles, after 120 days. Four, all males, were taken in September, 2 at 16 and 17 miles distant, to the east of the Isle of May, after 140 and 134 days, and measuring 36.5–38.8 cm., and 36–37.5 cm. respectively; 1, of 36–38.6 cm. (described as “nearly ripe”), was caught 34 miles to the north-east after 145 days, and another, measuring 35.5–37.7 cm., in the same direction, at a distance of 68 miles, after 150 days. Three were recaptured in October 1912, 1 male and 2 females. The male, of 33.5–38.5 cm., and described as “half-ripe,” was taken 32 miles to the north-east after 177 days; 1 of the females, of 32–35.5 cm., and therefore under adult size was caught, after 184 days, 15 miles to the north and east; the other, measuring 34.5–38.3 cm., was found, after 179 days, at a distance of 77 miles to the north-east, off Aberdeen.

In this quarter, therefore, the total number recaptured was 9, or 12.7 per cent., and all were taken outside the Firth of Forth, 8, or 88.8 per cent., to the north and east, and 1 to the south and east.

*Third Quarter.*—A female, of 38–41.3 cm., and described as “nearly ripe,” was recaptured in November, after 218 days, east of the Isle of May, at a distance of 16.5 miles; the rate of movement was 41.3 miles per 10 days. In December 4 marked plaice were taken, 2 males and 2 females, 3 to the north-east, and 1 far to the south-east. One of the males, measuring 35–39.1 cm., was caught, after 250 days, 71 miles to the northwards, off Aberdeen Bay; another, of 35–39.2 cm., and “nearly ripe,” was caught off Banff, in the Moray Firth, at a distance of 134 miles, after 243 days. One of the females, measuring 33–36.9 cm., and thus under adult size, was taken, after 222 days, 38 miles northwards, close in, near Montrose; it was described as “nearly ripe.” The other female, measuring 45–47.5 cm., and also “nearly ripe,” was caught, after 237 days, at a point 2 miles north-east of the E. Goodwin Light ( $51^{\circ} 17' N.$ ;  $1^{\circ} 30' E.$ ), a distance of about 357 miles; this fish was taken by a Ramsgate smack, and landed at Ramsgate, and it is of much interest, as showing that plaice from the Firth of Forth may, at rare intervals, migrate to the southern part of the North Sea. All these fish had moved with rapidity, the one taken on the Goodwin Sands showing an average rate of 15 miles per 10 days, the male caught in the Moray Firth an average rate of 5.5 miles, the male taken at Aberdeen Bay a rate of 2.8 miles, and the female caught at Montrose an average rate of 1.7 miles. In January 1913, 3 males were captured, all to the northwards, 2 in the Moray Firth, and 1 south-east of the Pentland Skerries. The 2 caught in the Moray Firth were taken close together, north-east of Tarbet Ness, at distances of 155 and 156 miles each, after 281 days; they measured respectively 34–37 cm., and 35.5–37.4 cm., and both were “spawning.” The male caught off the Pentland Skerries, at a distance of 164 miles, after, 268 days measuring 34.5–37.3 cm., and was “nearly ripe.” The rates of

movement of these males were nearly uniform, viz. respectively 5.5, 5.5, and 6.1 miles per 10 days.

Thus, in the third quarter, 8 of the marked plaice, or 11.3 per cent., were recaptured, 7, or 87.5 per cent., to the north and east, and 1 to the south and east; 3 were taken in the Moray Firth.

*Fourth Quarter.*—In February 1913, no fewer than 13 marked plaice were recaptured, 7 males and 6 females. Three were caught in the Firth of Forth, all females, 1, of 30–36 cm., and therefore under adult size, off Pittenweem, 5 miles distant, after 303 days, another, of 33.5–38 cm., off Largo, at a distance of 6 miles, after 309 days, the third, of 33–38.1 cm., after 303 days, off Elie, at a distance of 2 miles. The ovaries in each case were “immature.” One male, of 38.5–41.3 cm., and “ripe,” was taken off St. Abb’s Head, at a distance of 36 miles, after 283 days; a female, of 35.5–38.1 cm., “immature,” was taken, after 303 days, at a distance of 25 miles, to the east of the Isle of May; another female, of 32–37.1 cm., and “immature,” was got, after 309 days, 26 miles to the north and east. Five fishes, all males, were captured off the coast of Aberdeen, 3 on 26th February, after 308 days, all near together, 26 to 30 miles S.E. by E. of Aberdeen, at distances of 72 and 74 miles; their sizes were as follows:—37–40.2 cm., 32–37.2 cm., and 27–33.5 cm., and they were all “spawning.” The other two were caught, after 298 days, in the same locality, at distances of 71 and 72 miles; they measured 34–37 cm., and 40–41.3 cm., and were also “spawning.” The remaining two fish, a male and a female, were recaptured in the Moray Firth, the male 10 miles S.S.E. from Helmsdale, at a distance of 166 miles, after 288 days, measuring 38.5–39.7 cm., and “ripe”; the female, of 32.5–36.2 cm., was taken 1½ miles off Whitehills, near Banff, at a distance of 136 miles, after 292 days; it was “half-ripe.” The mean rate of movement of those taken off the coast of Aberdeen was 2.3 miles for 2 of the fishes, and 2.4 miles for 3 of the fishes, per 10 days; for those taken in the Moray Firth, the average rate was 5.7 for the male, and 4.6 for the female. Two males were recaptured in March 1913, both to the northwards; 1, 63 miles distant, off the coast of Aberdeen, in the same direction as the male referred to above; it measured 35–39.5 cm., and was “spawning”; the other, of 32–33.4 cm., was taken, after 336 days, at the Orkney Islands, at a distance of 192 miles; it also was “spawning”; the mean rate of movement of the former was 1.8 miles, and of the latter 5.7 miles per 10 days. In April 1913, 5 were recaptured, 3 males and 2 females. Two were taken on the 25th April, after 366 days, to the south and east; 1, of 38.5–40.9 cm., and “spent,” north of St. Abb’s Head, at a distance of 24 miles; the other, of 32–37.5 cm., and “immature,” was caught to the east of St. Abb’s Head, at a distance of 46 miles. One of the females was caught off Aberdeen, at a distance of 63 miles, after 344 days; it measured 34–38.8 cm., and was “immature”; the other, measuring 35–39.3 cm., was taken, after 351 days, off Tarbet Ness, in the Moray Firth, at a distance of 172 miles; the condition of the ovaries was not recorded. The third male was recaptured to the east of the Orkney Isles, at a distance of 179 miles, after 366 days; it measured 40.5 cm. when liberated, but the size on recapture and the condition of the testes were not ascertained.

Thus, in the fourth quarter, 20 fishes, or 28.2 per cent., were recaptured, of which 15, or 75 per cent., were taken to the north and east, with an average migration of 93 miles, and a mean rate of movement of 2.8 miles per 10 days; 3, or 15 per cent., were taken to the south and east, at an average distance of 35 miles, and a mean rate of 1 mile per 10 days; 2 were got to the north and west, within the Firth of Forth, the average distance being 4 miles and the mean rate 15 miles.

Within the 12 months after liberation, therefore, 46 marked plaice, or 64.8 per cent., were recaptured, 31, or 67.4 per cent., to the north-east, 10, or 21.7 per cent., to the south and east, and 5, or 10.9 per cent., to the north and west, within the Firth of Forth.

Of the remaining 25 fish, 14 were taken later in 1913, 4 males and 10 females. In May, 1 male and 3 females were got, all “spent,” the male, of 34–38.6 cm., off the Isle of May, at a distance of 15 miles to the south and east, after 376 days; one of the females, measuring 45–51 cm., in the Firth of Forth, off Largo, at a distance of 6 miles, after 386 days; a female, of 34.5–39.6 cm., was taken, after 375 days, offshore, to the east of Aberdeenshire, at a distance of 100 miles; the

remaining female, of 35-41.5 cm., was caught, after 393 days, to the north-east of Rattray Point, at a distance of 107 miles.

Four were recaptured in June, 3 males and 1 female, all to the north and east. One of the males, measuring 31.5 cm. on liberation, but of unknown size on recapture, was taken, after 421 days, off Fife Ness, at a distance of 16 miles; the condition of the testes was not recorded. Another was got on Aberdeen Bank, to the south-east of Aberdeen, at a distance of 63 miles, after 409 days; it measured 35.5-39.1 cm., and was "spent." The other male was caught, after 418 days, at a distance of 171 miles, east of the entrance to the Pentland Firth; it measured 33-37.6 cm., and was "immature." The female, of 40.5-45.8 cm., and "immature," was taken north of Aberdeen Bank, 85 miles distant, after 428 days.

In July, 2 females were captured, 1, of 32.5-41.1 cm., after 435 days, near the Bell Rock, at a distance of 27 miles; it was "immature." The other was recovered after 462 days, at Aberdeen Bank, at a distance of 75 miles; it measured 41.5-46.4 cm., and is described as "spent."

Two females were also recaptured in August, 1, of 31.5-42.2 cm., off the Isle of May, at a distance of 24 miles; the other was taken, after 492 days, at a distance of 18 miles, to the east of May Isle; it measured 32 cm. on liberation, but the size on recapture and the condition of the ovaries were not recorded.

Two females were taken in November, 1, of 35.5-48.5 cm., and described as "three-quarters ripe," after 559 days, off Tod Head, a distance of 52 miles to the north-east; and the other, of 33.5-41.1 cm., and also "three-quarters ripe," after 584 days, to the south-east of the Bell Rock, at a distance of 34 miles.

In 1914, 10 of the marked plaice were recaptured. A female, of 47-49.5 cm., was taken in January, after 638 days, off Whitehills, near Banff, at a distance of 136 miles; it was "spawning."

Two females were caught in February, and both were "spawning"; 1, of 44-49.2 cm., was taken, after 656 days, off Pennan Head, Moray Firth, at a distance of 127 miles; the other, of 40-49 cm., was caught, after 672 days, off Strathie Point, on the north coast of Scotland, at a distance of 208 miles.

In March, 2 males and 1 whose sex was not recorded were recaptured, the latter of 38.5-44.7 cm., and "ripe," to the north-east, of the Isle of May, at a distance of 24 miles; one of the males, of 35.5-43.2 cm., and also "ripe," was caught, after 695 days, to the north and east of the Bell Rock, at a distance of 31 miles; the other male, of 30-37 cm., and "spawning," was taken, after 680 days, near Buchanness, at a distance of 85 miles.

Two were recaptured in April, a female, of 33-40 cm., and "spent," after 707 days, at Aberdeen Bank, 78 miles to the north and east; and a male, of 39-42.5 cm., and "ripe," after 724 days; this fish was landed at Dundee, and the place of capture was recorded as "183 miles north-east of Caithness"; from this it is impossible to say where the fish was taken.

In May, a female, of 37-46.5 cm., and "spent," was recaptured, after 757 days, south-east of Noss Head, just outside the limit of the Moray Firth, at a distance of 149 miles.

The last fish caught in 1914 was taken in July, after 818 days, offshore, directly east of Aberdeen, at a distance of 93 miles; it was a male, of 32.5-41.7 cm., and described as "spent."

One fish, a male of 31-38.3 cm., was taken in 1915, in April, after 1074 days, 15 miles distant, to the east of the Isle of May, and was "spawning."

*Distances travelled*—10 miles and under.—Eight fishes, or 11.4 per cent., went distances of from 2½ to 6 miles, the average being 4 miles, namely, 1 male and 7 females (18.9 per cent.). All the fish were found in the Firth of Forth, the male and 3 of the females off Elie, 2 females off Largo, and 2 off Pittenweem.

10 to 20 miles.—Twelve fish, or 17.1 per cent., were recaptured at distances of from 11½ to 18 miles, namely, 6 males (18.7 per cent.), with an average of 16 miles, and 6 females (16.2 per cent.), with an average of 15 miles. Four of the males and 2 of the females were taken to the north and east, and 2 of the males and 4 of the females to the south and east.

*Under 20 miles*.—Thus, 20 of the marked plaice, or 28.6 per cent., were recovered within 20 miles of the station, 7 males (21.9 per cent.), with an average of 14.1 miles, and 13 females (35.1 per cent.), with an average of 9.1 miles.

20 to 50 miles.—Fifteen of the fishes, or 21·4 per cent., were recaptured at distances of from 24½ to 46 miles. Six (18·7 per cent.) were males, with an average migration of 34·2 miles, and 8 (21·6 per cent.) were females, with an average of 28 miles. Three of the males were found to the north and east, and 6 to the south and east. Five of the females were recaptured to the north and east, and 3 to the south and east.

50 to 100 miles.—Nineteen of the recaptured plaice, or 27·1 per cent., were got at distances varying from 52½ to 100 miles, namely, 11 males (34·4 per cent.), with an average distance of 73·3 miles, and 8 females (21·6 per cent.), with an average distance of 73·2 miles. All the males and 7 of the females were got to the north and east, at Aberdeen Bank or off the coast of Aberdeen; the female, which had moved to the south-east, was caught at a distance of 54 miles south-east of St. Abb's Head.

Over 100 miles.—Sixteen of the fishes, or no less than 22·8 per cent. of the total number recaptured, had migrated distances of over 100 miles. Eight (25 per cent.) were males, with a mean distance of 164·8 miles, and 8 (21·6 per cent.) were females, with an average distance of 174 miles. Of the males, 4 were recaptured in the Moray Firth, 2 off the Pentland Skerries, and 2 at the Orkney Islands. Five of the females were taken in the Moray Firth, 1 on the north coast of Scotland, at a distance of 208 miles, another to the north-east of Rattray Point, while a third was found 357 miles to the southward, near Ramsgate.

Ten of the fishes, or 14·1 per cent., were recaptured within the Firth of Forth, namely, 9 females (24·3 per cent.) and 1 male (3 per cent.). Sixty-one of the fishes, or 85·9 per cent., were recaptured outside the Firth of Forth, and of those, 8, or 11·3 per cent., 4 males and 4 females, were taken in the Moray Firth, while 7, or 9·8 per cent., had moved further, 4 to the north-east and 1 to the south and east.

#### MATURITY.

*Males.*—Of the 33 males recaptured, the condition of the testes was ascertained in 31.

Eleven were "spawning," and all but 1 were taken to the north and east. One, of 31–38·3 cm., was got in April 1915, after 1074 days, 15 miles to the south-east, off the Isle of May. Seven were caught off the coast of Aberdeenshire, 5 of them at Aberdeen Bank, to the south-east of Aberdeen, all in February 1913, at distances of from 71 to 74 miles; the smallest measured 27–33·5 cm., and the largest 40–41·3 cm. Another was got to the south-west of the Bank, at a distance of 63 miles; and another in March farther north, near Buchanness, at a distance of 85 miles. Two were found in the Moray Firth, both in January 1913, near together, on the same day, north-east of Tarbet Ness, at distances of 155 and 156 miles. The remaining male was taken at the Orkney Isles, at a distance of 192 miles.

Four of the males were "ripe." One was caught in February 1913, at a distance of 36 miles to the south and east, off St. Abb's Head. The second, also taken in February 1913, was found in the Moray Firth, north and east of Tarbet Ness, at a distance of 166 miles. The third was caught in March 1914, 31 miles to the north and east, near the Bell Rock. The fourth was taken in April 1914, with a record from Dundee of "183 miles north-east of Caithness."

Four were described as "spent"; 1, caught in April 1913, 24 miles to the south and east, to the north of St. Abb's Head; another in May 1913, 15 miles to the south and east, off the Isle of May; the third, in June 1913, 63 miles to the north and east, at Aberdeen Bank; and the fourth, in July 1914, farther offshore, to the east of Aberdeen Bank, at a distance of 93 miles from the station.

Three males were "nearly ripe." One was caught in September 1912, 34 miles to the north and east; another, in December 1912, in the Moray Firth, off Banff, at a distance of 134 miles; and the third, in January 1913, off the Pentland Firth, at a distance of 164 miles. One male, described as "half-ripe," was caught in October 1912, 32 miles to the north and east, off the Bell Rock.

Among 8 males of adult size on recapture, and described as "immature," 1 each was taken in April, May, June, August, and December, and 3 in September. The one caught in April, after 366 days, measured 32–37·5 cm., and was taken 46 miles to the south and east, to the east of St. Abb's Head. The one taken in May,

after 10 days, was caught near Elie, in the Firth of Forth, and measured 34-34.7 cm.

*Females*.—The condition of the ovaries was ascertained in 34 of the 37 females recaptured.

Three were "spawning"; 1 was caught in January 1914, in the Moray Firth, off Whitehills, near Banff, at a distance of 136 miles; the second was taken in February 1914, also in the Moray Firth, off Pennan Head, at a distance of 127 miles; and the third was recovered, also in February 1914, on the north coast of Scotland, off Strathie Point, at a distance of 208 miles. None of the females was described as "ripe."

Seven were "spent." One was caught in May 1912, near Pittenweem, in the Firth of Forth, 4 miles distant; another was taken off Largo, in the Firth of Forth, in May 1913, at a distance of 6 miles. Four were recaptured off the coast of Aberdeen, one in May 1913, at a distance of 100 miles, and well offshore; another, also in May 1913, to the north-east of Buchanness, at a distance of 107 miles; another was taken in July 1913, at Aberdeen Bank, a distance of 75 miles; and 1 in April 1914, also at Aberdeen Bank, a distance of 78 miles; the other female was recaptured just outside the Moray Firth, in May 1914, at a distance of 149 miles.

Two females were "nearly ripe"; 1, caught in November 1912, 16.5 miles to the north and east, off the Isle of May; the other, in December 1912, was the one taken at the Goodwin Sands, at a distance of 357 miles from the place of liberation, and landed at Ramsgate.

Two were "three-quarters ripe"; 1, caught in November 1913, 52 miles to the north and east, off Tod Head; the other, also taken in November, was got 34 miles to the north-east, in the vicinity of the Bell Rock. One was "half-ripe"; it was caught in July 1912, 24 miles to the south and east, off the Isle of May.

Among the females under adult size on recapture (38 cm.), 1, measuring 33-36.9 cm., was taken in a cod-net 38 miles to the north and east, in December 1912,  $\frac{3}{4}$  mile off Montrose Bay, and was described as "nearly ripe." Another, which measured 32.5-36.2 cm., was recaptured off Whitehills, in the Moray Firth, in February 1913, and was "half-ripe." These are examples of females which would probably spawn under the size I have fixed as the limit between mature and immature.

Eleven of the females above 38 cm. on recapture were "immature." Most of them were taken in summer, but 3 were caught in February 1913, and 1 on the 3rd April 1913, and thus within the limit of the spawning season. Of the 3 recovered in February, 1 taken off Largo, in the Firth of Forth, measured 33.5-38 cm.; another, taken at Elie, in the Firth of Forth, measured 33-38.1 cm.; a third was caught at a distance of 25 miles to the north and east, east of the Isle of May. These fishes are examples of the opposite of what is said above, and would evidently not reach sexual maturity until the next year, when they would be considerably larger in size. The same may be said of the fourth female, which was taken 63 miles to the north and east, near Aberdeen, and measured 34-38.8 cm.

#### EXPERIMENT IX.

9th May 1912.

One hundred plaice were marked and liberated in this experiment, 41 males, 57 females, and 2 whose sexes were not ascertained. The sizes of the males ranged from 27 cm. to 44 cm., and 19 were under the adult size; the sizes of the females were from 27 cm. to 53.5 cm., and 36 were under the adult size. The numbers liberated and recaptured, arranged in 5-cm. groups, are shown in the subjoined table:—

	cm.	cm.	cm.	cm.	cm.	cm.	Total.
	25-30.5	31-35.5	36-40.5	41-45.5	46-50.5	51-55.5	
F. Lib.	12	20	14	4	4	3	57
F. Recap.	3	11	7	2	1	2	26
♂ Lib.	11	24	3	3	—	—	41
M. Recap.	10	15	3	2	—	—	30
? Lib.	—	2	—	—	—	—	2
? Recap.	—	—	—	—	—	—	—



The plaice were trawled by the "Goldseeker" in Kirkcaldy Bay, Firth of Forth, on the 8th May, and were marked, and placed in tanks of running water between 3.10 and 6 p.m. They were liberated on the next day, at 8.30 a.m., none of them having died while in the tanks.

The number recaptured was 56, or 56 per cent., viz. 30 males, or 73.2 per cent., and 26 females, or 45.6 per cent.

Twenty-six of the males were of adult size on recapture, viz. from 33-45 cm., the average being 37.5 cm., as compared with a range of from 28-44 cm., and an average of 33.5 cm., on liberation; they were free for from 131 to 1054 days, averaging 413 days; they migrated distances of from 4½ to 184 miles, the mean being 50.1 miles, and the average rate of movement, per 10 days, was 1.2 miles.

Four of the males were under the adult size, the average being 32.1 cm., as against 28.5 cm. on liberation; the average period of liberty was 234 days, and the mean distance migrated 23.2 miles, with an average rate, per 10 days, of 1 mile.

Of the females, 17 were of adult size, from 38-53.9 cm., the average being 43.3 cm., compared with a range of from 27.5-53.5 cm. on liberation, and an average of 38.8 cm.; the days free ranged from 55 to 1031, averaging 497 days; the distances migrated were from 4½ to 155 miles, the mean being 49.3 miles, and the mean rate of movement, 1 mile per 10 days.

Nine of the females were under the adult size, the average being 35.1 cm., as compared with 32 cm. when they were liberated; they were at liberty for an average period of 236 days, and migrated distances of from 4½ to 88 miles, the mean being 29.1 miles, and the mean rate of travel, per 10 days, 1.3 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—None of the marked plaice was recaptured in May, but 2 were taken in June, a female, of 30 cm., on liberation, but of unknown size on recapture, was caught, after 34 days, near Kirkcaldy (where it was originally taken), in the Firth of Forth, about 10 miles to the westwards; the other was a male, of 31.5-32 cm., described as "spent" (and stale), which was taken to the south and east of Tod Head, 53 miles north-east of the station, after 35 days.

Three females were recaptured in July; 1, of 33 cm., on liberation, but of unknown size on recapture, was caught near Kirkcaldy, in the Firth of Forth, after 57 days; the other 2 were taken to the east of the Isle of May, at distances of 14½ and 33 miles, after 55 days and 78 days, respectively; the former measured 38.5-39.4 cm., and the latter was 36.5 cm. on liberation, but on recapture it was not recorded.

In this quarter, 5 fishes, or only 8.9 per cent. of the total recaptured, were taken, 2 within the Firth of Forth.

*Second Quarter.*—Three females were recaptured in August, 1, of 37.5-39.8 cm., after 92 days, near Wemyss, in the Firth of Forth; another, of 33.5-36.5 cm., was taken, after 113 days, to the north of St. Abb's Head, at a distance of 33 miles; the third, of 33-34.6 cm., was recaptured, after 114 days, off Aberdeen Bay, at a distance of 73 miles.

Three were taken in September, a male, of 32-37.4 cm., to the east of the Isle of May, at a distance of 34 miles, after 131 days; a female, of 34-38 cm., after 141 days, near St. Abb's Head, at a distance of 32 miles, to the south and east; another, also a female, of 32.5-35.2 cm., was taken, after 124 days, off Pittenweem, in the Firth of Forth, at a distance of about 4½ miles. One fish, a male, of 34.5-36.8 cm., was caught in October, after 170 days, far to the eastwards, at a distance of 76 miles.

Seven plaice, or 12.5 per cent., were recaptured in this quarter, 2 of them in the Firth of Forth.

*Third Quarter.*—Two were recaptured in November, a female, measuring 34.5-38.3 cm., after 197 days, off Largo, in the Firth of Forth, at a distance of 4½ miles, and a male, of 30-33.4 cm., after 183 days, near Buchanness, at a distance of 85 miles.

Three were caught in December, a female, of 46-47.2 cm. and "nearly ripe," after 207 days, to the east of the Isle of May, at a distance of 38 miles; a male, of 44-45 cm., and also "nearly ripe," after 230 days, to the east of the Isle of May, at a distance of 21½ miles; and a male, which measured 33.5 cm. on liberation,

but whose size on recovery was not recorded, after 232 days, off the Isle of May, at a distance of 17 miles to the south and east.

None was taken in January 1913, so that the total for this quarter was 5 fishes, or 8·9 per cent.

*Fourth Quarter.*—Nine of the marked plaice were taken in February 1913, 8 males and 1 female. Three of them were got in the Firth of Forth, viz. a female, of 39–41·4 cm., and “immature,” off Largo, after 278 days; a male, of 28–32·5 cm., “rather immature,” after 288 days, off Wemyss, at a distance of 9 miles; and a male, of 33·5–35·9 cm., and “immature,” after 289 days, off Leven, at a distance of 6½ miles. Two males, of 27·5–31·6 cm., and 38–39·1 cm., were taken near together, after 286 days, at 25½ miles and 26 miles distant, to the east of the Isle of May; the larger fish was “ripe,” and the smaller “immature.” Another male, of 34–38·1 cm., and “spawning” (“partly spent”), was caught, after 275 days, north and east of the Isle of May, at a distance of 17 miles. The other 3 males were taken off Aberdeen, 1, of 30·5–33·4 cm., at a distance of 61½ miles, after 294 days; the other 2, measuring 30–33 cms., and 32·5–35 cm., were caught, after 278 days and 281 days, at Aberdeen Bank, at distances of 75 and 76 miles; the former was “spawning” (“partly spent”) and the latter “ripe.”

Three were caught in March 1913, 2, a male, of 28–33·4 cm., and a female, of 29–32·5 cm., off St. Monans, in the Firth of Forth, at distances of 5 and 4½ miles, after 321 days and 296 days; both were “immature”; the third fish was a male, of 35·5–39·4 cm., and “ripe,” which was caught, after 313 days, off the mouth of the Tay, at a distance of 22½ miles.

Three males were recaptured in April 1913, all in the Firth of Forth, and all “immature”; 2, of 27–32·5 cm., and 28–33·8 cm., were got, after 330 and 333 days, off Pittenweem, at distances of 5 and 4½ miles; the third, measuring 28–33·8 cm., was found, after 346 days, more to the west, off Buckhaven, at a distance of 8½ miles.

In this quarter, which embraces the spawning period, or most of it, 15 marked plaice, or 26·8 per cent., were recaptured, of which 8 were taken in the Firth of Forth.

Thus, in the 12 months after liberation, 32 of the marked fish, or 57·1 per cent., were recaptured, 13 within the Firth of Forth.

Of the other fish recaptured, 7 were taken in the remaining part of 1913, 15 in 1914 and 2 in 1915.

In May 1913, 2 males were taken, far to the northwards, 1, measuring 33·5–35·9 cm., and described as “immature,” near Buchanness, after 381 days, at a distance of 88 miles, and the other, of 31·5–35·3 cm., and “spent,” after 359 days, to the east of the Orkney Isles. A female, measuring 43–47·4 cm., and “spent,” was taken in July, after 418 days, to the east of the Bass Rock, at a distance of 15½ miles. Two females were recaptured in September; 1, of 53·5 cm. on liberation, but of unknown size on recapture, after 495 days, to the east of the Isle of May, at a distance of 36 miles, and the other, of 38·5–44·1 cm., and described as “about half-ripe,” after 482 days, to the south-east of Aberdeen, at a distance of 57 miles. A male, of 37–40·2 cm., was taken in October, after 515 days, to the north-east of the Isle of May, at a distance of 22½ miles; and, in December, another male, measuring 38–41 cm., was caught, after 594 days, 12 miles E.N.E. of North Shields, at a distance of 86 miles, to the south and east.

In January 1914, 6 of the marked plaice were recaptured, 3 males and 3 females. One of the males, measuring 33–39·8 cm., and “nearly ripe,” was caught, after 625 days, 2 miles to the west of the Isle of May, and thus within the limits of the Firth of Forth, at a distance of 6½ miles; another, of 42–42·4 cm., and also “nearly ripe,” was caught, after 610 days, 23 miles to the north and east. A female, of 42·5–49·2 cm., and “ripe,” was taken, after 616 days, north of St. Abb’s Head, at a distance of 25½ miles to the south and east. The other 3 fish had migrated considerable distances to the north and east; a male, of 30–37·4 cm., and “ripe,” was taken, after 617 days, near Aberdeen Bank, at a distance of 66 miles; a female, of 31–37·3 cm., and described as “not ripe,” was recaptured, after 621 days, far off-shore, to the east of Aberdeen, at a distance of 88 miles; and another female, measuring 36–41 cm., and “fully half-ripe,” was caught, after 623 days, in the Moray Firth, 1½ miles off Whitehills, Banff, at a distance of 136 miles.

In February 1914, a female, measuring 33-34.3 cm., and "immature," was recovered within the Firth of Forth, after 659 days, off Pittenweem, at a distance of 5 miles.

Five of the marked plaice were recaptured in March, 3 males and 2 females. Two of the males, measuring 31.5-36.8 cm., and 34.5-37.5 cm., were taken, after 683 and 690 days, to the east of the Isle of May, at distances of  $24\frac{1}{2}$  and  $28\frac{1}{2}$  miles; the former was "ripe," and the latter "spawning." The third male, of 34-40 cm., with the condition of the testes unrecorded, was caught, after 675 days, off Flamborough Head, at a distance of 163 miles to the south and east, the mean rate of movement per 10 days being 2.4 miles. One of the females, of 51.5-53.9 cm., and described as "not ripe," was also got, after 663 days, to the south and east, 6 miles east of Blyth, at a distance of 82 miles, its mean rate of travel being 1.2 miles. The remaining female, of 38.5-43.5 cm., had gone far to the northwards, and was taken, after 678 days, in the Moray Firth, south-east of Berriedale Ness, at a distance of 154 miles; the condition of the ovaries was not recorded.

In April 1914, a female, of 27.5-38.1 cm., and "immature," was recaptured, after 698 days, off Buchanness, at a distance of 90 miles. The next fish taken in this year was a female in August, after 813 days, near the Bell Rock, at a distance of  $27\frac{1}{2}$  miles. The last fish recaptured in 1914 was a female, measuring 33.5-46 cm., and described as "about three-quarters ripe," which was taken in December, after 957 days, at Aberdeen Bank, at a distance of 72 miles.

In March 1915, two of the marked plaice were recovered; one, a female, measuring 35.5-43.7 cm., and "spawning," was found, after 1031 days, to the east of the Bell Rock, at a distance of 39 miles; the other, a male, of 35-44.1 cm., and "spawning," was caught, after 1054 days, at Aberdeen Bank, at a distance of 72 miles.

*Distances travelled—Under 10 miles.*—Thirteen of the marked plaice, or 23.2 per cent., were recaptured at distances of from  $4\frac{1}{2}$  to 9 miles, namely, 7 males (23.3 per cent.), with an average of 6.4 miles, and 6 females (23.1 per cent.), with an average of 5.3 miles. They were all taken within the Firth of Forth, 12 along the north shore, off Wemyss, Buckhaven, Leven, Largo, Pittenweem, and St. Monans, and one 2 miles from the Isle of May.

*10 to 20 miles.*—Six fishes, or 10.7 per cent., were got at distances of from  $10\frac{1}{2}$  to 17 miles, viz. 2 males, each of which moved 17 miles, and 4 females, with an average of 12.7 miles. Two of the females were found near Kirkcaldy, in the Firth of Forth, and the others off the Isle of May.

*Under 20 miles.*—Nineteen fish, or 33.9 per cent., therefore, migrated for journeys of less than 20 miles, viz. 9 males (30 per cent.), with an average of 8.8 miles, and 10 females (38.5 per cent.), with an average of 8.5 miles; 15 were recaptured within the Firth of Forth.

*20 to 50 miles.*—Seventeen, or 30.3 per cent. of the total number recaptured, were taken at distances of from  $21\frac{1}{2}$  to 39 miles, 9 males (30 per cent.), with an average distance of 25.3 miles, and 8 females (30.8 per cent.), with an average of 33.1 miles. Of the males, 8 migrated to the north and east, and 1 to the south and east; 5 of the females were found to the north and east, and 3 to the south and east.

*50 to 100 miles.*—Sixteen, or 28.6 per cent., were taken at distances of from 53 to 90 miles, viz. 10 males (33.3 per cent.), with an average of 74 miles, and 6 females (23.1 per cent.), with an average of 77.1 miles. Nine of the males were found to the north and east, off the coast of Aberdeen, 5 of them being recaptured in the region of Aberdeen Bank; the tenth male was caught off North Shields, 86 miles to the south and east. Five of the females were recaptured to the north and east, off the coast of Aberdeenshire, and 1 off Blyth, 82 miles to the south and east.

*Over 100 miles.*—Four were recaptured at distances of from 136 to 184 miles, 2 males, with an average of 173.7 miles, and 2 females, with an average of 145.2 miles. One of the males and both the females had migrated northwards, the male being taken off the Orkney Isles, and the females in the Moray Firth; one of the males had gone to the southwards, to off Flamborough Head, a distance of 163 miles.

Of the total recaptured, 16, or 28·6 per cent., were found within the Firth of Forth, 7 males (23·3 per cent.), and 9 females (34·6 per cent.), and 40, or 71·4 per cent., outside the Firth, viz. 23 males (76·6 per cent.), and 17 females (65·4 per cent.). Two, both females, were recaptured in the Moray Firth.

#### MATURITY.

*Males.*—Of the 30 males recaptured, the condition of the testes was ascertained in 26.

Four were "spawning," all recaptured to the north and east; 2 were taken at distances of 17 and 28½ miles, 1, of 34–38·1 cm., in February 1913, after 275 days, and the other, of 34·5–37·5 cm., in March 1914, after 690 days. The other 2 were caught at Aberdeen Bank, 1, of 30–33 cm., in February 1913, after 278 days, at a distance of 75 miles, and the other, measuring 35–44·1 cm., in March 1915, after 1504 days, at a distance of 72 miles.

Five were "ripe," all taken to the north and east. One, of 38–39·1 cm., was caught in February 1913, after 286 days, 26 miles distant; another, of 35·5–39·4 cm., was taken in March 1913, after 313 days, off the mouth of the Tay, at a distance of 22½ miles; a third, measuring 31·5–36·8 cm., was got in March 1914, after 683 days, 24½ miles distant; the fourth and fifth were caught at Aberdeen Bank, 1, of 32·5–35 cm., in February 1913, after 281 days, at a distance of 76 miles; and the other, of 30–37·4 cm., in January 1914, after 617 days, at a distance of 66 miles.

A male, of 31·5–35·3 cm., taken at the Orkney Isles, in May 1913, at a distance of 184 miles, after 359 days, was "spent." Another male, measuring 31·5–32 cm. (and thus under adult size), taken in June 1913, after 35 days, off Tod Head, at a distance of 53 miles, was also described as "spent."

Three males were "nearly ripe"; 2 were taken in January 1914, after 625 days and 610 days, 1, of 33–39·8 cm., within the Firth of Forth, 2 miles west of the Isle of May, and the other, of 42–42·4 cm., 23 miles to the north and east; the third, measuring 44–45 cm., was caught in December 1912, after 230 days, 21 miles to the north-east, east of the Isle of May.

Among the males of adult size on recapture were 9 whose testes are described as "immature." Four were taken in the Firth of Forth; 1, of 33·5–35·9 cm., in February 1913, after 289 days, near Leven; another, of 28–33·4 cm., in March 1913, after 296 days, off St. Monans; a third, of 28–33·8 cm., in April 1913, after 333 days, off Pittenweem; a fourth, of 28–33·8 cm., in April 1913, after 346 days, off Buchhaven. In May 1913, after 381 days, a male, of 33·5–35·9 cm., and described as "immature," was caught, off Buchanness, at a distance of 88 miles.

*Females.*—Of the 26 females recaptured, the condition of the ovaries was recorded for 19.

One was "spawning"; it was taken in March 1915, after 1031 days, to the east of the Bell Rock, at a distance of 39 miles; it measured 35·5–43·7 cm. Another female, measuring 42·5–49·2 cm., caught in January 1914, after 616 days, north of St. Abb's Head, at a distance of 25 miles, was said to be "ripe." A female, of 43–47·4 cm., caught in July 1913, after 418 days, 15 miles to the south and east, was described as "spent." Another, of 46–47·2 cm., caught in December 1912, after 207 days, 38 miles to the north and east, was "nearly ripe." One, of 33·5–46 cm., caught in December 1914, after 957 days, at Aberdeen Bank, at a distance of 72 miles, was "three-quarters ripe"; another, of 36–41 cm., taken in January 1914, after 623 days, at Whitehills, Banff, in the Moray Firth, was "fully half ripe"; and one, of 38·5–44·1 cm., caught in September 1913, after 482 days, south of Aberdeen Bank, at a distance of 57 miles, was "about half ripe."

Two of the 6 females whose ovaries were "immature" were recaptured in the spawning season, 1, of 39–41·4 cm., in February 1913, off Largo, in the Firth of Forth; the other, of 27·5–38·1 cm. (and thus just at adult size) was caught in April 1914, after 698 days, off Buchanness, at a distance of 90 miles.

## EXPERIMENT X.

26th March 1913.

The number of plaice marked and liberated in this experiment was 100, 28 being males, 71 females, and 1 whose sex was not ascertained. The males ranged in size from 30 to 39 cm., and 5 were under the adult size (33 cm.); the sizes of the females were from 31 to 59.5 cm., and 33 were under the adult size (38 cm.). In the following table they are arranged in 5-cm. groups:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	cm. 56-60.5	Total.
F. Lib.	—	23	24	18	2	3	1	71
F. Recap.	—	11	17	7	—	—	1	36
M. Lib.	2	21	5	—	—	—	—	28
M. Recap.	1	14	5	—	—	—	—	20
? Lib.	—	1	—	—	—	—	—	1
? Recap.	—	—	—	—	—	—	—	—

The fish used were taken by the "Goldseeker" at Station VI., in the Firth of Forth, off St. Monans, on the 26th March, and were liberated, all in good condition, after being in the tanks of running water for two hours and twenty minutes.

The number recaptured was 56, or 56 per cent., viz. 20 males, or 71.4 per cent., and 36 females, or 50.7 per cent.

Nineteen of the males were of adult size on recapture, namely, from 33 to 42 cm., with an average of 37.8 cm., as compared with a range of 30.5 to 39 cm., and an average of 34.8 cm. on liberation; they were at liberty for from 5 to 474 days, the mean being 216 days; the distances migrated varied from 2½ to 301 miles, the mean being 74.7 miles, and the mean rate of movement 3.6 miles per 10 days.

Of the females, 33 were of adult size on recapture, ranging from 38.4 to 61.9 cm., with a mean of 42.9 cm., as compared with 31 to 59.5 cm. and an average of 38.6 cm. on liberation; the periods of freedom varied from 54 to 634 days, the average being 283 days; the distances migrated ranged from 5 to 185 miles, with an average of 71.4 miles, and a mean rate of travel of 2.5 miles per 10 days. Three of the females were under the adult size, the average being 36.6 cm., as compared with 36 cm. on liberation; the average period of freedom was 60 days, and the mean distance travelled 11.8 miles, with a mean rate of 1.9 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In this period is included the remainder of the month of March, in which 2 males were recaptured, both in the Firth of Forth, and both "immature" 1, of 33-32.9 cm., was taken, after 2 days, off Largo, at a distance of 6 miles; the other, of 35.5-35.5 cm., was caught, after 5 days, off Pittenweem, at a distance of 6 miles.

Four were caught in April, 3 males and 1 female, all within the Firth of Forth, and all "immature." The female, which measured 37-37.2 cm., was taken off Largo, at a distance of 6 miles, after 30 days; all the males were recaptured off Pittenweem, at a distance of 4½ miles, after 13, 14, and 16 days; they measured 36.5-36.4 cm., 35.5-35.7 cm., and 37-37 cm., and were thus above the size of 33 cm., assigned as the minimum size of the adult males.

Six were recaptured in May, 2 males and 4 females, all "immature." One of the males, measuring 34.5-35.2 cm., was taken near Elie, in the Firth of Forth, after 54 days, at a distance of 2½ miles; the other male was caught to the east of the Isle of May, at a distance of 24½ miles, after 46 days; it measured 32.5-33 cm. Two of the females were found in the same direction as the last male, 1, measuring 39.5-39.2 cm., at a distance of 16½ miles, after 54 days, the other, measuring 35.5-35 cm., at a distance of 20 miles, after 36 days; the third female was got north-east of the Bell Rock, at a distance of 39 miles, after 61 days; it measured 37.5-38.4 cm.; the remaining female, of 39-39.3 cm., was taken, after 58 days, near Buchanness, at a distance of 86 miles.

Four of the plaice, all females, were caught in June. One, measuring 42·5–42·6 cm., and “spent,” was recaptured, after 73 days, 17 miles to the south-east; another, of 41–41·5 cm., and also “spent,” was taken, after 90 days, 26 miles to the north-east, near the Bell Rock; the third female, measuring 39–39·9 cm., and “immature,” was got, after 91 days, east of the Bell Rock, at a distance of 28½ miles; the fourth, of 42·5–44 cm., and “spent,” was taken, after 91 days, near Aberdeen Bank, at a distance of 59 miles.

In the first quarter, therefore, 16 of the marked plaice, or 29·6 per cent. of the total recaptured, were taken, 7 of them within the Firth of Forth.

*Second Quarter.*—Two females were taken in July. One, measuring 35·5–37·7 cm., and “immature,” was recaptured, after 113 days, to the westward, near Dysart, Firth of Forth, at a distance of 9½ miles; the other was caught to the east of the Isle of May, at a distance of 28 miles, after 124 days; it measured 38·5–41·6 cm.; the condition of the ovaries was not ascertained.

In August, a male, measuring 33–35·5 cm., was recaptured, after 147 days, 20½ miles to the north-east.

In September, a female, of 36–38·4 cm., and “half ripe,” was taken, after 174 days, to the east of the Isle of May, at a distance of 48 miles.

Thus, only 4 fishes, or 7·4 per cent., were recaptured in this quarter, 1 of them within the Firth of Forth.

*Third Quarter.*—In October, 2 females were recovered, both to the north and east; 1, measuring 34·5–40·7 cm., was taken, after 198 days, near the Bell Rock, at a distance of 24 miles; the other, of 36·5–41·8 cm., was caught, after 205 days, 25 miles to the north and east.

Four were recaptured in November, 2 females and 2 males. One of the males, measuring 30·5–37·4 cm., and “immature,” was taken, after 226 days, near the Bell Rock, at a distance of 22½ miles; the other male, of 39–40·8 cm., and “nearly ripe,” was found in the same direction, at a distance of 16½ miles, after 231 days. One of the females, measuring 42–44·8 cm., and “half ripe,” was recaptured near the Bell Rock, after 221 days, at a distance of 26 miles; the other female had gone much farther and was caught, after 222 days, near Buchanness, at a distance of 83 miles; it measured 37·5–40·5 cm., and was “three-quarters ripe.”

In December, 1 male, measuring 33·5–38·6 cm., and “immature,” was recaptured, after 259 days, also near Buchanness, at a distance of 89 miles.

Thus, 7 fish, or 12·9 per cent., were recaptured in the third quarter, all outside the Firth of Forth.

*Fourth Quarter.*—In the fourth quarter, which comprises the greater part of the spawning period, the number of fishes captured was greater. In January 1914, 1 male and 2 females were taken, all to the north and east. The male was got near Aberdeen Bank, at a distance of 70 miles, after 293 days; it measured 34–36·2 cm., and was “three-quarters ripe.” One of the females, measuring 37–41·3 cm., and described as “immature,” was captured, after 302 days, near Aberdeen, at a distance of 71 miles; the other female, which measured 40–44·3 cm., and was “three-quarters ripe,” was taken off Banff, in the Moray Firth, at a distance of 135 miles, after 304 days.

Six were got in February, 1 male and 5 females. One of the females, which measured 39·5–43·7 cm., was taken, after 328 days, 49 miles to the south and east, 6 miles N.E. of Longstone Light; the condition of the ovaries was not recorded. Two of the females were taken not far apart, near Aberdeen, 1 at a distance of 68 miles, after 329 days, and the other at a distance of 74 miles, after 339 days; they were both described as “immature,” and measured respectively 35–39·8 cm., and 36·5–41·3 cm. Two females and the male were recaptured in the Moray Firth, 1 of the females, after 331 days, off Banff, at a distance of 135 miles; it measured 33·5–41·3 cm., and was “spent.” The other female was got nearly at the same place, after 337 days; it measured 59·5–61·9 cm., and was “spent.” The male was taken farther to the west, off Tarbet Ness, at a distance of 177 miles, after 336 days; this fish on liberation measured 33 cm., but neither the size on recapture nor the condition of the testes was ascertained.

Ten of the plaice were recovered in March, 4 males and 6 females. Two of the females were got in the Firth of Forth, off Pittenweem, at a distance of 5 miles,

1, after 363 days, measuring 33-39.9 cm., and "immature," and the other, of 43.5-48 cm., after 365 days, and "spent." A third fish, of 35.5-41 cm., was taken, after 352 days, at a distance of 26½ miles to the north-east, "spawning." Another female, which measured 42-44.9 cm., and was described as "immature," was recaptured, after 345 days, 120 miles to the south and east, 35 miles S.E. by E. of North Shields. The two remaining females were taken in the Moray Firth, 1, which measured 39-43.9 cm., after 340 days, south of Smith Bank, at a distance of 153 miles, the condition of the ovaries not being recorded; the other, of 35 cm., on liberation, but of unknown size on recapture, was found, after 343 days, off Whitehills, Banff, at a distance of 135 miles; it was "immature." Three of the males were also recaptured in the Moray Firth, 1, measuring 35-41.6 cm., and "ripe," 25 miles north by east of Buckie (south-west of Smith Bank), after 343 days, the distance being 158 miles; another, measuring 35.5-40.4 cm., and "spawning," was taken in the same locality, at a distance of 160 miles, after 344 days; the third was caught by a foreign trawler and landed at Ostend, the precise position of capture in the Moray Firth not being stated; it measured 33.5 cm. on liberation, but no record was made of its size on recovery, or of the condition of the testes. One male had made its way to the west coast of Scotland, and was recaptured, after 351 days, at Gairloch, Ross-shire, a distance of 301 miles; it measured 37-42 cm., but the condition of the testes was not ascertained.

In this quarter, therefore, 19 marked plaice, or 34.5 per cent., were recovered, 2 in the Firth of Forth; 2 were taken to the south and east, and the others to the north and east.

Thus, in the 12 months immediately following the liberation of the fish, 46, or 83.6 per cent., were recaptured; the place of capture of one was not ascertained. All the other fish recovered were taken in the year 1914. Two were got in April, a female, of 31-42 cm., after 399 days, near Buchanness, at a distance of 85 miles, and a male, of 33-40 cm., after 379 days, at the mouth of the Moray Firth, at a distance of 135 miles; the condition of the reproductive organs was not ascertained for either of these fish.

In May, 2 females were caught, 1, of 32.5-42.3 cm., and "immature," after 401 days, to the east of the Shetlands, at a distance of 185 miles, and the other, of 39-44.8 cm., and also "immature," after 429 days, near Aberdeen, 65 miles away.

Three were recaptured in July, a male, of 35-39.5 cm., after 474 days, near Aberdeen, at a distance of 74 miles; a female, of 38.5-47.5 cm., after 464 days, off Buchanness, at a distance of 101 miles; and another female, of 37.5 cm. on liberation, but of unknown size on recapture, after 468 days, at the mouth of the Moray Firth, at a distance of 137 miles. Another female, of 34.5-40.8 cm., was recaptured in August, after 519 days, near Buchanness, at a distance of 88 miles; and the last fish to be taken, a female, of 41.5-48.2 cm., and "nearly ripe," was caught in December, after 634 days, near Aberdeen, at a distance of 74 miles.

*Distances travelled.*—Ten of the marked plaice, or 18.5 per cent., were recaptured at distances of from 2½ to 9½ miles, viz. 6 males (33.3 per cent.), with an average of 4.7 miles, and 4 females (11.1 per cent.), with an average of 6.4 miles. They were all taken within the Firth of Forth, on the north shore, 6 off Pittenweem, 2 off Largo, 1 off Elie, and 1 off Dysart.

*10 to 20 miles.*—Three, or 5.5 per cent., were got off the Isle of May, at 16½ and 17½ miles, 1 male and 2 females, the male and 1 of the females to the north and east, and the other female to the south and east.

*Under 20 miles.*—Thirteen fish, or 24.1 per cent., therefore, migrated journeys of less than 20 miles, 7 males (38.8 per cent.), with an average distance of 6.4 miles, and 6 females (16.6 per cent.), with an average of 9.9 miles.

*20 to 50 miles.*—Fourteen fish, or 25.9 per cent., travelled from 20½ to 49½ miles, namely, 3 males (16.6 per cent.), with an average of 22.5 miles, and 11 females (30.5 per cent.), with a mean distance of 31 miles. All the males were taken to the north and east, and 10 of the females, also to the north and east, the eleventh being got to the south and east.

*50 to 100 miles.*—Thirteen fish, or 24.1 per cent., migrated distances of from 59 to 89 miles, namely, 3 males (16.6 per cent.), with an average of 77.7 miles,

and 10 females (27·7 per cent.), with a mean of 75·4 miles. All these fish were found to the north and east, off the coast of Aberdeen.

*Over 100 miles.*—Fifteen fish, or 27·7 per cent., went over 100 miles, namely, 6 males (33·3 per cent.), with journeys of from 135 to 101 miles, and a mean of 176 miles, and 9 females (25 per cent.), with distances of from 101 to 185 miles, and a mean of 137·3 miles. All the males and 8 of the females were taken to the northward, 10 of them in the Moray Firth, 1 off the Orkney Isles, and another on the west coast of Scotland. One of the females went to the south-east, and was captured off North Shields.

Ten of the fishes recaptured, or 18·2 per cent., were recovered within the Firth of Forth, 6 males (31·6 per cent.) and 4 females (11·1 per cent.); while 45, or 81·8 per cent., had left the Firth; of these, 10, 5 males and 5 females, were got in the Moray Firth.

#### MATURITY.

*Males.*—One male was “spawning”; it measured 35·5–40·4 cm., and was taken in March 1914, after 344 days, to the south and west of Smith Bank, in the Moray Firth, at a distance of 160 miles. One male was described as “ripe”; it was also taken in March 1914, in the same locality as the spawning male, at a distance of 158 miles. One male was “nearly ripe”; it measured 39–40·8 cm., and was captured in November 1913, after 231 days, to the east of the Isle of May, at a distance of 16½ miles. A male, of 34–36·2 cm., taken in January 1914, after 293 days, near Aberdeen Bank, at a distance of 70 miles, was “three-quarters ripe.”

Among the “immature” males, the following were taken within the limits of the spawning season, all within the Firth of Forth:—One, of 33–32·9 cm., at Largo, in March 1913, after 2 days; another, also in March, after 5 days, at Pittenweem, and measuring 35·5–35·5 cm.; the third, taken in April 1913, after 13 days, was also got at Pittenweem, and measured 36·5–36·4 cm.; a fourth, of 35·5–35·7 cm., was taken in April, after 14 days, also off Pittenweem; where yet another, of 37–37 cm., was found 2 days later.

*Females.*—One female, of 35·5–41 cm., taken in March 1914, 26½ miles to the north and east, was “spawning.” None was “ripe,” but 6 are described as “spent.” One of these was got in the Firth of Forth, near Pittenweem, a distance of 5 miles, in March 1914; it measured 43·5–48 cm.; another, 42·5–42·6 cm., was taken in June 1913, 17 miles to the south and east; a third, of 41–41·5 cm., was recovered, also in June 1913, 26 miles to the north and east; the fourth was also recaptured in that month, 59 miles to the north and east; it measured 42·5–44 cm.; the remaining 2 were got in the Moray Firth, in February 1914, both off Banff, at a distance of 135 miles; they were respectively, in length, 33·5–41·3 cm. and 59·5–61·9 cm. One female was “nearly ripe”; it measured 41·5–48·2 cm., and was recaptured in December 1914, after 634 days, 74 miles to the north-east, near Aberdeen. Two were described as “three-quarters ripe”; 1 was taken in November 1913, near Buchanness, at a distance of 83 miles; it measured 37·5–40·5 cm.; the other, of 40–44·3 cm., was recovered in January 1914, off Banff, at a distance of 135 miles. Two were said to be “half ripe”; 1 of them, of 36–38·4 cm., was found in September 1913, 48½ miles to the north and east; the other, measuring 42–44·8 cm., was taken at a distance of 26 miles in the same direction, in November 1913.

Of the 16 adult females recaptured, whose ovaries were “immature,” 6 were taken within the spawning season; 1 of these was recaptured in January 1914, 71 miles distant, off the coast of Aberdeen, and it measured 37–41·3 cm.; another, of 36·5–41·3 cm., was taken in February 1914, in the same locality, at a distance of 74 miles; a third, measuring 35–39·8 cm., was found in the same neighbourhood, also in February 1914, at 68 miles distant; a fourth was recaptured in the Moray Firth, off Whitehills, at a distance of 135 miles, in March 1914; it was 35 cm. on liberation, but on recapture it was not recorded; a fifth, of 42–44·9 cm., was recovered off North Shields, at a distance of 120 miles to the south and east, in March 1914; and a sixth female, of 33–39·9 cm., was taken near Pittenweem, in the Firth of Forth, in March 1914.



## EXPERIMENTS AT 3 MILES N.E. OF FIDRA LIGHT.

Marked plaice were liberated on two occasions, near Fidra Light, in the Firth of Forth, near the south shore. The exact locality was 3 miles to the north-east of Fidra Island (Lat.  $56^{\circ} 6' N.$ ; Long.  $2^{\circ} 44' W.$ ), with a depth of about 27 fathoms.

## EXPERIMENT I.

5th December 1912.

The first experiment was made on 5th December 1912, when 100 marked plaice, comprising 41 males, 58 females, and 1 of unknown sex were liberated. The fish were trawled on the same day by the "Goldseeker," at the old "Garland" Station VI., in the Firth of Forth, viz. off Pittenweem.

When liberated, the males measured from 27.5 to 47.5 cm., and 11 were under adult size (33 cm.). The sizes of the females varied from 27 to 51.5 cm., and 21 were under adult size (38 cm.).

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	Total.
F. Lib. . . . .	1	8	24	16	8	1	58
F. Recap. . . . .	—	8	18	9	6	—	41
M. Lib. . . . .	3	18	13	6	1	—	41
M. Recap. . . . .	2	13	12	1	1	—	29
? Lib. . . . .	—	1	—	—	—	—	1
? Recap. . . . .	—	—	—	—	—	—	—

Of the males recaptured, 25 were of adult size, ranging from 33.9 to 43.5 cm., and averaging 38.5 cm., as compared with a range of from 30 to 47.5 cm., and an average of 35.9 cm. on liberation; they were at liberty for from 71 to 1124 days, the mean being 319 days; they migrated distances of from 11 to 271 miles, the average being 97.8 miles, and the mean rate of movement 3.5 miles. Four of the males were under adult size on recovery, averaging 31.5 cm., as against 31.2 cm. on liberation; they were free for an average period of 110 days, and migrated from 6 to 108 miles, the mean being 40 miles, and the mean rate of travel 3.6 miles. Of the females, 32 were of adult size on recapture, ranging from 38.3 to 50.9 cm., and averaging 43.6 cm., as compared with a range of from 31.5 to 50 cm., and a mean of 40.4 cm. on liberation; they were at liberty for from 21 to 863 days, the mean being 329 days; they migrated distances of from 8 to 170 miles, the average being 63 miles, and the mean rate of movement 1.9 miles. Nine of the females were under adult size on recapture, averaging 35.4 cm., as compared with 34.4 cm. on liberation; they were at liberty for an average period of 126 days, and moved distances of from 7 to 145 miles, the mean being 62.1 miles, and the mean rate of travel 4.9 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Two females were recaptured in December, both in Aberdeen Bay, at a distance of 72 miles to the north and east, 1 after 21 days, and the other after 25 days, the rates of movement, respectively, being equal to 34.3 and 28.8 miles per 10 days; both were "nearly ripe."

One male and 2 females were taken in January 1913; 1 of the females was found in the Firth of Forth, to the north-west of the station, off Largo, at a distance of 7 miles; the other female was recaptured far offshore, at a distance of 67 miles E.S.E. from Buchanness (Lat.  $57^{\circ} 21' N.$ , Long.  $0^{\circ} 20' E.$ ), at a distance of 127 miles, the mean rate of travel being 22.3 miles per 10 days; the male was taken to the westward, at Aberdour, in the Firth of Forth, at 19 miles distant.

Five males and 3 females were recaptured in February, all but 2 of the males to the north and east. One male was got in the Firth of Forth, off Wemyss, at a distance of 11 miles to the north and west; another, 13 miles to the east and south

off the Isle of May; the third female, also in the Firth of Forth, off Pittenweem, 9 miles to the north and east; 1 of the males, 11 miles to the north and east, near Fife Ness; a second, offshore, S.S.E. of Aberdeen, at a distance of 57 miles to the north and east; and a third, a little farther north, at a distance of 69 miles; the fourth was captured offshore to the south-east of Buchanness, at 99 miles distant to the north and east; the fifth was found in the Moray Firth, off Dunbeath, Caithness, at a distance of 166 miles; the mean rate of movement of this fish was 19.5 miles per 10 days.

In this quarter, 13 of the marked plaice, or 18.6 per cent., were recovered, 9 (69.2 per cent.) to the north and east, at an average distance of 76 miles in the mean direction N. 50° E.; 3 (23.1 per cent.) to the north and west, and 1 to the south and east.

*Second Quarter.*—Five females and 3 males were recaptured in March 1913, all but 1 to the north and east; the exception, a female, was taken in the Firth of Forth, near Largo, 7 miles to the north and west; another female was recaptured off Pittenweem in the Firth of Forth, at a distance of 8 miles to the north and east; a male was taken 27 miles to the north and east, near the Bell Rock, and a female off Fife Ness, at a distance of 15 miles. Three of the fish, 2 females and a male, were found in the Moray Firth, the 2 females off Banff, at a distance of 145 miles, and the male on the west side of Smith Bank, at a distance of 163 miles; the remaining male was caught south-east from Auskerry, Orkney Isles, at a distance of 191 miles. The mean rates of movement of the 3 fish found in the Moray Firth were respectively 12.5, 13.5, and 18.3 miles, and that of the fish which went to the Orkneys, 18.9 miles per 10 days.

Three males and 3 females were taken in April, all to the north and east; 1 of the females was recaptured off Pittenweem, in the Firth of Forth, at a distance of 9 miles; another was taken offshore, south-east of Aberdeen, at a distance of 57 miles; another was caught near Buchanness, at a distance of 84 miles, and 1 in Peterhead Bay, 90 miles away; another male was taken north-east of Rattray Head, at 108 miles distant, and a female near Berriedale Ness, Moray Firth, at a distance of 170 miles.

One male and 4 females were taken in May, the male in the Firth of Forth, near Largo, at a distance of 6 miles to the north and west, and 1 of the females 31 miles to the eastwards, offshore. The other 3 females were found to the north and east, 1 at a distance of 14 miles, north-east of the Isle of May, 1 far offshore, south-east of Buchanness, at a distance of 97 miles, and the other near Buchanness, at a distance of 91 miles.

In this quarter, therefore, 19 of the marked plaice, or 27.1 per cent., were recaptured, 16 (84.2 per cent.) to the north and east, at an average distance of 88 miles in the mean direction N. 47° W.; 2 (10.5 per cent.) to the north and west, and 1 to the south and east.

*Third Quarter.*—Two males and 2 females were recovered in June, all to the north and east, rather offshore, at distances of 37, 43, 43, and 58 miles.

None was recovered in July or August, so that these 4 fish represent all the recaptures in this quarter, or 5.7 per cent.

*Fourth Quarter.*—Two females were taken in September, both to the north and east, 1 south-east of Aberdeen, at a distance of 52 miles, and the other near Buchanness, at a distance of 83 miles.

Three males and 2 females were found in October, all to the north and east. A male was caught east of the Bell Rock, at a distance of 28 miles, and 1 female far offshore, north-east of the Bell Rock, at a distance of 81 miles; the other female was recaptured near Buchanness, at a distance of 83 miles, and the remaining 2 males off Noss Head, Caithness, at distances of 160 and 167 miles.

A male was recaptured in November, off Tod Head, at a distance of 57 miles to the north and east.

Thus, in the fourth quarter, 8 of the marked plaice, or 11.4 per cent., were taken, all to the north and east, at an average distance of 89 miles in the mean direction N. 50° E.

In the 12 months after liberation, 44, or 62.8 per cent., were recovered, 37 (84.1 per cent.) to the north and east; 5 (11.4 per cent.) to the north and west, and 2 to the south and east. The quarterly charts are remarkable as showing the pre-

ponderating migration northwards along the coast. Eight were taken within the Firth of Forth, and all the others to the north of the station, 9 being caught north of Rattray Head, on the north-east coast of Scotland.

Of the remaining fish, 3 were taken in 1913, 20 in 1914, 2 in 1915, and 1 in 1916.

Three males were captured in December 1913, 1, 23 miles to the north and east, to the east of the Isle of May, 1 off Noss Head, in the Moray Firth, at a distance of 155 miles to the north and east, and 1 at "Smith's Knoll," off Yarmouth (Lat.  $52^{\circ} 50' N.$ , Long.  $2^{\circ} 15' E.$ ), at 271 miles distant to the south and east. The fish taken off Noss Head had moved at the mean rate of 4.1 miles per 10 days, and the 1 caught at "Smith's Knoll," at 6.9 miles.

In January 1914, 1 male and 3 females were recaptured, all to the north and east, 2 females off the coast of Aberdeenshire, at distances of 71 and 72 miles, and the other female and the male in the Moray Firth, off Banff, at a distance of 145 miles.

A male was taken in February, south-east of Aberdeen, at a distance of 68 miles. In March, 3 males and 4 females were recaptured, but the position of capture of one of the males was not ascertained. One female migrated in a southerly direction, and was taken 24 miles E.  $\frac{1}{2}$  S. of Hartlepool, at a distance of 113 miles to the south and east. All the others migrated to the north and east, the 2 males for 19 and 40 miles respectively, and the 3 females for 18, 24, and 33 miles. Two females were recovered in April, both to the north and east, 1 south-east of Aberdeen, at 72 miles distant, and 1 near Buchanness, at a distance of 86 miles. A female was taken in May, far offshore, south-east of Aberdeen, at a distance of 106 miles; another female, in June, north of Kinnaird Head, at a distance of 122 miles to the north and east; another female in July, north-east of Rattray Head, at 113 miles to the north and east, and in August, 2 females at 16 and 17 miles to the north and east. None was taken in September, but in October a female was recaptured at an unknown place; it was found in a box of fish at Birmingham and forwarded to the "Fish Trades Gazette" in London, and the port of landing is said to be Milford Haven.

In April 1915, after 863 days, a large female, which measured 50 cm. on liberation, but whose size on recapture was not recorded, was taken 20 miles to the north and east. In June, a male was captured, near Buchanness, 91 miles to the north and east.

In January 1916, after 1124 days, a male, which measured 47.5 cm. on liberation, was caught "inside of May Isle," at an unknown place.

The chart, on which the lines of migration are represented for the whole experiment, shows a great predominance of migration northwards, along the coast, and spreading eastwards to the north of the Bell Rock, and off the coast of Aberdeen. Only two of the marked fish recaptured were taken to the south of the Firth of Forth, while 10 were got in the Moray Firth, or at its entrance, and 14 north of Rattray Head.

*Distances migrated*—10 miles and under.—Six, or 8.9 per cent., were found at distances of from 6 to 9 miles, 1 male and 5 females (12.5 per cent.), the former at a distance of 6 miles, and the latter at 8 miles on an average. The male and 2 of the females went to the north and west, and the others to the north and east, but all were recaptured within the Firth of Forth.

10 to 20 miles.—Ten, or 14.9 per cent., were got at distances of from 11 to 19 miles, 3 males (11.1 per cent.), with an average of 16.3 miles, and 7 females (17.5 per cent.), with an average of 14.7 miles. Two of the males and 5 of the females were found to the north and east, 1 male and 1 female to the north and west, and a female to the south and east. A male and female were recaptured in the Firth of Forth.

Thus, at distances under 20 miles, 16, or 23.9 per cent., were recaptured, 4 males (14.8 per cent.), with an average of 13.7 miles, and 12 females (30 per cent.), with a mean of 12 miles.

20 to 50 miles.—Eleven, or 16.4 per cent., moved from 20 to 43 miles, 5 males (18.5 per cent.), with an average of 31 miles, and 6 females (15 per cent.), with a mean of 32.3 miles. All the males and 5 of the females were taken to the north and east, and 1 female to the east and south.

50 to 100 miles.—Twenty-two, or 32.8 per cent., were recaptured at distances of from 52 to 99 miles, 9 males (33.3 per cent.), with an average of 74.8 miles, and

13 females (32·5 per cent.), with a mean of 75 miles. All were recaptured to the north and east, mostly off the coast of Aberdeenshire.

*Over 100 miles.*—Eighteen, or 26·9 per cent., were got at distances of from 106 to 271 miles, viz. 9 males (33·3 per cent.), with an average of 169·7 miles, and 9 females (22·5 per cent.), with an average of 132 miles. All the males but one, and all the females but one, were found to the north and east, mostly in the Moray Firth, or offshore; 1 male was taken at Smith's Knoll, off the coast of Norfolk, at a distance of 271 miles to the south and east, and 1 of the females off Hartlepool, at a distance of 113 miles in the same direction.

#### MATURITY.

*Males.*—The condition of the testes was recorded for 26 of the 29 recaptured.

Nine were described as "spawning," an unusual number, and all were taken to the north and east, 1 at a distance of 11 miles, and the others at distances of from 40 to 166 miles. Two were caught in February 1913 and January 1914, in the Moray Firth, at distances respectively of 166 and 145 miles; 2 were taken off Buchanness, 1 in February 1913, and the other in June 1915.

Two were said to be "ripe," 1 found in March 1913, off Auskerry, at a distance of 191 miles to the north and east; the other, in December 1913, at a distance of 23 miles to the north and east.

One was "spent." It was recaptured off Bell Rock, 19 miles to the north-east, after 480 days.

Three were "nearly ripe," 1 taken in November 1913, 57 miles to the north and east, near Tod Head; 1 in October 1913, in the Moray Firth, off Noss Head, at a distance of 167 miles; the third, in December 1913, also off Noss Head, at 155 miles distant.

Among those whose testes were "immature," was one, measuring 35·5–35·9 cm., taken in February 1913, 57 miles to the north and east, and another, of 39–39·8 cm., caught in April 1913, 90 miles to the north and east, in Peterhead Bay.

*Females.*—The condition of the ovaries was ascertained in 36 of the 41 recaptured. One, taken in March 1914, north-east of the Bell Rock, at 33 miles to the north and east, was "spawning."

Two were described as "ripe," 1 taken in January 1914, 71 miles to the north and east, off Aberdeen; the other, caught in May 1914, 106 miles to the north and east, far offshore.

Five were described as "spent," 1 caught in March 1913, in the Moray Firth, off Banff, at a distance of 145 miles; another, got in April 1913, within the Firth of Forth, off Pittenweem, at a distance of 9 miles; the third, in May 1913, south-east of Buchanness, at a distance of 97 miles to the north and east; the fourth, in April 1914, 72 miles to the north and east, off Aberdeen; and the last, in March 1914, at a distance of 24 miles to the north and east, near the Bell Rock.

Three were said to be "nearly ripe," 1 captured in December 1912, 72 miles to the north and east, off Aberdeen; 1 in January 1914, in the Moray Firth, off Macduff, at 145 miles distant; the third, in March 1914, 113 miles to the south and east, off Hartlepool.

Among those of adult size which were described as "immature," the following were taken within the limits of the spawning season:—One, in January 1914, which measured 36·5–43·7 cm., and was caught 72 miles to the north and east, off Aberdeen; 1, in February 1913, measuring 40–40·2 cm., recovered off Pittenweem, in the Firth of Forth, at a distance of 9 miles; 2, in March 1913, measuring respectively 37·5–38·3 cm. and 39–39·4 cm., within the Firth of Forth, off Pittenweem, at 8 and 15 miles distant; another female, recaptured in March 1914, 18 miles to the north and east, measuring 44·5–48·9 cm.

Among those under adult size, 2 were described as "spent," 1 taken off Banff, in the Moray Forth, 145 miles to the north and east, in March 1913, and measuring 37·5–37·8 cm.; the other, which measured 31·5–36·9 cm., was recaptured in April 1914, off Buchanness, 86 miles to the north and east. There was also one described as "nearly ripe," which measured 37·5–37·5 cm., and was taken in December 1912, 72 miles to the north and east.

## EXPERIMENT II.

30th May 1913.

In the second experiment at this station, which was made on 30th May 1913, 100 fish were liberated, consisting of 40 males, 59 females, and 1 whose sex was not ascertained. The males ranged in size from 27·5–41 cm., and 28 were under adult size. The females varied from 28·5 to 56·6 cm., and 43 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	cm. 56-60·5	Total.
F. Lib. . . . .	9	28	10	7	2	1	2	59
F. Recap. . . . .	4	15	4	4	1	—	—	28
M. Lib. . . . .	12	26	1	1	—	—	—	40
M. Recap. . . . .	6	16	1	—	—	—	—	23
? Lib. . . . .	—	1	—	—	—	—	—	1
? Recap. . . . .	—	1	—	—	—	—	—	1

The fish used in this experiment were trawled by the "Goldseeker" on the same day at the "Garland" Station II., in the Firth of Forth, *i.e.* in the North Bay, off West Wemyss.

The number recaptured was 52 (52 per cent.), comprising 23 males (57·5 per cent.), 28 females (47·5 per cent.), and the fish of unknown sex. All the males recaptured were of adult size, ranging from 34 to 43·5 cm., and averaging 37·3 cm., as compared with a range of from 27·5 to 36·5 cm. and a mean of 32·1 cm. on liberation; they were at liberty for from 99 to 981 days, the mean being 393 days; they migrated distances of from 6 to 204 miles, the average being 54 miles, and the mean rate of movement, 1·4 miles. Twenty of the females were of adult size, averaging 41·6 cm., and varying from 38·4 to 50·3 cm., as against a range of from 31·5 to 48·5 cm., and an average of 36·5 cm. on liberation; they were at liberty for from 161 to 815 days, the average being 359 days; they travelled from 6 to 145 miles, the mean being 57·3 miles, and the average rate of movement 1·6 miles per 10 days. Eight of the females were under the adult size, averaging 36·5 cm., as compared with 31·2 cm. on liberation; they were free for a mean period of 390 days, and moved from 7 to 88 miles, the average being 35·5 miles, and the mean rate, ·9 mile per 10 days.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—None of the marked fish was recaptured in the first 3 months following liberation.

*Second Quarter.*—A male was taken in September, after 99 days, off Wemyss Castle, in the Firth of Forth, at a distance of 10 miles to the north and west.

In November, a male and a female were captured, both to the north and east, at distances of 16 and 22 miles respectively. Only 3 fish were thus recovered in the second quarter.

*Third Quarter.*—Two males and 1 of unknown sex were recaptured in December 1913, the 2 males to the north and east, at distances of 22 and 26 miles, near the Bell Rock. The fish of unknown sex was captured 167 miles to the south and east, 28 miles N.E. by N. of Spurn Head; the mean rate of movement in this case was 8 miles per 10 days.

In January 1914, 1 male and 2 females were got, all to the north and east, the 2 females to the south-east of Aberdeen, offshore, at distances of 67 and 73 miles respectively, while the male was recaptured in the Moray Firth, off Banff, at 145 miles distant.

Three males and 3 females were taken in February 1914, one of the males in the Firth of Forth, 10 miles to the west and south; a female was also taken in the

Firth of Forth, at a distance of 7 miles to the north and west ; all the other fish were recaptured to the north and east, 1 of the males near Aberdeen, at 70 miles, the other male south-east of Aberdeen, at a distance of 67 miles, 1 of the females east of the Isle of May, at a distance of 20 miles, and the other in the Moray Firth, off Banff, at a distance of 145 miles.

Thus, in this quarter, 12 fish, or 23·1 per cent., were recovered, 9 (75 per cent.) to the north and east, at a mean distance of 70 miles in the mean direction N. 51° E., and 1 each to the north and west, to the south and east, and to the south and west.

*Fourth Quarter.*—In March 1914, 3 males and 8 females were got ; 1 of the males was taken 60 miles to the south and east, east of Longstone Light, Northumberland ; another, 18 miles to the north and east ; and the third, 85 miles to the north and east, near Buchanness ; 2 of the females migrated to the south and east, 1 to north-east of St. Abb's Head, a distance of 26 miles, and another to 22 miles S.E. by E.  $\frac{1}{4}$  S. from North Shields, a distance of 105 miles ; 3 were found in the Firth of Forth, 1 off Pittenweem, 6 miles to the north-east, and 2 off Buckhaven, 10 miles away to the north and west ; another female was captured 15 miles to the north and east, and 1, 76 miles in the same direction, east of Aberdeen ; the remaining female was found in the Moray Firth, but the precise position was not ascertained.

In April, 2 males and 2 females were recaptured, all to the north and east, 1 of the males at a distance of 23 miles, and 1 of the females at 35 miles ; the other female was taken off Kinnaird Head, at 119 miles distant to the north and east, and the other male in the Moray Firth, close to Noss Head, at a distance of 170 miles.

One male and 3 females were recaptured in May, the male 10 miles to the south and east, and all the females to the north and east, 1 south-east of Aberdeen, at a distance of 68 miles, the other 2 off Rattray Head, at distances of 104 and 107 miles respectively.

In the fourth quarter, therefore, 19 fishes, or 36·5 per cent., were recaptured, 13 (68 per cent.) to the north and east, at an average distance of 69 miles, in the mean direction N. 49° E., 4 (21 per cent.) to the south and east, and 2 to the north and west.

Thus, in the 12 months after liberation, 34 of the marked plaice, or 65·4 per cent., were recaptured, 24 (71 per cent.) to the north and east, 5 (14·9 per cent.) to the south and east, 4 to the north and west, and 1 to the south and west.

Of the remaining fishes in this experiment, 10 were recaptured in the remainder of 1914, 7 in 1915, and 1 in 1916.

In June 1914, a female was taken 73 miles to the north and east, off Aberdeen. In July, 2 females were got, 1 at a distance of 23 miles to the north and east, the other at 77 miles distant to the north and east, north-east of Aberdeen. In August, 2 males were recaptured, 1, 13 miles to the north and east, and the other 12 miles to the south and east. In September, 2 males and a female were caught, both the males in the Firth of Forth, 1 off Pittenweem, 6 miles to the north east, the other off Largo, 9 miles to the north and west ; the female was taken 25 miles to the south and east, off St. Abb's Head. A male and a female were recaptured in October, the male (which was landed at Dundee) described vaguely as having been recaptured " 8 miles east of the Firth of Forth " ; the female was taken east of the Isle of May, at a distance of 18 miles to the north and east.

A female was recovered in January 1915, at a distance of 88 miles to the north and east, offshore, to the south-east of Aberdeen. Another female was taken in March, after 665 days, off Dysart, in the Firth of Forth, 11 miles to the north and west. In April, 2 males and a female were got, the latter 13 miles to the north and east, 1 of the females 35 miles in the same direction, and the other male 68 miles E. by N. of Grimsby, at a distance of 204 miles to the south and east. A male and a female were taken in August, the male off Gosford, on the south shore of the Firth of Forth, at a distance of 9 miles to the south-west, and the female 29 miles to the north and east, off the Bell Rock.

The last fish to be captured was a male, which was taken in February 1916, after 981 days, 27 miles E.  $\frac{3}{4}$  S. of Flamborough Head, 168 miles away to the south and east.

While the general features of the lines of migration, as shown in the chart for the whole experiment, are very similar to those in the former experiment, in March, it differs in this respect, that 5 of the recaptured plaice were taken to the south of the

Firth of Forth, 4 of them off the English coast, as far south as off Spurn Point and Grimsby.

*Distances travelled*—10 miles and under.—Ten of the marked plaice, or 20 per cent., were recaptured at distances of from 6 to 10 miles, 6 males (27·3 per cent.), with an average of 9 miles, and 4 females (14·8 per cent.), with an average of 8½ miles. Five of the males, and all the females, were taken in the Firth of Forth, and 1 male 10 miles to the eastward.

10 to 20 miles.—Eight fish, or 16 per cent., were found at distances of from 11 to 18 miles, 4 males (18·2 per cent.), with an average of 15 miles, and 4 females (14·8 per cent.), with an average of 14¼ miles. Three of the males and 3 of the females were taken to the north and east, 1 of the males to the south and east, and 1 of the females to the westward, within the Firth of Forth, near Dysart, at a distance of 11 miles.

Thus, 18 fish, or 36 per cent., were recaptured at distances under 20 miles, 10 males (45·4 per cent.), with an average of 11·3 miles, 8 females (29·6 per cent.), with a mean of 11·25 miles. Ten of these were taken within the Firth of Forth.

20 to 50 miles.—Eleven, or 22 per cent., were recaptured at distances of from 20 to 35 miles, 4 males (18·2 per cent.), with an average of 26·5 miles, and 7 females (25·9 per cent.), with an average of 25·7 miles. All the males and 5 of the females were found to the north and east, the 2 remaining females being recaptured to the south and east.

50 to 100 miles.—Eleven fish, or 22 per cent., were found at distances of from 60 to 88 miles, 4 males (18·2 per cent.), with an average of 70·5 miles, and 7 females (25·9 per cent.), with an average of 74·6 miles. Three of the males and all the females had migrated to the north and east; the remaining male was found to the south and east, off North Shields.

Over 100 miles.—Ten fish, or 20 per cent., were got at distances of from 104 to 204 miles, 4 males (18·2 per cent.), with an average of 171·7 miles, 5 females (18·5 per cent.), with a mean of 116 miles, and 1 of unknown sex, which went 167 miles to the south and east. Of the males, 2, and of the females, 4, were taken to the north and east, the 2 males and 1 of the females in the Moray Firth, the remaining 2 males and 1 of the females to the south and east, off the English coast.

#### MATURITY.

*Males*.—The condition of the testes of 16 of the 23 recaptured was ascertained.

One, taken in March 1914, 18 miles to the north and east, was described as "ripe." Two were "nearly ripe," both found to the north and east, one at a distance of 22 miles, the other off Whitehills, Banff, at a distance of 145 miles.

Among those of adult size on capture, whose reproductive organs were "immature," were the following taken within the limits of the spawning season:—Three, in February 1914, 2 measuring 31·5–36·3 cm. and 32·5–38 cm., at 67 and 70 miles respectively to the north and east; the third measured 31–34·1 cm., and was taken near Gosford, in the Firth of Forth, at a distance of 10 miles; 1, measuring 33–37·3 cm., was recaptured in March 1914, near Buchanness, 85 miles to the north and east.

*Females*.—The condition of the ovaries was ascertained in 26 of the 28 females recaptured. One, caught in March 1914, 26 miles to the south and east, off St. Abb's Head, was described as "ripe."

Two were said to be "spent," 1 taken in April 1914, 35 miles to the north and east, the other in April 1915, 13 miles in the same direction.

Two were "three-quarters ripe," one caught in February 1914, off Banff, in the Moray Firth, at a distance of 145 miles, the other taken in October 1914, 18 miles to the north and east.

Among the females of adult size whose ovaries were "immature," the following were taken within the spawning season:—In January 1914, 1, of 34·5–39·7 cm., caught 73 miles to the north and east; 1, of 36–40·5 cm., taken in February 1914, 20 miles to the north and east; 4 recaptured in March 1914, 3 to the north and east, at 6, 15 and 76 miles respectively, and measuring 32·5–38·5 cm., 34–41·1 cm., and 35–38·4 cm.; the remaining female measured 48·5–50·3 cm., and was caught 105 miles to the south and east.

Among those under adult size (38 cm.) on recapture, was one described as "spawning"; it measured 34·5–37·6 cm., and was found in January 1914, 67 miles to the north and east, south-east of Aberdeen.

#### EXPERIMENTS AT TWENTY MILES EAST OF ISLE OF MAY.

At this position, which lies about Lat. 56° 17' N.; Long. 1° 58' W., where the depth is 29 fathoms, 10 experiments with marked plaice were made, extending from 28th November 1910 to 26th March 1913.

The number of fish liberated was 961, consisting of 352 males, 597 females, and 12 whose sexes were not determined.

Six hundred and forty-three, or 66·9 per cent., were recaptured, viz. 239 males (67·9 per cent.), 402 females (67·3 per cent.), and 2 of undistinguished sex (16·6 per cent.).

Particulars for each of these experiments are given in the following table:—

No of Experiment.	Date.	No. of Fish.								Percentages Recaptured.			
		Marked.				Recaptured.							
		♂	♀	(?)	Total.	♂	♀	(?)	Total.	♂	♀	(?)	Total.
I.	28 Nov. 1910.	38	59	1	98	28	43	—	71	73·7	72·9	—	72·4
II.	21 Mar. 1911.	20	30	1	51	13	22	—	35	65·	73·3	—	68·6
III.	25 Apr. 1911.	16	33	2	51	9	19	—	28	56·2	57·6	—	54·9
IV.	19 June 1911.	24	28	1	53	20	20	1	41	83·3	71·4	(100·)	75·5
V.	11 Sept. 1911.	49	56	—	105	30	34	—	64	61·2	60·7	—	60·9
VI.	7 Mar. 1912.	22	78	—	100	13	60	—	73	59·1	76·9	—	73·
VII.	24 Apr. 1912.	27	71	3	101	21	54	1	76	77·7	76·1	33·3	75·2
VIII.	10 May 1912.	43	56	1	100	26	33	—	59	60·4	58·9	—	59·
IX.	6 Dec. 1912.	78	122	2	202	55	77	—	132	70·5	63·1	—	65·3
X.	26 Mar. 1913.	35	64	1	100	24	40	—	64	68·6	62·5	—	64·
		352	597	12	961	239	402	2	643	67·9	67·3	16·6	66·9

#### EXPERIMENT I.

28th November 1910.

The number of plaice marked and liberated in this experiment was 98, consisting of 38 males, 59 females, and 1 whose sex was not ascertained. The sizes of the males ranged from 33–40·5 cm., and the sizes of the females from 32–53 cm. The sizes, in 5-cm. groups, are shown in the subjoined table:—

	cm. 31–35·5	cm. 36–40·5	cm. 41–45·5	cm. 46–50·5	cm. 51–55·5	Total.
F. Lib.	13	30	15	—	1	59
F. Recap.	11	20	11	—	1	43
M. Lib.	17	21	—	—	—	38
M. Recap.	12	16	—	—	—	28
? Sex Lib.	1	—	—	—	—	1
? Sex Recap.	—	—	—	—	—	—

The fish which were marked in this experiment were caught at Station VI. Firth of Forth (off St. Monans), at 4 p.m. on the 28th November 1910, and were marked and kept in tubs, with a good circulation of water, until 7 p.m., when they were liberated.

The number recaptured was 71, or 72·4 per cent., of those liberated; 28, or



73·7 per cent., of the males were recaptured, and 43, or 72·9 per cent. of the females. Of the males recaptured, 12 belonged to the smaller group and 16 to the larger. Among the females recaptured, 11 belonged to the first group (31–35·5 cm.); 20 belonged to the next group; 11 to the group measuring from 41–45·5 cm.; and the female over 51 cm. on liberation was also recaptured. All the males recaptured were of adult size (33 cm. or over), and the particulars in regard to them are as follows:—They had been at liberty for periods varying from 8 to no less than 1892 days, the average being 254·3 days. Their average size on liberation was 36·5 cm. and on recapture 38·2 cm. The position of recapture of 26 of the fishes was ascertained, and the distances migrated varied from 3·5 to 215 miles, the mean distance being 76·4 miles, and the mean rate 3·9 miles per 10 days. Of the females, 35 were of adult size on recapture; they had been at liberty for from 10 to 1566 days, the average being 375 days; their average size on liberation was 39·6 cm. and on recapture 43·6 cm.; the distances migrated (in the 33 cases in which it was ascertained) varied from 3·5 to 184 miles, the average distance being 64·8 miles, and the average rate of travel 1·78 miles per 10 days. The other 8 females were under adult size on recapture, the mean size being (in the 5 cases ascertained) 35·1 cm., both on liberation and on recapture; the periods of freedom varied from 3 to 462 days, the average being 95·7 days; the distances travelled (ascertained in 7 cases) was from 2 to 58 miles, the mean distance being 16·8 miles, and the mean rate of travel 3·9 miles per 10 days.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Of the 98 fishes liberated, 9 were recaptured in the following month, December 1910, viz. 4 males and 5 females. Four had migrated short distances of from 2 to 7 miles; 3 of these were immature females, and 1 was a male. Of the other 5, 2 had moved 13 miles, 1, an adult female, which was “almost ripe,” to the south-east of the Isle of May, the other, an adult male, also “almost ripe,” to the north-east of the island. Another male, described as “immature,” but measuring 38 cm. when liberated, was taken 15 miles away, to the north-east of St. Abb’s Head. Of the remaining 2, a female had travelled 56 miles north-east, and was taken off Aberdeen only 10 days after liberation; it was “nearly ripe.” The other, a male, described as “three-quarters mature,” had also gone north-east, and was taken at a distance of 76 miles, off Peterhead, after 20 days.

In January 1911—after about two months’ freedom—11 of the marked plaice were recaptured, viz. 5 males and 6 females. One of the males (33·3 cm.), described as “quite immature,” was caught 5 miles distant, and another, 13 miles, to the south-east of the Isle of May. Of the others, 7 (both males and females) had moved to the north-east, and were taken at distances ranging from 19 to 113 miles, mostly off the coast of Aberdeen; but 1, a female 39 cm. in length, and “nearly ripe,” off Banff, in the Moray Firth. Most of these fish were approaching maturity. Of the 2 remaining, 1 was caught 16 miles to the south-east, off St. Abb’s Head, and was “immature”; the other, a male, described as “maturing,” was taken to the north-west, south-east of Montrose, 26 miles distant.

Six were recaptured in February, 4 males and 2 females, all to the north-east—4 off the coast of Aberdeen, and 2 in the Moray Firth, off Banff, the distances travelled ranging from 36 to 113 miles. All these fish were described as “almost ripe,” or “spawning,” except 1 male which was “immature,” but as it was 35 cm. long, it may in reality have been “spent.”

Thus in the first 3 months, December 1910 and January and February 1911, 26 fishes were recaptured (or 36·6 per cent. of the total number recaptured). Thirteen were males and 13 were females (or respectively 46·4 per cent. of the total males, and 30·2 per cent. of the total females recaptured). Some of the fishes had moved considerable distances, over 100 miles, and as the table shows (and the chart indicates in a striking manner) the largest number had moved north and east along the coast. Fifteen (or 57·7 per cent. of those taken in this quarter) had migrated for an average distance of 62 miles N. 19° E. at rates varying from 3·8 to no less than 56 miles per 10 days, the mean rate being 14·2 miles. Three (or 11·5 per cent.) had moved in the mean direction N. 49° W. for from 2 to 26 miles, the average being 13 miles and the average rate 5·8 miles per 10 days. Four

(or 15·4 per cent.) had migrated an average distance of 8 miles in the mean direction S. 30° E., at a mean rate of 6·8 miles per 10 days. Four (or 15·4 per cent.) had moved an average distance of 11 miles S. 57° W., at an average rate of 7 miles per 10 days.

It will thus be seen that the predominant migration was along the coast to the northwards, 3 of the fishes being caught in the Moray Firth, off Banff, and, from the condition of the reproductive organs and the rapidity of movement, it is clear that the migration northwards was a spawning migration. One of the fishes, a female of 43·5 cm., had travelled to the north-east of Aberdeen in 10 days, or at the rate of 5·6 miles per day; a male, of 38·5 cm., had migrated 76 miles in 20 days, or at the rate of 3·8 miles per day, and was recaptured off Peterhead.

Of the 16 fishes which were got to the northward of the station, all were "ripe," "almost ripe," "approaching ripeness," or "spawning," except 4, which were "immature," namely, a male of 35 cm. which was caught off Aberdeen, and 3 females, 1 measuring 37·5 cm., another 38 cm., got off Aberdeen, and the third, measuring 34·5 cm., taken near the Bell Rock. On the other hand, of 10 fishes got to the south or eastward of the station, and regarding 8 of which the condition of the reproductive organs was determined, all were "immature" except 2, namely, a female, of 44·5 cm., which was caught after 31 days 13 miles south and west, "almost ripe," and a male, of 40·5 cm., got not far from the same position, after 19 days, also "almost ripe." There is other evidence that the plaice spawn in this neighbourhood.

*Second Quarter.*—In the next 3 months, March, April, and May 1911, 15 fishes were recaptured (or 21 per cent. of the total recaptured), 7 (or 25 per cent.) being males, and 8 (or 18·6 per cent.) being females. The position of recapture of 14 of the fishes was ascertained. In this quarter also the majority of the fishes migrated northwards, along the coast, namely, 12 (or 85·7 per cent.), the mean direction being N. 32° E., and the average distance 104 miles, the average rate of movement, per 10 days, being 8·63 miles. Of the 7 captured in March, 5 went northwards, while all those got in April and May took the same direction. One (or 7·1 per cent.) went north and west for 12 miles, and another went south and east for 21 miles. Five were recaptured in the Moray Firth, 1 at Fair Isle, and 1 at Shetland.

Of the 5 fishes got in the Moray Firth, the condition of the reproductive organs in 3 was not ascertained; the other 2, a male and a female, were "ripe" and "spawning." The male caught at Shetland was "spent," and that got near Fair Isle is described as "immature"; it was taken on 18th March, and measured 34·5 cm. Of 2 caught in the neighbourhood of Buchanness, 1 of 41 cm. was "spent," and the other of 36·5 cm. (and thus under adult size) was "immature." The other 3 fishes, 2 females of 37·5 and 38·5 cm., and a male of 33 cm., which were taken not far from the station, were "immature." The female which had moved north and west to the Bell Rock was under adult size (36 cm.), and was "immature"; but the female recaptured near St. Abb's Head on 29th March was "spent."

*Third Quarter.*—In the months June, July, and August 6 fishes (or 8·4 per cent. of the total recaptured) were caught, viz. 1 male and 5 females. The positions of recapture were ascertained for 5 of them; 3 (or 60 per cent.), 1 male and 2 females, had gone northwards for 106, 126, and 53 miles (2 into the Moray Firth), the average distance being 95 miles, and the mean direction from the station N. 33° E. Two moved west and south, 1 to the mouth of the Firth of Forth, and the other, well within it, to Aberlady Bay, the average distance being 23 miles.

The condition of the reproductive organs was ascertained in only 3 cases; the male, caught on 10th June, off Kinnaird Head, was described as "ripe"; the 2 females taken in June and August were "immature."

*Fourth Quarter.*—No fishes were recaptured in September, but 5 (7 per cent.) were got in October and November, 2 males and 3 females. Three (60 per cent.) were caught to the northwards, 2 females, well off shore at distances of 66 and 71 miles, and a male off Stonehaven at a distance of 30 miles. A female had moved almost directly east for 18 miles, and a male for only 3½ miles to the south and west. The males, caught respectively on 24th October and 10th November,

were described as "nearly ripe." The condition of the reproductive organ was ascertained for only 1 of the females; it was "immature."

Thus, within a year of liberation, 52, or 73·2 per cent., of the marked plaice were recaptured, particulars being obtained for 50 of them. Of these, 33 (or 66 per cent.) migrated to the north and east; 4 (or 8 per cent.) moved north and west; 6 (or 12 per cent.) went south and east; and 7 (or 14 per cent.) went south and west.

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 days (miles)	Range.	
							Distance.	Rate.
I. Dec. 1910. Jan. 1911. Feb. 1911.	N. & E.	15	57·7	N. 19° E.	62	14·2	19-113	3·8-5·6
	N. & W.	3	11·5	N. 49° W.	13	5·8	2-26	5·0-6·8
	S. & E.	4	15·4	S. 30° E.	8	6·8	5-16·5	1·16-16·6
	S. & W.	4	15·4	S. 57° W.	11	7·0	5-15	2-18·7
	...	...	26	36·6	...	...	...	2-113
II. Mar. 1911. April 1911. May 1911.	N. & E.	12	85·7	N. 32° E.	104	8·63	3·5-215	·23-18·9
	N. & W.	1	7·1	N. 39° W.	12	1·2	...	...
	S. & E.	1	7·1	S. 3° E.	21	1·7	...	...
	S. & W.	...	...	...	...	...	...	...
	...	...	14	19·7	...	...	...	...
III. June 1911. July 1911. Aug. 1911.	N. & E.	3	60	N. 33° E.	95	4·37	53-126	2·1-5·6
	N. & W.	...	...	...	...	...	...	...
	S. & E.	...	...	...	...	...	...	...
	S. & W.	2	40	S. 82° W.	23	·9	14-33	·6-1·3
	...	...	5	7·0	...	...	...	14-126
IV. Sept. 1911. Oct. 1911. Nov. 1911.	N. & E.	3	60	N. 40° E.	55	1·6	30-71	·9-2·2
	N. & W.	...	...	...	...	...	...	...
	S. & E.	1	20	S. 82° E.	18	·5	...	...
	S. & W.	1	20	S. 86° W.	3·5	·1	...	...
	...	...	5	7·0	...	...	...	...
SUMMARY.	N. & E.	33	66					
	N. & W.	4	8					
	S. & E.	6	12					
	S. & W.	7	14					
	...	...	50	70·4				

The date of recapture of 1 fish is unknown. The remaining 18 were recaptured as follows:—One in December 1911, 9 in 1912, 6 in 1913, none in 1914, 1 in 1915 (March), and 1 in 1916 (February).

The fish, a female, which was recaptured in December 1911 had moved 11 miles to the north-east, and was "almost ripe" when taken. Of the 9 fish caught in 1912 (from January to December), the place of recapture of 1 was not ascertained; of the remaining 8, 6 had migrated to the north-east, along the coast; 2 of these were caught in the Moray Firth, at distances of 157 and 129 miles; 1 of these, a male, taken in February, was "nearly ripe"; the other, also a male, caught

in October, was "immature." One, a female, was recaptured near Fair Isle, 184 miles away, in September; it was "spent." Two of the fish, both females, were recaptured off the coast of Aberdeen, at distances of 56 and 75 miles; 1 of these, taken in January, and measuring 42.5 cm. when liberated, is described as "rather immature"; the other, caught in June, was "immature." The sixth, a female, had gone 33 miles, and was taken, also in July, off Tod Head, "immature." One fish, a female, was caught in June 4 miles to the north-west; it was "spent." The eighth fish had migrated to the south-west, namely, a male, caught 4 miles from the place of liberation in December; it was "nearly ripe."

Of the 6 fishes caught in 1913, five were females, and 1 was a male. They had all moved northwards, along the coast, and had migrated distances of from 64 to 190 miles. The male was taken in September near Fair Isle, and was "immature." Of the 5 females, 1, caught in March off the Orkney Islands, was "spawning"; another, taken in March, off Buchanness, was "nearly ripe"; the third, caught in May, in the same neighbourhood, was "spent"; the fourth, recaptured in June, off Noss Head, in the Moray Firth, was "immature"; the condition of the ovaries of the fifth, which was taken north-east of Rattray Head in July, was not ascertained.

None of the marked fish belonging to this experiment was caught in 1914, but 1, a female, was recaptured on 13th March 1915, after 1566 days of freedom, only 11 miles south and east of the station; it was "spent."

In 1916, a male was caught on the 2nd February, after a period of freedom of 1892 days, or 5 years and 2 months. This fish was found in London, among fish from Scarborough, but, unfortunately, the place of capture was not ascertained; the fish was described as "spawning."

The summary of the resultant direction and distance in each quadrant is as follows:—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. & E.	Adult Males.	18	1577	87.6	N. 23° E.
	Adult Females.	26	1869	71.9	N. 31° E.
	Immature Females.	2	77	38.5	N. 19° E.
	Total	46	3523	76.6	N. 27° E.
N. & W.	Adult Males.	2	39	19.5	N. 48° W.
	Adult Females.	1	4	4	N. 39° W.
	Immature Females.	2	14	7	N. 46° W.
	Total	5	57	11.4	N. 45° W.
S. & E.	Adult Males.	2	12	6	S. 20° E.
	Adult Females.	3	50	17	S. 33° E.
	Immature Females.	2	21.5	10.7	S. 39° E.
	Total	7	83.5	11.9	S. 31° E.
S. & W.	Adult Males.	4	35.5	8.8	S. 63° W.
	Adult Females.	3	60	20	S. 55° W.
	Immature Females.	1	5	5	S. 50° W.
	Total	8	100.5	12.6	S. 58° W.
SUMMARY.					
N. & E.		46	3523	76.6	N. 27° E.
N. & W.		5	57	11.4	N. 45° W.
S. & E.		7	83.5	11.9	S. 31° E.
S. & W.		8	100.5	12.6	S. 58° W.
		66	...	...	...

*Distances travelled.*—Of the 66 fish, about which particulars exist, 10 (4 males and 6 females), or 15 per cent., were recaptured within 10 miles of the station, the average distance being 4.5 miles. Eleven (3 males and 8 females), or 16 per cent., were recaptured between 10 and 20 miles distant. Thus, 21 of the fish, or 31.3 per cent. of all those recaptured, were got within 20 miles of the place of liberation (10 per cent. of the males and 21 per cent. of the females).

*20 to 50 miles.*—Eleven (6 males and 5 females), or 16 per cent., of the fish were recaptured between 20 and 50 miles of the station, the average distance being for the males 35.5 miles and for the females 35 miles.

*50 to 100 miles.*—Sixteen, or 24 per cent., of the total recaptured had migrated distances of between 50 and 100 miles; 3 were males which had moved respectively 58, 76, and 61 miles, all to the north-east; 13 were females, of which 12 were of adult size and 1 barely adult size; all the females also had migrated in a north-easterly direction, along the coast, for distances varying from 53 to 93 miles, the average being 66 miles.

*Over 100 miles.*—No less than 18 fish, or 26·9 per cent., were got at distances exceeding 100 miles from the place of liberation, 12 being taken within the Moray Firth, 3 in the neighbourhood of Fair Isle, 2 at Orkney, and 1 at Shetland, all northward of the station. Of these, 10 were males and 8 females. The males had migrated distances of from 106 to 215 miles, and the females for distances of from 112 to 184 miles, the average being 136 miles.

The rate of movement of the fish which went north-east, especially for long distances, was somewhat remarkable in this experiment. In the case of the males, it ranged from 1·9 to 38 miles per 10 days. A few cases may be mentioned. One male migrated 76 miles northwards in 20 days, and was taken off Peterhead; another was found near Fair Isle, at a distance of 194 miles, after 110 days; a third had migrated 139 miles in 94 days; a fourth, 215 miles in 114 days, and so on. Among the females, the rate of movement was not, as a rule, quite so rapid; the rate per 10 days ranged up to 21·3 miles, and in one case it was even 5·6 miles per day; this fish, a large female, was caught on the 8th December, off Aberdeen, at a distance of 56 miles, and was "nearly ripe." Another female, which was captured "spent," in the Moray Firth, had travelled 112 miles in 112 days; another female had reached the same locality in 85 days, and it also was "spent"; and a third, also found in the same locality, "nearly ripe," had travelled 113 miles in 53 days.

#### MATURITY.

The condition of the reproductive organs was ascertained in 24 of the males. Five were "ripe" or "spawning." Two of these were captured in the Moray Firth in the following February and March, after 89 and 94 days respectively, having made the journey at the average rate of 12·7 and 14·8 miles per 10 days. A third was taken north of Kinnaird Head, in June, the 106 miles having been made at the mean rate of 5·5 miles per 10 days; a fourth was recaptured in February, north-east of Aberdeen, the rate of travel having been 6·1 miles per 10 days. The fifth was the fish which had been at liberty for over 5 years, and was captured on 2nd February 1916 at an unknown locality.

Seven of the males were "nearly ripe." Four were recaptured to the north, 1 in the Moray Firth in February 1912, 157 miles distant, having migrated at a mean rate per 10 days of 3·6 miles; 1 was taken north-east of Aberdeen on 18th January 1911, after 51 days, the rate of travel being 11·4 miles; another was caught off Tod Head in January 1911, having moved 36 miles at the mean rate of 8·2 miles per 10 days; the fourth was taken in October 1911, off Bervie, and had travelled the 30 miles at the rate of ·9 mile. Two of the "nearly ripe" males had gone short distances to the south and west; 1, taken in December 1912, after 754 days, only 4 miles distant, had gone at the rate of ·05 mile per 10 days; the other was found 3½ miles distant, in November, after 347 days, the mean rate being ·1 mile. The seventh fish was recaptured 13 miles to the westwards, off Fifeness, in December 1910, after 19 days, the mean rate being 6·8 miles.

Two of the males appear to have been "spent," and were both recaptured to the north of the station. One, of 37 cm., was caught on 22nd February, after 86 days, 36 miles distant, the rate of movement having been 4·2 miles; it was described as "spent" or "immature"; the other fish was recaptured on 22nd March 1911, near Whaligoe, Shetland, having migrated the 215 miles in 114 days, or at the rate of 18·9 miles per 10 days.

Of 8 males of adult size with "immature" reproductive organs, 5 were recaptured to the north, 1 in February 1911, after 81 days, north-east of Aberdeen, the rate of movement being 7·5 miles; the second was taken in April, 25 miles distant, north-east of May Isle, the rate in this case being 1·9 miles; the third was got near Fair Isle, in March 1911, having travelled 194 miles in 110 days, or at the rate of 17·6 miles; the fourth was recaptured off Orkney in October 1912, after 684 days, the rate being 1·9 miles; and the fifth was not found until September 1913, after 1027 days, off Fair Isle, the rate of progression being 1·8 miles. Two of these males were recaptured south and east, at distances of 5 and 7 miles, 1 in January 1911, the rate being 1·2 miles, and the other in December 1910, after 10 days, the rate being 7 miles. The eighth fish was caught after 8 days, 15 miles to the south and west, off St. Abb's Head, the rate of movement being 18·7 miles.

It may be mentioned that 2 of the 3 males in which the condition of the reproductive organs was not ascertained, but the position of recapture is recorded, 2 were taken in the Moray Firth, 1 in March 1911, after 112 days, 141 miles distant, having migrated at the rate of 12·6 miles per 10 days; the other, in April, after 133 days, having gone 143 miles, at the rate of 10·75 miles per 10 days. These males measured 35·7 and 38 cm. respectively, and had no doubt spawned in the Moray Firth. The third fish was caught on 5th January 1911, after 38 days, 13 miles to the south and west, the average rate being 3·4 miles.

The condition of the reproductive organs was ascertained in 29 of the 35 adult females recaptured, and in 5 of those under adult size. Among the adults, only 2 are described as "spawning" or "ripe"; both were recaptured to the north. One was caught in March 1911, after 112 days, near Banff, in the Moray Firth, having travelled 112 miles, at the mean rate of 10 miles per 10 days; the other was taken in March 1913, after 835 days, at the Orkney Islands, 164 miles distant, the rate in this case being 1·9 miles. Seven were "nearly ripe," and 6 were recaptured to the northwards. One had migrated with great rapidity, being caught 56 miles off, northward of Aberdeen, after 10 days, having moved at the rate of 5·6 miles *per day*. A second was taken close to the same place in February, after 85 days, the rate being 6·5 miles per 10 days. Two were recaptured off Banff, in the Moray Firth, 112 and 113 miles distant, 1 in January, after 53 days, and the other in February, after 85 days, the rate of travel being 21·3 and 13·2 miles per 10 days respectively. The fifth fish was caught in March 1913, after 830 days, off Buchanness, the rate in this case being ·8 mile per 10 days; and the sixth fish, which had gone northwards, was found 11 miles distant in December 1911, after 381 days, the rate being ·3 mile per 10 days. One of the "nearly ripe" females was recaptured in December, after 31 days, 13 miles to the south and west, the rate of travel being 4·2 miles.

Six of the females were "spent." Four were taken to the northwards, as follows:—One in April 1911, north-east of Aberdeen, having travelled the 65 miles in 149 days, at the rate of 4·4 miles per 10 days. The other 3 were recaptured much later, 1 in June 1912, after 563 days, only 4 miles distant; this fish measured 35 cm. on liberation, and 42·7 cm. on recapture; another was caught on 2nd September 1912, after 644 days, near Fair Isle, the rate for the 184 days being 2·8 miles per 10 days; the third was not recaptured till May 1913, after 885 days, off the coast of Aberdeen, 64 miles away, the rate being ·7 mile. Two of the "spent" females were recaptured to the south-east, 1 in March 1911, after 121 days, 21 miles distant, off St. Abb's Head, the rate being 1·7 miles; the other was taken in March 1915, after 1566 days, only 11 miles from the place of liberation.

Fourteen of the adult females were "immature," and the position of recapture of 12 of them was ascertained. Eleven of these had migrated northwards, and of them 5, at least, were taken beyond the limits of the spawning season, in June, July, August, and October. They had migrated distances of 33, 53, 71, 75, and 149 miles, to the coast of Forfar, or Aberdeen, and one to the Moray Firth, and were caught after considerable intervals (253 to 919 days), so that the rate of travel ranged from ·6 to 2·2 miles per 10 days. Of the others, 1 was taken in June 1911, after 59 days, off Aberdeen, the rate being 7·9 miles; this fish was only 38·2 cm. in length. Another was got in January 1912, after 404 days, near Aberdeen, the rate for the 56 miles being 1·4 miles; it was 46 cm. long, and is described as "rather immature"; another was caught in January 1911, after 60 days, off Stonehaven, the rate of travel being 6·6 miles, and it is described as "one-quarter ripe," and was 39·6 cm. long. One was recaptured in May 1911, after 156 days, only 6½ miles distant; another, also taken in May near Buchanness, had gone 75 miles, the rate per 10 days being 4·4 miles; it was 36·5 cm. on liberation and 38·5 cm. on recapture. The last, recaptured to the north, was taken in April 1911, only 3½ miles from the station; on liberation it measured 37·5 cm., and on recapture 38·3 cm.

Of 8 females, which were under adult size on recapture, the condition of the reproductive organs was ascertained in 5 cases. Two, both taken in January 1911, had migrated north and east; 1, of 37·5 cm., went 58 miles at the rate of 9·1 miles; the other, of 34·7 cm., had migrated 19 miles, at the rate of 3·8 miles. Two, one taken in December 1910, after 3 days, and the other in

January 1911, had migrated south and east for 5 and  $16\frac{1}{2}$  miles, at the rate of 16.6 and 2.7 miles. One was recaptured 12 miles to the north and west after 98 days, the rate being 1.2 miles, and the other had moved 5 miles south and west, the rate being 2 miles.

It is evident, from the above statement, that the majority of the adults migrated to the northwards for the purpose of spawning, and sometimes with great rapidity; but several of them remained in the neighbourhood of the place of liberation.

#### RELATION OF MOVEMENT TO SIZE.

As a rule, the largest males and females migrated long distances, but there were exceptions, especially among the females. Of the 10 largest males, on liberation or recapture, 8 migrated northwards for distances of from 30 to 215 miles; the reproductive organs of 2 caught in October were "immature"; in all the others, they were "ripe," or "nearly ripe," or "spent." But a male, which measured 35 cm. on liberation and 41.9 cm. on recapture, and which had been at liberty for 754 days, was taken in December, only 4 miles to the south-west, "nearly ripe." Another, of 40.5 cm., was got 13 miles to the north and west, towards the coast of Fife, after 19 days; it was "almost ripe." Of the 8 largest females, 4 were recaptured in the months of February and May, from 64 to 126 miles distant to the northwards; the condition of the reproductive organs of 3 was ascertained, and they were "almost spawning" or "spent." Three were recaptured to the south and west, distances of 13, 14, and 33 miles respectively; 1, in December, was "almost ripe"; 1, in June, was "immature"; and the third, in August, was not determined. The most remarkable case was the female which measured 38.5 cm. on liberation and 53.1 cm. on recapture, caught in March 1915, after 1566 days; it was found only 11 miles to the south and east of the station, and was "spent."

#### EXPERIMENT II.

21st March 1911.

In this experiment, 51 fishes were marked and liberated, 20 being males, 30 females, and 1 whose sex was not determined. The sizes of the males ranged from 29.5 cm. to 37 cm., and the sizes of the females from 27.5 cm. to 50 cm. The numbers liberated and recaptured are shown in the accompanying table, in groups of 5 cm.

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	Total.
F. Lib. . . . .	3	11	12	3	1	30
F. Recap. . . . .	2	8	9	2	1	22
M. Lib. . . . .	2	11	7	—	—	20
M Recap. . . . .	1	8	4	—	—	13
? Sex Lib. . . . .	—	—	1	—	—	1
? Sex Recap. . . . .	—	—	—	—	—	—

The fish in this experiment were, on the whole, smaller than usual, 22 of the 30 females and 6 of the 14 males being under adult size when liberated.

The fish were taken by trawl at Station VI., Firth of Forth (off St. Monans), about 2.35 p.m. on the 21st March, marked and placed in tanks with a good circulation, and liberated at 6.45 p.m.

The number recaptured was 35 (or 68.6 per cent. of the total marked), viz. 13 males (or 65 per cent. of the total males marked), and 22 females (or 73.3 per cent. of those marked). The proportion recaptured in each of the 5-cm. groups is indicated in the above table. Of the 13 males, 11 were of adult size on recapture; their periods of liberty ranged from 43 to 404 days, and averaged 241 days; their average size on liberation was 34.6 cm., and on recapture 38.3 cm.; the distances migrated ranged from  $4\frac{1}{2}$  to 160 miles, the mean being 53.7 miles, and the average rate per 10 days was 2.2 miles. The 2 immature males were at liberty for 11 and 38 days respectively; 1 migrated 23, and the other 5 miles.



The 17 adult females were at liberty for from 38 to 721 days, the average being 311 days; the mean size on liberation was 37.5 cm., and on recapture 42.7 cm.; they moved distances of from 4 to 74 miles, the mean being 28.8 miles, and the mean rate .9 miles per 10 days. The 5 immature females were at liberty for from 42 to 360 days, the mean being 236 days; the average size on liberation was 31.3 cm., and on recapture 35.3 cm.; they migrated distances of from 18 to 49 miles, the mean being 28.4 miles, and the mean rate 1.2 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the month after liberation, April 1911, only 3 fish (2 males and 1 female) were recaptured. The female and one of the males were taken 5 miles to the south and west; the other male had moved westwards to the coast of Fife (to the same locality where it was originally captured); it was a small fish (29.5 cm. in length), and had made the 23 miles at an average rate per 10 days of 20.9 miles.

In May, 4 were recaptured (2 males and 2 females), but the position of recapture of 1 of the males was not ascertained. The other male and 1 of the females had moved 6 and 4 miles respectively to the south and west; the other female, measuring 34 cm. on liberation, had gone westwards into the Firth of Forth, to the coast of Fifeshire, and was taken near Elie, 31 miles distant, the average rate of travel being 7.4 miles.

Two were taken in June (a male and a female); the latter was recaptured, after 72 days, 8½ miles to the north-east, and the male, after 78 days, 15 miles to the north-west, near the Bell Rock.

Thus 9 of the total recaptures, or 25.7 per cent., were made in the first quarter, and particulars in regard to 8 were ascertained. Four, or 50 per cent., moved distances of from 4 to 6 miles to the south and west; 3, or 37.5 per cent., moved north and west (2 of them into the Firth of Forth) for distances of from 15 to 31 miles, the average distance being 23 miles; and 1, 12.5 per cent., had gone 8½ miles to the north-east.

The feature of this quarter is the relatively small migration, and the predominance towards the coast, south-west and north-west. The condition of the reproductive organs was ascertained for 2 of the males and 4 of the females; they were all "immature." On liberation, 2 of the males were of adult size, measuring 33.5 and 34 cm.; 2 of the females were also of adult size, measuring 38 cm. and 44.5 cm. respectively. All the others were under adult size.

*Second Quarter.*—Six fishes (2 males and 4 females) were recaptured in July, August, and September, *i.e.* 17.2 per cent. of the total recaptured. The position of recapture of 1 was not ascertained; of the others, 3 (or 60 per cent.), *viz.* 2 males and 1 female, had migrated to the south and west, for distances of from 4 to 12 miles; 1 female was taken 18 miles to the north and west, near the Bell Rock, and the remaining female 5 miles north and east of the station. All the fish were, naturally, for the season "immature." On liberation, all except 2 females were of adult size, and on recapture 1 of these females had grown to adult size, the other measuring 37.1 cm.; the latter had moved the greatest distance of all, *viz.* 18 miles. The same feature is thus shown in the second quarter as in the first, the relatively small distance migrated, the absence practically of any recaptures to the northwards of the station, and the predominance to the south and west.

*Third Quarter.*—Only a single fish was recaptured in this quarter, a male, which was taken on 6th October, 6 miles to the south and west, and which is described as "nearly ripe."

*Fourth Quarter.*—In January, February, and March 1912, 12 of the marked plaice (or 34.3 per cent. of the total) were recaptured, the position of capture being ascertained for 11 of them. One was caught in January, 5 in February, and 6 in March. Three were males and 9 were females. The migration of these fishes presents contrast to those of the previous months, both in direction and distance. Only 1 was recaptured to the south and west, a small female, which measured 31 cm. on liberation and 33.5 cm. on recapture and was taken at Embleton Bay, Northumberland, a distance of 49 miles, on 15th March 1912, after 360 days, the rate of movement being 1.4 miles per 10 days; it was "immature."

Five of the fishes (45·4 per cent.), all females, moved to the north and west, for distances ranging from 21 to 23 miles, the average being 22 miles. Four of these, curiously, were recaptured practically at Station VI., Firth of Forth, where they had been originally taken, viz. from about half a mile to a mile off Pittenweem or St. Monans; 1 was recaptured in January, the other 3 in February, after periods of from 311 to 340 days. Three of them are described as "immature" or "rather immature"; their sizes on liberation and recapture were as follows:—36·5 to 41 cm.; 28 to 33·3 cm.; 27·5 to 37·9. One, whose sizes were 37·5 to 42·9 cm., caught on 19th February, is described as "half ripe." The remaining female, which moved north and west, was caught at the mouth of St. Andrews Bay, having moved 21 miles in 351 days; it was a large fish, measuring 50 to 50·3 cm., and was "spent" when caught on 6th March.

Other 5 of the fishes (45·4 per cent.) had migrated northwards, along the coast for considerable distances, varying from 51 to 160 miles, the mean being 112 miles. Three were males and 2 females. Two of the males were taken in the Moray Firth, 1 on 12th March 1912, after 357 days; its measurements were 36·5–41 cm., but the condition of the testes was not ascertained; the other was caught off Tarbet Ness on 29th February, after 345 days; its measurements were 37–42·4 cm., and this fish was "ripe." The apparent rate of movement of these 2 males were respectively 3·5 miles and 4·5 miles per 10 days. The third male, measuring 32·5–39·6 cm., was caught on 7th March, after 352 days, south-east of Auskerry, Orkney Isles, at a distance of 160 miles; it was "ripe," and had migrated at an apparent rate of 4·5 miles per 10 days. The 2 females had not gone so far, both being recaptured off the coast of Aberdeenshire, 1, measuring 41–45·1 cm., off Girdleness, a distance of 51 miles, on the 28th February, after 344 days, "fully half ripe,"; the other, measuring 33·5–40 cm., off Buchannness, a distance of 68 miles, on 26th March, after 371 days, "almost ripe." The rate of movement of these fishes was respectively 1·5 and 1·8 miles per 10 days.

It is evident that the features of this quarter differ from those presented in the previous months, and discloses a spawning migration to the north. These long-distance-fish were no doubt on their way north in the previous quarter; but there are reasons to support the view that the fish partaking in such spawning migrations do not begin to travel with great speed until the reproductive organs are well developed.

Thus, in the 12 months following liberation, 28 of the marked fish (or 80 per cent.) were recaptured, viz. 11 males (or 84·6 per cent.) and 17 females (or 77·3 per cent.), particulars as to direction and distance being furnished for 25 of them.

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. April 1911. May 1911. June 1911.	N. and E.	1	12·5	N. 24° E.	8·5	1·2	..	..
	N. and W.	3	37·5	N. 66° W.	23·	10·	15-21	1·9-20·9
	S. and E.	0	..	..	..	..	..	..
	S. and W.	4	50·	S. 65° W.	5·	1·2	4-6	·7-1·4
			8	25·7	..	..	..	4-31
II. July 1911. Aug. 1911. Sept. 1911.	N. and E.	1	20·	N. 24° E.	5·	·3	..	..
	N. and W.	1	20·	N. 44° W.	18·	1·7	..	..
	S. and E.	..	..	..	..	..	..	..
	S. and W.	3	60·	S. 62° W.	7·5	·6	4·5-12	·4-·9
			5	17·2	..	..	..	..
III. Oct. 1911. Nov. 1911. Dec. 1911.	N. and E.	..	..	..	..	..	..	..
	N. and W.	..	..	..	..	..	..	..
	S. and E.	..	..	..	..	..	..	..
	S. and W.	1	100·	S. 51° W.	6·	·3	..	..
			1	(2·8)	..	..	..	..
IV. Jan. 1912. Feb. 1912. Mar. 1912.	N. and E.	5	45·4	N. 26° E.	112·	3·2	51-160	1·5-4·5
	N. and W.	5	45·4	N. 77° W.	22·	·6	21- 23	·6- ·7
	S. and E.	..	..	..	..	..	..	..
	S. and W.	1	9·1	S. 2° W.	49·	1·4	..	..
			11	34·3	..	..	..	21-160
SUMMARY.	N. and E.	7	28·					
	N. and W.	9	36·					
	S. and E.	..	..					
	S. and W.	9	36·					
			25	80				

Of the remainder recaptured, 6 were taken in 1912, and 1 in 1913, and all but 1 of these were caught to the northwards, as follows :—

Sex.	Date.	Days Absent.	Sizes (cm.).	Distance (Miles).	Direction.	R.O.	Rate.
Female.	2nd April 1912.	378	32·5-38·7	23	N. 84° W.	Rather immature.	0·6
Male.	28th April 1912.	404	36 -40·2	41	N. 38° E.	?	1·0
Male.	17th April 1912.	393	33 -38·1	13	N. 37° E.	Ripe.	·0·3
Female.	31st May 1912.	437	38 -45	44	N. 40° E.	$\frac{1}{2}$ Devel.	1·0
Female.	28th May 1912.	434	34 -42·7	25	N. 32° E.	Immature.	0·6
Female.	10th Dec. 1912.	630	34·5-46·3	53	N. 58° E.	Nearly ripe.	0·8
Female.	11th Mar. 1913.	721	35·5-48·1	74	N. 28° E.	Nearly ripe.	1·0

Three of these were "ripe" or "nearly ripe," a male taken only 13 miles north and east of the station, and of the other 2, both females, 1 was caught off Aberdeen and the other off Buchanness.

The summary of the resultant direction and distance in each quadrant is as follows—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	5	306	61·2	N. 29° E.
	Adult Females.	8	328·5	41·1	N. 33° E.
		13	634·5	48·8	N. 32° E.
N. and W.	Adult Males.	1	15	15	N. 33° W.
	Immature Males.	1	23	23	N. 84° W.
	Adult Females.	4	89	22	N. 77° W.
	Immature Females.	4	93	23	N. 72° W.
		10	220	22	N. 71° W.
S. and E.		..	None.	..	..
S. and W.	Adult Males.	4	28·5	7	S. 62° W.
	Immature Males.	1	5	5	S. 80° W.
	Adult Females.	3	15	5	S. 56° W.
	Immature Females.	1	49	49	S. 2° W.
		9	97·5	10·8	S. 55° W.
SUMMARY.					
N. and E.		13	634·5	48·8	N. 32° E.
N. and W.		10	220	22	N. 71° W.
S. and E.		..	None.	..	..
S. and W.		9	97·5	10·8	S. 55° W.
		32	..	..	..

*Distances travelled.*—The number recaptured at distances of 10 miles or under from the station was 9, or 28·1 per cent., viz. 4 males and 5 females, the average distance being 5·5 miles. Between 10 and 20 miles, 4, of which 3 were males, were recaptured, so that the total number under 20 miles was 13, or 40·6 per cent., the average distance being for the males 8·8 miles and for the females 7·7 miles.

*20 to 50 miles.*—The number recaptured between 20 and 50 miles was 12, or 37·5 per cent., of which 2 were males, with an average distance of 32 miles, and 10 were females, with an average of 28·2 miles.

*50 to 100 miles.*—No males were recaptured at distances of over 50 and under 100 miles, but 4 females went to the north-east for from 51 to 74 miles, the mean being 61·5 miles.

*Over 100 miles.*—Three males were recaptured at distances of 126, 154, and 160 miles, 2 in the Moray Firth, and 1 at the Orkney Isles, the mean rate of migration per 10 days being respectively 3·5, 4·5, and 4·5 miles. As already stated, 2 of these fish were "ripe"; the condition of the testes of the third was not ascertained.

It is interesting to note that the male fish which was taken at Auskerry, in the Orkney Isles, had been previously marked and recaptured. It was originally marked and liberated on 8th February 1911, in the Firth of Forth, midway between Elie and Fidra, and was caught by the "Goldseeker" on 21st March 1911, at Station VI. in the Firth of Forth, off St. Monans, among the fish taken for the present experiment.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 7 of the 11 males recaptured. Three were "ripe," taken respectively in February, March, and April

1912, all to the north and east; 1 had moved only 13 miles; 1 was taken in the Moray Firth, at a distance of 154 miles; and the third at the Orkneys, a distance of 160 miles. The mean rate of travel per 10 days for the first was .36 miles, and for the other 2, 4.5 miles.

One "nearly ripe" male was caught in October 1911, 6 miles south and west.

Three adult males, taken respectively in June, July, and August, were "immature." The condition of the testes of 1 of the 2 males under adult size was ascertained; it was "immature"; the fish, which measured 32-32.3 cm., was caught in April 5 miles to the south and west.

*Females.*—Of 17 adult females, the condition of the ovaries was ascertained in 16. None was "fully ripe," but 3 were "nearly ripe," and all were recaptured north and east, distances of 53, 65, and 68 miles respectively, in December 1912, March 1913, and March 1912, the mean rate of movement being .8 miles, .9, and 1.8 miles.

One was "spent," a large fish, measuring 50-50.5 cm., and it was caught in St. Andrews Bay in March 1912.

Three were "maturing"; 1, described as "fully half ripe," was caught on 28th February 1912, 51 miles north and east, off the coast of Aberdeen; the measurements were 41-45.1 cm., and it would doubtless spawn that year. The second, measuring 38-45 cm. was "half-developed" when caught on 31st May 1912, 44 miles to the north-east; the third, measuring 37.5-42.9 cm., was also "half ripe" when caught on 19th February 1912, 23 miles west and north, in the Firth of Forth.

The ovaries of 9 were "immature." The fish had moved distances of from 4 to 25 miles, at rates ranging from .3 to 1.3 miles per 10 days; 4 were recaptured in June, July, August, and September; of the others, 2 had returned to the Firth of Forth, distances of 22 and 23 miles, and were taken in January and April; another, caught in April, had moved 5 miles to the south and west; 2 were caught in May.

Of the 5 females under adult size on recapture, the condition of the ovaries was ascertained in each; 3 had returned to the Firth of Forth, and were taken in February and May; 1 was found off the coast of Northumberland in March, and the fifth near the Bell Rock, in July.

### EXPERIMENT III.

25th April 1911.

The number of fishes marked and liberated in this experiment was 51, of which 16 were males, 33 were females, and 2 were of undetermined sex. The sizes of the males ranged from 30 cm. to 38 cm., and of the females from 29 cm. to 54.5 cm. The numbers liberated and recaptured are shown in the following table, arranged in groups of 5 cm. :—

	cm: 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	Total.
F. Lib. . . . .	5	11	8	8	1	33
F. Recap. . . . .	5	6	6	2	0	19
M. Lib. . . . .	1	9	6	—	—	16
M. Recap. . . . .	1	5	3	—	—	9
? Sex Lib. . . . .	—	2	—	—	—	2
? Sex Recap. . . . .	—	—	—	—	—	—

Of the males, only 1 measured less than 33 cm. on liberation, and of the females, 21 measured under 38 cm.

The fish for this experiment were caught by the "Goldseeker" at Station VI., in the Firth of Forth, about 3 p.m. on the 25th April, and were liberated about 8.30 p.m. on the same day. Three of the fish which had been marked died on the passage, and others were substituted for them.

The number of the marked fish recaptured was 28, or 54.9 per cent., viz. 9 males, or 56.2 per cent., and 19 females, or 57.6 per cent. Of the 9 males,

particulars of the sizes on recapture were ascertained for 8; they ranged from 34.4 to 42.4 cm. and averaged 37.8 cm.; the periods of liberty varied from 37 to 1073 days, the average being 318 days; the distances migrated were from 5 to 176 miles, the average being 79.4 miles, and the mean rate per 10 days 2.5 miles. Particulars were obtained with regard to 16 of the 19 females recaptured, of which 12 were of adult size and 7 under adult size; the periods of liberty of the former ranged from 25 to 999 days, and averaged 341 days; their sizes ranged from 38.5 to 44.8 cm., the average being 41.6 cm.; they migrated distances of from 4 to 174 miles, the average being 40.8 miles and the mean rate of travel was 1 mile per 10 days. The seven immature females were free for an average period of 119 days; their sizes on recapture ranged from 29.7 cm. to 37 cm., the mean being 34.5 cm.; the distances migrated ranged from 0 miles to 34 miles, the average being 14.6 miles, and the mean rate of travel per 10 days was 1.1 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Three fish, 2 females and a male, were recaptured in May, but particulars were ascertained only for 1 of the females; it had moved 5 miles to the south and west in 25 days, and was “immature.” In June, 6 were recaptured, 2 males and 4 females, all “immature,” but the position of recapture of 1 of the females was not ascertained. The two males had moved to the south and west for distances of 5 and 19 miles. One female had also gone in this direction for 5 miles. Another had moved for 7 miles to the south and east, and the other female had gone to the north and west for a distance of 12 miles. Three, all females, were caught in July, but the position of recapture of 1 was not ascertained. One of these, measuring 35 cm., was caught at the place where it was liberated, after 88 days; the other, measuring 36.5 cm., had gone back to the Firth of Forth, near to the locality where it was originally caught, a distance of 26 miles, at an average rate of 3.3 miles per 10 days.

Thus, 12 of the marked fishes (or 42.8 per cent. of the total number recaptured) were taken in May, June, and July, but particulars in regard to them were ascertained for only 7. Four (57 per cent.) had moved south and west for an average distance of 9 miles, the average rate being 2 miles per 10 days; 2 had gone north and west, the average distance being 19 miles, and the mean rate 2.5 miles; the remaining fish went south and east for 7 miles.

*Second Quarter.*—Four fishes (14.3 per cent.) were recaptured in August, September, and October, 3 respectively at 4, 6, and 9 miles from the station; the fourth fish had migrated a distance of 44 miles to the north and east, well off-shore, in 148 days, at an average rate of 2.9 miles.

*Third Quarter.*—Only 2 (7.1 per cent.) were recaptured in this quarter, both males, 1 in November and 1 in December. The former was caught in St. Andrews Bay, 23 miles distant to the west and north; it measured 39.9 cm., and was “nearly ripe.” The other male was taken to the north, off the coast of Aberdeen, 56 miles distant, after 240 days, and it was “three-quarters ripe.”

*Fourth Quarter.*—Two of the marked fish, both males, were recaptured in February 1912, 1, measuring 36 cm., in the Moray Firth, 126 miles distant, and the other, measuring 38.4 cm., south-east of Start Point, Orkney, 176 miles distant; the latter was “nearly ripe,” but the condition of the testes of the other was not determined. The mean rate of travel of these fishes was respectively 4.1 and 6 miles.

Thus, in the 12 months following liberation, 20, or 71.4 per cent., were recaptured, viz. 7 males (77.7 per cent.) and 13 females (68.4 per cent.). Particulars as to direction and distance were ascertained for 15 of them, viz. 4 (26.7 per cent.) had gone north and east, and the same number north and west; 2 (13.3 per cent.) went south and east; and 5 (33.3 per cent.) moved south and west.

Quarter	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction	Average Distance (miles).	Average Rate per 10 Days (Miles).	Range.	
							Distance.	Rate.
I. May 1911. June 1911. July 1911.	N. and E.	..	..	..	..	..	..	..
	N. and W.	2	28·6	N. 44° W.	19	2·5	12-26	1·8-3·3
	S. and E.	1	14·3	S. 36° E.	7	1·8	..	..
	S. and W.	4	57·1	S. 57° W.	9	2	5-19	1·3-3·3
			7	42·8	..	..	..	5-26
II. Aug. 1911. Sept. 1911. Oct. 1911.	N. and E.	1	25	N. 71° E.	44	2·9	..	..
	N. and W.	1	25	N. 58° W.	9	1·5	..	..
	S. and E.	1	25	S. 18° E.	4	·3	..	..
	S. and W.	1	25	S. 50° W.	6	·5	..	..
			4	14·3	..	..	..	..
III. Nov. 1911. Dec. 1911. Jan. 1912.	N. and E.	1	50	N. 20° E.	56	2·3	..	..
	N. and W.	1	50	N. 65° W.	23	1·1	..	..
	S. and E.	..	..	..	..	..	..	..
	S. and W.	..	..	..	..	..	..	..
			2	7·1	..	..	..	..
IV. Feb. 1912. Mar. 1912. April 1912.	N. and E.	2	100	N. 23° E.	151	5·05	126-176	4·1-6
	N. and W.	..	..	..	..	..	..	..
	S. and E.	..	..	..	..	..	..	..
	S. and W.	..	..	..	..	..	..	..
			2	7·1	..	..	..	..
SUMMARY.	N. and E.	4	26·7					
	N. and W.	4	26·7					
	S. and E.	2	13·3					
	S. and W.	5	33·3					
			15	71·4				

Of the remaining fish recaptured, 3, all females, were taken in May, June, and December 1912; 2, both females, in 1913, in May and June; and 2 in January and April 1914. Of the first group, none had migrated far—1 for 34 miles northwards to the neighbourhood of Stonehaven; another north-west for 21 miles to the neighbourhood of the Bell Rock; the third for 5 miles to the south-east. The 2 former were "immature," the latter was "nearly ripe." Both of the females taken in 1913 had moved north and east; 1, measuring 30-41·1 cm., was taken in June, after 784 days, 85 miles distant, off Buchanness, and the other, which measured 31·5-43 cm., had taken an unusual direction, and was captured in May, after 746 days, about 174 miles N. 66° E., in 39 fathoms (Lat. 58° 12' N.; long. 2° 8' E.), or about midway between Scotland and Norway. It was "spent." Both the fish taken in 1914 had also migrated north and east; 1, a female which measured 30·5-44·8 cm., was captured on 18th January, after 999 days, 59 miles distant, off Aberdeen; it was "nearly ripe." The other, a male, measuring 35-42·4 cm., was recaptured on 2nd April, after 1073 days, 151 miles distant, off the mouth of the Moray Firth, in 47 fathoms; the condition of the testes was not ascertained. With the exception of this male, all the fishes recaptured in 1913 and 1914 were considerably under adult size on liberation, and probably did not begin to migrate for a long time. For 1 fish, an adult male, no date of recapture is obtained.

The summary of the resultant direction and distance in each quadrant is as follows :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	4	368	92	N. 31° E.
	Adult Females.	4	362	90·5	N. 50° E.
	Immature Females.	1	34	34	N. 12° E.
		9	764	85	N. 37° E.
N. and W.	Adult Males.	1	23	23	N. 25° W.
	Adult Females.	1	21	21	N. 21° W.
	Immature Females.	3	47	16	N. 49° W.
		5	91	18	N. 46° W.
S. and E.	Adult Females.	1	4	4	S. 18° E.
	Immature Females.	1	7	7	S. 36° E.
		2	11	5·5	S. 27° E.
S. and W.	Adult Males.	2	24	12	S. 61° W.
	Adult Females.	4	21·5	5·4	S. 52° W.
		6	45·5	7·6	S. 55° W.
SUMMARY.					
N. and E.		9	764	85	N. 37° E.
N. and W.		5	91	18	N. 46° W.
S. and E.		2	11	5·5	S. 27° E.
S. and W.		6	45·5	7·6	S. 55° W.
		22	..	..	..

*Distances travelled.*—The number recaptured within 10 miles of the station was 9, or 39·1 per cent. of those whose position of capture was known, viz. 1 male and 8 females, the average distance being 5·1 miles. The number recaptured between 10 and 20 miles was 2, 1 male and 1 female. Thus, 11 of the 23 fishes recaptured, whose positions were known, or 47·8 per cent., were taken within 20 miles of the station, 2 (28·6 per cent.) being males, and 9 (56·2 per cent.) females.

*20 to 50 miles.*—The number recaptured between 20 and 50 miles was 5, or 21·7 per cent., viz. 1 male and 4 females, the average distance being 29·6 miles.

*50 to 100 miles.*—Three were recaptured within these limits, namely, a male at 56 miles, and 2 females at 59 and 85 miles, all to the north-east.

*Over 100 miles.*—Four were recaptured at distances of over 100 miles (17·4 per cent.), viz. 3 males (42·9 per cent.) and 1 female. The males migrated distances of 151, 126, and 176 miles respectively, the average being 151 miles, and the female migrated 174 miles.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in only 5 of the 9 males recaptured. Two were “nearly ripe,” viz. the 1 taken at Orkney, 176 miles distant, in February 1912, and the 1 taken off St. Andrew’s Bay, in November 1911. One was “three-quarters ripe,” viz. the fish caught in December 1911, 56 miles to the north, off the coast of Aberdeen.

The other two males were “immature,” and were both caught in June 1911, to the south-west of the station; 1 measuring 34·4 cm., at a distance of 19 miles, the other, of 35·1 cm., 5 miles distant.



*Females.*—Of 12 adult females, the condition of the ovaries was ascertained in 11. None were fully mature. Two were “nearly ripe,” 1 caught in January 1914, off the coast of Aberdeen, 59 miles to the north and east; the other, in December 1912, 5 miles to the south and west. One was “spent”; it was the fish caught midway between Scotland and Norway in May 1913. The other 8 females were “immature,” and none of them was taken within the limits of the spawning season, 1 being caught at the end of May, 4 in June, 1 in July, and 2 in September. The position of recapture is known for 6; 2 had migrated some distance north and east, 1 for 85 and the other for 44 miles; 1 was caught to the north and west; 1 to the south and east, and 2 to the south and west, short distances.

## EXPERIMENT IV.

19th June 1911.

Fifty-three fishes were marked and liberated in this experiment, 24 being males, 28 females, and 1 of undetermined sex. The sizes of the males ranged from 29 cm. to 41 cm., and of the females from 26 cm. to 51 cm. The numbers liberated between certain sizes in groups of 5-cm. are represented in the accompanying table, which also shows the numbers recaptured in the same groups:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	Total.
F. Lib.	2	17	7	1	—	1	28
F. Recap.	2	13	5	—	—	—	20
M. Lib.	2	10	11	1	—	—	24
M. Recap.	2	8	9	1	—	—	20
? Sex Lib.	—	—	—	1	—	—	1
? Sex Recap.	—	—	—	1	—	—	1

Eight of the males liberated (33 per cent.) were under adult size (33 cm.), and 22 of the females (78.6 per cent.) were also under adult size (38 cm.).

All the fish marked and liberated were caught by the “Goldseeker” at Station VI., Firth of Forth, at 3 p.m. on the 19th June; they were marked and kept in tanks of water until 7.35 p.m., when they were liberated.

The number recaptured was 41, or 77.3 per cent., viz. 20 males, or 83.3 per cent. of the males liberated, 20 females, or 71.4 per cent. of the females liberated, and the single fish of undetermined sex.

Of the 20 recaptured males, 16 were of adult size on recapture, the sizes ranging from 33.6 to 43.4 cm., and averaging 37.4 cm.; they were at liberty for from 1 to 757 days, the mean being 187 days; the distances migrated ranged from 5 to 144 miles, and averaged 39.3 miles, and the mean rate was 2.1 miles per 10 days. The 4 immature males were at liberty for from 13 to 56 days, the average being 35 days; the distances travelled were 5 and 6 miles, the mean being 5.3 miles, and the mean rate 1.9 miles.

Only 6 of the females were of adult size on recapture; they had been at liberty for from 13 to 1821 days, the average being 595 days, their average size on liberation was 37.2 cm., and on recapture 42.7 cm.; the distances migrated ranged from 6 to 43 miles and averaged 18.2 miles, and the mean rate was .3 mile.

Fourteen of the females were under adult size, the range being from 31.8 to 37 cm. and the average 34.3 cm.; they had been at liberty for from 13 to 299 days, the mean period being 82 days; they migrated distances of from 5 to 45 miles, the mean being 11.3 miles, and the mean rate 1.29 miles per 10 days.

The fish whose sex was not determined, either on liberation or recapture, had migrated north and east for 26 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—One fish, a male, of 36 cm., was caught the next day after liberation, 7½ miles to the south and west. In July, the month following liberation, 13 fish were taken (32.5 per cent.), 5 males, or 25 per cent., and 8 females, or 42.1

per cent. Particulars were ascertained for 11, 4 males and 7 females. With one exception, all the fishes were recaptured to the south and west of the station, at distances of from 5 to 10 miles, in the direction of the Firth of Forth and the coast to the east of it. All are described as "immature," except a male of 37-37.3 cm., which was caught 6 miles off on 2nd July, and was described as "ripe." One fish, of 37.5 cm., a male, had moved 17 miles west and north, to the vicinity of the Bell Rock, at a mean speed of 13.1 miles per 10 days. All the fish, it may be mentioned, had moved at a considerable rate, that of the others varying from 3.3 miles to 4.6 miles, with the exception of 1 of 1.6 miles.

In August, 5 of the marked fishes were recaptured (12.5 per cent.), 4 males and 1 female. The position was ascertained for 3 of the males and for the female; the female and 2 of the males were found at 5 and 6 miles to the south and west, and the other male was recaptured 6 miles to the north and east.

In September, 2, both females, were recaptured, 1, 12 miles to the south and west, and the other 13 miles to the south and east.

Thus, in the first 3 months after liberation, none of the fishes had made any considerable migration.

Thus, in July, August, and September, 21, or 52.5 per cent., of the total number recaptured, were taken, particulars being obtained for 18. Fifteen of those (or 83.3 per cent.) were recaptured to the south and west for a mean distance of 6 miles, and 1 each to the north and east, the north and west, and the south and east.

*Second Quarter.*—In October, November, and December, 8 fishes were recaptured, 4 females and 4 males. Four, 3 males and 1 female, had moved to the north and east (50 per cent.) for from 23 to 56 miles, the average being 43 miles; 4, 3 females and 1 male, to the south and west, for distances of from 5 to 19 miles, the average being 8 miles. A male of 32.5 to 35.2 cm., taken on 12th November, 5 miles to the south and west, was "nearly ripe"; another, caught in December, 56 miles to the north, and measuring 40-40.8 cm., was also "nearly ripe"; a third, caught 23 miles to the north, off Montrose, in December, and measuring 34.5-38.6 cm., was "three-quarters ripe"; and the fourth, taken on 30th November, 44 miles to the north, was "about half ripe." In this period, therefore, as the chart of the distances and directions quarterly shows, the characteristic feature of the migration is to the north and east, along the coast; while, in the period July to September, there was a marked concentration of the fish a short distance to the south and west.

*Third Quarter.*—Two fishes, both males, were caught in this quarter, and particulars were obtained only in regard to one of them. It measured 36-38.4 cm., and was caught in the Moray Firth, off the Ord of Caithness, at a distance of 144 miles, on 28th February 1912, after 254 days; it was "ripe."

*Fourth Quarter.*—Five fishes were recaptured in April, May, and June, 3 males and 2 females, but particulars in regard to 1 of the males were not obtained. The 2 males and 1 of the females had migrated to the north and east, and were taken as follows:—The female, measuring 35-38.7 cm., on 21st May, after 337 days, at 18 miles; 1 of the males, measuring 35.5-37.3 cm., on 19th April, off Aberdeen, at a distance of 55 miles; the other male, measuring 31.5-34.4 cm., in the Moray Firth, 137 miles distant, on 2nd May, after 318 days. The condition of the testes in this fish was not ascertained, but the other male was "partly spent" and the female was "immature."

Altogether, as shown in the accompanying table, 36 of the fishes, or 90 per cent., were recaptured within 12 months, 19 (or 95 per cent.) of the males, and 17 (or 89.4 per cent.) of the females. Particulars in regard to the positions of recapture of 31 were obtained: 19 (or 61.3 per cent.) moved to the south and west; 9 (or 29 per cent.) to the north and east; 2 (6.4 per cent.) to the north and west; and 1 (3.2 per cent.) to the south and east.

The feature of the two last quarters is the predominant movement northwards ; none was, in this period, recaptured south of the station.

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. July 1911. Aug. 1911. Sept. 1911.	N. and E.	1	5·55	N. 48° E.	6	1·2	...	...
	N. and W.	1	5·55	N. 46° W.	17	13·1	...	...
	S. and E.	1	5·55	S. 22° E.	13	1·5	...	...
	S. and W.	15	83·3	S. 51° W.	6	7·9	5-12	·9-75
			18	52·5	...	...	...	...
II. Oct. 1911. Nov. 1911. Dec. 1911.	N. and E.	4	50	N. 35° E.	43	2·9	23-56	1·2-3·5
	N. and W.	...	...	...	...	...	...	...
	S. and E.	...	...	...	...	...	...	...
	S. and W.	4	50	S. 56° W.	8	·6	5-19	·2-1·3
			8	20	...	...	5-56	·2-3·5
III. Jan. 1912. Feb. 1912. Mar. 1912.	N. and E.	1	100	N. 24° E.	144	5·7	...	...
	N. and W.	...	...	...	...	...	...	...
	S. and E.	...	...	...	...	...	...	...
	S. and W.	...	...	...	...	...	...	...
			1	5	...	...	...	...
IV. April 1912. May 1912. June 1912.	N. and E.	3	75	N. 35° E.	70	2·2	18-137	·5-4·3
	N. and W.	1	25	N. 38° W.	16	·5	...	...
	S. and E.	...	...	...	...	...	...	...
	S. and W.	...	...	...	...	...	...	...
			4	12·5	...	...	...	...
SUMMARY.	N. and E.	9	29					
	N. and W.	2	6·4					
	S. and E.	1	3·2					
	S. and W.	19	61·3					
			31	90				

Of the 5 remaining fish of the experiment, 1 was taken in 1912, 3 in 1913, and 1 in 1916. A female, measuring 35·5-43·2 cm., was caught on 5th October 1912, after 474 days, 12 miles to the north and east ; it was "about half ripe." In May 1913, the fish whose sex was not ascertained was recaptured 26 miles to the north and east, after 683 days. In July 1913, after 757 days, a male, measuring 36-41·8 cm., was caught only 5 miles to the north and east, and in October 1913, after 837 days, a female of 38-44·7 cm., was taken 17 miles to the south and east, off St. Abb's Head. The female caught in October 1912 was described as "half ripe." In June 1916, after nearly 5 years of freedom, a female was caught 43 miles to the north-east of the station. It measured 37-50·8 cm., but the condition of the reproductive organs was not recorded.



The mean direction taken, and the mean distance gone in each of the quadrants is shown in the following table :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	8	476	59	N. 31° E.
	Adult Females.	3	73	24	N. 62° E.
	Immature Females.	1	45	45	N. 62° E.
	?	1	26	26	N. 54° E.
		13	620	48	N. 40° E.
N. and W.	Adult Males.	1	17	17	N. 46° W.
	Immature Females.	1	16	16	N. 38° W.
		2	33	16·5	N. 42° W.
S. and E.	Adult Females.	2	30	15	S. 26° E.
S. and W.	Adult Males.	4	24·5	6·1	S. 49° W.
	Immature Males.	3	16	5	S. 51° W.
	Adult Females.	1	6	6	S. 50° W.
	Immature Females.	11	86	7·8	S. 56° W.
		19	132·5	7	S. 53° W.
N. and E. N. and W. S. and E. S. and W.	SUMMARY.				
		13	620	48	N. 40° E.
		2	33	16·5	N. 42° W.
		2	30	15	S. 26° E.
	19	132·5	7	S. 53° W.	
	36	...	...	...	

*Distances travelled.*—Nineteen of the fishes recaptured (or 52·8 per cent.) of those about which particulars were ascertained, were taken at distances not exceeding 10 miles from the station, viz. 9 males (56·2 per cent.) and 10 females (52·6 per cent.), the average distance for the males being 5·7 miles, and for the females 6·1 miles. Eight, or 22·2 per cent., were recaptured between 10 and 20 miles, viz. 1 male and 7 females, the average distance being 15½ miles. Thus, 27 or 75 per cent., were caught within 20 miles of the station.

*20 to 50 miles.*—Between 20 and 50 miles, 5 were recaptured (13·9 per cent.), 2 males at 23 and 44 miles, 2 females at 45 and 43 miles, and 1 of unknown sex at 26 miles, all north and east.

*50 to 100 miles.*—Between 50 and 100 miles, 2 males were recaptured, at 55 and 56 miles, both to the north of the station.

*Over 100 miles.*—Over 100 miles, the recaptures consisted of 2 males, both of which had migrated to the north, and were taken in the Moray Firth, 1 at 137 miles, and the other at 144 miles distant.

#### MATURITY.

*Males.*—Of the 16 adult males recaptured, the condition of the testes was ascertained in 12. Two were "ripe," viz. the one caught in February 1912, in the Moray Firth, at a distance of 144 miles, and the other the one caught on 2nd July 1911, after 13 days, 6 miles to the south and west.

One was "partly spent"; it was caught 55 miles to the north and east on 19th April 1912.

Two were "nearly ripe," 1 caught on 12th November 1911, 5 miles to the south and west, and the other on 21st December 1911, 56 miles north and east, off the coast of Aberdeen.

A male, taken on 30th November 1911, 44 miles north and east, was "about half ripe," and 1 caught on 21st December 1911, 23 miles north and east, off Montrose, was "three-quarters ripe."

The other 5 adult males, recaptured in the months of June, July, and August, were "immature." Of 4 males under adult size (33 cm.), the condition of the testes in 3 was ascertained; they were all "immature" and were recaptured in July and August 5 and 6 miles to the south and west, within a short period after liberation, viz. 13, 15, and 56 days respectively.

*Females.*—Of the 6 adult females, the condition of the ovaries was ascertained in 4. One, measuring 35.5–43.2 cm., was "about three-quarters ripe" when recaptured on 5th October 1912, 12 miles to the north and east. The others were "immature," and were caught in May, July, and September not far from the station.

Of 14 females under adult size (38 cm.) on recapture, the condition of the ovaries was ascertained in 12. They were caught in various months, 1 in April, 6 in July, 1 in September, 2 in October, 1 in November, and 1 in December. Only 1 had migrated to a moderate distance, viz. 45 miles to the north-east of Aberdeen, in 129 days; it measured 37 cm. in October. The others had moved distances of mostly 5 or 6 miles, and the greatest distance was 19 miles south and west.

#### EXPERIMENT V.

11th September 1911.

The number of fish marked and liberated in this experiment was 105, 49 being males and 56 females. The sizes of the males ranged from 30.5 cm. to 40 cm., and of the females from 27.5 cm. to 44.5 cm. The numbers liberated and recaptured, arranged in 5-cm. groups, are shown in the accompanying table:—

	cm. 25–30.5	cm. 31–35.5	cm. 36–40.5	cm. 41–45.5	cm. Total.
F. Lib. . . . .	1	16	35	4	56
F. Recap. . . . .	1	9	24	—	34
M. Lib. . . . .	2	24	23	—	49
M. Recap. . . . .	—	16	14	—	30

Five of the males were under adult size (33 cm.) and 39 of the females were under 38 cm.

The fish were taken on the usual ground, viz. Station VI., Firth of Forth ("Fluke Hole"), at 7.40 p.m. on 11th September; they were marked and kept in tanks of running water until 11.5 p.m. when they were liberated. None of the plaice died in the interval.

The number recaptured was 64, or 60.9 per cent. of the total marked, viz. 30 males, or 61.2 per cent., and 34 females, or 60.7 per cent. Of the 30 males, 29 were of adult size when recaptured; the sizes before liberation ranged from 33 to 40 cm., the average being 36.1 cm., and the sizes on recapture ranged from 34.1 cm. to 44.3 cm., the average being 37.3 cm.; the period of freedom varied from 7 to 640 days, the mean being 196 days; the distances migrated ranged from 2 to 238 miles, the average distance being 53.3 miles, and the average rate of movement was 2.7 miles per 10 days. Of the 34 females, 16 were of adult size when recaptured; the sizes on liberation varied from 33.5 to 40.5 cm., the average being 37.6 cm., and on recapture from 38 to 41.8 cm. the mean being 39.6 cm.; they were at liberty for from 23 to 439 days, the mean being 181 days; the distances travelled were from 4 to 81 miles, the mean being 33.5 miles, and the mean rate 1.8 miles. Eighteen of the females were under 38 cm. on recapture, their sizes then ranging from 28 to 37.9 cm., and averaging 35.6 cm.; they were free for from

7 to 211 days, the average being 91 days; the distances migrated varied from 5 to 107 miles, the mean being 27.4 miles, and the average rate 2.9 miles. In the case of 3 of the males, particulars of the date and position of capture were not ascertained.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the remainder of September, 5 fishes, 3 males and 2 females, were captured, and particulars were obtained in regard to all but 1 female. All the fishes had moved, as usual, immediately after the liberation, to the south and west, for distances of from 5 to 13½ miles, at rates varying from 9 to 5.9 miles per 10 days. In October, 11 were recaptured, 4 males and 7 females, and particulars were obtained in regard to all but 2 females. Four of the females and 1 of the males were found to the south and west, for distances of from 5 to 8 miles. One male was found to the south-east, at a distance of 8 miles; another male had gone directly north for 2 miles, and another to the north and west for 6 miles. The average distance was 6.2 miles, and the mean period of liberty 27 days. In November, the number taken was 4, all females, 3 of them south and west, 2 at distances of 4 and 5 miles respectively, while the third had moved into the Firth of Forth, and was caught on the south shore, in Gosford Bay, 26 miles distant, after 60 days; the fourth went 11 miles to the north-west in 60 days.

Thus in September, October, and November, 20 fishes, or 31.2 per cent. of the total recaptured, were taken, particulars being obtained for 17, of which 12, or 75 per cent., had moved south and west for an average distance of 9 miles, at a mean rate of 4 miles per 10 days. Two, or 12.5 per cent., had moved north and west for an average distance of 8 miles, and 1 south and east for a distance of 8 miles; only 1, a female, was found to the north and east, 10 miles distant, and a male had gone due north. The chart of the results for this quarter shows all the fishes, except 3, going west and south of the station.

*Second Quarter.*—In December, January, and February, quite a different condition is revealed, and this also of a kind we have seen before. The number recaptured was 20, or 31.2 per cent., 7 males and 13 females, and particulars were obtained for all but 1 of these. Ten, or 52.6 per cent., had migrated to the northwards for distances of from 13 to 188 miles, the average being 88 miles, and the average rate 5.8 miles. Four, or 21 per cent., went to the south-west, for distances of from 5 to 8 miles, the mean being 6 miles and the rate of travel .6 mile. Five, or 26.3 per cent., went north and west for distances of from 12 to 26 miles, the average being 21 miles, and the mean rate 1.8 miles; none was found to the south and east. The number taken in December was 8, 3 males and 5 females. Only 1 was found to the north-east, at a distance of 13 miles; 4 were got to the south and west, 3 at distances of 5 miles, and 1 at 8 miles; 3 were found to the north and west, 1 at a distance of 12 miles, 1 to the northwards of the Bell Rock, at 20 miles, and the third in St. Andrews Bay, 26.5 miles distant; the latter, a female, measured 34.5 to 33.9 cm., and the ovaries were "very immature."

In January, 2, both females, were caught; the position of capture of 1 was not ascertained, but the other was taken 49 miles to the north and east, off Aberdeen. This was the first fish caught far to the north, but in February there were several. In that month, 10 fishes were recaptured, 4 males and 6 females. Eight of them, including all the males, were taken to the north, at distances of from 53 to 188 miles, the mean being no less than 103 miles, while the periods of liberty ranged from 145 days to 169 days, and averaged 156 days. Two of the males were recaptured in the Moray Firth, and another ("nearly ripe" and measuring 36 to 36.5 cm.) had passed westwards through the Pentland Firth, and was taken off Sandside Bay, on the north coast of Caithness, after 155 days, the mean rate of travel in this case being 12.1 miles per 10 days. A female was recaptured nearly east of Kinnaird Head, 107 miles distant, and the other north-going fish were recovered on the north part of the coast of Aberdeen. The rate of movement per 10 days of the north-going fish was from 3.5 to 12.1 miles, and averaged 6.6 miles.

The condition of the reproductive organs was ascertained in 6 of these fish; 1 male was "ripe"; another "nearly ripe"; and the third "three-quarters ripe"; while a female was "fully half-ripe"; and another "half-ripe." Only 1 of these females was described as "immature," and it was only 28 cm. in

length when it was recaptured, though it had migrated a distance of 74 miles, and was caught a little north of Buchanness, after 169 days.

The remaining 2 fishes which were caught in February, both females, had gone westwards into the Firth of Forth, very near the place where they were originally taken, a distance of 22 or 22.5 miles; they measured respectively 36.5 to 37.3 cm. and 33.5 to 34 cm.; the former was "rather immature," and the latter "very immature."

We thus see that, as in other instances, the proportion recaptured to the north increases with the increase of the period of liberty, and that it is clearly a spawning migration.

*Third Quarter.*—In March, April, and May, 7 fishes, or 10.9 per cent., were recaptured, all to the north, the distances ranging from 36 to 238 miles, and averaging ing 102 miles, while the mean rate of travel was 4.9 miles. Five were males and 2 were females, but the particulars of the position of recapture of a male and a female were not ascertained. In March, a male, "nearly ripe," was caught 71 miles distant, off Buchanness. In April, 3 males and 2 females were recovered. One male was caught 64.5 miles distant, near Buchanness; it was "spent"; another male had passed through the Pentland Firth, and along the whole north coast of Scotland, and was caught 14 miles W.S.W. of Cape Wrath, 238 miles away, after 208 days, having migrated at a mean rate of 11.5 miles per 10 days; it was "partly spent"; the position where the third male was recaptured was not ascertained. This was the case also with one of the females, and the other female, measuring 35.5 to 36.6 cm., had moved least of all, and was caught after 211 days 36 miles to the north and east, off Tod Head; it was "immature." One fish, a male, was taken in May, after 261 days, only 2 miles north of the station; it measured 33 to 38.6 cm., and was "immature." In this quarter, therefore, the movements revealed were the same as in the one previous, namely, to the northwards, and in connection with reproduction.

*Fourth Quarter.*—In the next three-monthly period, 8 fishes, or 12.8 per cent., were recaptured, 4 males and 4 females. Six, or 75 per cent., had migrated to the north and east, for from 25 to 81 miles, the average being 46.6 miles, and thus the distances were much less than in the previous months; the mean rate of travel was 1.6 miles per 10 days. One had gone northwards for 12 miles, and 1 south and east for 14 miles. Of the 8 fishes caught, 7 were taken in June, 5, 2 males and 3 females, to the north and east, mostly off the coast of Aberdeen, and not so near the coast as the specimens in the earlier part of the year, but more offshore, the distances ranging from 25 to 54 miles; 1 of the other 2, a male, was got 12 miles to the westward, towards the mouth of the Firth of Forth, and the remaining fish, also a male, 14 miles to the south and east, off St. Abb's Head. The condition of the reproductive organs was ascertained in 5 cases; they were "immature," except 1 female, caught on 4th June south-east of Aberdeen, 44 miles distant, which was "partly spent." None was recaptured in August.

Altogether, in the 12 months following liberation, 55 fishes, or 85.9 per cent. of the total recaptured, were again caught, viz. 23 males (76.7 per cent. of all males recaptured) and 32 females (95.9 per cent. of all females). The position of capture was ascertained for all except 1 male and 5 females. Two had moved directly north for a distance of 2 miles; 2 (42.9 per cent.) had migrated to the north and east; 16 (32.7 per cent.) had gone to the south and west; 8 (16.3 per cent.) north and west, and 2 (4.1 per cent.) south and east.

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. Sept. 1911. Oct. 1911. Nov. 1911.	N.	1	5.9	N.	2	.7	..	..
	N. and E.	1	5.9	N. 28° E.	10	4.5	..	..
	N. and W.	2	11.8	N. 73° W.	8	2.1	6-11	1.8-2.5
	S. and E.	1	5.9	S. 49° E.	8	3.2	..	..
	S. and W.	12	70.6	S. 55° W.	9	4	4-36	6-7.1
		17	26.6	..	..	..	4-26.5	6-7.1
II. Dec. 1911. Jan. 1912. Feb. 1912.	N. and E.	10	52.6	N. 25° E.	88	5.8	13-188	1.3-12.1
	N. and W.	5	26.3	N. 54° W.	21	1.8	12-26.5	1.1-3.3
	S. and E.	..	..	..	..	..	..	..
	S. and W.	4	21	S. 48° W.	6	.6	5-8	5-9
		19	29.7	..	..	..	5-188	5-12.1
III. Mar. 1912. April 1912. May 1912.	N.	1	20	N.	2	.1	..	..
	N. and E.	4	80	N. 21° E.	102	4.9	36-238.5	1.7-11.5
	N. and W.	..	..	..	..	..	..	..
	S. and E.	..	..	..	..	..	..	..
	S. and W.	..	..	..	..	..	..	..
		5	7.8	..	..	..	..	..
IV. June 1912. July 1912. Aug. 1912.	N. and E.	6	75	N. 39° E.	46.6	1.6	25-81	9-2.7
	N. and W.	1	12.5	N. 84° W.	12	.4	..	..
	S. and E.	1	12.5	S. 3° E.	14	.5	..	..
	S. and W.	..	..	..	..	..	..	..
		8	12.5	..	..	..	..	..
SUMMARY.	N.	2	4.1					
	N. and E.	21	42.9					
	N. and W.	8	16.3					
	S. and E.	2	4.1					
	S. and W.	16	32.7					
		49	76.6					

Of the remaining fishes, 5 were recaptured in 1912, 3 in October and 2 in November; 1 was taken in June 1913. Four were males and 2 were females, but the position of recapture of 1 of those was not ascertained. All the others were recaptured to the north and east of the station, 2 males in October, 44 and 101 miles distant; a male and a female in November, 82 and 68 miles distant, after 434 and 439 days respectively; while the fish taken in June 1913 was the male measuring 34.5-40 cm., which was caught after 640 days 20 miles to the north-east, off Tod Head. The males taken in October were respectively "nearly ripe" and "half-ripe"; the condition of the reproductive organs of the other 4 fishes was not ascertained.

It may be noted that, of the fish which were got farthest out from shore on the east coast, the majority were recaptured in June (viz. Nos. 3611, 3603, 3570, 3609, 3531, 3619); two, farthest out of all, were caught in November, and two others in October (see chart). There appears from this to be an offshore movement in summer.



A summary of the mean direction and distance in each quadrant is shown in the following table :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	14	855	61	N. 35° E.
	Adult Females.	7	373	53	N. 36° E.
	Immature Females.	5	290	58	N. 23° E.
		26	1518	58·4	N. 33° E.
N. and W.	Adult Males.	4	50	12·5	N. 47° W.
	Immature Females.	4	82	20·5	N. 77° W.
		8	132	16·5	N. 62° W.
S. and E.	Adult Males.	2	22	11	S. 26° E.
S. and W.	Adult Males.	3	21	7	S. 63° W.
	Immature Males.	1	13·5	13·5	S. 35° W.
	Adult Females.	5	30	6	S. 50° W.
	Immature Females.	7	67	9	S. 54° W.
		16	131·5	8·2	S. 53° W.
N.	Adult Males.	2	4	2	N.
SUMMARY.					
N. and E.		26	1518	58·4	N. 33° E.
N. and W.		8	132	16·5	N. 62° W.
S. and E.		2	22	11	S. 26° E.
S. and W.		16	131·5	8·2	S. 53° W.
N.		2	4	2	N.
		54	..	..	..

*Distances travelled.*—Eighteen of the fishes, or 33·3 per cent., of those about which particulars exist, were recaptured at distances not exceeding 10 miles from the station, viz. 12 females (42·9 per cent.) and 7 males (26·9 per cent.). The mean distance for the females was 5·9 miles, and for the males 5·5 miles. All the females had moved to the south and west except one, which was got 10 miles to the north and east; of the males, 2 were got to the north, 1 north-west, 2 south-west, and 1 south-east. Between 10 and 20 miles, 8 fishes were recaptured (14·8 per cent.), 6 being males (23·1 per cent.) and 1 a female, the average distance being 17·1 miles. Thus, 26 fishes (48·1 per cent.) were recaptured at distances not exceeding 20 miles, 13 being males (50 per cent.) and 13 females (46·4 per cent.).

*20 to 50 miles.*—Thirteen (22·2 per cent.) were recaptured at distances of from 20 to 50 miles, the average distance being 30·6 miles. Five were males and 8 were females (19·2 and 28·6 per cent. respectively of the total males and females of which particulars were ascertained).

*50 to 100 miles.*—Ten fishes (18·5 per cent.) were got, 4 males and 6 females, the average distance for the former being 68 miles and for the latter 65·5 miles, and the average distance for both combined was 66·7 miles. They were all taken to the north-east of the station.

*Over 100 miles.*—Six (11·1 per cent.) were taken at distances exceeding 100 miles, namely 5 males and 1 female. All had moved north and east, along the coast. The distances migrated by the males were 101, 126, 155, 188, and 238 miles, the average being 162 miles; 2 were caught in the Moray Firth, 1 off Kinnaird

Head, 1 on the north coast, and 1 on the west coast, off Cape Wrath. The female had gone a distance of 107 miles, to a position north-east of Kinnaird Head.

#### MATURITY.

*Males.*—Of the 29 males which were of adult size on recapture, the condition of the testes was ascertained in 24. One was "ripe"; it was taken on 13th February 1912, after 155 days, 57 miles to the north, a little north and east of Aberdeen, the mean rate of travel having been 3·7 miles.

Seven were "nearly ripe," viz. 1 taken in October 1911, 6 miles to the south and west; another on 13th December 1911, 20 miles north and west; a third on 26th December, 12 miles north and west; the fourth on 13th February, on the north coast, 188 miles distant; the fifth on 14th March 1912, 71 miles north and east; the sixth in April 1912, at a position unspecified; and the seventh in October 1912, 31 miles north and east.

Three of the males were "spent," all got to the north, 2 off the coast of Aberdeen, 64 and 44 miles distant, in April and June 1912 respectively, and the third west of Cape Wrath, 238 miles distant, in April 1912.

In 5 the testes were "maturing"; 1, caught in February 1912, in the Moray Firth, 155 miles distant, was described as three-quarters ripe. Two, caught in October 1911, 2 and 6 miles to the northwards, were "fully half ripe"; 1, taken in October 1912, also "half ripe," was caught 101 miles north and east; a third, "nearly half ripe," was caught in September 10 miles to the south and west.

Eight were "immature," but particulars about only 5 of them were obtained; they were caught in the months May, June, September, October, and December, at distances of from 2 to 32 miles distant.

*Females.*—Of 16 adult females, the condition of the ovaries was obtained in 13. None was "ripe"; 1 was "nearly ripe," and was caught in December 8 miles to the south and west.

Two were "maturing"; 1 was caught in February 53 miles to the north and east; particulars regarding the other 1 were not given.

Ten were "immature"; of 1 of these, caught in April, particulars were not obtained; 2 were caught in December, each 5 miles to the south and west; 3 were taken in June, all north and east, for distances of 25, 43, and 54 miles; 1 was got in July, 81 miles north and east; 1 in October, about which particulars do not exist; 1 in November, 4 miles to the south and west; and 1 in January, 49 miles north and east.

Of 18 females under the adult size on recapture, 1 was "nearly ripe." It measured 37–37·4 cm., and was caught on 15th November, after 65 days, 5 miles to the south-west; 1, taken in February, 63 miles to the north and east, and measuring 37–39 cm., was "fully half ripe."

Thirteen were "immature"; they were caught as follows:—1 in January, 3 in February, 1 in April, 2 in September, 2 in October, 2 in November, and 2 in December. The position of recapture was ascertained for 11 of these females; 3 were taken to the north and east, at distances of 10, 36, and 74 miles; 4 were got to the north and west, at distances of 11, 22, 22, and 26 miles; 4 were caught south and west, 3 at 5 miles, and the fourth at 26 miles, the latter in the Firth of Forth.

#### EXPERIMENT VI.

7th March 1912.

In this experiment the number of plaice marked and liberated was 100, the males numbering 22, and the females 78. The sizes of the males ranged from 32 to 48·5 cm., and of the females from 31 to 60 cm. Five of the males were under 33 cm. and 42 of the females under 38 cm., when liberated. The numbers liberated and recaptured, in 5-cm. groups, are shown in the accompanying table:—

	cm.	cm.	cm.	cm.	cm.	cm.	Total.
	31–35·5	36–40·5	41–45·5	46–50·5	51–55·5	56–60·5	
F. Lib.	28	36	8	2	—	4	78
F. Recap.	22	29	4	1	—	4	60
M. Lib.	13	7	1	1	—	—	22
M. Recap.	8	3	1	1	—	—	13

The fish used in this experiment were caught at Station VI., Firth of Forth (Fluke Hole), on the 6th of March; they were marked between 5.50 and 6.50 p.m., kept in tanks of running water and liberated on the 7th at 10 a.m. None of them died in the tanks.

The number recaptured was 73 (or 73 per cent. of the total marked), viz. 13 males (59.1 per cent.) and 60 females (76.9 per cent.). Of the 13 males, 12 were of adult size on recapture; the lengths on liberation varied from 32.5 to 48.5 cm., the mean being 36.4 cm., and on recapture from 33.9 to 48.5 cm., the average being 38.9 cm.; the periods of liberty ranged from 6 to 772 days, the mean being 210 days; the distances migrated were from 1 to 114 miles, averaging 30 miles, and the mean rate of travel was 1.4 miles per 10 days. Of the 60 females, 43 were of adult size on recapture; the sizes on liberation were from 33.5 to 60 cm., the mean being 39.8 cm., and the sizes on recapture varied from 38 to 61.6 cm., the average being 42.8 cm.; the periods of freedom were from 5 to 801 days, and averaged 238 days; the distances migrated ranged from 5 to 173 miles, the mean being 31.6 miles, and the average rate 1.3 miles. Seventeen of the females were under adult size on recapture; on liberation, the sizes varied from 31 to 38 cm., the mean being 34.1 cm.; and on recapture, from 31.3 to 37.7 cm., with an average of 34.7 cm., the periods of freedom were from 1 to 120 days, averaging 31 days, and the distances migrated ranged from 4 to 23 miles, the mean being 12.1 miles and the mean rate 3.9 miles per 10 days.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the remainder of the month of March, 13 fishes (17.8 per cent.) were recaptured, 3 males and 10 females. All had moved in a more or less westward direction. Six were taken to the south and west, at distances of from 5 to 16 miles, and 7 to the north and west, at distances of from 10 to 23 miles. One of the females, measuring 33.5 cm. to 33.8 cm., had moved back to near the position in the Firth of Forth where it was originally caught, or 23 miles in 16 days, or at the rate of 14.4 miles per 10 days. All the fish, indeed, had travelled more quickly than usual, and for a somewhat greater distance. In those caught to the south and west, the average distance was 10.3 miles in an average period of 4.7 days, the mean rate being 2.2 miles per day. One female was recaptured 16 miles to the south-west on the following day, and another 3 miles almost in the same direction 2 days after liberation, the rate in these cases being respectively 16 miles and 1.5 miles per day. With 2 exceptions, these fish, both females and males, were under adult size, the 2 females referred to measuring 34 and 33.5 cm. respectively. A female of 38 cm. had moved 6 miles in 7 days, and a male of 37.5 cm. 5 miles in 8 days. Of the 7 found to the north-west, 6 of which were females, the average distance was 13.3 miles in a mean period of 7.6 days, the mean rate being 1.75 miles per day. One female was adult, measuring 41 cm., and the male measured 33.5 cm. With 1 exception, the reproductive organs of the 13 fishes were "immature." The female, which measured 41 cm. and had moved 10 miles to the north and west, was captured after 5 days, and was "half ripe."

In April, 11 were recaptured (or 15.1 per cent. of the total), 10 females and 1 male. Particulars were obtained for all but 1 of the females. Five were caught to the south-west, at distances of from 4 to 16 miles, the average distance being 7.8 miles, and the mean rate 2 miles per 10 days. One was taken to the north and west, at a distance of 20 miles, the rate of travel being 3.7 miles; 1 was got 9 miles to the south-east; and 3 to the north-east, at distances of 34, 79, and 86 miles, the first off Tod Head and the other 2 at a considerable distance offshore from Buchanness, the mean rate of movement of these 2 being respectively 19.3 and 22 miles per 10 days. The reproductive organs in all cases were "immature."

The number recaptured in May was 13 (or 18.3 per cent.), 12 being females (20.7 per cent.), and 1 male (7.7 per cent.). Six, all females, had moved south and west, 5 of them for 5 miles and 1 for 6 miles, after from 63 to 82 days (average 76 days), and the rate of movement varied from .6 to .8 mile per 10 days, the mean being .7 mile. Three females were found to the north-west, in

the vicinity of the Bell Rock, at distances of from 10 to 18 miles, the average being 15 miles; the periods of liberty ranged from 56 to 63 days, and the mean rate from 1·7 to 3 miles. The male was recaptured to the south and east, only 1 mile from the station, after 68 days. Two females had moved north and east for 20 miles in 74 and 85 days respectively, the rates being 2·7 and 2·3 miles. The position of recapture of the remaining female was not ascertained. All the fish were "immature," except 2 females. One, measuring 39·5 to 41·3 cm., was described as "spent"; it was taken 5 miles to the south-west on 27th May. Another, measuring 40 to 40·9 cm., got on 2nd May 17 miles to the north-west was "rather immature."

Thus, the number recaptured in March, April, and May was 37, or 50·7 per cent. of all those recaptured; 5 (38·5 per cent.) were males, and 32 (53·3 per cent.) were females. Particulars in regard to 35 were ascertained; 17 (48·6 per cent.) moved to the south and west for an average distance of 8 miles at a mean rate of 18·1 miles, this high rate being due to the rapid movement of the fish in March, as described above. Two (5·7 per cent.) went south and east for an average distance of 5 miles; 11 (31·4 per cent.) moved north and west for an average distance of 14 miles, the mean rate being 13 miles; 5 were caught north and east, at distances of from 20 to 86 miles, the average being 48 miles, and the mean rate 11·3 miles. The outstanding feature of this quarter (well brought out on the chart) was the movement more or less westwards, chiefly south and west, partly north and west; but, 2 of the fishes, both females, caught in April had, as we have seen, gone a long distance to the north and east.

*Second Quarter.*—In June, July, and August, 11 fishes (15·1 per cent.) were recaptured, of which 3 (23·1 per cent.) were males and eight (13·3 per cent.) were females. Four females were taken in June, 2, 5 and 6 miles to the south and west, 1, 7 miles to the north and west, and 1, 13 miles north and east. Three were caught in July, 2 to the north and west, a male at a distance of 18½ miles, and a female at 16 miles; a female went north-east for a distance of 37 miles. Four were recaptured in August, 2 males and 2 females. Two were found to the south-west, a male at a distance of 9 miles, and a female at 15 miles; a male went 10 miles to the north and west, and a female 17 miles to the north-east. In this quarter, therefore, 4 of the fishes (36·3 per cent.) were found to the south and west, the average distance being 9 miles and the mean rate ·6 mile; 4 (36·3) were found to the north and west, for an average distance of 13 miles, the mean rate being 1 mile; 3 (27·3 per cent.) were found north and east, the average distance being 22 miles, and the mean rate 1·9 miles. All the fishes were described as "immature," except a female measuring 46 to 47·2 cm., caught on 13th June, 7 miles to the north and west, which was described as "apparently spent."

*Third Quarter.*—In this quarter only 6 fishes (8·2 per cent.) were recaptured, 3 females and a male in September, and 2 females in October. Two females, taken in September, were found at 5 and 6 miles to the south and west; 2, a male and a female, were caught at 11 and 15 miles to the north and west, the male in September and the female in October; and 2 females were taken to the north-east, 1 in September, off Tod Head, at a distance of 35 miles, and the other in October, north-east of Kinnaird Head, at a distance of 92 miles, showing a mean rate per 10 days of 4·4 miles. All were "immature," except a female caught on 11th September 6 miles to the south-west, which was described as "half-ripe."

*Fourth Quarter.*—Two, a male and a female, were recaptured in December, and 6, 1 male and 5 females, in February 1913, making 8 in all, or 10·9 per cent. of the total recaptured. Two females had migrated into the Firth of Forth, 1, taken on 5th December and measuring 38 to 42 cm., to the south of the bay, off Aberlady, a distance of 37 miles; it was "three-quarters ripe"; the second returned to the vicinity of the locality where it was originally caught on the north shore; it was taken on 20th February 1913, and measured 34·5 to 38·8 cm., and was "immature." One female was caught on 3rd February 1913, 29 miles to the south and east; it measured 38 to 43 cm., and was "immature." Five of the fish (62·5 per cent.) had migrated to the north and east for distances of from 37 to 114 miles, the average being 58 miles, and the mean rate 1·8 miles; most of these were recaptured off the coast of Aberdeen at distances of from 37 to 46 miles,

but 1 male was taken in the Moray Firth, at a distance of 114 miles, the apparent mean rate being 3·9 miles. This fish, caught on 26th December, off Banff, was "ripe," as was also a large female taken south-east of Aberdeen, on 17th February 1913. A male, caught off Aberdeen on 16th February, was "partly spent"; it measured 32·5 to 34·8 cm.; another female, measuring 59 to 59·8 cm., caught on 14th February, 37 miles to the north-east, off Tod Head, was "spawning."

Altogether, within 12 months of liberation, 62 fishes, or 84·9 per cent. of the total recaptured, were again caught, viz. 11 males (84·6 per cent. of all males recaptured) and 51 females (85 per cent.). The position of capture was ascertained for all, except 2 females; 15 had migrated to the north and east, 18 to the north and west, 3 to the south and east, and 24 to the south and west.

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. Mar. 1912. April 1912. May 1912.	N. and E.	5	14·3	N. 28° E.	48	11·3	20-86	2·3-22
	N. and W.	11	31·4	N. 49° W.	14	13	10-23	1·7-26
	S. and E.	2	5·7	S. 68° E.	5	·9	1-9	·1-1·8
	S. and W.	17	48·6	S. 48° W.	8	18·1	4-16	·6-160
			35	50·7	..	..	..	1-86
II. June 1912. July 1912 Aug. 1912.	N. and E.	3	27·3	N. 44° E.	22	1·9	13-37	1·1-3·2
	N. and W.	4	36·3	N. 22° W.	13	1	7-18·5	·6-1·5
	S. and E.	Nil.						
	S. and W.	4	36·3	S. 49° W.	9	·6	5-15	·5-9
			11	15·1	..	..	..	5-37
III. Sept. 1912. Oct. 1912. Nov. 1912.	N. and E.	2	33·3	N. 21° E.	63	3·1	35-92	1·9-4·4
	N. and W.	2	33·3	N. 47° W.	13	·6	11-15	·6-7
	S. and E.	Nil.						
	S. and W.	2	33·3	S. 49° W.	5	·25	5-6	·2-3
			6	8·2	..	..	..	5-92
IV. Dec. 1912. Jan. 1913. Feb. 1913.	N. and E.	5	62·5	N. 38° E.	58	1·8	37-114	1·1-3·9
	N. and W.	1	12·5	N. 83° W.	32	·9	..	..
	S. and E.	1	12·5	S. 43° E.	29	·9	..	..
	S. and W.	1	12·5	S. 79° W.	37	1·3	..	..
			8	10·9	..	..	..	..
SUMMARY.	N. and E.	15	25					
	N. and W.	18	30					
	S. and E.	3	5					
	S. and W.	24	40					
			60	84·9				

Of the remaining 11 fish, 6, 5 females and 1 male, were recaptured in 1913, viz. 3 in March, 1 each in July, September, and November. Two of the females, taken in March, were recaptured to the north-east, 1 in the Moray Firth, and the other east of the Orkneys, distances of 130 and 173 miles, showing a mean rate of travel per 10 days of 3·5 and 4·5 miles respectively; 2, a male and a female, were got to the north and west, at distances of 22 and 32 miles, the latter being in the Firth of Forth; 2 females were recaptured to the south and east, 1 at a distance of 16 miles, and the other, offshore, at 96 miles distant. Five, 1 male and 4 females, were caught in 1914, one in March, 3 in April, and 1 in May; three had gone northwards for distances of from 11 to 109 miles, and 2 migrated north-west for distances of 5 and 25 miles respectively.

A summary of the mean direction and distance in each quadrant is given in the following table :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	3	239	79	N. 33° E.
	Adult Females.	16	759	47·4	N. 34° E.
	Immature Females.	1	20	20	N. 15° E.
		20	1018	50·9	N. 33° E.
N. and W.	Adult Males.	5	73	14·6	N. 53° W.
	Adult Females.	10	179	18	N. 51° W.
	Immature Females.	7	98	14	N. 53° W.
		22	350	16	N. 52° W.
S. and E.	Adult Males.	1	1	1	S. 73° E.
	Adult Females.	3	141	47	S. 63° E.
	Immature Females.	1	9	9	S. 64° E.
		5	151	30	S. 65° E.
S. and W.	Adult Males.	3	18·5	6·2	S. 37° W.
	Immature Males.	1	16	16	S. 24° W.
	Adult Females.	13	115	8·8	S. 57° W.
	Immature Females.	7	66	9·4	S. 46° W.
		24	215·5	9	S. 50° W.
SUMMARY.					
N. and E.		20	1018	50·9	N. 33° E.
N. and W.		22	350	16	N. 52° W.
S. and E.		5	151	30	S. 65° E.
S. and W.		24	215·5	9	S. 50° W.
		71	..	..	..

*Distances travelled.*—Twenty-five of the fishes, or 35·2 per cent. of the total recaptured, were taken at distances not exceeding 10 miles from the place of liberation. Five (38·5 per cent.) were males, the average distance being 6 miles, and 20 (34·5 per cent.) were females, the average distance being 6·1 miles. Of the total, 18 went south and west, 5 north and west, and 2 south and east. Between 10 and 20 miles, 20 fishes were recaptured (28·2 per cent.), 4 (30·8 per cent.) being males, and 16 (27·6 per cent.) females; the average distance for the males was 14·1 miles, and for the females 14·7 miles. Five moved to the south and west, 11 to the north and west, three to the north and east, and 1 to the south and east. Thus, 48 of the fishes, or 67·6 per cent. of all recaptured, were taken within a distance of 20 miles of the station.

*20 to 50 miles.*—Eighteen, or 25·3 per cent., were found between 20 and 50 miles, 2 (15·4 per cent.) males, and 16 (27·6 per cent.) females, the average distance for the former being 33·7 miles, and for the latter 31·7 miles. Six had moved north and west, all into the Firth of Forth, to the neighbourhood of the locality where they were originally caught; 1 moved south and west, also into the Firth of Forth, 1 south and east, and 10 north and east, to the coasts of Forfarshire and Aberdeenshire.

*50 to 100 miles.*—Four fishes (5·6 per cent.), all females, were recaptured at distances of from 79 to 96 miles from the station, the average distance being

88 miles. Three went north and east to the coast of Aberdeenshire, and 1 almost directly east to the offshore grounds.

*Over 100 miles.*—Four (5·6 per cent.), 2 males and 2 females, were taken at over 100 miles, and all to the north. One male was got off Buchanness, and the other in the Moray Firth; 1 of the females was caught in the Moray Firth, and the other at Stronsay, in the Orkneys, 173 miles distant.

#### MATURITY.

*Males.*—The condition of the reproductive organs was ascertained in each of the 12 males which were of adult size on recapture. Two were "ripe"; 1 taken on 18th April 1914, after 772 days, off Buchanness, 109 miles to the north-east, the other caught on 26th December 1912, after 294 days, in the Moray Firth, at a distance of 114 miles.

Two were "spent"; 1 was caught on 16th February 1913, after 346 days, off Aberdeen, at a distance of 45 miles, and the other on 1st March 1913, after 359 days, in the Firth of Forth, at a distance of 22½ miles.

The other 8 were "immature"; 2 were taken in March, 1 in April, 1 in May, 1 in July, 2 in August, and 1 in September. They had migrated distances of from 1 to 18½ miles, 4 to the north-west, 3 to the south-west, and 1 to the south-east.

*Females.*—The condition of the ovaries was ascertained in 38 of the 43 adult females. Two were "spawning," 1, of 59·8 cm., caught on 14th February 1913, after 344 days, 37 miles to the north and east, off Tod Head, and the other, measuring 43·3 cm., on 23rd March 1913, after 381 days, at Stronsay, Orkney Islands, 173 miles distant from the place of liberation.

One was "ripe"; it was taken on 17th February 1913, after 347 days, off the coast of Aberdeen, 46 miles to the north and east.

One was "nearly ripe" on 16th February 1913, and was caught in the same locality.

Four were "spent," viz. 1, measuring 57·5 cm., taken in the Firth of Forth, off Pittenweem, on 23rd March 1914, after 746 days; 1, of 47·2 cm., got on 13th June 1912, after 98 days, 7 miles to the north and west; a third, of 41·3 cm., taken on 27th May 1912, after 81 days, 5 miles to the south and west; the fourth, measuring 61·6 cm., on 17th May 1914, after 801 days, off Tod Head, 36 miles to the north and east.

Four were "maturing." They were caught in March, September, November, and December; 1 in the Firth of Forth, another 96 miles distant to the eastwards, the third 10 miles to the north and west, and the fourth 6 miles to the south and west.

Twenty-six were "immature." Two were taken in February, 5 in April, 8 in May, 3 in June, 2 each in July, August, September, and October. Three had moved considerable distances; 1, of 38·5 cm., was caught on 15th April 1912, after 39 days, off Aberdeenshire, 86 miles distant; another, of 48·1 cm., was taken on 4th October 1912, after 211 days, off Rattray Head, a distance of 92 miles; the third, of 39·9 cm., was caught on 17th April 1912, after 41 days, off Buchanness, at a distance of 79 miles.

#### EXPERIMENT VII.

*24th April 1912.*

In this experiment 101 fishes were liberated, viz. 27 males, 71 females, and 3 whose sex was not determined. The sizes of the males ranged from 32 to 40 cm., and the sizes of the females from 32 to 63 cm. Of the females, 16 measured from 31 to 35·5 cm.; 32 from 36 to 40·5 cm.; 15 from 41 to 45·5 cm.; 4 from 46 to 50·5 cm.; 2 from 51 to 55·5 cm.; and 2 over 61 cm. Of the males, 15 measured from 31 to 35·5 cm., and 12 from 36 to 49 cm. Three, whose sex was not ascertained, measured 36, 37, and 38 cm. Only 1 male and 11 females were under the adult size on liberation (33 cm. and 38 cm.).

The fish for this experiment were caught on Station VI., Firth of Forth (a little offshore, between St. Monans and Pittenweem, in from 12 to 20 fathoms), on 23rd April. They were marked between 4·35 and 6 p.m., and kept in tanks, with a good circulation of water, until 1.30 p.m. next day, when they were liberated.

The number recaptured was 76, or 75·2 per cent. of those liberated, of which 21,

or 77·7 per cent., were males, 54, or 76·1 per cent., females, and 1 was of unknown sex. Of the males recaptured, 11, or 73·3 per cent., were of the first group mentioned above, of smaller fish, and 10, or 83·3 per cent., of the larger group. Among the females recaptured, 14, or 87·5 per cent., belonged to the smaller group (under 36 cm.), 26, or 81·2 per cent., to the next largest group, 11, or 73·3 per cent., to the group from 41 to 45·5 cm.

All the males were of adult size on recapture, and the particulars in regard to them are as follows :—They had been at liberty for from 33 to 798 days, the average being 293·6 days ; their average size on liberation was 35·7 cm., and on recapture 38·5 cm. ; the distances migrated ranged from 5 to 156 miles, the average being 42·75 miles, and the mean rate of movement 1·5 miles per 10 days.

Of the 54 females, 46 were of adult size on recapture ; they had been at liberty for from 7 to 868 days, the average period being 203·8 days ; their average size on liberation was 40·1 cm., and on recapture 43·2 cm. ; the distances migrated varied from 3 to 300 miles, the mean distance being 28·8 miles, and the average rate of travel per 10 days was 1·4 miles.

The other 8 females were under the size of maturity on recapture, the mean size being 35·8 cm. against 33·9 cm. on liberation ; they had been at liberty for from 12 to 163 days, or an average of 93 days ; the distances travelled were from 4 to 8 miles, the average being 5·9 miles, or at the rate of ·6 mile per 10 days.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In May 1912, the month following their liberation, 13 fish were recaptured, 12 females and 1 male. The position of capture was ascertained for all but 1 female ; 4 of the fishes, including the male, had moved to the south and west, in the direction of the coast south of the Firth of Forth, for distances of from 5 to 6 miles ; 5 had gone to the south and east, for distances of from 6 to 24 miles ; 2 north and west for 5½ and 23 miles, 1 directly east.

In June, 11 were recaptured, 4 males, 6 females, and 1 of unknown sex. Three had moved to the south-west, for from 5 to 9 miles, 2 to the south and east, each for 5 miles, and 6 to the north and east for from 5 to 20 miles.

In July, 7 were taken, 6 females and 1 male. Two had moved south and west, each for 5 miles, 2 north and east, for 5 and 8 miles, and 3 to the north and west, in the direction of the coast, for 11, 14, and 15 miles.

Thus, in the first three months following liberation, viz. May, June, and July, 31 fishes were recaptured (or 40·8 per cent. of the total recaptured), particulars being ascertained for 30 of them. Six were males, 22 females, and 1 of undetermined sex, the percentages being 28·6 of the total males recaptured, and 40·7 of the total females recaptured. There was thus a considerable excess of females. None of the fishes had moved to any great distance, the maximum being 24 miles ; and (as the chart shows very well) they were tolerably well dispersed in all directions around the station. In the accompanying table, in which the particulars are summarised, it will be seen that 8 fishes (or 26·7 per cent.) moved to the north and east for a mean distance of 9·4 miles ; 5 (or 16·7 per cent.) moved north and west for a mean distance of 13·7 miles ; 7 (or 23·3 per cent.) moved south and east for a mean distance of 12·5 miles ; 9 fishes (or 30 per cent.) moved south and west for a mean distance of 6 miles ; and 1 had gone directly east for 3 miles.

*Second Quarter.*—In the next three months, August, September, and October, 13 fishes (or 17·1 per cent. of the total) were recaptured ; 3 were males (or 14·3 per cent. of the total males recaptured) ; and 10 were females (or 18·5 per cent.). In this period the majority of the fishes were caught to the south and west, viz. 8 (or 61·5 per cent.), but they had moved only short distances, from 4 to 15 miles, the mean being 6·8 miles. One had gone north and west for 9 miles, and 1 south and east for 34 miles. Other 2 fishes had moved north and east, to off the coast of Aberdeen, 1 for 37 and the other for 50 miles ; and 1 had gone west for 10 miles.

*Third Quarter.*—In the 3 months, November and December 1912, and January 1913, 10 fishes (or 13·2 per cent. of the total recaptured) were taken, 3 being males (or 14·3 per cent.) and 7 females (or 13 per cent.). In this case also the majority were caught to the south and west, viz. 5 (or 50 per cent.), but the distances were again very small, from 4 to 15 miles, the mean being 7·8 miles. None was got



to the north and west, and only 1 to the south and east, 11 miles distant. Four of the fishes (or 40 per cent.) were taken to the north and east, having migrated northerly along the coast, the distances travelled ranging from 70 to 149 miles, the mean being no less than 104 miles. One, a male, was caught on 21st January 1913, 149 miles away, off Kinnaird Head. Another, a female, was also got off Kinnaird Head, 127 miles distant, on 12th January 1913. The condition of the reproductive organ of the male was not determined, but, as it was 41·7 cm. in length, it was probably "mature," or approaching maturity; the female, a large fish of 64 cm., was "nearly ripe."

The characteristic of this quarter, especially obvious on the chart, was the migration to the north.

*Fourth Quarter.*—Nine fishes (or 11·8 per cent. of the total) were recaptured in February, March, and April 1913. Five were females (9·3 per cent. of the total females recaptured), and 4 (or 19 per cent.) were males. Of the total, 8 (or 88 per cent.) were taken in the north, at distances varying from 8 to 115 miles, the average being 58 miles. Only 1 was got to the south-west, at a distance of 5 miles, and none to the north and west, or to the south and east.

Altogether, 63 of the fishes (or 83 per cent.) were recaptured within 12 months after liberation, 46 being females, 16 males, and 1 of undetermined sex. Particulars of recapture were ascertained for all but 1 of these. Twenty-two (35·5 per cent.) moved north and east; 6 (9·7 per cent.) went north and west; 9 (14·5 per cent.) south and east; 23 (37·1 per cent.) south-west; 1 (1·6 per cent.) directly east; and 1 went west.

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. May 1912. June 1912. July 1912.	N. and E.	8	26·7	N. 51° E.	9·4	2	5-20	·6-5·3
	N. and W.	5	16·7	N. 35° W.	13·7	5·3	5·5-23	1·5-19·2
	S. and E.	7	23·3	S. 35° E.	12·5	9·6	5-24	1·1-20
	S. and W.	9	30·	S. 52° W.	6·	1·4	5-9	·5-2·1
	E.	1	3·3	E.	3·	3·3	..	..
		30	39·5	..	..	..	5-24	·5-20
II. Aug. 1912. Sept. 1912. Oct. 1912.	N. and E.	2	15·4	N. 38° E.	43·5	2·8	37-50	2·1-3·4
	N. and W.	1	7·7	N. 79° W.	9·	·6	..	..
	S. and E.	1	7·7	S. 14° E.	34·	2·6	..	..
	S. and W.	8	61·5	S. 39° W.	6·8	·5	4-15	·2-1·5
	W.	1	7·7	W.	10·	·7	..	..
		13	17·1	..	..	..	5-50	·2-3·4
III. Nov. 1912. Dec. 1912. Jan. 1913.	N. and E.	4	40	N. 34° E.	104	3·8	70-149	2·5-5·5
	N. and W.	Nil.						
	S. and E.	1	10	S. 7° E.	11	·5	..	..
	S. and W.	5	50	S. 69° W.	7·8	·3	4-15	·1-·6
		10	13·2	..	..	..	4-149	·1-5·5
IV. Feb. 1913. Mar. 1913. April 1913.	N. and E.	8	88	N. 34° E.	58	1·8	8-115	·3-3·9
	N. and W.	Nil.						
	S. and E.	Nil.						
	S. and W.	1	12·	S. 52° W.	5	·1	..	..
		9	11·8	..	..	..	5-115	·1-3·9
SUMMARY.	N. and E.	22	35·5					
	N. and W.	6	9·7					
	S. and E.	9	14·5					
	S. and W.	23	37·1					
	E.	1	1·6					
	W.	1	1·6					
		62	81·6					

In the first 3 months, May, June, and July 1912. the fish were recaptured fairly evenly in all directions around the station, none at any great distance, and most to the south and west, *i.e.* in the direction of the coast between Dunbar and St. Abb's Head. In the second quarter, August, September, and October, the majority of the fish were also got south and west, and this was also true in the third quarter, November, December, and January. In the fourth quarter, only 1 was taken in this direction. It is to be noted that all the fishes got to the south-west were taken on practically the same ground, at a short distance from the place of liberation, so that they did not make any definite migration as the months passed.

The outstanding feature of this experiment is the migration to the north and east, along the coast, which became evident in the second quarter, was emphasised in the third quarter, and was most conspicuous in the fourth quarter, when 88 per cent. moved in this direction. It is to be observed that all these fish had migrated considerable distances, some of them somewhat over 100 miles.

The remaining fish in this experiment were recaptured as follows:—Seven in 1913, in May, June, July, August, October, and December; and 6 in 1914, in February (3 fish), April, July, and September. The direction and distances were ascertained for all those caught in 1913; 4 had migrated north and east, *viz.* 3 females for distances of 8, 21, and 75 miles, and 1 male for a distance of 132 miles. The females were immature, except the 1 which had migrated 75 miles; it was taken in July, and is described as “apparently spent.” The male, caught in the Moray Firth in December, was “ripe.” One of the fishes, a female, had moved 4 miles to the south-west, and was taken in August “immature”; another female had gone directly east for 42 miles; and a male was taken in October, 8 miles north-west of the station, and was “about half ripe.”

Of the 3 caught in February 1914 the particulars in regard to 1, a male, were not ascertained. The other 2 were females; 1, a large fish of 64 cm., was taken after 660 days, 30 miles to the south-west (off Fidra), within the Firth of Forth, and is described as “nearly ripe.” The other had apparently a remarkable journey. It was landed at Grimsby, and is stated to have been caught at Lat.  $53^{\circ} 40' N.$ ; Long.  $5^{\circ} 15' E.$ , or off Terschelling Island, on the Dutch coast, a distance of about 300 miles from the place of liberation. It was described as “spent.”

One fish, a male, moved to the north-west, and was taken at a distance of 8 miles, in April; it was “ripe.” One, also a male, had moved 156 miles north-east, and was found near Pentland Skerries in July 1914, after 798 days, “mature.” The last, a female, caught in September, 10 miles directly west, was described as “half ripe.”

A summary of the resultant direction and distance in each quadrant is as follows :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	12	668	55·7	N. 39° E.
	Adult Females.	13	555	42·7	N. 37° E.
	Immature Females.	1	8	8	N. 77° E.
	?	1	10	10	N. 43° E.
		27	1241	45·9	N. 39° E.
N. and W.	Adult Males.	3	27	9	N. 21° W.
	Adult Females.	5	66·5	13·3	N. 49° W.
		8	93·5	11·7	N. 39° W.
S. and E.	Adult Males.	1	5	5	S. 3° E.
	Adult Females.	7	416·5	59·5	S. 34° E.
	Immature Females.	2	11	5·5	S. 34° E.
		10	432·5	43·2	S. 31° E.
S. and W.	Adult Males.	4	32	8	S. 58° W.
	Adult Females.	16	126·5	7·9	S. 57° W.
	Immature Females.	5	28·5	5·7	S. 36° W.
		25	187	7·5	S. 53° W.
W.	Adult Females.	2	20	10	W.
E.	Adult Females.	2	45	22·5	E.
SUMMARY.					
N. and E.		27	1241	45·9	N. 39° E.
N. and W.		8	93·5	11·7	N. 39° W.
S. and E.		10	432·5	43·2	S. 31° E.
S. and W.		25	187	7·5	S. 53° W.
W.		2	20	10	W.
E.		2	45	22·5	E.
		74	..	..	..

*Distances travelled.*—The majority of the marked fish did not move far from the station. Of the 76 recaptured, 39 (or 52·7 per cent.) were recovered at distances of 10 miles or less, the average being 6·2 miles, viz. the 8 immature females (100 per cent.), 8 males (40 per cent.), 22 adult females (48·9 per cent.), and the fish of unknown sex. Ten (13·5 per cent.) were recaptured between 10 and 20 miles distant, 3 males (15 per cent.) and 7 females (13·2 per cent.). Thus, 49 fish, or 66·2 per cent. of all those recaptured, were got within 20 miles of the station, 11 males (55 per cent.), 37 females (69·8 per cent.), and 1 of unknown sex.

*20 to 50 miles.*—Thirteen (17·1 per cent.) were recaptured, viz. 4 males, or 19 per cent. of all the males recaptured, and 9 females, or 16·7 per cent.

*50 to 100 miles.*—Six fish (7·9 per cent.) were got between 50 and 100 miles from the place of liberation, 2, or 9·5 per cent., being males, and 4, or 7·4 per cent. females.

*Over 100 miles.*—Six (7·9 per cent.) were recaptured at distances over 100 miles; 3, or 14·3 per cent., were males, and 3, or 5·6 per cent., were females.

Of the 12 fishes (15·8 per cent. of all recaptures) which had migrated 50 miles or over, the 5 males had gone distances of from 71 to 156 miles, all north-

ward, 2 being taken off the coast of Aberdeenshire, 1 in the Moray Firth, 1 off the Moray Firth, and 1 at the eastern opening of the Pentland Firth. Four were caught in the following winter and spring, and the fifth in the spring of 1914,—that is to say, all during the spawning season. The condition of the testes was ascertained in 3 cases, and they were “ripe” or “mature.” These fish had moved at a mean rate of from 2·2 to 5·5 miles per 10 days.

Of the 7 females, 6 had migrated also to the north, distances of from 50 to 127 miles; 4 of these were taken off the coast of Aberdeenshire, 1 in the Moray Firth, and 1 off the Moray Firth; 4 were caught in January, February, and March 1913, in the next spawning season, and they were “nearly ripe,” “ripe,” or “spent”; 1, taken in July 1913, was “apparently spent,” and the remaining fish (which had gone 50 miles), taken in September, was “immature.” The rate of movement in these cases also was rapid, varying from a mean of 1·7 to 4·8 miles per 10 days. The seventh female was the one which was recorded as caught on 22nd February 1914, off Terschelling Island, on the Dutch coast, a distance of 300 miles S. 43° E.; it was “spent,” and had moved at the rate of 4·5 miles per 10 days.

It is evident that these long migrations were for spawning purposes.

#### MATURITY.

The condition of the reproductive organs was ascertained in 55 of the fish, as follows:—Two were “spawning,” both males, and both recaptured to the north, off the coast of Aberdeen, in March 1913, not far apart, viz. 48 and 49 miles respectively from the station. (A third fish, a female, was captured in this region, 46 miles distant, in April, and was “immature.”) Two fishes were “ripe,” a female, caught in March 1913, 74 miles to the north-east, and a male caught in April 1913, 92 miles north-east. All the fish actually “spawning” or “ripe” were thus recaptured to the northward. Seven fishes were “nearly ripe”; 1, a female, got in August 1912, 5 miles to the south-west, is described as in this condition; a male was taken 37 miles to the north-east in October 1912; a female, in January 1913, 70 miles to the north-east, and another female, also in January, 127 miles to the north-east. Three were recaptured in the south-west, in addition to the one mentioned above, a male, at a distance of 15 miles, in December 1912; a female, also in December, at a distance of 5 miles, and another female, in January 1913, at a distance of only 4 miles from the place of liberation. The condition of the reproductive organs of 2 males, taken in January 1913, at 71 and 149 miles to the northward, was unfortunately not ascertained. Four fishes are described as “spent,” all females; 1, caught in June 1912, 20 miles to the north-east; another, taken in February 1913, in the Moray Firth, 115 miles distant; a third, in May 1912, 6 miles to the south-west; the fourth, in June, 8½ miles to the south-west.

#### RELATION OF MOVEMENT TO SIZE.

There does not appear to be any clear relation between the size of the males and the distance migrated. The sizes on liberation and on recapture of the 5 males above referred to were as follows:—40–49·2 cm., 39–41·7 cm., 36–39·8 cm., 32–40·8 cm.; 35–41 cm. Some of the large specimens had moved very small distances. Thus, 1 of 39·5 cm. on liberation and 42·2 cm. on recapture, had moved apparently only 8 miles to the north and west, though it had been at liberty for a period of 722 days. Another, of 35 cm. on liberation and 49·7 cm. on recapture, had moved only 8 miles also north and west, after 538 days of freedom. In the case of the females, the majority of the larger specimens moved only short distances. The sizes of the 7 females above referred to were as follows:—40–46 cm., 35–39·3 cm., 37–41·3 cm., 35–45·6 cm., 37·5–42·5 cm., 39·5–44·9 cm., 41–44·9 cm. But other large females, which had, in many cases, been at liberty for long periods, had apparently moved very small distances, as the following table shows:—

No. of Fish.	Size.		Date of Recapture.	Days Free.	Distance (miles).	Direction.	R.O.
	Lib. (cm.)	Recap.(cm.)					
4501	62·5	64·	13 Feb. 1914.	660	21	S. 83° W.	Nearly ripe.
4474	52·	53·1	1 Aug. 1912.	99	5	S. 52° W.	Nearly ripe.
4543	48·5	49·4	27 May 1912.	33	6	S. 52° W.	Spent.
4028	44·5	44·9	14 May 1912.	20	5·5	N. 53° W.	Immature.
4491	44·	49·6	20 Aug. 1913.	483	4	S. 57° W.	Immature.
4473	44·	44·	1 May 1912.	7	14	S. 70° E.	Immature.
4558	43·5	43·3	17 June 1912.	54	8·5	S. 41° E.	Spent.
4534	42·	42·1	6 May 1912.	12	23	N. 81° W.	Immature.
4475	40·5	49·9	9 Sept. 1914.	868	10	W.	$\frac{1}{2}$ ripe.
4559	40·5	45·4	1 April 1913.	342	5	S. 52° W.	Immature.
4464	40·5	44·8	5 Oct. 1912.	164	5	S. 52° W.	$\frac{3}{4}$ ripe.
4531	41·	44·9	12 Jan. 1913.	263	127	N. and E.	Nearly ripe.
4477	40·	46·	14 Feb. 1913·	296	115	N. and E.	Spent.
4527	39·5	44·9	10 July 1913.	442	75	N. 53° E.	Appar. spent.
4525	35·	45·6	22 Feb. 1914.	669	300	S. 43° E.	Spent.

It will be seen that the majority of the large females, though often at liberty for long periods—as much as 868 and 660 days—were recaptured within a few miles of the station. It is clear from this, and from the condition of the ovaries, that many of the large females may remain in the neighbourhood of the station and spawn there, without undertaking any migration worth speaking of.

#### EXPERIMENT VIII.

10th May 1912.

In this experiment 100 fishes were marked and liberated, viz. 43 males, 56 females, and 1 whose sex was not determined. The sizes of the males ranged from 28·5 cm. to 42 cm., and of the females from 26 cm. to 53·5 cm. The numbers liberated and recaptured, arranged in 5-cm. groups, are shown in the accompanying table:—

	cm.	cm.	cm.	cm.	cm.	cm.	Total.
	25-30·5	31-35·5	36-40·5	41-45·5	46-50·5	51-55·5	
F. Lib.	6	26	15	6	1	2	56
F. Recap.	4	17	7	4	1	—	33
M. Lib.	8	24	10	1	—	—	43
M. Recap.	6	15	5	—	—	—	26
? Lib.	—	1	—	—	—	—	1
? Recap.	—	—	—	—	—	—	—

On liberation, 10 of the males and 39 of the females were under adult size, viz. 33 cm. and 38 cm. respectively. The fish were taken in Kirkcaldy Bay, Firth of Forth, partly on the 8th May and partly on the 9th; they were marked between 9.30 and 10 a.m., and between 1.40 and 2.15 p.m. on the 9th, and kept in tanks of running water, in the usual way, until 11.30 a.m. on the 10th, when they were liberated. None of the fish died in the tanks.

The number of the marked fish recaptured was 59 (59 per cent.), of which 26, or 60·4 per cent., were males, and 33, or 58·9 per cent., were females. Twenty-three of the males were of adult size, when recaptured, and 3 under that size (33 cm.). The lengths of those of adult size varied on liberation from 28·5 to 39 cm., the average being 33·6 cm., and on recapture from 33·2 to 41·1 cm., the average being 36·5 cm.; the periods of freedom varied from 14 to 679 days, the mean being 189 days; the distances migrated were from 2 to 229 miles, the mean being 29·2 miles, and the average rate of travel was 1·06 miles per 10 days. The periods of freedom of the 3 males which were under 33 cm. on recapture ranged from 1 to 75 days, the

mean being 39 days ; the distances migrated varied from 5 to 10 miles, and averaged 7 miles. Of the 33 females, 17 were of adult size on recapture ; the sizes on liberation were from 32 to 50·5 cm., the average being 38·5 cm., and on recapture from 38·6 to 49·8 cm., the mean being 41·6 cm. They were at liberty for from 1 to 862 days, the average being 196 days ; they migrated distances of from 4 to 91 miles, with a mean distance of 14·3 miles, and the average rate per 10 days was ·87 mile. Sixteen were under 38 cm. on recapture, the average length being 34·1 cm., and the average on liberation 32·1 cm. ; the periods of freedom ranged from 2 to 680 days, the mean being 135 days ; the distances migrated were from 5 to 33 miles, averaging 12·3 miles, and the mean rate per 10 days ·9 mile.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In May, 7 of the marked fishes were recaptured, 3 males and 4 females. Five of them were taken to the south and west, at distances of from 5 to 11 miles, the one which was taken at 11 miles being caught on the following day ; 1 had moved south and east for 5 miles, and another north and west for 9 miles. Three of the females measured 44, 44, and 50·5 cm. respectively, and were “ spent ” ; the fourth, of 28·5 cm., was “ immature.”

Nine were recaptured in June, 4 males and 5 females ; 2 were taken at 9 miles to the south and west, 3 at 6, 7, and 11 miles to the northwards, 2 at 6 and 8 miles to the south and east, and 2 at 5 and 6½ miles to the north and east. All the females were under 38 cm. ; 3 of the males were above 33 cm.

Eleven were recaptured in July, 5 males and 6 females ; 6 were taken to the south and west at distances of from 4 to 17 miles ; 1, 10 miles to the south and east ; 1, 4 miles directly east ; and 3, 12, 15, and 18 miles to the north and west.

Thus the number recaptured to the end of July was 27, or 45·8 per cent. of the total recaptures. One had gone directly east, 2 (7·4 per cent.) north and east, 7 (26 per cent.) north and west, 4 (14·8 per cent.) south and east, and 13 (48·1 per cent.) south and west.

*Second Quarter.*—In August, September, and October, 14, or 23·7 per cent., were taken, viz. 5 males and 9 females, and the positions of recapture of all but 1 of the females was ascertained. Two had gone directly west for 4 and 8 miles, 1 went south and east for 5 miles, 2 north and west for 12 and 15 miles, 3 north and east for 12, 17, and 56 miles, and 5 (38·4 per cent.) south and west for from 5 to 14 miles.

*Third Quarter.*—Only 2 were recaptured in the next 3 months, viz. a male, “ fully half-ripe,” in December, off Aberdeen, at a distance of 54 miles, and a female, “ immature,” in January 1913, 5 miles to the south and west.

*Fourth Quarter.*—Nine, or 15·2 per cent., were got in this quarter, 4 in February, 3 in March, and 2 in April. One was taken 5 miles to the south-west—a female of 39 cm. and “ immature ” ; 2, both males, were got to the north-west, 1 at a distance of 15 miles, and the other in the Firth of Forth, at a distance of 23 miles ; the former was “ spawning,” and the latter “ immature.” Five were found to the north-east, 4 off the coast of Aberdeen, at distances of from 33 to 91 miles ; 2, both males, were “ spawning ” or “ ripe ” ; the fifth was taken at a distance of 21 miles in the same direction. The remaining fish is reported to have been recaptured 163 miles E. ½ N. of Flamborough Head (Lat. 55° 5' N. ; Long. 4° 10' E.) on the 15th March 1913, after 309 days, the distance migrated being 219 miles S. 55° E. It was a male, measuring 30·5 cm. on liberation and 38·8 cm. on recapture ; the condition of the testes was not ascertained.

Altogether, in the 12 months following liberation, 52 fishes were caught, or 88·1 per cent. of the total number recaptured, viz. 23 males (88·5 per cent.) and 29 females (87·9 per cent.). The position of recapture of 51 was ascertained ; 11 (21·6 per cent.) went to the north and east, and the same number to the north and west ; 1 was got directly east, and 2 directly west ; 6 (11·8 per cent.) were taken to the south and east ; and 20 (39·2 per cent.) to the south and west.

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. May 1912. June 1912. July 1912.	E.	1	3·7	E.	4·	·5	..	..
	N. and E.	2	7·4	N. 46° E.	5·7	1·8	5-6·5	1-2·7
	N. and W.	7	26·	N. 36° W.	11·	3·	6-18	1·4-6·4
	S. and E.	4	14·8	S. 27° E.	7·	3·5	5-10	1·3-8·3
	S. and W.	13	48·1	S. 58° W.	9·	14·2	4-17	·7-110
		27	45·8	..	..	..	4-18	·7-110
II. Aug. 1912. Sept. 1912. Oct. 1912.	N. and E.	3	23·1	N. 58° E.	28·	2·1	12-56	·8-4·5
	N. and W.	2	15·4	N. 47° W.	14·	·9	12·5-15	·8-1·
	S. and E.	1	7·7	S. 3° E.	5·	·4	..	..
	S. and W.	5	38·4	S. 53° W.	10·	1·	5-14	·3-1·5
	W.	2	15·4	W.	6·	·5	4-8	·3-8
		13	22·	..	..	..	5-56	·3-4·5
III. Nov. 1912. Dec. 1912. Jan. 1913.	N. and E.	1	50·	N. 16° E.	54·	2·4	..	..
	N. and W.	..	..	..	..	..	..	..
	S. and E.	..	..	..	..	..	..	..
	S. and W.	1	50·	S. 52° W.	5·	·2	..	..
		2	3·4	..	..	..	..	..
IV. Feb. 1913. Mar. 1913. April 1913.	N. and E.	5	55·5	N. 44° E.	48·	1·6	21-91	·8-3·1
	N. and W.	2	22·2	N. 72° W.	19·	·6	15-23	·4-8
	S. and E.	1	11·1	S. 55° E.	219·	7·1	..	..
	S. and W.	1	11·1	S. 52° W.	5·	·2	..	..
		9	15·3	..	..	..	..	..
SUMMARY.	N. and E.	11	21·6					
	N. and W.	11	21·6					
	S. and E.	6	11·8					
	S. and W.	20	39·2					
	E. W.	1 2	2· 3·9					
		51	86·4					

Of the remaining fishes, 4 were recaptured in 1913, 1 each in June, July, August, and October, and 3 in 1914, 2 in March, and the third in September. The position of recapture of the latter was not ascertained. Two of those caught in 1913 had migrated to the north and west for distances of  $5\frac{1}{2}$  and  $22\frac{1}{2}$  miles, and 2 to the north-east, for 10 miles and 64 miles respectively. The 2 taken in March 1914, after 679 and 680 days of freedom, were caught only 2, and  $5\frac{1}{2}$  miles to the north-east and south-west respectively.

A summary of the mean direction and distance in each quadrant is shown in the following table :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	8	298·5	37	N. 43° E.
	Adult Females.	2	101	50·5	N. 42° E.
	Immature Females.	4	71	17·7	N. 50° E.
		14	470·5	33·6	N. 45° E.
N. and W.	Adult Males.	7	94	13	N. 57° W.
	Immature Males.	1	6	6	N. 30° W.
	Adult Females.	2	34·5	17·2	N. 16° W.
	Immature Females.	3	37	12	N. 25° W.
		13	171·5	13·2	N. 41° W.
S. and E.	Adult Males.	2	227	113·5	S. 35° E.
	Immature Males.	1	10	10	S. 66° E.
	Adult Females.	2	10	5	S. 3° E.
	Immature Females.	1	6	6	S. 25° E.
		6	253	42	S. 28° E.
S. and W.	Adult Males.	4	35	8·7	S. 61° W.
	Immature Males.	1	5	5	S. 52° W.
	Adult Females.	8	59	7·4	S. 47° W.
	Immature Females.	8	78·5	9·8	S. 67° W.
		21	177·5	8·4	S. 58° W.
W.	Adult Males.	1	8	8	W.
	Adult Females.	1	4	4	W.
		2	12	6	W.
E.	Adult Males.	1	4	4	E.
SUMMARY.					
N. and E.		14	470·5	33·6	N. 45° E.
N. and W.		13	171·5	13·2	N. 41° W.
S. and E.		6	253	42	S. 28° E.
S. and W.		21	177·5	8·4	S. 58° W.
W.		2	12	6	W.
E.		1	4	4	E.
		57	..	..	..

*Distances travelled.*—Thirty of the marked plaice, or 52·6 per cent., were caught within 10 miles of the place of liberation, viz. 12 males (46·2 per cent.), with an average distance of 6 miles, and 18 females (58·1 per cent.), with an average distance of 6·1 miles. One of the males was got directly east, and 1 male and 1 female directly west; 3 males and 11 females were found to the south and west; 3 males and 1 female to the north and west; 2 males and 2 females to the north and east; and 2 males and 3 females to the south and east.

*10 to 20 miles.*—Sixteen, or 28·1 per cent., were recaptured between 10 and 20 miles, 7 (26·9 per cent.) being males, and 9 (29 per cent.) females; the average distance for the males was 14·1 miles, and for the females 13·8 miles. Seven of the fish were taken to the south and west, 7 to the north and west, and 2 to the north



and east. Thus, 46 of the 57 recaptured fish, whose positions were known, *i.e.* 80·7 per cent., were found within 20 miles of the station, *viz.* 19 males (73·1 per cent.) and 27 females (87·1 per cent.).

*20 to 50 miles.*—Six, or 10·5 per cent., of the fish were got between 20 and 50 miles of the station, 3 (11·5 per cent.) being males, with an average distance of 39·3 miles, and 3 being females, with an average distance of 25·5 miles. Four fish, 2 males and 2 females, went to the north and east, and 2, a male and a female, to the north and west.

*50 to 100 miles.*—Four of the marked plaice, or 7 per cent., went distances of from 50 to 100 miles, 3 (11·5 per cent.) being males, going an average distance of 59·3 miles, and 1 female for a distance of 91 miles. All had gone to the north-east.

*Over 100 miles.*—Only 1 fish, a male, went a journey of over 100 miles. It was recaptured off Flamborough Head, 219 miles off in a south-easterly direction from the place of liberation.

#### MATURITY.

*Males.*—Of the males recaptured, 23 were of adult size, and the condition of the testes in 20 of them was ascertained. Two were "spawning," *viz.* 1, of 37–41·1 cm., taken off Aberdeen, at a distance of 46 miles, on 16th February 1913, after 282 days, and another, of 37·5–39·3 cm., caught on 25th April 1913, after 350 days, 15 miles to the north-west, off St. Andrews Bay.

One was described as "ripe"; it was caught on 18th March 1913, after 312 days, off Aberdeen, at a distance of 49 miles, and near the place where the spawning male above referred to was captured.

Three males were described as "spent"; 1 was got in May 1912, 9 miles north and west; another was taken in August 1913, 5½ miles north and west, and the third in September 1912, 13 miles to the south and west.

A male, taken on 17th December 1912, 54 miles distant, close inshore off Aberdeen, was "fully half-ripe."

The other 13 adult males were "immature." One was caught in February 1913, after 280 days, in the Firth of Forth, off Pittenweem; it measured 29·5–33·2 cm. Another, measuring 30–35·6 cm., was caught on 20th March 1914, after 679 days, only 2 miles to the north-west of the station. Of the remainder, 1 was taken in May, 3 in June, 4 in July, 1 in August, and 2 in October. Most of them were got near the station, at distances of from 4 to 18 miles, 1 to the east, 1 to the west, 3 to the north-west, 3 to the north-east, 3 to the south-west, and 1 to the south-east.

*Females.*—Of the females, 17 were of adult size, the condition of the ovaries being ascertained in 15. None was "spawning" or "ripe," but 4 were "spent." One, of 44–43·7 cm., was taken in May, after 6 days, 5 miles to the south and east; another, of 50·5–49·8 cm., was caught on the day after liberation 11 miles to the south-west; the third, measuring 44–44 cm., was taken in May, after 17 days, also 5 miles to the south and west; and the fourth, of 34–41·2 cm., was taken in June 1913, after 400 days, 10 miles to the north and east.

Two were "maturing," caught respectively in July and October, 4 and 5 miles to the south and west.

The other nine were "immature," and were caught as follows:—One in January 1913, after 255 days, 5 miles to the south and west; it measured 34–38·8 cm.; 1, whose size on liberation was about 40 cm., the size on recapture not recorded, was caught in February 1913, after 292 days, off Aberdeen, 91 miles to the north and east; a third, measuring 39–42·2 cm., was caught in March 1913, after 305 days, 5 miles to the south and west. Of the remaining fish, 3 were taken in July, 2 at 12 miles, and 1 at 22½ miles distant, 1 in August at 14 miles, and 2 in September at 4 and 5 miles respectively.

#### EXPERIMENT IX.

*6th December 1912.*

In this experiment 202 plaice were marked and liberated, 78 being males, 122 females, and 2 whose sexes were not ascertained. The sizes of the males ranged from 26·5 to 45 cm., and of the females from 27·5 to 54·5 cm.

The numbers liberated and recaptured are shown, in groups of 5 cm., in the following table :—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	Total.
F. Lib.	10	41	36	25	7	3	122
F. Recap.	5	31	19	18	2	2	77
M. Lib.	7	39	28	4	—	—	78
M. Recap.	4	29	19	3	—	—	55
? Lib.	—	—	2	—	—	—	2
? Recap.	—	—	—	—	—	—	—

The fish which were marked in this experiment were caught at Station VI., Firth of Forth (off St. Monans), at 4 p.m. on the 6th December, and were liberated the same evening about 8 o'clock, all in good condition.

The number recaptured was 132, or 65·3 per cent. of those liberated, comprising 55 males (70·5 per cent.) and 77 females (63·1 per cent.). The date of recapture of one was not ascertained.

Of the males caught, all but 4 were over 33 cm. in length, and may accordingly be considered adult. These, 51 in number, had been free for periods ranging from 12 to 670 days, the average being 283 days; their sizes on liberation ranged from 27·5 to 43 cm., the mean being 35·5 cm., and on recapture they ranged from 33·4 to 44·6 cm., with an average of 37·5 cm. The positions of recapture were ascertained for 48 of them; the distances travelled varied from 1·5 to 239·5 miles, the mean being 43·7 miles, and the average rate of travel per 10 days 1·9 miles. Of the 4 immature males, the average period of freedom was 85 days, the average size on liberation 31·6 cm., and on recapture 31·3 cm.; they had migrated distances of from 26 to 138 miles, the mean being 84 miles, and the average rate of movement 9·8 miles.

Of the females, 49 were of adult size, and the positions of recapture of all except 1 were ascertained. The sizes on liberation varied from 31·5 to 54·5 cm., the average being 40·1, and on recapture from 38·5 to 55·4 cm., with an average of 43·7 cm.; they were at liberty for periods varying from 3 to 965 days, the mean being 344 days, and the distances travelled ranged from 3 to 176 miles, the mean being 56·1 miles, and the average rate of travel per 10 days 1·7 miles. Of the 28 females of immature size, the positions of recapture were ascertained for 26. They were free for from 3 to 383 days, the mean being 150 days; they moved from 2 to 191 miles, the average distance being 44½ miles, and the mean rate of migration per 10 days was 2·8 miles; on liberation, their sizes varied from 27·5 to 37 cm., averaging 33·4 cm., and on recapture from 28 to 37·8 cm., the mean being 35·1 cm.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Of the 202 fishes set free, 7 were recaptured in the same month, 6 females and 1 male, and the position of recapture was determined in each case, except in that of one of the females. Four of the fishes, including the male, had migrated for a distance of 5 miles, 3 to the south-east, and 1 to the south-west; the other 2 had moved north-east, 1 for a distance of 21 miles in 3 days, and the other for 62 miles, being taken, after 20 days, off the coast of Aberdeen. This fish measured only 34·3 cm. on recapture, and was "immature."

Seven were taken in January 1913, the next month after liberation, 5 males and 2 females. One, a male, was got 17 miles to the north-west, after 42 days; another, a female, was found 3 miles to the south-east; and 4, 1 female and 3 males, to the north-east, off the coast of Aberdeen, at distances ranging from 42 to 73 miles; the position of recapture of the remaining male was not ascertained.

In February, 17 plaice were recaptured, 8 females, and 9 males, the position of capture being ascertained in all cases. One female moved 12 miles to the south-west, 5 migrated north-west distances of from 17 to 32 miles, 10 moved to the north and east, distances ranging from 44 to 239 miles. Most of these were taken off the coast of Aberdeen; 3 were found in the Moray Firth, and 1, a male which measured 35 to 35·2 cm., was taken off Cape Wrath, at a distance of 239·5 miles, on the 28th February, after 84 days, the rate of travel in this case

being 2.85 miles per day. The remaining fish, which measured 35.5 to 35.8 cm., was caught 191 miles to the south-east by a Grimsby trawler, on 12th February, after 77 days; the position where it was recaptured was about 29 miles E.  $\frac{1}{4}$  S. of Spurn Point ( $53^{\circ} 40' N.$ ;  $0^{\circ} 55' E.$ ); the condition of the reproductive organ was not ascertained.

Thus during the first 3 months after liberation, viz. December 1912, January and February 1913, 31 fishes (23.5 per cent.) were recaptured, the positions of recapture of 29 being determined. Of these, 16 (55.2 per cent.) migrated to the north and east, for an average distance of 79 miles, the mean rate of movement being 17.3 miles per 10 days; 6 (20.7 per cent.) moved to the north-west, for a mean distance of 24 miles, the average rate of travel per 10 days being 3.4 miles; 5 (17.2 per cent.) moved south and east for an average distance of 42 miles, the mean rate of travel being 7.6 miles; and 2 (6.9 per cent.) went to the south-west, for an average distance of 8 miles, the mean rate of travel being 9.2 miles per 10 days.

It will be observed that, in this quarter, a large proportion of the fish went in a northerly direction, with considerable rapidity, the mean direction being N.  $31^{\circ}$  E.

*Second Quarter.*—In the next 3 months, 21 fishes (15.9 per cent.) were taken, the positions of 19 being ascertained. In March, 10 of the fishes were recaptured, 4 males and 6 females; 1 moved directly west for 12 miles, and 1, a male, south-west for 15 miles; a third, a female, went north and west, into the Firth of Forth, for a distance of 26 miles; 6 moved north-east distances of from 29 to 157 miles, 4 of them being caught in the Moray Firth, after intervals of from 91 to 110 days, and the other 2 were got off the coast of Aberdeen. The position of recapture of one of the females was not ascertained. In April, 3 males and 3 females were taken, the position of one of the males not being given. One, a male, had gone 32 miles north and west, into the Firth of Forth, and was caught near the place where it was originally captured. The other 4 fishes had gone north and east, for distances of from 44 to 139 miles, 2 being taken off the coast of Aberdeen, and 2 in the Moray Firth. Two males and 3 females were recaptured in May; 1 of the females had moved 17 miles to the south-west; the remaining 4 fishes had gone north-east, 3 being got off the coast of Aberdeen, at distances varying from 55 to 83 miles, while the fourth was caught in the Moray Firth, at a distance of 146 miles from the place of liberation.

Of the 19 fishes, whose positions of capture were ascertained in this quarter, 14 (73.7 per cent.) had migrated north-east, the mean direction being N.  $27^{\circ}$  E., and the average distance 95 miles. One fish moved directly west, and 2 (10.5 per cent.) north and west, for an average distance of 29 miles; 2 went south-west, for an average distance of 16 miles.

*Third Quarter.*—In June, July, and August, 32 fish (24.2 per cent.) were recaptured, of which the positions were ascertained in the cases of 31. In June, 12 were recaptured, 2 males and 10 females. One female went directly west for 10 miles; 4 migrated to the north and west, for distances varying from  $6\frac{1}{2}$  to 26 miles; 7 migrated to the north and east, for distances varying from 19 to 112 miles, most of them being taken off the coast of Aberdeen, and one in the Moray Firth. In July, 11 fishes were captured, 5 males and 6 females. Three, 2 males and a female, were taken to the south-west, at distances of from 5 to 18 miles. Five had moved to the north-west, for distances of 15, 16, and 19 miles; 1 was found 3 miles directly east; and 2 to the north-east, both males, at distances of 8 and 25 miles respectively. In August, 9 of the fishes were recaptured, 6 males and 3 females. Two of the males were taken at distances of 5 and 6 miles respectively to the south and west; 1 male and 2 females had moved north and west, 2 for 13 and 1 for 15 miles, and 3, 2 males and a female, had migrated to the north and east, for distances of from 23 to 67 miles; the position of capture of 1 male was not ascertained.

Altogether, in this quarter, 1 fish moved west and 1 east; 12 (38.7 per cent.) migrated north and east for an average distance of 46 miles, at a mean rate of 2.2 miles per 10 days; 12 (38.7 per cent.) had moved north and west, for an average distance of 15 miles, the mean rate being .7 mile per 10 days; none was found to the south and east, but 5 (16.1 per cent.) were got to the south-west, the average distance being 9 miles, and the mean rate per 10 days, .4 mile.

*Fourth Quarter.*—In September, October, and November, 12 fishes (9.1 per

cent.) were recaptured, and the positions of all of them were determined. In September, 5 were taken, 3 males and 2 females. One male and 1 female were got to the south and west, at 5 and 6 miles distant respectively. One male had migrated 32 miles to the north and west, and a male and a female for distances of 37 and 41 miles respectively to the north and east. In October, 4 fishes were recaptured 3 males and a female. One male was got 4 miles directly west, a female 12 miles north and west, and 2 males at distances of 65 and 69 miles to the north-east. In November, 3 fishes were recaptured, 2 males and 1 female. One male had moved 14 miles north and west, another male 73 miles north and east, and a female 52 miles in the same direction, both of the latter being taken off the coast of Aberdeen.

Altogether, in this quarter, 6 of the fishes (50 per cent.) had moved north and east, for an average distance of 56 miles, the mean rate being 1·7 miles per 10 days; 3 (25 per cent.) had gone to the north-west, for an average distance of 19 miles; and 2 (16·7 per cent.) had migrated for a mean distance of 5 miles to the south and west.

Thus, in the 12 months immediately following liberation, 96 plaice, or 72·7 per cent. of the total number recaptured, were again taken, and the positions of recapture were ascertained for 91 of them. With regard to the direction, 48 (52·7 per cent.) had moved north and east; 23 (25·3 per cent.), north and west; 11 (12·1 per cent.) south and west; 5 (5·5 per cent.) south and east; 3 (3·3 per cent.) directly west; and 1 (1·1 per cent.) directly east.

These particulars are shown in the following table:—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. Dec. 1912. Jan. 1913. Feb. 1913.	N. and E.	16	55·2	N. 31° E.	79	17·3	21-239	5·5-70
	N. and W.	6	20·7	N. 62° W.	24	3·4	17-32	2·6-4·2
	S. and E.	5	17·2	S. 10° E.	42	7·6	3-191	·9-4·2
	S. and W.	2	6·9	S. 61° W.	8	9·2	5-12	1·9-16·6
			29	22·	..	..	..	3-239
II. Mar. 1913. April 1913. May 1913.	N. and E.	14	73·7	N. 27° E.	95	8·	29-157	2·6-17
	N. and W.	2	10·5	N. 85° W.	29	2·3	26-32	2·2-2·4
	S. and E.	Nil.						
	S. and W.	2	10·5	S. 63° W.	16	1·2	15-17	1-1·4
	W.	1	5·3	W.	12	1·1	..	..
		19	14·4	..	..	..	15-157	1-17
III. June 1913. July 1913. Aug. 1913.	N. and E.	12	38·7	N. 33° E.	46	2·2	8-112	·3-5·5
	N. and W.	12	38·7	N. 49° W.	15	·7	6-26	·3-1·3
	S. and E.	Nil.						
	S. and W.	5	16·1	S. 62° W.	9	·4	5-18	·2-·8
	W.	1	3·2	W.	10	·5	..	..
	E.	1	3·2	E.	3	·1	..	..
		31	23·5	..	..	..	5-112	·2-5·5
IV. Sept. 1913. Oct. 1913. Nov. 1913.	N. and E.	6	50	N. 42° E.	56	1·7	37-73	1·3-2·1
	N. and W.	3	25	N. 50° W.	19	1·	12-32	·4-1·2
	S. and E.	Nil.						
	S. and W.	2	16·7	S. 51° W.	5	·2	5-6	·2
	W.	1	8·3	W.	4	·1	..	..
		12	9·1	..	..	..	5-73	·2-2·1
SUMMARY.	N. and E.	48	52·7					
	N. and W.	23	25·3					
	S. and E.	5	5·5					
	S. and W.	11	12·1					
	E.	1	1·1					
	W.	3	3·3					
		91	68·9					

Of the remaining 35 fish of the experiment, about which particulars are known, 5, all females, were taken in December 1913, 1 of them 10 miles directly east, and 2 to the south-west, 1 at a distance of 2 miles, and the other in the Firth of Forth, at a distance of 43 miles. The remaining 2 fish migrated north and east for distances of 67 and 68 miles respectively.

Twenty-six were got in 1914. Of 5 taken in January, 2 males and 3 females, 1 male was recaptured 16 miles to the north-west; the remaining male and 3 females were all taken off Banff, in the Moray Firth, at distances of 113 and 114 miles; they were "nearly ripe." Four, 1 male and 3 females, were recaptured in February. The male and 2 of the females were taken north and east, the male at 16 miles distant, and the females in the Moray Firth, at distances of 113 and 152 miles respectively. The remaining female had migrated in a south-easterly direction for a distance of 186 miles from the place of liberation, being found at Lat.  $55^{\circ} 14' N.$ ;  $3^{\circ} 4' E.$ , which is a point about 158 miles east by south of N. Shields. These fish were "spawning" or nearly ripe." In March, 1 male and 4 females were recaptured, 1 female 3 miles to the south and west, another, also a female, 97 miles to the south-east, and the remaining fish to the north-east; 1 along the coast of Aberdeen, 36 miles distant, and 2, a male and a female, in the Moray Firth, at distances of 139 and 145 miles. In April, 3 fish were taken, one male and 2 females; the male was caught  $1\frac{1}{2}$  miles from the place of liberation, after 481 days, and was "ripe"; one of the females was got 15 miles to the north and west, and the other off the coast of Aberdeen,  $64\frac{1}{2}$  miles to the north-east. Two females, taken in May, had moved to the north-east; one measuring 32-38.7 cm. was found only 7 miles distant, and the other, got off the Pentland Skerries, 152 miles distant, was "spent." One fish, a female, was caught in June, 10 miles to the east. Two were taken in July, a male and a female, both to the north-east, one at a distance of 35 miles and the other at 29 miles. One male was caught in August 11 miles to the north-west, and another in September, 71 miles to the north-east. One was taken in October 49 miles to the north-east, and a female in December 7 miles to the south-east.

Of the 4 caught in 1915, all were females, and the positions of recapture of 3 were ascertained. One was taken in January 15 miles to the north-west, after 785 days. One was got in April, 29 miles to the north-west, within the Firth of Forth, near the original place of capture. The third fish was found in July, after 965 days, off the coast of Aberdeen, 31 miles to the north-east of the station.

A summary of the mean distance and direction in each quadrant is shown in the following table.—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	28	1528·5	54·6	N. 30° E.
	Immature Males.	3	212	71	N. 29° E.
	Adult Females.	30	1748·5	58·4	N. 33° E.
	Immature Females.	10	680	68	N. 29° E.
		71	4169	58·7	N. 31° E.
N. and W.	Adult Males.	12	240	20	N. 59° W.
	Immature Males.	1	26	26	N. 58° W.
	Adult Females.	6	110·5	18·4	N. 59° W.
	Immature Females.	9	150	17	N. 54° W.
		28	526·5	18·8	N. 57° W.
S. and E.	Adult Males.	1	5	5	S. 3° E.
	Adult Females.	3	276	92	S. 32° E.
	Immature Females.	3	201	67	S. 7° E.
		7	482	69	S. 17° E.
S. and W.	Adult Males.	6	60	10	S. 62° W.
	Adult Females.	6	74·5	12·4	S. 61° W.
	Immature Females.	2	19	9·5	S. 53° W.
		14	153·5	11	S. 61° W.
W.	Adult Males.	1	4	4	W.
	Immature Females.	2	22	11	W.
		3	26	9	W.
E.	Adult Females.	3	23	7·7	E.
SUMMARY.					
N. and E.		71	4169	58·7	N. 31° E.
N. and W.		28	526·5	18·8	N. 57° W.
S. and E.		7	482	69	S. 17° E.
S. and W.		14	153·5	11	S. 61° W.
W.		3	26	9	W.
E.		3	23	7·7	E.
		126	..	..	..

*Distances travelled.*—Twenty-two of the fishes (17·5 per cent.) were taken at distances not exceeding 10 miles from the place of liberation. Seven were males (or 13·5 per cent. of the total number of males recaptured), and they had moved from  $1\frac{1}{2}$  to 8 miles, the mean being 4·9 miles; 3 had gone south and west, 2 north and east, 1 south and east, and 1 directly west. Fifteen were females (or 20·3 per cent. of the total number of females recaptured), and they had migrated distances of from 2 to 10 miles, the mean being 5·9 miles; 5 were found to the south and west, 3 to the south and east, 3 directly east, 2 north and west, 1 north and east, and 1 directly west.

*10 to 20 miles.*—Twenty-five of the fishes (19·8 per cent.) migrated distances between 10 and 20 miles. Twelve males (23·1 per cent.) were taken between 11 and 19 miles, the average being 15 miles; 3 were recaptured to the south and west,

8 to the north and west, and 1 to the north and east. Thirteen were females (17·6 per cent.), which had travelled also an average distance of 15 miles; 2 were taken to the south and west, 9 to the north and west, 1 directly west, and 1 north and east.

Thus, at distances not exceeding 20 miles, 47 plaice were recaptured, or 37·3 per cent. of the whole, namely, 19 males and 28 females.

*20 to 50 miles.*—Thirty-four of the fish (27 per cent.) were got between 20 and 50 miles from the station. Of these, 16 (30·8 per cent.) were males, which had migrated for an average distance of 36·3 miles; 5 were taken to the north-west, 3 of them within the Firth of Forth, and 11 to the north and east. Eighteen were females (24·3 per cent.), and they had moved an average distance of 35·7 miles; 1 was found to the south-west, 4 to the north-west—these 5 fish were taken in the Firth of Forth. The remaining 13 had moved to the north-east, and were recaptured chiefly off the Aberdeenshire coast.

*50 to 100 miles.*—Twenty-one of the recaptured plaice (16·7 per cent.) had moved distances of from 52 to 97 miles. Eight (15·4 per cent.) were males, the average journey being 64 miles, all to the north-east, the fish being mainly taken off the coast of Aberdeen. Thirteen (17·6 per cent.) were females, the mean distance travelled in this case being 69 miles. One was got 97 miles to the south and east, and all the others to the north-east, off the coast of Aberdeen.

*Over 100 miles.*—No fewer than 24 fish (19 per cent.) went distances of over 100 miles, viz. from 112 to 239½ miles. Nine of these (17·3 per cent.) were males, which had moved an average distance of 152 miles. Eight of these were recaptured in the Moray Firth, and one off Cape Wrath. Fifteen (20·3 per cent.) were females, which had migrated a mean distance of 135 miles, 2 to the south and east, for 176 and 191 miles respectively, all the others to the north-east, 12 being recaptured in the Moray Firth, and 1 near the Pentland Firth.

#### MATURITY.

*Males.*—The condition of the reproductive organs was ascertained in 42 of the 51 adult males taken.

Four were "spawning"; 1, measuring 36·5–35·9 cm., caught on 8th March 1913, 157 miles northwards, in the Moray Firth; a second, measuring 35·5–35·5 cm., on 13th February 1913, 54 miles to the north-east, off the coast of Aberdeen; the third, of 36–38·7 cm., on 25th February 1914, after 446 days, 16 miles north and east; and the fourth, measuring 43–43·3 cm., on the 18th February 1913, 49 miles to the north and east.

Four were "ripe," 1, of 35·5–35·5 cm., captured on 11th February 1913, 28 miles north and west, off St. Andrews Bay, and 3 to the north-east, at distances of from 1½ to 44 miles, in April 1913, April 1914, and August 1913. One of these, a large fish, measuring 42·5–44·6 cm., was recaptured only a mile and a half from the station, after 481 days.

Seven were "nearly ripe"; 3 of these were taken to the north-east, at distances of 46, 65, and 114 miles, the last-named being got in the Moray Firth in January 1914; 3 were taken to the north-west, all near the Bell Rock, at 17, 6, and 16 miles; the remaining fish was recaptured 5 miles to the south-east in December 1912.

Two were described as "spent," 1, of 38–37·8 cm., caught in March 1913, after 99 days, 150 miles to the northwards, in the Moray Firth; the other, of 38·5–39·9 cm., in May 1913, off the coast of Aberdeen, at a distance of 69 miles.

Two, both caught in October, were described as "half-ripe"; 1 had moved 4 miles directly west, and the other 49 miles to the north and east, after 670 days.

The remainder of the fish were "immature"; 5 were taken in July, 5 in August, 4 in September, 3 in January, 1 each in March, April, May, and October, and 2 in June. Eight were found to the north and east, at distances of from 25 to 71 miles, after intervals of from 45 to 637 days. Two of these were taken within the limits of the spawning season, 1, of 39–38·9 cm., on 20th January 1913, off Aberdeen, 42 miles distant; the other, measuring 35·5–35·8 cm., on 12th May 1913, also off Aberdeen, at a distance of 55 miles. Eight were recaptured to the north and west, at distances of from 11 to 32 miles; 1, measuring 33·5–36·6 cm., caught in August

1914, after 622 days, had moved only 11 miles. Of these fish, 2 were caught within the limits of the spawning season, 1, measuring 33·5–33·8 cm., in January 1913, after 42 days, at a distance of 17 miles, and the other, measuring 33–34·7 cm., in April 1913, after 143 days, within the Firth of Forth, 32 miles distant. Six of the immature males were taken to the south and west, at distances of from 5 to 18 miles. One, of 33–33·4 cm., was caught in March 1913, at a distance of 15 miles.

*Females.*—Forty-nine of the recaptured fish were adult females, and the condition of the ovaries was ascertained in 44 cases. Of these, 6 were “spawning”; 2 were captured in January 1914, after 411 days, both in the Moray Firth, near Banff; they measured respectively 42·5–46·7 cm. and 51·5–55·2 cm., the distances travelled being 113 and 114 miles; 2 were taken in February 1913, after 72 and 75 days, at distances of 50 and 44 miles to the north and east, off the coast of Aberdeen; they measured respectively 46–46·2 cm. and 40–40 cm.; 1, of 35·5–46 cm., was got in December 1914, after 747 days, only 7 miles distant to the south and east; another, of 41·5–45·2 cm., was taken in March 1914, after 461 days, only 3½ miles distant to the south and west.

Four were “ripe.” Of 2, taken in March 1914, 1 was captured 36 miles to the north and east, after 457 days; it measured 54·5–55·4 cm.; the other was found 97 miles south and east, after 475 days; it measured 42–45 cm.; a third fish, measuring 39–45 cm., was taken in February 1914, after 424 days, 186 miles to the south and east; the fourth was caught in April 1914, after 488 days, 64½ miles to the north and east, off the coast of Aberdeen; it measured 36·5–42 cm. It is interesting to note that 2 of these “ripe” females were recaptured at such considerable distances to the south and east.

Seven of the adult females were “spent.” One was taken in June 1914, after 557 days, only 10 miles directly east; it measured 31·5–44 cm.; another, caught in April 1915, after 846 days, was found in the Firth of Forth, near where it was originally captured, at a distance of 29 miles; it measured 45–51·4 cm.; the remaining 5 fish were caught to the north-east; 1, taken in April 1913, after 133 days, was got off Rattray Head, 139 miles distant; it measured 45–45·5 cm., was taken in June 1913, after 198 days, 19 miles to the north-east; 1, measuring 41–45·6 cm., was found in July 1914, after 579 days, also in the Firth of Forth, near the place where it was originally captured; 1, measuring 35·5–42·9 cm., was caught in May 1914, after 531 days, off the Pentland Skerries, 152 miles to the north and east; the last fish, measuring 41·5–50·8 cm., was taken in July 1915, after 965 days, off the coast of Aberdeen, at a distance of 31 miles to the north and east.

Five were “nearly ripe.” One, of 35–39·2 cm., was taken in December 1913, after 360 days, 67 miles to the north-east, off the coast of Aberdeen; another, measuring 41·5–44·6 cm., was caught in February 1914, after 437 days, in the Moray Firth, 113 miles distant; 1, of 44·5–44·3 cm., was recaptured in January 1913, after 32 days, 3 miles to the south-east; the fourth, of 43–43·1 cm., was caught in February 1913, after 62 days, 12 miles to the south and west; and the fifth, measuring 42·5–46·7 cm., was taken in January 1915, after 785 days, only 15 miles to the north and west.

Five of the females were “advanced in maturity,” “three-quarters,” or “fully half-ripe.” One, of 44–47·9 cm., was caught in July 1913, after 236 days, 3 miles directly east; another, 50·5–51·4 cm., was recaptured in December 1913, after 361 days, 43 miles south and west, in the Firth of Forth; 3 remaining fish were caught to the north and east; 1, measuring 40–43 cm., in January 1914, after 411 days, off Whitehills, in the Moray Firth, 114 miles distant; another, 36·5–40 cm., was taken in September 1913, after 272 days, 41 miles distant; and the remaining fish, 38–44·3 cm., was recovered in November 1913, after 341 days, off the coast of Aberdeen, 52 miles distant.

Seventeen of the adult females were “immature.” Those caught in the months from December to May were as follows:—One, of 40·5–39·7 cm., was got after 3 days, 5 miles to the south-west; another, 45·5–45·4 cm., was taken in February 1913, after 78 days, off Buchanness, 68 miles to the north and east; a third, of 39·5–40·3 cm., was taken in April 1913, after 129 days, 114 miles to the north and east, in the Moray Firth; the fourth, measuring 38·5–39·3 cm., was taken in March 1913, after 110 days, 29 miles to the north and east; the fifth, 39·5–40 cm., was taken in February 1913, 23 miles north and west, in the Firth of Forth, near the



place where it was originally captured; the sixth, 40.5–41.4 cm., was taken in April 1913, after 119 days, off the coast of Aberdeen, 49 miles to the north and east; the seventh, measuring 32–41.5 cm., was caught in March 1915, after 816 days, but the place of recapture in this case was not ascertained; the eighth fish, measuring 32.5–40.5 cm., was taken in April 1914 after 502 days, only 15 miles distant, north and west; the ninth fish, 32–38.7 cm., was got in May 1914, after 534 days, 7 miles to the north and east; a tenth fish, measuring 33–39.3 cm., was taken in December 1913, after 376 days, 10 miles directly east.

## EXPERIMENT X.

26th March 1913.

In this experiment, 100 fishes were marked and liberated, of which 35 were males, 64 females, and 1 whose sex was not ascertained. The sizes of the males ranged from 32 to 41.5 cm., and of the females from 32 to 42.5 cm. The numbers liberated and recaptured are shown in the adjoining table, arranged in groups of 5 cm. :—

	cm. 31–35.5	cm. 36–40.5	cm. 41–45.5	Total.
F. Lib. . . . .	27	32	5	64
F. Recap. . . . .	22	16	2	40
M. Lib. . . . .	26	8	1	35
M. Recap. . . . .	18	5	1	24
? Lib. . . . .	—	—	1	1
? Recap. . . . .	—	—	—	—

The fish were caught at the usual place, namely, Station VI., Firth of Forth (off St. Monans), and were liberated, after five hours' retention in the tanks on board.

The number recaptured was 64, or 64 per cent., namely, 24 males, or 68.6 per cent., and 40 females, or 62.5 per cent.

Of the 24 males, 22 were of adult size on recapture, and 2 immature. The adults were at liberty for periods varying from 14 to 912 days, the average being 296 days; their sizes on liberation varied from 32 to 41.5 cm., the average being 34.9 cm., and on recapture from 33.4 to 43.6 cm., with an average of 38.3 cm.; they had migrated distances of from 2 to 215 miles, the mean being 60.6 miles, and the mean rate of movement 2 miles per 10 days. The 2 immature males were taken at distances of 15 and 25 miles, after 14 and 12 days respectively.

Of the 40 females, 28 were of adult size on recapture; they measured from 32 to 41.5 cm. on liberation, the average size being 36.7 cm., and on recapture from 38 to 48.6 cm., the mean being 42.8 cm.; they were free for periods from 77 to 911 days, the average being 359 days; they had migrated distances of from 6 to 112 miles, the mean being 32.5 miles, and the mean rate of travel .9 mile in 10 days. The 12 immature females had been at liberty for periods ranging from 9 to 203 days, the average being 90 days; the average size on liberation was 33.9 cm., and on recapture 35.9 cm.; they had migrated distances of from 5 to 44½ miles, the mean distance being 15.25 miles, and the mean rate of travel, per 10 days, 1.7 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the month after liberation, April 1913, 5 of the fish, 3 males and 2 females, were recaptured, all immature. The 2 females had moved directly west for distances of 12 miles, and were caught 9 days after liberation. The 3 males were recaptured after 12 and 14 days, at distances of from 15 to 29½ miles to the north and west, 1, measuring 34 cm., being taken in the Firth of Forth, near Station VI.

In May, only 2 fishes were recaptured, both females; 1 was taken 11 miles to the north-east, and the other 12 miles directly west; both were under adult size.

Six were recaptured in June, 3 males and 3 females. One male had moved directly west for 4½ miles, 1 to the south-west for 2 miles, and the third north-east

for a distance of 8 miles ; the last-mentioned fish was 41·5 cm. long on liberation. One of the females was got 16 miles to the north and west, east of St. Andrews Bay ; the second was taken 20 miles to the north-east ; and the third 44½ miles to the north and east, off the coast of Aberdeen.

Thus, in the first 3 months after liberation, 13 fish, or 20·3 per cent. of the total recaptured, were taken ; 4 (30·8 per cent.) had moved to the north and east, to the north and west, and directly west for distances respectively of 21, 21, and 10 miles, at average rates per 10 days of 2·9, 13·6, and 7·4 miles. The remaining fish had moved 2 miles to the south and west.

*Second Quarter.*—In July, 2 males and 3 females were recaptured ; 1 of the males had moved for 10 miles directly east, and the other for 5 miles to the south and west. Two of the females had also moved south and west, 1 for a distance of 5 miles, and the other for 8 miles ; the remaining female was caught 19 miles to the north-west, after 106 days. In August, 9 fish were recaptured, 3 males and 6 females, but the position of recapture of one of the females was not ascertained. The 3 males had migrated to the north-east, and were taken at distances of 25, 27, and 52 miles, off the coasts of Forfarshire and Aberdeenshire. A female had also moved in the same direction, for a distance of 7 miles, while 2 females had moved 6 and 8 miles respectively to the south-west ; another female had migrated 10 miles directly east, and the last 24 miles to the south-east, to the east of St. Abb's Head. In September, 3 females were recaptured, one 4 miles directly west, after 173 days, one 6 miles to the south-west, after 165 days, and one 21 miles to the north and west, after 184 days. Thus, in the second quarter after liberation, 17 fishes, or 26·6 per cent., were recaptured, the position of recapture being known for all but 1. Five (31·2 per cent.) went to the south and west for an average distance of 6 miles, the mean rate of travel being ·5 mile in 10 days ; 4 (25 per cent.) had moved an average distance of 28 miles to the north and east, the mean rate per 10 days being 1·8 miles ; 3 (18·8 per cent.) had gone an average distance of 16 miles to the north and west, at a mean rate of ·8 mile per 10 days ; 2 had gone directly east, each for 10 miles, and 1 directly west for 4 miles, while the remaining fish was found 24 miles to the south and east.

*Third Quarter.*—In October, 1 female was recaptured, 13½ miles to the north-west, after 203 days. A female was also taken in November, 12 miles to the north-west, after 226 days, while in December, 2 males and 2 females were got ; 1 of the males was found 14 miles north and west, after 273 days, and the other 73 miles to the north-east, off the coast of Aberdeen, after 270 days ; 1 of the females had also migrated to the north and east, for a distance of 58 miles, while the remaining female was captured 9 miles to the south and east, after 251 days.

Six fish, or 9·4 per cent., therefore, were taken in these 3 months. Three of them (50 per cent.) went an average distance of 13 miles to the north and west the mean rate of movement being ·6 mile per 10 days ; 2 (33·3 per cent.) went a mean distance of 65 miles to the north and east, the rate of travel being 2·4 miles per 10 days ; the remaining fish was taken 9 miles to the south-east, the mean rate being ·3 mile.

*Fourth Quarter.*—In January 1914, a male was taken in the Moray Firth, off Banff, at 113 miles distant, the mean rate of travel being 3·6 miles per 10 days. Two males and 2 females were taken in February ; 1 of the males was found on the north coast of Scotland, near Whiten Head, at a distance of 215 miles, after 324 days, the mean rate of travel being 6·6 miles per 10 days ; it was "ripe." The other male, which also was "ripe," was taken in the Moray Firth, at a distance of 148 miles, after 330 days, the average rate of movement being 4·5 miles. The females had not moved far ; 1 was got 11 miles to the north-west, after 330 days, and the other 17 miles to the south-east, also after 330 days ; these fish had moved at a mean rate of respectively ·3 and ·5 mile. In March, 2 males and 2 females were recaptured ; 1 of the males was taken in the Moray Firth, off Clythness, 140 miles distant, after 343 days ; the other was caught 21 miles off Hartlepool, 102 miles in the opposite direction, after 102 days ; the mean rate of travel in these two cases was respectively 4·1 and 2·9 miles per 10 days. One of the females was taken, after 343 days, 28½ miles to the north-west, in the Firth of Forth, near the place of original capture ; the other was caught north-east of Kinnaird Head.

Thus, in the fourth quarter, 9 fishes, or 14·1 per cent., were recaptured; 5 (55·5 per cent.) were taken to the north and east, at an average distance of 144 miles, the mean rate of travel per 10 days being 4·3 miles; 2 each were got north and west and south and east, the average distance being 20 and 59 miles respectively, and the mean rate of travel ·5 and 1·7 miles.

In the 12 months following liberation, therefore, 45 fish, or 70·3 per cent., were recaptured, particulars being ascertained for 44 of them, or 68·7 per cent. Fifteen (34·1 per cent.) were found to the north and east; 12 (27·3 per cent.) to the north and west; 6 (13·6 per cent.) to the south and west; 5 (11·4 per cent.) to the west; 4 (9·1 per cent.) to the south and east; and 2 directly east.

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. April 1913. May 1913. June 1913.	N. and E.	4	30·8	N. 23° E.	21	2·9	8-44·5	·9-5·2
	N. and W.	4	30·8	N. 69° W.	21	13·6	15-29·5	1·9-21·1
	S. and E.	Nil.						
	S. and W.	1	7·6	S. 3° W.	2	·26	..	..
	W.	4	30·8	W.	10	7·4	4·5-12	·5-13·3
		13	20·3	..	..	..	8-44·5	·9-21·1
II. July 1913. Aug. 1913. Sept. 1913.	N. and E.	4	25	N. 22° E.	28	1·8	7-52	·4-3·5
	N. and W.	3	18·8	N. 59° W.	16	·8	8-21	·1-1·8
	S. and E.	1	6·2	S. 30° E.	24	1·5	..	..
	S. and W.	5	31·2	S. 50° W.	6	·5	5-8	·4-·7
	E.	2	12·5	E.	10	·8	10-10	·7-·9
	W.	1	6·2	W.	4	·2	..	..
		16	25·	..	..	..	5-52	·1-3·5
III. Oct. 1913. Nov. 1913. Dec. 1913.	N. and E.	2	33·3	N. 33° E.	65	2·4	58-73	2·1-2·7
	N. and W.	3	50·	N. 39° W.	13	·6	12-14	·5-·7
	S. and E.	1	16·6	S. 52° E.	9	·3	..	..
	S. and W.	Nil.						
		6	9·4	..	..	..	12-73	·5-2·7
IV. Jan. 1914. Feb. 1914. Mar. 1914.	N. and E.	5	55·5	N. 23° E.	144	4·3	106-215	2·9-6·6
	N. and W.	2	22·2	N. 79° W.	20	·5	11-28·5	·3-·8
	S. and E.	2	22·2	S. 45° E.	59	1·7	17-102	·5-2·9
	S. and W.	Nil.						
		9	14·1	..	..	..	11-215	·3-6·6
SUMMARY.	N. and E.	15	34·1					
	N. and W.	12	27·3					
	S. and E.	4	9·1					
	S. and W.	6	13·6					
	E.	2	4·5					
	W.	5	11·4					
		44	68·7					

Of the remaining 19 fish, 15 were recaptured in 1914. One male and 2 females were taken in April, at distances of from 64 to 106 miles to the north and east. One of the females was "spent," and the other "immature," while the male was "ripe." Three females were caught in May, 1, 8 miles to the south-east, after 421 days, "spent"; 2 were got to the north-east, 1 at a distance of 10 and the other at 18 miles, the latter being "immature." One male and 3 females were recaptured in June, all to the north and east, at distances of from 20½ to 73 miles. One of the females is described as "spent," the others as "immature." Two females were taken in July, but particulars of the place of capture of one were not ascertained; the other was taken after 488 days, off St. Abb's Head, the condition of the ovaries not being recorded. A male was got in August, 15 miles to

the north and west, and 2 males in October, one 2 miles to the south-west, after 574 days, and the other in the Moray Firth, 139 miles away, after 562 days.

Four fish were recaptured in 1915. Two females, taken in May, had both migrated to the north and east; one was caught, 112 miles distant, in the Moray Firth, after 768 days; both of these fish are described as "spent." In September, a male and a female were recovered, both to the north and east, off the coast of Aberdeen, the male at a distance of 48, and the female at a distance of 28 miles, after periods, the male of 912 days, and the female of 911 days.

A summary of the mean distance and direction in each quadrant is shown in the following table:—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	13	790	61	N. 24° E.
	Adult Females.	14	652·5	46·6	N. 34° E.
	Immature Females.	2	55·5	27·7	N. 32° E.
		29	1498	51·7	N. 29° E.
N. and W.	Adult Males.	3	58·5	19·5	N. 62° W.
	Immature Males.	2	40	20	N. 63° W.
	Adult Females.	5	80·5	16·1	N. 69° W.
	Immature Females.	3	48·5	16·2	N. 46° W.
		13	227·5	17·5	N. 61° W.
S. and E.	Adult Males.	1	102	102	S. 10° E.
	Adult Females.	4	67	17	S. 62° E.
	Immature Females.	1	24	24	S. 30° E.
		6	193	32	S. 48° E.
S. and W.	Adult Males.	3	9	3	S. 19° W.
	Adult Females.	1	6	6	S. 50° W.
	Immature Females.	3	19	6	S. 49° W.
		7	34	5	S. 37° W.
W.	Adult Males.	1	4·5	4·5	W.
	Adult Females.	1	4	4	W.
	Immature Females.	3	36	12	W.
		5	44·5	8·9	W.
E.	Adult Males.	1	10	10	E.
	Adult Females.	1	10	10	E.
		2	20	10	E.
SUMMARY.					
N. and E.		29	1498	51·7	N. 29° E.
N. and W.		13	227·5	17·5	N. 61° W.
S. and E.		6	193	32	S. 48° E.
S. and W.		7	34	5	S. 37° W.
W.		5	44·5	8·9	W.
E.		2	20	10	E.
		62	..	..	..

*Distances travelled.*—Seventeen fish, or 28 per cent. of the total number recaptured, were taken at distances not exceeding 10 miles, viz. 6 males (25 per cent.), which had migrated an average distance of 5·2 miles, and 11 females (29·7 per cent.), which had moved an average distance of 7·4 miles. Three of the males were taken to the south and west, at distances of 2 and 5 miles; one was

recaptured 8 miles to the north and east, one 10 miles directly east, and one  $4\frac{1}{2}$  miles directly west. Of the females, 4 had moved distances of from 5 to 8 miles to the south and west, 2 for 8 and 9 miles respectively south and east, 2 north and east, 1 for 7 and the other for 10 miles, 1 for a distance of 8 miles north and west, one 10 miles directly east, and the last 4 miles directly west.

*10 to 20 miles.*—Fifteen of the fish, or 24·2 per cent. of the total, had migrated distances between 10 and 20 miles. Three (12·5 per cent.) were males, which had moved north and west for an average distance of 14·6 miles, and 12 (31·6 per cent.) were females, which had migrated an average distance of 14·5 miles; 5 were found to the north and west, at distances of from 11 to 19 miles; 3 were recaptured at 12 miles distant directly west; 1 was taken 17 miles to the south and east; and 3 to the north and east, at distances of from 11 to 20 miles.

Thus, within 20 miles of the station, 32 plaice were recaptured, or 51·6 per cent. of the whole, viz. 23 females and 9 males.

*20 to 50 miles.*—Twelve of the recaptured plaice, or 19·3 per cent., had moved distances of between 20 and 50 miles. Five were males (20·8 per cent.), the average distance migrated being 30·9 miles; 2 were found to the north and west, 1 of them within the Firth of Forth; the remaining 3 had gone distances of from 25 to 48 miles to the north and east. Eight (21 per cent.) were females, which had travelled an average distance of 29·7 miles; 4 went distances of from  $20\frac{1}{2}$  to  $44\frac{1}{2}$  miles north and east; 2 for 21 and  $28\frac{1}{2}$  miles north and west, and 2 for 24 and 33 miles to the south and east.

*50 to 100 miles.*—Eight of the fish, or 12·9 per cent., had migrated distances of between 50 and 100 miles, all to the north and east. Three (12·5 per cent.) were males, which had migrated an average distance of 60 miles, and five (13·1 per cent.) were females, and the average distance travelled in their case was 63·6 miles.

*Over 100 miles.*—Nine of the fishes, or 14·5 per cent. of the total number recaptured, were taken at distances over 100 miles. Seven of these (29·2 per cent.) were males, which had travelled an average distance of 138 miles, 6 of them to the north and east for distances varying from 106 to 215 miles, and 1 to the south and east, for a journey of 102 miles. Two (5·3 per cent.) were females, which had migrated an average distance of 109 miles, to the Moray Firth.

#### MATURITY.

*Males.*—Of the 22 adult males, which were recaptured, the condition of the testes was ascertained in 19 cases. Four were "ripe," and all had migrated to the north and east, 3 being caught in the Moray Firth and 1 on the North coast of Scotland. One, measuring 36–38·3 cm., was taken in January 1914, after 309 days, off Banff, at a distance of 113 miles. A second, of 37·5–41·6 cm., was captured in February 1914, after 324 days, off Whiten Head, at a distance of 215 miles. The third fish, of 33·5–38·3 cm., was also taken in February 1914, after 330 days, in the Moray Firth, at a distance of 148 miles. And, the fourth "ripe" male, measuring 32·5–34·8 cm., was taken in April 1914, after 386 days, 106 miles distant, off Kinnaird Head. The mean rate of movement in these cases was respectively 3·6, 6·6, 4·5, and 2·7 miles per 10 days.

Two of the males were "nearly ripe." One, of 35·5–43·6 cm., was taken in October 1914, after 562 days, in the Moray Firth, at a distance of 139 miles. The other, of 32·5–42·1 cm., was recaptured in September 1915, after 912 days, 48 miles to the north and east, off Aberdeen. The rate of migration in these cases was respectively 2·47 and ·5 miles per 10 days.

Thirteen of the males were "immature." One was caught in April, 4 in June, 2 in July, 4 in August, 1 in October, and 1 in December. The fish recaptured in April measured 34–33·5 cm., and was found in the Firth of Forth, at a distance of 29·5 miles, after 14 days. The fish taken in December measured 34–37 cm., and was got at a distance of 14 miles to the north and west, after 273 days. Two of the "immature" males had migrated for some distance to the north and east, 1, of 37·5–38·8 cm., being taken in August 1913, after 147 days, 52 miles distant; and the other, measuring 35–43·2 cm., in June 1914, after 434 days, 55 miles distant, both off the coast of Aberdeen.

Of the 28 adult females recaptured, the condition of the ovaries was ascertained

in 24 cases. One, of 38·5–42·8 cm., was “nearly ripe,” and was captured in September 1913, after 173 days, 4 miles to the west.

Six are described as “spent.” One, of 39·5–46·2 cm., was caught in May 1914, after 421 days, 8 miles to the south and east. All the others were taken to the north-east. One of these, 34–41·7 cm., was caught in April 1914, after 377 days, off the coast of Aberdeen, at a distance of 64 miles. Another, of 33–42 cm., was got in May 1914, after 406 days, 10 miles distant. A third, of 32–39·8 cm., was recovered in June 1914, after 452 days, off the coast of Aberdeen, at a distance of 73 miles. The fourth fish was taken in May 1915, after 767 days, also off the coast of Aberdeen, at a distance of 55 miles; it measured 33–42·5 cm. The last fish measured 40·5–48·2 cm., and was also caught in May 1915, after 768 days, in the Moray Firth, at a distance of 112 miles.

One fish, of 35–47·2 cm., caught in September 1915, after 911 days, 28 miles to the north and east, was “half ripe.”

The remaining plaice were “immature.” One was got in February, 2 in March, 1 in April, 1 in May, 2 in June, 1 in July, 3 in August, 2 in September, 1 in November, and 2 in December. Particulars in regard to those taken between December and May are as follows:—Of the 2 caught in December 1913, 1 had moved 9 miles to the south and east, after 251 days, and the other, 58 miles to the north and east, after 271 days. The fish caught in February, measuring 38·5–42·6 cm., was found, after 330 days, 11 miles to the north and west. Of the 2 taken in March, 1, measuring 38–42·1 cm., was found 28½ miles north-west, after 343 days, in the Firth of Forth; the other, measuring 37–44·8 cm., was recaptured, after 358 days, off Rattray Head, 106 miles to the north and east. The fish, captured in April, measuring 40·5–48·6 cm., had moved 68 miles to the north and east, after 377 days. The plaice, recovered in May 1914, after 422 days, measured 33·5–40·6 cm., and was found 18 miles to the north and east.

#### EXPERIMENTS AT 40 MILES EAST OF THE ISLE OF MAY.

Four experiments were made at this place, approximately Lat. 56° 23' N.; Long. 1° 23' W., where the depth is about 29 fathoms. The particulars of the experiments are as follows:—

No. of Experiment.	Date.	No. of Fish.								Percentages Recaptured.			
		Marked.				Recaptured.							
		♂	♀	(?)	Total.	♂	♀	(?)	Total.	♂	♀	(?)	Total.
I.	13 July 1911.	42	29	...	71	20	19	...	39	47·6	65·5	...	54·9
II.	12 Sept 1911.	30	69	3	102	14	46	1	61	46·6	66·6	33·3	59·8
III.	12 June 1912.	27	60	3	90	16	36	2	54	59·3	60·	66·6	60·
IV.	12 June 1913.	36	82	1	119	16	38	...	54	44·4	46·3	...	45·4
		135	240	7	382	66	139	3	208	48·9	57·9	42·9	54·4

#### EXPERIMENT I.

13th July 1911.

In this experiment, 71 fish were liberated, 42 being males and 29 females. The males measured from 24 to 46·5 cm., and the females from 24·5 to 44 cm. The number of males under the adult size (33 cm.) was 26, and of the females (38 cm.), 27. The numbers liberated and recaptured are shown in the following table, arranged in 5-cm. groups:—

	cm. 25–30·5	cm. 31–35·5	cm. 36–40·5	cm. 41–45·5	cm. 46–50·5	Total.
F. Lib. . . . .	12*	11	5	1	—	29
F. Recap. . . . .	9	7	2	1	—	19
M. Lib. . . . .	19†	19	3	—	1	42
M. Recap. . . . .	5	11	3	—	1	20

\* One at 24·5 cm.

† One at 24 and one at 24·5 cm.

The plaice used in this experiment were taken on Station II., Firth of Forth (Kirkcaldy Bay), on the same day as they were marked and liberated.

The number recaptured was 39, or 54·9 per cent., namely, 20 males (47·6 per cent.) and 19 females (65·5 per cent.). Sixteen of the males were over adult size, ranging from 33·3 to 45·8 cm., and averaging 37·7 cm., as compared with a range of 30·5 to 46·5 cm., and a mean of 34·9 cm. on liberation; the periods of freedom varied from 28 to 599 days, the mean being 269·5 days; the distances migrated were from 6·5 to 187 miles, and the mean rate of movement, per 10 days, was 1·4 miles. Of the four recaptured males under adult size, the average was 30·2 cm., compared with 28·7 cm. on liberation; they travelled a mean distance of 43·8 miles in an average period of 184 days, at a mean rate of 2·4 miles per 10 days.

Nine of the females were over the adult size on recapture, the range being from 38·5 to 44 cm., and the average size 41·5 cm., as compared with 29 to 44 cm. and an average of 35·4 cm., on liberation; they were absent for from 19 to 761 days, the mean being 503 days; their range of miles travelled was 13 to 83, averaging 43 miles; they had travelled at a mean rate of ·85 mile per 10 days.

Ten were under the adult size, namely, from 27 to 33·2 cm., the mean size being 30·8 cm., as compared with 26·5 to 33 cm. and an average of 29·7 cm. on liberation; the periods of freedom varied from 42 to 379 days, averaging 132·4 days, and they travelled journeys of from 6 to 59 miles, the mean being 30·2 miles, and the average rate of movement, per 10 days, 2·3 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In July (which is here included in this quarter), 1 male, measuring 34–33·3 cm., was taken, after 15 days, 10 miles to the westward, in the direction of the Isle of May.

In August, 1 male and 3 females were recovered; the male, of 37–36·9 cm., was taken, after 28 days, to the east of the Bell Rock, at a distance of 6½ miles in a north-easterly direction; 1 of the females, of 39–38·6 cm., was caught, after 19 days, to the south-east of Aberdeen, at 23 miles distant; another, measuring 26·5–27 cm., was taken, near Buchan Ness, at a distance of 59 miles; the third female, of 32–32·7 cm., was recaptured, after 46 days, offshore, to the south-east of Longstone Light, at a distance of 56 miles.

Five fish were recaptured in September, 2 males and 3 females; 1 of the males, of 46·5–45·8 cm., and described as “about half ripe,” was taken, after 57 days, 12 miles to the south and west; the other male was caught at the same place, on the same day, and measured 33·5–35 cm., and was “immature”; 1 of the females, measuring 33–32·1 cm., was recaptured, after 71 days, 12 miles to the southwards; another female, of 28–29·2 cm., was got, after 77 days, to the south-east of the Bell Rock, at a distance of 19 miles; the third female, measuring 29·5–31·5 cm., was recovered, after 68 days, near the Isle of May, at a distance of 33 miles to the westward.

In this quarter, therefore, 10 fishes, or 25·6 per cent. of the total recaptured, were obtained, namely, 4 males (20 per cent.) and 6 females (31·6 per cent.).

*Second Quarter.*—In October, 4 of the marked plaice were recovered, 3 males and 1 female; the female, measuring 30·5–32·3 cm., was taken, after 106 days, off Fife Ness, at a distance of 34 miles; one of the males, measuring 32·5–34·5 cm., was recovered, after 82 days, east of the Isle of May, at a distance of 24 miles from the Station; another, of 30·5–30·5 cm., was taken, after 84 days, 24 miles to the westward, off Fife Ness; the third male, of 35–35·2 cm., was got, after 100 days, 31 miles to the south and west, towards the mouth of the Firth of Forth.

In November, a female, measuring 44–43·8 cm., was recaptured, after 139 days, offshore, near Aberdeen Bank, at a distance of 40 miles.

In December, two males and two females were caught, but the position of one of the males and of one of the females was not recorded; the other male, which measured 32–37 cm., was taken, after 144 days, at a distance of 24 miles to the south and west, towards the mouth of the Firth of Forth; the female, of 29·5–30·2 cm., was caught, after 154 days, 6 miles to the north and west.

Nine fish, then, or 23·1 per cent., 5 males and 4 females, were taken in the second quarter, the positions of 7 being recorded.

*Third Quarter.*—In January 1912, a male, of 28–30·2 cm., was recovered, after 179 days, in St. Andrews Bay, at 44 miles distant.

In February, a female, measuring 31·5–33·2 cm., was taken, after 216 days, in the same direction, at a distance of 27 miles.

In March, 3 males were recaptured; 1, measuring 29·5–30·4 cm., went to the south shore of the Firth of Forth, being got, after 236 days, about half a mile from Newhaven, a distance of 63 miles; another male, of 27–29·6 cm., was also recaptured in the Firth of Forth, after 239 days, on the north shore, to the east of Elie, at a distance of 44 miles; both these fish were “immature”; the third male had migrated to the southwards, and was caught, after 252 days, 32 miles off Spurn Point, at a distance of 187 miles; its size on liberation was 34 cm., but neither the size nor the condition of the testes was recorded on recapture.

In this quarter, therefore, 5 fishes, or 12·8 per cent., were taken, 4 males and 1 female.

*Fourth Quarter.*—None was recaptured during this period.

In the 12 months immediately following the liberation of the fish, 24, or 61·5 per cent., were recovered, the positions being recorded in all but two cases. Four (18·2 per cent.) went north and east; 8 (36·4 per cent.) north and west; 2 (9·1 per cent.) south and east; 7 (31·8 per cent.) south and west; and 1 (4·5 per cent.), directly west.

Particulars for each of the quarters and for the whole year are shown in the following table:—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. July 1911. Aug. 1911. Sept. 1911.	N. and E.	3	30·	N. 7° E.	29·	9·4	6·5–59·	2·3–14
	N. and W.	2	20·	N. 79° W.	14·	4·5	10–19·	2·5–6·6
	S. and E.	1	10·	S. 15° E.	56·	12·2	..	..
	S. and W.	3	30·	S. 51° W.	12·	1·9	12·	1·7–2·1
	W.	1	10·	W.	28·	·65	..	..
		10	25·6	..	..	..	6·5–59·	1·7–14·4
II. Oct. 1911. Nov. 1911. Dec. 1911.	N. and E.	1	14·3	N. 35° E.	40·	2·9	..	..
	N. and W.	3	42·8	N. 81° W.	21·	2·1	6–34·	·4–3·2
	S. and E.		Nil.					
	S. and W.	3	42·8	S. 83° W.	26·	2·5	24–31·	1·7–3·1
		7	17·9	..	..	..	6–34·	·4–3·2
III. Jan. 1912. Feb. 1912. Mar. 1912.	N. and E.		Nil.					
	N. and W.	3	60·	N. 79° W.	38·	1·8	27–44·	1·2–2·4
	S. and E.	1	20·	S. 9° E.	187·	7·4	..	..
	S. and W.	1	20·	S. 86° W.	63·	2·7	..	..
		5	12·8	..	..	..	..	..
IV. April 1912. May 1912. June 1912.	N. and E.		Nil.					
	N. and W.		Nil.					
	S. and E.		Nil.					
	S. and W.		Nil.					
SUMMARY.	N. and E.	4	18·2					
	N. and W.	8	36·4					
	S. and E.	2	9·1					
	S. and W.	7	31·8					
	W.	1	4·5					
		22	56·4					



The next recaptures in this experiment were in July, when 1 male and 2 females were taken. The male, measuring 35·5–40·3 cm., was got, after 361 days, near Buchanness, at a distance of 63 miles to the north and east; another, a female of 29–38·5 cm., was taken, after 366 days, near Tod Head, 34 miles to the north and west; the second female, which measured 28·5–30·8 cm., was found, after 379 days to the north-east of St. Abb's Head, at a distance of 26 miles.

In August, a male, of 33–37·3 cm., was recovered, after 403 days, south-east of the Isle of May, at a distance of 26 miles. In September, 2 males were recaptured; 1, which measured 32–38·6 cm., was taken, after 427 days, to the east of the Isle of May, at a distance of 28 miles; the other, of 33–41·7 cm., was caught, after 428 days, in the offshore waters, to the south-east of Aberdeen, at a distance of 24 miles. In December, a female was recovered, after 511 days, to the north-east of Rattray Point, at a distance of 82 miles; it measured 36·5–44 cm., and was described as "immature."

Eight of the marked plaice were taken in 1913. In February, a male, measuring 32·5–37·2 cm., was caught, after 596 days, near Aberdeen Bank, at 38 miles distant; the condition of the testes was not recorded. Three were taken in March, a male, of 39·5–41·7 cm., and "spawning," a little south of Aberdeen, at a distance of 45 miles; another male, of 30·5–34·5 cm., and also "spawning" ("partly spent"), after 616 days, near Aberdeen Bank, a distance of 36 miles away; the third, a female of 35–40·6 cm., and "immature," was got, after 614 days, at the same locality, 38 miles distant. In April, after 657 days, a female was found 13 miles to the south and west; it measured 35 cm. on liberation, but neither the size on recapture, nor the condition of the ovaries was recorded. In July, 2 females were recovered, 1, of 34–43·6 cm., and "spent," after 728 days, offshore, to the south-east of Buchanness, at a distance of 61 miles; the other, measuring 30·5–40 cm., and "immature," was taken, after 733 days, at a distance of 14 miles to the south and west. The last fish to be recaptured was a female, of 35–43 cm., which was taken in August, after 761 days, to the north-east of Rattray Point, at a distance of 83 miles.

The following table gives the mean distance and direction in each quadrant for all the fish recovered from the experiment :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	5	167	33	N. 17° E.
	Adult Females.	6	327	54	N. 22° E.
	Immature Females.	1	59	59	N. 5° E.
		12	553	46	N. 19° E.
N. and W.	Adult Males.	2	55	27	N. 48° W.
	Immature Males.	3	112	37	N. 82° W.
	Adult Females.	1	34	34	N. 21° W.
	Immature Females.	4	86	21	N. 77° W.
	10	287	29	N. 67° W.	
S. and E.	Adult Males.	1	187	187	S. 9° E.
	Immature Females.	1	56	56	S. 15° E.
		2	243	121	S. 12° E.
S. and W.	Adult Males.	6	129	21	S. 78° W.
	Immature Males.	1	63	63	S. 86° W.
	Adult Females.	2	27	13	S. 36° W.
	Immature Females.	2	38	19	S. 31° W.
		11	257	23	S. 63° W.
W.	Adult Males.	1	28	28	W.
	Immature Females.	1	33	33	W.
		2	61	30	W.
SUMMARY.					
N. and E.		12	553	46	N. 19° E.
N. and W.		10	287	29	N. 67° W.
S. and E.		2	243	121	S. 12° E.
S. and W.		11	257	23	S. 63° W.
W.		2	61	30	W.
		37	..	..	..

*Distances travelled*—10 miles and under.—Three of the marked plaice were recaptured at distances of 6, 6½, and 10 miles, 2 males and 1 female, 2 to the westwards and 1 to the northwards.

10 to 20 miles.—Six fishes, or 16·2 per cent., were caught at distances of from 12 to 19 miles, viz. 2 males and 4 females; both the males and 3 of the females had moved to the south and west, and the remaining female to the north and west.

*Under 20 miles.*—Thus, 9 of the plaice, or 24·3 per cent., were recaptured at distances of less than 20 miles, 4 being males (21 per cent.) and 5 females (29·9 per cent.).

20 to 50 miles.—Twenty of the recaptured plaice were found at distances of from 23 to 45 miles, or 54·2 per cent., viz. 12 males (63·2 per cent.) and 8 females (44·4 per cent.). Four of the males and 1 of the females were caught to the south and west; 4 males and 3 females to the north and west; 1 male and 1 female directly west; 3 males and 3 females north and east.

50 to 100 miles.—Seven, or 18·9 per cent., were taken from 56 to 83 miles away, 2 males (10·5 per cent.) and 5 females (27·8 per cent.). One of the males and 4 of the

females went to the north and east, being recovered off the coast of Aberdeenshire ; a female was recaptured at a distance of 56 miles to the south and east, off the coast of Northumberland ; a male was taken in the Firth of Forth, off Newhaven, at a distance of 63 miles.

*Over 100 miles*—One fish only, a male, went a journey of over 100 miles, being recaptured off Spurn Point, a distance of 187 miles to the south and east.

#### MATURITY.

The condition of the testes was ascertained in 17 of the recaptured males.

Two were "spawning"; 1, measuring 39.5–41.7 cm., was taken in March 1913, after 599 days, between Aberdeen and Stonehaven, at a distance of 45 miles to the north and west ; the other ("partly spent") measured 30.5–34.5 cm., and was also caught in March 1913, after 616 days, at Aberdeen Bank, a distance of 36 miles to the north and east.

One male, of 37–37.1 cm., recaptured in December 1911, after 147 days, was "nearly ripe," but the position where it was taken was not recorded. Another male, of 46.5–45.8 cm., caught in September 1911, after 57 days, 12 miles south and west, was "about half-ripe."

All the others were "immature"; none of those of adult size was caught within the spawning season.

*Females.*—The condition of the ovaries was recorded in 16 of the 19 recaptured.

None was "spawning" or "ripe"; 1, of 34–43.6 cm., taken in July 1913, after 728 days, far off the coast of Aberdeen, at a distance of 61 miles, was "spent"; another, of 29–38.5 cm., caught in July 1912, after 366 days, near Tod Head, at a distance of 34 miles, was "apparently spent."

All the others were "immature," including 1, of 35–40.6 cm., caught in March 1913, after 614 days, at Aberdeen Bank, 38 miles distant.

#### EXPERIMENT II.

12th September 1911.

In this experiment, 102 plaice were marked and liberated, comprising 30 males, 69 females, and 3 of unknown sex. The sizes of the males ranged from 32.5 to 42 cm., and of the females from 28 to 64 cm. Only 2 males were under the adult size (33 cm.) and 21 of the females (38 cm.). The numbers liberated and recaptured are shown in the accompanying table, in groups of 5 cm.

	cm. 25–30.5	cm. 31–35.5	cm. 36–40.5	cm. 41–45.5	cm. 51–55.5	cm. 61–65.5	Total.
F. Lib. . . . .	4	7	41	15	1	1	69
F. Recap. . . . .	—	3	30	12	1	—	46
M. Lib. . . . .	—	12	16	2	—	—	30
M. Recap. . . . .	—	6	7	1	—	—	14
? Lib. . . . .	1	1	—	1	—	—	3
? Recap. . . . .	—	1	—	—	—	—	1

The fish which were marked were taken at Station VI., Firth of Forth (off St. Monans), between 6 and 8 p.m. on the 11th September, and were set free at 1.40 a.m. on the 12th.

The number recaptured was 61, or 59.8 per cent., namely, 14 males, or 46.6 per cent., 46 females, or 66.6 per cent., and 1 of undistinguished sex.

Of the 14 males, the periods of freedom varied from 6 to 555 days, the average being 179 days ; the sizes on liberation ranged from 33.5–41 cm., the average being 36.5 cm. ; the sizes on recapture varied from 34.8 to 40.8 cm., the mean being 37.8 cm. ; the distances migrated were from 2 to 208.5 miles, the average being 49.9 miles, and the mean rate of travel 2.78 miles per 10 days.

Forty of the females were of adult size on recapture, viz. from 38.1 to 54.1 cm., the average being 42.6 cm., compared with a range of from 35.5 to 54 cm., on liberation, and an average of 40.3 cm. ; they were free for from 3 to 897 days, the

mean being 260 days; the distances migrated varied from 9 to 151.5 miles, the average being 49.4 miles, and the mean rate of movement 1.9 miles per 10 days. Six of the females were under the adult size, the average being 36.6 cm., as compared with 35.9 cm. when liberated; the average period of freedom was 93 days, the mean distance travelled 36.5 miles, and the mean rate of movement per 10 days, 3.9 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In September, which is included in this quarter, 6 fish were recaptured, 1 male and 5 females, 1 of the females to the west, and all the others to the south and west. The male, measuring 39.5–39.2 cm., was taken, after 6 days, 24 miles to the south-west; 2 of the females were got, 3 days after liberation, both 12 miles to the south-west, 1, measuring 40–39.8 cm., and the other, 40–39.4 cm.; 2 were taken after 7 days, both to the south-west, 1, of 34.5–34.5 cm., at a distance of 19 miles, and the other, of 39.5–38.6 cm., at a distance of 9 miles; the last female, which measured 37–37.1 cm., was got, after 16 days, to the east of the Isle of May, at a distance of 30 miles to the westward. The rates of movement of these fishes were considerable, in three cases amounting to 40 miles per 10 days, or 4 miles per day.

In October, 6 fish were recaptured, 2 males, 3 females, and 1 whose sex was undetermined. One of the males, measuring 39–38.5 cm., and “nearly half-ripe,” was caught, after 22 days, off Fife Ness, at a distance of 28½ miles to the west; the other male, which measured 36–35.8 cm., and “immature,” was recovered, after 24 days, 13½ miles to the south-west; 1 of the females, measuring 44.5–44 cm., and “nearly ripe,” was caught, after 27 days, to the east of St. Abb’s Head, at a distance of 30 miles south-west of the station; another female, of 40–41.2 cm., and “fully half-ripe,” was caught, after 36 days, offshore, to the east of Aberdeen, at a distance of 42 miles to the north and east; the remaining female, measuring 37.5–38.3 cm., and also “fully half-ripe,” was recaptured, after 42 days, off Tod Head, at a distance of 30 miles; the fish, whose sex was unknown, was taken, after 27 days, off Dunbar, a distance of 40 miles in a south-westerly direction.

In November, 4 females were recaptured, but the position of capture of 1 was not recorded. One, measuring 54–54.1 cm., and “nearly ripe,” was got, after 59 days, near the Bell Rock, at a distance of 36 miles; another, measuring 38–37.8 cm., and the condition of whose ovaries was not determined, was taken, after 63 days, to the south and east, off Whitby, at a distance of 102 miles; the other female, whose size on recapture was 42.3 cm., was taken, after 74 days, off the Isle of May, at a distance of 34 miles to the south and west; this fish was originally liberated between Elie and Fidra, on the 19th June 1911, and recovered by the “Goldseeker” at Station VI., Firth of Forth, on the 11th September, when trawling for fish for this experiment; it was then liberated on the 12th September, 40 miles east of the Isle of May.

In the first quarter, therefore, 16 of the plaice, or 26.2 per cent., were recaptured, namely, 3 males, 12 females, and 1 of unknown sex; 9 had moved to the south and west, 1 to the west, 3 to the north and west, and 1 each to the north-east and south-east; the position of 1 was not recorded.

*Second Quarter.*—In December, 6 fishes were recaptured, 3 males and 3 females. One of the males, which measured 35 cm. on liberation, was taken, after 83 days, 13 miles to the south-west; another, measuring 35–34.8 cm., and “nearly ripe,” was taken, after 92 days, in the same locality, at a distance of 16 miles; the third, of 39–38.4 cm., and “nearly ripe,” was caught, after 108 days, to the east of the Isle of May, at a distance of 28 miles. One of the females, which measured 42 cm. on liberation, was taken, after 83 days, to the east of the Isle of May, at a distance of 24 miles; another, of 38.5–38.1 cm., was recaptured, after 86 days, 17 miles to the westward; the remaining fish, which measured 36–36.6 cm., was taken, after 93 days, to the east of the Isle of May, at a distance of 24 miles.

In January 1912, a female, which was 44–46 cm., and “nearly ripe,” was recovered, after 133 days, off Aberdeen, at a distance of 47 miles to the north and east.

In February, 7 of the marked plaice were got, 3 males and 4 females. One of the males, which measured 36–37.6 cm., and the condition of whose testes was not

recorded, was caught, after 152 days, 10 miles east by north of Hartlepool, 97 miles to the south and west; another, of 41–40·8 cm., and the condition of whose testes was not ascertained, was caught, after 154 days, at Aberdeen Bank, 39 miles to the north and east; the third male, which measured 35–37·8 cm., and the condition of whose testes was not ascertained, was recovered south of Aberdeen Bank, at a distance of 30 miles to the north and east. One of the females, of 40–39·3 cm., and the condition of whose ovaries was not determined, was recaptured, after 150 days, at Aberdeen Bank, at a distance of 41 miles; another, of 34–36·2 cm., and described as “half-ripe,” was taken, after 156 days, to the east of the Isle of May, at a distance of 24 miles; a third, of 40–40 cm., and “ripe,” was taken, after 164 days, off Banff, in the Moray Firth, at a distance of 110 miles; the remaining female, which measured 38·5–39 cm., and was said to be “nearly ripe,” was caught, after 144 days, off the Orkney Isles, at a distance of 151 miles.

Thus, in the second quarter, 14 fishes, or 22·9 per cent., were recaptured, 6 males and 8 females. Two had moved directly west, 6 south and west, and 6 north and east.

*Third Quarter.*—Three females were recaptured in March 1912, but the position of 1 was not recorded; 1, measuring 41·5–41·7 cm., and “ripe,” was taken near Buchanness, at a distance of 60 miles, after 181 days; the other, which measured 37·5–39·3 cm., and the condition of the ovaries of which was not known, was caught, after 187 days, 19 miles to the north and east.

In April, 5 were recaptured, 1 male and 4 females. The male, which was 39 cm. on liberation, but whose size on recapture and the condition of the testes were not ascertained, was taken, after 225 days, 11 miles S.S.W. of Sule Skerry, off the north coast of Scotland, at a distance of 208 miles. All the females were “immature”; 1, of 36–37·7 cm., was recaptured, after 222 days, to the east of the Isle of May, at a distance of 20 miles directly west; another, of 39·5–41 cm., was found, after 227 days, off Buchanness, at a distance of 65 miles; the third, of 38–40·9 cm., was caught, after 229 days, to the south-east of Aberdeen, at a distance of 32 miles; the fourth, measuring 41–42·5 cm., was recaptured, after 231 days, 15½ miles to the north and west.

Two were got in May, a male, of 33·5–36 cm., after 262 days, at a distance of only 2 miles to the east, and a female, of 36·5–39·5 cm., and “immature,” after 261 days, offshore, off the coast of Aberdeen, at a distance of 47 miles to the north and east.

In this quarter, then, 10 fishes, or 16·4 per cent., were recovered, viz. 2 males and 8 females. The position of capture of 1 was unknown; 1 was found to the east, 1 to the west, 5 to the north-east, and 2 to the north-west.

*Fourth Quarter.*—Five were recovered in June 1912, 1 male and 4 females. The male, of 34–38 cm., and described as “mature,” was taken, after 276 days, 8 miles to the south and west; one of the females, measuring 41–44·6 cm., was caught, after 286 days, 47 miles to the north and east, far offshore; another, of 40·5–45·2 cm., was caught, after 269 days, near Aberdeen, at a distance of 44 miles to the north and east; the third, of 38·5–42·6 cm., and described as “apparently spent,” was taken, after 273 days, 21 miles to the westwards; the fourth female, measuring 40·5–42·1 cm., was found at a distance of 26 miles to the north and east.

A female, of 39·5–42·2 cm., was taken in July 1912, after 314 days, to the north-east of Aberdeen, at a distance of 51 miles.

In August, 3 females were recaptured, all to the north and east. One, measuring 42·5–44·3 cm., and “about half-ripe,” was captured, after 324 days, far offshore (80 miles east of Buchanness; 57° 51' N.; 0° 20' E.) to the north and east, at a distance of 112 miles; another, of 39·5–43·5 cm., and “immature,” was captured, after 344 days to the north-east of Kinnaird Head, at a distance of 97 miles; the third female, of 41–43·2 cm., and described as “three-quarters ripe,” was taken, after 351 days, 50 miles N.N.E. of Buchanness, at a distance of 117 miles from the station.

In the first 12 months after liberation, 49 of the marked plaice, or 80·3 per cent., were recovered, particulars as to position of recapture being recorded for 47. Nineteen (40·4 per cent.) travelled to the north and east; 16 (34 per cent.) to the south and west; 6 (12·8 per cent.) to the north and west; 4 (8·5 per cent.) directly west; and 1 each to the south-east and directly east.

These particulars are set forth in the following table :—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. Sept. 1911. Oct. 1911. Nov. 1911.	N. and E.	1	6·6	N. 35° E.	42·	11·6	..	..
	N. and W.	3	20·	N. 60° W.	31·	8·7	28·5-36·6	1-12·9
	S. and E.	1	6·6	S. 1° E.	102·	16·2	..	..
	S. and W.	9	60·	S. 67° W.	22·	20·3	12-40·5	1·5-40
	W.	1	6·6	W.	30·	18·7	..	..
		15	24·6	..	..	..	12-40·5	1·5-40
II. Dec. 1911. Jan. 1912. Feb. 1912	N. and E.	6	42·8	N. 21° E.	69·	4·6	30-151·5	1·8-10·5
	N. and W.		Nil.					
	S. and E.		Nil.					
	S. and W.	6	42·8	S. 69° W.	33·	2·8	13·5-97	1·5-6·4
	W.	2	14·3	W.	22·	2·3	17-28	1·9-2·6
		14	22·9	..	..	..	13·5-151·5	1·5-10·5
III. Mar. 1912. April 1912. May 1912.	N. and E.	5	55·5	N. 25° E.	80·	3·6	19-208·5	1-9·26
	N. and W.	2	22·2	N. 7° W.	24·	1·03	15·5-32·5	·7-1·4
	S. and E.		Nil.					
	S. and W.		Nil.					
	E.	1	11·1	E.	2·	·9	..	..
	W.	1	11·1	W.	20·	·9	..	..
		9	14·8	..	..	..	15·5-208·5	·7-9·26
IV. June 1912. July 1912. Aug. 1912.	N. and E.	7	77·8	N. 21° E.	71·	2·2	26·5-117·5	·9-3·5
	N. and W.	1	11·1	N. 79° W.	21·	·77	..	..
	S. and E.		Nil.					
	S. and W.	1	11·1	S. 46° W.	8·	·3	..	..
		9	14·8	..	..	..	..	..
SUMMARY.	N. and E.	19	40·4					
	N. and W.	6	12·8					
	S. and E.	1	2·1					
	S. and W.	16	34·					
	W.	4	8·5					
	E.	1	2·1					
		47	77·					

Five of the remaining fishes were recaptured in 1912. Two were taken in September, 1, a female, of 40-42·7 cm., and "nearly ripe," after 376 days, on the station, without having apparently migrated at all; the other was a male, of 36·5-39·2 cm., also taken after 376 days, offshore, to the south and east of Buchanness, at a distance of 59 miles.

Two females were recaptured in October, 1, of 42-46·6 cm., after 391 days, to the east of the Bell Rock, at a distance of 15 miles; the other, measuring 40-44·3 cm., was caught, after 402 days, far offshore, to the east of the Berwickshire coast, at a distance of 50 miles to the south and east.

A female, of 36·5-48·4 cm., was caught in November, after 431 days, 26 miles farther to the east, at a depth of 40 fathoms.

Five were taken in 1913. In March, 2 females and 1 male were got; 1 of the females, measuring 43-46 cm., and "spent," was caught, after 561 days, in the Firth of Forth, near Elie, at 46 miles distant to the westwards; the other female, of 41·5-44·5 cm., was taken 26 miles E.  $\frac{1}{4}$  S. of Scarborough, 132 miles to the south and east; the condition of the ovaries was not recorded; the male, of 33·5-37·9 cm., and described as "spent," was caught, after 555 days, off Noss Head, at a distance of 131 miles to the north and east.

A female, of 38·41·1 cm., and "spent," was recovered in July, after 665 days, 15 miles to the westwards.

In December, after 817 days, another female, of 35·5–46·2 cm., was taken, off Noss Head, 128 miles to the north-east.

One fish only was got in 1914. It was a female, of 40·5–48·2 cm., and "spawning," taken in February, after 897 days, near Aberdeen, at 52 miles distant to the north and west.

A summary of the mean distance and direction in each quadrant, travelled by all the marked fish recaptured from this experiment, is given in the following table:—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	5	467	93	N. 24° E.
	Adult Females.	17	1204	71	N. 21° E.
		22	1671	76	N. 22° E.
N. and W.	Adult Males.	1	28	28	N. 85° W.
	Adult Females.	8	247	31	N. 39° W.
		9	275	31	N. 44° W.
S. and E.	Adult Females.	3	208	69	S. 45° E.
	Immature Females.	1	102	102	S. 1° E.
		4	310	77	S. 34° E.
S. and W.	Adult Males.	6	171	28	S. 61° W.
	Adult Females.	6	121	20	S. 65° W.
	Immature Females.	3	67	22	S. 77° W.
	? Sex.	1	40	40	S. 79° W.
		16	399	25	S. 67° W.
W.	Adult Males.	1	28	28	W.
	Adult Females.	3	42	14	W.
	Immature Females.	2	50	25	W.
		6	120	20	W.
E.	Adult Males.	1	2	2	E.
SUMMARY.					
N. and E.		22	1671	76	N. 22° E.
N. and W.		9	275	31	N. 44° W.
S. and E.		4	310	77	S. 34° E.
S. and W.		16	399	25	S. 67° W.
W.		6	120	20	W.
E.		1	2	2	E.
		58	..	..	....

*Distances travelled—Under 10 miles*—Four of the fish, or 6·9 per cent., were recaptured at distances of from 2 to 10 miles, viz. 2 males (14·3 per cent.), with an average of 5 miles, and 2 females (4·6 per cent.), with an average of 9·5 miles. Two were found to the south and west, 1 to the east, and 1 to the west.

*10 to 20 miles.*—Eleven, or 18·9 per cent., were got at distances of from 12 to 19 miles, viz. 3 males (21·4 per cent.), with an average of 14·3 miles, and 8 females (18·6 per cent.), with an average of 15·6 miles. All the males and 3 of the females

went south and west, in the direction of the mouth of the Firth of Forth; 2 of the females moved directly west, 2 to the north and west, and 1 to the north and east.

*Under 20 miles.*—Thus, 15, or 25·8 per cent., were taken within 20 miles of the station, 5 males (35·7 per cent.), with an average of 10·6 miles, and 10 females (23·2 per cent.), with an average of 14·4 miles.

*20 to 50 miles.*—Twenty-six of the recaptured plaice or 44·8 per cent., were taken at distances of from 20 to 47 miles, 5 males (35·7 per cent.), with an average of 29·9 miles, 20 females (46·5 per cent.), with an average of 33·5 miles, and 1 whose sex was not recorded. One of the males and 2 of the females were found directly west, towards the Firth of Forth; 1 of the males and 5 of the females went north and west, mostly towards the Firth of Forth; 2 males and 7 females went north and east; 1 male and 5 females were found to the south and west, as was also the fish of unknown sex; and 1 female was got to the south and east.

*50 to 100 miles.*—Eight of the recaptured plaice, or 13·8 per cent., were taken at distances of from 50 to 97½ miles, viz. 2 males (14·3 per cent.), with a mean of 78 miles, and 6 females (13·9 per cent.), with a mean of 62·7 miles. One of the males and 4 of the females went to the north and east, off the coast of Aberdeenshire; the other male went south and west to off Hartlepool; 1 female was found to the north and west, off Aberdeen, and another to the south and east.

*Over 100 miles.*—Nine were recovered at distances of from 102 to 208 miles, 2 males (14·3 per cent.), with an average of 169·7 miles and 7 females (16·3 per cent.), with a mean of 122 miles. The 2 males and 5 females were taken to the northwards, off Buchanness, in the Moray Firth, and on the north coast of Scotland, while 2 of the females were caught to the south-east, off Whitby and Scarborough.

#### MATURITY.

*Males.*—Of the 14 males recaptured, the condition of the testes was ascertained only in 8.

One, of 34–38 cm., taken in June 1912, after 276 days, at a distance of 8 miles to the south and west, was described as “ripe.” Two were “nearly ripe,” 1, of 35–34·8 cm., got in December 1911, after 92 days, 16 miles to the south and west, and the other, of 39–38·4 cm., also found in December, after 108 days, 28 miles to the westwards.

One was “spent”; it measured 33·5–37·9 cm., and was caught off Noss Head, Moray Firth, in March 1913, after 555 days.

Another, of 39–38·5 cm., was described as “nearly half-ripe,” and was caught in October 1911, after 22 days, 28 miles to the north and west.

The remaining 3 were “immature”; 2 were taken in the month of September, and 1 in October.

*Females.*—Of the 46 females caught, the condition of the ovaries was recorded for 36.

One, measuring 40·5–48·2 cm., was “spawning,” and was taken in February 1914, after 897 days, at Aberdeen Bay, a distance of 52 miles to the north and west.

Two were “ripe”; 1, of 40–40 cm., was caught in February 1912, after 164 days, off Whitehills, Banff, in the Moray Firth, at a distance of 110 miles; the other, of 41·5–41·7 cm., was taken in March 1912, after 181 days, near Buchanness, at a distance of 60 miles to the northwards.

Five were “nearly ripe”; 1, of 44·5–44 cm., was found in October 1911, after 27 days, 30 miles to the south and west, east of St. Abb's Head; the second, measuring 54–54·1 cm., was taken in November 1911, after 59 days, 36 miles to the north and west, off St. Andrews Bay; the third, measuring 44–46 cm., was caught in January 1912, after 133 days, near Aberdeen, at a distance of 47 miles to the northwards; the fourth, of 38·5–39 cm., was recaptured in February 1912, after 144 days, near the Orkney Isles, at a distance of 151 miles; the position where the remaining female was taken is unknown.

Two were described as “spent”; 1, of 43–46 cm., was got in March 1913, after 561 days, in the Firth of Forth, between St. Monans and Pittenweem, at a distance of 46 miles; the other, of 38–41·1 cm., was caught in July 1913, after 665 days, 15 miles to the westwards. Another female, of 38·5–42·6 cm., was taken in June 1912, after 273 days, 21 miles to the north and west, and was described as “apparently spent.”



One was "three-quarters ripe"; it measured 41-43.2 cm., and was recovered in August 1912, after 351 days, 50 miles N.N.E. of Buchanness, a journey of 117 miles.

Three were said to be "fully half-ripe," 2 being recaptured in October 1911, 1, measuring 37.5-38.3 cm., 30 miles to the north-west, and the other, of 40-41.2 cm., 42 miles to the north and east; the position of the third was not recorded. One, of 42.5-44.3 cm., was described as "about half-ripe"; it was recaptured in August 1912, far offshore, to the north-east of Buchanness, at a distance of 112 miles. A female, of 41-44.6 cm., taken in June 1912, offshore, at a distance of 47 miles to the north and east, was said to be "a quarter ripe."

All the other females of adult size were "immature." Three were caught in the month of April; 1, of 41-42.5 cm., after 231 days, 15 miles to the north and west; another, of 39.5-41 cm., after 227 days, off Buchanness, at a distance of 65 miles to the north and east; the third, after 229 days, 32 miles to the north and west.

A female, which measured only 34-36.2 cm., and was caught in February 1912, after 156 days, 24 miles to the south and west, was described as "half-ripe."

### EXPERIMENT III.

12th June 1912.

The number of plaice marked and liberated in this experiment was 90, comprising 27 males, 60 females, and 3 whose sexes were not determined. The sizes of the males ranged from 29.5-41 cm., and 12 were under the adult size (33 cm.); the sizes of the females ranged from 24.5-48 cm., and 40 were under the adult size (38 cm.). The numbers liberated and recaptured are shown in the following table, arranged in groups of 5 cm. :—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	Total.
F. Lib. . . . .	10*	24	16	8	2	60
F. Recap. . . . .	7	17	7	5	—	36
M. Lib. . . . .	5	18	3	1	—	27
M. Recap. . . . .	2	11	3	—	—	16
? Lib. . . . .	—	1	1	—	—	3†
? Recap. . . . .	—	1	—	—	—	2†

\* One at 24.5 cm.

† Two no sizes given.

The plaice used in this experiment were trawled by the "Goldseeker" in Kirkcaldy Bay, Firth of Forth, on the 11th June 1912, and were marked and put in tanks between 2.50 and 3.55 p.m.; they were liberated at 1.20 p.m. on the following day. Eighteen of the marked fish, on this occasion, died while in the tanks.

The number recaptured was 54, or 60 per cent., viz. 16 males (59.3 per cent.), 36 females (60 per cent.), and 2 whose sexes were unknown.

Thirteen of the males were of adult size, measuring, on recapture, from 34.6-41.9 cm., with an average of 38.3 cm., compared with 29.5-37.5 cm., and a mean of 33.5 cm. on liberation; the fish were at liberty for from 17 to 1377 days, the mean being 453 days; the distances migrated varied from 9 to 194 miles, with an average of 58.2 miles, and a mean rate of movement, per 10 days, of 1.3 miles.

Three males were immature, the average size being 32.4 cm., as compared with 32 cm. on liberation; they were free for an average period of 132 days, the average distance travelled being 20.6 miles, and the mean rate of movement 1.56 miles per 10 days.

Twelve of the females were of adult size on recapture, averaging 43 cm., and ranging from 38.5-49.3 cm., as compared with an average size of 38.9 cm., and a range of 33.5-44.5 cm. on liberation; they were at liberty for from 26 to 1001 days, the mean being 466 days; they moved journeys of from 3½ to 120 miles, the average being 45 miles, and the mean rate of migration, per 10 days, .97 mile.

Twenty-four of the females were under adult size, ranging from 29.4-37.5 cm., the mean being 33.9 cm., as compared with a variation of from 28 to 38 cm., and a mean of 32.5 cm. on liberation; they were free for from 15 to 400 days, the average being 142.6 days; the distances moved ranged from 3½ to 59 miles, the mean being 27.7 miles, and the mean rate 1.99 miles per 10 days.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In June 1912, which is included in this period, 2 males and a female were recaptured. One of the males, of 33–32·5 cm., and “spent,” was taken the next day after liberation, at a position described as 23½ miles S.E. ¼ S. of Tod Head, which represents a distance of 21 miles to the north-west; the fish was taken by an English trawler and landed at North Shields. The other male, which measured 35–34·6 cm., and was “immature,” was got, after 17 days, 9 miles to the north and west. The female, which was 34·5–33·1 cm., was taken, after 15 days, 3½ miles to the westward.

In July, 9 fish, all females, were recaptured, all but 1 being under adult size. One, measuring 38·5–38·8 cm., was recovered, after 26 days, off St. Abb’s Head, at a distance of 24 miles. Another, of 35·5–36 cm., was also captured to the east of St. Abb’s Head, at a distance of 28 miles to the south and west. A third, measuring 35–35 cm., was taken, after 30 days, 15 miles to the south and west. A fourth, of 38–37·5 cm., was recaptured, after 45 days, to the north-east of St. Abb’s Head, at a distance of 14 miles to the south-east of the station. The fifth, measuring 37–37·1 cm., was taken, after 42 days, north-east of the Bell Rock, at a distance of 25 miles. The sixth, of 32·5–32·9 cm., was caught, after 36 days, 15 miles to the north-west. The seventh, of 38–37·3 cm., was found, after 40 days, at a distance of 13 miles in the same direction. The 2 remaining fish moved directly west, 1, of 32–31·7 cm., being taken, after 37 days, at a distance of 32 miles, near the Isle of May, and the other, which measured 31–30·6 cm., in the same direction, at 12 miles distant, after 29 days.

Two females were recovered in August, 1, of 41·5–41·3 cm., after 64 days, at 3½ miles to the north and east, and the other, of 35 cm., on liberation was taken, after 75 days, to the south-east of Longstone Light, at 59 miles distant.

In the first quarter, then, 14 fishes were recaptured, or 25·9 per cent., 2 males and 12 females. Five (35·7 per cent.) had migrated north and west, towards the coast; 4 (28·6 per cent.) to the south and west, towards the Firth of Forth; 2 had moved south and east; 2 west; and 1 north and east.

*Second Quarter.*—In September, 4 fish were taken, 3 females and 1 male, the females all being under the adult size. The male, which measured 36·5–37·8 cm., was caught, after 92 days, 18 miles to the south and west. One of the females was got in the same locality, at a distance of 16½ miles, after 104 days. Another was taken, after 90 days, off the Isle of May, at 32 miles distant to the south and west. The remaining female was recaptured, after 86 days, 13 miles to the south and west.

One female was recovered in October, off St. Abb’s Head, at a distance of 24 miles, after 125 days; it measured 28–29·4 cm.

Two females were recaptured in November. One, of 34–37·5 cm., was taken, after 161 days, 23 miles to the south and west. The other, which measured 30–32·1 cm., was caught, after 145 days, 24 miles to the south and west, towards the Firth of Forth.

Thus, 7 fish, or 12·9 per cent., were recaptured in the second quarter, all of them to the south and west.

*Third Quarter.*—In December 1912, 3 males were taken, 1, measuring 32–32·4 cm., after 194 days, 15 miles to the west. Another, of 32–35·2 cm., and “nearly spent,” was got, after 196 days, off Sule Skerry, on the north coast of Scotland, at a distance of 194 miles. The third male, of 31–32·5 cm., and described as “very immature,” was caught, after 201 days, to the north and west, off St. Andrews Bay, at 26 miles distant.

In January 1913, a female was taken, after 222 days, at a locality unspecified.

In February, seven plaice were recovered, 2 males and 5 females. One of the males, which measured 37·5–38 cm., but the condition of whose testes was not determined, was caught, after 238 days, offshore, at 139 miles to the south-east (54° 20' N.; 0° 30' E.). The other male, of 34–37·2 cm., and “spawning,” was recaptured to the south-east of Aberdeen, at a distance of 37 miles, after 260 days. One of the females, which measured 38–40·8 cm., and was “immature,” was got, after 237 days, near Aberdeen, at a distance of 47 miles. Another female, which was 41·5–41·6 cm., and is described as “apparently spent,” was found, after 259

days, off Fife Ness, at a distance of 31 miles to the westwards. The other 3 females were under the adult size. One was taken, after 238 days, 26 miles to the north and east; another, after 248 days, was got in St. Andrews Bay, close inshore; and the third, after 253 days, well into the Firth of Forth, to the west of Elie, at a distance of 58 miles.

In the third quarter, therefore, 11 fishes, or 20·4 per cent., were recaptured, but the position of 1 was not recorded; of the others, 5 (50 per cent.) went north and west, towards the coast, and 3 north and east; 1 went south and east, and 1 directly west.

*Fourth Quarter.*—A female, of 34–37·2 cm., and “immature,” was recaptured in March 1913, after 285 days, offshore, off Aberdeen, at a distance of 43 miles.

In April, after 296 days, a female, of 42–45·3 cm., and “spent,” was taken 5 miles to the east.

Four were caught in May, 1 male and 3 females. The male, measuring 35·5–37·3 cm., and “spent,” was caught, after 350 days, off Montrose, at a distance of 31 miles to the north and west; one of the females, of 37·5–41·7 cm., the condition of whose ovaries was not recorded, was taken, after 337 days, at a distance of 15½ miles in the same direction; another, measuring 30·5–33·5 cm., and “immature,” was recovered, after 328 days, off Dunbar, 34 miles to the south and west; and 1, of 30·5–33·5 cm., and “immature,” was caught, after 352 days, to the north of Aberdeen, at a distance of 59 miles.

Thus, in the fourth quarter, 6 plaice, or 11·1 per cent., were recaptured, 2 to the north and east, 2 to the north and west, 1 to the east, and 1 to the south and west.

In the 12 months immediately following liberation, 38 of the marked plaice, or 70·4 per cent., were taken, but the place of capture of 1 was not known. Twelve (32·4 per cent.) migrated north and west, towards the coast; 6 (16·2 per cent.) to the north and east; 12 (32·4 per cent.) to the south and west, towards the Forth; 3 each to the west and to the south and east, and 1 to the east.

Particulars for all the fish recovered in the first year after liberation are shown in the following table :—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. June 1912. July 1912. Aug. 1912.	N. and E.	1	7.1	N. 56° E.	3.5	.55	..	..
	N. and W.	5	35.7	N. 45° W.	14.	45.3	3.5-25	2.3-2.10
	S. and E.	2	14.3	S. 13° E.	36.	5.5	14-59	3.1-7.9
	S. and W.	4	28.6	S. 51° W.	21.	6.6	15.5-28	4.3-9.4
	W.	2	14.3	W.	22.	6.4	12-32	4.1-8.6
		14	25.9	..	..	..	..	..
II. Sept. 1912. Oct. 1912. Nov. 1912.	N. and E.	..	Nil.					
	N. and W.	..	Nil.					
	S. and E.	..	Nil.					
	S. and W.	7	100.	S. 59° W.	22.	1.9	13-32	1.4-3.5
		7	12.9	..	..	..	..	..
III. Dec. 1912. Jan. 1913. Feb. 1913.	N. and E.	3	30.	N. 9° E.	86.	4.1	26-194	1.1-9.9
	N. and W.	5	50.	N. 64° W.	42.	1.7	26-58.	1.2-2.3
	S. and E.	1	10.	S. 11° E.	139.	5.8	..	..
	S. and W.	1	Nil.					
	W.	1	10.	W.	15.	.8	..	..
		10	18.5	..	..	..	..	..
IV. Mar. 1913. April 1913. May 1913.	N. and E.	2	33.3	N. 11° E.	51.	1.6	43-59	1.5-1.7
	N. and W.	2	33.3	N. 35° W.	23.	.7	15.5-31	.5- .9
	S. and E.	1	Nil.					
	S. and W.	1	16.6	S. 78° W.	34.	1.03	..	..
	E.	1	16.6	E.	5.	.17	..	..
		6	11.1	..	..	..	..	..
SUMMARY.	N. and E.	6	16.2					
	N. and W.	12	32.4					
	S. and E.	3	8.1					
	S. and W.	12	32.4					
	E.	1	2.7					
	W.	3	8.1					
		37	68.5					

Six of the remaining fish recaptured were taken in the remainder of 1913, 8 in 1914, 1 in 1915, and 1 in 1916.

In June 1913, after 363 days, a female, of 34.5-38.8 cm., and "immature," was caught near the Isle of May, 34 miles to the south and west.

Two males and a female were recovered in July, the female, of 32-35 cm., after 400 days, east of St. Abb's Head, at a distance of 20 miles to the south and west, one of the males, of 36-40.6 cm., after 393 days, near the Bell Rock, at a distance of 29 miles to the north and west, and the other, of 33-38 cm., after 407 days, in the same locality, at a distance of 28 miles.

In October, a male, of 32.5-39.2 cm., and "fully half ripe," was captured, after 477 days, in the Firth of Forth, off Elie, at a distance of 46 miles to the north and west; one, of unknown sex, and whose size, by an omission, was not recorded on liberation nor on recapture, was caught, after 491 days, north of the Great Fisher Bank (58° 18' N.; 4° 2' E.) at a depth of 37 fathoms, the distance being 190 miles eastward from the station; it was taken by an English trawler and landed at Hull, but only the label came into my possession.

A male, measuring 31-40.3 cm., and "immature," was taken in February 1914, after 616 days, off Tod Head, 29 miles to the northward.

Two females were got in March 1914, one, of 33.5-38.5 cm., after 643 days,

near the Isle of May, at a distance of 30 miles westward, and the other, of 42-44·7 cm., after 639 days, off Flamborough Head (54° 35' N. ; 0° 22' E.), at a distance of 120 miles to the south-east ; it was "immature."

In May 1914, a male, of 30·5-39 cm., was recaptured at a distance of 13 miles to the north-west, after 706 days, and one of unrecorded sex, which measured 34-43 cm., and was "spent," was taken, after 691 days, 17 miles to the south and west.

In July, after 758 days, a male which measured 33-41·9 cm., and was "immature," was recovered offshore, to the south-east of Aberdeen, at a distance of 37 miles.

Two females were got in October, one, measuring 44·5 cm. on liberation and "half ripe," after 863 days, north-east of St. Abb's Head, at a distance of 24 miles to the south-west ; the other, of 39-49 cm., and described as "about three-quarters ripe," was taken offshore to the north-east of Kinnaird Head, at a distance of 103 miles, after 868 days.

In March 1915, a female, which measured 35-46·8 cm., and was "spawning," was recovered, after 1001 days, off Banff, at 109 miles distant.

In March 1916, a male, of 29·5-38·4 cm. and "immature," was taken, after 1377 days, in the Moray Firth, off Sarclet, Caithness, at a distance of 146 miles.

Particulars of all the marked fish recaptured from this experiment are set forth in the following table :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	4	414	103	N. 15° E.
	Adult Females.	3	215	72	N. 25° E.
	Immature Females.	3	128	42	N. 8° E.
		10	757	76	N. 16° E.
N. and W.	Adult Males.	6	156	26	N. 59° W.
	Immature Males.	2	47	23	N. 39° W.
	Adult Females.	3	93	31	N. 38° W.
	Immature Females.	5	145	29	N. 69° W.
		16	441	28	N. 56° W.
S. and E.	Adult Males.	1	139	139	S. 11° E.
	Adult Females.	1	120	120	S. 13° E.
	Immature Females.	2	73	36	S. 13° E.
		4	332	83	S. 13° E.
S. and W.	Adult Males.	1	18	18	S. 75° W.
	Adult Females.	3	82	27	S. 67° W.
	Immature Females.	11	244	22	S. 55° W.
	? Sex.	1	17	17	S. 84° W.
		16	361	23	S. 61° W.
E.	Adult Females.	1	5	5	E.
	„ ? Sex.	1	190	190	E.
		2	195	97	E.
W.	Immature Males.	1	15	15	W.
	Adult Females.	1	30	30	W.
	Immature Females.	2	44	22	W.
		4	89	22	W.
N.	Adult Males.	1	29	29	N.
SUMMARY.					
N. and E.		10	757	76	N. 16° E.
N. and W.		16	441	28	N. 56° W.
S. and E.		4	332	83	S. 13° E.
S. and W.		16	361	23	S. 61° W.
E.		2	195	97	E.
W.		4	89	22	W.
N.		1	29	29	N.
		53	..	..	..

*Distances travelled*—10 miles and under.—Four fish, or 7·5 per cent., travelled journeys of from 3½ to 9 miles, namely, 1 male and 3 females. The male and 1 of

the females moved to the north and west, another of the females to the north and east, and the remaining female to the east.

*10 to 20 miles.*—Twelve fish, or 22·6 per cent., migrated distances of from 12 to 18 miles, namely, 3 males (18·7 per cent.), with an average of 15·5 miles, and 8 females (22·8 per cent.), with an average of 14·4 miles. One of the males and 1 of the females went directly west, 1 male and 2 females north and west, 1 male and 4 females south and west, and 1 female south and east; 1 of unknown sex was got 17 miles to the westward.

*Under 20 miles.*—Thus, under 20 miles, 16 fish, or 30·2 per cent., were recaptured; 4 males (25 per cent.), with an average of 13·9 miles, and 11 females (31·4 per cent.), with an average distance of 11·5 miles.

*20 to 50 miles.*—Twenty-seven fish, or 51 per cent., migrated distances of from 21 to 47 miles, namely, 9 males (56·2 per cent.), with an average of 31·6 miles, and 18 females (51·4 per cent.), with an average of 30·5 miles. One of the males went directly north and 2 of the females directly west; 6 males and 4 females went north and west; 2 males and 2 females to the north and east; and 10 females to the south and west.

*50 to 100 miles.*—Three fish, or 5·7 per cent., were found at distances between 50 and 100 miles. They were all females (8·6 per cent.), with an average of 58·6 miles. One was taken to the north and east, off Aberdeen; another westwards in the Firth of Forth; and the third to the south and east.

*Over 100 miles.*—Seven fish, or 13·2 per cent., migrated distances of from 103 to 194 miles, namely, 3 males (18·75 per cent.), with an average of 159·8 miles, and 3 females (8·6 per cent.), with an average of 111 miles. Two of the males were taken to the north and 1 to the south and east, and 2 of the females were also found to the north and 1 to the south and east. One whose sex was not determined was recovered near the Great Fisher Bank, 190 miles to the eastward.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 14 of the 16 males recaptured.

Two were "spawning," both taken to the north and east, 1, of 34–37·2 cm., in February 1913, after 260 days, off Aberdeen, at a distance of 37 miles, and the other, in December 1912, after 196 days, off Sule Skerry, on the north coast of Scotland, at a distance of 194 miles.

One male is described as "spent." It measured 35·5–37·3 cm., and was recaptured in May 1913, after 350 days, off Montrose, at a distance of 31 miles.

A male, of 32·5–39·2 cm., was taken in the Firth of Forth, off Pittenweem, at a distance of 46 miles, in October 1913, and was "fully half ripe."

Among the males with "immature" testes, 2 were got within the limits of the spawning season, 1 in February 1914, after 616 days, 29 miles to the north, 31–40·3 cm. in length; the other, of 29·5–38·4 cm., was taken in March 1916, after 1377 days, off Sarclet, in the Moray Firth, at a distance of 146 miles.

Among the males under adult size on recapture, 1, measuring 33–32·5 cm., taken in June 1912, on the next day after liberation, at a distance described as 21 miles north and west, was said to be "spent."

*Females.*—The condition of the ovaries was recorded in 30 of the 36 recaptured females.

One was "spawning"; it measured 35–46·8 cm., and was caught in March 1915, after 1001 days, off Banff, in the Moray Firth, at a distance of 109 miles.

One was described as "spent"; it measured 42–45·3 cm., and was recovered in April 1913, after 296 days, 5 miles to the eastward. Another, of 41·5–41·6 cm., caught in February 1913, after 259 days, 31 miles to the north and west, was described as "apparently spent."

A female, of 39–49 cm., caught in October 1914, after 868 days, north-east of Rattray Point, at a distance of 103 miles, was "about three-quarters ripe"; and another, also taken in October 1914, after 863 days, 24 miles to the west and south, was "half-ripe."

Among the females under adult size on recapture, whose ovaries were "im-

mature," 2 were taken within the limits of the spawning season; 1, measuring 33.5-38.5 cm., was caught in March 1914, 30 miles to the westward; the other, measuring 38-40.8 cm., was recaptured near Aberdeen, in February 1913, at a distance of 47 miles.

## EXPERIMENT IV.

12th June 1913.

In this experiment, 119 plaice were marked and liberated, consisting of 36 males, 82 females, and 1 whose sex was not ascertained. The sizes of the males varied from 27 to 45 cm., and 11 were under adult size (33 cm.). Of the females, the sizes were from 24.5 to 56.5 cm., and 25 were under adult size (38 cm.). The numbers liberated and recaptured, arranged in 5-cm. groups, are shown in the following table:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	cm. 56-60.5	Total.
F. Lib.	9*	6	30	24	9	3	1	82
F. Recap.	2	2	13	13	5	2	1	38
M. Lib.	7	9	15	5	—	—	—	36
M. Recap.	4	3	7	2	—	—	—	16
? Lib.	1	—	—	—	—	—	—	1
? Recap.	—	—	—	—	—	—	—	0

\* One at 24.5 cm.

The fish were caught at the place where they were liberated, viz. 40 miles east of the Isle of May.

The number recaptured was 54, or 45.4 per cent., viz. 16 males (44.4 per cent.) and 38 females (46.3 per cent.). Thirteen of the males were over adult size on recapture, ranging from 36.5-44.7 cm., with an average of 39.9 cm., compared with a range of 30-42.5 cm., and an average of 37.3 cm. on liberation; they were at liberty for from 53 to 993 days, the mean being 335 days; they migrated distances of from 10½ to 149 miles, the mean being 64.5 miles, and the average rate of movement 1.9 miles per 10 days. Three of the males were under adult size, the average being 28.8 cm., compared with 28.3 cm. on liberation; they were free for a mean period of 76 days, and travelled an average distance of 23.5 miles, at a mean rate of 3.1 miles. Thirty-four of the females were of adult size on recapture, the average being 44.9 cm., and the range from 38.8 to 55.3 cm., compared with an average of 42.6 cm., and a range of 29 to 56.5 cm. on liberation; the periods of freedom varied from 29 to 989 days, the mean being 290 days; the distances travelled varied from 11 to 141 miles, the average being 36.5 miles, and the mean rate 1.35 miles. Four were under adult size, the mean being 33.9 cm., as compared with 32.7 cm. on liberation; they were at liberty for an average of 147 days, and travelled a mean distance of 32.2 miles, at an average rate of 2.2 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—None of the fish was recovered in June. In July, 6 were taken, 1 male and 5 females. The male was caught off St. Abb's Head, after 29 days, a distance of 26 miles to the south and west. A female, of 34-34 cm., was taken 5 miles to the south and west, after 30 days; another, of 42.5-42.5 cm., was caught 19 miles to the south and east, after 34 days; a third, of 56.5-55.3 cm., was taken, after 44 days, 21 miles to the north and east; a fourth, of 53-52.7 cm., and described as "spent," was caught, after 29 days, in the same locality, a little farther to the west, at a distance of 21 miles; the fifth female, of 39.5-38.8 cm., was recaptured, after 43 days, south-east of Aberdeen, at a distance of 36 miles.

Eight were recaptured in August, 3 males and 5 females. All the males were taken to the south and west; 1, of 42.5-42 cm., after 53 days, 10½ miles distant; another, of 30.5-30 cm., after 72 days, 17 miles in the same direction, to the north-east of St. Abb's Head; the third, measuring 37-38.2 cm., after 68 days, to the east of the Isle of May, at a distance of 24 miles. One of the females, of 51-50.9 cm., and described as "spent," was taken, after 70 days, 23 miles to the south-west, north-east of Longstone Light; the other 4 females went to the northwards;

1, of 36·5–37·3 cm., was found, after 57 days,  $6\frac{1}{2}$  miles to the north ; 1, of 44·5–44 cm., was taken, after 74 days, 30 miles distant, south and east of Aberdeen ; after 79 days, another, measuring 42·5–41 cm., and described as “immature,” was got near the same place, at a distance of 33 miles ; and the remaining one, of 44–44 cm., was recaptured, after 65 days, farther offshore, at a distance of 31 miles.

In this quarter, therefore, 14 of the marked plaice, or 25·9 per cent. of the total, were recovered, 6 (42·8 per cent.) to the north and east (mean direction, N. 26° E.) ; 6 went to the south and west (mean direction, S. 39° W.) ; 1 was found to the north and west ; and 1 to the south and east.

*Second Quarter.*—Three females and a male were taken in September 1913, the male, of 40–40 cm., after 83 days, south-east of Tod Head, at a distance of 24 miles to the north and west. One of the females, measuring 38·5–39·9 cm., was recaptured after 103 days, at a distance of 11 miles to the west and south ; another, of 38–39·3 cm., was taken, after 95 days, to the east of the Isle of May, at a distance of 24 miles from the station ; another female, of 41·5–41·3 cm., was recaptured, after 107 days, offshore, 35 miles to the north and east.

In October, 4 were recaptured, 1 male and 3 females. The male, of 27·5–29·7 cm., was taken, after 127 days, close to the Bell Rock, at a distance of 27 miles to the north and west ; 1 of the females, measuring 41–40·5 cm., was got, after 113 days, east of the Isle of May, at a distance of 23 miles to the south and west ; another, of 37–40·7 cm., was caught, after 137 days, 30 miles to the eastwards, in the off shore waters ; the remaining female, which measured 42·5 cm. on liberation, was caught, after 120 days, in the Firth of Forth, off Portobello, at a distance of 62 miles.

None was taken in November.

In the second quarter, then, 8 fishes, or 14·8 per cent., were recovered, 4 (50 per cent.) to the south and west, 2 to the north and west, and 1 each to the north and east and south and east.

*Third Quarter.*—A male and a female were taken in January 1914 ; the male, which measured 45–44·7 cm., was “spawning,” and was recovered, after 226 days, in the Moray Firth, off Banff, at a distance of 108 miles ; the female, of 46·5–48·5 cm., was “spent,” and was recaptured, after 228 days, offshore, to the south-east of Aberdeen, at a distance of 37 miles. A male was taken in February, after 261 days, in the Moray Firth, off Brora, at a distance of 149 miles ; it measured 40–41·2 cm., and was “spawning.”

Thus, in this quarter, only three fishes, or 5·5 per cent., were recovered, all to the north and east.

*Fourth Quarter.*—Three males and 3 females were got in March 1914. One of the males, which measured 39·5–40·8 cm., was taken, after 262 days, 20 miles north-east of Scarborough, at a distance of 121 miles to the south and east ; the condition of its testes was not recorded ; another male, which measured 36–38·3 cm., and was “spawning,” was caught, after 277 days, south-east of Aberdeen, at a distance of 31 miles ; the third male, of 40–40 cm., was found 11 miles E.  $\frac{3}{4}$  S. of Clyth Ness, in the Moray Firth, at a distance of 133 miles, after 275 days ; the condition of the testes was not ascertained. One of the females, which measured 43·5–44·6 cm., and was “spawning,” was recaptured, after 268 days, 4 miles E.S.E. of Ord Head, in the Moray Firth, at a distance of 141 miles ; another, of 41·5–45·9 cm., and “spawning,” was taken, after 267 days, south-east of the Bell Rock, at a distance of 24 miles ; the remaining female, which was 40·5–41·6 cm., was taken offshore, to the east of St. Abb’s Head, after 277 days, at a distance of 16 miles ; the condition of the ovaries was not recorded.

In April, 3 females and 1 male were recaptured. The male, of 31·5–36·5 cm., and “immature,” was caught near the Bell Rock, at a distance of 33 miles, after 307 days. One of the females, which measured 45·5–48·6 cm., and was described as “immature,” was taken 11 miles to the west and north, after 313 days ; the other 2 females were taken off the coast of Aberdeen, 1, of 39–41·8 cm., and “spent,” near Buchanness, at a distance of 62 miles, after 306 days, and the other, also “spent,” offshore to the south-east of Buchanness, at a distance of 68 miles, after 314 days.

Four females were recaptured in May ; one, measuring 48·5–50·9 cm., and “spent,” after 344 days,  $15\frac{1}{2}$  miles to the north and east ; another, of 39·5–41·5 cm., and also “spent,” after 336 days, north of Aberdeen, at a distance of 54 miles ;



the third, of 41-43.5 cm., and "immature," was caught, after 334 days, near Buchanness, at a distance of 64 miles; and the fourth, which measured 40.5-44.1 cm., and was also "immature," after 349 days, offshore, east of St. Abb's Head, at a distance of 25 miles to the south and east.

In this quarter, 14 fish, or 25.9 per cent., were got, 7 (50 per cent.) to the north and east, 4 (28.6 per cent.) to the north and west, and 3 (21.4 per cent.) to the south and east.

In the 12 months after liberation, 39 or 72.2 per cent., were recovered, 17 (43.6 per cent.) to the north and east, 10 (25.6 per cent.) to the south and west, 7 (17.9 per cent.) to the north and west, and 5 (12.8 per cent.) to the south and east.

These particulars are set forth in the following table :—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles.)	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. June 1913. July 1913. Aug. 1913.	N. and E.	6	42.8	N. 26° E.	26	4.6	6.5-36	1.14-8.7
	N. and W.	1	7.1	N. 1° W.	21.5	7.4	..	..
	S. and E.	1	7.1	S. 53° E.	19.5	5.74	...	..
	S. and W.	6	42.8	S. 39° W.	17.6	3.6	5-26	1.6-8.97
			14	25.9	..	..	..	..
II. Sept. 1913. Oct. 1913. Nov. 1913.	N. and E.	1	12.5	N. 75° E.	35	3.27	..	..
	N. and W.	2	25	N. 35° W.	25	2.5	24-27.5	2.16-2.89
	S. and E.	1	12.5	S. 77° E.	30.5	2.2	..	..
	S. and W.	4	50	S. 81° W.	30.1	2.7	11-62.5	1.07-5.2
			8	14.8	..	..	..	..
III. Dec. 1913. Jan. 1914. Feb. 1914.	N. and E.	3	100	N. 19° E.	99	4.03	37.5-149.5	1.6-5.72
	N. and W.		Nil.					
	S. and E. S. and W.		Nil. Nil.					
		3	5.5	..	..	..	..	..
IV. Mar. 1914. April 1914. May 1914.	N. and E.	7	50	N. 12° E.	79.2	2.7	31-141.5	1.1-5.28
	N. and W.	4	28.6	N. 60° W.	21	.69	11-33	.35-1.07
	S. and E.	3	21.4	S. 9° E.	54	1.9	16-121	.58-4.61
	S. and W.		Nil.					
			14	25.9	..	..	..	..
SUMMARY.	N. and E.	17	43.6					
	N. and W.	7	17.9					
	S. and E.	5	12.8					
	S. and W.	10	25.6					
			39	72.2				

Of the rest of the plaice recaptured, 9 were taken in the remainder of 1914, 4 in 1915, and 2 in 1916.

In June 1914, 4 females and 1 male were caught, the male, of 36.5-39.8 cm., and "spawning" ("partly spent"), after 354 days, 18 miles to the north and west; 1 female, measuring 48-50.7 cm., and "spent," was taken, after 355 days, 14 miles in the same direction, and on the same day, another female, of 46.5-51.6 cm., and described as "immature," was got off Aberdeen, at a distance of 43 miles; after 359 days, another female, of 42.5-46.1 cm., and "immature," was taken offshore, to the south-east of Aberdeen, at a distance of 45 miles; the remaining female, which measured 27.5-30.3 cm., was recaptured within the Firth of Forth, off Leven, at a distance of 55 miles to the westwards.

A female, of 39.5-43.3 cm., was taken in July, after 400 days, offshore, to the south-east of Buchanness, at 53 miles distant.

In August, after 429 days, another female, of 33·5–42 cm., was taken in Aberdeen Bay, at the distance of 52 miles.

In November, after 530 days, a female, of 50–53·7 cm., and “fully half-ripe,” was caught, near Buchanness, 59 miles away.

In December, a female was taken, after 545 days, south-east of Aberdeen, at a distance of 30 miles; it measured 40–48·2 cm., and was “nearly ripe.”

In January 1915, after 587 days, a male, of 35·5–40·3 cm., and “ripe,” was caught north-east of Longstone Light, at a distance of 25 miles to the south and west.

Another male, of 31·5–37·3 cm., and “immature,” was taken in February, after 618 days, offshore, to the south-east of Aberdeen, at a distance of 26 miles.

In May, after 702 days, a female, measuring 29–38·8 cm., and “immature,” was recovered north-east of the Bell Rock, 24 miles away to the north and west.

In November, after 876 days, a female, of 40–44·1 cm., and “about three-quarters ripe,” was taken, offshore, to the eastwards, at a distance of 25 miles.

A female was recaptured in February 1916, after 989 days; it measured 41 cm. on liberation, but the size on recapture, and the place where it was caught, were not recorded.

The last fish of the experiment to be recovered was a male, of 30–40·4 cm., and “ripe,” which was captured in March 1916, after 993 days, to the south of Clyth Ness, in the Moray Firth, at a distance of 135 miles.

The following table shows the mean direction and distance, in each quadrant, for all the fish recaptured:—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	6	582	97	N. 10° E.
	Adult Females.	16	812	51	N. 27° E.
	Immature Females.	1	6	6	N. 5° E.
		23	1400	61	N. 22° E.
N. and W.	Adult Males.	3	75	25	N. 42° W.
	Immature Males.	1	27	27	N. 63° W.
	Adult Females.	7	161	23	N. 42° W.
	Immature Females.	1	55	55	N. 1° W.
		12	318	26	N. 40° W.
S. and E.	Adult Males.	1	121	121	S. 6° E.
	Adult Females.	5	115	23	S. 48° E.
		6	236	39	S. 41° E.
S. and W.	Adult Males.	3	59	19	S. 45° W.
	Immature Males.	2	43	21	S. 36° W.
	Adult Females.	4	81	20	S. 62° W.
	Immature Females.	2	67	33	S. 63° W.
		11	250	23	S. 53° W.
N.	Adult Females.	1	30	30	N.
<b>SUMMARY.</b>					
N. and E.		23	1400	61	N. 22° E.
N. and W.		12	318	26	N. 40° W.
S. and E.		6	236	39	S. 41° E.
S. and W.		11	250	23	S. 53° W.
N.		1	30	30	N.
		53	..	..	..

*Distances travelled*—10 miles and under.—Two females were recaptured at 5 and  $6\frac{1}{2}$  miles south and west and north and east respectively, 3·8 per cent. of the total fish recaptured, and 5·4 per cent. of the total females.

10 to 20 miles.—Nine, or 16·9 per cent., were taken at distances of from  $10\frac{1}{2}$  to  $19\frac{1}{2}$  miles, viz. 3 males (18·7 per cent.), with an average of 15·2 miles, and 6 females (16·2 per cent.), with an average of 14·5 miles; 2 of the males and 1 of the females were found to the south and west, the other male and 3 of the females being taken to the north and west, and 2 females to the south and east.

*Under 20 miles.*—Thus, 11 fish, or 20·7 per cent., were recovered at distances under 20 miles from the place of liberation, 3 males (18·7 per cent.), with an average of 15·2 miles, and 8 females (21·6 per cent.), with an average of 12·3 miles.

20 to 50 miles.—Twenty-seven of the fish, or 50·9 per cent., were recaptured at distances of from  $21\frac{1}{2}$  to 45 miles, viz. 8 males (50 per cent.), with a mean of 27·1 miles, and 19 females (51·3 per cent.), with an average of 29·7 miles. Three of the males and 3 of the females were found to the north and west, 2 males and 9 females to the north and east, 3 males and 3 females to the south and west, while 1 female was caught directly northwards.

50 to 100 miles.—Nine, or 16·9 per cent., were recaptured at distances of from 52 to 68 miles, the average being 58·9 miles; they were all females (24·3 per cent.), and 6 were caught to the north and east, 2 to the westwards, within the Firth of Forth, and 1 to the north and west.

*Over 100 miles.*—Six, or 11·3 per cent., were recovered at distances of from 103 to 149 miles; 5 were males (31·5 per cent.), with an average of 129·3 miles, and 1 (2·7 per cent.) was a female, which migrated 141 miles to the Moray Firth. Four of the males were taken in the Moray Firth, and 1, 20 miles north-east of Scarborough, 121 miles south and east.

#### MATURITY.

*Males.*—The condition of the testes was recorded in 13 of the 16 males recaptured.

Four were "spawning," one, of 36·5–39·8 cm., taken in June 1914, east of the Bell Rock, at a distance of 18 miles to the north and west; another, of 36–38·3 cm., was caught in March 1914, south-east of Aberdeen, at a distance of 31 miles; the third, which measured 45–44·7 cm., was recaptured in January 1914, off Banff, in the Moray Firth, at a distance of 108 miles; the fourth, of 40–41·2 cm., was also taken in the Moray Firth, in February 1914, off Brora, at a distance of 149 miles.

Two were described as "ripe"; 1, measuring 35·5–40·3 cm., was taken in January 1915, to the northward of Longstone Light, at a distance of 25 miles to the south and west; the other, of 30–40·4 cm., was caught in March 1916, in the Moray Firth, off Clyth Ness, at a distance of 135 miles.

Among those whose reproductive organs were described as "immature," 1, measuring 31·5–37·3 cm., was caught in February 1915, to the south-east of Aberdeen, at a distance of 26 miles; another, of 31·5–36·5 cm., was taken in April 1914, 33 miles to the north and west, near the Bell Rock.

*Females.*—The condition of the ovaries in 29 of the 38 recaptured was recorded.

Two were "spawning"; one, measuring 41·5–45·9 cm., was got in March 1914, to the westwards, at a distance of 24 miles, near the Bell Rock; the other, of 43·5–44·6 cm., was taken in March 1914 also, in the Moray Firth, off Ord Head, at a distance of 141 miles.

One, measuring 42·5–41 cm., caught on 30th August 1913, by an English trawler, south-east of Aberdeen, at a distance of 33 miles north and east from the station, was landed at Hartlepool, and is described as "mature."

One, of 40–48·2 cm., was taken in December 1914, south-east of Aberdeen, at a distance of 30 miles north of the station, and was "nearly ripe."

Eight were described as "spent"; one, of 46·5–48·5 cm., was taken in January 1914, offshore, to the east and south of Aberdeen, at a distance of 37 miles; another, of 48·5–50·9 cm., was recaptured in May 1914,  $15\frac{1}{2}$  miles to the north and west; a third, of 39·5–41·5 cm., was recovered also in May 1914, south of Buchanan-

ness, at a distance of 54 miles; a fourth, of 51-50.9 cm., was taken in August 1913, east of St. Abb's Head, at 23 miles distant to the south and west; the fifth, of 39-41.8 cm., was recaptured in April 1914, near Buchananness, at a distance of 62 miles; the sixth, measuring 48-50.7 cm., was caught in June 1914, 14 miles to the north and west; the seventh, of 40-43.4 cm., was taken in April 1914, offshore, south-east of Buchananness, at 68 miles distant, and the last, measuring 53-52.7 cm., was caught in July 1913, 21 miles to the northwards.

A female, measuring 40-44.1 cm., was taken in November 1915, offshore, 25 miles to the eastwards, and was "about three-quarters ripe"; and 1, of 50-53.7 cm., taken in November 1914, near Buchananness, at a distance of 59 miles, was "fully half ripe."

Among the females whose ovaries were "immature," 1 was recovered in April 1914, 11 miles to the north and west; it measured 45.5-48.6 cm. The others were taken mostly in the summer months.

#### EXPERIMENTS AT 50 MILES EAST OF ISLE OF MAY.

At this station, which lies approximately at 56° 24' North Latitude and 1° 6' West Longitude, with a depth of about 36 fathoms, marked plaice were liberated on two occasions, in July and in September 1912. The following table shows the particulars of these experiments:—

No. of Experiment.	Date.	No. of Fish.								Percentages Recaptured.			
		Marked.				Recaptured.							
		♂	♀	(?)	Total.	♂	♀	(?)	Total.	♂	♀	(?)	Total.
I.	6 July 1912.	47	58	2	107	32	39	...	71	68.1	67.2	...	66.3
II.	21 Sept. 1912.	37	61	2	100	12	24	...	36	32.4	39.3	...	36
	Total.	84	119	4	207	44	63	...	107	52.4	52.9	...	51.7

#### EXPERIMENT I.

6th July 1912.

In this experiment, 107 marked plaice were liberated, viz. 47 males, 58 females, and 2 whose sexes were not ascertained. The sizes of the males ranged from 28 to 45 cm., and 17 were under the adult size. The sizes of the females varied from 29 to 61 cm., and 43 were under the adult size. The numbers liberated and recaptured, arranged in 5-cm. groups, are shown in the following tables:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	cm. 61-65.5	Total.
F. Lib.	9	28	15	2	1	2	1	58
F. Recap.	7	18	10	2	1	1	—	39
M. Lib.	6	25	13	3	—	—	—	47
M. Recap.	3	18	10	1	—	—	—	32
? Lib.	—	1	1	—	—	—	—	2
? Recap.	—	—	—	—	—	—	—	—

The fish used were recaptured in Kirkcaldy Bay, Firth of Forth, and marked between 2 and 3 p.m. on the 5th July, and were set free at 5.40 a.m. on the 6th; only one died in the tanks, in the interval.

The number recaptured was 71, or 66.3 per cent., viz. 32 males, or 68.1 per cent., and 39 females, or 67.2 per cent.

Twenty-eight of the males, when recaptured, were of adult size, the average being 37.5 cm., and the range from 33.2 to 42 cm., as compared with a mean of

34.9 cm., and a range of 30 to 40 cm., on liberation. The periods of liberty varied from 24 to 794 days, the mean being 285 days. The distances migrated were from  $6\frac{1}{2}$  to 247 miles, the average being 65.7 miles, and the mean rate of movement, per 10 days, 2.3 miles.

Four of the males were under the adult size on recapture, the average being 31.9 cm., as compared with 32.1 cm. on liberation. The mean period of freedom was 31 days, and the average distance migrated 28.7 miles, the mean rate being 9.1 miles per 10 days.

Twenty of the females were of adult size on recapture, the average being 42.6 cm., and the range from 38.3 to 50.6 cm., as compared with an average of 37.5 cm., and a range of 29.5 cm. to 47.5 cm. on liberation. The periods of freedom were from 63 to 1011 days, the mean being 431 days. The distances moved were from  $14\frac{1}{2}$  to 131 miles, the average being 40.1 miles, and the mean rate .9 mile.

Nineteen of the females were under the adult size when recaptured, namely, from 29.5 to 37.7 cm., averaging 33.7 cm., as compared with a range of 29 cm. to 37.5 cm., and a mean size of 32.1 cm. on liberation. They were at liberty for from 17 to 591 days, the average being 195 days, and the distances travelled varied from 19 to 57 miles, the average being 34.1 miles, and the mean rate, per 10 days, 1.9 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Three males and 3 females were recaptured in July, all to the south and west, mostly towards the mouth of the Firth of Forth, and the coast south of it. One of the males, measuring 33–32.6 cm., was taken, after 9 days, east of St. Abb's Head, at a distance of  $19\frac{1}{2}$  miles; another, of 32.5–31.6 cm., was got, after 17 days, 15 miles distant; a third, measuring 37.5–37.1 cm., was recovered, after 24 days, north of St. Abb's Head, at a distance of  $38\frac{1}{2}$  miles. Of the females, one, of 34.5–33.1 cm., was taken, after 18 days,  $20\frac{1}{2}$  miles distant; another, of 29–29.5 cm., after 24 days, east of the Isle of May, at a distance of 34 miles; and the third, which measured 31.5–30.7 cm., after 17 days, nearly east of Longstone Light, at a distance of  $26\frac{1}{2}$  miles. The mean rates of movement of these fish were from 8.8 to 21.6 miles per 10 days.

A male and 2 females were recaptured in August; the male, of 31–32.2 cm., after 39 days, off the mouth of the Firth, at a distance of  $39\frac{1}{2}$  miles to the south and west; one of the females, of 31–31.2 cm., after 39 days, in the same locality, at a distance of 36 miles; and the other female, measuring 31.5–32 cm., after 44 days, a little to the east of the Isle of May, at a distance of 42 miles to the west.

Six were recaptured in September, 3 males and 3 females. One of the males, of 33–34.2 cm., had migrated 10 miles directly west in 78 days; another, of 32–31.5 cm., was found off Fife Ness, at a distance of 41 miles, after 61 days; the third male, of 37–37 cm., was taken, after 69 days, to the south east of Tod Head, at a distance of 26 miles to the north and west; one of the females, of 44–43 cm., was got, after 63 days, to the north-east of Longstone Light, at a distance of 32 miles to the south and west; another, of 30.5–31 cm., was caught, after 76 days,  $22\frac{1}{2}$  miles to the south and west, towards the Firth of Forth; the remaining female, of 35–35.5 cm., was recaptured, after 71 days, far offshore, to the south-east of Buchanness, at a distance of 57 miles to the north and east.

In the first quarter, therefore, 15 of the marked plaice, or 21.1 per cent., were taken, 10 (66.7 per cent.) to the south and west; 2 (13.3 per cent.) to the north and west; 2 to the west, and 1 to the north and east.

*Second Quarter.*—Three males and 1 female were recaptured in October, the female, of 32.5–33.6 cm., after 91 days, 19 miles to the north and west; 1 of the males, measuring 35–34.7 cm., was taken, after 94 days, 11 miles to the south and west; another, of 34.5–36.4 cm., was recaptured, after 107 days, off the Moray Firth, to the south-east of Noss Head, at a distance of 126 miles; the remaining male, which was 45 cm. on liberation, but whose size on recapture was not recorded, was taken, after 114 days, to the south-east of Longstone Light, at a distance of 71 miles to the south and east.

Three females and 2 males were taken in November, all described as "immature." One of the males, of 36.5–36.7 cm., was caught, after 137 days, north-east of Longstone Light, at a distance of 26 miles to the south and west; the

other, of 31·5–33·4 cm., was taken north-east of St. Abb's Head, at a distance of 24 miles to the south and west, after 135 days. One of the females, of 33–34·8 cm., was recaptured, after 146 days, to the north-east of St. Abb's Head, at a distance of 31 miles to the south and west; another, of 40·5–42·8 cm., was caught, after 125 days, south-east of Aberdeen, at a distance of 32 miles to the north and east; the remaining female, measuring 37·5–37·6 cm., was caught at Tod Head, at a distance of 44 miles, after 140 days.

Three males and 3 females were recaptured in December 1912; one of the males, which measured 36·5–38·2 cm. and was "three-quarters ripe," was taken, after 159 days, 6½ miles to the south and west; another, of 37·5–39 cm., was caught, after 165 days, 15 miles to the south and west; and the third, of 37·5–37·6 cm., and "spawning" ("partly spent"), was recaptured, after 162 days, south-east of Aberdeen, at a distance of 38 miles to the north. The position of recapture of one of the females was not ascertained; one of the others, measuring 39·5–41·2 cm., and "immature," was taken, after 158 days, 16½ miles to the north-west; and the other, of 39–40 cm., was caught, after 157 days, east of St. Abb's Head, at a distance of 22 miles to the south and west.

Thus, 15 plaice, or 21·1 per cent., were recaptured in this quarter, the position of capture being recorded for 14; of these, 7 (50 per cent.) were found to the south and west, 3 (21·4 per cent.) to the north and west, 2 to the north and east, and 1 each to the south and east, and to the north.

*Third Quarter.*—Four males and 3 females were recaptured in February 1913. Four were got in the same locality, at Aberdeen Bank, viz. 3 males and a female. The males measured respectively 35·5–38·1 cm., 38–39·1 cm., and 39·5–41·4 cm.; the first and the third were "spawning," and the second "ripe"; they were taken, the first and second, after 223 days, at a distance of 37 miles, and the third, after 235 days, at a distance of 35½ miles to the northwards. The female, which measured 41–41·9 cm., and was "spawning," was taken, after 230 days, at a distance of 35 miles. The remaining male, measuring 34–35·9 cm., was recaptured, after 213 days, in the Moray Firth, off Banff, at a distance of 110 miles, and was "ripe." The other 2 females were recaptured in the Firth of Forth; 1, measuring 33–36·3 cm., after 237 days, off Pittenweem, at a distance of 55 miles to the westwards; the other, of 38·5–39·2 cm., farther to the west, off Buckhaven, at a distance of 65 miles, after 231 days; both were "immature."

Three females were recaptured in March; 1, of 32–33·7 cm., and "immature," after 251 days, at Aberdeen Bank, at a distance of 38 miles to the north and west; another, of 30·5–33·8 cm., after 262 days, near Pittenweem, in the Firth of Forth, at a distance of 56 miles to the westwards; and the third, of 52 cm., when set free, but of unrecorded size on recovery, after 257 days, in the Moray Firth, 18 miles E.S.E. from Noss Head, at a distance of 131 miles.

In the third quarter, then, 10 of the marked plaice, or 14·1 per cent., were taken, 7 (70 per cent.) to the north and west, and 3 to the north and east.

*Fourth Quarter.*—A male and a female were recaptured in April, the male, of 30–33·2 cm., and "immature," after 277 days, in the Firth of Forth, 1 mile off Pittenweem, 56 miles to the westwards, and the female, of 30·5–32·2 cm., and also "immature," after 269 days, 25 miles to the north and west.

Four males and 2 females were taken in May; the 2 females, both "immature," were recaptured in the same locality north-east of the Bell Rock, after 311 and 313 days, 1 measuring 34–39 cm., and the other 29–30·4 cm., and the distances migrated were 22 and 20 miles to the north and west; one of the males, of 40–40 cm., and "spent," was caught, after 302 days, at a distance of 15½ miles to the south and west; another, of 32·5–36·2 cm., was taken, after 326 days, 19 miles to the north and west; another, of 33·5–36 cm., after 314 days, far offshore, east of Buchanness, at a distance of 84 miles to the north and east, the condition of the testes not being stated; the remaining male, which measured 33–35·9 cm., and was "spent," was recaptured, after 301 days, off Rona Island, which lies in the Atlantic, north-west of Cape Wrath, at a distance of 247 miles from the place of liberation.

Three females and a male, all "immature," were caught in June, the male, of 34–37·8 cm., after 335 days, near the Isle of May, 40 miles to the westwards; one of the females, of 38–41 cm., after 352 days, north-east of Longstone Light, at a distance of 36 miles to the south and west; another, of 34·5–38·3 cm., after

352 days, north and east of the Bell Rock, at 37 miles distant to the north and west ; and the third, of 34·5–36·5 cm., after 335 days, at a distance of 19½ miles in the same direction.

In the fourth quarter, therefore, 12 of the marked plaice, or 16·9 per cent., were recaptured, 7 (58·3 per cent.) to the north and west ; 3 (25 per cent.) to the south and west, and 2 to the north and east.

In the first 12 months after liberation, 52 fish, or 73·2 per cent., of all those recovered, were taken, the position of 51 being known ; of these, 20 (39·2 per cent.) went to the south and west ; 19 (37·2 per cent.) to the north and west ; 8 (15·7 per cent.) to the north and east ; 2 to the west, and 1 each to the south and east and to the north.

Particulars for these 12 months are given in the following table :—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles.)	Range.	
							Distance.	Rate.
I. July 1912. Aug. 1912. Sept. 1912.	N. and E.	1	6·6	N. 48° E.	57	8·02	..	..
	N. and W.	2	13·3	N. 45° W.	33	5·3	26·5–41	3·8–6·7
	S. and E.	Nil.						
	S. and W.	10	66·7	S. 62° W.	28	11·5	15–39·5	2·9–21·6
	W.	2	13·3	W.	26	5·4	10–42	1·3–9·5
		15	21·1	..	..	..	..	..
II. Oct. 1912. Nov. 1912. Dec. 1912.	N. and E.	2	14·3	N. 3° E.	79	7·2	32·5–126·5	2·6–11·8
	N. and W.	3	21·4	N. 51° W.	26	2·1	16·5–44	1–3·1
	S. and E.	1	7·1	S. 25° E.	71	6·22	..	..
	S. and W.	7	50·	S. 51° W.	19	1·4	6·5–31	·4–2·1
	N.	1	7·1	N.	38	2·3	..	..
		14	19·7	..	..	..	..	..
III. Jan. 1913. Feb. 1913. Mar. 1913.	N. and E.	3	30·	N. 2° E.	61	2·8	37–110	1·7–5·2
	N. and W.	7	70·	N. 41° W.	59	2·4	35–131	1·5–5·1
	S. and E.	Nil.						
	S. and W.	Nil.						
		10	14·1	..	..	..	..	..
IV. April 1913. May 1913. June 1913.	N. and E.	2	16·6	N. 26° E.	165	5·4	84–247·5	2·7–8·2
	N. and W.	7	58·3	N. 49° W.	28	·9	19–56	·6–2
	S. and E.	Nil.						
	S. and W.	3	25·	S. 39° W.	30·8	·9	15·5–40·5	·5–1·2
		12	16·9	..	..	..	..	..
SUMMARY.	N. and E.	8	15·7					
	N. and W.	19	37·2					
	S. and E.	1	1·9					
	S. and W.	20	39·2					
	N.	1	1·9					
	W.	2	3·9					
		51	71·8					

Of the other marked fish, 6 were taken in the remainder of 1913. In July, a male and a female were recaptured, the male, of 34–38·7 cm., after 379 days, far offshore, to the south-east of Aberdeen, at a distance of 22½ miles, and the female, of 29–34·2 cm., after 373 days, to the east of the Isle of May, at a distance of 26 miles. Two females were taken in August, 1, of 34·5–39·4 cm., after 400 days, 22 miles to the north and west, and the other, of 32–37·6 cm., after 405 days, near the Bell Rock, at a distance of 40 miles. A male and a female were recaptured in September, the male, of 34·5–38 cm., after 449 days, far offshore, at a distance of 41 miles to the north and east, and the female, of 33·5–42·9 cm., after 433 days, south-east of Aberdeen, at a distance of 24 miles to the north and west.

Eleven were recovered in 1914. A male, of 35·5–42 cm., and of unknown maturity, was taken in January, after 568 days, off Flamborough Head, at a distance of 148 miles to the south and east. Two males and a female were taken in February, the female at an unknown position; one of the males, of 30·5–38 cm., and “mature,” after 580 days, on the Whitby Ground, at a distance of 104 miles to the south and west, and the other, of 37–37·6 cm., and “spawning” (“almost spent”), after 592 days, in the opposite direction, viz. in Edrachilles Bay, on the west coast of Sutherland, at a distance of 236 miles. A male and a female were recaptured in March, the male, of 30–38·5 cm., the condition of whose testes was not recorded, after 619 days, near Clyth Ness, in the Moray Firth, at a distance of 130 miles, and the female, of 47·5–49·5 cm., and “spawning,” after 614 days, near the Bell Rock, at a distance of 36 miles to the north and west. In April, 2 females were taken, 1, of 38·5–45·8 cm., and “spent,” after 637 days, north-east of St. Abb’s Head, at a distance of 22 miles; the other, measuring 37·5–50·6 cm., and “spent,” after 662 days, off Aberdeen, at a distance of 38·5 miles. Two females were taken in July, 1, measuring 34·5–45·7 cm., and “spent,” after 741 days, north-east of the Bell Rock, at a distance of 33 miles to the north and west; the other, which measured 31–41·8 cm., after 738 days, offshore, south-east of Aberdeen, at a distance of 14½ miles. In September, after 794 days, a male, measuring 33–41·8 cm., was taken, north-east of Rattray Point, at a distance of 81 miles.

Two were recaptured in 1915, 1, a female, in March, after 989 days, off Hartlepool, at a distance of 103 miles to the south and west; it measured 36·5–47·3 cm., and was “spawning.” In April, after 1011 days, another female, which measured 29·5–38·8 cm., was captured north of the Bell Rock, at a distance of 38 miles to the north and west.



A summary of the mean distance and direction in each quadrant, travelled by all the marked plaice recaptured, is shown in the following table :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	11	1152·5	104·8	N. 18° E.
	Adult Females. Immature Females.	3 1	85·5 57	28·5 57	N. 15° E. N. 48° E.
		15	1295·	86·3	N. 19° E.
N. and W.	Adult Males.	4	137·	34·	N. 31° W.
	Immature Males. Adult Females. Immature Females.	1 11 9	41 460· 318·	41· 42· 35·	N. 85° W. N. 48° W. N. 54° W.
		25	956·	38·	N. 49° W.
S. and E.	Adult Males.	2	219·5	109·7	S. 14° E.
S. and W.	Adult Males.	9	281·5	31·	S. 48° W.
	Immature Males. Adult Females. Immature Females.	3 5 7	74· 215·5 196·5	25· 43· 28·	S. 62° W. S. 22° W. S. 73° W.
		24	767·5	32·	S. 51° W.
W.	Adult Males.	1	10·	10·	W.
	Immature Females.	1	42·	42·	W.
		2	52·	26·	W.
N.	Adult Males.	1	38·	38·	N.
SUMMARY.					
N. and E.		15	1295·	86·3	N. 19° E.
N. and W.		25	956·	38·	N. 49° W.
S. and E.		2	219·5	109·7	S. 14° E.
S. and W.		24	767·5	32·	S. 51° W.
N.		1	38·	38·	N.
W.		2	52·	26·	W.
		69	..	..	..

*Distances travelled—Under 10 miles.*—Two fish, or 2·9 per cent., were taken, both males (6·2 per cent.), with an average distance of 8·3 miles.

*10 to 20 miles.*—Ten fish, or 14·5 per cent., went distances of from 11 to 19½ miles. Six were males (18·7 per cent.), with an average of 15·8 miles, and 4 (10·8 per cent.) were females, with a mean distance of 17·4 miles. Five of the males went to the south and west; the other male and 3 of the females moved to the north and west, the fourth female to the north and east.

*Under 20 miles.*—Thus, under 20 miles, 12 fish, or 17·4 per cent., migrated journeys, 8 males (25 per cent.), with an average of 13·9 miles, and 4 females (10·8 per cent.), with a mean distance of 17·4 miles.

*20 to 50 miles.*—Forty fish, or 57·9 per cent., went from 20 to 50 miles, namely, 13 males (40·6 per cent.), with an average of 34·4 miles, and 27 females (72·9 per cent.), with an average of 31 miles. Five males and 11 females were found to the south and west, 4 males and 2 females to the north and east, 3 males and 13 females to the north and west, 1 male directly north, and 1 female directly west.

50 to 100 miles.—Eight of the marked plaice, or 11·6 per cent., were recaptured at distances of from 55½ to 84 miles, namely, 4 males (12·5 per cent.), with an average of 73 miles, and 4 females (10·8 per cent.), with an average of 58·5 miles. Two of the males and 1 of the females went north and east, 1 of the males and 3 females north and west, the remaining male being found to the south and east.

Over 100 miles.—Nine fish, or 13 per cent., were taken at distances of from 103 to 247 miles, namely, 7 males (21·9 per cent.), with an average distance of 157·5 miles, and 2 females (5·4 per cent.), with an average of 117 miles. Five of the males went to the north and east, 1 of the males to the south and east, the remaining male and 1 of the females to the south and west, and 1 of the females to the north and west. Two of the males and 1 of the females were got off the English coast, and the remainder in the Moray Firth, and the north coast of Scotland.

It may be noted that four of the plaice had returned to the Firth of Forth.

#### MATURITY.

*Males.*—The condition of the testes in 24 of the 32 males recaptured was ascertained.

Four were "spawning," and were taken as follows :—One, of 37·5–37·6 cm., on the 15th December 1912, at Aberdeen Bank, at a distance of 38 miles to the north ; another, of 35·5–38·1 cm., in February 1913, in the same locality, at a distance of 37 miles ; the third, also in February 1913, at a distance of 35 miles, near the same place ; the fourth, in February 1914, in Edrachilles Bay, on the west coast of Scotland, at a distance of 236 miles.

Three were described as "ripe," 1 taken in the Moray Firth, off Whitehills, in February 1913, at a distance of 110 miles ; another, in the same month, at Aberdeen Bank, at a distance of 37 miles ; and the third, in February 1914, off Whitby, at a distance of 104 miles, to the south and west. One, said to be "three-quarters ripe," and measuring 36·5–38·2 cm., was captured in December 1912, 6½ miles to the south and west.

Two were "spent," both got in May 1913, one, 15½ miles to the south and west, and the other, at Rona, north-west of Cape Wrath, at a distance of 247 miles.

Of 10 males of adult size whose testes were "immature," 1 was recaptured within the limits of the spawning season. It measured 30–33·2 cm., and was taken in April 1913, in the Firth of Forth, off Pittenweem, at a distance of 56 miles.

*Females.*—Of the 39 fish recaptured, the condition of the ovaries was ascertained in 34. Three were "spawning," 1, of 41–41·9 cm., got in February 1913, at Aberdeen Bank ; another, of 47·5–49·5 cm., in March 1914, near the Bell Rock, at a distance of 36 miles to the north and west ; the third was caught in March 1915, off Hartlepool, at a distance of 103 miles to the south and west.

Four females were described as "spent." Two were taken in April 1914 ; 1, measuring 38·5–45·8 cm., to the east of St. Abb's Head, at a distance of 22 miles to the south and west ; the other, which measured 37·5–50·6 cm., at Aberdeen Bank, at a distance of 38 miles to the north and east ; 1, caught in April 1915, after 1011 days, was taken near the coast north of the Bell Rock, at a distance of 38 miles to the north and west ; the fourth, which measured 34·5–45·7 cm., was found in the same locality, at a distance of 33 miles.

Of 9 adult females whose ovaries were "immature" on recapture, 1 was taken in the spawning season ; it measured 38·5–39·2 cm., and was recaptured off Buckhaven, in the Firth of Forth, at a distance of 65 miles.

#### EXPERIMENT II.

21st September 1912.

In this experiment, 100 plaice were marked and liberated, 37 being males, 61 females and 2 of undetermined sex. The males ranged in size from 31 cm. to 44·5 cm., and the females from 33 cm. to 56·5 cm. ; 7 of the males and 30 of the females were under the adult size on liberation. The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows :—

	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	cm. 56-60.5	Total.
F. Lib.	16	28	11	1	4	1	61
F. Recap.	7	10	6	—	1	—	24
M. Lib.	19	16	2	—	—	—	37
M. Recap.	5	7	—	—	—	—	12

The plaice for this experiment were captured on the 20th September, in the Dornoch Firth (Moray Firth), where the "Goldseeker" had been working, and were kept in tanks, after being marked, until 2.40 p.m. on the 21st, when they were liberated.

The number recaptured was 36, or 36 per cent., which is a very small percentage compared with other experiments; the number of males was 12 (32.4 per cent.), and the number of females, 24 (39.3 per cent.).

Eleven of the males were of adult size on recapture, viz. from 33.4-42.7 cm., with an average of 38.6 cm., compared with a range of from 31-37.5 cm., and an average of 35.4 cm. on liberation; they were at liberty for from 21 to 666 days, the mean being 359 days; the distances migrated were from 5 to 42½ miles, the mean being 27.3 miles and the average rate of travel .76 mile.

Twenty of the females were of adult size, averaging 43.4 cm., and ranging from 38.5 to 50.5 cm., compared with an average of 40.2 cm., and a range of from 32.5 to 51 cm. on liberation; they were at liberty for from 22 to 629 days, the mean being 316 days, and travelled from 45 to 123 miles, the average being 29.4 miles, and the mean rate, .9 mile. Four of the females were under adult size, averaging 36.3 cm., as compared with 34.6 cm.; they were at liberty for an average of 205 days, and migrated a mean distance of 35.8 miles, the average rate, per 10 days, being 1.75 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—None was recaptured in September. In October, 3 males and 3 females were got; 2 of the males were found to the south and west, 1, measuring 37.5-37.2 cm., after 24 days, at a distance of 5 miles; another, which was 33-33.4 cm., after 19 days, at a distance of 22 miles, towards the Firth of Forth; the third, which measured 36.5-36 cm., after 21 days, 22 miles to the south and east; one of the females, measuring 44-43.3 cm., was recaptured, after 22 days, 11 miles to the south-east; another, of 40.5-40 cm., was taken at Aberdeen Bank, after 31 days, at a distance of 30 miles northward; these two females were described as "half ripe," the remaining fish, which measured 34.5 cm. on liberation, but whose size on recapture was not recorded, was taken, after 20 days, 11 miles to the south-west.

Two females were taken in November, both "immature"; 1, measuring 38-38.5 cm., was caught south of Aberdeen Bank, at a distance of 25 miles, after 53 days; the other, which measured 36.5-36.8 cm., was taken near the Bell Rock, at a distance of 44 miles to the north and west, after 45 days.

None was recaptured in December.

Thus, in this quarter, 8 fishes, or 22.2 per cent., were taken, 3 (37.5 per cent.) to the south and west, 2 to the south and east, 2 to the north and west, and 1 to the north and east.

*Second Quarter.*—In January 1913, a male, of 31-30.4 cm., was taken, after 121 days, 34½ miles to the south and west, to the east of the Isle of May.

A male and two females were recaptured in February, the male, of 36-36.5 cm., and "nearly ripe," after 161 days, east of the Isle of May, at a distance of 30½ miles to the north and west; one of the females was taken, after 150 days, 37 miles to the north-east, at Aberdeen Bank; it measured 42.5-43 cm., and was "nearly ripe"; the other, which was 51-50.5 cm., was got, after 151 days, south of Aberdeen Bank, at a distance of 27 miles to the north and west. The condition of the reproductive organ of this fish was not recorded.

In March, a male and a female were recovered, the male, of 37.5-38.9 cm., and "spawning" ("partly spent") after 186 days, off St. Abb's Head, at a distance of 32 miles to the south and west, and the female, of 45-45.3 cm. (the condition of the ovaries unrecorded), after 186 days, near Aberdeen Bank, at a distance of 30 miles to the north and west.

Six fish, therefore, were recaptured in the second quarter, or 16·6 per cent., 3 to the north and west, 2 to the south and west, and 1 to the north and east.

*Third Quarter.*—Only one fish was recovered in this quarter, a female, taken in May, after 241 days, to the south-east of Tod Head, at a distance of 34 miles to the north and west; it measured 34·5–35·8 cm., and was “immature.”

*Fourth Quarter.*—Three females were taken in July; 1, of 43–44 cm., and “immature,” after 288 days, offshore, to the south-east of Aberdeen, at a distance of 35 miles; another, of 40–41·8 cm., after 313 days, 18 miles to the south and west; and the third, of 40·5–43·1 cm., and “spent,” after 310 days, 19 miles to the south and west.

Two females were recaptured in August, both “spent,” and both after 335 days, 13 miles to the north and west.

Three females were taken in September, 1, of 35–40·5 cm., after 360 days, 23 miles to the north and west, towards St. Andrews Bay; another, of 38–44·4 cm., after 349 days, off Longstone Light, at a distance of 40 miles to the south and west; and the third, of 37·5–39·9 cm., after 361 days, at Aberdeen Bank, a distance of 34 miles to the north and east.

Thus, in this quarter, 8 of the marked plaice, or 22·2 per cent., were recaptured, 3 (37·5 per cent.) to the south and west, 3 to the north and west, and 2 to the north and east.

In the 12 months after liberation, therefore, 23 fish, or 63·8 per cent., were recovered, 9 (39·1 per cent.) to the north and west, 8 (34·8 per cent.) to the south and west, 4 to the north and east, and 2 to the south and east.

The following table gives particulars as to the mean distance and direction of the plaice caught in the first year:—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. Oct. 1912. Nov. 1912. Dec. 1912.	N. and E.	1	12·5	N. 2° E.	30·	9·7	..	..
	N. and W.	2	25·	N. 38° W.	39·	7·2	25–44	4·7–9·8
	S. and E.	2	25·	S. 44° E.	16·	7·7	11–22	5·–10·5
	S. and W.	3	37·5	S. 54° W.	12·8	6·5	5–22·5	5·5–11·8
		8	22·2	..	..	..	..	..
II. Jan 1913 Feb. 1913. Mar. 1913.	N. and E.	1	16·7	N. 3° E.	37·	2·5	..	..
	N. and W.	3	50·	N. 35° W.	29·	1·8	27	–30·5
	S. and E.		Nil.					
	S. and W.	2	33·3	S. 81° W.	33·	2·3	32·5–34·5	1·7–2·8
		6	16·6	..	..	..	..	..
III. April 1913. May 1913. June 1913.	N. and E.		Nil.					
	N. and W.	1	100·	N. 47° W.	34·	1·4	..	..
	S. and E.		Nil.					
	S. and W.		Nil.					
		1	2·8	..	..	..	..	..
IV. July 1913. Aug. 1913. Sept. 1913.	N. and E.	2	25·	N. 22° E.	35·	1·1	34–35·5	·9–1·2
	N. and W.	3	37·5	N. 27° W.	16·	·5	13–23·	·4–6
	S. and E.		Nil.					
	S. and W.	3	37·5	S. 41° W.	26·	·8	18–40·	·6–1·1
		8	22·2	..	..	..	..	..
SUMMARY.	N. and E.	4	17·4					
	N. and W.	9	39·1					
	S. and E.	2	8·7					
	S. and W.	8	34·8					
		23	63·8					

Of the others recaptured, 4 were taken in the remainder of 1913, 8 in 1914, and 1 in 1915.

A male and a female were recaptured in October 1913, the male, of 31–34.1 cm., to the south and east of Aberdeen, at a distance of 42½ miles, and the female, of 33.5–39.9 cm., north of St. Abb's Head, at a distance of 36 miles to the south and west. Two females were got in December, but the position of capture of 1 was not ascertained; the other, of 41–45 cm., was caught north-east of St. Abb's Head, at a distance of 22 miles to the south and west.

In January 1914, a male, of 35.5–40.2 cm., and "nearly ripe," was recovered near Aberdeen Bank, at a distance of 29 miles to the north and west. A male and a female were taken in February, the male, measuring 36–42.7 cm., and "ripe," south-east of the Isle of May, at a distance of 39 miles to the south and west; the female, of 33–36.2 cm., and "immature" was got in St. Andrews Bay, at a distance of 54½ miles to the north-west. Two females were recaptured in April, 1 of 39–50 cm., 17 miles to the north and west, and "immature," the other, of 40–43 cm., in the Moray Firth, off Lossiemouth, at a distance of 123 miles. In June, a male, of 36.5–41 cm., was taken, at a distance of 15½ miles to the south and west, and a female, measuring 32.5–45.2 cm., 4½ miles in the same direction. In July, a male, of 36.5–41.2 cm., was recovered north of the Bell Rock, at 37 miles distant to the north and west.

The last fish of the experiment to be recaptured was a male, of 33.5–42.1 cm., and "spawning," which was taken in March 1915, after 892 days, to the south-east of Aberdeen, at a distance of 25 miles.

A summary of the mean distance and direction in each quadrant, for the whole experiment, is given in the following table:—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	1	25	25	N. 23° E.
	Adult Females.	5	259	52	N. 10° E.
		6	284	47	N. 12° E.
N. and W.	Adult Males.	4	138	34	N. 37° W.
	Adult Females.	7	148	21	N. 19° W.
	Immature Females.	3	132	44	N. 14° W.
		14	418	30	N. 34° W.
S. and E.	Adult Males.	1	22	22	S. 30° E.
	Adult Females.	1	11	11	S. 59° E.
		2	33	16	S. 44° E.
S. and W.	Adult Males.	5	113	23	S. 60° W.
	Immature Males.	1	34	34	S. 85° W.
	Adult Females.	6	139	23	S. 46° W.
	Immature Females.	1	11	11	S. 69° W.
		13	297	23	S. 56° W.
SUMMARY.					
N. and E.		6	284	47	N. 12° E.
N. and W.		14	418	30	N. 34° W.
S. and E.		2	33	16	S. 44° E.
S. and W.		13	297	23	S. 56° W.
		35	..	..	..

*Distances travelled—Under 10 miles.*—Two fish, or 5·7 per cent., were found at distances under 10 miles, 1, a male, at 5 miles, and a female at 4½ miles.

*10 to 20 miles.*—Eight fish, or 22·8 per cent., were recaptured at distances of from 11 to 19½ miles, namely, 1, a male, which had migrated 15½ miles to the south and west, 1 to the south and east, and 3 to the north and west.

*Under 20 miles.*—Thus, 10 fish, or 28·6 per cent., were found at distances under 20 miles, two males (16·6 per cent), with an average of 10 miles, and 8 females (34·8 per cent.), with an average of 16 miles.

*20 to 50 miles.*—Twenty-three fish, or 65·7 per cent., were recaptured at distances of from 22 to 44 miles, viz. 10 males (83·3 per cent.), with an average of 31·5 miles, and 13 females (56·5 per cent.), with an average of 32·1 miles. Four males and 6 females went to the north and west, 4 males and 3 females to the south and west, one male to the south and east, 1 male and 4 females to the north and east.

*50 to 100 miles.*—One female was got at a distance of 54½ miles to the west and north (St. Andrews Bay).

*Over 100 miles.*—One female was taken in the Moray Firth, at a distance of 123 miles.

#### MATURITY.

*Males.*—The condition of the reproductive organs was known in 9 cases. Two were “spawning,” 1, which measured 37·5–38·9 cm., being taken in March 1913, 32½ miles to the south and west, off St. Abb’s Head, and the other, of 33·5–42·1 cm., in March 1915, offshore, at a distance of 25 miles north and east.

Two were “ripe,” 1, of 36–36·5 cm., taken in February 1913, 30½ miles to the westward, and the other, of 36–42·7 cm., in February 1914, to the south-east of the Isle of May, at a distance of 39 miles to the westward. One was “nearly ripe”; it measured 35·5–40·2 cm., and was got in January 1914, near Aberdeen Bank, at a distance of 29 miles to the north and west.

*Females.*—The condition of the ovaries was recorded in 15 of the 24 cases. None was “spawning.” One, of 42·5–43 cm., caught in February 1913, at Aberdeen Bank, 37 miles to the north and east, was “nearly ripe.”

Three were “spent”; 1, of 40·5–43·1 cm., caught in July 1913, 19½ miles to the south and west, and 2 taken in August 1913, 13 miles to the north and west; 1, measuring 40–42·5 cm., and the other, 43–45·4 cm. Two were “half-ripe”; 1, of 40·5–40 cm., was got in October 1912, at Aberdeen Bank, and the other, of 44–43·3 cm., also taken in October 1912, 11 miles to the south and east. Among the adult females whose ovaries were “immature” was 1, taken in April 1914, 17 miles to the north and west, and measuring 39–50 cm.

#### EXPERIMENT AT ST. ANDREWS BAY.

##### 3rd December 1913.

On 3rd December 1913, 59 plaice were marked and liberated in St. Andrews Bay, namely, 34 males and 25 females, the Tay Fairway Buoy lying N.E./E. 3 miles (Lat. 56° 23' N.; Long. 2° 54' W.; depth, 11 fathoms).

The fish used were caught by the “Goldseeker” in Kirkcaldy Bay on the previous day.

The sizes of the males ranged from 29·5 to 40·5 cm., and 8 were under the adult size (33 cm.) when liberated. The females ranged from 27·5 to 62·5 cm., and 15 were under the adult size (38 cm.) on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25–30·5	cm. 31–35·5	cm. 36–40·5	cm. 41–45·5	cm. 46–50·5	cm. 51–55·5	cm. 61–65·5	Total.
F. Lib. . . . .	4	10	4	1	2	3	1	25
F. Recap. . . . .	3	6	2	—	—	—	—	11
M. Lib. . . . .	1	18	15	—	—	—	—	34
M. Recap. . . . .	1	10	8	—	—	—	—	19

Thirty of the marked plaice, or 50·8 per cent., were recaptured, comprising 19 males (55·9 per cent.) and 11 females (44 per cent.).

Sixteen of the males were of adult size on recapture, measuring from 33·3 to 39·7 cm., and averaging 35·9 cm., as compared with a range of from 32 to 37·5 cm., and a mean of 35·4 cm. on liberation; they were at liberty for from 3 to 495 days, the mean being 134 days; they migrated distances of from  $1\frac{1}{2}$  to 166 miles, the average being 39·5 miles, and the mean rate of movement, 2·9 miles. Three of the males were under the adult size on recovery, averaging 31·3 cm., as against 31 cm. on liberation; they were free for a mean period of 100 days, and migrated distances of from 12 to 84 miles, the average being 39 miles, and the mean rate of travel 3·8 miles.

Four of the females were of adult size on recapture, averaging 41·8 cm., as compared with 36·1 cm. on liberation; they were at liberty for an average period of 502·5 days, and migrated an average distance of 35·5 miles, the mean rate being 3·8 mile. Seven were under the adult size, ranging from 26·9 to 36·5 cm., and averaging 31·8 cm., as compared with a range of from 27·5 to 35·5 cm., and a mean of 31·6 cm. on liberation; they were free for from 22 to 117 days, the mean being 67 days; they travelled distances of from  $1\frac{1}{2}$  to 38 miles, the average being 13 miles, and the mean rate, per 10 days, 1·9 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In December 1913, 5 males and 2 females were recaptured, 1 of the females at a distance of 12 miles to the south and east, 1 male 12 miles to the north and east, and all the others to the south and west, near the shore, in St. Andrews Bay, at distances of  $1\frac{1}{2}$  and 2 miles.

A female was captured in January 1914,  $2\frac{1}{2}$  miles to the south-west, also close inshore, and in February, 2 males and 1 female were taken, all outside the Bay, to the south and east, at the following distances:—One male at 15 miles, the other at 20 miles, and the female at 11 miles.

In this quarter, 11 of the marked plaice, or 37·9 per cent., were recaptured, 6 (54·5 per cent.) to the south and west, 4 (36·4 per cent.) to the south and east, and 1 to the north and east.

*Second Quarter.*—Six males and 4 females were recaptured in March 1914, 4 of the males and 2 of the females to the south and east, at distances of from 12 to 20 miles; 1 female had moved up the coast, to the neighbourhood of Tod Head, a distance of 38 miles to the north-east; 1 female migrated round Fife Ness, to within the mouth of the Firth of Forth, a distance of 13 miles, while a male was taken, after 99 days, in the Moray Firth, close to Tarbet Ness, a distance of 166 miles northwards, the rate of movement in this case being 16·7 miles per 10 days; another male was caught quite close to Rattray Head, after 92 days, a distance of 84 miles to the northward; its mean rate of movement was 9·1 miles per 10 days.

In April, 2 males were taken, both at a distance of 12 miles to the south and east. None was recovered in May.

Thus, in the second quarter, 12 fishes, or 41·4 per cent., were recaptured, 9 (75 per cent.) at a mean distance of 15 miles in the mean direction S. 57° E., and 3 (25 per cent.) at an average distance of 96 miles in the mean direction N. 47° E.

*Third Quarter.*—A female and a male were recaptured in June, the female to the eastwards, at a distance of 34 miles, and the male in the Moray Firth, near Berriedale Ness, at 159 miles distant, the mean rate of movement being 8·4 miles.

None was taken in July and August, so that these 2 fish represent the total for the third quarter (6·9 per cent.).

*Fourth Quarter.*—Only 2 fish were taken in this quarter, namely, a male in September, 7 miles east from the Bass Rock, at 19 miles distant to the south and east, and another male in November, at a distance of 15 miles to the south and east.

Within the 12 months after liberation, 27 of the marked plaice, or 93·1 per cent., were recaptured, 16 (59·2 per cent.) to the south and east, 6 (22·2 per cent.) to the south and west, and 5 (18·5 per cent.) to the north and east.

The remaining 3 fishes of the experiment were taken as follows:—A male, in April 1915, in the Moray Firth, close to Clyth Ness, at a distance of 158 miles to the northwards, a female, in July 1915, 26 miles to the south-east, south-east of May Isle, and a female, in December 1916, after 1105 days, 30 miles E.S.E. of Aberdeen, at a distance of 67 miles to the north and east.

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	4	495	124	N. 51° E.
	Immature Males.	1	84	84	N. 47° E.
	Adult Females.	1	67	67	N. 67° E.
	Immature Females.	1	38	38	N. 50° E.
		7	684	98	N. 53° E.
N. and W.			Nil.		
S. and E.	Adult Males.	8	130	16	S. 67° E.
	Immature Males.	2	32	16	S. 52° E.
	Adult Females.	3	75	25	S. 40° E.
	Immature Females.	4	48	12	S. 51° E.
		17	285	17	S. 57° E.
S. and W.	Adult Males.	4	6·5	2	S. 50° W.
	Immature Females.	2	4	2	S. 38° W.
		6	10·5	2	S. 46° W.
SUMMARY.					
N. and E.		7	684	98	N. 53° E.
N. and W.		..	..	..	..
S. and E.		17	285	17	S. 57° E.
S. and W.		6	10·5	2	S. 46° W.
		30	..	..	..

*Distances travelled*—10 miles and under.—Six of the marked fish, or 20 per cent., were recaptured at distances of from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  miles, namely, 4 males (21 per cent.), with an average of 1·6 miles, and 2 females (18·2 per cent.), with a mean of 2 miles. All were taken to the south and west, within St. Andrews Bay.

10 to 20 miles.—Fourteen, or 46·6 per cent., were got at from 11 to 19 miles, 9 males (47·4 per cent.), with an average of 15 miles, and 5 females (45·4 per cent.), with an average of 12·6 miles. Eight of the males and all the females were caught to the south and east, 1 of the males to the north and east.

Thus, 20 fish, or 66·6 per cent., migrated distances of less than 20 miles, 13 males (68·4 per cent.), with an average of 10·8 miles, and 7 females (63·4 per cent.), with an average of  $9\frac{1}{2}$  miles.

20 to 50 miles.—Five, or 16·6 per cent., were found at distances of from 20 to 38 miles, 2 males (10·5 per cent.), with an average of 20 miles, and 3 females (27·3 per cent.), with an average of 33 miles. Both the males and 2 of the females were recovered to the south and east, and 1 of the females to the north and east.

50 to 100 miles.—Two of the fish, or 6·6 per cent., were taken as follows:—A male, at a distance of 84 miles to the north and east, at Rattray Head, and a female, off Aberdeen, at a distance of 67 miles to the north and east.

Over 100 miles.—Three males (15·8 per cent.) were taken in the Moray Firth, at distances of 158, 159, and 166 miles, respectively.

#### MATURITY.

*Males*.—The condition of the testes was ascertained in 15 of the 19 recaptured. Two were "spawning," both taken in March 1914, at distances of 17 and 20 miles to the south and east.

Four were described as "nearly ripe"; 1 was taken in December 1913,  $1\frac{1}{2}$  miles to the south and west, and another, in the same month, at a distance of 2 miles



in the same direction; the third was caught in December 1913, at 12 miles to the north and east, and the fourth in November 1914, 15 miles to the south and east.

Among those of adult size (33 cm.), the following, captured during the spawning season, were described as "immature":—One, of 33–33·3 cm., in February 1914, 15 miles to the south and east; 2 in March 1914, measuring respectively 34–34·7 cm., and 33–33·3 cm., 17 miles and 15 miles to the south and east, and 1 taken in April 1914, 12 miles to the south-east, which measured 34–35·2 cm.

On the other hand, among the males under adult size was 1 described as "ripe," which measured 29·5–29·9 cm., and was taken in February 1914, 20 miles to the south and east.

*Females.*—The condition of the ovaries was recorded for 10 of the 11 recaptured. All were described as "immature" (including 1 taken in March 1914, and measuring 38·5–38·5 cm.), except the last, caught in December 1916, 67 miles to the north and east, which was described as "ripening."

#### EXPERIMENTS AT ABERDEEN BANK.

At this station, which lies about 35 miles to the south-east of Aberdeen, in Lat. 56° 55' N.; Long. 1° 8' W., and where the depth is about 37 fathoms, marked plaice were liberated on eight different occasions, between June 1910 and November 1913. The following table gives the main particulars of each experiment:—

	Liberated.				Recaptured.				Percentage.			
	♂	♀	?	Total.	♂	♀	?	Total.	♂	♀	?	Total.
1. 10 June 1910. . .	149	177	10	336	94	107	...	201	63·1	60·4	...	59·8
2. 21 Oct. 1910. . .	114	152	16	282	76	112	7	195	66·6	73·7	13·7	69·1
3. 19 July 1911. . .	49	60	...	109	23	34	...	57	46·9	56·7	...	52·3
4. 6 July 1912. . .	49	50	1	100	31	31	...	62	63·3	62·	...	62·
5. 21 Sept. 1912. . .	44	55	1	100	11	29	...	40	24·4	52·7	...	40·
6. 27 Mar. 1913. . .	28	72	...	100	22	55	...	77	78·6	76·4	...	77·
7. 21 May 1913. . .	43	57	...	100	30	35	...	65	67·4	61·4	...	65·
8. 13 Nov. 1913. . .	49	51	...	100	18	26	...	44	36·7	51·	...	44·
	525	674	28	1227	305	429	7	741	58·1	63·6	25·	60·4

Altogether, 1227 plaice were marked and set free, of which 525 were males, 674 were females, and 28 were of undetermined sex. The number recovered was 741, or 60·4 per cent., namely, 305 males (58 per cent.), 429 females (63·6 per cent.), and 7 of unknown sex (25 per cent.). The percentage of recaptures varied in different cases from 44 to 77.

#### EXPERIMENT I.

##### 10th June 1910.

In this experiment, the large number of 336 fish were marked and set free, consisting of 149 males, 177 females, and 10 whose sexes were not ascertained. The males ranged in size from 20 to 40 cm., and 78 were under the adult size when liberated. The sizes of the females ranged from 23 to 56 cm., and 164 were under the adult size on liberation. The sizes of those whose sexes were not distinguished varied from 28·5 to 38·5 cm.

The numbers of the fish marked and recaptured, arranged in 5-cm. groups, are shown in the following table:—

	cm. 20–24·5	cm. 25–30·5	cm. 31–35·5	cm. 36–40·5	cm. 41–45·5	cm. 56–60·5	Total.
F. Lib. . . . .	2	48	82	41	3	1	177
F. Recap. . . . .	1	29	49	25	2	1	107
M. Lib. . . . .	4	46	76	23	—	—	149
M. Recap. . . . .	1	27	50	16	—	—	94
? Lib. . . . .	—	2	4	4	—	—	10
? Recap. . . . .	—	—	—	—	—	—	0

The fish used in this experiment were trawled by the "Goldseeker" in Aberdeen Bay on the 10th June, and were liberated at the station the same evening, between 9.45 and 10.40 p.m.

The number recaptured was 201, or 59.8 per cent., namely, 94 males (63.1 per cent.) and 107 females (60.4 per cent.).

Of the males, 73 were of adult size on recapture, ranging from 33 to 44.4 cm., and averaging 36.7 cm., as compared with a range of from 24.5 to 39 cm., and an average of 33.5 cm., on liberation; they were at liberty for from 4 to 1398 days, the mean being 283 days; they migrated distances of from 4 to 199 miles, the average being 36.6 miles, and the mean rate 1.3 miles per 10 days. Twenty-one were under the adult size on recovery, namely, from 26.7 to 32.9 cm., the mean being 30.6 cm., as compared with a range of 26.5 to 32.5 cm., and a mean of 29.1 cm. on liberation. They were at liberty for from 4 to 272 days, the average being 95 days; they migrated distances of from 4 to 52 miles, the mean being 21.8 miles, and the mean rate 2.3 miles.

Fifty-one of the females were of adult size on recapture, ranging from 38.2 to 57.6 cm., and averaging 41.8 cm., as compared with a range of from 25.5 to 56 cm., and an average of 34.8 cm. on liberation; their periods of freedom varied from 7 to 1447 days, the mean being 447 days; they moved distances of from 1½ to 126 miles, the average being 30.5 miles, and the mean rate .7 mile. Fifty-six were under the adult size, ranging from 28.5 to 37.7 cm., and averaging 34 cm., as compared with a range of from 24.5 to 36.5 cm., and a mean of 31.6 cm. on liberation; they were at liberty for from 2 to 636 days, the mean being 180 days; they travelled journeys of from 3 to 114 miles, the average being 27.1 miles, and the mean rate, per 10 days, 1.5 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

Owing to the number of marked plaice recaptured, this experiment is of special value. The chart, on which are presented all the lines between the position of liberation and of recapture of each fish, shows that the majority moved to the north-west and the south-west, towards the coast, but a considerable number went farther north, several to the Orkney Isles, and 1 to the west coast. On the other hand, only 1 fish was recaptured to the south of the Firth of Forth, or Lat. 56° N.

*First Quarter.*—Thirteen of the marked plaice were recaptured in June, viz. 5 males and 8 females. One of the males was caught after 20 days at the place of liberation; 2 were found to the north and west at distances of 15 and 22 miles; 1 to the north at 10 miles distant; and 1 to the south and west at a distance of 5½ miles. Two of the females had moved to the north and west for distances of 9 and 15 miles respectively; 4 were found to the north and east at distances of from 10 to 45 miles, the latter being offshore, east of Rattray Point; 1 was caught 4 miles to the south and west; and another 6 miles to the south and east.

Twenty were recovered in July, 9 males and 11 females. Five of the males were taken to the south and west, at distances of from 10 to 16 miles; 2 were got to the south and east, at 9 and 11 miles distant; 1 was found 11 miles to the north and west; and 1, 4 miles to the north and east, after 38 days. Five of the females were taken to the south and west, at distances of from 12 to 34 miles; 1, directly west, at 21 miles distant; 3 to the north and west, at distances of from 12 to 34½ miles; and 2 to the south and east, at 8 and 21 miles distant.

Nine were recovered in August, 6 males and 3 females. Three of the males were found to the south and west, at distances of from 7 to 31 miles; 2 to the north and east, 4 and 23½ miles away; and 1, 12½ miles to the north and west. One of the females was got 3 miles to the south and west, 1, 9 miles to the north and west, and 1, 8½ miles to the south and east.

In this quarter, the total number recaptured was 42, or 20.9 per cent.; 10 (24.4 per cent.) had moved an average distance of 16 miles in a mean direction N. 53° W., the average rate of movement being 15.5 miles per 10 days; 8 (19.5 per cent.) had gone an average distance of 15 miles in the mean direction N. 30° E., the average rate of movement being 21.9 miles per 10 days; 16 (39 per cent.) migrated a mean distance of 14 miles S. 55° W., the average rate of movement being 3.9 miles; 6 (14.6 per cent.) went an average distance of 10.6 miles in the mean direction S. 44° E., at the average rate of 4.6 miles; 1 fish moved 21 miles directly west.

*Second Quarter.*—In September, 17 of the liberated plaice were recovered, 11 males and 6 females. Three of the males were found at distances of from 15 to 48 miles to the south and west, 5 at distances of from 8 to 35 miles to the north and west, 2 at 16 and 30 miles to the north and east, and 1, 8 miles to the south and east. Three of the females were recaptured at distances of from  $14\frac{1}{2}$  to 45 miles to the south and west, 1, 13 miles to the north and east, another 8 miles to the south and east, and 1,  $9\frac{1}{2}$  miles to the north and west.

In October, 17 were recaptured, 10 males and 7 females. Four of the males were taken at distances of from 4 to 48 miles to the south and west; 4 were found at distances of from  $7\frac{1}{2}$  to 21 miles to the north and west; and 2 at  $16\frac{1}{2}$  and 20 miles to the north and east. Three of the females were recaptured at 10 miles to the south and west; 2 at 6 and  $7\frac{1}{2}$  miles to the north and west; 1 at 10 miles to the north and east; and 1,  $8\frac{1}{2}$  miles to the south and east.

In November, 13 fish were got, but the place of capture of 1, a male, was not ascertained. The others consisted of 5 males and 7 females. Three of the males were taken at distances of from 24 to 37 miles to the north and west, and 2 at 17 and 52 miles respectively to the south and west. Two of the females were taken at 40 and 45 miles to the south and west; 3 at distances of from 17 to 114 miles to the north and east; and two 24 and 30 miles to the north and west.

Thus, in the second quarter, 47 of the marked plaice, or 23·4 per cent., were taken; the position of capture of 1 was not ascertained, and of the remaining 46 (22·9 per cent.) 17 (36·9 per cent.) migrated an average distance of 29 miles in the mean direction S.  $51^{\circ}$  W., at a mean rate of 2·4 miles per 10 days; 17 (36·9 per cent.) moved an average distance of 17 miles in the mean direction N.  $37^{\circ}$  W., at a mean rate of 1·7 miles; 9 (19·6 per cent.) went a mean distance of 29·8 miles in the mean direction N.  $27^{\circ}$  E.; and 3 (6·5 per cent.) migrated an average distance of 8·1 miles in the mean direction S.  $42^{\circ}$  E., at the mean rate of ·7 mile per 10 days.

*Third Quarter.*—Ten were recovered in December, 5 males and 5 females, but the place of capture of 1 male and 1 female was not ascertained. Two of the remaining males were found at 23 and 30 miles to the north and west, 1, 11 miles to the south and west, and 1, 18 miles to the south and east. Two of the females were taken at 28 and 30 miles to the north and west, and 2 at 20 and 44 miles to the south and west.

In January 1911, 2 males and 1 female were recovered all to the north and west, one of the males at a distance of  $16\frac{1}{2}$  miles and the other off Banff, in the Moray Firth, at a distance of 77 miles; the latter was "ripe and running." The female was caught near Buchan Ness, at a distance of 40 miles.

Fourteen were taken in February 1911, 9 males and 5 females. All these fish were also recaptured to the north and west, 2 males and a female off Banff, in the Moray Firth, at a distance of 77 miles; the female was "nearly ripe," and the males "spawning." One of the males had made a long journey, and was recaptured, after 257 days, 13 miles S.W. by W. of Cape Wrath ( $58^{\circ} 26' N.$ ;  $5^{\circ} 14' W.$ ), a distance of 199 miles, the mean rate of migration being 7·7 miles per 10 days; it was "ripe." Three males were taken near Aberdeen, at distances of  $30\frac{1}{2}$  and 34 miles. A male and 2 females were got near Buchanness, at distances of 34, 37, and 39 miles; a male was caught near Montrose, at a distance of 43 miles, and 1 near Tod Head, at a distance of 31 miles. A female was recovered off Buchanness at a distance of 26 miles, and another only 4 miles from the place of liberation.

The number recaptured in this quarter was 27, or 13·4 per cent., the place of capture of 2 not being ascertained. Of the remaining 25 (12·4 per cent.), 22 (88 per cent.) migrated an average distance of 45 miles in the mean direction N.  $35^{\circ}$  W., at a mean rate of 1·9 miles per 10 days; 2 (8 per cent.) moved south and west, and 1 south and east.

*Fourth Quarter.*—In March 1911, 13 of the marked plaice were recaptured, 7 males and 6 females. They were all found to the north-west, with one exception, a male, recaptured 11 miles to the north and east. Three of the males were taken in the Moray Firth, at distances of 77, 93, and 103 miles. A female was recaptured east of the Orkney Isles, a distance of 97 miles. A male was taken north of Kinnaird Head, at a distance of 64 miles. Five of the fishes, 2 males and 3 females, were taken to the south-east of Aberdeen, 4 at distances of 8 and 1 at 10 miles. Two females went 32 and 34·5 miles to the northwards, being taken off Buchanness.

In April, 3 males and 4 females were recaptured, 1 male and 1 female to the north-

east, 2 females to the south-west, and all the others to the north-west. A male and a female were taken in the Moray Firth, at distances of 93 and 102 miles. One of the males was caught off Kinnaird Head at a distance of 51 miles; a female, which measured 26·5–31·8 cm., was recovered at the mouth of the Tay, 56 miles to the south-west. A male and a female were found to the south-east of Aberdeen at 21 and 8 miles distant, while a female went 26 miles to the south-west.

In May, 9 were taken, 3 males and 6 females. Two of the males had moved to the north-west; 1 was taken off Buchanness, at a distance of 33 miles, and the other in the Moray Firth at 98 miles distant; the remaining male was found 15 miles to the south and west. Two of the females had moved to the north and west for distances of 8 and 36 miles respectively; 1 was found 12 miles to the north and east, and 2, 16 and 45 miles to the south and west; the remaining female migrated for 19 miles directly west.

In this quarter, 29 fishes, or 14·4 per cent., were recaptured; 19 (65·5 per cent.) moved an average distance of 49 miles in the mean direction N. 21° W., at the mean rate of 1·5 miles; 5 (17·2 per cent.) moved a mean distance of 32 miles in the mean direction S. 49° W., at an average rate of ·9 mile; 3 (10·3 per cent.) moved to the north and east; and 1 each to the west and to the south and east.

Altogether, in the 12 months after liberation, 145 of the fishes, or 72·1 per cent., were recaptured, the positions of 4 not being ascertained.

Of the remaining 141 (70·1 per cent.), 68 (48·2 per cent.) were found to the north and west; 40 (28·4 per cent.) to the south and west; 20 (14·2 per cent.) to the north and east, 11 (7·8 per cent.) to the south and east, and 2 directly west.

A summary of the mean distance and direction in each quadrant, for the first year after liberation, is given in the following table:—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. June 1910. July 1910. Aug. 1910	N. and E.	8	19·5	N. 30° E.	15	21·9	4–45	·8–7·5
	N. and W.	10	24·4	N. 53° W.	16	15·5	9–34·5	1·4–5·5
	S. and E.	6	14·6	S. 44° E.	10·6	4·6	6–21	1·2–10
	S. and W.	16	39·	S. 55° W.	14·	3·9	3–34	·5–13·7
	W.	1	2·4	W.	21·	7	..	..
		41	20·4	..	..	..	..	..
II. Sept. 1910. Oct. 1910. Nov. 1910.	N. and E.	9	19·6	N. 27° E.	29·8	2·2	10–114	·8–7·7
	N. and W.	17	36·9	N. 37° W.	17	1·7	6–37	·5–5·8
	S. and E.	3	6·5	S. 42° E.	8·1	·7	8–8·5	·7–9
	S. and W.	17	36·9	S. 51° W.	29·	2·4	4–55	·3–5·4
		46	22·9	..	..	..	..	..
III. Dec. 1910. Jan. 1911. Feb. 1911.	N. and E.			Nil.				
	N. and W.	22	88·	N. 35° W.	45·	1·9	4–199·5	·2–7·8
	S. and E.	1	4·	S. 85° E.	18·	·9	..	..
	S. and W.	2	8·	S. 48° W.	32·	1·8	20–49	1·1–2·6
		25	12·4	..	..	..	..	..
IV. Mar. 1911. April 1911. May 1911.	N. and E.	3	10·3	N. 39° E.	24·	·8	11–51	·3–1·7
	N. and W.	19	65·5	N. 21° W.	49·	1·5	8–103	·2–3·5
	S. and E.	1	3·4	S. 24° E.	8·	·25	..	..
	S. and W.	5	17·2	S. 49° W.	32·	·9	15·5–56·5	·4–1·9
	W.	1	3·4	W.	19·	·6	..	..
		29	14·4	..	..	..	..	..
SUMMARY.	N. and E.	20	14·2					
	N. and W.	68	48·2					
	S. and E.	11	7·8					
	S. and W.	40	28·4					
	W.	2	1·4					
		141	70·1					

Thirty-one of the remaining fishes which were recaptured were caught in the remainder of 1911.

In June, 4 females and 2 males were taken, the position of 1 of the males not being ascertained. The other male and 3 of the females were found to the north and west, at distances of from 6 to 35 miles; the remaining female was taken  $1\frac{1}{2}$  miles to the south-east of the place of liberation.

Three males and 6 females were recovered in July. Two of the males and 3 of the females were taken to the north-west, at distances of from 6 to 35 miles; 1 male and 2 females were captured at distances from 10 to 54 miles to the south-west, off the Isle of May; the remaining female was found at a distance of 16 miles to the north-east.

Two males and 5 females were recaptured in August, 1 of the males and 2 of the females at distances of from 5 to 28 miles to the north and west, and the remaining 4 fishes to the south and west, at distances of from 15 to 72 miles; 1 of these, a female, was taken near the Bell Rock, and another female south-east of St. Abb's Head, in the offshore waters, both being under adult size.

In September, 3 females were recovered, one 24 miles to the south and west, another 27 miles directly west, and the remaining fish 52 miles to the south-east, offshore.

In October, 1 male and 2 females were taken, the male and one of the females, to the north-west, at 36 and 11 miles distant respectively, and the other female at a distance of 85 miles to the south and east, far offshore.

A male was taken in November, in the Moray Firth, at a distance of 97 miles to the north and west.

In December, 2 males were recovered, one  $14\frac{1}{2}$  miles to the north-west, and the other 21 miles to the north-east.

Twenty of the marked plaice were recaptured in 1912. A female was taken in the Moray Firth, off Clyth Ness, at a distance of 88 miles, after 597 days, and it was "spawning." Three females were taken in February, 2 to the south-west, at distances of 60 and 75 miles respectively, the latter, which measured 28-38.2 cm., in the Firth of Forth, near Elie, and the former, of 25-34.7 cm., near the Isle of May, both being "immature"; the third female, of 32-42.3 cm., and "nearly ripe," was taken to the east of Orkney, at a distance of 126 miles to the north and west.

In March, 2 males and a female were taken, all to the north and west. One of the males was got in the Moray Firth, at a distance of 117 miles, and was "ripe"; the other was also recovered in the Moray Firth, at 90 miles distant, but the condition of the testes was not recorded; the female, which measured 27-35.4 cm., was recaptured 12 miles distant.

Two females were caught in April, one 46 miles to the south and west, east of the Isle of May, the other at a distance of 11 miles to the north and west.

Three females were recaptured in May, the position of 1 not being recorded; 1 was taken 35 miles to the north and west, and the other 8 miles to the south and east.

A male and a female were got in June, the male 23 miles to the north and west, and the female 46 miles to the south and west, east of the Isle of May.

A female was recaptured in July, 103 miles to the south and east, offshore, in Lat.  $57^{\circ} 10' N.$ ; Long.  $2^{\circ} E.$

A male was recovered in August, but the place of capture was not recorded.

In September, 1 male and 2 females were taken, the male 73 miles to the north, off Kinnaid Head, and both the females to the south and west, at distances of 10 and 24 miles respectively.

A female was taken in December 13 miles to the north and east.

Three of the marked plaice were recaptured in 1913. In February, a female, which was "spawning," was caught 9 miles to the north and west.

In May, a male and a female were recovered, the male at a distance of 22 miles to the north and east, and the female offshore, at a distance of 65 miles to the eastward.

The 2 remaining fishes from this experiment were taken as follows:—A male in the Moray Firth, north-east of Clyth Ness, at a distance of 106 miles in April, and a female 18 miles to the north and west in May; the former was "ripe," and the latter "spent."

The following table shows how all the fish of the experiment were distributed in each quadrant :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	8	193	24	N. 36° E.
	Immature Males.	4	35	9	N. 36° E.
	Adult Females.	4	73	18	N. 60° E.
	Immature Females.	8	229	29	N. 30° E.
		24	530	22	N. 35° E.
N and W.	Adult Males.	45	1928	43	N. 32° W.
	Immature Males.	6	158	26	N. 32° W.
	Adult Females.	24	795	33	N. 35° W.
	Immature Females.	20	443	22	N. 41° W.
		95	3324	35	N. 35° W.
S. and E.	Adult Males.	1	8	8	S. 24° E.
	Immature Males.	3	38	13	S. 73° E.
	Adult Females.	7	243	35	S. 46° E.
	Immature Females.	6	138	23	S. 42° E.
		17	427	25	S. 48° E.
S. and W.	Adult Males.	13	252	19	S. 55° W.
	Immature Males.	8	225	28	S. 42° W.
	Adult Females.	14	391	28	S. 61° W.
	Immature Females.	19	627	33	S. 54° W.
		54	1495	28	S. 54° W.
N.	Adult Males.	1	73	73	N.
W.	Adult Females.	1	19	19	W.
	Immature Females.	2	48	24	W.
		3	67	22	W.
SUMMARY.					
N. and E.		24	530	22	N. 35° E.
N. and W.		95	3324	35	N. 35° W.
S. and E.		17	427	25	S. 48° E.
S. and W.		54	1495	28	S. 54° W.
N.		1	73	73	N.
W.		3	67	22	W.
		194	..	..	..

*Distances travelled—10 miles and under.*—Fifty-two of the fish, or 26·8 per cent., went distances not exceeding 10 miles, namely, 20 males (22·5 per cent.), with an average of 7·3 miles, and 32 females (30·5 per cent.), with an average of 7·8 miles.

*10 to 20 miles.*—Forty-two of the fish, or 21·6 per cent., were found at distances between 10 and 20 miles, namely, 21 males (23·6 per cent.) with an average of 14·3 miles, and twenty-one females (20 per cent.), with a mean of 14 miles.

Thus, 94 fish, or 48·4 per cent., were recovered within 20 miles of the place of liberation, namely, 41 males (46·1 per cent.), with an average distance of 11 miles, and 53 females (50·5 per cent.), with a mean of 10·2 miles.

*20 to 50 miles.*—Sixty-eight fish, or 35 per cent., migrated distances of from

20 to 50 miles, 31 males (34·8 per cent.), with an average distance of 30·9 miles, and 37 females (35·2 per cent.), with an average of 33·6 miles. Nineteen males and 17 females had gone to the north and west; 7 males and 15 females to the south and west; 5 males and 2 females to the north and east; 1 female south and east; and 2 directly west.

*50 to 100 miles.*—Twenty-four, or 12·4 per cent., were found at distances between 50 and 100 miles, 13 males (14·6 per cent.), with an average distance of 78 miles, and 11 females (10·5 per cent.), with an average of 71·1 miles. Ten of the males and 3 of the females were got to the north and west, one male to the north and east, 1 male and 5 females to the south and west, 1 male directly north, and 3 females to the south and east.

*Over 100 miles.*—Eight fish, or 4·1 per cent., were taken at distances exceeding 100 miles, 4 males (4·5 per cent.), with a mean of 131·4 miles, and 4 females (3·8 per cent.), with a mean of 111·5 miles. All the males and two of the females were found to the north and west, in the Moray Firth, off Cape Wrath, and east of the Orkneys; 1 was recaptured to the north and east, also off Orkney; and the other in the offshore waters to the eastwards.

#### MATURITY.

*Males.*—Of the 94 males recaptured, the condition of the testes was ascertained in 68.

Four were "spawning"; 1, which measured 37·5–37·5 cm., was captured in January 1911, after 223 days, off Banff, in the Moray Firth, at a distance of 77 miles; 2 were taken in February, also off Banff, after 249 and 260 days, measuring respectively 39–38·9 cm., and 32–36·4 cm.; the fourth male was got in March 1911, after 294 days, 103 miles to the northwards, off Rattray Point; it measured 35–38·4 cm.

Five were described as "ripe." One, measuring 30–33·3 cm., was recaptured in February 1911, after 257 days, off Cape Wrath, at a distance of 200 miles; another, of 32–35·8 cm., was taken in April 1911, 51 miles to the north and east, off Buchanness; the third was recaptured also in April 1911, 21 miles to the north and west; the fourth was taken in March 1912, after 637 days, in the Moray Firth, off Brora, at a distance of 117 miles, and measured 29–33·6 cm.; the fifth was got in April 1914, after 1398 days, near Clyth Ness, in the Moray Firth, at a distance of 106 miles, and it measured 36·5–44·4 cm.

Four of the males were said to be "spent." Two were recovered in February 1911, 30 and 34 miles respectively to the north and west; one was recaptured in May 1911, 98 miles to the north and west, in the Moray Firth; and the fourth, in May 1913, 22 miles to the north-east.

Five were described as "nearly ripe." Three were got in December, the place of capture of 1, however, not being recorded; one of the others was found 11 miles to the north and west, after 188 days, and the other 14 miles to the north and west, after 564 days; the third fish was taken in November 1911, 97 miles to the north and west, in the Moray Firth; the remaining fish was captured in June 1912, after 747 days, 23 miles to the north and west.

Among those of adult size on recapture whose testes were "immature," were the following taken within the limits of the spawning season:—1, measuring 34–36·7 cm., at a distance of 16½ miles to the north-west, in January 1911; 4 in February 1911, at distances of from 31 to 43 miles to the north-west; 2 in March 1911, each at 8 miles distant to the north and west.

Among the fishes which were under the adult size (33 cm.) on recapture was 1 which measured 27–31·3 cm., taken in December 1910, 18 miles to the south and east, and described as "nearly ripe."

*Females.*—The condition of the ovaries was recorded in 80 of the 107 recaptured.

Four were "spawning," all taken to the north and west. One was caught in January 1912, after 597 days, 88 miles to the northward, and measured 25·5–40·1 cm.; another, of 40–40·8 cm., on 23rd February 1911, at a distance of 26 miles; the third in February 1913, after 982 days, at a distance of only 9 miles, and measuring 29–41·3 cm.; and the fourth, of 32·5–42·1 cm., in April 1912, after 676 days, at a distance of 11 miles.

One female, of 38·5–48·1 cm., taken in December 1912, after 928 days, at a distance of 13 miles to the north and east, was described as “nearly spawning.”

None was described as “ripe,” but 3 were “nearly ripe.” One of these, which measured 36·5–39·4 cm., was taken off Banff in February 1911; another, of 32–42·3 cm., in February 1912, off Auskerry, Copinshay, Orkney Isles, at a distance of 126 miles; the third, which measured 32–45·9 cm., was captured in September 1912, 24 miles to the south and west.

Four were “spent,” 1 caught in July 1911, 35 miles to the north-west, 1 in May 1912, the position of capture not being ascertained; a third, also in May 1912, 8 miles to the south and east, and the fourth in May 1914, after 1447 days, 18 miles to the north and west.

Two taken in March 1911 were described as “spent or immature”; they measured 32·5–38·4 cm. and 34·5–38·3 cm., and were caught 34 and 32 miles to the north and west.

Among those of adult size, whose ovaries were said to be “immature,” were 3 taken in April, and measuring 36–39·8 cm., 36·5–38·9 cm., and 29–40·9 cm.; they were caught 26 miles to the south and west, 8 miles to the south and east and 46 miles to the south and west respectively; another, of 28–38·2 cm., was taken in the Firth of Forth, between Largo and Elie, at a distance of 75 miles, in February 1912.

## EXPERIMENT II.

21st October 1910.

In this experiment, 282 plaice were marked and liberated, comprising 114 males, 152 females, and 16 whose sexes were not ascertained. The sizes of the males ranged from 27 to 41 cm., and 14 were under the adult size on liberation; the females ranged from 27 to 45·5 cm. in length, and 90 of them were below the adult size. Those whose sexes were not recorded varied in length from 33·5 to 40 cm.

The numbers marked and recaptured, arranged in 5-cm. groups, are given in the following table:—

	cm. 25–30·5	cm. 31–35·5	cm. 36–40·5	cm. 41–45·5	Total.
F. Lib. . . . .	6	46	83	17	152
F. Recap. . . . .	2	27	69	14	112
M. Lib. . . . .	3	51	59	1	114
M. Recap. . . . .	1	33	42	—	76
? Lib. . . . .	—	5	11	—	16
? Recap. . . . .	—	1	6	—	7

The fish used in this experiment were trawled by the “Goldseeker” early in the afternoon of the 19th October, in Aberdeen Bay, between Slains Castle and Collieston. As there was a heavy sea that day, the vessel anchored in Peterhead Bay, where it had to remain until the morning of the 21st, when it steamed to Aberdeen Bank and liberated the fish about noon.

The number recaptured was 195, or 69·1 per cent., namely, 76 males (66·6 per cent.), 112 females (73·7 per cent.), and 7 of unknown sex (43·7 per cent.).

Of the males, 71 were of adult size on recapture, averaging 38·1 cm., and ranging from 33 to 49·2 cm., as compared with an average of 36·1 cm., and a range of from 32 to 40·5 cm. on liberation; they were at liberty for from 4 to 1326 days, the mean being 244 days; they migrated distances of from 4 to 194 miles, the mean being 63·4 miles, and the mean rate of movement 2·6 miles. Five of the males were under adult size, the average being 31 cm., as compared with a mean of 31·5 cm. on liberation; they were free for an average period of 156 days, and migrated a mean distance of 55·4 miles, at an average rate of 3·5 miles per 10 days.

Seventy-nine of the females were of adult size on recapture, the mean being 41·9 cm., and the range from 38 to 51·9 cm., as compared with an average of 38·8 cm., and a range of from 33 to 44·5 cm. on liberation; their periods of freedom varied from 5 to 799 days, and averaged 283 days; they moved distances of from



3½ to 196 miles, the mean being 50.6 miles, and the mean rate of travel 1.8 miles. Thirty-three of the females were under adult size on recapture, varying from 27.3 to 37.9 cm., and averaging 35.6 cm., as compared with a range of from 27 to 38 cm., and an average of 34.8 cm. on liberation; they were at liberty for from 6 to 526 days, the mean being 129 days; they travelled journeys of from 4 to 140 miles, the mean being 30.5 miles, and the average rate 2.4 miles.

The 7 whose sexes were not ascertained were free for a mean period of 185 days; their sizes on recovery averaged 40.7 cm., as compared with 39 cm. on liberation; they travelled journeys of from 8½ to 197 miles, the average being 81.8 miles, and the mean rate 4.4 miles per 10 days.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Eight fish were recaptured in the remainder of October, 4 males and 4 females. Three of the males and 3 of the females moved to the north and west, for distances ranging from 7 to 13 miles; 1 male and 1 female were found 4 miles to the south and west.

In November, 10 of the marked plaice were recaptured, 5 males, 4 females, and 1 whose sex was not ascertained. The last-named fish and 1 male and 1 female were found to the north and west, at distances of from 8 to 44 miles; 2 males and 2 females were taken to the south and west, at distances of from 17 to 45 miles; 1 male had moved 48 miles to the south and east, and other 2 to the north and east, a male for 25 miles to near Buchanness, and a female 29 miles offshore to the south-east of Buchanness.

In December, 9 fishes were recovered, 3 males, 5 females, and 1 of unknown sex. Two of the males moved distances of 20 and 32 miles respectively to the north and west; the other male was found 10 miles to the south and west; 3 of the females were also taken to the south and west, at distances of from 10 to 49 miles, 2 being recaptured near Montrose, and another near the Bell Rock; 1 female moved 10 miles to the north and east, and another 104 miles to the north and west, being got, after 65 days, in the Moray Firth, to the east of Clyth Ness; the fish of unknown sex was also recaptured in the Moray Firth, off Whitehills, at a distance of 77 miles to the north and west.

In the first quarter, then, 27 fishes, or 13.9 per cent., were recovered, 13 (48.1 per cent.) to the north and west; 10 (37 per cent.) to the south and west; 3 to the north and east; and 1 to the south and east.

*Second Quarter.*—In January 1911, 14 fishes were recaptured, 5 males and 9 females. All were taken to the north and west, except 1 female to the south and east, and another to the south and west. No less than 9 of these fish, namely, 4 males and 5 females, were taken in the Moray Firth, 6 of them off Banff, at a distance of 77 miles, and other 3 at distances of 93 and 97 miles; 1 female was got on the north coast of Scotland, north-west of Dunnet Head, at 140 miles distant, after 84 days; another was taken at Buckhaven, near Buchanness, at a distance of 41 miles; another, south-east of Buchanness, at a distance of 30 miles; 1 of the females was recovered offshore at a distance of 17 miles to the south and east, and another at a distance of 15 miles to the south and west.

Twenty-four of the plaice, 13 males, 10 females, and 1 of unknown sex, were recaptured in February; no fewer than 22 were got to the north and west; 1 female was taken to the south and west; and a male to the south and east. Thirteen, viz. 12 males and 1 female, were recovered in the Moray Firth, 8 in the cod-nets off Banff, at distances of 77 and 78 miles, the others mostly off the coast of Caithness, at distances of 101 to 107 miles. All the males but one were "spawning" or "ripe," and the exception was "nearly ripe"; the female was "almost ripe"; the fish of unknown sex was captured after 130 days at a distance of 197 miles to the north and west, namely, 11½ miles W.S.W. of Cape Wrath (58° 29' N.; 5° 15' W.); it was "spawning"; 1 male was taken at a distance of 17 miles to the south and east; it was described as "mature"; a female was recaptured a little east of the Isle of May, at a distance of 59 miles to the south and west; it was "just about to spawn"; 7 females were taken at distances of from 11 to 34 miles north and west; they were all "immature"; 1 female, measuring 37.5-37.8 cm., recovered 16 miles to the north and west, was described as "ripe."

Thirty of the marked plaice, 10 males and 20 females, were recovered in March. Twenty-six had migrated north and west, 2 north and east, and 2 south and west. Six of the fishes, 3 females and 3 males, were taken in the Moray Firth, or to the east of it, 2 off Banff, at a distance of 77 miles, and the others at distances of from 93 to 107 miles; 1 of the males and 1 of the females were described as "spawning," the condition of the reproductive organs of the others not being recorded; a male, which was "ripe," was taken on the north coast, near Strathie Point, at a distance of 150 miles; another, also "ripe," was caught near Cape Wrath, on the west coast, at a distance of 194 miles; other females were got at shorter distances to the north-west, from 6 to 43 miles; most of these fish were either "spent" or "spawning." One male, which was "spawning," was caught north-east of St. Abb's Head, at a distance of 45 miles to the south and west, and another 20 miles in the same direction. A female, "spent," was taken 61 miles to the north-east, north-east of Kinnaird Head.

Thus, in this quarter, 68 fishes, or 34·9 per cent., were recaptured; 60 (88·2 per cent.) had migrated an average distance of 61 miles in the mean direction N. 26° W., the average rate of movement being 5·3 miles; 4 (5·9 per cent.) had moved an average distance of 35 miles in the mean direction S. 39° W., at a mean rate of 3·1 miles; 2 were taken to the north and east, and 2 to the south and east.

*Third Quarter.*—In April 1911, 22 of the marked plaice were recovered, 5 males, 15 females, and 2 whose sexes were not recorded. Thirteen of the fishes were found to the north and west, 4 to the north and east, and 5 to the south and west. A male was caught in the Moray Firth, at a distance of 101 miles, and a female off Banff, at a distance of 77 miles, and 1 of unknown sex at a distance of about 93 miles, also in the Moray Firth; a male was taken east of Noss Head, 104 miles away; a female was caught at 115 miles distant, offshore, to the east of the Orkneys, and 1 off Cape Wrath, on the west coast, at a distance of 196 miles; most of the remaining fish were found at comparatively short distances to the north and west; a male, of 27–27·7 cm., was taken at the mouth of the Tay, 59 miles to the south and west.

Seven were recovered in May, 4 males and 3 females. The position of 2 of the males was unknown; 1 of the other 2 went to the Moray Firth, and the second 18 miles to the south and west; 1 of the females was found 20 miles to the south and west, another 34 miles to the north and west, near Buchanness, while the third was recaptured on the north coast, off Whiten Head, at a distance of 156 miles; it was "spent."

Thirteen were taken in June, 3 males, 9 females, and 1 of unknown sex. Seven were found to the north and west, 4 to the south and west, and 2 to the north and east. Two of the males were recaptured in the Moray Firth, at distances of 87 and about 93 miles, and 2 females, both "spent," were taken to the east of Aukerry, Orkneys, at distances of 135 and 137 miles; a female, "spent," was caught, offshore, north-east of St. Abb's Head, at a distance of 35 miles to the south and west, and a male, described as "ripe," was taken 32 miles to the north and west, near Buchanness; the remaining fishes had migrated short distances, of from 5 to 15 miles.

In the third quarter, therefore, 42 of the fish, or 21·5 per cent., were recovered, but the place of recapture of 2 was not ascertained. Of the remaining 40 (20·5 per cent.), 23 (57·5 per cent.) migrated an average distance of 58 miles in the mean direction N. 15° W., at an average rate of 3 miles per 10 days; 6 (15 per cent.) migrated an average distance of 79 miles in the mean direction N. 7° E., at the mean rate of 3·9 miles; and 11 (27·5 per cent.) moved an average distance of 23 miles in the mean direction S. 59° W., at a mean rate of 1·2 miles.

*Fourth Quarter.*—Eleven of the marked fish were recaptured in July, 3 males and 8 females. Seven were taken to the north and west, 3 to the north and east, and 1 to the south and west. One of the females was taken in the Moray Firth, at a distance of 98 miles; another, east of the Bell Rock, 33 miles away to the south and west; and a third, 25 miles to the north and east, offshore; all the other fish were found at short distances from the station, from 3 to 13 miles.

Six were recaptured in August, 4 males and 2 females; 3 went to the north and west, 2 to the north and east, and 1 to the south and west. Two of the males were taken in the Moray Firth, at distances of about 93 and 94 miles; a female

was caught east of Auskerry, Orkneys, at a distance of 132 miles; the other 3 had moved short distances of 9, 15, and 17 miles respectively.

A male and 2 females were recovered in September, the male and 1 of the females 25 miles and 12 miles respectively to the north and east; the other female was taken off Noss Head, in the Moray Firth, at a distance of 104 miles.

Thus, in the fourth quarter, twenty of the marked fish, or 10·2 per cent., were recaptured, 11 (55 per cent.) at an average distance of 41 miles in the mean direction N. 16° W.; 7 (35 per cent.) at an average distance of 32 miles in the mean direction N. 36° E.; and 2 (10 per cent.) to the south and west.

Altogether, within the 12 months after liberation, 157 plaice, or 80·5 per cent., were got, but the place of capture of 2 was not recorded. Of the remaining 155 (79·5 per cent.), 107 (69 per cent.) were found to the north and west, 27 (17·4 per cent.) to the south and west, 18 (11·6 per cent.) to the north and east, and 3 (1·9 per cent.) to the south and east.

Particulars of all the marked plaice recaptured within the first 12 months are set forth in the following table:—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. Oct. 1910. Nov. 1910. Dec. 1910.	N. and E.	3	11·1	N. 36° E.	22	9·7	10·5-29·5	2-19·6
	N. and W.	13	48·1	N. 31° W.	29	13·1	7-104	2·5-27
	S. and E.	1	3·7	S. 14° E.	48	12	..	..
	S. and W.	10	37	S. 63° W.	21	8·5	4-49	1·7-25·2
			27	13·9	..	..	..	..
II. Jan. 1911. Feb. 1911. Mar. 1911.	N. and E.	2	2·9	N. 23° E.	44	3	28-61	1·7-4·2
	N. and W.	60	88·2	N. 26° W.	61	5·3	6·5-197	·4-16·6
	S. and E.	2	2·9	S. 9° E.	17	1·6	..	1·4-1·8
	S. and W.	4	5·9	S. 39° W.	35	3·1	15-59	1·5-5·7
			68	34·9	..	..	..	..
III. April 1911. May 1911. June 1911.	N. and E.	6	15	N. 7° E.	79	3·9	12-137·5	·7-6·9
	N. and W.	23	57·5	N. 15° W.	58	3	5-196·5	·2-10·3
	S. and E.			Nil.				
	S. and W.	11	27·5	S. 59° W.	23	1·2	3·5-59	·2-3·5
			40	20·5	..	..	..	..
IV. July 1911. Aug. 1911. Sept. 1911.	N. and E.	7	35	N. 36° E.	32	1·1	3·5-132	·1-4·6
	N. and W.	11	55	N. 16° W.	41	1·4	4-104·5	·1-3·8
	S. and E.			Nil.				
	S. and W.	2	10	S. 63° W.	24	·8	15-33	·5-1·2
			20	10·2	..	..	..	..
SUMMARY.	N. and E.	18	11·6					
	N. and W.	107	69					
	S. and E.	3	1·9					
	S. and W.	27	17·4					
		155	79·5					

Of the remaining fish, 4 were recaptured in the remainder of 1911. In October a male was caught 38 miles to the north and west, off Buchanness, and a female 24 miles to the south and west. In November, a male, "nearly ripe," was taken 8 miles N.N.W. of Cape Wrath, at a distance of 190 miles. In December, a female, also "nearly ripe," was got off Noss Head, Moray Firth, at a distance of 100 miles.

Twenty-nine were recovered in 1912. In January, a male, "nearly ripe," was caught north-east of Kinnaird Head, at a distance of 72 miles. Ten were taken in February, 6 males, 3 females, and 1 of unknown sex. Seven had migrated to the north and west, 2 to the north and east, and 1 to the south and west. Four, 2 males,

a female, and 1 of unknown sex, were recaptured in the Moray Firth, at distances of from 105 to 117 miles; the female was "ripe," one of the males "about ripe," and the other "three-parts ripe"; a male, "ripe," was taken west of the Orkney Isles, at a distance of 146 miles; a female, which had migrated 26 miles to the north and west, was "spawning," and a male, found 22 miles to the south and west, was "nearly ripe"; the other 3 fish had moved distances of only 6, 7, and 8 miles respectively. Two males and 3 females were recovered in March. Two of the females were taken in the Moray Firth, at distances of about 93 and 108 miles; in neither was the condition of the ovaries ascertained; a male, "ripe," was caught to the south-east of Auskerry, Orkneys, at a distance of 127 miles; another male, also "ripe," was got off Buchanness, at a distance of 32 miles to the north and west; and a female, "partly spent," at a distance of 10 miles to the north and west. A male and a female were taken in April, the male, "spent," at a distance of only 5 miles to the north and west; the female, also "spent," near the Pentland Skerries, 114 miles to the north and west. In May, a female, "spent," was captured 52 miles to the north and east, off Rattray Point. Three females and a male were taken in June, 1 female "spent," off Noss Head, Moray Firth, at a distance of 98 miles; another, 25 miles to the north and east, off Buchanness; and the third, 15 miles to the south and west; the male, off Auskerry, Orkneys, at a distance of 127 miles to the north and east. Two females were recovered in August, both to the north and east, 1 at a distance of only  $7\frac{1}{2}$  miles, and the other offshore, south-east of Buchanness, at a distance of 39 miles. A female was taken in September, 8 miles north-west from Fair Isle, at a distance of 157 miles to the north and east. In October, another female was got 9 miles south-east from Fair Isle, at a distance of 150 miles to the north and east. In November, a female was caught  $6\frac{1}{2}$  miles to the north and west. In December, another female was taken 8 miles in the same direction; both were "nearly ripe."

Two were recaptured in 1913, both in March, a female, offshore, north-east of Kinnaird Head, at a distance of 77 miles to the north and east, and a male on the north coast, 5 miles north of Sandside, at a distance of 148 miles north and west; the condition of the ovary of the female was not recorded; the male was "spawning."

Two males were recaptured in 1914, 1 in January, 8 miles to the north and west, and the other in June, 10 miles south-east of Fair Isle, at a distance of 146 miles to the north and east; the former was "three-quarters ripe," and the latter "spent."

The following table shows the particulars of distance and direction in each quadrant for all the fish of the experiment:—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	8	542	68	N. 18° E.
	Adult Females.	24	1445	60	N. 28° E.
		32	1987	62	N. 25° E.
N. and W.	Adult Males.	50	3558	71	N. 17° W.
	Immature Males.	3	207	69	N. 24° W.
	Adult Females.	42	2220	53	N. 22° W.
	Immature Females.	27	877	32	N. 43° W.
	? Sex.	6	556	93	N. 12° W.
		128	7418	58	N. 85° W.
S. and E.	Adult Males.	2	65	32	S. 11° E.
	Adult Females.	1	17	17	S. 9° E.
		3	82	27	S. 11° E.
S. and W.	Adult Males.	9	201	22	S. 55° W.
	Immature Males.	2	69	34	S. 81° W.
	Adult Females.	12	303	25	S. 54° W.
	Immature Females.	6	126	21	S. 61° W.
	? Sex.	1	15	15	S. 81° W.
		30	714	24	S. 28° W.

## SUMMARY.

N. and E.	32	1987	62	N. 25° E.
N. and W.	128	7418	58	N. 85° W.
S. and E.	3	82	27	S. 11° E.
S. and W.	30	714	24	S. 28° W.
	193	..	..	..

*Distances travelled*—10 miles and under.—Thirty-one fish, or 16·1 per cent., were found within distances not exceeding 10 miles, namely, 10 males (13·5 per cent.), with an average distance of 6·35 miles, and 20 females (17·8 per cent.), with an average of 76 miles, and 1 of unknown sex, which was found at a distance of 8½ miles.

10 to 20 miles.—Thirty-nine fish, or 20·2 per cent., were got at distances of from 10½ to 18½ miles, namely, 11 males (14·9 per cent.), with an average distance of 14·5 miles, and 27 females (24·1 per cent.), with a mean of 13·5 miles, and 1 of unknown sex, at a distance of 15½ miles.

Thus, 70 of the marked plaice, or 36·3 per cent., were recovered at distances under 20 miles, 21 (28·4 per cent.) being males, with an average distance of 10·6 miles, and 47 females (41·9 per cent.), with a mean of 11 miles, and 2 of undistinguished sex with an average of 12 miles. Twelve of the males, 31 of the females, and 1 of undetermined sex were found to the north and west, 2 males and 7 females to the north and east, 6 males, 8 females and 1 of unknown sex to the south and west, and 1 male and 1 female to the south and east.

20 to 50 miles.—Forty-seven of the marked fish, or 24·3 per cent., were recaptured at distances of from 20 to 49 miles, viz. 15 males (20·3 per cent.), with an average of 33·6 miles, and 32 females (28·6 per cent.), with an average of 31·7 miles. Eight males and 16 females went to the north and west, 2 males and 7 females to the north and east, 4 males and 9 females to the south and west, and 1 male to the south and east.

50 to 100 miles.—Forty of the fish, or 20·7 per cent., were recaptured at distances

of from 50 to 100 miles, viz. 20 males (27 per cent.) with an average of 82.1 miles, 17 females (15.2 per cent.), with an average of 80.5 miles, and 3 (42.8 per cent.) of unknown sex, with an average of 78.5 miles. Eighteen males, 13 females, and 3 of unknown sex were found to the north and west; 1 male and 3 females to the north and east; 1 male and 1 female to the south and west. Eighteen of the males, 12 of the females, and 2 of unknown sex, or 32 altogether of the 40, were recaptured in the Moray Firth.

*Over 100 miles.*—Thirty-six fish, or 18.6 per cent., were recovered at distances of from 101 to 197 miles, namely, 18 males (24.3 per cent.), with an average of 126.8 miles, 16 females (14.3 per cent.) with a mean of 131.4 miles, and 2 of undetermined sex (28.6 per cent.), with an average of 156.5 miles. Fifteen of the males, 8 of the females, and the 2 of unknown sex had migrated to the north and west; 3 males and 8 females to the north and east; none was found to the south and west, nor to the south and east. Eight males, 5 females, and 1 of the unknown sexes were recaptured in the Moray Firth, mostly off the coast of Caithness, and 2 of the males just outside the limits of the firth. Two males and 2 females were taken on the north coast of Scotland. Three males and 3 females were got in the neighbourhood of the Orkney Isles. One male and 2 females were taken near Fair Isle, and 2 males and 1 female off Cape Wrath, on the west coast. A female was caught at the entrance to the Pentland Firth, and another far offshore to the east of Noss Head.

#### MATURITY.

*Males.*—Of the 76 males recaptured, the condition of the testes was ascertained in 60. Nine were "spawning"; 7 of them were caught in the Moray Firth, 6 near Banff, at a distance of 77 miles, and 1 on the Caithness coast, at a distance of 104 miles; 1 was recaptured off Sandside, on the north coast of Caithness, at a distance of 148 miles, and 1, 45 miles to the south and west, to the east of the Firth of Forth. Two were taken in January 1911, 4 in February 1911, 2 in March 1911, and 1 in March 1913.

Sixteen were "ripe," of which 7 were recaptured in the Moray Firth, 3 at Banff, at a distance of 77 miles, and the others at distances of from 101.5 to 107 miles. One was got on the north coast, at a distance of 150½ miles, 2 off Orkney, at distances of 127 and 146 miles, 1 off Cape Wrath, at a distance of 194 miles, 2 off Buchanness, at 32 miles distant, 1, 4 miles to the north and west of the station, and 1, 17 miles to the south and east; the locality of recapture of the remaining fish was not ascertained. Eight of these were taken in February 1911, 1 in February 1912, 2 in March 1911, 2 in March 1912, 1 in May 1911, 1 in June 1911, and 1 in July 1911.

Five were described as "spent," 1 taken in June 1914, after 1362 days, near Fair Isle, at a distance of 146 miles, and the others at, respectively, 5, 15, 17, and 29 miles to the north and west, 3 in March 1911, and 1 in April 1912.

Eight were "nearly ripe." Two were recaptured in the Moray Firth at distances of 78 and 105 miles, 1 near Cape Wrath, at a distance of 190 miles, 1 to the north of Rattray Point, at a distance of 72 miles, 2 off Buchanness, at distances of 32 and 38 miles, 1, 8½ miles to the north and west; the remaining male was recaptured 22 miles to the south and west. One of these fish was got in January, 4 in February, 1 in October, 1 in November, and 1 in December.

Two were described as "three-quarters ripe," 1 taken in the Moray Firth in February 1912, at a distance of 117 miles, and the other in January 1914, 8 miles to the north and west.

Fourteen were described as "immature." Two were recovered in April, both to the south and west, at distances of 3½ and 32 miles respectively; 2 were caught in May, the place of recapture of 1 being unrecorded, the other being taken 18 miles to the south and west. Two were taken at considerable distances, 1 in the Moray Firth, in August 1911, 94 miles away, and the other in June 1912, off Auskerry, Orkneys, at 127 miles distant.

*Females.*—Of the 112 females recovered, the condition of the reproductive organs was ascertained in 92.

Eight were "spawning"; 6 were recaptured to the north and west, 1 to the south and west, and 1 to the north and east. One was taken in the Moray Firth, off Banff, at a distance of 77 miles; another off Stronsay, 140 miles distant to the

north-east; 1, 20 miles to the south and west, and the others at distances of from 10 to 32 miles to the north and west. One was captured in February, 6 in March, and 1 in April.

Two were "ripe," 1 got 59 miles to the south and west, off the Isle of May, in February 1911, and the other in the Moray Firth, at a distance of 105 miles, in February 1912.

Twenty-one were said to be "spent"; 9 were recaptured to the north and west, at distances of from 13 to 196 miles, the latter in the neighbourhood of Cape Wrath; another was taken on the north coast, off Whiten Head, at 156 miles distant; 1 off the Pentland Skerries, at 114 miles, and 2 in the Moray Firth, at 77 and 98 miles distant respectively. Nine were recovered to the north and east, 2 at Auskerry, Orkneys, at 135 and 137 miles distant: 1 north of Rattray Point, at a distance of 52 miles; 1 east of the Orkneys, at a distance of 115 miles; another off Kinnaird Head, at 61 miles distant, and the others at distances of from 12 to 30 miles; 3 were taken at 15½, 33, and 35 miles to the south and west. Of these fish, 4 were caught in March, 8 in April, 2 in May, 5 in June, 1 in July, and 1 in August.

Eight of the females were described as "nearly ripe"; all were taken to the north and west, 5 in the Moray Firth, off Banff and Whitehills, at a distance of 77 and 78 miles, 1 off the Pentland Firth, at 100 miles distant, and 2 at short distances from the station, namely, 6½ and 8 miles. Four of these fish were taken in January, 1 in February, 1 in November, and 2 in December.

Twenty were "immature." One, of 39-39.6 cm., was caught in January 1911, 15 miles to the south and west; 1, of 39-41.7 cm., was taken in March 1911, 12 miles to the north and west; 2 were got in April 1911, 1 measuring 37.5-40.1 cm., 12 miles to the north and west, and 1, of 36.5-38.9 cm., 33 miles to the north-west; and 1, of 37.5-40.1 cm., in May 1911, 20 miles to the south and west. All the others were taken outside the limits of the spawning season.

Among the females under the size assigned for first maturity, viz. 38 cm., 1 was "ripe," 1 "nearly ripe," 3 "spent," and 1 "spent or immature." The "ripe" fish measured 37.5-37.8 cm., and was taken in February 1911, after 103 days, 16½ miles to the westwards; the "nearly ripe" plaice measured 37-36.9 cm., and was got in January 1911, after 95 days, in the Moray Firth, at a distance of 97 miles. All those described as "spent" were taken in March 1911, and all to the north and west; 1, of 36.5-37.7 cm., at a distance of 6½ miles; another, of 37-37.9 cm., at a distance of 7½ miles; a third, of 37-37.4 cm., at a distance of 15 miles, and the fourth, which was "spent or immature," measuring 36.5-37.2 cm., at a distance of 13½ miles.

Among those whose sexes were unknown was one described as "spawning"; it measured 39.5-39 cm., and was captured in February 1911, after 130 days, off Cape Wrath, on the west coast, at a distance of 197 miles.

#### EXPERIMENT III.

19th July 1911.

The number of plaice marked and liberated in this experiment was 109, of which 49 were males and 60 were females. The sizes of the males ranged from 23.5 to 43.5 cm., and of the females from 24.5 to 47.5 cm. On liberation 35 of the males and 37 of the females were under the adult size.

The numbers marked and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	Total.
F. Lib. . . . .	19*	10	21	9	1	60
F. Recap. . . . .	6†	5	16	6	1	34
M. Lib. . . . .	33‡	10	3	3	—	49
M. Recap. . . . .	14§	6	2	1	—	23

\* Two at 24.5 cm.

† One at 23.5 and 1 at 24.5 cm.

‡ One at 24.5 cm.

§ One at 23.5 cm.

The fish used in this experiment were caught in Cruden Bay, Aberdeenshire, on the 18th July, at 9 p.m., and they were liberated on 19th July, at 2 a.m. Two died in the tanks on the way.

The number recaptured was 57, or 52·3 per cent., rather a low proportion. Twenty-three (46·9 per cent.) were males, and 34 (56·7 per cent.) were females.

Of the males, 10 were of adult size on recapture, ranging from 33·7 to 44·8 cm., and averaging 38·7 cm., in comparison with a range of from 29 to 41 cm. and an average of 34·4 cm. on liberation; they were free for from 15 to 883 days, the mean being 380 days; they migrated distances of from 8 to 102 miles, the mean being 39·3 miles, and the average rate of travel was 1 mile per 10 days.

Thirteen of the males were under adult size, averaging 28·5 cm., and ranging from 23·8 to 32 cm., compared with a range of from 23·5 to 33 cm. and an average of 27·7 cm. on liberation; they were at liberty for from 9 to 323 days, the mean period being 83 days, and they moved journeys of from 6 to 55 miles, the average being 26·2 miles, and the mean rate was 3·15 miles.

Twenty-three of the females were of adult size on recapture, ranging from 38·6 to 46·9 cm., and averaging 41·8 cm., as compared with a variation of from 31 to 47·5 cm., and an average of 38·9 cm. on liberation; their periods of freedom varied from 13 to 701 days, the average being 275 days; they travelled from 4 to 169 miles, the average being 31·1 miles, and the mean rate was 1·1 miles per 10 days.

Eleven were under the adult size, the average length being 31·4 cm., and the range from 25 to 37·9 cm., compared with a range of from 24·5 to 37·5 cm., and a mean of just 30·9 cm. on liberation; they were free for from 10 to 209 days, the average being 91·5 days, and the distances migrated were from 4 to 52 miles, the average being 24·9 miles, and the mean rate of movement 2·7 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the remainder of July, 5 of the marked fishes were recaptured, 2 males and 3 females, but the particulars in regard to 1 of the females were not recorded. The 2 males and 1 of the females were found to the northwards at distances of from  $8\frac{1}{2}$  to  $12\frac{1}{2}$  miles; the other female was got 15 miles to the south and slightly to the east.

In August, 10 were recovered, 7 males and 3 females. Two of the females and 4 of the males were taken to the south and west, at distances of from 11 to 41 miles, the rates of movement varying from 7·3 to 17·8 miles per 10 days. One male went to the east of the Bell Rock; the other 3 males and the remaining female were found to the westwards and slightly northwards, at distances of from 4 to 29 miles.

Two males and 4 females were recaptured in September, both the males and two of the females to the south and west, and 2 females to the north and west. One of the males and one of the females were caught off St. Andrew's Bay, west of the Bell Rock, at distances of 52 and 55 miles; one of the females was caught to the east of the Isle of May, at a distance of 51 miles; the other male was recaptured east of the Bell Rock, at a distance of 34 miles; the 2 females which moved to the north and west were found at distances of 4 and 19 miles respectively.

In this quarter, 21 of the marked plaice, or 36·8 per cent., were recaptured, the position of capture of 20 (35·1 per cent.) being recorded. Ten (50 per cent.) were found at an average distance of 31 miles in the mean direction S.  $59^{\circ}$  W.; 9 (45 per cent.), 11½ miles in the mean direction N.  $73^{\circ}$  W.; and 1, 15 miles S.  $1^{\circ}$  E. The general feature on the chart showing the lines between the station and the place of capture is the movement westward and south-westwards, towards the coast and the mouth of the Firth of Forth. None was recaptured to the north of a line between the station and Aberdeen. With two exceptions, all the males were under the adult size on recapture, while 3 females were over adult size. The reproductive organs in all case where their condition was recorded were "immature" or "very immature."

*Second Quarter.*—One male and 3 females were got in October, the male and 1 of the females to the south and west, and 2 females to the north and west. Of the 2 females captured to the north and west, 1 was found at a distance of only 6 miles; it measured 36·5–38·8 cm., and was "nearly ripe"; the other, of 41·5–



41·6 cm., was taken near Aberdeen, at a distance of  $26\frac{1}{2}$  miles, and was "rather immature." The male, of 26·7 cm., and "very immature," was taken to the south-west of the Bell Rock, at a distance of 47 miles; and the remaining female, offshore, to the east of the Isle of May, at a distance of 35 miles; it measured 42·5–42·8 cm., and was "nearly ripe."

Seven were taken in November, 1 male and 6 females. The male and 3 of the females were got to the north and west, 2 of the females off Aberdeen, at distances of 25 and 28 miles respectively, and both were "nearly ripe"; the other female was found 4 miles to the north and west, and the male, which was "about half ripe," 17 miles to the westwards. Of the 3 females which migrated to the south and west, 1 was found east of the Isle of May, at a distance of 52 miles; it measured 30 cm., and was "immature"; the other 2, also under adult size, were found near Montrose, at a distance of 39 and 42 miles.

Only 1, a female, of 39–40·4 cm., and "half ripe," was got in December, 7 miles to the north and west.

Thus, in the second quarter, 12 of the marked plaice, or 21 per cent., were recaptured, 7 (58·3 per cent.) at an average distance of 16·2 miles in the mean direction N.  $45^{\circ}$  W., and 5 (41·7 per cent.) at an average distance of 43 miles in the mean direction S.  $60^{\circ}$  W. The feature of the chart is much the same as in the first quarter, none of the fish being found north of Lat.  $57^{\circ} 15' N$ .

*Third Quarter*—A male, described as "three-quarters ripe," was taken in January 1912, to the north-east of the Bell Rock, at a distance of 24 miles to the south and west; it measured 29·5–31·8 cm.

Two males and 2 females were recaptured in February, 1 of the males  $16\frac{1}{2}$  miles to the north-east, the other male and the 2 females to the north and west, at distances of 7 and 10 miles. One of the females, which moved 7 miles, was "fully ripe," and measured 38–39·2 cm.

None was taken in March.

In this quarter, therefore, only 5 of the marked plaice, or 8·8 per cent., were recovered, 3 at an average distance of 9 miles in the mean direction N.  $51^{\circ}$  W., 1 to the north-east and 1 to the south and west. The chart shows a change from the previous quarters, 4 of the 5 fish being taken to the north of the station, but none north of Lat.  $57^{\circ} 57' N$ .

*Fourth Quarter*.—A male and 3 females were got in April, 1 of the females to the north and east, at a distance of 26 miles, and all the others to the north and west, at distances of 7, 9, and 13 miles respectively. One of the females was described as "spent"; it measured 37·5–40 cm., and was found 13 miles to the north and west.

In May, a male, "spent," was recaptured in the Moray Firth, at a distance of 100 miles to the north and west.

In June, a male and two females were taken, the male 30 miles to the north and west, 1 of the females 12 miles to the north and east, and the other 15 miles to the south and west.

In this quarter, 8 of the marked plaice, or 14 per cent., were recovered, 5 (62·5 per cent.) at an average distance of 32 miles in the mean direction N.  $24^{\circ}$  W.; 2 (25 per cent.) 19 miles in the mean direction N.  $49^{\circ}$  E.; and 1 to the south and west. All but one were found to the northwards of the station.

Thus, in the first 12 months after liberation, 46, or 80·7 per cent., were recaptured, the positions of 45 (78·9 per cent.) being known. Twenty-four (53·3 per cent.) were got to the north and west; 17 (37·8 per cent.) to the south and west; 3 to the north and east; and 1 to the south and east.



The following table sets forth these particulars for the first year :—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. July 1911. Aug. 1911. Sept. 1911.	N. and E.	9	45°	Nil.	11·5	6·7	4-29	·8-14·5
	N. and W.	1	5°	N. 73° W.	15°	15°	..	..
	S. and E.	10	50°	S. 1° E.	3·1	10°	11-55	5·2-17·8
	S. and W.			S. 59° W.				
		20	35·1	..	..	..	..	..
II. Oct. 1911. Nov. 1911. Dec. 1911.	N. and E.	7	58·3	Nil.	16·2	1·5	4-28	·3-3·3
	N. and W.			N. 45° W.				
	S. and E.	5	41·7	Nil.	43°	3·8	35-52·5	3·0-4·65
	S. and W.			S. 60° W.				
		12	21·05	..	..	..	..	..
III. Jan. 1912. Feb. 1912. Mar. 1912.	N. and E.	1	20°	N. 9° E.	16·5	·7	..	..
	N. and W.	3	60°	N. 51° W.	9°	·4	7-10	·3-5
	S. and E.	1	20°	Nil.	24°	1·24	..	..
	S. and W.			S. 56° W.				
		5	8·8	..	..	..	..	..
IV. April 1912. May 1912. June 1912.	N. and E.	2	25°	N. 49° E.	19°	·65	12-26·5	36-95
	N. and W.	5	62·5	N. 24° W.	32°	1·06	7-100	·24-3·3
	S. and E.	1	12·5	Nil.	15°	·44	..	..
	S. and W.			S. 67° W.				
		8	14·0	..	..	..	..	..
SUMMARY.	N. and E.	3	6·7					
	N. and W.	24	53·3					
	S. and E.	1	2·2					
	S. and W.	17	37·8					
		45	78·9					

The remaining plaice of the experiment were recaptured as follows; :—Four in the remainder of 1912, and 7 in 1913.

A female was caught in September 1912, after 422 days, 9 miles to the south and west, and another in October, after 461 days, 29 miles to the south and west. In November, a male was taken far offshore, north-east of Kinnaird Head, at a distance of 102 miles to the north and east; it measured 32·5-38·1 cm., and was "about half ripe"; a female, described as "mature," was also taken in November, offshore, to the south-east, at a distance of 28 miles.

Two females were recovered in February 1913, 1 of 37-45·4 cm., and "rather immature," to the north-east of the Orkneys, at a distance of 169 miles to the north and east; and the other, measuring 35-41·3 cm., and "immature," 13½ miles to the north and west. In April, a female of 31-40·8 cm., and "nearly ripe," was recaptured 30 miles E. by S. ½ S. of Hantlepool, at a distance of 138 miles to the south and west. In June, a male and a female were taken, the male 30 miles to the south and west, to the east of the Bell Rock, and the female, described as "spent," 33 miles to the north and west. A male was got in October, off Kinnaird Head, at a distance of 65 miles; it was said to be "nearly ripe." The last fish from the experiment was a male, caught in December 1913, after 883 days, 41 miles to the south and west, north-east of the Isle of May; it was "nearly ripe," and measured 34-44·8 cm.

The following table sets forth the particulars of distance and direction in each quadrant for all the fish of the experiment :—

[TABLE.

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	2	167	83	N. 36° E.
	Immature Males.	1	16	16	N. 9° E.
	Adult Females.	3	207	69	N. 36° E.
		6	390	65	N. 31° E.
N. and W.	Adult Males.	5	144	29	N. 49° W.
	Immature Males.	5	85	17	N. 64° W.
	Adult Females.	11	169	15	N. 42° W.
	Immature Females.	5	49	10	N. 67° W.
		26	447	17	N. 52° W.
S. and E.	Adult Females.	1	28	28	S. 27° E.
	Immature Females.	1	15	15	S. 1° E.
		2	43	21	S. 14° E.
S. and W.	Adult Males.	3	82	27	S. 44° W.
	Immature Males.	7	238	34	S. 61° W.
	Adult Females.	8	309	38	S. 53° W.
	Immature Females.	4	184	46	S. 69° W.
		22	813	37	S. 57° W.
SUMMARY.					
N. and E.		6	390	65	N. 31° E.
N. and W.		26	447	17	N. 52° W.
S. and E.		2	43	21	S. 14° E.
S. and W.		22	813	37	S. 57° W.
		56	..	..	..

*Distances travelled—Under 10 miles.*—Fourteen, or 25 per cent., were recaptured at distances not exceeding 10 miles, 5 males (21·7 per cent.), with an average of 8·3 miles, and 9 females (27·3 per cent.), with an average of 6·4 miles. All the males and 8 of the females were found to the north and west, and 1 of the females to the south and west.

*10 to 20 miles.*—Fourteen, or 25 per cent., were taken at distances of from 11 to 19 miles, 5 males (21·7 per cent.), with an average of 14·6 miles, and 9 females (27·3 per cent.), with an average of 14·5 miles. Two of the males and 4 of the females went to the north and west; 2 of the males and 3 of the females to the south and west; 1 male and 1 female to the north and east; and a female to the south and east.

Twenty-eight of the fish, therefore, or 50 per cent., were recaptured at distances under 20 miles, viz. 10 males (43·5 per cent.), with an average distance of 11·45 miles, and 18 females (54·5 per cent.), with a mean distance of 10·5 miles.

*20 to 50 miles.*—Nineteen, or 33·9 per cent., were recovered at distances of from 21 to 47 miles, 9 males (39·1 per cent.), with an average of 33 miles, and 10 females (30·3 per cent.), with an average of 31 miles. Seven of the males and 4 of the females were found to the south and west; 2 of the males and 4 of the females to the north and west; 1 female to the south and east, and 1 to the north and east.

*50 to 100 miles.*—Six, or 10·7 per cent., went from 51 to 100 miles, 3 males (13 per cent.), with a mean of 73·3 miles, and 3 females (9·1 per cent.), with an average of 52 miles. All the females were found to the south and west, opposite the mouth of the Firth of Forth, or St. Andrew's Bay; 1 male was taken in the Moray Firth, 1 north of Kinnaird Head, and 1 off St. Andrew's Bay.

Over 100 miles.—Three, or 5·3 per cent., were got at distances over 100 miles, a male, far offshore, 102 miles in the mean direction N. 71° E., and 2 females, 1 near Fair Isle, at a distance of 169 miles to the north and east, and the other off Hartlepool, at a distance of 138 miles to the south and west.

#### MATURITY.

*Males.*—Of the 23 recaptured, the condition of the testes was ascertained for 21. None was described as “ripe.” Two were “nearly ripe,” 1 taken in December 1913, 41 miles to the south and west, and the other in October 1913, 65 miles to the north and east.

One was said to be “spent”; it was got in the Moray Firth, at a distance of 100 miles, in May 1912.

Two taken in November were described as “about half ripe,” 1, 17 miles to the north and west, and 1, 102 miles N. 71° E.

One of those described as “immature” was taken in April 1912, 9 miles to the north and west; it measured 29·5–33·7 cm.

Among the males under 33 cm. on recapture was 1, of 29·5–31·8 cm., taken in January 1912, 24 miles to the south and west, and described as “three-quarters ripe.”

*Females.*—The condition of the ovaries was recorded in 30 of the 34 females recovered. One was “fully ripe”; it was caught in February 1912, 7 miles to the north and west, and measured 38–39·2 cm.; another, of 38·5–42 cm., was “ripe,” and was caught on 5th November 1912, 28 miles to the south and east.

Two were “spent”; 1, of 37·5–40 cm., caught in April 1912, 13 miles to the north and west, and the other, of 47·5–43·3 cm., 33 miles to the north and west.

Five were “nearly ripe,” 3 caught at distances of 6, 25, and 28 miles to the north and west, 1 in October 1911, and 2 in November 1911; 1 in October 1911, 35 miles to the south and west, and 1, in April 1913, after 634 days, off Hartlepool, 138 miles to the south and west.

Among those of adult size which were “immature” on recapture were the following:—Two taken in February, measuring respectively 35–41·3 cm. and 37–45·4 cm., at distances of 13½ miles to the north and west, and 169 miles to the north and east; 2 in April 1912, 1, of 37·5–40·4 cm., 7 miles to the north and west, and 1, of 39·5–42·1 cm., 26 miles to the north and east.

#### EXPERIMENT IV.

6th July 1912.

In this experiment, 100 fish were marked and liberated, 49 males, 50 females, and 1 whose sex was not ascertained. The sizes of the males ranged from 29 to 41 cm., and 20 were under the adult size; the sizes of the females ranged from 28·5 cm. to 60 cm., and 35 were under the adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	cm. 56-60·5	Total.
F. Lib.	7	23	11	3	3	1	2	50
F. Recap.	3	15	6	1	3	1	2	31
M. Lib.	11	29	8	1	—	—	—	49
M. Recap.	5	19	6	1	—	—	—	31
? Lib.	—	1	—	—	—	—	—	1
? Recap.	—	—	—	—	—	—	—	0

The fish used in this experiment were taken in Kirkcaldy Bay, in the Firth of Forth, on 5th July, and were marked and placed in tanks between 3·5 and 3·30 p.m. They were liberated at 8·20 p.m. on the 6th, 10 of them having died in the tanks in the interval.

The number recaptured was 62, or 62 per cent., viz. 31 males (63·3 per cent.) and 31 females (62 per cent.).

Twenty-eight of the males were of adult size on recapture, ranging from 33·2 to 44 cm., and averaging 37 cm., as compared with a range of 29 to 41 cm., and an average of 34·7 cm. on liberation; they were free for from 5 to 822 days, the mean being 291 days; they migrated distances of from 5 to 172 miles, the mean being 60·7 miles, and the average rate of movement 2·1 miles. Three were under the adult size, averaging 30·9 cm., as compared with 30·2 cm. on liberation; they were at liberty for a mean period of 124 days, and moved a mean distance of 30·2 miles at an average rate of 2·4 miles.

Eighteen of the females were of adult size, averaging 46·3 cm. and ranging from 38·5 to 60·2 cm., as compared with an average of 42·3 cm. and a range of 31·5 cm. to 60 cm. on liberation; they were at liberty for from 39 to 1188 days, the mean being 382 days; they moved distances of from 8 to 106 miles, the average being 35·8 miles, and the mean rate of movement ·9 mile. Thirteen were under the adult size, ranging from 29·8 to 37·4 cm., and averaging 33·7 cm., as compared with a range of from 29·5 to 36 cm., and a mean of 32·2 cm. on liberation; they were free for from 28 to 362 days, the average being 190 days; and they travelled journeys of from 7 to 70·5 miles, the average being 43·7 miles, and the mean rate 2·3 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Two males were got in the same month as they were liberated, 1, 10½ miles to the south and east, and the other 19 miles to the north and west.

Four females and 1 male were taken in August, the male 9 miles to the north and east, and all the females to the south and west, at distances of from 24 to 54 miles. Three of them were recovered near the Bell Rock, 2 to the west of it, towards St. Andrew's Bay, at distances of 52 and 54 miles, and the other to the south-east of it, at a distance of 47 miles. The fourth female, described as "spent," was found at a distance of 24 miles.

One male and 5 females were recaptured in September, the male 16½ miles to the south and east, and 1 of the females 34 miles in the same direction, in the offshore waters; of the other females, 1 was taken 11 miles directly west; another, near Tod Head, 30 miles to the westwards; a third, 24 miles to the south and west; the fourth, 57 miles to the south and west, to the north of St. Abb's Head. On the chart, the lines of movement, with a few exceptions, are towards the coast, spreading out between Tod Head and St. Abb's Head.

In this quarter, 13 of the marked plaice, or 20·9 per cent., were taken, 6 at an average distance of 43 miles, in the mean direction of S. 65° W.; 3 (23·1 per cent.) to the south and east, 2 to the north and west (N. 77° W.), 1 west, and 1 north and east.

*Second Quarter.*—Three males and a female were recovered in October, 1 of the males to the north and west, and the other fish to the south and west, the female at a distance of 23 miles, 1 of the males at 24 miles, and another at 44 miles, near the Bell Rock; the remaining male was taken near Tod Head, at a distance of 30 miles to the west and south.

Three males and 1 female were taken in November, 1 of the males near Tod Head, 30 miles to the westwards, and all the others to the south and west, 1 of the males at a distance of 20 miles, another south-east of the Bell Rock, at a distance of 41 miles, and the female off Dunbar, 65 miles to the south and west.

Two males were caught in December, 1, "nearly ripe," off Aberdeen, at a distance of 23 miles to the north and west; the other, 27 miles E. ½ S. of Hartlepool, at a distance of 133 miles to the south and west.

In this quarter, 10, or 16·1 per cent., were recaptured, 7 (70 per cent.) to the south and west for an average distance of 50·3 miles, the mean direction being S. 54° W.; 3 (30 per cent.) were got to the north and west, the mean distance being 28 miles in the mean direction N. 66° W. The chart shows much the same condition as in that for the previous quarter, only 1 marked plaice being caught to the north of the station.

*Third Quarter.*—In January 1913, 3 males and a female were recaptured. The female, measuring 33–34·5 cm., and "immature," was taken in the Firth of Forth, near Elie, at a distance of 65 miles to the south and west; 1 of the males was caught 88 miles to the south, 42 miles E.S.E. ½ S. of Longstone Light; it measured

33·5 cm. on liberation, but the size on recapture and the condition of the testes were not recorded; another male, of 35–35·6 cm., and “nearly ripe,” was caught in the Moray Firth, near Banff, at a distance of 77 miles; and the third was recovered 114 miles to the south and west, 8 miles E.  $\frac{1}{2}$  S. of Tynemouth; it measured 35–35 cm., and was described as “mature.”

Three males and 4 females were taken in February, all but 1 of the females to the north and west. Four were taken in the Moray Firth, 2, a male and a female, at nearly the same place, close to Clyth Ness, at a distance of 106 and 106 $\frac{1}{2}$  miles; the male measured 38·5–40·3 cm., and was “spawning” (“partly spent”), and the female measured 50·5–50·2 cm., and was “about ripe”; a male was taken off Banff, at a distance of 77 miles, measuring 34·5–34·8 cm., and being described as “ripe”; the fourth, a male, of 32–33·2 cm., and “ripe,” was got off Tarbet Ness, at 100 miles distant; a female, measuring 33·5–36·5 cm., and “immature,” was recovered 11 miles to the north and west; and another female, of 30–32·9 cm., was taken in St. Andrew’s Bay, at a distance of 63 miles; the last female, which measured 46–46·5 cm., and was “almost ripe,” was caught 8 miles to the north and west.

Three males were recaptured in March, 1, of 34–36·8 cm., but of unknown maturity, 35 miles E.  $\frac{1}{2}$  N. of Flamborough Head, at a distance of 172 miles to the south and east; another, of 34–36·4 cm., and “immature,” only 5 miles to the north and west, and the third, in the Moray Firth, north-east of Tarbet Ness, at a distance of 108 miles; it measured 39·5–40·2 cm., and was “spawning” (“partly spent”).

In this quarter, 14 of the marked plaice, or 22·6 per cent., were recaptured, 9 (64·3 per cent.) to the north and west, at an average distance of 66 miles in the mean direction N. 16° W.; 3 at an average distance of 81 miles in the mean direction S. 54° W.; 1 to the south; and 1 to the south and east. The migration lines on the chart show a great difference, 6 passing northwards to the Moray Firth, 3 to the southwards, and 2 south and west, to the Firth of Forth and St. Andrew’s Bay.

*Fourth Quarter.*—Three females and a male were taken in April, the male in Aberdeen Bay, 35 miles to the north and west, one of the females 7 miles to the south and east, another 15 miles to the south and west, while the third had migrated to near Elie, in the Firth of Forth, a distance of 70 miles. All these fish were “immature.”

In May, 3 females and a male were recaptured, the male at the entrance to the Moray Firth, off Noss Head, at a distance of 104 miles; it was “spent.” One of the females was taken 32 miles to the north and west, “spent”; another, 34 miles to the north and east; and the third 39 miles to the south and west, offshore, to the east of the Isle of May.

A female was caught in June, 16 miles to the south and west.

In this quarter, 9 of the marked plaice, or 14·5 per cent., were recovered; 4 (44·4 per cent.) to the south and west (mean direction, S. 67° W.); 3 to the north and west, and 1 each to the north-east and the south-east.

In the year after liberation, 46, or 74·2 per cent., were recovered, 20 (43·5 per cent.) to the south and west; 17 (36·9 per cent.) to the north and west; 5 to the south and east; 2 to the north and east; 1 west and 1 south.

The following table gives a summary of these particulars:—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. July 1912. Aug. 1912. Sept. 1912.	N. and E.	1	7·7	N. 69° E.	9	2·1	..	..
	N. and W.	2	15·4	N. 77° W.	25	21·2	19-30·5	4·5-38
	S. and E.	3	23·1	S. 24° E.	20	19·6	10·5-34	2·1-52·5
	S. and W.	6	46·1	S. 65° W.	43	9·7	24-57	3·9-19·5
	W.	1	7·7	W.	11	1·4	..	..
		13	20·9	..	..	..	..	..
II. Oct. 1912. Nov. 1912. Dec. 1912.	N. and E.			Nil.				
	N. and W.	3	30	N. 66° W.	28	2·3	23·5-30	1·4-3·3
	S. and E. S. and W.	7	70	Nil. S. 54° W.	50·3	3·8	20·5-133	1·4-8·3
		10	16·1	..	..	..	..	..
III. Jan. 1913. Feb. 1913. Mar. 1913.	N. and E.			Nil.				
	N. and W.	9	64·3	N. 16° W.	66	3·01	5-108	·19-4·7
	S. and E.	1	7·1	S. 6° E.	172	6·5	..	..
	S. and W. S.	3 1	21·4 7·1	S. 54° W. S.	81 88·5	4·1 4·7	63·5-114	2·9-6·1
		14	22·6	..	..	..	..	..
IV. April 1913. May 1913. June 1913.	N. and E.	1	11·1	N. 7° E.	34·5	1·05	..	..
	N. and W.	3	33·3	N. 20° W.	57	1·8	32-104	1-3·3
	S. and E.	1	11·1	S. 24° E.	7	·25	..	..
	S. and W.	4	44·4	S. 67° W.	35	1·2	15·5-70·5	·45-2·4
		9	14·5	..	..	..	..	..
SUMMARY.	N. and E.	2	4·3					
	N. and W.	17	36·9					
	S. and E.	5	10·8					
	S. and W.	20	43·5					
	W.	1	2·2					
	S.	1	2·2					
		46	74·2					

Of the other fish recaptured, 7 were taken in the remainder of 1913, 6 in 1914, and 3 in 1915.

In July 1913, a female was taken off the Bell Rock, at a distance of 36 miles to the south and west. In August, a male was caught off Dunbar, at a distance of 59 miles to the south and west. In September, 2 females were recaptured, 1, 28 miles to the north and west, and the other, offshore, at a distance of 54 miles to the east and north. A female was taken in October, also offshore, to the south and east, at a distance of 81 miles. In December, a male and a female were caught, the male, of 34-37·6 cm., and "nearly ripe," 26 miles to the north and west, off Aberdeen, and the female, measuring 60-60·2 cm., and also "nearly ripe," to the west of the Bell Rock, at a distance of 51 miles to the south and west.

In January 1914, a male, of 37·5-40 cm., and "ripe," was recaptured 7 miles to the north and west, and in February 2 males, the condition of whose testes was not recorded, both in the Moray Firth and 1 north-east of Tarbet Ness, at a distance of 117 miles, and the other south-east of the same, at a distance of 106 miles. A male, of 33·5-40 cm., and "spawning," was taken in March, to the north-east of Kinnaird Head, at a distance of 71 miles to the north and east. Another, measuring 33·5-41·1 cm., and "ripe," was caught in May, 9½ miles to the north and west. In October, a male, of 34·5-44 cm., and "fully half ripe," was recovered at a distance of only 3 miles to the south of the station.

In January 1915, a female, of 32-49 cm., and "immature" was taken to the south-east of Buchanness, at a distance of 34 miles to the north and east. In

March, another female, of 31·5–40·5 cm., and “immature,” was caught 28 miles to the south and west, and in October, after 1188 days, the last fish, a female, of 34·5–52 cm., and “rather immature,” was recaptured only 10 miles distant, to the north and west.

The following table gives a summary of the mean distance and direction, in each quadrant, for all the fish of the experiment :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (Miles.)	Average Distance (Miles.)	Mean Direction.
N. and E.	Adult Males.	2	80	40	N. 36° E.
	Adult Females.	2	88	44	N. 45° E.
	Immature Females.	1	34	34	N. 7° E.
		5	202	40	N. 34° E.
N. and W.	Adult Males.	16	944	59	N. 26° W.
	Immature Males.	1	35	35	N. 34° W.
	Adult Females.	5	184	37	N. 37° W.
	Immature Females.	2	41	20	N. 57° W.
		24	1204	50	N. 31° W.
S. and E.	Adult Males.	2	188	94	S. 7° E.
	Immature Males.	1	10	10	S. 47° E.
	Adult Females.	2	115	57	S. 21° E.
	Immature Females.	1	7	7	S. 24° E.
		6	320	53	S. 21° E.
S. and W.	Adult Males.	7	394	56	S. 40° W.
	Immature Males.	1	44	44	S. 72° W.
	Adult Females.	8	246	31	S. 70° W.
	Immature Females.	9	483	54	S. 62° W.
		25	1167	47	S. 59° W.
S.	Adult Males.	1	88	88	S.
W.	Adult Females.	1	11	11	W.
SUMMARY.					
N. and E.		5	202	40	N. 34° E.
N. and W.		24	1204	50	N. 31° W.
S. and E.		6	320	53	S. 21° E.
S. and W.		25	1167	47	S. 59° W.
S.		1	88	88	S.
W.		1	11	11	W.
		62	..	..	..

*Distances travelled*—10 miles and under.—Eight of the marked plaice, or 12·9 per cent., were recaptured at distances of from 3 to 10 miles, 5 males (16·1 per cent.), with an average of 6·7 miles, and 3 females (9·7 per cent.), with an average of 8·3 miles. Three of the males and 2 of the females were found to the north and west, 1 male to the south and west, 1 to the north and east, and 1 female to the south and east.

10 to 20 miles.—Seven, or 11·3 per cent., were taken at distances of from 10½ to 19 miles, 3 males (9·7 per cent.), with an average of 15·3 miles, and 4 females (12·9 per cent.), with an average of 13·4 miles. One of the males and 1 of the females were found to the north and west, 2 males to the south and east, 2 females to the south and west, and 1 to the west.



Thus, 15 of the fish, or 24·2 per cent., were got at distances under 20 miles, 8 males (25·5 per cent.), with an average distance of 9·9 miles, and 7 females (22·6 per cent.), with a mean of 11·2 miles.

*20 to 50 miles.*—Twenty-two of the recaptured plaice, or 35·5 per cent., were taken at distances of from 20½ to 47 miles, 9 males (29 per cent.), with an average of 30·7 miles, and 13 females (41·9 per cent.), with an average of 32 miles. Five of the males and 3 of the females were found to the north and west, 4 males and 7 females to the south and west, 2 females to the north and east, and 1 female to the south and east.

*50 to 100 miles.*—Sixteen, or 25·8 per cent., were taken at distances of from 51 to 100 miles, 6 males (19·3 per cent.), with an average of 79 miles, and 10 females (32·2 per cent.), with an average of 61·5 miles. Three of the males were taken to the north and west, 1 male and 1 female to the north and east, 1 male and 8 females to the south and west, 1 male to the south, and 1 female to the south and east.

*Over 100 miles.*—Nine, or 14·5 per cent., migrated distances of from 104 to 172 miles, viz. 8 males (25·8 per cent.), with an average of 120·1 miles, and 1 female (3·2 per cent.), which went 106 miles. Five of the males and the female were recaptured in the Moray Firth, or its vicinity, while 3 of the males were taken off the coast of England, to the southwards.

#### MATURITY.

*Males.*—Of the 31 males recaptured, the condition of the testes was recorded for 25.

Three were "spawning," 2 being taken in the Moray Firth, and the third off Kinaird Head, the former in February and March 1913, after 231 and 244 days respectively, at distances of 106 and 108 miles; the latter, in March 1914, after 612 days, at a distance of 71 miles; all were large, measuring respectively 39·5–40·2 cm., 38·5–40·3 cm., and 33·5–40 cm.

Five were described as "ripe"; 2 of them were taken in the Moray Firth, in February 1913, after 214 and 216 days, at distances of 77 and 100 miles respectively; 1 was caught off Tynemouth in January 1913, at a distance of 114 miles, after 186 days, and 2 were taken short distances to the north and west, 1 at 7 miles in January 1914, and the other at 9½ miles in May 1914.

One was said to be "spent": it was taken in the Moray Firth, in May 1913, at a distance of 104 miles.

Four were described as "nearly ripe"; one was got in January 1913, off Banff, in the Moray Firth, at a distance of 77 miles; another, in November 1912, 41 miles to the south and west, the third in December 1912, 23½ miles to the north and west, and the fourth in December 1913, 26½ miles to the north and west.

Among those of adult size on recapture and described as "immature," was the following fish, taken within the limits of the spawning season:—It measured 34–36·4 cm., and was caught in March 1913, at a distance of only 5 miles to the north and west.

*Females.*—The condition of the ovaries was recorded in 28 of the 31 females recaptured.

None was "spawning" or "ripe."

Two were described as "spent," 1, measuring 59–59·3 cm., taken in August 1912, 24 miles to the south and west; the other, of 40–43·1 cm., taken in May 1913, 32 miles to the north and west.

Four were described as "nearly ripe"; 1, of 52–51·4 cm., was taken in November 1912, after 139 days, off Dunbar, 65 miles to the south and west; another, of 60–60·2 cm., was caught in December 1913, after 524 days, to the west of the Bell Rock, at a distance of 51 miles to the south and west; the third was caught in February 1913, after 229 days, in the Moray Firth, at a distance of 106 miles; it measured 50·5–50·2 cm.; the fourth, measuring 46–46·5 cm., was recaptured, also in February 1913, only 8 miles distant, to the north and west.

Among those of adult size, with "immature" ovaries, 3 were recaptured in the spawning season, viz. 1 of 32–49 cm., in January 1915, after 933 days, 34 miles to the north and east; 1, taken in March 1915, after 997 days, 28 miles to the south and west; a third, of 37–39·9 cm., caught in April 1913, after 271 days, 15½ miles to the south and west.

## EXPERIMENT V.

21st September 1912.

One hundred plaice were marked and liberated in this experiment, 44 males, 55 females, and one of undetermined sex. The males ranged in size from 30 to 44 cm., and 4 were under adult size on liberation; the females ranged from 31.5 to 53 cm., and 22 were under the adult size when liberated.

The following table shows the numbers of those marked and recaptured, arranged in 5-cm. groups:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	Total.
F. Lib.	—	11	26	12	4	2	55
F. Recap.	—	6	15	7	1	—	29
M. Lib.	1	18	24	1	—	—	44
M. Recap.	—	5	6	—	—	—	11
? Lib.	—	1	—	—	—	—	1

The fish which were marked were taken by the trawl of the "Goldseeker" in the Dornoch Firth, Moray Firth, in the middle of the day on 20th September, and were liberated at 11 a.m. on the 21st.

The number recaptured was 40, or 40 per cent., a very low proportion, viz. 11 males (24.4 per cent.) and 29 females (52.7 per cent.). All the males were of adult size when recaptured, the sizes ranging from 31.8 to 40.5 cm., and averaging 37.2 cm., as compared with a range of from 31.5 to 37 cm. and an average of 35.3 cm. on liberation; they were free for from 26 to 986 days, the mean being 269 days; they migrated distances of from 7 to 65 miles, the mean being 21.2 miles, and the average rate of movement .8 mile. Twenty-three of the females were of adult size when recaptured, ranging from 38 to 47.5 cm., and averaging 42.7 cm., as compared with a range of from 32 to 46 cm. on liberation, and an average of 39.25 cm.; they were at liberty for from 25 to 882 days, the mean being 308 days; they migrated for distances of from 3 to 56 miles, the average being 18.9 miles, and the mean rate of movement .6 mile. Six were under the adult size, averaging 36.1 cm., as compared with 35.7 cm. on liberation; they were free for a mean period of 135 days, and travelled distances of from 6 to 51 miles, the mean being 23.1 miles, and the average rate 1.7 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—None was taken in the remainder of September. Two males and 3 females were captured in October, 1 male and 1 female at 9 and 13½ miles to the north and west, 1 female 4 miles to the south and east, and a male and a female to the south and west, at distances of 7½ and 19 miles. Two females were recovered in November, one 11 miles to the north and east, and the other off Rattray Head, at a distance of 42 miles to the north and east. One male and 4 females were taken in December, the male 24 miles to the south and west, a female 19 miles in the same direction, and another female 43½ miles in the same direction, to the east of the Isle of May; a female, of 42-42 cm., and described as "spawning," was taken 10½ miles to the westwards, and another, of 46-45.5 cm., and "nearly ripe," at 17 miles to the north and west.

In this quarter, 12 of the marked plaice, or 30 per cent. were taken, 5 (41.7 per cent.) at an average distance of 23 miles in the mean direction S. 56° W.; 3 (25 per cent.) at an average distance of 13 miles in the mean direction N. 64° W.; 2 to the north and east, and 1 each to the south and east and to the west. The chart shows the general lines of migration west and south-west towards the coast, from about the level of Tod Head to St. Abb's Head, but 3 fishes were recaptured to the north of the station.

*Second Quarter.*—A male and a female were recovered in January 1913, the male, of 36-36.3 cm., and "ripe," near Buchanness, 35 miles to the north and west,

and the female, the condition of whose ovaries was not recorded, 29 miles to the south and west, offshore, to the east of the Bell Rock. A male and a female were taken in February, the male at a distance of 10 miles to the north and west, and the female at  $15\frac{1}{2}$  miles distant in the same direction; both were "spawning," the male measuring 36.5–36.8 cm., and the female 44–44.3 cm. Three females were caught in March, but the position of capture of 1 was not recorded. One of the others, of 42.5–43.4 cm., was taken at a distance of 8 miles to the north and west, and was "spawning"; the other, measuring 38–37.8 cm., and "rather immature," was got nearly at the same place.

In this quarter, 7 were recaptured, or 17.5 per cent., the positions being recorded for 6 (15 per cent.), and of these 5 were found to the north and west, at an average distance of 15 miles, the mean direction being N. 25° W.; the other fish was taken to the south and west. The chart shows the radiating lines going to the north and west, 5 of the 6 fish being taken to the northwards.

*Third Quarter.*—Two males and 3 females were taken in April 1913, but the position of capture of one of the females was not ascertained. One female was found  $10\frac{1}{2}$  miles to the west, and the other 6 miles to the north and west; one of the males was taken 12 miles to the north and west, and the other 15 miles to the south and west; all these fish were "immature." A female, of 45–46 cm., was caught in May off Rattray Head, at a distance of 48 miles to the north and west, and was "spent."

In this quarter, 6 fishes, or 15 per cent., were taken, the positions being known for 5; 3 were found to the north and west, and 1 each to the south-west and the west.

*Fourth Quarter.*—A male and a female were recaptured in July 1913, the male 18 miles to the south and west, and the female to the east of the Isle of May, at a distance of 51 miles to the south and west. Two females and a male were taken in August, the male at 7 miles and one of the females at  $14\frac{1}{2}$  miles to the north and west, and the other female  $13\frac{1}{2}$  miles to the north and east.

In this quarter, 5, or 12.5 per cent., were caught, 2 to the north and west, 2 to the south and west, and 1 to the north and east.

Thus, in the 12 months immediately following the liberation of the fish, 30 marked plaice were recovered, or 75 per cent., but the positions of 2 were not recorded. Of the remaining 28, 13 (46.4 per cent.) were found to the north and west, 9 (32.1 per cent.) to the south and west, 3 (10.7 per cent.) to the north and east, 2 to the west, and 1 to the south and east.

A summary of the mean distance and direction in each quadrant for the first year is as follows :—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. Oct. 1912. Nov. 1912. Dec. 1912.	N. and E.	2	16·6	N. 32° E.	26	4·2	11-42	2·2-6·2
	N. and W.	3	25·	N. 64° W.	13	3·15	9-17	2·3-4·35
	S. and E.	1	8·3	S. 3° E.	4	1·6	..	..
	S. and W.	5	41·7	S. 56° W.	23	4·7	7·5-43·5	2·5-11·2
	W.	1	8·3	W.	10·5	1·1	..	..
		12	30·	..	..	..	..	..
II. Jan. 1913. Feb. 1913. Mar. 1913.	N. and E.			Nil.				
	N. and W.	5	83·3	N. 25° W.	15	1·1	8-35·5	·4-2·8
	S. and E.	1	16·6	Nil.			..	..
	S. and W.	1	16·6	S. 40° W.	29	2·4	..	..
		6	15·	..	..	..	..	..
III. April 1913. May 1913. June 1913.	N. and E.			Nil.				
	N. and W.	3	60·	N. 6° W.	22	·97	6-48	·3-2·02
	S. and E.	1	20·	Nil.			..	..
	S. and W.	1	20·	S. 67° W.	15	·75	..	..
	W.	1	20·	W.	10·5	·5	..	..
		5	12·5	..	..	..	..	..
IV. July 1913. Aug. 1913. Sept. 1913.	N. and E.	1	20·	N. 62° E.	13·5	·4	..	..
	N. and W.	2	40·	N. 12° W.	10·7	·3	7-14·5	·2-·5
	S. and E.			Nil.				
	S. and W.	2	40·	S. 40° W.	34·	1·2	18-51	·6-1·8
			5	12·5	..	..	..	..
SUMMARY.	N. and E.	3	10·7					
	N. and W.	13	46·4					
	S. and E.	1	3·6					
	S. and W.	9	32·1					
	W.	2	7·1					
		28	70·					

Of the other fishes recaptured, 2 were taken in the remainder of 1913, 6 in 1914, and 2 in 1915.

Two females were taken in November 1913, one,  $5\frac{1}{2}$  miles to the south, and the other, described as "three-quarters ripe," north-east of Kinnaird Head, at a distance of  $56\frac{1}{2}$  miles to the north and east. A female was taken in January 1914, 8 miles to the north and west; it also was "three-quarters ripe." In February, a male, described as "spawning," was taken  $30\frac{1}{2}$  miles to the north and west. In March, a female, "spent," was taken 9 miles to the north and west. In May, a female, also "spent," was got  $9\frac{1}{2}$  miles to the north and west; in September, a female, north-east of Rattray Head, 53 miles to the north and east; and in October, a female 3 miles to the south.

In February 1915, after 882 days, a female, described as "spent," was taken 7 miles to the north and west; and in June, after 986 days, a male, north-east of Longstone Light, Northumberland, 65 miles to the south and west.

The above particulars for the whole experiment are summarised in the following table :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Females.	4	164	41	N. 25° E.
	Immature Females.	1	11	11	N. 48° E.
		5	175	35	N. 29° E.
N. and W.	Adult Males.	6	103	17	N. 21° W.
	Adult Females.	10	148	15	N. 36° W.
	Immature Females.	2	14	7	N. 19° W.
		18	265	15	N. 29° W.
S. and E.	Adult Females.	1	4	4	S. 3° E.
S. and W.	Adult Males.	5	129	26	S. 51° W.
	Adult Females.	3	51	17	S. 32° W.
	Immature Females.	3	113	38	S. 51° W.
		11	293	27	S. 46° W.
W.	Adult Females.	2	20	10	W.
S.	Adult Females.	1	5	5	S.

## SUMMARY.

N. and E.	5	175	35	N. 29° E.
N. and W.	18	265	15	N. 29° W.
S. and E.	1	4	4	S. 3° E.
S. and W.	11	293	27	S. 46° W.
W.	2	20	10	W.
S.	1	5	5	S.
	38			

*Distances travelled*—10 miles and under.—Fourteen of the fish, or 36·8 per cent., were found at distances of from 3 to 10 miles, 4 males (36·4 per cent.), with an average of 8·4 miles, and 10 females (37 per cent.), with a mean of 6·8 miles. Three of the males and 7 of the females had moved to the north and west, 1 male and 1 female to the south and west, 1 female to the south and east, and 1 female to the south.

10 to 20 miles.—Thirteen, or 34·2 per cent., were found at distances of from 10½ to 19 miles, 3 males (27·3 per cent.), with a mean of 15 miles, and 10 females (37 per cent.), with an average of 14·4 miles. One male and 4 females were taken to the north and west, 2 males and 2 females to the south and west, 2 females to the north and east, and 2 females to the west.

Twenty-seven of the plaice, therefore, or 71 per cent., were recaptured at distances under 20 miles, viz. 7 males (63·6 per cent.), with an average of 11·2 miles, and 20 females (74·1 per cent.), with a mean of 10·6 miles.

20 to 50 miles.—Seven, or 18·4 per cent., were got at distances of from 24 to 48 miles, 2 males (27·3 per cent.), with a mean of 30 miles, and 4 females (14·8 per cent.), with an average of 40·6 miles. Two of the males and 1 female went to the north and west; 1 male and 2 females to the south and west, and 1 female to the north and east.

50 to 100 miles.—Four, or 10·5 per cent., were taken at distances of from 51 to 65 miles, 1 male and 3 females (11·1 per cent.), with a mean of 53·5 miles. The male and 1 of the females were caught to the south and west, and 2 females to the north and east. None of the fish was found at a distance over 100 miles.

## MATURITY.

*Males.*—The condition of the testes was recorded for 10 of the 11 males. Two were "spawning," 1, measuring 36.5–36.8 cm., caught in February 1913, 10 miles to the north and west, and the other, of 36.5–39.9 cm. in February 1914, 30½ miles to the north and west.

A male, of 36–36.3 cm., taken in January 1913, 35½ miles to the north and west, was described as "ripe." One, of 35.5–34.8 cm., taken in December 1912, 24 miles to the south and west, was said to be "nearly ripe."

Two, described as "immature," were caught in the spawning season, both in April, 1, 15 miles to the south and west, and the other 12 miles to the north and west; they measured respectively 34.5–35.7 cm. and 36.5–36.5 cm.

*Females.*—The condition of the ovaries was ascertained in 23 of the 29 recaptured. Two were "spawning," 1, of 44–44.3 cm., being captured in February 1913, 15½ miles to the north and west, and the other, of 42.5–43.4 cm., in March 1913, 8 miles to the north and west.

One was described as "nearly spawning"; it measured 42–42 cm., and was captured in December 1912, 10½ miles to the westwards.

Five were described as "spent," but the position of 1 was not recorded; the others were taken as follows:—One in May 1913, 48 miles to the north and west, off Rattray Head; another, in March 1914, 9 miles to the north and west; the third, in May 1914, 9½ miles to the north and west; and the fourth, in February 1915, after 882 days, 7 miles to the north and west.

Four were "nearly ripe"; 1 was taken in November 1912, 42 miles to the north and east; another, in December 1912, 17 miles to the north and west; the third, in November 1913, 56 miles to the north and slightly to the east; and the fourth, in January 1914, 8 miles to the north and west.

Among those in which the ovaries were "immature," 1, of 39–39.5 cm., was captured in April 1913, 10½ miles to the west.

## EXPERIMENT VI.

27th March 1913.

One hundred plaice were marked in this experiment, 28 males and 72 females. The males ranged in size from 29.5–41.5 cm., and 6 were under adult size, and the females from 31.5 to 55 cm., of which 49 were under adult size.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25–30.5	cm. 31–35.5	cm. 36–40.5	cm. 41–45.5	cm. 46–50.5	cm. 51–55.5	Total
F. Lib.	—	34	31	4	2	1	72
F. Recap.	—	26	23	4	1	1	55
M. Lib.	1	19	7	1	—	—	28
M. Recap.	1	14	6	1	—	—	22

The fish used were taken by the "Goldseeker" in the Firth of Forth, place unspecified, on the afternoon of the 26th, and were liberated about 2 a.m. on the 27th, after being in the tanks for 11 hours, "all in good condition."

The number recaptured was 77, or 77 per cent., viz. 22 males (78.6 per cent.) and 55 females (76.4 per cent.). All the males were of adult size on recapture, ranging from 33.2 to 43.8 cm., and averaging 38.6 cm., as compared with a range of from 29.5 to 41.5 cm., and an average of 34.8 cm. on liberation; they were free for from 5 to 671 days, the mean being 253 days, and they migrated distances of from 4 to 154 miles, the average being 36.6 miles, and the mean rate of movement 1.4 miles. Thirty-two of the females were of adult size, ranging from 38 to 55.3 cm., and averaging 43.8 cm., as compared with a range of from 32 to 55 cm., and an average of 38.8 cm. on liberation; they were at liberty for from 4 to 1457 days, the mean being 294 days, and they moved distances of from 3 to 198 miles; the mean being 30.5 miles, and the average rate 1 mile. Twenty-two of the females were under the adult size on recapture, ranging from 31.3 to 37.9 cm., and averaging 35.3 cm., as compared with a range of from 31.5 to 37.5 cm., and a mean of 34.2

cm. on liberation ; they were at liberty for from 3 to 349 days, the average being 74 days, and they travelled distances of from 4 to 68 miles, the average being 24·7 miles, and the mean rate 3·35 miles per 10 days.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the remainder of March, 5 females were recaptured, 4 to the north and west, at distances of from  $6\frac{1}{2}$  to 9 miles, and 1,  $10\frac{1}{2}$  miles to the north and east. One, measuring 44–44·3 cm., was “spent” ; it was taken  $6\frac{1}{2}$  miles to the north and west.

Ten females and 4 males were taken in April, 6 to the north and west, at distances of from 4 to 9 miles, 5 to the south and west, at distances of from 11 to 25 miles, 2 directly north, at distances of 11 miles, and 1, 13 miles to the south and east. Four of the females were described as “spent,” 2 caught to the north and west, and 2 to the south and west.

In May, 5 females and 2 males were taken ; 3 to the north and west, 3 to the south and west, and 1 to the north and east ; the last named, a male, of 41·5–42·3 cm., is described as having been caught, after 46 days, 154 miles to the north and east, offshore, in 69 fathoms (Lat.  $59^{\circ} 5' N.$  ; Long.  $1^{\circ} 20' E.$ ), and was landed at North Shields ; a male and 2 females, taken to the north and west, had gone distances of  $9\frac{1}{2}$ ,  $9\frac{1}{2}$ , and  $16\frac{1}{2}$  miles respectively ; of the 3 females recaptured to the south and west, 1 was got at a distance of 19 miles, 1 near the Bell Rock, at a distance of 45 miles, and the other north of the Bell Rock at a distance of 40 miles.

In this quarter, 26 of the marked plaice, or 34·2 per cent., were recovered, 13 (50 per cent.) to the north and west, at an average distance of 8 miles in the mean direction N.  $55^{\circ} W.$  ; 8 to the south and west, in the mean direction S.  $67^{\circ} W.$ , at an average distance of 23 miles ; 2 (7·7 per cent.) to the north and east ; 2 to the north, and 1 to the south and east. The lines of migration on the quarterly chart mostly radiate towards the coast, to the westwards and south, but 8 of the fish were recaptured to the north of the station.

*Second Quarter.*—Nine females and 1 male were taken in June, 4 to the north and west, and 6 to the south and west. Three of the females were caught at distances of  $16\frac{1}{2}$ , 19, and 19 miles respectively to the north and west, and the male off Noss Head, Moray Firth, at a distance of 96 miles in the same direction. Of the 6 females taken to the south and west, one was got east of St. Abb’s Head, at a distance of 58 miles ; another was taken north of St. Abb’s Head, at a distance of 52 miles ; a third south-east of the Bell Rock, at a distance of 48 miles ; one offshore, east of the Isle of May, at a distance of 39 miles ; another at a distance of 32 miles ; and the last at 5 miles distant.

A female was recaptured in July, 16 miles to the north and east.

In August, 2 males and 4 females were taken, 3 of the females to the south and west, and 1 to the north-west ; 1 male was taken to the north-west, and the other to the south and east ; 1 female had migrated 33 miles to the south and west, and was caught to the east of the Bell Rock ; other 2 were found 15 and  $15\frac{1}{2}$  miles to the south and west ; 1 female was taken 20 miles to the north and west, south-east of Aberdeen ; 1 male was recaptured 4 miles to the north and west, and another 26 miles to the south and east, in the offshore waters.

In this quarter, 17 fish, or 22·4 per cent., were recovered. Nine (52·9 per cent.) went to the south and west, in the mean direction S.  $53^{\circ} W.$ , at an average distance of 34 miles ; 6 were taken to the north and west, at a mean distance of 29 miles, in the mean direction N.  $63^{\circ} W.$  ; and 1 each to the north and east and south and east. The migration lines on the chart are much the same as in the first quarter, but are spread more seawards, to the south.

*Third Quarter.*—A male was caught in September, 12 miles to the north and west ; another in October,  $26\frac{1}{2}$  miles to the south and east ; and a female in November, to the south-east of the Bell Rock, at a distance of 43 miles to the south and west.

Thus, only 3 of the marked plaice were recaptured in the third quarter, or 3·9 per cent.

*Fourth Quarter.*—Two males and 2 females were taken in December, one of the females  $22\frac{1}{2}$  miles to the north and west, south-east of Aberdeen, and the other

near Buchanness, 34 miles to the north and west; 1 male was taken south-east of Aberdeen, at a distance of 26 miles, and the other off Dunbar, at 64 miles distant to the south and west.

In January 1914, a female was caught in the Moray Firth, off Banff, at a distance of 77 miles, and was "nearly ripe."

In February, a male was recaptured in the Moray Firth, close to Tarbet Ness, at a distance of 113 miles, and a female 23 miles to the south and west.

In this quarter, 7 fish, or 9·2 per cent., were recaptured, 5 (71·4 per cent.) to the north and west, and 2 to the south and west.

In the 12 months immediately following the liberation, 53 of the marked plaice, or 69·7 per cent., were taken, 25 (47·2 per cent.) to the north and west, 20 (37·7 per cent.) to the south and west, 3 (5·7 per cent.) to the north and east, 3 to the south and east, and 2 to the north.

A summary of these particulars is given in the following table :--

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. Mar. 1913. April 1913. May 1913.	N. and E.	2	7·7	N. 47° E.	82	34·2	10·5-154	33·5-35
	N. and W.	13	50	N. 55° W.	8	10·1	4-16·5	1·7-30
	S. and E.	1	3·8	S. 72° E.	13	26	..	..
	S. and W.	8	30·8	S. 67° W.	23	17·3	11-45	3·2-50
	N.	2	7·7	N.	11	15·7	..	..
		26	34·2	..	..	..	..	..
II. June 1913 July 1913. Aug. 1913.	N. and E.	1	5·9	N. 13° E.	16	1·55	..	..
	N. and W.	6	35·3	N. 63° W.	29	3·8	4-96	·3-14·5
	S. and E.	1	5·9	S. 3° E.	26	1·8	..	..
	S. and W.	9	52·9	S. 53° W.	34	3·7	15-58	1·1-6·5
			17	22·4	..	..	..	..
III. Sept. 1913. Oct. 1913. Nov. 1913.	N. and E.	1	33·3	Nil.	12	·75	..	..
	N. and W.	1	33·3	N. 5° W.	26·5	1·3	..	..
	S. and E.	1	33·3	S. 3° E.	43·5	1·9	..	..
	S. and W.	1	33·3	S. 63° W.	..	..	..	..
			3	3·9	..	..	..	..
IV. Dec. 1913. Jan. 1914. Feb. 1914	N. and E.	1	33·3	Nil.	12	·75	..	..
	N. and W.	5	71·4	N. 22° W.	55	1·8	22·5-113	·9-3·4
	S. and E.	2	28·6	Nil.	43	1·6	23-64	·7-2·5
	S. and W.	2	28·6	S. 68° W.	..	..	..	..
			7	9·2	..	..	..	..
SUMMARY.	N. and E.	3	5·7					
	N. and W.	25	47·2					
	S. and E.	3	5·7					
	S. and W.	20	37·7					
	N.	2	3·8					
		53	69·7					

Of the other fish recaptured, 20 were taken in the remainder of 1914, 2 in 1915, and 1 in 1917.

In March 1914, 2 males and a female were got, the males at 10 and 12 miles to the north and west, and the female in the Firth of Forth, near Elie, at a distance of 68 miles to the south and west.

Three females were recovered in April, 2 at 11 and 11½ miles to the north and west, and 1 on the west coast of Scotland, 13 miles W.S.W. of Cape Wrath, at a distance of 198 miles.

In May, 2 females and a male were recaptured, one of the females 39 miles to the south and west, south-east of the Bell Rock, and the other north and east of



Rattray Head, at a distance of 76 miles to the north and east. The male was got on the north coast of Scotland, north-west of Holburn Head, at a distance of 144 miles.

In June, 2 males and 3 females were taken, one of the males 4 miles to the north and east, and the other 17 miles to the north and west; one of the males was found 7 miles to the south and east, one 26 miles to the north and east, and the third 26 miles to the south and west, north-east of the Bell Rock.

Two females were recaptured in July, one 3 miles to the south and west, and the other 15½ miles to the south.

In September, a male was taken 10½ miles to the north and west, and a female 28 miles to the north and east.

A female was caught in October, after 567 days, only 5 miles to the north and west, and in December, a male 30 miles to the westwards, near Stonehaven.

In January 1915, a male and a female were got, both to the north and west, the male at a distance of 8 miles, and the female at 12 miles.

A male was recaptured in March 1917, after 1457 days, at a distance of 108 miles to the north and west.

The following table gives a summary of particulars relative to all the fish captured from the experiment :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	2	158	79	N. 34° E.
	Adult Females.	4	146	36	N. 30° E.
	Immature Females.	1	19	19	N. 47° E.
		7	323	46	N. 34° E.
N. and W.	Adult Males.	15	588	39	N. 42° W.
	Adult Females.	15	545	36	N. 39° W.
	Immature Females.	8	83	10	N. 67° W.
		38	1216	32	N. 46° W.
S. and E.	Adult Males.	2	52	26	S. 3° E.
	Adult Females.	1	7	7	S. 58° E.
	Immature Females.	1	13	13	S. 72° E.
		4	72	18	S. 34° E.
S. and W.	Adult Males.	2	80	40	S. 52° W.
	Adult Females.	11	257	23	S. 56° W.
	Immature Females.	11	424	38	S. 61° W.
		24	761	32	S. 58° W.
N.	Adult Males.	1	11	11	N.
	Immature Females.	1	11	11	N.
		2	22	11	N.
S.	Adult Females.	1	15	15	S.
SUMMARY.					
N. and E.		7	323	46	N. 34° E.
N. and W.		38	1216	32	N. 46° W.
S. and E.		4	72	18	S. 34° E.
S. and W.		24	761	32	S. 58° W.
N.		2	22	11	N.
S.		1	15	15	S.
		76	..	..	..

*Distances travelled*—10 miles and under.—Nineteen, or 25 per cent., of the recaptured plaice were taken at distances of from 3 to 10 miles, viz. 7 males (31·8 per cent.), with an average of 6·8 miles, and 12 females (22·2 per cent.), with a mean of 6·4 miles. Six of the males and 10 of the females were found to the north and west, 1 male to the north and east, 1 female to the south and east, and 1 to the south and west.

10 to 20 miles.—Twenty-five or 32·9 per cent., were recovered at from 10½ to 19½ miles. Six (27·3 per cent.) were males, with an average of 13 miles, and 19 (35·2 per cent.) were females, with an average of 15 miles. Four of the males and 7 of the females were found to the north and west, 1 male and 7 females to the south and west, 2 females to the north and east, 1 male and 1 female to the north, 1 to the south, and 1 to the south and east.

Thus, 44, or 57·9 per cent., were taken at distances under 20 miles, 13 males (59·1 per cent.), with an average of 9·7 miles, and 31 females (57·4 per cent.), with a mean of 11·8 miles.

20 to 50 miles.—Twenty, or 26·3 per cent., were found at distances of from 20 to 48 miles, 4 males (18·2 per cent.), with an average of 27·2 miles, and 16 females (29·6 per cent.), with an average of 32·8 miles. Two of the males and 3 of the females went to the north and west, 2 males to the south and east, 11 females to the south and west, and 2 females to the north and east.

50 to 100 miles.—Seven, or 9·2 per cent., moved for from 52 to 96 miles, 2 males (9·1 per cent.), with a mean of 80 miles, and 5 females (9·2 per cent.), with an average of 66 miles. One of the males and 1 female were found to the north and west; 1 of the males and 3 of the females to the south and west, and 1 female to the north and east. A male was caught off Noss Head, in the Moray Firth, and a female off Banff, Moray Firth. One female was recaptured in the Firth of Forth, near Elie, and 2 to the east and south-east of the Isle of May.

Over 100 miles.—Five, or 6·6 per cent., were got at distances of from 113 to 198 miles, 3 males (13·6 per cent.), with an average of 137 miles, and 2 females (3·7 per cent.), one of which moved 198 miles, and was found off Cape Wrath, on the west coast of Scotland, and the other 108 miles to the Moray Firth. Two of the males were found in the Moray Firth, and one off the north coast of Scotland.

#### MATURITY.

*Males*.—The condition of the testes was recorded in 20 of the 22 males recaptured. One was described as “ripe”; it was taken in January 1915, only 8 miles to the north-west of the station, and measured 37–43·1 cm.

One, of 32·5–38·3 cm., was “about three-quarters ripe,” and was captured off Stonehaven, 30 miles to the west and north, in December 1914, after 623 days.

Among those of adult size (33 cm.), described as “immature,” recaptured within the limits of the spawning season, 2 were taken in March 1914, 1 measuring 33·5–37·6 cm., 10 miles to the north and west, and the other, of 33–40·4 cm., recovered 12 miles to the north and west; 4 were taken in April, 2 at 5½ and 6½ miles to the north and west, 1, 11 miles to the north, and the fourth 16 miles to the south and west; they measured 37·5–37·5 cm., 33–33·2 cm., 35–35·4 cm., and 35–34·6 cm.

*Females*.—The condition of the ovaries was ascertained in 48 of the 54 females recaptured.

None was described as “spawning” or “ripe.” One was “nearly ripe,” and measured 33–39 cm.; it was taken off Banff, in the Moray Firth, at a distance of 77 miles, in January 1914. One, of 41·5–54·4 cm., taken in December 1913, 22½ miles to the north and west, was described as “about three-quarters ripe.” Of other 2, described as “about half ripe,” 1 was got in August 1913, 15½ miles to the south and west, and the other in October 1914, 5 miles to the north and west.

Ten of the females were said to be “spent.” One was taken in March 1913, after 4 days, 6½ miles to the north and west; it measured 44–44·3 cm. Six were taken in April, 4 in 1913, and 2 in 1914; of the former, 2 were got 4 and 9 miles to the north and west, and 2, 15 miles and 25 miles to the south and west; of the 2 recaptured in April 1914, 1 was found at 11 and the other at 11½ miles to the north and west. Two were taken in June 1913, both to the south-west, at 15 and 52 miles distant. The tenth fish was taken in March 1917, after 1457 days, 108 miles

to the north and west. All those fish were large, above 44 cm., on recovery, except 1, which measured 39–39.1 cm.

Amongst those of adult size, with “immature” ovaries (13 in number), none was recaptured within the limits of the spawning season.

#### EXPERIMENT VII.

21st May 1913.

One hundred plaice were marked and liberated in this experiment, 43 males and 57 females. The males measured from 27 to 46 cm., and 8 were under the adult size (33 cm.) on liberation; the females varied from 28.5 to 63.5 cm., and 15 were under the adult size when liberated.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	cm. 56-60.5	cm. 61-65.5	Total.
F. Lib.	2	5	23	15	4	5	2	1	57
F. Recap.	1	2	16	9	4	2	—	1	35
M. Lib.	4	15	20	3	1	—	—	—	43
M. Recap.	1	11	15	2	1	—	—	—	30

The fish used in this experiment were caught in the Dornoch Firth on the 20th May, in the forenoon, and were set free, in good condition, on the following day, at 4.30 a.m.

The number recaptured was 65, or 65 per cent., viz. 30 males (67.4 per cent.) and 35 females (61.4 per cent.). Twenty-six of the males were of adult size on recovery, ranging from 33.3 to 46 cm., and averaging 39.7 cm., as compared with a range of from 29.5 to 46 cm., and an average of 36.98 cm. on liberation; they were at liberty for from 0 to 945 days, the mean being 267 days, and they migrated distances of from 7 to 62 miles, the mean being 26.3 miles, and the mean rate .98 mile. Four of the males were under the adult size, averaging 31.5 cm., as compared with 30.25 cm. on liberation; they were free for a mean period of 63 days, and moved from 17 to 49½ miles, the average being 35.7 miles, and the mean rate, per 10 days, 5.7 miles. Thirty-one of the females were of adult size, averaging 44.4 cm., and ranging from 38 to 63.1 cm., as compared with a range of from 32.5 to 63.5 cm., and an average of 42.5 cm. on liberation; they were at liberty for from 0 to 636 days, the mean being 197 days, and they migrated distances of from 7 to 109 miles, the mean being 29.7 miles, and the average rate of movement 1.5 miles. Four of the females were under adult size, the average being 33.5 cm., as compared with 33.2 cm. on liberation; they were at liberty for an average period of 26 days, and travelled from 7 to 44 miles, the mean being 29 miles, and the mean rate 10.9 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Four of the marked plaice were recaptured on the day of liberation, all by a Grimsby trawler, 3 at a distance given as 8 miles to the south and west, and 1 at 7 miles to the south and west; with the exception of 1 of the females, which measured 36.5–36.2 cm., they were all of adult size.

Fourteen were got in June, 10 females and 4 males. Three of the males were taken to the south and west, at distances of 28, 30, and 49½ miles, the last-named close to the Bell Rock, and the others in the same direction; the other male was found 11 miles to the north and east; 7 of the females were found to the south and west, at the following distances:—21, 28, 30, 37 (to the east of the Bell Rock), 27½, 44 (south-east of the Bell Rock), 59 (east of St. Abb’s Head); 1 was recaptured 19 miles to the north and west, and 1 at 11 miles to the north and east; the remaining female was taken off Noss Head, in the Moray Firth, at a distance of 109 miles to the north and west, the mean rate of travel in this case being 42.8 miles per 10 days.

Three males and a female were recovered in July, 2 of the males to the south and west, at distances of 24 and 51 miles (to the east of the Isle of May), and the

third  $17\frac{1}{2}$  miles to the north and east; the female went to the offshore waters, 64 miles to the south and east, 91 miles east of St. Abb's Head.

In this quarter, then, 22 of the marked plaice, or 33·8 per cent., were recaptured, 16 (72·7 per cent.) to the south and west, at an average distance of 29 miles in the mean direction S.  $65^{\circ}$  W.; 3 (13·6 per cent.) north and east; 2 north and west; and 1 south and east.

*Second Quarter.*—In August, 3 males and 3 females were caught, all to the south and west, except 1 female, which was taken 17 miles to the south and east; the others were taken at distances of 24, 29,  $33\frac{1}{2}$ , 47, and 52 miles, the last-named east of St. Abb's Head.

Two males and 2 females were caught in September, 1 of the females 11 miles to the north and east, and all the others to the south and west, at distances of 15,  $15\frac{1}{2}$ , and 18 miles.

Two females and 1 male were recaptured in October, all to the south and west, at distances of 24, 32, and  $40\frac{1}{2}$  miles, the last-mentioned being to the east of the Bell Rock.

In this quarter, 13 of the marked fish, or 20 per cent., were recaptured, of which 11 (84·6 per cent.) were taken to the south and west, at an average distance of 30 miles, in the mean direction S.  $42^{\circ}$  W.; 1 was caught to the north and east, and 1 to the south and east.

*Third Quarter.*—In November, a female was got off Tod Head, at a distance of 20 miles to the west and north.

In December, a male and a female were taken, the male  $13\frac{1}{2}$  miles to the north and west, and the female 16 miles to the south and west.

In January 1914, 2 males and 1 female were captured, the female and 1 of the males at 10 miles distant to the north and west; the other male 62 miles to the south and west, south-west of the Isle of May.

Thus, in this quarter, 6 fishes, or 9·4 per cent., were recaptured, 4 (66·6 per cent.) at an average distance of 13 miles in the mean direction N.  $76^{\circ}$  W., and 2 to the south and west.

*Fourth Quarter.*—A male and a female were caught in February 1914, the female 8 miles to the north and west, and the male 21 miles to the south and west.

In March, a male and a female also were recovered, both to the south and west, at distances of  $20\frac{1}{2}$  and 52 miles respectively, the latter north of St. Abb's Head.

Two males and 2 females were taken in April, the males to the north and west, at distances of 9 and 34 miles, the latter in Aberdeen Bay; the females were got to the south and west, at distances of 36 and 49 miles, the latter offshore, east of St. Abb's Head.

Eight fishes, or 12·3 per cent., were recaptured in this quarter, 5 (62·5 per cent.) at an average distance of 36 miles in the mean direction S.  $55^{\circ}$  W., and 3 (37·5 per cent.) to the north and west.

Altogether, within the 12 months following the liberation, 49 of the marked plaice, or 75·4 per cent., were recovered, 34 (69·3 per cent.) to the south and west, 9 (18·4 per cent.) to the north and west, 4 to the north and east, and 2 to the south and east. These particulars are summarised in the following table:—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. May 1913. June 1913. July 1913.	N. and E.	3	13·6	N. 19° E.	13	3·4	11-17·5	3·1-3·7
	N. and W.	2	9·1	N. 42° W.	64	25·7	10-109	7·9-43·6
	S. and E.	1	4·5	S. 40° E.	64	12·1	..	..
	S. and W.	16	72·7	S. 65° W.	29	12·3	7-59·5	..
		22	33·8	..	..	..	..	..
II. Aug. 1913. Sept. 1913. Oct. 1913.	N. and E.	1	7·7	N. 42° E.	11	1·05	..	..
	N. and W.	1	7·7	Nil.	17	1·8	..	..
	S. and E.	11	84·6	S. 37° E.	30	2·7	15-52	1·3-5·7
	S. and W.	13	20·	S. 42° W.	..	..	..	..
III. Nov. 1913. Dec. 1913. Jan. 1914.	N. and E.	4	66·6	Nil.	13	·6	10-20	·4-1·05
	N. and W.	2	33·3	N. 76° W.	39	1·7	16-62	·8-2·5
	S. and E.	6	9·4	Nil.	..	..	..	..
	S. and W.	2	33·3	S. 53° W.	..	..	..	..
IV. Feb. 1914. Mar. 1914. April 1914.	N. and E.	3	37·5	Nil.	17	·5	8-34	2·7-1
	N. and W.	5	62·5	N. 45° W.	36	1·2	21-52	·7-1·8
	S. and E.	8	12·3	Nil.	..	..	..	..
	S. and W.	5	62·5	S. 55° W.	..	..	..	..
SUMMARY.	N. and E.	4	8·2					
	N. and W.	9	18·4					
	S. and E.	2	4·1					
	S. and W.	34	69·3					
		49	75·4					

Of the other fishes recaptured, 14 were taken in the remainder of 1914 and 2 in 1915.

In May 1914, 3 males and 2 females were recaptured, 1 of the males at a distance of 12 miles to the north and west, a male and a female 40 miles to the south and west; the remaining female 41 miles, and the remaining male 34 miles in the same direction.

Two males were taken in June, 1, 20 miles to the south and east, and 1, 21 miles to the south and west.

In July, 2 females were recaptured, 1, 17½ miles to the south and west, and 1, 26 miles to the north and west.

A male was taken in August, 7 miles to the south and west, and 2 females in October, both to the south and west, at distances of 46 and 50 miles respectively, 1 close to the Bell Rock, and the other to the south-east of the Isle of May.

A male was taken in November, north-east of the Isle of May, at a distance of 47 miles to the south and west, and another in December, 13 miles to the north and west.

In February 1915, a female was captured, after 636 days, 9 miles to the north and west, and in December of the same year a male, after 945 days, 30 miles to the north and west, south-east of Buchanness.

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	1	11	11	N. 1° E.
	Immature Males.	1	17	17	N. 16° E.
	Adult Females.	2	22	11	N. 41° E.
		4	50	12	N. 25° E.
N. and W.	Adult Males.	7	121	17	N. 37° W.
	Adult Females.	7	201	29	N. 63° W.
		14	322	23	N. 50° W.
S. and E.	Adult Males.	1	20	20	S. 38° E.
	Adult Females.	2	81	40	S. 38° E.
		3	101	34	S. 38° E.
S. and W.	Adult Males.	17	530	31	S. 56° W.
	Immature Males.	3	125	42	S. 61° W.
	Adult Females.	20	614	31	S. 53° W.
	Immature Females.	4	116	29	S. 67° W.
		44	1385	31	S. 56° W.
SUMMARY.					
N. and E.		4	50	12	N. 25° E.
N. and W.		14	322	23	N. 50° W.
S. and E.		3	101	34	S. 38° E.
S. and W.		44	1385	31	S. 56° W.
		65	..	..	..

*Distances travelled—Under 10 miles.*—Ten of the marked plaice, or 15·4 per cent., were found at distances of from 7 to 10 miles, viz. 4 males (13·3 per cent.), with an average of 8·2 miles, and 6 females (17·1 per cent.), with a mean of 8 miles. Two of the males and 3 of the females were got to the south and west, and 2 males and 3 females to the north and west.

*10 to 20 miles.*—Fourteen, or 21·5 per cent., migrated distances of from 11 to 19 miles, viz. 7 males (23·3 per cent.), with an average of 14·3 miles, and 7 females (20 per cent.), with an average of 15·3 miles. Three of the males and 1 of the females were taken to the north and west, 2 males and 3 females to the south and west, 2 males and 2 females to the north and east, and 1 female to the south and east.

Thus, 24, or 36·9 per cent., went distances under 20 miles, 11 males (36·6 per cent.), with an average of 12 miles and 13 females (37·1 per cent.), with an average also of 12 miles.

*20 to 50 miles.*—Thirty-four, or 52·3 per cent., travelled distances between 20 and 50 miles, 16 (53·3 per cent.) being males, with an average of 33 miles, and 18 (51·4 per cent.) females, with a mean also of 33 miles. Two males and 2 females were found to the north and west, 13 males and 16 females to the south and west, and 1 male to the south and east.

*50 to 100 miles.*—Six, or 9·2 per cent., moved distances of from 51½ to 64 miles, 3 males (10 per cent.), with an average of 55 miles, and 3 females (8·6 per cent.), with a mean of 58·5 miles. All the males and 2 of the females were found to the south

and west; they were taken off the mouth of the Firth of Forth, except one got in the offshore waters, more to the east.

*Over 100 miles.*—Only 1 fish, a female, was recaptured over 100 miles; it was taken off Noss Head, Moray Firth, at a distance of 109 miles to the north and west.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 28 of the 30 males recaptured.

One was described as “spawning”; it was caught 12 miles to the north and west, in May 1914.

Four were “ripe”; 2 were taken 9 miles and 11 miles respectively to the north and west, in April 1914, and June 1913; 2 were found to the south and west, at distances of 21 and 52 miles, in February 1914 and March 1914.

Four were described as “spent,” all taken to the south and west, at distances of 28, 40, 34, and 51½ miles respectively, in June 1913, May 1914, May 1914, and July 1913.

Six were “nearly ripe,” 4 taken to the north and west, at distances of 10, 13½, 13, and 30 miles respectively, in January 1914, December 1913, December 1914, and December 1915; 2 were taken to the south and west, at 62 miles, in January 1914, and at 47 miles in November 1914.

Among the adult males described as “immature,” 1, of 29·5–36·1 cm., was caught 34 miles to the north and west, on 23rd April 1914.

*Females.*—The condition of the ovaries was recorded for 29 of the the 35 females recaptured.

Two were “spawning,” 1 taken in February 1914, 8 miles to the north and west, and 1 in March 1914, 21 miles to the south and west.

One was “nearly ripe”; it was taken in January 1914, 10 miles to the north and west.

Seven were described as “spent”; 2 of them were got to the north and west, at distances of 9 and 19 miles in February 1915 (after 636 days), and June 1913 respectively; 1 went to the north and east for 11 miles, being taken in June 1913; 4 were recovered to the south and west, at distances of 30½, 36, 27½, and 24 miles, in June 1913, April 1914, June 1913, and August 1913 respectively.

Three were said to be “three-quarters ripe”; 1 went to the north and west for 20 miles, being caught in November 1913, the other 2 to the south and west, at distances of 46 and 16 miles, in October 1914 and December 1913 respectively.

Among the 11 of adult size, which were described as “immature,” one was taken on 8th May 1914, at a distance of 41 miles to the south and west; it measured 38·5–42·5 cm.

#### EXPERIMENT VIII.

13th November 1913.

One hundred fishes were marked and liberated in this experiment, namely, 49 males and 51 females. The males ranged in size from 28·5 to 48·5 cm., and 8 of them were under the adult size when liberated. The females measured from 26·5 to 51·5 cm., and 21 were under adult size.

The numbers liberated and recaptured are shown, arranged in 5-cm. groups, in the following table:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	Total.
F. Lib. . . .	8	8	12	8	14	1	51
F. Recap. . . .	1	2	6	6	10	1	26
M. Lib. . . .	2	13	17	16	1	—	49
M. Recap. . . .	—	4	7	6	1	—	18

The fish used in this experiment were taken by the “Goldseeker” in Burghhead Bay, Moray Firth, on the 11th November 1913, before 3 p.m., and they were liberated on the 13th at 4 a.m., the fish meanwhile being kept in tubs of running water.

The number recaptured was 44, or 44 per cent., a low proportion; 18 (36·7 per cent.) were males, and 26 (51 per cent.) were females. Seventeen of the males were of adult size on recapture, averaging 40·8 cm., and ranging from 34·7 to 48·5 cm., as compared with a range of 31·5 to 48·5 cm., and a mean of 39·5 cm. on liberation; they were at liberty for periods of from 15 to 732 days, the mean being 197 days; the distances travelled varied from 4 to 150 miles, the mean being 54·3 miles, and the average rate of travel 2·7 miles. Twenty-three of the females were of adult size, ranging from 39 to 51·8 cm., and averaging 45·9 cm., as compared with a range of from 34 to 51·5 cm., and an average of 43·4 cm., on liberation; their periods of freedom varied from 8 to 673 days, the mean being 229·9 days; the distances travelled ranged from 2 to 110 miles, the average being 27·1 miles, and the mean rate of travel 1·2 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Two fish were caught in the remainder of November, 1, a female, after 8 days, 26 miles to the north and west, off Tod Head, and a male 48 miles to the south-west, near the Bell Rock.

A female was taken in December, 23 miles to the north and west, off Girdleness.

One male and 5 females were recaptured in January 1914, all to the north and west, except 1 female, which was taken 52 miles to the south and west, south of the Bell Rock; the male was found 4 miles distant, and 3 of the females at 10 miles; the remaining female was got off Buchanness, at a distance of 35 miles.

In this quarter, 9 fishes, or 20·4 per cent., were recaptured, 7 (77·8 per cent.) at an average distance of 17 miles, N. 57° W., and 2 to the south and west.

*Second Quarter.*—In February, 6 males and 1 female were recaptured, 2 of the males to the south and west, at distances of 15½ and 42 miles, the latter to the east of the Bell Rock; 1 male was taken at 8 miles to the north-west, and a female 32 miles in the same direction, in Aberdeen Bay; 2 of the males were got in the Moray Firth, 1 near Banff, at a distance of 74½ miles, and the other north of Tarbet Ness, at a distance of 119 miles; the remaining male was recovered on the north coast of Scotland, 4 miles east of Strathie Point, at a distance of 150½ miles.

In March, 3 males and 3 females were recaptured; a male and a female were taken at 45 and 48 miles respectively to the south and west, to the south-east of the Bell Rock; 1 female was recaptured 4½ miles to the north and east; and the remaining fish were taken in the Moray Firth, the female north-east of Tarbet Ness, at a distance of 110 miles, one of the males off Burghead Bay, at a distance of 106 miles, and the other south-west of Clyth Ness, at 110 miles distant.

A female was taken in April, 37½ miles to the south and west, south-east of the Bell Rock.

In this quarter, 14 fish, or 31·8 per cent., were recaptured, 8 (57·1 per cent.) to the north and west, at an average distance of 89 miles in the mean direction N. 19° W.; 5 (35·7 per cent.) to the south and west, at an average distance of 38 miles in the mean direction S. 6° W.; and 1 was found to the north and east.

*Third Quarter.*—One male and 3 females were recovered in May, all to the south and west, the male at a distance of 31½ miles, and the females at respectively 15½, 37, and 53 miles; of the last 2, the former was got east of the Bell Rock, and the latter north-east of St. Abb's Head.

One male and 4 females were recaptured in June, the male 46½ miles to the south and west, north-east of St. Abb's Head, and a female 21 miles to the south and west; the other 3 females were taken to the north and west, at distances of 9, 12½, and 12½ miles respectively.

In July, a male was caught 41 miles to the south and west, east and south of the Bell Rock.

In this quarter, 10 of the marked plaice, or 22·7 per cent., were recovered, 7 (70 per cent.) to the south and west, at an average distance of 35 miles in the mean direction S. 56° W., and 3 (30 per cent.) at a mean distance of 11 miles in the mean direction N. 15° W.

*Fourth Quarter.*—A male was taken in September, north of St. Abb's Head,



at a distance of 57 miles to the south and west; and in October, a female was found near Scurdyness, Montrose, at a distance of 39 miles to the south and west.

Thus, there were only 2 fish (4·5 per cent.) recaptured in the fourth quarter.

In the 12 months after liberation, 35 of the marked plaice, or 79·5 per cent., were recovered, 18 (51·4 per cent.) to the north and west, 16 (45·7 per cent.) to the south and west, and 1 to the north and east. These particulars are summarised, quarterly, in the following table:—

Quarter.	Direction.	No. of Fish Caught.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. Nov. 1913. Dec. 1913. Jan. 1914.	N. and E.				Nil.			
	N. and W.	7	77·8	N. 57° W.	17	7·1	4-85	·63-32·5
	S. and E.				Nil.			
	S. and W.	2	22·2	S. 66° W.	50	·7	48-52·5	9·5-32
		9	20·4	..	..	..	..	..
II. Feb. 1914. Mar. 1914. April 1914.	N. and E.	1	7·1	N. 50° E.	4·5	·36	..	..
	N. and W.	8	57·1	N. 19° W.	89	8·2	8-150·5	·82-15·0
	S. and E.				Nil.			
	S. and W.	5	35·7	S. 60° W.	38	3·2	15·5-48	1·82-4·0
		14	31·8	..	..	..	..	..
III. May 1914. June 1914. July 1914	N. and E.				Nil.			
	N. and W.	3	30	N. 15° W.	11	·5	9-12·5	·43-·6
	S. and E.				Nil.			
	S. and W.	7	70	S. 56° W.	35	1·8	15·5-53	·91-2·75
		10	22·7	..	..	..	..	..
IV. Aug. 1914. Sept. 1914. Oct. 1914.	N. and E.				Nil.			
	N. and W.				Nil.			
	S. and E.				Nil.			
	S. and W.	2	100	S. 63° W.	48	1·5	..	..
		2	4·5	..	..	..	..	..
SUMMARY.	N. and E.	1	2·8					
	N. and W.	18	51·4					
	S. and E.	0	..					
	S. and W.	16	45·7					
		35	79·5					

Of the remaining fish, only 1 was taken in the remainder of 1914, and 7 in 1915.

In November 1914, a male was recaptured 38 miles to the south and west, off-shore, to the north-east of St. Abb's Head.

A female was caught in January 1915, 32 miles to the north and west, at Aberdeen Bay. In February, a male was got only 4 miles to the north and west. In April, a female went 24 miles to the south and west. In July, a female had gone 30 miles to the north and west, north-east of Aberdeen. In September, 2 females, were taken, 1, 2 miles to the south and west, and the other 8 miles to the north and west. And, in November, after 732 days, a male was caught 13 miles to the north and west.



[TABLE.]

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Females.	1	4	4	N. 50° E.
N. and W.	Adult Males.	9	588	65	N. 29° W.
	Adult Females.	13	349	27	N. 36° W.
	Immature Females.	1	10	10	N. 61° W.
		23	947	41	N. 35° W.
S. and E.			Nil.		
S. and W.	Adult Males.	8	332	41	S. 50° W.
	Immature Males.	1	31	31	S. 54° W.
	Adult Females.	8	241	30	S. 57° W.
	Immature Females.	2	87	43	S. 72° W.
		19	691	36	S. 55° W.
SUMMARY.					
N. and E.		1	4	4	N. 50° E.
N. and W.		23	947	41	N. 35° W.
S. and E.			Nil.		
S. and W.		19	691	36	S. 55° W.
		43	..	..	..

*Distances travelled*—10 miles and under.—Ten, or 23·2 per cent., were recaptured at distances of from 2 to 10 miles, 3 males (16·6 per cent.), with an average of 5·3 miles, and 7 females (28 per cent.) with a mean of 7·6 miles. All the males and 5 of the females were found to the north and west, 1 female to the north and east, and 1 to the south and west.

10 to 20 miles.—Five, or 11·6 per cent., were got at distances of from 12½ to 15½ miles, 2 males (11·1 per cent.), with an average of 14 miles, and 3 females (12 per cent.), with an average of 13·5 miles. One male and 2 females were found to the north and west, 1 male and 1 female to the south and west.

Thus, under 20 miles from the station, the number recaptured was 15, or 34·9 per cent., viz. 5 males (27·7 per cent.), with an average of 8·9 miles, and 10 females (40 per cent.), with a mean of 9·4 miles.

20 to 50 miles.—19 of the marked plaice, or 44·2 per cent., were recovered at distances of from 21 to 48 miles, 7 males (38·8 per cent.), with an average distance of 42 miles, and 12 females (48 per cent.), with an average of 32 miles. All the males and 6 of the females were found to the south and west, and 6 females to the north and west.

50 to 100 miles.—Four, or 9·3 per cent., were taken at distances of from 52½ to 74½ miles, 2 males (11·1 per cent.), with an average of 66 miles, and 2 females (8 per cent.), with a mean of 52·7 miles; 1 male migrated north and west, and the other and both females to the south and west.

Over 100 miles.—Five fish, or 11·6 per cent., were recaptured at distances of from 106 to 150½ miles, 4 males (22·2 per cent.), with an average of 121·5 miles, and 1 female (4 per cent.), which migrated 110 miles. All these fish were taken to the north and west.

#### MATURITY.

*Males*.—The condition of the testes was recorded for 17 of the 18 males recaptured.

Five were "spawning"; 4 were taken to the north and west, and 1 to the south and west, the latter in March 1914, north-east of St. Abb's Head, at a distance of 45 miles; 1 of those which migrated to the north and west was taken at a

distance of 8 miles, in February 1914, 2 of the others in the Moray Firth, at distances of 106 and 119½ miles, in March and February 1914, while the third was captured off the north coast of Scotland, in February 1914, at a distance of 150½ miles; the rate of travel of the last fish was 9·1, 11·2, and 15 miles per 10 days of freedom.

Three were "ripe," 1 taken 4 miles to the north-west, in January 1914, 1, 42 miles to the south and west, in February 1914, off the Bell Rock, and the third in the Moray Firth in March 1914, at a distance of 110 miles.

One was described as "nearly ripe"; it was taken in November 1913, 48 miles to the south and west, off the Bell Rock. One, said to be "three-quarters ripe," was got in November 1915, 13 miles to the north and west.

Among those of adult size described as "immature" were 2 taken in February 1914, 1, 15½ miles to the south and west, which measured 36-36·3 cm., and the other, taken in the Moray Firth, at a distance of 74 miles, and measuring 37·5-37·7 cm.; the third was captured in February 1915, 4 miles to the north and west, and measured 31·5-41 cm.

*Females.*—The condition of the ovaries was ascertained in 25 of the 26 females recaptured.

Two were "spawning," 1 taken in January 1914, 35 miles to the north and west, off Buchanness, and the other in March 1914, in the Moray Firth, at a distance of 110 miles.

One was described as "ripe"; it was caught in January 1914, at a distance of 52½ miles to the south and west, south of the Bell Rock.

Five were said to be "spent"; 4 were taken in June 1914, 3 of them to the north-west at 9, 12½, and 12½ miles, and the fourth 21 miles to the south and west, and 1 in May 1914, 15½ miles to the south and west.

Three were "nearly ripe"; they were all taken to the north and west, 1 in November 1913, at a distance of 26 miles, 1 in December 1913, at 23 miles, and the third in February 1914, at a distance of 32 miles. Two were described as "about three-quarters ripe," 1 taken in January 1915, 32 miles to the north and west, the other in September 1915, 8 miles to the north and west.

Of those of adult size on recapture, whose ovaries were "immature," 5 were taken within the limits of the spawning season, 2 in January 1914, both at 10 miles to the north and west, and measuring respectively 40-40·5 cm., and 42·5-42·7 cm.; 1 was taken in March 1914, 4½ miles to the north and west, and measured 36·5-39 cm.; 1 was caught in April 1914, 37½ miles to the south and west, measuring 38·5-41·2 cm.; another in April 1915, 24 miles south and west, measuring 34-42·2 cm.

#### EXPERIMENTS NEAR FAIR ISLE.

In the neighbourhood of Fair Isle, 8 experiments were made, extending from 4th November 1910 to 22nd November 1912, 940 plaice being marked and liberated, of which 371 were males, 551 females, and 18 of unknown sex.

The number recaptured was 461, or 49 per cent., viz. 180 males (48·5 per cent.); 275 females (49·9 per cent.), and 6 of unknown sex (33·3 per cent.).

Place.	Date.	Liberated.				Recaptured.				Percentages Recaptured.			
		♂	♀	(?)	Total.	♂	♀	(?)	Total.				
59° 20' N. 1° 3' W.	4 Nov. 1910.	109	133	4	246	63	83	1	147	57·8	61·7	...	59·3
59° 28' N. 1° 26' W.	15 Sept. 1910.	14	15	1	30	7	7	...	14	50·	46·6	...	46·7
59° 30' N. 1° W.	15 Sept. 1910.	100	155	7	262	51	77	3	131	51·	49·7	(42·9)	50·
59° 26' N. 1° 14' W.	15 Sept. 1910.	10	20	...	30	7	12	...	19	70·	60·	...	63·3
59° 20' N. 1° 3' W.	11 April 1911.	33	37	...	70	11	20	...	31	33·3	54·1	...	44·3
59° 44' N. 0° 33' W.	12 Oct. 1911.	32	64	4	100	14	26	2	42	43·7	40·6	(50·)	42·
59° 20' N. 1° 3' W.	19 June 1912.	31	71	...	102	11	35	...	46	35·5	49·3	...	45·1
59° 20' N. 1° 3' W.	22 Nov. 1912.	42	56	2	100	16	15	...	31	38·1	26·8	...	31·
Total.		371	551	18	940	180	275	6	461	48·5	49·9	33·3	49·

## EXPERIMENT I.

4th November 1910.

In this experiment, the large number of 246 plaice were marked and liberated, at a position 22 miles south-east of Fair Isle, 59° 20' N. ; 1° 3' W., where the depth is 44 fathoms. Of the total, 109 were males, 133 females, and 4 of unknown sex. The males measured from 30.5 to 40 cm., and 7 were under adult size when liberated. The females ranged from 31.5 to 48.5 cm., and 63 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	Total.
F. Lib. . . . .	—	36	72	23	2	133
F. Recap. . . . .	—	26	45	11	1	83
M. Lib. . . . .	2	49	58	—	—	109
M. Recap. . . . .	—	28	35	—	—	63
? Lib. . . . .	—	1	3	—	—	4
? Recap. . . . .	—	—	1	—	—	1

The fish used in this experiment were taken by the "Goldseeker" in Aberdeen Bay on the afternoon of the 3rd November, and were liberated at 9 o'clock on the morning of the 4th.

The number recaptured was 147, or 59.3 per cent., namely, 63 males (57.8 per cent.), 83 females (61.7 per cent.), and 1 whose sex was not ascertained. All the males were of adult size on recapture, ranging from 33.1 to 47.8 cm., and averaging 38.6 cm., as compared with a range of from 32.5 to 40 cm., and a mean of 36.2 cm. on liberation; they were free for from 1 to 175 days, the mean being 281 days; they migrated distances of from 6½ to 208 miles, the average being 75.6 miles, and the mean rate 2.6 miles. Of the females, 60 were of adult size on recapture, averaging 44.1 cm., and ranging from 38.4 to 54.5 cm., as against a range of from 32 to 46.5 cm., and an average of 38.8 cm. on liberation; they were at liberty for from 28 to 1313 days, the mean being 206 days; they travelled distances of from 10 to 149 miles, the mean being 52.6 miles, and the average rate 2.5 miles. Twenty-three of the females were under adult size on recapture, averaging 35.3 cm., and ranging from 32.5 to 37.3 cm., as against an average of 34.6 cm., and a range of from 31.5 to 36.5 cm. on liberation; their periods of freedom varied from 1 to 214 days, the mean being 99 days; they moved distances of from 6 to 137 miles, the average being 62.7 miles, and the mean rate 6.4 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In November, 1 male and 5 females were taken, the male at a distance of 6 miles to the north and west; 4 of the females were also taken to the north and west, at distances of 6, 6, 10, and 17 miles; the remaining female had moved south and west for a distance of 24 miles.

In December, 2 males and 5 females were taken. One of the males was recaptured at the entrance to the Moray Firth, south-east of Noss Head, 73 miles to the south and west, the rate of movement being 16.2 miles per 10 days; the other male was recaptured about 5 miles E.S.E. of Stonehaven, 147 miles to the southward, the rate of movement being 27.7 miles per 10 days; of the females, 1 was taken by a foreign trawler in the Moray Firth, at an unspecified place, and landed at Ostend; another was recaptured to the north of the Shetlands, off Noup Head, 61 miles to the north and west; the other 3 were caught to the south and west, 2 near Noss Head, in the Moray Firth, at distances of 75 and 79 miles respectively, and the third off Rattray Head, at 100 miles distant; the rates of movement of these fish were respectively 14.1, 23.9, and 26.3 miles per 10 days.

In January 1911, 3 males and 6 females were taken. All the males were recaptured to the south and west, 1 at the entrance to the Pentland Firth, 57 miles distant, 1 near Noss Head, in the Moray Firth, at a distance of 73 miles, and the third off Tod Head, Kincardineshire, 153 miles to the south and west; the rates of movement in these cases were 7.4, 9.3, and 21.2 miles. Two of the females were

taken in the "Moray Firth," and landed at a foreign port; the others had all moved to the south and west; 1 was taken at the Shetland Isles, 45 miles away; another, at the entrance to the Pentland Firth, at a distance of 63 miles; 1 was recaptured on the north coast, off Whiten Head, at a distance of 116 miles; and the remaining female was taken near Aberdeen, at a distance of 137 miles; the latter had moved 21.1 miles in 10 days.

In this quarter, therefore, 22 fish were recovered, or 14.9 per cent., 16 (73 per cent.) to the south and west and 6 (27 per cent.) to the north and west. An examination of the chart shows the general movement south-west to the northern part of the Moray Firth, and, in the case of 3 of the fish, southwards to the coast of Aberdeen or Kincardine.

*Second Quarter.*—In February 1911, 3 males and 2 females were caught, 1 of the males in the "Moray Firth" by a foreign trawler; another to the east of the Orkneys, 36 miles to the south and west, and the third to the west of the Orkneys, 8 to 10 miles S.S.E. of Sule Skerry, at a distance of 100 miles. One of the females was taken to the north and west, off Noup Head, Orkneys, at a distance of 68 miles; the other, north-east of Rattray Head, at a distance of 81 miles to the south and west.

In March, 8 males and 3 females were recaptured, all to the south and west; 1 of the males and 1 of the females were taken in the "Moray Firth," and landed at a foreign port; another female was taken east of the Shetland Isles, at a distance of 36 miles; the remaining female was captured north of Kinnaird Head, at a distance of 79 miles; of the males, 1 was got at the same place, off Kinnaird Head, at a distance of 79 miles; another, on the north coast, off Sandside Bay, at 95 miles distant; 2 others were taken also on the north coast, farther to the westward, off Rabbit Island, at a distance of 112 miles; another was captured close to Tarbet Ness, in the Moray Firth, at 123 miles distant; the 2 remaining males had migrated to the west coast, 1 being taken 10 miles W.S.W. from Cape Wrath, at a distance of 138 miles, and the other in the Gairloch ( $57^{\circ} 43' N.$ ;  $5^{\circ} 43' W.$ ) at a distance of 208 miles; the rates of movement of the last 2 were respectively 10.5 and 16.4 miles per 10 days.

In April, 18 of the marked plaice were recaptured, consisting of 7 males, 10 females, and 1 whose sex was not ascertained. Two of the females were taken by foreign trawlers in the Moray Firth, the position unspecified; a third female was recovered to the north-west of the Shetlands, off Ronasvoe, at 86 miles to the north-east; a fourth was taken off Foula, 51 miles to the north and west; the others were got at the following localities:—36 miles to the south-west, off Auskerry; 85 miles to the south-west, off Kinnaird Head; 41 miles to the south-west, off Auskerry; 35 miles to the south-west, east of the Orkney Isles; 72 miles to the south-west, south-east of Noss Head; and 12 miles W.  $\frac{1}{2}$  N. of Cape Wrath, at a distance of 140 miles. Of the males, 1 was taken 41 miles to the north-west, at the Orkney Isles; another, south-west of Cape Wrath, at a distance of 131 miles; another, east of the Orkney Isles, 41 miles to the south and west; the fourth, east of the Shetlands, at 37 miles to the south and west; the fifth, on the north coast, off Whiten Head, at 109 miles distant; the sixth, 63 miles to the south-west, off Noss Head; the remaining male was recaptured 16 miles east of the Bell Rock, at a distance of 170 miles to the south and west; the fish whose sex was unknown was taken east of the Orkneys, at a distance of 40 miles to the south and west.

Thus, in the second quarter, 34 fish, or 23.1 per cent., were recaptured, 29 (85.2 per cent.) to the south and west, 4 (11.8 per cent.) to the north and west, and 1 to the north and east. The migration chart shows the same general features as in the first quarter, with this difference that several of the fish were found to the westwards, towards Cape Wrath, and south of it, and a considerable number east of the Orkney Isles, and some northwards towards the Shetlands.

*Third Quarter.*—In May, 2 males and 14 females were recaptured, the position of 1 of the females not being ascertained. The 2 males were taken to the south-west, east of the Orkneys, at 37 and 45 miles to the south and west. Eight of the females were also got to the south and west, 5 east of the Orkneys, at distances of from 36 to 44 miles; 1 was taken far in the Moray Firth, to the north-east of Tarbet Ness, 102 miles to the south and west; another near the Pentland Firth, 52 miles to the south and west; 1 on the north coast, off Strathie Point, about 100

miles distant ; another female was taken  $5\frac{1}{2}$  miles off Cape Wrath, 127 miles to the south and west ; another 17 miles to the north and west ; 1 is described as having been captured 178 miles E. by S. of Aberdeen ( $57^{\circ} 20' N.$  ;  $3^{\circ} 30' E.$ ), 187 miles to the south and east. One female went to the north and east for 22 miles ; another to the north and west for 30 miles, and the remaining female had no particulars of capture recorded.

In June, 25 of the marked plaice were recaptured, 15 males and 10 females. Twelve of the males migrated to the south and west, all, with one exception, being captured to the east of the Orkney Isles, at distances of from 33 to 43 miles from the station ; the exception was taken off the north coast of Scotland, at a distance of 79 miles to the westward ; 3 males had moved to the north and west ; 2 were taken to the west of the Orkney Isles, off Stack Skerries, at a distance of 95 and 96 miles, and one 6 miles off Foula, 52 miles distant. Of the females, 9 were taken to the south and west, 8 of them being captured to the east of the Orkney Isles, at distances of from 32 to 40 miles ; the other female was found in the Moray Firth, off Portknockie, on the south shore, at a distance of 102 miles ; the remaining female was recaptured to the north and west, at a distance of 15 miles.

In July, 4 males and 5 females were taken ; 2 of the males were found to the south and west, at 14 and 41 miles, and 2 to the north and west, at 14 and 49 miles ; the latter near Foula. Two of the females were taken to the south and west, at 14 and 21 miles, and 3 to the north and west, at 10, 13, and 16 miles.

In this quarter, 50 fish, or 34 per cent., were recaptured, the place of capture being known for 49 (33.3 per cent.), and of these, 34, or 69.4 per cent., migrated a mean distance of 44 miles in the mean direction  $S. 76^{\circ} W.$ , 13, or 26.5 per cent., an average distance of 44 miles in the mean direction  $N. 54^{\circ} W.$ , while 1 moved north and east, and 1 south and east. The migration chart shows a great concentration of the plaice to the east of the Orkney Isles, where most were recaptured.

*Fourth Quarter.*—A male and a female were taken in August, the male 36 miles to the south and west, to the east of the Orkneys, and the female 17 miles to the north and west.

In September, a male was recovered 16 miles to the north and west, and in October, another male 9 miles to the north and west.

In this quarter, only 4 fish, or 2.7 per cent., were taken, 3 to the north and west, and 1 to the south and west.

In the 12 months immediately following liberation 110 marked plaice, or 74.8 per cent., were recaptured, of which 9 had no particulars given ; 71 (70.3 per cent.) migrated to the south and west ; 27 (26.7 per cent.) to the north and west ; 2 to the north and east, and 1 to the south and east.

Of the remaining fish, 2 were taken in the remainder of 1911, 27 in 1912, 3 in 1913, and 3 in 1914.

In November 1911, a male was taken off the Pentland Skerries, 60 miles to the south and west, and in December, another male was recaptured  $10\frac{1}{2}$  miles N.W. by N. of Cape Wrath, on the west coast, 138 miles to the westwards.

Two females were taken in January 1912, 1, 15 miles to the north and west, and the other 24 miles to the north and east, off Sumburgh Head, Shetland. In February, 4 males and a female were taken, the latter 48 miles to the south and west, east of the Orkneys. All the males had moved to the westwards ; 1 was taken off Strathie Point, on the north coast, at a distance of 99 miles ; another was found 6 miles W.N.W. of Loch Laxford, on the west coast, at a distance of 145 miles ; another south-west of Cape Wrath, at a distance of 144 miles, and the last 7 miles to the north and west, to the Butt of Lewis, at a distance of 169 miles. The 3 males last referred to had travelled at the mean rate of from 3 to 3.5 miles per 10 days. One male and 3 females were taken in March, the male off Lossiemouth, in the Moray Firth, 100 miles to the south and west ; 1 of the females was taken on the north coast, off Whiten Head, at a distance of 107 miles ; another farther north of the same place, at a distance of 102 miles, and the third 27 miles N.E.  $\frac{3}{4}$  E. of the Butt of Lewis, at a distance of 149 miles. A male and 2 females were recaptured in April, the male 7 miles E.S.E. from Stack Skerry, west of the Orkneys, at a distance of 99 miles ; 1 female in the Moray Firth, south of Tarbet Ness, at a distance of 92 miles to the south and west, and the other off Cape Wrath, at a distance of 121 miles. Two females were taken in May, both

to the north and west, 1 at 15 miles and the other at 50 miles, 6 miles south-east of Foula. Two males and 3 females were taken in June, 1 of the males and 1 of the females near Foula, 51 and 53 miles to the north and west; the others were got to the south and west, the male and 1 female to the east of the Orkneys, at 33 and 38 miles, and the other female in the Moray Firth, about midway between Noss Head and Kinnaird Head, at a distance of 80 miles. In July, a male and 2 females were recaptured, the females to the north and west, at 13 miles, and the male near Rattray Head, 95 miles to the south and west. A female was recaptured in August, close to Noss Head, in the Moray Firth, 82 miles to the south and west. In November, a male was taken north of Kinnaird Head, 66 miles to the south and west, and a female near Duncansby Head, 63 miles to the south and west. A male was taken in March 1913, to the east of the Orkneys, at a distance of 39 miles to the south and west, and in April, a female off Strathie Point, on the north coast, at a distance of 100 miles to the south and west. A male was taken in August, offshore, south-east of Aberdeen, 154 miles to the southwards, and in January 1914, a male was recaptured  $1\frac{1}{2}$  miles off Whitehills, on the south coast of the Moray Firth, at a distance of 109 miles to the south and west. A female was recaptured in May 1914, 13 miles to the north and west, and the last fish of the experiment was taken in June 1914, after 1313 days, a female, also 13 miles to the north and west.

An inspection of the migration chart for this experiment shows the lines radiating in great numbers to the south and west, the greater number to the east of the Orkneys and into the western half of the Moray Firth. A number moved down the east coast of Scotland; 6 were taken north east of Kinnaird Head, and 6 farther to the south, 1 of them to the eastern side of the Bell Rock. Six fish were recaptured near Foula, Shetlands, and 1 farther to the north, off the west of the Shetlands. Two were taken to the north-west of the Orkneys, and 26 west and south-west of the Orkneys; 9 on the north coast; 8 in the vicinity of Cape Wrath; 2 off the Butt of Lewis, and 1 in the Gairloch, close to the Isle of Skye.

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Females.	2	46	23	N. 8° E.
	Immature Females.	1	86	86	N. 7° E.
		3	132	44	N. 8° E.
N. and W.	Adult Males.	14	935	67	N. 61° W.
	Adult Females.	22	949	43	N. 51° W.
	Immature Females.	5	107	21	N. 53° W.
		41	1991	48	N. 55° W.
S. and E.	Immature Females.	1	187	187	S. 33° E.
S. and W.	Adult Males.	47	3674	78	S. 67° W.
	Adult Females.	31	1898	61	S. 75° W.
	Immature Females.	12	811	68	S. 46° W.
	? Sex.	1	40	40	S. 77° W.
		91	6423	70	S. 67° W.
SUMMARY.					
N. and E.		3	132	44	N. 8° E.
N. and W.		41	1991	48	N. 55° W.
S. and E.		1	187	187	S. 33° E.
S. and W.		91	6423	70	S. 67° W.
		136	..	..	..

*Distances travelled*—10 miles and under.—Six fish, or 4·4 per cent., were recaptured at distances of from 6 to 10 miles, namely, 2 males (3·3 per cent.), with an average of 7·5 miles, and 4 females (5·4 per cent.), with an average of 8 miles. All the fish were found to the north and west.

10 to 20 miles.—Sixteen, or 11·8 per cent., were recaptured at distances of from 13 to 17 miles; 3 males (4·9 per cent.), with an average of 14·6 miles, and 13 females (17·6 per cent.), with an average of 14·7 miles. Two of the males and 12 of the females were found to the north and west, 1 male and female to the south and west.

Thus, 22, or 16·2 per cent., were recaptured under 20 miles; 5 males (8·2 per cent.), with an average of 12·2 miles, and 17 females (22·9 per cent.), with an average of 13·1 miles.

20 to 50 miles.—Forty-nine fish, or 36 per cent., were recaptured at distances of from 21 to 50 miles, namely, 22 males (36·1 per cent.), with an average of 38·9 miles, 26 females (35·1 per cent.), with an average of 36·5 miles, and 1 of unknown sex. Twenty of the males and 21 of the females were found to the south and west; 2 males and 3 females to the north and west, and 2 females to the north and east.

50 to 100 miles.—Thirty-eight fish, or 27·9 per cent., were taken at distances of from 51 to 100 miles, namely, 18 males (29·5 per cent.), with an average of 79·5 miles, and 20 females (27 per cent.), with an average of 76·1 miles. Twelve males and 15 females were found to the south and west; 6 males and 4 females to the north and west, and 1 female to the north and east.

Over 100 miles.—Twenty-seven fish, or 19·8 per cent., were recaptured at distances of from 102 to 208 miles, namely, 16 males (26·2 per cent.), with an average of 141·5 miles, and 11 females (14·9 per cent.), with an average of 126·4 miles. Fourteen of the males and 6 of the females were found to the south and west; 2 males and 4 females to the north and west; and 1 female to the south and east; most of these fish were recaptured on the north coast of Scotland, or in the neighbourhood of Cape Wrath, but some of them were recaptured on the east coast of Scotland.

#### MATURITY.

*Males*.—The condition of the testes was recorded for 42 of the 63 recaptured.

Eight were "spawning;" 3 were taken in March 1911, to the south and west, 1 at a distance of 79 miles, and 2 at a distance of 112 miles: the former was recaptured near Kinnaird Head, in the Moray Firth; the 2 latter on the north coast towards Cape Wrath. Two were taken in April 1911, also on the north coast, at distances of 109 and 131 miles. One was taken in February 1912, also on the north coast, at 99 miles distant, and another in June 1912, to the east of the Orkneys, at 38 miles distant to the south and west. The eighth "spawning" male was taken in January 1914, after 1175 days, off Whitehills, on the south shore of the Moray Firth, 109 miles to the south and west.

Nine were described as "ripe"; two were taken in January 1911, one in the Moray Firth, off Noss Head, 73 miles to the south and west; the other off Tod Head, Kincardineshire, on the east coast, at a distance of 153 miles to the south and west. In February 1911, two were taken; 1, 36 miles to the south and west, east of the Orkneys, the other on the north coast at a distance of 100 miles to the westward. One was caught in March 1911, south-west of Cape Wrath, 138 miles to the south and west; 2 were taken in June 1911, both east of the Orkneys, 35 and 40 miles to the south and west; 1 caught in July 1911, near Foula, 49 miles to the north and west, and 1 taken in February 1912, south-west of Cape Wrath, at 145 miles distant.

Nine were described as "spent;" 1 taken in March 1911, on the north coast, at Sandside Bay, 95 miles to the south and west; another in April 1911, east of the Orkneys, at a distance of 41 miles to the westward; 3 in June 1911, east of the Orkneys, 37 and 38 miles south and west; 1 was taken in July 1911, east of the Orkneys, 41 miles to the south and west; another in April 1912, on the north coast, at a distance of 99 miles. In June 1912, 1 was recaptured near Foula, 51 miles to the north and west, and in July 1912, another near Rattray Head, 95 miles to the south and west.

Five were "nearly ripe," 1 taken in October 1911, 9 miles to the north and



west; another in November 1911, 60 miles to the south and west, near the Pentland Skerries, the third in December 1910, in the Moray Firth, 73 miles to the south and west, off Noss Head; the fourth in March 1912, north of Tarbet Ness, in the Moray Firth, 100 miles to the south and west; the fifth in November 1912, north of Kinnaird Head, 66 miles to the south and west.

One described as " $\frac{1}{4}$  ripe" was taken in December 1910, off Stonehaven, on the east coast, at a distance of 147 miles to the south and west.

Among those whose testes were "immature," was one measuring 34-34.2 cm. It was recaptured in April 1911, near the Bell Rock, at a distance of 170 miles to the south and west.

*Females.*—The condition of the ovaries was ascertained in 57 of the 83 recaptured.

Only one was "spawning"; it was taken in April 1913, after 907 days, on the north coast, at a distance of 100 miles to the south and west.

Two were described as "ripe," 1 taken in March 1912, on the north coast, at a distance of 107 miles, and the other in June 1911, east of the Orkneys, 32 miles to the south and west.

Three were "nearly ripe," 2 taken in January 1911, both to the south and west, 1 east of the Orkneys, at a distance of 45 miles, and the other on the north coast, at a distance of 116 miles; 1 was taken in December 1910, off Noup Head.

No less than 17 were described as "spent"; 2 were taken in April 1911, 1 near Foula, 15 miles to the north and west, the other south-west of Cape Wrath, 140 miles to the south and west; 1 was caught in May 1911, on the north coast, off Strathie Point, 100 miles to the south and west; 1 in June 1911, to the east of the Orkneys, 39 miles to the south and west, and 2 in July 1911, 1, 21 miles to the south and west, the other 10 miles to the north and west. A "spent" female was recaptured in March 1912, off Strathie Point, on the north coast, at a distance of 102 miles to the westwards; in January 1912, another was captured 15 miles to the north and west, and in April, 2, one off Noss Head, in the Moray Firth, 92 miles to the south and west, and the other near Cape Wrath on the west coast, at a distance of 121 miles; 2 were taken in May 1912, 1, 15 miles to the north and west, and the other at Foula, 50 miles to the north and west. Two were taken in June, 1 near Foula, 53 miles to the north and west, and the other east of the Orkneys, 33 miles to the south and west. In May 1914, 1 was taken 13 miles to the north and west, and in June, another 13 miles to the north and west. The seventh "spent" fish had no date of recapture given.

Among those of adult size with "immature" ovaries, 2 were recaptured in April 1911, 1 measuring 39-40.6 cm., at the entrance to the Moray Firth, north of Kinnaird Head, and the other measuring 37.5 to 39.5 cm., east of the Orkneys, 36 miles to the south and west.

Among the females under adult size recaptured, was 1 taken in March 1911, off Kinnaird Head, 79 miles to the south and west, which was described as "spawning," measuring 34 to 35.5 cm.

#### EXPERIMENT II.

15th September 1910.

At this station, 7 miles S.E. by  $\frac{1}{2}$  E. of Fair Isle ( $59^{\circ} 28' N.$ ;  $1^{\circ} 26' W.$ ), where depth was 52 fathoms, 30 marked plaice were liberated on 15th September 1910, namely, 14 males, fifteen females, and 1 of undetermined sex. The size of the males was from 32.5 to 38.5 c.m., and of the females 34 to 43.5 c.m., and 2 of the males and 10 of the females were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	Total
F. Lib. . . . .	—	5	8	2	15
F. Recap. . . . .	—	2	5	—	7
M. Lib. . . . .	—	8	6	—	14
M. Recap. . . . .	—	4	3	—	7
? Sex . . . . .	—	—	1	—	1

The fish used were caught in the vicinity by the "Goldseeker" on the same day.

The number recaptured was 14, or 46·7 per cent. ; 7 males (50 per cent.) and 7 females (46·6 per cent.). Six of the males were of adult size on recapture, averaging 38·8 cm., compared with 35 cm. on liberation ; they were at liberty for an average period of 385 days, and migrated from 8 to 236 miles, the average being 66·5 miles, and the mean rate of movement 1·7 miles. Five of the females were of adult size, averaging 41·8 cm. as against 37·3 cm. on liberation ; they were at liberty for an average period of 319 days, and migrated distances of from 5 to 136 miles, the mean being 62·9 miles, and the mean rate 1·97 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—A male was recaptured in September, on the same day as it was liberated, at about  $6\frac{1}{2}$  miles to the south and west.

In October, 2 females were taken, 1 thirty miles to the south and west, and the other  $5\frac{1}{2}$  miles to the south and east.

In November, a female was recaptured 5 miles to the south and east.

In this quarter, 4, or 28·6 per cent. were recaptured.

None was recaptured in the second quarter, and only 1 in the third quarter, a male, north-east of Noss Head, 56 miles to the south and west.

*Fourth Quarter.*—In June, 2 males and 2 females were taken, 1 male 8 miles to the north and east, and the other 32 miles to the south and west, to the east of the Orkneys. One female was also taken to the east of the Orkneys, 34 miles to the south and west. The other female was recaptured on the west coast, 8 miles west by north of Loch Inchard, south of Cape Wrath, at a distance of 136 miles.

In July, a male was taken east of the Orkneys, 20 miles to the south and west, and a female  $6\frac{1}{2}$  miles to the south and east.

None was recaptured in August, so that the total for this quarter was 6, or 42·8 per cent., and in the 12 months following liberation, the number was 11, or 78·6 per cent., of which 7, or 63·6 per cent., were found to the south and west ; 3 to the south and east, and 1 to the north and east.

Of the remaining fish, a male was taken in May 1912, near Foula, 47 miles to the northwards ; another male in July 1912, at a position described as  $56^{\circ} 49' N.$  ;  $4^{\circ} E.$ , or 236 miles to the south and east. It was landed at Cuxhaven by a German trawler. The last fish for this experiment was taken in August 1912, off Aberdeen, 133 miles to the south.

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	1	8	8	N. 53° E.
N. and W.			Nil.		
S. and E.	Adult Males.	1	236	236	S. 28° E.
	Adult Females.	2	11	5	S. 42° E.
	Immature Females.	1	5	5	S. 43° E.
		4	252	63	S. 39° E.
S. and W.	Adult Males.	3	108	36	S. 49° W.
	Immature Males.	1	6	6	S. 4° W.
	Adult Females.	2	170	85	S. 79° W.
	Immature Females.	1	30	30	S. 24° W.
		7	314	45	S. 48° W.
N.	Adult Males.	1	47	47	N.
S.	Adult Females.	1	133	133	S.
SUMMARY.					
N. and E.		1	8	8	N. 53° E.
N. and W.		..	..	..	..
S. and E.		4	252	63	S. 39° E.
S. and W.		7	314	45	S. 48° W.
N.		1	47	47	N.
S.		1	133	133	S.
		14	..	..	..

*Distances migrated*—10 miles and under.—Five fish, or 35·7 per cent., were recaptured at distances of from 5 to 8 miles, 2 males (28·6 per cent.), with an average of 7·25 miles, and 3 females (42·8 per cent.), with an average of 5·6 miles; 1 male was found to the north and east, and 1 to the south and west, while all the females were taken to the south and east.

None was taken between 10 and 20 miles.

20 to 50 miles.—Five, or 35·7 per cent., were found at distances of from 20 to 47 miles, 3 males (42·8 per cent.), with an average of 33 miles, and 2 females (28·6 per cent.), with an average of 32 miles; 1 of the males was found to the north, and all the other fish to the south and west.

50 to 100 miles.—One male was recaptured off Noss Head, 56 miles to the south and west.

Over 100 miles.—Three, or 21·4 per cent., were taken at distances over 100 miles, including the male taken by the Cuxhaven trawler above referred to, and 2 females which migrated, 1, 133 miles to the south, and was caught off Aberdeen, and the other on the west coast at 136 miles distant.

#### MATURITY.

*Males*.—The condition of the testes was ascertained for 6 of the 7 recaptured. One taken in May 1912, near Foula, 47 miles to the northwards, was "spawning."

Two were "ripe"; 1 taken in March 1911, off Noss Head, 56 miles to the south and west, the other in June 1911, 8 miles to the north and east.

One caught in June 1911, 32 miles to the south and west, east of the Orkneys, was "spent."

*Females.*—The condition of the ovaries was described in all of the females recaptured. None was “spawning,” “ripe,” or “nearly ripe.”

Two were described as “spent”; 1 taken in June 1911, 34 miles to the south and west, east of the Orkneys, and the other in August 1912, off Aberdeen, 133 miles south.

#### EXPERIMENT III.

15th September 1910.

At this station lying 19 miles E.S.E. of Fair Isle ( $59^{\circ} 30' N.$ ;  $1^{\circ} W.$ ), where the depth is about 75 fathoms, 262 marked plaice were liberated on 15th September 1910, viz. 100 males, 155 females, and 7 whose sexes were not ascertained. The males measured from 30 to 41.5 cm., and 5 were under adult size on liberation; the sizes of the females ranged from 32 to 47.5 cm., and 79 were under adult size when liberated.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	Total.
F. Lib. . . . .	—	37	94	20	4	155
F. Recap. . . . .	—	16	50	9	2	77
M. Lib. . . . .	1	44	54	1	—	100
M. Recap. . . . .	—	17	33	1	—	51
? Lib. . . . .	—	1	6	—	—	7
? Recap. . . . .	—	1	2	—	—	3

The fish used were taken by the “Goldseeker” in Aberdeen Bay on the previous day.

The number recaptured was 131, or 50 per cent., viz. 51 males (51 per cent.), 77 females (49.7 per cent.), and 3 of unknown sex (42.9 per cent.). Fifty of the males were of adult size on recapture, ranging from 34.1 to 43.4 cm., and averaging 38.3 cm., as compared with a range of from 32 to 41.5 cm., and a mean of 36.6 cm. on liberation; they were free for from 1 to 954 days, the mean being 223 days; they travelled distances of from 7 to 315 miles, the mean being 79.4 miles, and the average rate 3.5 miles. Of the females, 56 were of adult size on recapture, ranging from 38.2 to 52.2 cm., and averaging 43.2 cm., as compared with a range of from 34.5 to 47.5 cm., and a mean of 38.9 cm. on liberation; their periods of freedom varied from 4 to 1197 days, and averaged 339 days; they migrated distances of from 2 to 205 miles, the mean being 54.5 miles, and the mean rate was 1.6 miles. Twenty-one were under adult size, averaging 36.1 cm., and ranging from 32.0 to 37.9 cm., as compared with a range of from 33 to 38 cm., and a mean of 35.8 cm. when liberated; they were free from 4 to 968 days, the average being 143.9 days, and they travelled from 7 to 116 miles, the average being 41.6 miles, and the mean rate 3.2 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the remainder of September, 2 males and 6 females were recaptured, 1 of the males 25 miles to the south and east, and the other north of Kinnaird Head, 75 miles to the south and west; 2 of the females were taken at 9 and 38 miles to the south and west, 1, 24 miles to the south and east, 1, 10 miles to the north and west, and 2 on the same day 4 miles east of Fetlar, Shetland, 66 miles to the north and east. These statements are according to those made when the fish were returned, but some of them are obviously erroneous. Thus, the male described as taken north of Kinnaird Head was captured on the day following that on which it was liberated, which would mean that it migrated 75 miles in a single day! And the two females described as taken near Fetlar, had only been 4 days in the water, which would mean a rate of migration of over 16.5 miles per day.

Three males and 10 females were taken in October, 2 of the males to the south and west, at 47 and 66 miles, the latter a little north of Kinnaird Head, and the

former offshore, east of Noss Head ; the third male was taken 7 miles to the south and east ; 5 of the females were found to the south and west, at 7, 7, 31, 38, and 80 miles ; another was taken 15 miles to the south and east, 1, 64 miles to the north and east, near Fetlar, Shetland, and another 31 miles to the north and east, and 2 to the north and west, at 14 and 27 miles ; the fish taken at Fetlar had moved rapidly, at the rate of 4 miles per day ; the mean rate of movement of the other plaice recaptured this month varied from 2·2 to 40 miles per 10 days.

In November, 5 males, 4 females, and 1 of unknown sex were recaptured. Four of the females were taken to the south and west, at distances of 24, 62, 67, and 150 miles, the first E.S.E. off Sumburgh Head, the second off Roseness, Orkney, the third N.N.E. off Buchanness, and the fourth to the south-east of Aberdeen ; 1 of the males was found 69 miles to the south and west, at the entrance to the Pentland Firth ; another, 16 miles to the north and west ; a third, 27 miles to the north and east, east of Sumburgh Head, and the other 2, 20 and 37 miles to the south and east ; the fish of unknown sex was taken 13 miles to the north and west.

Altogether, in this quarter, 31, or 23·7 per cent., were recovered, of which 15 (48·4 per cent.) were found to the south and west, at an average distance of 51 miles in the mean direction S. 45° W. ; 6 (19·3 per cent.) were taken to the south and east, 5 to the north and west, and 5 to the north and east.

*Second Quarter.*—Three males were recaptured in December, 1 near land, north of Sumburgh Head, Shetland, 28 miles to the north and east, another north and east of Kinnaird Head, offshore, 60 miles to the south and west, and the third 7 miles E.N.E. of Aberdeen, 142 miles to the south and west ; the mean rate of movement of this fish was 15·1 miles per 10 days.

Six males and 5 females were taken in January 1911, all but 1 to the south and west ; the exception was a male, captured 5 miles N.E. of Noup Head, Orkneys, 61 miles to the north and west ; another male was taken at an unspecified place in the Moray Firth ; of those which migrated to the south and west, 1 female was taken 18 miles distant, another 50 miles, east of the Orkneys ; 2 females and a male were recaptured near the Pentland Skerries, at the entrance to the Pentland Firth, at 70 and 72 miles ; a male was captured in Sinclair Bay, near Wick, Moray Firth, 89 miles distant, and a female and a male south-east of Noss Head, Moray Firth, at 88 and 89 miles ; the remaining male was taken 1½ miles off Knock Head, Banff, Moray Firth, at a distance of 116 miles.

Six females were taken in February 1911, 1, 26 miles to the east and north, 2 to the north and west, at 7 and 38 miles, the fourth 46 miles to the south and west, the fifth 1 mile off Keiss, Wick, in the Moray Firth, 90 miles to the south and west, and the remaining female at Banff, Moray Firth, 116 miles to the south and west.

In this quarter, 20, or 15·3 per cent., were got, of which 15, or 75 per cent., were found to the south and west, 1 at an unknown place in the Moray Firth, and the other 14, or 73·7 per cent., at an average distance of 80 miles in the mean direction S. 56° W. ; 3 (15·8 per cent.) were caught to the north and west, and 2 to the north and east.

*Third Quarter.*—In March, 6 males and 3 females were taken ; the position of 1 female, found in a consignment of fish from Granton, was not ascertained ; all the others were found to the westwards and south-west. One, a male, was caught east of the Orkneys, at 44 miles ; another, a female, in the Moray Firth, south-east of Noss Head, at a distance of 98 miles ; 2, a male and a female, were taken off Strathie Point, on the north coast, 110 and 112 miles to the west and south ; and another male a little farther to the west, off Rabbit Islands, at 122 miles ; another male was taken on the west coast, south of Cape Wrath, at 158 miles ; another male was recaptured 1½ miles off Banff, on the south coast of the Moray Firth, at 117 miles, and the last male was taken 8 miles off Buchanness, 130 miles distant.

In April, 5 males and 2 females were got, all to the west and south, a male at 21 miles ; 4, 2 males and 2 females, were taken east of the Orkneys at 45 and 47 miles ; 2 males were taken to the westwards, one 4 miles S.E. of Stack Skerry, north-east of Cape Wrath, and the other 6 miles north of Loch Erribol, near Cape Wrath.

Two males and 7 females were taken in May, the place of capture of 2 of the females not being ascertained; 2 of the other females were found in the Moray Firth, to the south and west, at unspecified places; a female was recovered 17 miles to the south and west, 1 near Foula, Shetland, 42 miles to the north and west; 2 males were taken east of the Orkneys, 45 and 63 miles to the south and west, and a female off Whiten Head, on the north coast, at 112 miles.

In this quarter, 25, or 19·1 per cent., were found, the positions being known for 22; all but one were found to the south and west, 21, or 95·4 per cent., at an average distance of 83 miles in the mean direction S. 65° W., and one was taken to the north and west.

*Fourth Quarter.*—Twenty were taken in June 1911, 10 males, 9 females, and 1 of unknown sex. A female and the fish of unknown sex were caught near Foula, Shetland, 43 and 44 miles to the north and west; a male was also taken to the north of the Shetlands, on the east side, off Fetlar, 65 miles to the north and east; a female was got 10 miles to the north and west; all the others were recaptured to the south and west, 1, a female, at 18 miles, towards Fair Isle; 10, 4 males and 6 females, were recaptured to the east of the Orkneys, at distances of from 39 to 59 miles; the other fish were taken to the westwards, a male off Sule Skerry, at 103 miles; another male near Cape Wrath, at 138 miles; a third male 14 miles E.N.E. of Cape Wrath, at 130 miles; and a fourth, 7 miles north-east of Cape Wrath, at 137 miles; the remaining male was recaptured at Scourie Bank, in the Minch, south-west of Cape Wrath, at a distance of 168 miles.

Two males and 7 females were got in July, all but 2 to the south and west, 3 south-east of Fair Isle, at distances of from 12 to 19 miles, and 5 east of the Orkneys, at distances of from 14 to 57 miles; the remaining fish, a female, was taken 18 miles S.E. of Noss Head, Moray Firth, at a distance of 85 miles.

One fish, a female, was recaptured in August, in the Moray Firth, precise place unknown.

In this quarter, 30 of the marked plaice were recaptured, or 22·9 per cent.; 24 (82·7 per cent.) were got to the south and west, 23 of them (79·3 per cent.) at an average distance of 62 miles in the mean direction S. 69° W.; 4 were taken to the north and west, 1 to the north and east, and 1 directly west.

Within 12 months of liberation, 106 marked plaice, or 80·9 per cent., were recovered; 75, or 75·7 per cent., were taken to the south and west, 13, or 13·1 per cent., to the north and west, 8 to the north and east, 6 to the south and east, and 1 directly west.

Of the other fish recaptured, 8 were taken in the remainder of 1911, 9 in 1912, and 8 in 1913.

In September 1911, a female was taken 7 miles south-east of Fair Isle, at a distance of 11 miles to the north and west. Two males and 3 females were recaptured in October, 2 females south of Sumburgh Head, at 16 and 19 miles to the north and west, and the third 11 miles to the south and west, south-east of Fair Isle; of the two males, 1 migrated to the south and west, to the east of the Orkneys, for 55 miles, and the other to the north and west, to the Shetlands, a distance of 36 miles. In November, a male was recaptured "188 miles E. by S.  $\frac{1}{4}$  S." of Aberdeen, which is a position a few miles to the north and west of the Great Fisher Bank, at a distance of 198 miles to the south and east; and a plaice of unspecified sex, near Buchanness, Aberdeenshire, at a distance of 115 miles to the south and west.

A male was taken in January 1912, off Fair Isle, at a distance of 19 miles to the south and west, and in April a male and two females, the male near Foula, Shetland, 45 miles to the north and west, 1 of the females 105 miles to the eastwards, offshore, and the other near the Butt of Lewis, Hebrides, 182 miles to the westwards. In May, a male was taken to the east of the Orkneys, at a distance of 50 miles to the south and west, and a female near Foula, 44 miles to the north and west. In June, a female was recaptured in the Moray Firth, south-east of Noss Head, at a distance of 85 miles to the south and west. In July, another female went 2 miles to the south and west, and in November a female at a place unrecorded.

In January 1913, a female was recaptured on the north coast, 7 miles off Holburn Head, at a distance of 99 miles; in March, a female to the east of the Orkneys, 45 miles to the south and west, and in April, a male and a female, the latter at the entrance to the Moray Firth, south-east of Noss Head, at a distance of 67 miles, and

the male on the southern edge of the Dogger Bank (Lat.  $54^{\circ} 10' N.$ ; Long.  $2^{\circ} 42' E.$ ), at a distance of 315 miles to the south and east. Two females were taken in May, both near Foula, at 44 and 47 miles; in June, a female was recaptured on the north coast, off Strathie Point, at a distance of 117 miles, and the last fish to be taken, a female, was got in December 1913, after 1197 days, at the mouth of the Firth of Forth, 205 miles to the south and west.

The migrations of the marked plaice from this station are of considerable interest, and it may be worth while considering the subject as illustrated on the migration charts. Thirty-one fish, recaptured in the first three months, had dispersed chiefly to the south and west, in the direction of the Moray Firth and the east coast of Scotland; three were taken on the eastern side of the north part of the Shetlands, and 2 near the entrance to the Pentland Firth. All the fish, except the two last-named, were taken between  $0^{\circ}$  and  $2^{\circ} W.$  Long., 3 of them between  $60^{\circ}$  and  $61^{\circ} N.$  Lat., 18 between  $59^{\circ}$  and  $60^{\circ} N.$  Lat., 8 between  $58^{\circ}$  and  $59^{\circ} N.$  Lat., and 1 between  $57^{\circ}$  and  $58^{\circ}$  (south-east of Aberdeen).

In the next three months (December 1910 and January and February 1911) the majority of the fish were found more to the westwards, but still to the south, the lines radiating from the station to the east of the Orkneys, on the north, and to the south shores of the Moray Firth on the south. Seven were taken between  $0^{\circ}$  and  $2^{\circ} W.$  Long., and 12 between  $2^{\circ}$  and  $4^{\circ} W.$  Long.; none was got north of  $60^{\circ} N.$  Lat.; 8 were found between  $59^{\circ}$  and  $60^{\circ} N.$  Lat., 8 between  $58^{\circ}$  and  $59^{\circ} N.$  Lat., and 3 between  $57^{\circ}$  and  $58^{\circ} N.$  Lat.

In the third quarter, March, April, and May, the migration lines run in the same general direction, but more of them penetrate farther to the westwards. Only 1 fish was taken to the northwards, while 21, or over 95 per cent., were got to the south and west; 7 were found to the east of the Orkneys, in the direction of the Pentland Firth, 6 off the north coast of Scotland, and 1 on the west coast. Four were found between  $0^{\circ}$  and  $2^{\circ} W.$  Long., 10 between  $2^{\circ}$  and  $4^{\circ}$ , and 6 between  $4^{\circ}$  and  $6^{\circ}$ . One was recaptured between  $60^{\circ}$  and  $61^{\circ} N.$  Lat., 5 between  $59^{\circ}$  and  $60^{\circ}$  and 13 between  $58^{\circ}$  and  $59^{\circ}$ .

In the fourth quarter, the same conditions as in the last are indicated, but the number of fish found to the east of the Orkneys is greater. Twelve were got between  $0^{\circ}$  and  $2^{\circ} W.$  Long., 11 between  $2^{\circ}$  and  $4^{\circ}$ , and 5 between  $4^{\circ}$  and  $6^{\circ} W.$  Long. Three were taken between  $60^{\circ}$  and  $61^{\circ} N.$  Lat., 16 between  $59^{\circ}$  and  $60^{\circ}$ , and 10 between  $58^{\circ}$  and  $59^{\circ}$ .

In the chart showing the lines of migration for all the fishes recaptured, the chief feature is the concentration to the south and west. A large number were recovered to the south-east of Fair Isle, at comparatively short distances from the station, and a still larger number were taken to the east of the Orkneys; 10 were recaptured within the Moray Firth, 3 being taken off Banff, on the south shore, and most of the others south-east of Noss Head; 12 were got on the north coast of Scotland, as far west as Cape Wrath; 2 to the south of Cape Wrath, and 1 near the Butt of Lewis, far to the westwards. A number were taken at Foula, to the west of the Shetlands, and 4 on the north and east parts of these islands. One was recaptured near the Great Fisher Bank, and another on the south edge of the Dogger Bank, while 5 were found on the east coast of Scotland. The movement in this direction of a number of fish from the Fair Isle stations is interesting and remarkable, and is elsewhere dealt with.

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	3	120	40	N. 27° E.
	Adult Females.	2	171	85	N. 56° E.
	Immature Females.	4	187	47	N. 41° E.
		9	478	53	N. 39° E.
N. and W.	Adult Males.	4	158	39	N. 30° W.
	Adult Females.	12	323	27	N. 42° W.
	Immature Females.	3	61	20	N. 48° W.
	? Sex.	2	57	28	N. 45° W.
		21	599	28	N. 37° W.
S. and E.	Adult Males.	4	384	96	S. 27° E.
	Immature Males.	1	20	20	S. 73° E.
	Immature Females.	2	39	19	S. 44° E.
		7	443	63	S. 39° E.
S. and W.	Adult Males.	38	3230	85	S. 60° W.
	Adult Females.	37	2325	63	S. 63° W.
	Immature Females.	9	462	51	S. 59° W.
	? Sex.	1	115	115	S. 28° W.
		85	6132	72	S. 60° W.
W.	Adult Females.	1	14	14	W.
SUMMARY.					
N. and E.		9	478	53	N. 39° E.
N. and W.		21	599	28	N. 37° W.
S. and E.		7	443	63	S. 39° E.
S. and W.		85	6132	72	S. 60° W.
W.		1	14	14	W.
		123	..	..	..

*Distances travelled*—10 miles and under.—Eight, or 6·5 per cent., were recaptured at distances of from 2 to 10 miles, 1 male at 7 miles to the south and east, and 7 females (10 per cent.), with an average of 7·4 miles, 4 to the south and west, and 3 to the north and west.

10 to 20 miles.—Sixteen, or 13 per cent., were recaptured at from 11 to 19 miles, 3 males (6 per cent.), with an average of 17 miles, 12 females (17·1 per cent.), with an average of 15·3 miles, and 1 of unknown sex, at 13 miles to the north and west; 2 of the males and 5 of the females were got to the south and west, 1 male, 5 females, and 1 of unknown sex to the north and west, 1 female to the south and east, and 1 to the west. Twenty-four fish, or 19·5 per cent., were, therefore, found under 20 miles, viz. 4 males (8 per cent.), 19 females (27·1 per cent.), and 1 of unspecified sex.

20 to 50 miles.—Forty-six, or 37·4 per cent., were recaptured at distances of from 20 to 50 miles, viz. 17 males (34 per cent.), with an average of 38·3 miles, 28 females (40 per cent.), with an average of 39 miles, and 1 of unknown sex. Ten of the males and 18 of the females were taken to the south and west, 2 of the males, 7 of the females, and 1 of unknown sex to the north and west, 3 of the males and 1 of the females to the south and east, 2 of the males and 2 of the females to the north and east.

50 to 100 miles.—Twenty-eight, or 22·8 per cent., were found at distances of



from 55 to 99 miles, viz. 13 males (26 per cent.), with an average of 67·7 miles, and 15 females (21·4 per cent.), with a mean of 77·1 miles. Eleven of the males and 12 of the females were taken to the south and west, 1 male to the north and west, and 1 to the north and east, and 3 females to the north and east.

*Over 100 miles.*—Twenty-five, or 20·3 per cent., were recaptured at distances of from 103 to 315 miles, viz. 16 males (32 per cent.), with an average of 145 miles, 8 females (11·4 per cent.), with a mean of 137·4 miles, and 1 of unknown sex, which was recaptured 115 miles to the south and west. Of the males, 15 were taken to the south and west, and 1 to the south and east, while 7 of the females were taken to the south and west, and 1 to the north and east.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 34 of the 51 males recaptured. None was "spawning," but 10 were described as "ripe," 3 caught in March 1911, to the south and west, 1 east of the Orkneys, at a distance of 44 miles, another on the north coast, off Strathie Point, at 110 miles, and the third at Banff, on the south shore of the Moray Firth, at 117 miles. Two were recaptured in April 1911, 1, 21 miles to the south and west, and the other on the north coast, at Loch Erribol, 130 miles to the south and west. Three were recaptured in June 1911, 1 east of the Orkneys, at 50 miles to the south and west, the second at Fetlar, 65 miles to the north and east, and the third off the north coast, near Sule Skerry, at a distance of 103 miles to the south and west. In July 1912, a "ripe" male was taken 15 miles to the south and west, and in April 1912, another near Foula, 45 miles to the north and west. Seven were described as "nearly ripe," 4 taken in January 1911, one 61 miles to the north and west, off Noup Head, 1 near the Pentland Skerries, 72 miles to the south and west, a third 89 miles to the south and west, and the fourth off Knock Head, 116 miles to the south and west. In December 1910, 1 was caught off Aberdeen, 142 miles to the south and west, and in October 1911, another 36 miles to the north and west, at the Shetlands; the last was recovered in January 1912, 19 miles to the south and west. Six were described as "spent," all taken to the south and west, 1 in March 1911, on the north coast, at Rabbit Islands, at 122 miles; 1 in April 1911, near Stack Skerry, at 110 miles; 3 in June, 2 east of the Orkneys, at 40 and 44 miles; the third at Scourie Bank, south-west of Cape Wrath, at 168 miles; another was taken in May 1912, east of the Orkneys, at a distance of 50 miles.

*Females.*—In 63 of the 77 recaptured, the condition of the ovaries was recorded. None was described as "spawning," and only 1 as "ripe," which was taken in June 1911, 18 miles to the south and west. Three were "nearly ripe," 1 found in October 1910, 80 miles to the south and west, another in January 1911, 18 miles to the south and west, and the third in December 1913, after 1197 days, 205 miles to the south and west. Twelve were described as "spent"; 2 were recaptured in February 1911, 1 east of the Orkneys, 46 miles to the south and west, and the other near Wick, 90 miles to the south and west; 1 was recaptured in March 1911, on the north coast, 112 miles to the south and west, and 1 in May 1911, also on the north coast, at a distance of 112 miles. One was taken in June 1911, 39 miles to the south and west, and 1 in July, 12 miles to the north and west. In April 1912, 1 was recaptured near the Butt of Lewis, 182 miles to the south and west; in May 1912, 1, 44 miles to the north and west; in June 1912, 1 south-east of Noss Head, 85 miles to the south and west; in January 1913, a "spent" female was recaptured on the north coast, 99 miles to the south and west; in March 1913, 1 east of the Orkneys, at 45 miles, and in June, after 1004 days, another on the north coast, at a distance of 117 miles.

Among females under adult size on recapture (38 cm.) 1, which measured 38–37·9 cm., was recovered in February 1911, after 163 days, at Banff, 116 miles to the south and west, and was described as "about to spawn"; another, measuring 36·5–36·6 cm., was taken in February 1911, 7 miles to the north and west, and was described as "nearly ripe."

Among those fish of adult size, whose reproductive organs were described as "immature," and which were captured during the spawning season, were the following:—Two males, 1 measuring 37–38·3 cm., caught in January 1911, at

Sinclair Bay, near Wick, 89 miles to the south and west, and the other measuring 33·5–34·1 cm., caught in March 1911, near Buchan Ness, 130 miles to the south and west. One female, which measured 38–38·2 cm., taken in January 1911, south-east of Noss Head, 88 miles to the south and west, was “immature.”

## EXPERIMENT IV.

15th September 1910.

In this experiment, 30 plaice, taken by the “Goldseeker” in the locality, were liberated 13 miles S.E. by E.  $\frac{1}{3}$  E. of Fair Isle (59° 26' N.; 1° 14' W.), comprising 10 males and 20 females. The males measured from 33 to 40 cms., and all were of adult size; the females ranged from 33·5 to 43·5 cms., and 7 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25–30·5	cm. 31–35·5	cm. 36–40·5	cm. 41–45·5	cm. 46–50·5	Total.
F. Lib. . . . .	—	3	14	3	—	20
F. Recap. . . . .	—	2	8	2	—	12
M. Lib. . . . .	—	6	4	—	—	10
M. Recap. . . . .	—	3	4	—	—	7

The number recaptured was 19, or 63·3 per cent., 7 males (70 per cent.) and 12 females (60 per cent.).

Six of the males were of adult size on recapture, averaging 38·2 cm., as compared with 37·5 cm. when liberated; they were at liberty for from 137 to 630 days, the mean being 301 days; they migrated distances of from 1 to 134 miles, the mean being 78·8 miles, and the mean rate was 2·6 miles. Eleven of the females were of adult size when recaptured, averaging 42·6 cm. as against 39·4 cm.; they were at liberty for from 45 to 417 days, the mean being 233 days; they migrated distances of from 4 to 167 miles, the mean being 45·8 miles, and the mean rate 1·4 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In October, 2 females were taken, one 18 miles to the south and west, and the other 42 miles to the north and west, to the north of the Shetlands. A female was caught in November, east south-east of Sumburgh Head, 32 miles to the north and east.

In this quarter these were the only 3 fish obtained (15·8 per cent.).

*Second Quarter.*—In January, a male was recaptured 1 mile off Whitehills, near Banff, in the Moray Firth, 113 miles to the south and west.

*Third Quarter.*—Two females and a male were taken in April, a male 1 mile to the north and east, and both females to the south and west, near together, at 35 and 36 miles east of the Orkneys.

In May, a male and 2 females were recaptured, the male 46 miles to the north and west, near Foula, and both females to the south and west, 1 east of the Orkneys, at a distance of 53 miles, and the other off the north coast of Scotland, 10 miles north-east of Whiten Head, 105 miles distant.

In this quarter, 6, or 31·6 per cent., were recaptured, 4 (66·6 per cent.) to the south and west, and 1 each to the north and east, and north and west.

*Fourth Quarter.*—Two males and 2 females were taken in June, 1 of the females 5½ miles to the west, all the others to the south and west, a female at a distance of 32 miles east of the Orkneys; 1 male in the Moray Firth, north and west of Banff, at 106 miles, and the other male 4 miles east-north-east of Cape Wrath, on the west coast, at a distance of 134 miles.

These were all the fish taken in this quarter.

In the 12 months, 14 fish, or 73·7 per cent., were recaptured; 9 (64·3 per cent.) to the south and west; 2 each to the north-east and north-west, and 1 to the west. The date of recapture of 2 other fish was not ascertained; 1, a female, was taken

on the east coast, near Montrose, 167 miles to the south and west ; the place of capture of the other, a male, was not ascertained.

Two fish were recaptured in 1911, a female in September, 4 miles to the north and west, and a female in November, 6 miles to the north and west. The last fish for this experiment was a male, taken in June 1912, 16 miles north of Banff, at a distance of 100 miles.

The following table shows how all the fish of the experiment were distributed in each quadrant :--

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	1	1	1	N. 29° E.
	Immature Females.	1	32	32	N. 62° E.
		2	33	16	N. 45° E.
N. and W.	Adult Males.	1	46	46	N. 7° W.
	Adult Females.	3	52	17	N. 35° W.
		4	98	24	N. 28° W.
S. and E.		..	..	..	..
S. and W.	Adult Males.	3	347	116	S. 55° W.
	Immature Males.	1	106	106	S. 47° W.
	Adult Females.	7	446	64	S. 56° W.
		11	899	82	S. 55° W.
W.	Adult Females.	1	5	5	W.
SUMMARY.					
N. and E.		2	33	16	N. 45° E.
N. and W.		4	98	24	N. 28° W.
S. and E.		..	..	..	..
S. and W.		11	899	82	S. 55° W.
W.		1	5	5	W.
		18	..	..	..

*Distances migrated*—10 miles and under.—Four fish, or 22·2 per cent., were recaptured at from 1 to 6 miles, namely, 1 male and 3 females ; a male was found to the north and east ; 1 female to the west, and the two others to the north and west.

10 to 20 miles.—A female was taken 18 miles to the south and west.

20 to 50 miles.—Six, or 33·3 per cent., were recaptured between these distances, 1 male at 46 miles to the north and west, and 5 females (41·6 per cent.), with an average of 35·4 miles ; 3 to the south and west ; 1 to the north and west, and 1 to the north and east.

50 to 100 miles.—Two were taken, a male, 100 miles to the south and west, and a female 53 miles to the south and west.

Over 100 miles.—Five, or 27·7 per cent., were recaptured at distances over 100 miles ; three males (50 per cent.), with an average of 117·8 miles, and 2 females (16·6 per cent.), with an average of 136 miles ; all were taken to the south and west.

#### MATURITY.

*Males*.—The condition of the testes was ascertained in only 2 of the 7 males recaptured ; 1 taken near Foula, 46 miles to the north and west, in May 1911, was "ripe"

*Females.*—The condition of the ovaries was ascertained in 10 of the 12 females recaptured. One was "spawning"; it was taken in April 1911, to the east of the Orkneys, 35 miles to the south and west; 1, taken in November, 6 miles to the north and west, was "nearly ripe," and 2 were described as "spent"; 1 recaptured in April 1911, east of the Orkneys, 36 miles to the south and west, and the other on the north coast, off Whiten Head, 105 miles to the westwards

## EXPERIMENT V.

11th April 1911.

In this experiment, 70 plaice, 33 males and 37 females, were liberated at the same place as before, 59° 20' N.; 1° 3' W., on the 11th April 1911. The males ranged in size from 24.5 to 39 cm., and 25 were under adult size on liberation; the females measured from 25 to 67 cm., and 20 were under adult size when liberated.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	Total.
F. Lib.	13	6	4	3	6	4	37†
F. Recap.	1	3	3	3	5	4	20†
M. Lib.	22*	9	2	—	—	—	33
M. Recap.	3	7	1	—	—	—	11

\* Two at 24.5 cm. † One at 67 cm.

The fish used were taken by the "Goldseeker" in the Dornoch Firth, Moray Firth, on the 8th April, in the forenoon. The fish were placed in tubs of running sea water, and the vessel proceeded to visit certain hydrographic stations; owing to bad weather it had to return to the Dornoch Firth on the 9th April, where it lay until the evening of the 10th. The fish were liberated about 11 a.m. on the 11th, and although they had been in the tubs for 3 days, and the weather was very rough, only 1 marked plaice died in the tubs.

The number recaptured was 31, or 44.3 per cent., namely, 11 males, or 33.3 per cent., and 20 females, or 54.1 per cent. Ten of the males were of adult size on recapture, ranging from 34.8 to 47.5 cm., and averaging 39.3 cm., as compared with a range of from 26 to 36 cm., and an average of 32.5 cm., on liberation; they were at liberty for from 126 to 1349 days, the mean being 430 days; they migrated distances of from 13 to 113 miles, the mean being 67.6 miles, and the mean rate of movement 1.5 miles. Seventeen of the females were of adult size, averaging 50.8 cm., and ranging from 39.7 to 68 cm., as compared with a range of from 31 to 67 cm., and an average of 46.6 cm., on liberation; they were at liberty for from 79 to 1023 days, the mean being 304 days; they migrated distances of from 6 to 188 miles, the mean being 45.4 miles, and the mean rate 1.5 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—None was taken in April or May, and only 1, a female, in June; it was caught east of the Orkneys, 33 miles to the south and west.

*Second Quarter.*—One male and 5 females were recaptured in July, the male 16 miles to the north and west, and 4 of the females to the north and west, at 11, 12, 13, and 13 miles; the remaining female was taken near Rattray Head, 97 miles to the south and west.

Two males and a female were taken in August, the female 10 miles to the north and west; 1 of the males off Kinnaird Head, 90 miles to the south and west, and the other 8 miles south-east of Baltasound Light, at the north of the Shetlands, 79 miles to the north and east.

A male and a female were taken in September, the male 13 miles, and the female 12 miles to the north and west.

In this quarter, 11, or 35·5 per cent., were recaptured, 8 (72·7 per cent.) to the north and west ; 2 to the south and west, and 1 to the north and east.

*Third Quarter.*—A female was recaptured in October, 6 miles to the north and west, and in November, 2 males and 4 females ; 1 of the males and 1 of the females were taken to the east of the Orkneys, at 41 and 40 miles to the south and west ; the other male was recaptured off Duncansby Head at the entrance to the Pentland Firth, 63 miles to the south and west, and the female was taken in the Moray Firth, north of Kinnaird Head, 82 miles to the south and west. The remaining 2 females were found 12 miles to the north and west.

In this quarter, 7, or 22·6 per cent., were recaptured ; 4 (57·1 per cent.) to the south and west, and 3 to the north and west.

*Fourth Quarter.*—A male was recaptured in February 1912, in the Moray Firth, 4 miles off Dunbeath, Caithness, 96 miles to the south and west. In March, 2 males were taken ; 1 at an unknown place in the "Moray Firth," and the other also in the Moray Firth, south-east of Noss Head, 76 miles to the south and west.

In this quarter, 3, or 9·7 per cent., were recaptured.

In the 12 months, 22, or 70·9 per cent., were recaptured, the position being known for all but 1 ; 11 (52·4 per cent.) were found to the north and west ; 9 (42·8 per cent.) to the south and west, and 1 to the north and east.

Five were taken in the remainder of 1912, 1 in 1913, and 3 in 1914. In April 1912, a female was recaptured near Buchanness, 118 miles to the south and west, and in May, 2 females, 1 east of the Orkneys, 42 miles to the south and west, and the other off Rattray Head, 104 miles to the south and west. In July, another female was taken offshore, south-east of Buchanness, at a distance of 118 miles to the south and west, and in November, another female, offshore, east of the Firth of Forth, 188 miles to the south and partly east. In June 1913, after 808 days, a female was recaptured to the north of the Shetlands, near Balta, 84 miles to the north and east. In January 1914, a female was taken 20 miles to the south and west ; in May, a male, after 1132 days, 38 miles to the south and west, east of the Orkneys, and the last fish, a male, was recaptured in December 1914, after 1349 days, near Buchanness, 113 miles to the south and west.

The chart of the lines of migration of this experiment, shows the general movement to have been first of all to the north and west, for short distances, towards Fair Isle ; also to the south and west, to the east of the Orkneys and into the Moray Firth, while a number of fish migrated to the southwards, 5 having been taken in the vicinity of Rattray Head and Buchanness, and 2 farther to the eastwards in the offshore waters. Two moved northwards to the north of the Shetlands. None of the fish of this experiment was taken on the north coast of Scotland or on the west coast.

The following table shows how all the fish of the experiment were distributed in each quadrant :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	1	79	79	N. 27° E.
	Adult Females.	1	84	84	N. 25° E.
		2	163	81	N. 26° E.
N. and W.	Adult Males.	1	13	13	N. 11° W.
	Immature Males.	1	16	16	N. 59° W.
	Adult Females.	9	101	11	N. 27° W.
		11	130	12	N. 29° W.
S. and E.	Adult Females.	1	188	188	S. 6° E.
	Immature Females.	1	118	118	S. 1° E.
		2	306	153	S. 3° E.
S. and W.	Adult Males.	7	517	74	S. 57° W.
	Adult Females.	6	399	66	S. 55° W.
	Immature Females.	2	137	68	S. 52° W.
		15	1053	70	S. 55° W.
SUMMARY.					
N. and E.		2	163	81	N. 26° E.
N. and W.		11	130	12	N. 29° W.
S. and E.		2	306	153	S. 3° E.
S. and W.		15	1053	70	S. 55° W.
		30	..	..	..

*Distances migrated*—10 miles and under.—Only 2 (6·6 per cent.) were found under this category, both females (10 per cent.) ; 1 at 6 and 1 at 10 miles, both to the north and west.

10 to 20 miles.—Nine, or 30 per cent., were taken at from 11 to 16 miles ; 2 males (20 per cent.), with an average of 14·5 miles, and seven females (35 per cent.), with an average of 12·1 miles. Both males and all the females were found to the north and west.

Thus, 11 were recaptured at distances under 20 miles, 2 males and 9 females (45 per cent.).

20 to 50 miles.—Six, or 20 per cent., were found at distances of from 20 to 42 miles ; 2 males (20 per cent.), with an average of 39·5 miles, and 4 females (20 per cent.), with an average of 33·7 miles. All these fish were found to the south and west.

50 to 100 miles.—Eight, or 26·6 per cent., were taken at between 63 and 97 miles ; 5 males (50 per cent.), with an average of 80·8 miles, and 3 females (15 per cent.), with an average of 87·6 miles ; 4 of the males and 2 of the females were found to the south and west, and 1 male and 1 female to the north and east.

Over 100 miles.—Five, or 16·6 per cent., were recaptured at distances of from 104 to 188 miles ; 1 male with a distance of 113 miles to the south and west, and 4 females (20 per cent.), with an average of 132 miles, 2 to the south and east, and 2 to the south and west.

#### MATURITY.

*Males*.—The condition of the testes was recorded for 8 of the 11 males. One, taken in December 1914, off Buchanness, 113 miles to the south and west, was

“spawning”; and another, taken in March 1912, off Noss Head, in the Moray Firth, was “ripe.”

Among those “immature” was 1, measuring 34·5 to 36·1 cm., taken in the Moray Firth, off Dunbeath, 96 miles to the south and west, in February 1912.

*Females*.—The condition of the ovaries was ascertained in 18 out of the 20 recaptured.

None was “ripe,” but 3 were “nearly ripe.” Two were taken in November 1911; 1, 12 miles to the north and west, and the other north of Kinnaird Head, 82 miles to the south and west; a third was taken in January 1914, after 1023 days, 20 miles to the south and west.

Six were “spent.” One recaptured in June 1911, east of the Orkneys, 33 miles to the south and west; 2 taken in July 1911, 11 and 12 miles to the north and west; and another in April 1912, near Buchanness, 118 miles to the south and west; the fifth in May 1912, also near Buchanness, at a distance of 104 miles to the south and west; and the last in June 1913, to the north of the Shetlands, off Balta, 84 miles to the north and east.

#### EXPERIMENT VI.

12th October 1911.

This experiment was made on 12th October 1911, when 100 marked plaice, comprising 32 males, 64 females, and 4 whose sexes were not determined, were liberated about 35 miles east of Fair Isle, 59° 44' N.; 0° 33' W. The males measured from 28 to 51 cm., and 5 were under adult size on liberation; the sizes of the females varied from 27·5 to 65 cm., and 25 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	cm. 61-65·5	Total.
F. Lib. . . . .	2	10	21	12	13	5	1	64
F. Recap. . . . .	1	3	10	4	5	3	—	26
M. Lib. . . . .	5	2	14	8	2	1	—	32
M. Recap. . . . .	—	2	5	6	1	—	—	14
? Lib. . . . .	—	1	2	—	1	—	—	4
? Recap. . . . .	—	—	1	—	1	—	—	2

The fish used in this experiment were recaptured by the “Goldseeker” in Burghhead Bay, on the south shore of the Moray Firth, in the early afternoon of the 11th October, and they were liberated on the 12th at 5.30 p.m., 2 having died in the interval.

The number recaptured was 42, or 42 per cent., viz. 14 males (43·7 per cent.), 26 females (40·6 per cent.), and 2 whose sexes were unknown. All the males were of adult size on recapture, averaging 41·4 cm., and ranging from 34 to 50 cm., as compared with an average of 40·3 cm., and a range of from 34 to 51 cm. on liberation; they were free for from 15 to 882 days, the mean being 213 days; they travelled distances of from 18 to 397 miles, the average being 111·6 miles, and the mean rate was 5·2 miles. Twenty-one of the females were of adult size, ranging from 39·3 to 58·2 cm., and averaging 46·1 cm., as against a range of from 35·5 to 55 cm., and an average of 43·6 cm., when liberated; they were at liberty for from 16 to 586 days, the mean being 262 days; they migrated from 23 to 170 miles, the mean being 87·5 miles, and the mean rate was 3·3 miles. Five of the females were under adult size on recapture, averaging 34·2 cm., as compared with 33·4 cm. on liberation; they were at liberty for an average period of 160 days, and migrated distances of from 63 to 125 miles, the average being 94 miles, and the mean rate 5·9 miles.

#### EXTENT AND DIRECTION OF MIGRATION.

*First Quarter*.—A male and a female were captured in the remainder of October, the male 18 miles to the north and west, and the female 40 miles to the southwards.

Three males and 3 females were got in November, 2 males east of the Orkneys, at 66 and 77 miles to the south and west, and the other male and 1 female in the Moray Firth, south-east of Noss Head, at 105 and 106 miles to the south and west; another female was taken 28 miles to the south and west, near Fair Isle, and the third to the south-east, offshore, at a distance of 90 miles. A female was found in December, in the same region as the last, 85 miles to the south and east.

Thus, in this quarter, 9, or 21·4 per cent., were recovered, 6 (66·6 per cent.) to the south and west, 2 to the south and east, and 1 to the north and west.

*Second Quarter.*—In January 1912, 2 males and 2 females were got, 1 female 23 miles to the south and west, near Fair Isle, and 1 to the south and east, in the same locality as the 2 above referred to, at a distance of 84 miles; 1 of the males was taken south-east of Noss Head, in the Moray Firth, at 105 miles to the south and west, and the other south-east of Aberdeen, 164 miles to the south and west. A male and a female were taken in February, the male 83 miles to the west, 4 miles off Noup Head, Orkney, and the female near Clyth Ness, in the Moray Firth, at a distance of 119 miles. Two males and 2 females were recaptured in March, a male and a female at the Shetlands, the female off Ronasvoe, at a distance of 81 miles, and the male 1 mile west of Cheynies Isles, on the south-west coast of the Shetlands, at a distance of 46 miles; the other female was taken off Buchanness, 125 miles to the south and west, and the other male is represented as having been caught at the Sylt Outer Ground, off the coast of Schleswig, 397 miles to the south and east; the fish was landed at Hamburg by a German trawler, and the average rate of movement works out at 27·6 miles per 10 days.

In this quarter, therefore, 10 were taken, or 23·8 per cent., 5 (50 per cent.) to the south and west, 2 each to the north and west and south and east, and 1 to the west.

*Third Quarter.*—A female was taken in April, in the Moray Firth, close to Clyth Ness, at a distance of 113 miles to the south and west. In May, 2 males and 3 females were recaptured, 1 of the males 46 miles to the north and west, near Foula, and all the others to the south and west, 2 females off Duncansby Head, 92 and 95 miles distant, and 2, a male and a female, off Noss Head, in the Moray Firth, at 98 and 101 miles distant. In June, a female was recaptured to the east of the Orkneys, at a distance of 62 miles to the south and west.

In this quarter, then, 7, or 16·7 per cent., were found, 6 (85·7 per cent.) to the south and west, and 1 to the north and west.

*Fourth Quarter.*—A female was recaptured in July, 28 miles to the south and west, south-east of Fair Isle. In August, a female was got to the east of the Orkneys, 63 miles to the south and west, and in September, 3 females, 2 to the south and west, at 31 and 58 miles, and the third on the east side of the Shetlands, to the north, off Balta, 63 miles to the north and east.

In the fourth quarter, therefore, 5, or 11·9 per cent., were taken, 4 (80 per cent.) to the south and west, and 1 to the north and east.

In the 12 months, 31 of the marked plaice, or 73·8 per cent., were taken, 21 (67·7 per cent.) to the south and west, 4 each to the north and west and south and east, and 1 each to the north and east and the west.

Of the remaining fish, 4 were recovered in the remaining months of 1912, 6 in 1913, and 1 in 1914.

In October 1912, a female was landed at Aberdeen, which was described as having been captured 120 miles N.E.  $\frac{1}{2}$  E. from Grimsby ( $55^{\circ} 24' N.$ ;  $1^{\circ} 17' E.$ ), 267 miles to the south and west, the mean rate of movement in this case being 7·2 miles per 10 days. A male and 2 females were taken in November 1912, the male south and east of Fair Isle, 31 miles to the south and west, 1 female south and east of Noss Head, in the Moray Firth, 105 miles to the south and west, and the other on the west coast at Loch Laxford, 170 miles to the westwards.

Two females were taken in March 1913, both to the south and west, 1 east of the Orkneys, 68 miles distant, and the other 2 miles off Cullen, on the south coast of the Moray Firth, at a distance of 139 miles. A male was taken in April, off Burghhead, Moray Firth, 145 miles to the south and west; in May, a female east of the Orkneys, at 74 miles to the south and west; in June, 1 of unknown sex, off St. Abb's Head, 230 miles to the south and west; and in December, another of unknown sex, off Holburn Head, on the north coast of Scotland, at an unspecified position.



The last fish to be taken was a male, which was caught on the west coast of Scotland, 5 miles N. by W. of Ru Stoer, south-west of Cape Wrath, at a distance of 178 miles to the south and west.

The following table shows how all the fish of the experiment were distributed in each quadrant :—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Immature Females.	1	63	63	N. 12° E.
N. and W.	Adult Males.	3	110	36	N. 57° W.
	Adult Females.	1	81	81	N. 56° W.
		4	191	48	N. 56° W.
S. and E.	Adult Males.	1	397	397	S. 30° E.
	Adult Females.	1	90	90	S. 36° E.
	Immature Females.	2	169	84	S. 20° E.
		4	656	164	S. 26° E.
S. and W.	Adult Males.	9	972	108	S. 60° W.
	Adult Females.	19	1666	88	S. 60° W.
	Immature Females.	2	238	119	S. 41° W.
	? Sex.	1	230	230	S. 27° W.
		31	3106	100	S. 58° W.
W.	Adult Males.	1	83	83	W.
SUMMARY.					
N. and E.		1	63	63	N. 12° E.
N. and W.		4	191	48	N. 56° W.
S. and E.		4	656	164	S. 26° E.
S. and W.		31	3106	100	S. 58° W.
W.		1	83	83	W.
		41	..	..	..

*Distances travelled.*—None was recaptured under 10 miles, and only 1 under 20 miles, a male taken 18 miles to the north and west.

*20 to 50 miles.*—Eight, or 19·5 per cent., were found at distances of from 23 to 46 miles; 3 males (21·4 per cent.), with an average of 41 miles, and 5 females (19·2 per cent.), with a mean of 30 miles; 2 males were taken to the north and west; 1 male and all the females to the south and west.

*50 to 100 miles.*—Sixteen, or 39 per cent., were taken at distances of from 58 to 98 miles; 3 males (21·4 per cent.), with an average of 75·3 miles, and 13 females (50 per cent.), with an average of 77·8 miles; 2 of the males and 8 of the females were found to the south and west, 3 females to the south and east, 1 female to the north and west, and 1 to the north and east, and 1 male to the west.

*Over 100 miles.*—Sixteen, or 39 per cent., migrated distances of from 101 to 397 miles, viz. 7 males (50 per cent.), with an average of 171 miles, 8 females (30·8 per cent.), with a mean of 143 miles; and 1 of unknown sex, which went 230 miles to the south and west; 6 of the males and all the females migrated to the south and west, and 1 male to the south and east.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 11 of the 14 recaptured. Two were "spawning," 1 taken in March 1912, at the Shetlands, 46 miles to the

north and west, the other in March 1914, on the west coast, south-west of Cape Wrath, 178 miles to the west and south. One was "apparently ripe"; it was caught in November 1911, off Noss Head, in the Moray Firth, 105 miles to the south and west. Four were "nearly ripe," 1 caught in October 1911, 18 miles to the north and west, and the others to the south and west, at 31, 66, and 77 miles, the last 2 to the east of the Orkneys. Two were "three-quarters ripe," 1 taken in January 1912, off Aberdeen, 164 miles to the south and west, the other in February 1912, off Noup Head, Orkneys, 83 miles to the westward.

*Females.*—The condition of the ovaries was recorded for 23 of the 26 females recaptured. One was "spawning"; it was taken in March 1912, 69 miles to the north and west, at the Shetlands. Another was described as "fully ripe," and was captured in October 1911—a date which suggests it was not spawning—40 miles to the south and west. Six were "nearly ripe"; 1 was caught in January 1912, 23 miles to the south and west, another in September 1912, 58 miles to the south and west, 1 in November 1911, 28 miles to the south and west, another in November 1911, offshore, to the south and east, at a distance of 90 miles; the other 2 were recaptured in November 1912, 1 off Noss Head, in the Moray Firth, at 105 miles, and the other at Loch Laxford, on the west coast, at 170 miles. Six were described as "spent," all taken to the south and west, 2 in May 1912, off Noss Head, 95 miles and 98 miles distant, 1 in July 1912, at 28 miles, 1 in August 1912, east of the Orkneys, at 63 miles, 1 in March 1913, close to Cullen, on the south shore of the Moray Firth, at 139 miles, and the last in May 1913, east of the Orkneys, at 74 miles distant. A female, measuring 39.5–39.7 cm., taken in February 1912, near Clyth Ness, in the Moray Firth, was described as "immature."

#### EXPERIMENT VII.

19th June 1912.

In this experiment, 102 marked plaice, 31 males and 71 females, were liberated on 19th June 1912, also at the station 59° 20' N.; 1° 3' W. The males ranged in size from 28.5 to 41 cm., and 15 were under adult size on liberation; the females measured 29 to 63 cm., and 36 were under adult size when liberated.

The fish used in this experiment were taken by the "Goldseeker" in Dornoch Firth, on the 18th June, in the forenoon, and were liberated at 7 a.m. on the 19th.

The numbers liberated and recaptured, arranged in 5-cm. groups, are shown in the following table:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	cm. 56-60.5	cm. 61-65.5	Total
F. Lib.	4	27	13	8	6	6	4	3	71
F. Recap.	—	13	7	5	4	3	1	2	35
M. Lib.	5	20	5	1	—	—	—	—	31
M. Recap.	1	6	4	—	—	—	—	—	11

Forty-six of the marked plaice were recaptured, or 45.1 per cent., namely, 11 males (35.5 per cent.) and 35 females (49.3 per cent.). Ten males were of adult size, ranging from 33.5 to 43.8 cm., and averaging 38.3 cm., as compared with an average of 34.4 cm., and a range of from 30.5 to 38.5 cm. on liberation; they were at liberty for from 123 to 623 days, the mean being 339 days; they migrated distances of from 24 to 109 miles, the mean being 68.8 miles, and the mean rate of movement 1.9 miles. Twenty-six of the females were of adult size on recapture, ranging from 38.2 to 62.1 cm., and averaging 47.2 cm., as against a range of from 32 to 62 cm., and an average of 44.1 cm. on liberation; they were at liberty for from 110 to 881 days, the mean being 333 days; they migrated from 8 to 215 miles, the mean being 55.5 miles, and the mean rate 1.7 miles. Nine of the females were under the adult size on recapture, averaging 35.3 cm., and ranging from 34.3 to 36.7 cm., as compared with an average of 34.5 cm., and a range of from 32 to 38 cm. on liberation; they were at liberty for from 75 to 339 days, the mean being 152 days; they migrated distances of from 28 to 120 miles, the mean being 66.4 miles, and the mean rate 4.3 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—None was taken in June or July, but in August a male was recaptured and landed at Dundee by a local trawler with an intimation that the fish was taken "16 miles north-west of the Bell Rock," a position which is well on land. On the assumption that it was 16 miles south-east of the Bell Rock, the distance would be 190 miles to the south and west, and the mean rate of movement 34·5 miles per 10 days; on the assumption that it was 16 miles to the north-east of the Bell Rock, the distance would be 163 miles, and the mean rate of movement 29·6 miles. This fish measured 32–31·8 cm., and was "immature."

Four females were taken in September, all to the south and west; 1, 7 miles south-east from Start Light, Orkneys, at a distance of 35 miles; another, north and east of Kinnaird Head, at a distance of 52 miles, and 1 a little to the north east of Kinnaird Head, at a distance of 89 miles, and the fourth to the south-east of Buchanness, at a distance of 120 miles.

In this quarter, 5 fish, or 10·9 per cent., were recaptured, all to the south and west.

*Second Quarter.*—One male and 6 females were recaptured in October, the male 24 miles to the north and west; a female 14 miles in the same direction; another female was taken 56 miles to the south and east, in the offshore waters, and the other four to the south and west; 1 at a distance of 31 miles; another at 61 miles, the third at 88 miles, near Kinnaird Head, and the fourth 6 or 7 miles south-south-east from Buchanness, at a distance of 180 miles.

In November, 3 females were recaptured; 1 in the Moray Firth, the position unspecified, the other 2 at 8 and 11 miles to the north and west. A female was taken in December, 59 miles to the south and west, north-east of Duncansby Head.

In this quarter, 11 fish, or 23·9 per cent., were recaptured, the position being known for 10 (21·7 per cent.). Five were found to the south and west; 4 to the north and west, and 1 to the south and east.

*Third Quarter.*—None was recaptured in January, but 1 male and 6 females were taken in February. Place of capture of the male was not ascertained, the fish being found on the market at Billingsgate. Five of the females were found to the south and west; 2 of them at 37 and 39 miles, to the east of the Orkneys, 1 at 28 miles and 2 in the Moray Firth, south-east of Berriedale Head, at 95 and 99 miles. The remaining female is described as having been captured 95 miles to the east and south, in the offshore waters.

In March, 2 males and a female were taken all to the south and west; the female and 1 of the males to the east of the Orkneys at 42 and 45 miles; the other male in the Moray Firth, south east of Clyth Ness at 90 miles distant.

In this quarter, 10 fish, or 21·7 per cent., were captured, the place of capture being recorded for 9 (19·6 per cent.), of which 8 (88·9 per cent.) were found to the south and west, and 1 to the south and east.

*Fourth Quarter.*—In April, 2 females were recaptured, both to the north and west, 1 near Start Point, Orkneys, at 39 miles, the other 7 miles west by north from Foula, Shetlands, at 63 miles distant.

In May, 2 males and 2 females were recaptured, the females to the north and west, at distances of 10 and 44 miles, the latter near Start Point, Orkneys; the males were found to the south and west, 1 east of the Orkneys, at a distance of 39 miles, the other near Cullen, on the south shore of the Moray Firth, at a distance of 109 miles.

In June, 1 male and 2 females were recaptured, the male 40 miles north and west, near Auskerry, Orkneys; the females, south and west, 1 east of the Orkneys, at a distance of 44 miles, the other south-east of Noss Head, in the Moray Firth, at a distance of 78 miles.

In this quarter, nine of the marked plaice, or 19·6 per cent., were recaptured, 5 to the north and west, and 4 to the south and west.

In the 12 months following liberation, 35 of the marked plaice, or 76·1 per cent., were taken, the position being recorded for 33 (71·7 per cent.). Twenty-two (66·6) per cent. to the south and west, 9 to the north and west, and 2 to the south and east.

Of the remaining fishes, 5 were recaptured in the remainder of 1913, and 6 in

1914. In July 1913, a female was taken 43 miles to the south and west, east of the Orkneys. In August, a female was recaptured by a German trawler, and landed at Cuxhaven, with the intimation that it was taken on the Great Fisher Bank ( $57^{\circ}$  N.  $4'$  E.), at a distance of about 215 miles to the south and east. In November, a female was recaptured 11 miles to the south and east, and in December, a male and a female, the latter 77 miles to the south and west, south-east of Noss Head, Moray Firth, and the male 101 miles to the north and west, 5 miles from Sule Skerry.

In January 1914, a female was caught 12 miles to the north and east. In February, a male was got in the "Moray Firth," and landed at Grimsby by a foreign trawler. In March, a male and a female were recaptured, the female south-east of Noss Head, at a distance of 75 miles to the south and west, the male south-east of Berriedale Ness, in the Moray Firth, 103 miles to the south and west. In May, a female was recaptured near Foula, Shetlands, 52 miles to the north and west, and in November, a female 8 miles S.S.W. of Sumburgh Head, Shetland, at a distance of 25 miles.

The following table shows how all the fish of the experiment were distributed in each quadrant:—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Females.	1	12	12	N. $7^{\circ}$ E.
N. and W.	Adult Males.	3	165	55	N. $63^{\circ}$ W.
	Adult Females.	8	222	28	N. $34^{\circ}$ W.
	Immature Females.	1	44	44	N. $82^{\circ}$ W.
		12	431	36	N. $45^{\circ}$ W.
S. and E.	Adult Females.	3	321	107	S. $41^{\circ}$ E.
	Immature Females.	1	56	56	S. $57^{\circ}$ E.
		4	377	94	S. $45^{\circ}$ E.
S. and W.	Adult Males.	5	386	77	S. $65^{\circ}$ W.
	Immature Males.	1	190	190	S. $27^{\circ}$ W.
	Adult Females.	14	889	63	S. $58^{\circ}$ W.
	Immature Females.	6	421	70	S. $39^{\circ}$ W.
		26	1886	72	S. $54^{\circ}$ W.
SUMMARY.					
N. and E.		1	12	12	N. $7^{\circ}$ E.
N. and W.		12	431	36	N. $45^{\circ}$ W.
S. and E.		4	377	94	S. $45^{\circ}$ E.
S. and W.		26	1886	72	S. $54^{\circ}$ W.
		43	..	..	..

*Distances travelled*—10 miles and under.—Two fish, or 4·6 per cent. were taken at 8 and 10 miles; they were both females.

10 to 20 miles.—Four fish, or 9·3 per cent., were recaptured at 11, 12, and 14 miles; they were all females (11·8 per cent.). Two were taken to the north and west, 1 to the north and east, and 1 to the south and east.

Thus, under 20 miles, 6 fish, or 13·9 per cent., were recaptured, all females (17·6 per cent.), with an average of 11 miles.

20 to 50 miles.—Fifteen of the marked plaice, or 34·9 per cent., were recovered at distances of from 24 to 45 miles 4 males (44·4 per cent.), with an average of 37 miles, and 11 females (32·3 per cent.), with an average of 37 miles. Two of the

males and 8 of the females were found to the south and west, 2 of the males and 3 of the females to the north and west.

50 to 100 miles.—Fifteen fish, or 34·9 per cent., were recaptured at distances of from 52 to 99 miles, 1 male 90 miles to the south and west, and fourteen females (41·2 per cent.), with an average of 74 miles. Ten were found to the south and west, 2 to the north and west, and 2 to the south and east.

Over 100 miles.—Seven fish, or 16·3 per cent., were recaptured at distances of from 101 to 215 miles (on the supposition that 1 of the fish was really taken on the Great Fisher Bank, and not in the Moray Firth). Four were males (44·4 per cent.), with an average of 125·7 miles, and 3 (8·8 per cent.) were females, with an average of 151 miles. Three of the males and 2 of the females were found to the south and west, 1 of the males to the north and west, and 1 of the females to the south and east.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 6 of the 11 recaptured. Two were "spawning"; 1 was taken in March 1913, 45 miles to the south and west, east of the Orkneys; the other in March 1914, 103 miles to the south and west, off Berriedale Ness, in the Moray Firth. One was "nearly ripe"; it was captured in December 1913, off the north coast, near Sule Skerry, 101 miles to the westward.

*Females.*—The condition of the ovaries was recorded for 28 of the 35 recaptured. One was "spawning"; it was taken to the east of the Orkneys, in February 1913, at a distance of 39 miles to the south and west. Five were "nearly ripe"; 1, taken in October 1912, 14 miles to the north and west; another, in November 1912, 8 miles to the north and west; the third, in September 1912, to the north of Kinnaird Head, 52 miles to the south and west; the fourth, in November 1912, 11 miles to the north and west; and the fifth, in January 1914, 12 miles to the northward. One was "three-quarters ripe"; it was taken in November 1913, 11 miles to the south and east. Seven were described as "spent"; 1, taken in February 1913, 37 miles to the south and west, east of the Orkneys; another, in April 1913, 39 miles to the north and west, near Start Point, Orkney; the third, in May 1913, 10 miles to the north and west; the fourth, in June 1913, 44 miles to the south and west, east of the Orkneys; the fifth, in July 1913, 43 miles to the south and west, east of the Orkneys; the sixth, in March 1914, south-east of Noss Head, 75 miles to the south and west; and the last, in May 1914, near Foula, 52 miles to the north and west.

Among the adult fish whose ovaries were "immature" was 1 taken in March 1913, 42 miles to the south and west, east of the Orkneys; it measured 40–41·4 cm.

#### EXPERIMENT VIII.

22nd November 1912.

In the last experiment near Fair Isle, 100 plaice were marked and liberated, at 59° 20' N.; 1° 3' W., 42 males, 56 females, and 2 whose sexes were not ascertained. The sizes of the males ranged from 25 to 43 cm., and 2 were under adult size on liberation; the females measured from 32·5 to 48·5 cm., and 38 were below adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	Total.
F. Lib. . . . .	—	18	28	8	2	56
F Recap. . . . .	—	2	10	3	—	15
M. Lib. . . . .	1	21	18	2	—	42
M. Recap. . . . .	—	7	9	—	—	16
? Lib. . . . .	—	1	1	—	—	2
? Recap. . . . .	—	—	—	—	—	—

The fish used in this experiment were taken by the "Goldseeker" in the forenoon of the 21st November, in the Dornoch Firth (Moray Firth).

The number recaptured was 31, or 31 per cent., viz. 16 males (38·1 per cent.) and 15 females (26·8 per cent.). Fifteen of the males were of adult size on recapture, ranging from 33·7 to 44·5 cm., and averaging 37·3 cm., as compared with a range of from 33 to 40·5 cm., and a mean of 36 cm. on liberation; they were at liberty for from 27 to 569 days, the mean being 174 days; they migrated distances of from 11 to 205 miles, the mean being 83·9 miles, and the mean rate 4·7 miles. Twelve of the females were of adult size, ranging from 38·7 to 51·4 cm., and averaging 43·9 cm., as against a range of from 33·5 to 43 cm., and an average of 38·9 cm. on liberation; they were at liberty for from 59 to 681 days, the average being 346 days; they travelled distances of from 9 to 114 miles, the mean being 50·7 miles, and the mean rate 1·5 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—A male was recaptured in December, north-east of Buchanness, 44 miles to the southwards. In January 1913, 3 males and a female were taken, the female close to the place where the male was captured in December, at a distance of 44 miles to the south, 1 of the males offshore to the south and east, at a distance of 90 miles, the second male south-east of Noss Head, Moray Firth, at a distance of 76 miles to the south; the third male is described as having been taken, after 47 days, on the Great Fisher Bank, 205 miles to the south-east, the rate of movement being 43·6 miles per 10 days; this fish was landed at Grimsby, and was probably caught elsewhere than the place mentioned. Two males and 3 females were taken in February, 1 of the males 16 miles to the south and west, and the other 126 miles to the south and west, near Aberdeen; 1 of the females was taken 11 miles to the north and east, another 27 miles to the south and east, and the third 41 miles to the north and west, 5½ miles off Fitful Head, Shetland.

In this quarter, 10, or 32·25 per cent., were recaptured, 4 to the south and west, 4 to the south and east, and 1 each to the north and east, and north and west.

*Second Quarter.*—In March 1913, 4 males and 2 females were got, the place of capture of 1 of the males not being ascertained; the other 3 were taken to the south and west, 1 east of the Orkneys, at a distance of 41 miles, 1 in the Moray Firth near Tarbet Ness, at a distance of 110 miles, and the third between Buchanness and Aberdeen, at a distance of 119 miles. One of the females was taken east of the Orkneys, 46 miles to the south and west, and the other offshore, 79 miles to the south and east. A male was caught in April, 44 miles E. ¼ S. from the Bell Rock, 162 miles to the southwards, and in May, a male and female, the female 11 miles and the male 13 miles to the north and west.

In this quarter, 9, or 29 per cent., were got, positions being known for 8, or 25·8 per cent., of which 5 (62·5 per cent.) were recaptured to the south and west, 2 to the north and west, and 1 to the south and east.

*Third Quarter.*—In July, a male was taken 11 miles to the north and west, and in August, 2 females, 1, 17 miles to the north and west, 5 miles from Fair Isle, and the other on Smith Bank, Moray Firth, 89 miles to the south and west.

Only 3, or 9·7 per cent., therefore, were found in this quarter, 2 to the north and west, and 1 to the south and west.

*Fourth Quarter.*—Only 1 was taken in this quarter, a male captured in September, near Noss Head, Moray Firth, 76 miles to the south and west.

In the 12 months after liberation, 23 or 74·2 per cent., were recovered, positions being known for 22, or 70·9 per cent.; 11 (50 per cent.) were taken to the south and west, 5 each to the north and west and south and east, and 1 to the north and east.

The remaining captures were all in 1914. In January, a female was taken 51 miles to the north and west, on the west of the Shetlands. In March, a male and a female were found, both in the Moray Firth, one off Noss Head, 76 miles to the south and west, the other near Clyth Ness, 93 miles in the same direction. A female was taken in April, 6 miles from Buchanness, 114 miles to the south and west, another female in May, east of the Orkneys, 35 miles to the south and west, a male and a female in June, the female 9 miles to the north and west, and the male 34 miles to the south and west, east of the Orkneys. The last fish from

the experiment was recovered in October 1914; it was a female which was got off Grimsby, Orkneys, 56 miles to the south and west.

The following table shows how all the fish of the experiment were distributed in each quadrant:—

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Immature Females.	1	11	11	N. 19° E.
N. and W.	Adult Males.	2	24	12	N. 26° W.
	Adult Females.	4	88	22	N. 29° W.
	Immature Females.	1	41	41	N. 4° W.
		7	153	22	N. 25° W.
S. and E.	Adult Males.	2	295	147	S. 56° E.
	Adult Females.	3	150	50	S. 28° E.
		5	445	89	S. 39° E.
S. and W.	Adult Males.	10	856	86	S. 45° W.
	Immature Males.	1	41	41	S. 63° W.
	Adult Females.	5	370	74	S. 59° W.
	Immature Females.	1	46	46	S. 82° W.
		17	1313	78	S. 53° W.
SUMMARY.					
N. and E.		1	11	11	N. 19° E.
N. and W.		7	153	22	N. 25° W.
S. and E.		5	445	89	S. 39° E.
S. and W.		17	1313	78	S. 53° W.
		30	..	..	..

*Distances travelled*—10 miles and under.—Only 1, a female, was found under 10 miles; it had moved 9 miles to the north and west.

10 to 20 miles.—Six, or 20 per cent., were taken between 11 and 17 miles, 3 males (20 per cent.), with an average of 13·3 miles, and 3 females (20 per cent.), with an average of 13 miles. Two of the males and 2 of the females were found to the north and west, one male to the south and west, and 1 female to the north and east.

Thus, 7 fish, or 23·3 per cent., were captured under 20 miles.

20 to 50 miles.—Eight, or 26·6 per cent., were found at distances between 27 and 46 miles, 3 males (20 per cent.), with a mean of 39·6 miles, and 5 females (33·3 per cent.), with an average of 38·6 miles. All the males and 2 of the females were found to the south and west, 2 females to the south and east, and 1 to the north and west.

50 to 100 miles.—Nine, or 30 per cent., were recaptured at distances of from 51 to 93 miles, 4 males (26·2 per cent.), with an average of 83·7 miles, and 5 males (33·3 per cent.), with an average of 70·2 miles. Three of the males and 3 of the females migrated to the south and west, 1 male and 1 female to the south and east, and 1 female to the north and west.

Over 100 miles.—Six, or 20 per cent., were found at distances exceeding 100 miles, 5 males (33·3 per cent.), with an average of 144·4 miles, but this includes a fish said to have been captured at the Great Fisher Bank, and 1 female which was found 114 miles to the south and west. All the males went to the south and west, except the 1 described as caught on the Great Fisher Bank.

## MATURITY.

*Males.*—The condition of the testes was ascertained in 10 of the 16 recaptured. Three were "spawning," 1 taken in February 1913, off Aberdeen, 126 miles to the south and west, another in March 1913, near the same place, at a distance of 119 miles, the third in March 1914, in the Moray Firth, near Clyth Ness, 93 miles to the south and west. One was described as "ripe"; it was recovered in February 1913, 16 miles to the south and west. One was "spent"; it was got in May 1913, 13 miles to the north and west. Two were "nearly ripe," 1 captured in December 1912, 44 miles to the south and west, and 1 in January 1913, south-east of Noss Head, in the Moray Firth, at a distance of 76 miles.

*Females.*—The condition of the ovaries was recorded in 13 of the 15 recaptured. None was "spawning," but 1 was "ripe"; it was captured on 19th August 1913, at Smith Bank, Moray Firth, 89 miles to the south and west. Three were described as "spent," 1 taken in March 1914, south-east of Noss Head, in the Moray Firth, 76 miles to the south and west, another in April 1914, near Buchanness, 114 miles to the south and west, and the third in May 1914, 35 miles to the south and west, to the east of the Orkneys. Among the females described as "immature," was 1, taken in March 1913, 79 miles to the eastwards, offshore, and it measured 39-39.4 cm., and another, measuring 35-44.7 cm., taken in January 1914, 9 miles to the north and west.

## EXPERIMENTS AT 100 MILES EAST OF THE ISLE OF MAY.

At this station, which lies in Lat. 56° 40' N.; Long. 1° 21' E., with a depth of water of between 40 and 50 fathoms, marked plaice were liberated on 2 occasions, namely, in June 1912 and June 1913. Particulars in regard to the liberated fish, and those recaptured, are as follows:—

No. of Experiment.	Date.	No. of Fish.								Percentage Recaptured.			
		Marked.				Recaptured.							
		♂	♀	(?)	Total.	♂	♀	(?)	Total.	♂	♀	(?)	Total.
I.	12 June 1912.	39	47	5	91	14	15	...	29	35.9	31.9	...	32.
II.	13 June 1913.	42	58	1	101	10	15	...	25	23.8	25.9	...	24.7
	Total.	81	105	6	192	24	30	...	54	29.6	28.6	...	28.1

## EXPERIMENT I.

12th June 1912.

In this experiment, 91 plaice were marked, namely, 39 males, 47 females, and 5 whose sexes were not determined. The sizes of the males, on liberation, ranged from 26.5 to 38 cm., and 19 were under adult size; the sizes of the females varied from 27 to 54 cm., and 35 were under the adult size. The numbers liberated and recaptured, arranged in 5-cm. groups, are set forth in the following table:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	Total.
F. Lib.	11	20	10	3	2	1	47
F. Recap.	1	7	5	1	—	1	15
M. Lib.	11	24	4	—	—	—	39
M. Recap.	5	6	3	—	—	—	14
? Lib.	1	1	3	—	—	—	5
? Recap.	—	—	—	—	—	—	0



The fish used in this experiment were trawled by the "Goldseeker," in Kirkcaldy Bay, on the afternoon of the 11th June, and were marked between 3.35 and 6.25 p.m. They were kept in tanks of running water until midnight on the following day, when they were liberated. Nine had succumbed in the tanks.

The number recaptured was 29, or 32 per cent., namely 14 males (35.9 per cent.) and 15 females (31.9 per cent.).

Of the males taken, 11 were of adult size, the average being 38.2 cm., and the range from 35 to 42.1 cm., as compared with a mean of 34.2 cm., and a range of from 28 to 38 cm. on liberation; they were free for from 121 to 795 days, the mean being 497 days; they migrated distances of from 21 to 100 miles, the average being 59.4 miles, and the mean rate, per 10 days, 1.2 miles. Three of the males were under the adult size, the average being 30 cm., as compared with 29.3 cm., on liberation; they were free for a mean period of 107 days, and migrated an average distance of 60.6 miles, the mean rate of travel, per 10 days, being 5.65 miles.

Seven of the females were of adult size on recovery, ranging from 39 to 53.3 cm., with an average of 43.9 cm., as compared with a mean of 41.6 cm. on liberation; they were free for from 22 to 912 days, the mean being 386 days; they travelled distances of from 4 to 119 miles, the average being 74 miles, and the mean rate of travel, per 10 days, was 1.9 miles. Eight were under the adult size, the average being 33.4 cm., as compared with 33.6 cm. on liberation; they were at liberty for a mean period of 217 days, and migrated distances of from 42½ to 132 miles, the average being 70.5 miles, and the mean rate of movement 3.2 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—None was caught in June, but 2 females were recaptured in July, 1, after 22 days, a few miles off Tod Head, at a distance of 80 miles to the westwards, having travelled at the mean rate of 36.4 miles per 10 days; it measured 54–53.3 cm., and was "spent"; the other was taken to the east of the Isle of May, 75 miles to the westwards, after 40 days, or at the mean rate of 18.9 miles per 10 days; it measured 29.5–27.9 cm., and was "immature."

Two females were recaptured in August, 1 off Longstone Light, after 70 days, at a distance of 76 miles to the south and west, the average rate of migration being 10.8 miles per 10 days; it measured 39–39 cm.; the other female was got to the east of May Isle, at a distance of 52 miles, after 78 days, the rate of travel being 6.6 miles per 10 days; it measured 34.5–35 cm.

Four fish, therefore, or 13.8 per cent., were taken in the first quarter, 3 of them being to the west and south.

*Second Quarter.*—Two males and 3 females were recaptured in September, 1 of the males, after 87 days, 72 miles to the westward, off the Isle of May, the other, after 107 days, 41 miles to the north and west, to the south-east of Aberdeen; 1 of the females was taken south-east of Longstone Light, after 96 days, at a distance of 82 miles to the south and west; another was recaptured, after 102 days, north-east of the Bell Rock, at a distance of 42 miles to the north-west; the remaining female, which measured 31–30 cm., was got offshore, at a distance of 117 miles E. by S. ½ S. of Longstone Light (Lat. 55° 40' N.; Long. 1° 55' E.).

In October, 2 males were recovered, 1 south-east of May Isle, at a distance of 50 miles to the south and west, the other, 69 miles to the north and west, at a point east of the Bell Rock.

A male was taken in November, far offshore, to the north-east of Buchanness, at a distance of 100 miles to the north and east, in 62 fathoms.

Thus, in the second quarter, 8 fishes, or 27.6 per cent., were recaptured, 3 to the north and west, and two to the south and west.

*Third Quarter.*—Only 1 was taken in this period, namely, a female in February 1913, 60 miles to the north and west, at Aberdeen Bank; it measured 37–37.6 cm., and was "immature."

*Fourth Quarter.*—Two males and a female were got in May 1913; the female was taken in the Firth of Forth, about 3 miles S.S.W. of Buckhaven, at a distance of 117 miles to the westwards; it measured 36.5–39.2 cm., and was "immature."

The 2 males were recaptured to the north-east of the Bell Rock, not far apart, 1 at a distance of 65 and the other at 69 miles to the north and west.

Within the first 12 months after liberation, then, 16 fishes, or 55·2 per cent., were recaptured, 7 (43·75 per cent.) to the north and west, and 5 (31·25 per cent.) to the south and west.

Of the remainder, 7 were taken in 1913, and 6 in 1914. Two females were recovered in June 1913, both off Aberdeen, not far apart, at distances of 60 and 63 miles respectively to the north and west. A female was recaptured in July, 132 miles to the south and west, 2 miles S.W./W.  $\frac{1}{2}$  S. of the Tees Buoy. A male was taken in September, south-east of Aberdeen, at a distance of 39 $\frac{1}{2}$  miles to the north and west. In October, 2 males and 1 female were caught, the female near the place of liberation, at a distance of 4 miles to the south and east; 1 of the males had migrated westward for a distance of 88 miles, and was recaptured east of the Isle of May; the other was caught to the south-east of Buchanness, at a distance of 40 miles to the north and west.

In April 1914, a male was taken to the east of Aberdeen, at a distance of 48 miles to the north and west, "immature." A male and a female were recaptured in July, the male 50 miles to the N.W., south-east of Aberdeen, the female 39 miles to the west and north. In August, a male was recaptured 21 miles to the north and west of the station. In September, a male was got north-east of May Isle, at a distance of 82 miles. The last fish to be recovered in the experiment was a female, measuring 33 cm. on liberation, but of unknown size on recapture, which was taken in December 1914, after 912 days, off Banff, in the Moray Firth, at a distance of 119 miles.

The chart shows that almost all these fish migrated towards the shore from the deeper water, where they were liberated, to the shallower water near the coast, and with a rapidity much greater than usual. The only exceptions are 3, 1 which moved to the north and east, and 2 which went to the south and east.

*Distances travelled—10 miles and under.*—Only 1 fish, or 3·4 per cent., was taken under 10 miles—a female, which was found 4 miles to the east and south. This, indeed, was the only fish recaptured within 20 miles of the station.

*20 to 50 miles.*—Nine, or 31 per cent., were taken at distances of from 21 to 50 miles, 7 males (50 per cent.), with an average of 41·3 miles, and 2 females (13·3 per cent.), with a mean distance of 40·7 miles. They all migrated towards the coast, the 2 females and 6 of the males to the north and west, and 1 of the males to the south and west.

*50 to 100 miles.*—Sixteen fishes, or 55·2 per cent., were found at distances of from 52 to 100 miles, 7 males (50 per cent.), with an average of 77·9 miles, and 9 females (60 per cent.), with an average distance of 69·7 miles. With 2 exceptions, they all travelled towards the coast, to the west or north-west, but 4 of the females went to the south and west; of the 2 exceptions referred to, 1 went north and east, and was recaptured far offshore, to the north and east of Buchanness, and the other went south and east, also offshore.

*Over 100 miles.*—Three of the females were taken at distances over 100 miles, 1 in the Firth of Forth, 117 miles to the west, another, in the Moray Firth, off Banff, at a distance of 119 miles, and the third, off the Tees, 132 miles to the south and west.

#### MATURITY.

*Males.*—The condition of the testes in 12 of the 14 recaptured was ascertained. They were all "immature"; 9 were above adult size, but only 1 was recaptured within the limits of the spawning season, viz. on 21st April 1914, at a distance of 48 miles to the north and west, off the coast of Aberdeen; it measured 30·5–36·5 cm.

*Females.*—The condition of the ovaries was ascertained in only 9 of the 15 females recovered. None was "spawning" or "ripe"; 1, of 54–53·3 cm., taken in July 1912, near Tod Head, 80 miles to the west and north, was "spent." All the others were "immature," and none was taken within the limits of the spawning season.

#### EXPERIMENT II.

13th June 1913.

In this experiment, 101 plaice were marked and liberated, viz. 42 males, 58 females, and 1 whose sex was not determined. The males ranged in size from

25.5 cm. to 40.5 cm., and 25 were under the adult size on liberation; the females varied from 25 to 47.5 cm., and 35 were under adult size. The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	Total.
F. Lib. . . . .	17	12	15	12	2	57
F. Recap. . . . .	3	4	4	3	1	15
M. Lib. . . . .	23	8	11	—	—	42
M. Recap. . . . .	5	3	2	—	—	10
? Lib. . . . .	1	—	—	—	—	1
? Recap. . . . .	—	—	—	—	—	0

There is doubt as to where the fish used in this experiment were captured, as there is no record on the subject, but, as the "Goldseeker" was working with the herring-trawl on the 12th and 13th to the east of the Isle of May, it is probable that they were caught in that locality.

Only 25, or 24.7 per cent., of the marked plaice were recaptured, 10 males (23.8 per cent.) and 15 females (25.9 per cent.).

Six of the males recaptured were of adult size, ranging from 33.6 to 40.7 cm., and averaging 37 cm., as compared with a range of 30.5 to 39.5 cm., and an average of 34.8 cm. on liberation; they were at liberty for from 54 to 943 days, the mean being 394 days; the distances migrated varied from 50 to 71 miles, the average being 58 miles, and the mean rate of travel 1.5 miles. Four of the males were under adult size on recapture, the average being 30.8 cm., as compared with 27.6 cm. on liberation; they were at liberty for a mean period of 423 days, and migrated distances of from 42-112 miles, the average being 83.2 miles, and the mean rate 1.9 miles.

Ten of the females were of adult size, ranging from 38.8 to 48.8 cm., and averaging 42.6 cm., compared with a range of from 29 to 47 cm., and an average of 39.3 cm. on liberation; they were at liberty for from 150 to 1065 days, the mean being 402 days; they migrated distances of from 19 to 167 miles, the average being 74.2 miles, and the mean rate 1.8 miles. Five of the females were under adult size, the average being 32.7 cm., as compared with 31.3 cm. on liberation; they were free for an average period of 248 days, and migrated from 10 to 181 miles, the average being 79.4 miles, and the mean rate 3.2 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Only 1 fish was recovered in this quarter, a male, taken in August, after 54 days, 57 miles to the westwards, south and east of Tod Head.

*Second Quarter.*—A male and a female were recaptured in September, the male, after 106 days, at Aberdeen Bank, a distance of 58 miles to the north and west; the female, after 90 days, off St. Abb's Head, at a distance of 75 miles to the south and west.

A female was caught in October, after 130 days, 10 miles to the south and west of the station.

Two females were recaptured in November, 1, 19 miles to the north and east, and the other in the offshore waters, 39 miles to the south and a little west.

Thus, in this quarter, 5 were recovered, or 20 per cent., 3 to the south and west, and 2 to the north and west.

*Third Quarter.*—Only 1 was caught in this period, a female, in December, after 181 days, off Aberdeen, at a distance of 61 miles.

*Fourth Quarter.*—Five were taken in April 1914, 2 males and 3 females; both males had migrated in the same direction, 1 being got south of the Bell Rock, at the entrance to St. Andrew's Bay, at a distance of 94 miles, and the other to the east of the Bell Rock, at a distance of 71 miles; they measured respectively 28.5 to 30.7 cm., and 39.5 to 40.7 cm., and were "immature." The 3 females were described as "spent"; 1, of 43.5-47 cm., taken at Aberdeen Bank, at a distance of 59 miles

to the north and west; another, of 40.5–41 cm., caught in the Moray Firth, off Banff, at a distance of 122 miles to the north and west; and the third, of 28.5–30 cm., 60 miles E.  $\frac{1}{2}$  S. of Spurn Point, at a distance of 181 miles to the south. There is little doubt that, from the size of this fish, its description as “spent” was a mistake.

Two females were recovered in May, both to the south and west, one, measuring 31.5–31.5 cm., at Holy Isle, Northumberland, at a distance of 94 miles, and the other, of 38.5–40 cm., south-east of Longstone Light, at a distance of 79 miles.

In the fourth quarter, therefore, 7 of the fish, or 28 per cent., were recaptured, 4 (57.1 per cent.) to the north and west, 2 to the south and west, and 1 to the south.

Thus, in the 12 months immediately following liberation, 14 plaice, or 56 per cent., were recovered, 8 (57.1 per cent.) to the north and west, 5 (35.7 per cent.) to the south and west, and 1 to the south.

In the remainder of 1914, other 9 fishes were taken; none was recaptured in 1915; 2 were obtained in 1916.

In July 1914, 2 males and a female were taken, one of the males 42 miles to the south and west, and the other near Aberdeen Bank, 50 miles to the north and west; the female was taken offshore, east of Aberdeen, at a distance of 37 miles to the north and west. A female was caught in September, after 461 days, near shore, west of Longstone Light, Northumberland, at a distance of 93 miles to the south and west; it measured 30.5–39 cm. In October, after 483 days, a male, of 26.5 cm. on liberation, but of unknown size on recapture, was got offshore, 74 miles N.E. by E.  $\frac{1}{2}$  E. of Flamborough Head, at a distance of 112 miles to the south and east. Two males and a female were recovered in November, the female, of 47–47.8 cm., offshore, 80 miles E.  $\frac{1}{2}$  N. from Grimsby, at a distance of 167 miles to the south and east; one of the males, of 33.5–35.7 cm., north-east of Longstone Light, 60 miles to the south and west; and the other, of 26.5–32 cm., near the Bell Rock, at a distance of 84 miles to the west and north. A female, of 29–39.7 cm., was caught in December, after 553 days, near the coast to the south-east of Aberdeen, at a distance of 70 miles to the north-west.

In January 1916, after 943 days, a male, of 30.5–38 cm., and “spawning,” was recovered, near Aberdeen Bank, at a distance of 50 miles to the north and west. In May, after 1065 days, a female, which measured 44.5–48.8 cm., was recaptured offshore, at a distance of 33 miles to the north and east.

As in the previous experiment at this station, the chart, on which the lines of migration are drawn, shows that the movement of the great majority of the marked plaice was westwards towards the coast, the most notable exceptions being those which were taken off Flamborough Head and off Grimsby.

*Distances travelled*—10 miles and under.—Only 1 fish, a female, was found in this category, at 10 miles to the south and west.

10 to 20 miles.—One female was got 19 miles to the north and west.

20 to 50 miles.—Six, or 24 per cent., were recaptured at distances of from 33 to 50 miles, 3 males (30 per cent.), with an average of 47.5 miles, and 3 females (20 per cent.), with an average of 36.3 miles. Two of the males and 1 of the females were taken to the north and west, off the coast of Aberdeen, a male and a female were found to the south and west, and 1 female to the north and east.

50 to 100 miles.—Thirteen, or 52 per cent., were got at distances of from 57 to 94 miles, 6 males (60 per cent.), with an average of 70.7 miles, and 7 females (46.7 per cent.), with an average of 75.9 miles. Five of the males and three of the females were found to the north and west, 1 male and 4 females to the south and west.

Over 100 miles.—Four, or 16 per cent., migrated more than 100 miles, 1 male, which went 112 miles to the south and east, and 3 females, 1 of which travelled to the north and east for a distance of 122 miles, being taken in the Moray Firth, while the other 2 migrated to the southwards, 1 for 167 and the other for 181 miles.

#### MATURITY.

*Males*.—The condition of the testes was ascertained only in 5 of the 10 recaptured. One was “spawning”; it measured 30.5–38 cm., and was caught in

January 1916, after 943 days, near Aberdeen Bank, 50 miles to the north and west. The others were "immature," including one measuring 39·5–40·7 cm., caught on 29th April 1914.

*Females.*—The condition of the ovaries were ascertained in 12 of the 15 recaptured. None was "spawning" or "ripe," but three were described as "spent." One, of 43·5–47 cm., was taken at Aberdeen Bank, at a distance of 59 miles to the north and west, in April 1914; another, of 40·5–41 cm., was taken in the Moray Firth, off Banff, at a distance of 122 miles, on the 1st April 1914; the third, which was much under the adult size, measuring 28·5–30 cm., was described as "spent," doubtless by mistake. The other females were "immature."

#### EXPERIMENT AT 220 MILES EAST OF THE ISLE OF MAY.

16th June 1913.

At this position, which lies in Lat. 57° 15' N.; Long. 3° 54' E., near the Great Fisher Bank, 106 marked plaice were liberated on 16th June 1913, in a depth of 37 fathoms. Fifty of the fish were males, the sizes ranging from 26·5–48 cm., and 19 were under the adult size. Fifty-five were females, ranging in size from 26–57 cm., 39 being under the adult size. There was only 1 fish whose sex was not determined.

As no record exists on the subject, there is some doubt as to the place where the fish used in this experiment were captured, but, as the vessel had been trawling in the neighbourhood on that day and the day before, it is probable they were obtained locally.

The numbers liberated and recaptured, arranged in groups of 5 cm., are shown in the following table:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 56-60·5	Total.
F. Lib. . . . .	3	28	15	4	4	1	55
F. Recap. . . . .	—	4	4	1	—	—	9
M. Lib. . . . .	7	26	11	5	1	—	50
M. Recap. . . . .	—	6	2	—	—	—	8
? Lib. . . . .	—	1	—	—	—	—	1
? Recap. . . . .	—	—	—	—	—	—	0

Only 17 of the marked plaice, or 16 per cent., were recaptured, namely, 8 males (16 per cent.) and 9 females (16·4 per cent.).

Seven of the males were of adult size on recapture, ranging from 35·7–40·3 cm., and averaging 38·1 cm., as compared with a range of from 32·5–37 cm., and an average of 35 cm. on liberation; they were at liberty for from 80 to 397 days, the mean being 207 days; the distances migrated were from 15 to 53·5 miles, the average being 32·1 miles, and the mean rate 1·8 miles.

Six of the females were of adult size on recovery, ranging from 38·2–45·3 cm., and averaging 41·6 cm., as compared with a variation of 34–45 cm., and a mean of 38·2 cm. on liberation; they were at liberty for from 72 to 440 days, the mean being 227 days; the distances migrated varied from 8 to 228 miles, the average being 92·6 miles, and the mean rate, per 10 days, 4·1 miles. Three of the females were under the adult size on recapture, the average being 35 cm., compared with 33·6 cm., on liberation; they were free for an average period of 59 days, and migrated a mean distance of 25·2 miles, at a mean rate of 4·2 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

The fish in this experiment moved in various directions, so that the lines of movement, as represented on the chart, are stellate.

*First Quarter.*—A female, of 32–31·9 cm., was taken in July, after 15 days, 32½ miles to the eastwards (S. 82° E.) In August, 2 females were recaptured, both

to the south-east, at distances of 16 and 24 miles; 1, measuring 38-38.2 cm., was described as "spent."

In this quarter, 3 fishes, or 17.6 per cent., were recaptured.

*Second Quarter.*—Three males and 2 females were got in September, 2 of the males to the south and east, at distances of 28 and 33.5 miles; the third male was caught 12 miles to the north; 1 of the females was recovered 27 miles to the south-west, the other 51 miles to the north.

In October, a female was taken 8 miles to the south-west; it measured 45-45.3 cm., and is described as "spent."

Two males were recaptured in November, one 29½ miles to the south and west, the other 39 miles to the south and east.

Thus, in this quarter, the number recovered was 8, or 47.1 per cent.

*Third Quarter.*—In this period, only 1 fish was taken, namely, a female, in February, after 239 days, in the Moray Firth; it was got by a German trawler, and landed at Bremerhaven, and was stated to have been captured 10½ miles N. ¾ E. of Cullen, Banffshire, at a distance of 218 miles. No other fish was recaptured within the first year after liberation, so that the total taken in the 12 months was 12, or 70.6 per cent., 6, or 50 per cent., to the south and east, 3, or 25 per cent., to the south and west, 2 to the north and west, and 1 to the north and east.

In July 1914, 2 males and a female were recovered. The female was taken at a distance of 27 miles to the north and west; 1 of the males was found in the same direction, at a distance of 53 miles, and the other, 15 miles to the south-west; the latter, which measured 32.5-38.8 cm., was described as "spent."

In August 1914, after 440 days, a female, measuring 39.5-43.6 cm., was taken, by an English trawler, and landed at Grimsby, 20 miles E.S.E. of Flamborough Head (Lat. 54° N.; Long. 0° 25' E.), at a distance of 228 miles to the south and west.

The date of recapture of 1 of the fishes, a male, taken 26 miles to the south, was not recorded.

*Distances travelled—10 miles and under.*—One fish, or 5.9 per cent., a female, was got at 8 miles distant to the south and west.

*10 to 20 miles.*—Two fishes, or 11.8 per cent., a male and a female, went distances of 15 and 16 miles respectively, the former to the south and west, and the latter to the south and east of the station.

*Under 20 miles.*—Thus, 3 fishes, or 17.7 per cent., went journeys of less than 20 miles, 2 to the south and west, and 1 to the south and east.

*20 to 50 miles.*—Nine plaice, or 52.9 per cent., went distances of from 24 to 39 miles, namely, 5 males (62.5 per cent.) and 4 females (44.4 per cent.). Three of the males and 2 of the females were recaptured to the south-east, 2 males and 1 female to the south and west, and 1 female to the north and west.

*50 to 100 miles.*—Two fish, or 11.8 per cent., were recaptured at distances of between 50 and 100 miles, namely, a male, 53.5 miles to the north-west, and a female, 51 miles to the north and east.

*Over 100 miles.*—Three plaice (17.7 per cent.) went journeys of more than 100 miles, the average distance being 189 miles. A male and a female were got to the north and west at, respectively, 121 and 218 miles distant, the latter being described as captured in the Moray Firth. The other female went 228 miles to the south and west, being taken off Flamborough.

#### MATURITY.

*Males.*—The condition of the testes was ascertained only in four cases. None was "spawning" or "ripe," but 1, measuring 37-39 cm., was taken in November 1913, at a distance of 29 miles to the south and west, and described as "nearly ripe." Another, of 32.5-38.8 cm., was taken at 15 miles distant, to the south-west, in July 1914, and was said to be "spent." All the others were "immature."

*Females.*—The condition of the ovaries was recorded in 6 of the 9 females recaptured. None was "spawning" or "ripe." Two were described as "spent," 1, taken in August 1913, 24 miles to the south and east, and the other in October 1913, 8 miles to the south and west. All the others were "immature."

## EXPERIMENTS AT GREAT FISHER BANK.

A number of experiments were made in the region of the Great Fisher Bank, extending from April 1910 to June 1912, but most of them referred to very small numbers. The particulars are given in the following table :—

No. of Experiment.	Date.	No. of Fish.								Percentages Recaptured.			
		Marked.				Recaptured.							
		♂	♀	(?)	Total.	♂	♀	(?)	Total.	♂	♀	(?)	Total.
I.	14 April, 1910.	3	1	...	4	1	1	...	2	33·3	(100)	...	50·
II.	15 April, 1910.	7	3	...	10	1	...	...	1	14·3	...	...	10·
III.	15 April, 1910.	6	6	...	12	1	...	...	1	16·6	...	...	8·3
IV.	16 June, 1910.	106	156	25	287	46	69	1	116	43·4	44·2	4·0	40·4
V.	17 June, 1910.	6	5	5	16	1	...	1	2	16·6	...	20·	12·5
VI.	21 June, 1910.	5	6	1	12	2	1	...	3	40·	16·6	...	25·
VII.	14 July, 1911.	50	43	9	102	22	20	1	43	44·	46·5	11·1	42·1
VIII.	15 July, 1911.	10	14	2	26	1	5	...	6	10·	35·7	...	23·1
IX.	13 June, 1912.	38	57	3	98	5	10	...	15	13·2	18·5	...	15·8
X.	14 June, 1912.	...	3	2	5	...	1	...	1	...	33·3	...	20·
XI.	14 June, 1912.	4	7	2	13	2	2	...	4	50·	28·6	...	30·8
XII.	14 June, 1912.	...	3	...	3	...	...	...	...	...	...	...	...
		235	304	49	588	82	109	3	194	34·9	36·2	6·1	33·1

## EXPERIMENTS I, II, AND III.

On April 14 and 15 1910, 26 marked plaice, 16 males and 10 females, were liberated to the north-west of the Bank and on the Bank, 4 at one locality, 10 at another, and 12 at the third, which was on the Bank; only 4 of the fish, or 15·4 per cent., were recaptured, 3 males (18·7 per cent.) and 1 female. One of the males was taken in July of the same year, 200 miles north-east of Spurn Point (Lat. 56° 25' N.; Long. 3° 10' E.), a distance of 56 miles in the direction S. 33° W., and had moved at the mean rate of 5·8 miles per 10 days. The female, which measured 42–41 cm., was recaptured in June, after 57 days, 47 miles N. 89° W., and had moved at the rate of 8·2 miles per 10 days. One of the other males was captured in May 1911, 55 miles distant, in the direction S. 9° E., and the mean rate was 1·4 miles. The remaining male was got in July 1911, 52 miles in the direction of S. 62° W., the average rate of movement being 1·1 miles. None of the fish went to the northwards.

These plaice were all trawled in the neighbourhood of the places where they were liberated. Two were landed at London and 2 at Hull, and nothing was recorded as to the condition of the reproductive organs.

## EXPERIMENT IV.

16th June 1910.

In this experiment, 287 plaice, comprising 106 males, 156 females, and 25 whose sexes were not determined, were liberated, to the north-west of the Bank, in Lat. 57° 25' N.; Long. 3° 35' E., in 34 fathoms. These fish were not taken locally, but in the northern part of Aberdeen Bay, off Slains Castle and Cruden Scours, by the "Goldseeker," in the afternoon of the 15th June, and were liberated between 10 and 11 p.m. on the 16th, having been kept in tubs of running water in the interval. The males ranged in size from 31·5 to 41 cm., and 6 were under adult size (33 cm.) on liberation; the sizes of the females varied from 30 to 52 cm., and 125 were under adult size (38 cm.) on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 51-55·5	Total
F. Lib. . . . .	2	78	72	3	1	156
F. Recap. . . . .	—	35	32	2	—	69
M. Lib. . . . .	—	59	46	1	—	106
M. Recap. . . . .	—	25	20	1	—	46
? Lib. . . . .	—	11	14	—	—	25
? Recap. . . . .	—	1	—	—	—	1

The number recaptured was 116, or 40·4 per cent., viz. 46 males (43·4 per cent.), 69 females (44·2 per cent.), and 1 whose sex was not ascertained. The place of capture of 6 of the fish was not ascertained, or was uncertain. One was found at Billingsgate, 1 on the pontoon, Grimsby, 1 at Altona, 1 at Ymuiden, and 1 at London. So far as the port of landing is recorded, 41 of the fish were landed at London, 31 at Hull, 14 at Hamburg, 7 at Altona, 7 at Grimsby, 6 at Aberdeen, and 1 each at Ymuiden, Cuxhaven, and Bremerhaven.

Of the remaining fish, 44 were of adult size on recapture, averaging 37·8 cm., and ranging from 33 to 45·6 cm., as compared with a mean of 35·8 cm., and a range of from 31·5 to 41 cm., on liberation; they were at liberty for from 10 to 1314 days, the mean being 266 days; they moved distances of from 1½ to 220 miles, the average being 38·1 miles, and the mean rate of travel 1·4 miles. Two of the recaptured males were under adult size; they were free for a mean period of 17 days, and moved 18 miles and 25 miles respectively. Of the females, 32 were of adult size on recovery, averaging 41·4 cm., and ranging from 38 to 48·4 cm., as against a range of from 32 to 41·5 cm., and a mean of 36·7 cm. on liberation; they were at liberty for from 6 to 1044 days, the average being 415 days; they migrated distances of from 1½ to 232 miles, the average being 45·1 miles, and the mean rate 1·1 miles. Thirty-seven were under adult size, ranging from 30·5 to 37·7 cm., and averaging 35·1 cm., as compared with a range of from 32·5 to 40 cm., and an average of 35·3 cm., on liberation; they were free for from 4 to 495 days, the mean being 114 days; they migrated from 1½ to 148 miles, the average being 35·7 miles, and the mean rate of movement was 3·3 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the remainder of June, 5 males and 11 females were taken. With one exception, they were found at short distances from the station, and the exception is more than doubtful. Three of the males and 3 of the females had moved to the south and west for from 1½ to 15 miles; 2 of the males were found to the south and east, 1 at 6 miles, and the other, along with 1 of the females, at 21 miles; 5 of the females went to the north and east, 4 being caught on the same day, and probably by the same vessel, as they were all landed at London, at a distance of 5 miles, and 1 at a distance of 10 miles. One female, landed at Cuxhaven, is represented as having been recaptured after 4 days, at a distance of 112 miles to the westwards, which is obviously a mistake.

Eleven males and 12 females were recaptured in July, but the place of capture of 1 of the males is not recorded. Nine of the other males and 6 of the females were taken to the south and east, the males at distances of from 14 to 25 miles, and the females at distances of from 11 to 23 miles. One male and 1 female were found to the north and west, at distances of 12 and 27 miles. Four females were taken to the south and west, 3 at distances of from 8 to 15 miles, and 1, after 24 days, at 113 miles distant, representing a mean rate of travel of 4·7 miles per day; it is probably erroneous.

One male and 4 females were recaptured in August, the male and 1 female to the south and east, at distances of 35 and 31 miles; the other 3 females to the



north and west, 2, taken on the same day, at 10 miles and the third at 25 miles distant.

In this quarter, 44 of the marked plaice, or 37·9 per cent., were recovered, but the position of 1 was not ascertained. Of the remaining 43 (37·1 per cent.), 20 were found to the south-east, at a mean distance of 19 miles in the mean direction S. 56° E. ; 10 (23·2 per cent.) went an average distance of 18 miles in the mean direction S. 22° W. ; 7 (16 per cent.) went 31 miles in the mean direction N. 49° W. ; and 6 (13·9 per cent.) went an average distance of 6 miles in the mean direction N. 23° E. On the migration chart, the majority of the lines are to the eastwards and southwards.

*Second Quarter.*—None was caught in September, but 2 males and 3 females were taken in October, 1 of the males 39 miles to the south and west, and the other 35 miles to the south and east. Of the females, 1 was taken 15 miles to the north and west, and the other 2 at 12 and 19 miles to the north and east.

Six males and 6 females were recaptured in November. Two of the males were found at 15 and 51 miles to the north and east, 2 at 45 and 47 miles to the north and west, 1 at 57 miles to the south and east, and 1 at 220 miles to the south and east, at Borkum Riff (about Lat. 54° N. ; Long. 6° E.), the mean rate of movement being 13·7 miles per 10 days ; this fish measured 37–37 cm., and was landed at Altona by a German trawler. The place of recapture of 1 of the females was not ascertained ; of the others, 2 had travelled distances of 17 and 42 miles to the north and west, and 2 were taken by a German trawler 39 miles N.-W.  $\frac{1}{2}$  W. of Hanstholm, in the mouth of the Skagerak, Denmark, at 142 miles distant to the south and east. The remaining female is stated to have been taken at a distance of 225 miles to the north and east (Lat. 60° 20' N. ; Long. 3° 10' E.), the mean rate of movement representing 13·7 miles per 10 days ; this fish was captured by a German trawler and landed at Hamburg.

In this quarter, therefore, 17 fish, or 14·6 per cent., were recaptured, but the position of 1 was not recorded. Of the others (13·8 per cent.), 5 were taken to the north and east, at an average distance of 64 miles ; 5 to the north-west, at a mean distance of 33 miles ; and 5 to the south-east, at an average distance of 119 miles ; while 1 was found to the south and west.

*Third Quarter.*—A male and a female were recovered in December 1910, at distances of 40 and 43 miles to the north and east.

A male was got in January 1911, 37 miles to the north and east, and a female in February, 88 miles to the north and west.

Thus, in the third quarter, only 4 of the marked plaice, or 3·4 per cent., were recaptured, 3 to the north and east, and 1 to the north and west.

*Fourth Quarter.*—None was taken in March, but in April a male and 3 females were caught, 1 female 21 miles to the south and east, another 14 miles to the north and east, and the third 14 miles to the north and west ; the male was taken 45 miles E.  $\frac{3}{4}$  S. of Aberdeen, at a distance of 137 miles to the westward, and landed at Aberdeen.

In May, 8 males, 14 females, and 1 of unknown sex were recaptured ; the position of capture of 1 of the males was not ascertained ; 3 were found to the north and east, at distances of 10, 11, and 13 miles ; 1 at 36 miles to the north and west ; another 12 miles to the south and east ; and 2 at 5 and 16 miles to the south and west. Of the females, 3 were found to the north and east, at distances of 5, 10, and 41 miles respectively ; 8 were recaptured to the north and west, at distances of 2, 11, 15, 17, 19, 34, 47, and 52 miles ; 1 was got 18 miles to the south and east, and 2 to the south and west, 1 at 13 miles and the other at 130 miles distant, to the east of Hartlepool.

In the fourth quarter, 27, or 23·3 per cent., of the marked plaice were recaptured, but the position of capture of 2 was not recorded. Of the remaining 25 (21·5 per cent.), 11 (44 per cent.) were found at an average distance of 35 miles in the mean direction N. 55° W. ; 7 (28 per cent.) at an average distance of 15 miles in the mean direction N. 22° E. ; 4 (16 per cent.) at an average distance of 41 miles S. 46° W. ; and 3 (12 per cent.) to the south and east.

Thus, in the 12 months, 92, or 79·3 per cent., were recaptured, the positions of 4 not being ascertained. Of the remaining 88 (75·9 per cent.), 28 (31·8 per cent.) were taken to the south and east ; 24 (27·3 per cent.) to the north and west ; 21

(23·9 per cent.) to the north and east, and 15 (17 per cent.) to the south and west. These particulars are summarised in the following table :—

Quarter.	Direction.	No. of Fish.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. June 1910. July 1910. Aug. 1910.	N. and E.	6	13·9	N. 23° E.	6·	6·3	5-10	3·15-16·6
	N. and W.	7	16·3	N. 49° W.	31·	49·8	10-112	1·85-280·
	S. and E.	20	46·5	S. 56° E.	19·	10·15	6-35	5·45-21
	S. and W.	10	23·2	S. 22° W.	18·	9·1	1·5-113	1·25-47·1
			43	37·1				
II. Sept. 1910. Oct. 1910. Nov. 1910.	N. and E.	5	31·25	N. 41° E.	64·	4·1	12-225	·9-13·7
	N. and W.	5	31·25	N. 50° W.	33·	2·2	15-47	1·1-3·2
	S. and E.	5	31·25	S. 66° E.	119·	7·8	35-220	3·0-13·8
	S. and W.	1	6·25	S. 38° W.	39·	2·9	..	..
			16	13·8				
III. Dec. 1910. Jan. 1911. Feb. 1911.	N. and E.	3	75·	N. 73° E.	40·	2·2	37-43	1·7-2·5
	N. and W.	1	25·	N. 20° W.	88·	3·6	..	..
	S. and E.				Nil.			
	S. and W.				Nil.			
		4	3·4					
IV. Mar. 1911. April 1911. May 1911.	N. and E.	7	28·	N. 22° E.	15·	·4	5-41	·1-1·2
	N. and W.	11	44·	N. 55° W.	35·	1·1	2-137	·1-4·6
	S. and E.	3	12·	S. 38° E.	17·	·5	12-21	·35-·7
	S. and W.	4	16·	S. 46° W.	41·	1·2	5-130	·1-3·8
			25	21·5				
Summary.	N. and E.	21	23·9					
	N. and W.	24	27·3					
	S. and E.	28	31·8					
	S. and W.	15	17·0					
			88	75·9				

Of the other fish, 9 were recaptured in the remainder of 1911, 11 in 1912, 2 in 1913, and 1 in 1914.

In July 1911, a male was taken 47 miles to the north and west. In August, a male was got 36 miles to the north and west, and 2 females at 47 and 91 miles respectively to the south and east. Two females were found in October, 1, 75 miles to the south and west, and the other 148 miles to the south, about Lat. 55° N.; Long. 5° E. In November, a male was taken 91 miles to the south and east, and a female 12 miles to the north and west. In December, a male was found 66 miles to the north and west.

In May 1912, 1 male and 4 females were taken, the male 19 miles to the north and west, 1 of the females 39 miles to the south and east, another 38 miles to the south and west, the third, 45 miles to the north and east; the remaining female was captured on the north coast of Scotland, 4 miles N.W./W.  $\frac{3}{4}$  W. of Dunnet Head, at a distance of 230 miles. In June, a male was captured 29 miles to the north-east, and a female at a distance of 21 miles in the same direction. Two males and 2 females were recovered in October, 1 of the males 11 miles to the south and east, and the other 69 miles to the south and west; 1 of the females was taken 68 miles to the south and west, and the other 45 miles to the north and west.

In January 1913, a female was recaptured 45 miles to the south and east, and in April, another female, after 1044 days, at a position not ascertained.

The last fish of the experiment to be recaptured was a male, which was taken in January 1914, after 1314 days, 156 miles to the north and west, namely, 30 miles S.E./E. of Aberdeen.

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	8	209	26	N. 47° E.
	Adult Females.	8	371	46	N. 24° E.
	Immature Females.	8	97	12	N. 39° E.
		24	677	28	N. 37° E.
N. and W.	Adult Males.	10	601	60	N. 35° W.
	Adult Females.	13	482	37	N. 54° W.
	Immature Females.	9	384	43	N. 49° W.
		32	1467	46	N. 47° W.
S. and E.	Adult Males.	16	606	38	S. 51° E.
	Immature Males.	2	43	21	S. 72° E.
	Adult Females.	4	222	55	S. 33° E.
	Immature Females.	11	460	42	S. 57° E.
	? Sex.	1	18	18	S. 40° E.
		34	1349	39	S. 52° E.
S. and W.	Adult Males.	7	147	21	S. 41° W.
	Adult Females.	6	324	54	S. 34° W.
	Immature Females.	6	162	27	S. 27° W.
		19	633	33	S. 34° W.
S.	Immature Females.	1	148	148	S.
SUMMARY.					
N. and E.		24	677	28	N. 37° E.
N. and W.		32	1467	46	N. 47° W.
S. and E.		34	1349	39	S. 52° E.
S. and W.		19	633	33	S. 34° W.
S.		1	148	148	S.
		110			

*Distances travelled.*—10 miles and under.—Nineteen fish, or 17·3 per cent., were recovered at distances of from  $1\frac{1}{2}$  to 10 miles, 5 males (11·6 per cent.), with an average of 4·8 miles, and 14 females (21·2 per cent.), with a mean of 6 miles. Three of the males and 3 of the females were taken to the south and west, 1 of the males and 8 of the females to the north and east, 1 of the males to the south and east, and 3 of the females to the north and west.

10 to 20 miles.—Thirty-four fish, or 30·9 per cent., were recaptured at distances of from 11 to 19 miles, 15 males (34·9 per cent.), with an average of 14·6 miles, 18 females (27·3 per cent.), with an average of 14·3 miles, and 1 of unknown sex. Nine of the males and 3 of the females were found to the south and east, 3 of the males and 3 of the females to the north and east, 2 males and 8 females to the north and west, and 1 male and 4 females to the south and west.

Thus, 53 fish, or 48·2 per cent., were taken under 20 miles from the station, 20 males (46·5 per cent.), with an average of 12·2 miles, 32 females (48·5 per cent.), with an average of 10·6 miles, and 1 of unknown sex.

20 to 50 miles.—Thirty-six fish, or 32·7 per cent., were recovered at distances of from 20 to 47 miles, 15 males (34·9 per cent.), with an average of 34·3 miles, and 21 females (31·8 per cent.), with a mean of 33 miles. Six of the males and 9 of the females were found to the south and east, 5 of the males and 7 of the females to the

north and west, 3 males and 4 females to the north and east, 1 male and 1 female to the south and west.

*50 to 100 miles.*—Ten fish, or 9·1 per cent., were got at distances of from 51 to 91 miles, 5 males (11·6 per cent.), with an average of 66·8 miles, and 5 females (7·6 per cent.), with an average of 74·8 miles. Two of the males and 1 of the females were caught to the south and east, 1 of the males to the north and east, 1 male and 2 females to the south and west, and 1 male and 2 females to the north and west.

*Over 100 miles.*—Eleven fish, or 10 per cent., were recovered at distances of from 112 to 232 miles, 3 males (6·9 per cent.), with an average of 171 miles, and 8 females (12·1 per cent.), with a mean of 155·5 miles. One of the males and 2 of the females went to the south and east, 2 males and 2 females to the north and west, 2 females to the south and west, 1 to the north and east, and 1 to the south.

#### MATURITY.

*Males.*—As previously stated, most of these fish were taken by English or by foreign trawlers, only the records coming into my possession. Thus, the condition of the testes was ascertained in only 8 of the 46 males recaptured.

Five were described as “ripe,” 1 taken in December 1910, 43 miles to the north and east, 1 in April, 1911, 137 miles to the north and west, 1 in October 1912, 11 miles to the south and east, 1 also in October 1912, 69 miles to the south and west and 1 in January 1914, after 1314 days, 156 miles to the north and west.

A male taken in October 1910, 35 miles to the south and east, was described as “maturing,” and 1 captured in May 1911, 36 miles to the north and west, was said to be “spent.”

*Females.*—The condition of the ovaries was recorded for 13 of the 69 females recovered.

One was “ripe”; it was taken on the ground  $1\frac{1}{2}$  miles to the south and west, in June 1911.

Among the females under adult size, 1, measuring 33·5–37 cm., caught in May 1911, 52 miles to the north and west, was described as “ripe.”

#### EXPERIMENT VII.

14th July 1911.

In this experiment, which was made north-west of the Bank, at 57° 25' N.; 3° 35' E., 102 plaice were marked and liberated, viz. 50 males, 43 females and 9 whose sexes were not determined. The males measured from 29 to 42·5 cm., and 23 were under adult size when liberated; the females varied from 28 to 44 cm., and 33 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25–30·5	cm. 31–35·5	cm. 36–40·5	cm. 41–45·5	cm. 46–50·5	Total.
F. Lib. . . . .	8	20	13	2	—	43
F. Recap. . . . .	4	7	7	2	—	20
M. Lib. . . . .	11	24	14	1	—	50
M. Recap. . . . .	2	10	9	1	—	22
? Lib. . . . .	1	7	—	—	1	9
? Recap. . . . .	—	1	—	—	—	1

The fish used in this experiment were trawled by the “Goldseeker” in the Firth of Forth, mostly at Station VI., off St. Monans, and in part at Station II., viz. Kirkcaldy Bay. They were caught on the 13th July, between 10 a.m. and 4 p.m., and liberated at midnight on the 14th.

Three marked plaice were captured by the “Goldseeker” at Station VI., and taken to put away again at the Fisher Bank, but they died *en route*, in addition to other 6 which had been marked, and 36 which were in the tubs unmarked.

The number recaptured was 43, or 42·1 per cent., viz. 22 males (44 per cent.),

20 females (46·5 per cent.), and 1 of unknown sex (11·1 per cent.). Nineteen of the males were of adult size on recapture, ranging from 33 to 45·5 cm., and averaging 38·9 cm., as compared with a range of from 30 to 42·5 cm., and a mean of 35·8 cm., on liberation; they were free for periods of from 45 to 1117 days, the mean being 384 days; they migrated distances of from 9 to 96 miles, the mean being 34·5 miles, and the average rate of movement, ·85 mile. Three were under the adult size, averaging 31·8 cm., as compared with 31·7 cm. on liberation; they were at liberty for an average period of 135 days, and travelled from 15 to 54 miles, the mean being 37 miles, and the average rate 2·7 miles. Sixteen of the females were of adult size on recapture, averaging 42·8 cm., and ranging from 38·7 to 47·5 cm., as compared with a mean of 36·1 cm., and a range of from 28 to 44 cm. on liberation; they were at liberty for from 291 to 923 days, the mean being 661 days; they travelled from 17 to 217 miles, the average being 73·9 miles, and the mean rate, 1·1 miles. Four were under adult size, averaging 31 cm., as against 31·4 cm. on liberation; they were free for a mean period of 109 days, and moved from 27 to 205 miles, the average being 79·5 miles, and the mean rate 7·3 miles. So far as the port of landing is recorded, 11 were landed at Aberdeen, 6 each at London and Grimsby, 5 each at Hull and Hamburg, 4 at Cuxhaven, 2 at Altona, 2 at North Shields, and 1 at Ymuiden.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Three males were recaptured in August, all to the south and east, at distances of 27, 37, and 54 miles respectively.

In September, 2 males were taken, also to the south and east, at 11 and 15 miles. These were the only marked plaice caught in this quarter (11·6 per cent.), all to the south and east.

*Second Quarter.*—Three males, 2 females, and 1 of unknown sex were taken in October, the 2 females, 1 of the males, and the fish whose sex was not determined to the south and east, the male at 29 miles, and the female at 27 and 36 miles. The fish of unknown sex was taken 25 miles W./N.  $\frac{3}{4}$  N. of Hanstholm, Denmark, at the mouth of the Skagerak, the apparent rate of movement being 17·25 miles per 10 days. A male was caught 12 miles to the south and west, and another 34 miles to the north and west.

Four males and 2 females were taken in November, but the position of capture of 1 of the males was not recorded. The females and 1 male were taken to the south and east, the male at a distance of 59 miles, and 1 of the females at 50 miles; the other female was found 20 miles west of List, in the northern part of the island of Sylt, Germany (54° 56' N.; 7° 49' E.), at a distance of 205 miles, the mean rate of movement having been 17·5 miles; a male was recaptured 19 miles to the north and east, and another 19 miles to the north and west.

None was taken in December, so that the total recovered in the second quarter was 12, or 27·9 per cent., but the position of 1 was unknown. Of the remaining 11 (25·6 per cent.), 7 (63·6 per cent.) were got to the south and east, at an average distance of 78 miles in the mean direction S. 37° E.; 2 (18·2 per cent.) were found to the north and west, and 1 each to the north and east, and south and west.

*Third Quarter.*—No plaice were recaptured during this period.

*Fourth Quarter.*—In April 1912, a female was taken 136 miles to the south and east, off Jutland Bank, and in May 2 males, 1, 42 miles to the south and east, and the other at an unknown locality.

Two females were recovered in June, both to the north and west, 1 at 17 miles and the other at 25 miles.

Five were found in this quarter, or 11·6 per cent., but the position of 1 was unknown; 2 were taken to the north and west, and 2 to the south and east.

In the 12 months immediately following the liberation of the fish, 22, or 51·2 per cent., were recaptured, the positions of 2 being unknown; of the remainder (46·5 per cent.), 14 (70 per cent.) were got to the south and east, 4 to the north and west, and 1 each to the north and east, and south and west.

Of the others, 5 were taken in the remainder of 1912, 11 in 1913, and 5 in 1914.

In July 1912, a male was taken 17 miles to the north and west. In October, a male was caught 20 miles to the north and west, and a female 217 miles in the same direction, 30 miles north-east of Sumburgh Head, Shetland. In November, a

male was taken 96 miles to the north and west, and a female 45 miles, also to the north and west.

In January 1913, a female had gone 80 miles to the north and west, and in March another female was taken, but the place of recapture was unrecorded. The next recapture was a female in May 1913, 29 miles to the south and east. In July, a female was captured, 77 miles E.N.E.  $\frac{1}{4}$  N. of Rattray Head, 131 miles to the north and west. Two females were recovered in September, 1, 19 miles to the south and west, and 1, 36 miles to the south and east. In October, a male was taken 39 miles to the south and east, and in November, another male 52 miles to the north and west. In December, a male and two females were found, all to the north and west, the male at a distance of 70 miles, and 2 females at 60 miles.

In January 1914, 3 females were taken, 2 at 80 and 99 miles to the north and west, and 1, 74 miles to the south and east. In May, a male was found 36 miles to the north and west, and in August, after 1117 days, another male, which measured 34.5-44.2 cm., at a distance of only 9 miles to the north and west.

*Distances travelled*—10 miles and under.—Only 1 fish, or 2.5 per cent., was taken under 10 miles, viz. a female, at 9 miles to the north and west.

10 to 20 miles.—Eight, or 20 per cent., were found at distances of from 11 to 19 miles, 6 males (30 per cent.), with an average of 15.5 miles, and 2 females (10.5 per cent.), with a mean of 18 miles. Two of the males were taken to the south and east, 2 males and 1 female to the north and west, 1 male and 1 female to the south and west, and 1 male to the north and east.

Nine fish, or 22.5 per cent., were thus recaptured at distances under 20 miles.

20 to 50 miles.—Fourteen fish, or 35 per cent., were got at distances of from 20 to 45 miles, 8 males (40 per cent.), with an average of 33 miles, 6 females (31.6 per cent.), also with an average of 33 miles. Three of the males and 2 of the females were taken to the north and west, and 5 males and 4 females to the south and east.

50 to 100 miles.—Twelve fish, or 30 per cent., were found at distances of from 50 to 99 miles, viz. 5 males (25 per cent.), with a mean of 66 miles, and 7 females (36.8 per cent.), with a mean of 71.8 miles. Three of the males and 5 females went to the north and west, and all the other fish to the south and east.

Over 100 miles.—No males were found over 100 miles away, but 4 females (21 per cent.) went distances of from 131 to 217 miles, the average being 172.25 miles; 2 were got to the south and east, and 2 to the north and west; 1 of unknown sex was recovered 138 miles to the south and east.

#### MATURITY.

*Males*.—The condition of the testes was recorded for only 6 of the 22 recaptured.

One was "spawning" ("nearly spent"); it was taken in May 1914, after 1043 days, 36 miles to the north and west, and measured 30-41.3 cm.

Three were described as "nearly ripe," all taken to the north and west, 1 in November 1911, at a distance of 19 miles; another in November 1913, at 52 miles, and the third in December 1913, at a distance of 70 miles; these fish were all above adult size when liberated.

One, taken in October 1912, 20 miles to the north and west, was said to be "three-quarters ripe."

*Females*.—Of the 20 recaptured, the condition of the ovaries was recorded in 7.

One was "spawning"; it measured 33.5-44.5 cm., and was taken in January 1914, 99 miles to the north and west.

Two were described as "ripening," 1 found in January 1913, 80 miles to the north and west, the other in January 1914, also 80 miles to the north and west.

One was said to be "spent"; it was caught in June 1912, 25 miles to the north and west. Another, also taken in June 1912, 17 miles to the north and west, was described as "apparently spent."

#### OTHER EXPERIMENTS.

Some other experiments were made in this region.

On 15th July 1911, 26 plaice, which had been caught in the vicinity, were marked and liberated at the same position as on the 14th, viz. 10 males, 14 females, and 2 whose sex was not ascertained. The males ranged in size from 31 to 51.5

cm., and 1 only was under adult size on liberation; the size of the females was from 32 to 59 cm., and 2 were under adult size. The number recaptured was 6, or 23.1 per cent., 1 male and 5 females. The male was recaptured in March 1912, 94 miles to the south and west. One of the females was taken in October 1912, 12 miles to the south and west, and another, also in October, 37 miles to the south and east; the third was found in November 1911, 110 miles to the south and west; the fourth, in January 1912, 217 miles to the south and west, 159 miles E.  $\frac{1}{4}$  S. of Spurn Head; and the last, at a distance of 220 miles to the south and east.

On 17th June 1910, 17 plaice, captured in the vicinity, were marked and liberated at the position  $57^{\circ} 20' N.$ ;  $3^{\circ} 39' E.$ , viz. 6 males, 6 females, and 5 whose sexes were not ascertained. Only 2 were recaptured, a male in May 1911, 10 miles to the south and west, and 1 of unknown sex in August 1910, 11 miles to the north and west.

On the day following, 6 fish, 2 males and 4 females, were liberated at  $57^{\circ} 1' N.$ ;  $3^{\circ} 52' E.$ , and on the 20th, 4 plaice, 3 males and a female, at  $56^{\circ} 58' N.$ ;  $4^{\circ} 15' E.$ , but no fish from either of these 2 experiments was recaptured.

On 21st June 1910, 12 plaice, caught in the locality, were marked and set free at the position  $56^{\circ} 37' N.$ ;  $3^{\circ} 42' E.$ , 5 males, 6 females, and 1 of unknown sex. Three were recaptured, a male in July 1910, 45 miles to the north and west, another male in February 1911, 86 miles to the south and west, and a female in October 1910, 34 miles to the south and east.

On 13th June 1912, 98 marked plaice were liberated at the position  $57^{\circ} 12' N.$ ;  $4^{\circ} E.$ , viz. 38 males, 57 females, and 3 whose sexes were not ascertained. The fish used were taken by the "Goldseeker" on the 11th June, in Kirkcaldy Bay, were marked on the 12th, and liberated on the 13th; 6 fish died in the tanks in the interval. The males ranged in size from 27 to 42 cm., and 23 were under adult size; the females ranged from 27.5 to 48.5 cm., and 43 were under adult size.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	Total.
F. Lib. . . . .	16	22	11	6	2	57
F. Recap. . . . .	2	6	1	1	—	10
M. Lib. . . . .	17	14	5	2	—	38
M. Recap. . . . .	2	2	1	—	—	5
? Lib. . . . .	—	1	2	—	—	3
? Recap. . . . .	—	—	—	—	—	—

Only 15, or 15.8 per cent., were recaptured, 5 males (13.2 per cent.) and 10 females (18.5 per cent.). All the males were of adult size on recapture, ranging from 36.9 to 43.5 cm., and averaging 40.2 cm., as compared with a range of from 28.5 to 41 cm., and an average of 33.6 cm. on liberation; they were at liberty for the average period of 672 days, and migrated from 36 to 86 miles, the mean being 50.5 miles, and the mean rate of movement .75 mile. Six of the females were of adult size, ranging from 38.6 to 48 cm., and averaging 43.2 cm., as compared with a range of from 33.5 to 45.5 cm., and an average of 37.2 cm. on liberation; they were at liberty for from 116 to 1293 days, the mean being 588 days; they migrated distances of from 62 to 179 miles, the average being 108.4 miles, and the mean rate 1.8 miles. Four were under adult size, averaging 32.5 cm., as compared with an average of 30.5 cm. on liberation; they were at liberty for the mean period of 268 days, and travelled distances of from 2 to 247 miles, the mean being 77.5 miles, and the average rate of movement 2.9 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

The first fish to be caught were taken in October 1912, viz. 2 females, one 27 miles to the south and east, and the other 72 miles to the south and west.

The next was a female captured in March 1913, only 2 miles to the south and west. In May, a female was said to have been taken in the Firth of Forth,  $\frac{1}{2}$  mile off Portobello, on the south shore, having migrated a distance of 247 miles to the westwards, in 322 days, or at the mean rate of 7.7 miles per 10 days; this fish was sent from a firm at Leith, with an intimation that it was caught in a crab-net at the above locality. In June, a female was recovered 34 miles to the south and west. In August, a male 36 miles to the south and east; and in September, 2 females, one 62 miles to the south and west, and one 94 miles to the north and west. In December, a female was taken 18 miles north of Hanstholm Light, 145 miles to the south and east.

In January 1914, a male had gone 86 miles to the south and east. In April, a female was recaptured 97 miles to the south and east, in July a male 32 miles to the south and east, in August 2 males to the north and west, at 48 and 50 miles.

No other fish from this experiment was recaptured until December, 1915, when a female was found, after 1293 days, on the Sylt Ground, 179 miles to the south and east.

*Distances travelled*—10 miles and under.—One fish, a female, was caught 2 miles to the south and west, after 263 days.

None was recaptured between 10 and 20 miles.

20 to 50 miles.—Five, or 33.3 per cent., were taken at distances of from 27 to 48 miles, 3 males (60 per cent.), with an average of 39 miles, and 2 females (20 per cent.), with a mean of 30.5 miles. Two of the males and 1 of the females were taken to the south and east, 1 male to the north and west, and 1 female to the south and west.

50 to 100 miles.—Six, or 40 per cent., were recaptured at distances of from 50 to 97 miles, 2 males, with an average of 68.25 miles, and 4 females (40 per cent.) with an average of 81.6 miles. One male and 1 female went to the south and east, 1 male and 1 female to the north and west, and 2 females to the south and west.

Over 100 miles.—Three fish, or 20 per cent., were recaptured at distances of from 145 to 247 miles; they were all females (30 per cent.), and 2 were taken to the south and east, 1 off Hanstholm Light, and another on the Sylt Ground; the third is described as having been found in the Firth of Forth, 247 miles to the westwards.

#### MATURITY.

As the condition of the reproductive organs was not recorded in the fish landed at foreign, or at most English, ports, little can be said on this subject. The female recorded as having been captured in the Firth of Forth measured 28–31.2 cm., and was, of course, “immature.” A female, taken in September 1913, 62 miles to the south and west, was described as “mature”; it measured 45.5–48 cm.; a male, taken in August 1913, 36 miles to the south and east, was “about half mature.”

The remaining experiments in the region of the Great Fisher Bank were as follows:—

On 14th June 1912, 3 females and 2 of unknown sex, caught locally, were marked and liberated at 57° 16' N.; 4° 8' E., and 1 female was recaptured on the 9th July following, 4 $\frac{1}{2}$  miles to the westwards.

On the same day, 13, also taken locally, were liberated at 57° 19' N.; 4° E., comprising 4 males, 7 females, and 2 of unknown sex. Four, or 30.8 per cent., were recaptured, 2 males and 2 females. One of the males was found in September 1913, 34 miles to the south and east, and the other in July 1912, 7 miles to the north and east. One of the females was got in July 1912, 7 miles to the north and east, and the other in November 1913, after 506 days, 17 miles to the south and east.

Three females, caught in the vicinity, were marked and set free also on the 14th June, at 57° 15' N.; 3° 52' E., but none was recaptured.

#### EXPERIMENT AT 22 MILES S.S.E. FROM CRUDEN SCAURS.

8th March 1912.

One experiment was made at this locality, which lies 22 miles S.S.E. of Cruden Scaurs, or 25 miles S. 10° E. of Buchanness (Lat. 57° 6' N.; Long. 12° 5' W.), with a



depth of 43 fathoms. It was intended to liberate these fish at Aberdeen Bank, but, owing to a strong south-easterly gale, they had to be set free at this position, which lies 14 miles N. 24° W. of the station on Aberdeen Bank.

The number liberated was 100, consisting of 20 males and 80 females. The males ranged in size from 33 to 36·5 cm., and all were of adult size when liberated. The females ranged from 32 to 47 cm., and 60 were under the adult size when liberated.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	Total.
F. Lib. . . . .	54	12	11	3	80
F. Recap. . . . .	34	8	6	3	51
M. Lib. . . . .	19	1	—	—	20
M. Recap. . . . .	15	—	—	—	15

The fish were trawled by the "Goldseeker" in Aberdeen Bay on the 8th March 1912, and marked between 1.30 and 3.25 p.m. They were liberated later on the same day.

Sixty-six, or 66 per cent., were recaptured, namely, 15 males (75 per cent.) and 51 females (63·7 per cent.). All the males were of adult size on recapture, averaging 39·1 cm., and ranging from 34·8 to 49 cm., as compared with an average of 34·1 cm., and a range of from 33·5 to 35 cm. on liberation; their periods of freedom varied from 2 to 849 days, the mean being 331 days; they migrated distances of from 12 to 201 miles, the mean being 90 miles and the mean rate of movement 2·7 miles. Thirty-nine of the females were of adult size when recaptured, ranging from 38·1 to 52·8 cm., and averaging 43·1 cm., as compared with a range of from 32 to 46·5 cm., and an average of 37 cm. on liberation; they were at liberty for from 6 to 1001 days, the mean being 395 days; they moved distances of from 7 to 176 miles, the average being 51·4 miles, at a mean rate of 1·3 miles. Twelve were under adult size, averaging 35·4 cm., and ranging from 33·4 to 37·6 cm., as compared with a range of from 32·5 to 35 cm., and a mean of 33·6 cm. on liberation; they were free for from 21 to 336 days, the average being 126 days, and they travelled distances of from 5 to 87 miles, the mean being 28·25 miles, and the average rate, per 10 days, 2·2 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In March, 1 male and 4 females were taken, the male at a distance of 12 miles to the south and west, and 1 of the females 11 miles in the same direction; 2 of the females were got to the north and west, at Cruden Bay, distances of 19 and 22 miles respectively; the third female was recaptured off Buchanness, at a distance of 22 miles.

In April, 1 male and 6 females were taken, all but 1 of the females at Cruden Bay, where they were originally taken by the "Goldseeker," at distances of 22 and 23 miles to the north and west; the exceptional female was taken farther south, at a distance of 12 miles to the north and west.

In May, a female was caught 56 miles to the south and west, about 16 miles east of the Isle of May.

Thus, in the first quarter, 13 of the marked plaice, or 19·7 per cent., were recaptured, 9 (69·2 per cent.) at an average distance of 21 miles in the mean direction N. 23° W., 3 (23·1 per cent.) at an average distance of 26 miles in the mean direction S. 38° W., and 1 to the north and east.

*N.B.*—See Chart.

*Second Quarter.*—In June, 3 females were taken, one 5 miles to the south and east, and the other 2 off Buchanness, at distances of 19 and 23 miles to the north and east.

In July, 2 females were caught, one 34 miles to the south and west, east of the Bell Rock, and one 50 miles N.  $\frac{1}{2}$  W. from Hoy Head (Lat. 59° 46' N.; Long. 3° 40' W.), at a distance of 176 miles to the north and west.

None was got in August, so that, in this quarter, 5 fish, or 7·6 per cent., were

recaptured, 2 to the north and east, and 1 each to the north and west, south and east, and south and west.

*Third Quarter.*—In September, a male was taken 29 miles to the south and west.

In October, 3 females were recaptured, 2 of them 21 miles to the north and west, near the coast south of Cruden Bay, and 3 east of the Bell Rock, at a distance of 43 miles to the south and west.

Three females were taken in November, 2 to the south and west, at distances of 10 and 25 miles, and 1 at Cruden Bay, at a distance of 22 miles to the north and west.

In this quarter, 7 fish, or 10·6 per cent. were recovered, 4 (57·1 per cent.) to the south and west, and 3 (42·8 per cent.) to the north and west.

*Fourth Quarter.*—Two were found in December, 1, a female, near Aberdeen, at a distance of 18 miles to the north and west, the other, a male, off Banff, Moray Firth, at a distance of 62 miles to the north and west.

In January 1913, 3 females and 1 male were recaptured. One of the females was taken off Buchanness, at a distance of 21 miles to the north and east; the male and the other 2 females were recaptured in the Moray Firth, off Banff, at distances of 61 and 62 miles.

In February, 3 males and 4 females were got, the 3 males and 2 of the females to the north-west, 1 female to the north, and the other to the south and east; the last had moved only 6 miles; the female which went to the north had migrated 20 miles, and was taken off Buchanness; of the others, 4 were taken in the Moray Firth, 2 females at distances of 74 and 87 miles, and 2 males at 95 and 104 miles; the remaining male was found 6 or 7 miles south-west from Rackwick Bay, Orkneys, at a distance of 129 miles.

In this quarter, 13 fish, or 19·7 per cent., were recaptured, of which 10 were taken to the north and west, 1 each to the north and east, the north, and the south and east.

In the 12 months immediately following the liberation, 38 fish, or 57·6 per cent., were recovered, 23, or 60·5 per cent., to the north and west, 8, or 21·1 per cent., to the south and west, 4, or 10·5 per cent., to the north-east, 2 to the south and east, and 1 to the north. These particulars are summarised in the following table:—

Quarter.	Direction.	No. of Fish.	Per Cent. of Total.	Mean Direction.	Average Distance (miles.)	Average Rate per 10 Days (miles.)	Range.	
							Distance.	Rate.
I. Mar. 1912. April 1912. May 1912.	N. and E.	1	7·7	N. 4° E.	22·	1·3	..	..
	N. and W.	9	69·2	N. 23° W.	21·	6·3	12-23	·8-10·5
	S. and E.			Nil.				
	S. and W.	3	23·1	S. 38° W.	26·	28·4	11-56	7·-60·
		13	19·7					
II. June 1912. July 1912. Aug. 1912.	N. and E.	2	40·	N. 14° E.	21·	2·05	19-23	1·7-2·4
	N. and W.	1	20·	N. 6° W.	176·	14·8	..	..
	S. and E.	1	20·	S. 6° E.	5·	·5	..	..
	S. and W.	1	20·	S. 34° W.	34·	2·7	..	..
		5	7·6					
III. Sept. 1912. Oct. 1912. Nov. 1912.	N. and E.			Nil.				
	N. and W.	3	42·8	N. 33° W.	21·	·9	21-22	·8-·9
	S. and E.			Nil.				
	S. and W.	4	57·1	S. 45° W.	27·	1·2	10-43	·4-1·9
		7	10·6					
IV. Dec. 1912. Jan. 1913. Feb. 1913.	N. and E.	1	7·7	N. 18° E.	21·	·7	..	..
	N. and W.	10	77·	N. 7° W.	75·	2·3	18-129	·6-3·6
	S. and E.	1	7·7	S. 13° E.	6·	·2	..	..
	S. and W.			Nil.				
	N.	1	7·7	N.	20·	·6	..	..
		13	19·7					
SUMMARY.	N. and E.	4	10·5					
	N. and W.	23	60·5					
	S. and E.	2	5·3					
	S. and W.	8	21·1					
	N.	1	2·6					
		38	57·6					

Of the remaining fish, 18 were recaptured in 1913 and 9 in 1914.

In March 1913, 3 males and 3 females were taken, all the males in the Moray Firth, 2 off Banff, at a distance of 61 miles, and 1 off the Ord of Caithness, at 91 miles. Two of the females were also found in the Moray Firth, off Tarbet Ness, at distances of 89 and 99 miles; the third female was recaptured 14 miles E.S.E. of Auskerry, at 116 miles distant to the north and east.

In April, 3 males and 2 females were recovered, but the position of 1 female, which was taken by a Dutch trawler and landed at Ymuiden, was not ascertained; probably it was captured in the Moray Firth; the 3 males were taken to the north and west, 1 of them off Tarbet Ness, in the Moray Firth; the other 2 were caught on the same day off Scourie Bank, at a distance of 200 miles (Lat. 58° 20' N.; Long 5° 40' W.); the remaining female was taken 19 miles to the east and south.

In May, 3 females were recaptured, 1 at Cruden Bay, at a distance of 23 miles, another 7 miles south-east, off Aberdeen, the third 43 miles to the south and west, off the Bell Rock

In July, a female was captured at the mouth of the Tay, at a distance of 56 miles to the south and west.

In September, another female was taken 8 miles north-east from Buchanness, at a distance of 31 miles to the north and east.

In October, a female was captured south-east of Noss Head, at 78 miles to the north and west, and in December, another female, in the same locality, at a distance of 84 miles.

Two females were taken in January 1914, both off Whitehills, Banff, 62 miles away.

In February, 2 females were caught, 1 off Kinnaird Head, at a distance of 44 miles to the north and west, the other in the Moray Firth, off Tarbet Ness, at a distance of 90 miles.

In March, 2 females were taken, 1, 49 miles to the south and west, off the Bell Rock, and the other, 97 miles to the north and west, near Noss Head, in the Moray Firth.

A female was taken in May, 47 miles to the south and west, south-east of the Bell Rock.

In July, a male was recaptured 15 miles E. by S. of Auskerry, Orkneys, at a distance of 120 miles to the north-east, and in December, a female, 14 miles S.S.E. of Fair Isle, at a distance of 133 miles to the north and east.

One female had no date of recapture.

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Males.	1	120	120	N. 7° E.
	Adult Females.	6	342	57	N. 9° E.
	Immature Females.	1	23	23	N. 23° E.
		8	485	61	N. 11° E.
N. and W.	Adult Males.	12	1188	99	N. 4° W.
	Adult Females.	20	1225	61	N. 12° W.
	Immature Females.	8	271	34	N. 19° W.
		40	2684	67	N. 11° W.
S. and E.	Adult Females.	2	26	13	S. 67° E.
	Immature Females.	2	11	5	S. 9° E.
		4	37	9	S. 38° E.
S. and W.	Adult Males.	2	41	20	S. 38° W.
	Adult Females.	9	340	38	S. 44° W.
	Immature Females.	1	34	34	S. 34° W.
		12	415	35	S. 43° W.
N.	Adult Females.	1	20	20	N.
<b>SUMMARY.</b>					
N. and E.		8	485	61	N. 11° E.
N. and W.		40	2684	67	N. 11° W.
S. and E.		4	37	9	S. 38° E.
S. and W.		12	415	35	S. 43° W.
N.		1	20	20	N.
		65			

*Distances travelled*—10 miles and under.—Four fish, or 6.25 per cent., were recaptured at distances of 5 to 10 miles. They were all females (8 per cent.), with an average distance of 7 miles; 3 were found to the south and east, and 1 to the south and west.

10 to 20 miles.—Seven, or 10.9 per cent., went distances of from 11 to 19 miles, namely, 1 male and 6 females (12 per cent.). The male had migrated 12 miles, and the average distance for the females was 16.3 miles. The male and 1 female were found to the south and west, 3 females to the north and west, 1 to the south and east, and 1 to the north and east.

Thus, under 20 miles, 11 fish, or 17.2 per cent., were found, 1 male (7.1 per

cent.) and 10 females (20 per cent.), the latter having an average distance of 12·6 miles.

*20 to 50 miles.*—Twenty-four fish, or 37·5 per cent., were recovered at distances of from 21 to 49 miles, 2 males (14·3 per cent.), with an average of 25·5 miles, and 22 females (44 per cent.), with a mean of 28·3 miles. One of the males and 11 of the females were taken to the north and west, the other male and 6 females to the south and west, 4 females to the north and east, and 1 to the north.

*50 to 100 miles.*—Twenty-two of the marked plaice, or 34·3 per cent., were recaptured at distances of from 56 to 100 miles, namely, 7 males (50 per cent.), with an average of 75·9 miles, and 15 females (30 per cent.), with a mean of 74·5 miles. All the males and 13 of the females were found to the north and west, and 2 females to the south and west. All the males were recaptured in the Moray Firth, 4 of them off Banff; 11 of the females were taken in the Moray Firth, 3 off Banff; 1 of the females went to the mouth of the Tay, and another east of the Isle of May.

*Over 100 miles.*—Eight fish, or 12·5 per cent., were got at distances of from 104 to 201 miles. Five (35·7 per cent.) were males, with an average of 151·2 miles, and 3 (6 per cent.) were females, with a mean of 141·6 miles. One of the males was taken in the Moray Firth (Dornoch Firth), 2 on the north coast of Scotland, off Scourie Bank, and 2 at the Orkney Isles; two of the females were also taken at Orkney, and 1 near Fair Isle.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 14 of the fifteen males recaptured.

Three were "spawning," 2 taken in February 1913, 1 in the Moray Firth, at a distance of 104 miles, the other at the Orkneys, at a distance of 129 miles; the third was found in March 1913, off Banff, in the Moray Firth, at 61 miles distant.

Four were described as "ripe," all caught in the Moray Firth, 2 off Banff, at distances of 61 and 62 miles, in December 1912 and March 1913, and 2 taken respectively in February and March, off the coast of Caithness, at distances of 95 and 91 miles respectively.

Three were described as "spent," namely, 2 taken off Scourie Bank, on the north coast, in April 1913, at 201 miles distant, and the third recaptured in July 1914, after 849 days, off the Orkneys, at a distance of 120 miles to the north and east.

One male, recovered in January 1913, off Banff, in the Moray Firth, at a distance of 61 miles, was said to be "nearly ripe."

Among the males of adult size, whose testes were "immature," 2 were found within the limits of the spawning season, 1 in March 1912, after 2 days, at a distance of 12 miles to the south and west; it measured 34·5–34·8 cm.; the other, which measured 34·5–35·2 cm., was taken in April, 22 miles to the north and west, in Cruden Bay.

*Females.*—Of the 51 recaptured, the conditions of the ovaries were recorded for 43.

Three were described as "spawning," 1 taken in March 1914, after 740 days, 49 miles to the south and west, near the Bell Rock; another, got in March 1913, off Aukerry, Orkney, 116 miles away to the north and east; the third, recaptured in December 1914, near Fair Isle, 133 miles to the north and east.

One, recaptured in February 1913 in the Moray Firth, off Buckie, at 74 miles distant, was described as "ripe."

Eight were said to be "spent," 4 being taken to the north-west, 2 to the south-west, and 2 to the south-east. Of those caught to the south-east, 1 was recaptured in May 1913, at 7 miles distant, and the other in April 1913, at a distance of 19 miles. Of those which went to the south and west, 1 was taken in May 1912, at 56 miles distant, east of the Isle of May, and the other in May 1914, at a distance of 47 miles, also east of the Isle of May. Of the 4 which migrated north and west, 1 was taken in March 1912, after 19 days, near Cruden Bay, and another also in March 1912, after 17 days, off Buchanness, at a distance of 22 miles. Of the 2 remaining fish, 1 was caught in March 1913, in the Moray Firth, at a distance of 99 miles, and the other in July 1912, on the west side of the Orkney Isles, off Hoy Head, at 176 miles distant.

Four were "nearly ripe," 1 taken in January 1913, in the Moray Firth, at a distance of 62 miles, another in December 1913, north of Rattray Head and south-east of Noss Head, at 84 miles to the north and west, a third in January 1914, in the Moray Firth, off Whitehills (Banff), a distance of 62 miles, and the fourth in February 1914, after 700 days, near Kinnaird Head, at a distance of 44 miles to the north and west.

Three were described as "three-quarters ripe," 1 taken in November 1912, 10 miles to the south and west; another also in November 1912, 22 miles to the north and west, at Cruden Bay; the third was recaptured in January 1914, after 678 days, at Whitehills, in the Moray Firth, at a distance of 62 miles.

Three were said to be "half-ripe," 1 caught in March 1912, after 6 days, 11 miles to the south and west, and measuring 42.7 cm.; another in April 1912, after 36 days, 23 miles to the north and west, and measuring 46.9 cm.; the third, in September 1913, 31 miles to the north and east, and measuring 52 cm.

Among the females of adult size whose reproductive organs were "immature" were the following captured within the limits of the spawning season:—One, measuring 33.5–42.2 cm., in January 1913, 21 miles to the north and east; another, of 33–42.4 cm., taken in March 1914, in the Moray Firth, near Lybster, at a distance of 97 miles; and 1, caught in May 1913, 23 miles to the north and west, which measured 43.4 cm.

Among the females under adult size whose ovaries were "immature" were 2 taken in February 1913, and measuring respectively 33.5–37.6 cm. and 33–37.2 cm.

#### EXPERIMENT AT RATTRAY HEAD.

*7th July 1912.*

At this place, which lies about 13 miles S. 79° E. from Rattray Head, in Lat. 57° 38' N.; Long. 1° 25' W., where the depth is 40 fathoms, 101 fish were marked and liberated, 46 males and 55 females. The males ranged in size from 28.5 to 45.5 cm., and 17 were under adult size when liberated. The females measured from 29 to 48 cm., and 43 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, are shown in the following table:—

	cm. 25–30.5	cm. 31–35.5	cm. 36–40.5	cm. 41–45.5	cm. 46–50.5	Total.
F. Lib. . . . .	3	30	17	4	1	55
F. Recap. . . . .	1	15	11	1	—	28
M. Lib. . . . .	9	29	7	1	—	46
M. Recap. . . . .	4	14	4	1	—	23

The fish used in this experiment were trawled by the "Goldseeker" in Kirkcaldy Bay, Firth of Forth, on the 6th July, and were marked between 1.45 p.m. and 2.45 p.m., and then placed in tubs of running water. They were liberated on the 7th, at 4.10 a.m., 4 having died in the tubs.

The number recaptured was 52, or 51.5 per cent., namely, 24 males (52.2 per cent.) and 28 females (50.9 per cent.). Eighteen of the males were of adult size on recapture, averaging 37.1 cm., and ranging from 33.8 to 45.9 cm., as compared with a mean of 35.1 cm., and a range of from 30 to 45.5 cm., on liberation; they were at liberty for periods of from 26 to 738 days, the mean being 276 days; they migrated distances of from 11½ to 74 miles, the mean being 41.2 miles, and the mean rate of movement, 1.4 miles. Six of the males were under adult size, averaging 31.9 cm., as against 31.4 cm. on liberation; they were free for a mean period of 119 days, and moved from 10 to 57½ miles, the average being 26.5 miles, and the mean rate of movement, per 10 days, 2.2 miles.

Fifteen of the females were of adult size on recapture, varying from 38 to 46.2 cm., and averaging 41.1 cm., as compared with a range of from 32 to 41 cm., and an average of 37 cm. on liberation; their periods of liberty varied from 17 to 1397 days, the average being 302 days; they travelled distances of from 7½ to 141 miles, the average being 35.1 miles, and the mean rate 1.2 miles per 10 days.

Thirteen were under adult size on recapture, averaging 33.6 cm., and ranging from 28.1 to 37 cm., as compared with a range of from 30 to 36.5 cm., and a mean of 32.9 cm. on liberation; they were free for periods of from 11 to 405 days, the average being 179 days; the distances moved varied from 13 to 78 miles, the average being 27.5 miles and the mean rate 1.5 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the remainder of July, 2 females and 1 male were taken, the male 10 miles to the north and west, the females at 17 and 28 miles to the south and west respectively.

In August, 2 males and 2 females were found, all to the south and west, the males at distances of 16 and 22 miles, the females at 10½ and 14 miles.

In September, 1 male and 3 females were recovered, the male at a distance of 56½ miles to the south and east, in the offshore waters; 1 of the females went 14½ miles to the north and west, to off Kinnaird Head, and the other 2, 16 miles to the south-west.

In this quarter, 11 marked plaice, or 21.1 per cent., were got, 8 (72.7 per cent.) at an average distance of 17 miles in the mean direction S. 39° W., 2 (18.2 per cent.) to the north and west, and 1 to the south and east. The chart, with the lines of migration, shows that 7 of these fish were recaptured at a short distance to the south-east of Buchanness.

*Second Quarter.*—In October, 1 male and 2 females were taken, all to the south and west, at distances of (for the male) 30½ miles and (for the females) 17½ and 18 miles respectively.

In November, 4 males and 2 females were got, all to the south-west, except 1 of the males, which was captured in the Moray Firth, off Buckie, at a distance of 52 miles to the north and west; the other males were recaptured at 17½, 18, and 21 miles, and the females at 14 and 20 miles.

In December, 2 females were recaptured, 1 at a distance of 19½ miles to the south and west, and the other 7 miles south from Fair Isle, at 116 miles distant to the north and east.

In this quarter, therefore, 11 of the marked plaice, or 21.1 per cent., were recovered, of which 9 (81.8 per cent.) were taken to the south and west, at a mean distance of 19 miles, and in the mean direction S. 49° W.; 1 was got to the north and east, and 1 to the north and west. The chart of migrations shows the same general features as in the last quarter, 8 of the fish being recaptured to the south-east of Buchanness, not far from shore.

*Third Quarter.*—In January 1913, 2 males and 1 female were taken, all in the Moray Firth, 2 off Banff, at a distance of 36½ miles, and 1 off Lossiemouth, at a distance of 57½ miles.

Two males and 2 females were recaptured in February, 1 male 11 miles to the south and west, the other 12½ miles to the north and west, and the 2 females in the same direction, at distances of 11 and 13 miles.

In March, 1 male and 3 females were taken, all to the north and west, 1 female off Rattray Head, at 13 miles distant, another off Banff, in the Moray Firth, at a distance of 37 miles, and the third female and the male were taken in the Moray Firth, north of Tarbet Ness, at distances of 70 and 78 miles.

In this quarter, then, 11 marked plaice, or 21.1 per cent., were recovered, 10 of them (90.9 per cent.) at an average distance of 36 miles in the mean direction N. 56° W., and 1 to the south and west. The chart of migration lines shows a difference from those of the two previous quarters, 4 of the fish being caught close inshore to the westward, and 6 in the Moray Firth, only 1 being recaptured near Buchanness, to the south and west.

*Fourth Quarter.*—In April 1913, 2 males and 1 female were taken, the female 35 miles to the south and west, close inshore, near Aberdeen, and the 2 males in the Moray Firth, 1 near Tarbet Ness, at a distance of 74 miles, and the other south-east of Noss Head at a distance of 61 miles.

In May, 3 females were recovered, 1, 18½ miles to the north and west, close inshore, at Kinnaird Head; another in the Moray Firth, off Cullen, at a distance of

45½ miles north and west, the third 9 miles S.S.W. from Foula (59° 58' N.; 2° 5' W.), at a distance of 141 miles.

A female was recaptured in June, at only 7½ miles distant to the north and west.

In this quarter, 7 of the marked plaice, or 13·5 per cent., were recaptured, 5 (71·4 per cent.) at an average distance of 41 miles in the mean direction N. 51° W., and 1 to the north-east, and 1 to the south-west.

Altogether, within the 12 months after liberation, 40 of the marked plaice, or 76·9 per cent., were recaptured, 19 (47·5 per cent.) to the south and west, 18 (45 per cent.) to the north and west, 2 (5 per cent.) to the north-east, and 1 to the south-east. These particulars are summarised in the following table :—

Quarter.	Direction.	No. of Fish.	Per Cent. of Total.	Mean Direction.	Average Distance (miles).	Average Rate per 10 Days (miles).	Range.	
							Distance.	Rate.
I. July 1912. Aug. 1912. Sept. 1912.	N. and E.			Nil.				
	N. and W.	2	18·2	N. 9° W.	12·	4·7	10-14·5	1·8-7·7
	S. and E.	1	9·1	S. 9° E.	56·5	8·1	..	..
	S. and W.	8	72·7	S. 39° W.	17·	6·8	10·5-28	2·2-16·5
		11	21·1					
II. Oct. 1912. Nov. 1912. Dec. 1912.	N. and E.	1	9·1	N. 16° E.	116·5	7·1	..	..
	N. and W.	1	9·1	N. 39° W.	52·	3·7	..	..
	S. and E.			Nil.				
	S. and W.	9	81·8	S. 49° W.	19·	1·65	14-30·5	1-2·7
		11	21·1					
III. Jan. 1913. Feb. 1913. Mar. 1913.	N. and E.			Nil.				
	N. and W.	10	90·9	N. 56° W.	36·	1·6	11-78	·5-2·9
	S. and W.	1	9·1	S. 45° W.	11·5	·5	..	..
		11	21·1					
IV. April 1913. May 1913. June 1913.	N. and E.	1	14·3	N. 9° E.	141·	4·3	..	..
	N. and W.	5	71·4	N. 51° W.	41·	1·4	7·5-74·	·2-2·6
	S. and E.			Nil.				
	S. and W.	1	14·3	S. 54° W.	35·	1·2	..	..
		7	13·5					
Summary.	N. and E.	2	5·					
	N. and W.	18	45·					
	S. and E.	1	2·5					
	S. and W.	19	47·5					
		40						

Of the remaining fish of the experiment recaptured, 3 were taken in the remainder of 1913, 4 in 1914, and 1 in 1916.

A male was taken in July 1913, 13 miles to the north and west. In August, a female was got in the offshore waters, at a distance of 57½ miles to the south and east. In September, a female was found 24 miles to the north-west, north-east of Kinnaird Head.

In January 1914, a male and a female were taken, both to the south and west, at distances respectively of 41 and 28 miles, the male in the offshore waters, and the female inshore, near Aberdeen. In March, a male was captured in the Moray Firth, near Clytleness, at 64 miles distant. In July, another male was taken offshore, at a distance of 48 miles to the south and west.

The last fish to be recaptured was a female, in May 1916, after 1397 days, at a distance of 17 miles to the south and west.

The chart for the whole of this experiment shows a concentration of the fish,



generally speaking, to the south-west of Buchanness, where a large number were recaptured.

Quadrant.	Sex.	No. of Fish.	Aggregate Distance (miles).	Average Distance (miles).	Mean Direction.
N. and E.	Adult Females.	2	257	128	N. 12° E.
N. and W.	Adult Males.	8	428	53	N. 40° W.
	Immature Males.	3	79	26	N. 47° W.
	Adult Females.	6	136	23	N. 48° W.
	Immature Females.	5	159	32	N. 46° W.
		22	802	36	N. 44° W.
S. and E.	Adult Males	1	56	56	S. 9° E.
	Immature Females.	1	57	57	S. 7° E.
		2	113	56	S. 8° E.
S. and W.	Adult Males.	7	172	25	S. 38° W.
	Immature Males.	2	52	26	S. 47° W.
	Adult Females.	7	130	19	S. 37° W.
	Immature Females.	7	139	20	S. 49° W.
		23	493	21	S. 42° W.
SUMMARY.					
N. and E.		2	257	128	N. 12° E.
N. and W.		22	802	36	N. 44° W.
S. and E.		2	113	56	S. 8° E.
S. and W.		23	493	21	S. 42° W.
		49			

*Distances travelled*—10 miles and under.—Two fish, or 4·1 per cent., were got at distances under 10 miles, namely, 1 male (4·8 per cent.), at 10 miles to the north and west, and 1 female (3·6 per cent.), 7½ miles to the north and west.

10 to 20 miles.—Twenty-one fish, or 42·8 per cent., were recaptured at distances of from 10½ to 19½ miles, 6 males (28·6 per cent.), with an average of 14·7 miles, and 15 females (53·5 per cent.), with a mean of 15·3 miles. Four of the males and 10 of the females were found to the south and west, 2 males and 5 females to the north and west.

Thus, 23 fish, or 46·9 per cent., were got under 20 miles from the station, 7 males (33·3 per cent.), with an average of 14·1 miles, and 16 females (57·1 per cent.), with an average of 14·9 miles.

20 to 50 miles.—Fourteen fish, or 28·6 per cent., were taken at distances of from 21 to 48 miles, 6 males (28·6 per cent.), with an average of 33·2 miles, and 8 females (28·6 per cent.), with an average of 31·7 miles. Five of the males and 4 of the females were found to the south and west, 1 of the males and 4 of the females to the north and west. One male and 3 females went to the Moray Firth.

50 to 100 miles.—Ten of the marked plaice, or 20·4 per cent., were recaptured at distances of from 52 to 78 miles, 8 males (38·1 per cent.), with an average of 62 miles, and 2 females (7·1 per cent.), with an average of 67·7 miles. Seven of the males and 1 of the females had migrated to the north and west, and 1 male and the other female to the south and east. Seven of the males and 1 of the females went to the Moray Firth.

Over 100 miles.—No male, but 2 females were recaptured at distances over 100 miles, 1 near Fair Isle, at a distance of 116 miles, the other off Foula, at 141 miles distant.

## MATURITY.

*Males.*—Of the 24 recaptured, the condition of the testes was recorded for 18.

One was “spawning”; it was taken in March 1914, off Clythness, at a distance of 64 miles to the north and west.

Two were “nearly ripe,” 1 taken in January 1913, off Banff, 36½ miles to the north and west, the other in January 1914, 41 miles to the south and west, in the offshore waters. One was described as “three-quarters ripe”; it had gone 18 miles to the south and west, in November 1912.

Among those of adult size, whose testes were described as “immature,” 2 were taken within the limits of the spawning season, 1 in February 1913, 11½ miles to the south and west, the other in April 1913, off Tarbet Ness, Moray Firth, at a distance of 74 miles to the north and west. Among the males under adult size (33 cm.) was 1 measuring 31–32·8 cm., taken in the Moray Firth off Lossiemouth, in January 1913; it was described as “nearly ripe.”

*Females.*—Of the 28 taken, the condition of the ovaries was ascertained in 27 cases.

None was described as “ripe” or “nearly ripe,” but 1, “apparently spent,” and measuring 36·5–39·7 cm., was taken in May 1913, off Foula, 141 miles to the northward.

Among those of adult size whose reproductive organs were “immature,” were 4 taken within the limits of the spawning season, 1 in January 1913, measuring 39–40 cm., in the Moray Firth, off Macduff; 2 in February 1913, measuring respectively 37–39·8 cm., and 33·5–38·5 cm., which were taken inshore, near Rattray Head, at distances of 11 and 13 miles to the north and west; the fourth, which measured 35·5–36·1 cm., was captured in January 1914, after 563 days, 28 miles to the south and west.

## EXPERIMENTS AT SMITH BANK, MORAY FIRTH.

Ten experiments were made at Smith Bank, in the Moray Firth, or its immediate vicinity, extending from February 1911 to November 1913, the particulars being given in the accompanying table:—

Place.	Date.	Liberated.				Recaptured.				Percentage Recaptured.			
		♂	♀	(?)	Total.	♂	♀	(?)	Total.	♂	♀	(?)	Total.
58° 10' 30" N. 2° 55' 30" W.	18 Feb. 1911.	21	21	...	42	11	12	...	23	52·4	57·1	...	54·8
58° 10' N. 2° 55' W.	14 Mar. 1911.	27	33	...	60	14	18	...	32	51·8	54·5	...	53·3
58° 10' 30" N. 2° 55' 30" W.	19 April 1911.	20	30	...	50	3	11	...	14	15·	36·7	...	28·
58° 10' N. 2° 55' W.	19 Sept. 1911.	36	63	2	101	22	24	2	48	61·1	38·1	...	47·5
58° 10' N. 2° 55' W.	11 Oct. 1911.	37	60	3	100	24	30	2	56	64·9	50·	66·6	56·
58° 5' N. 2° 30' W.	20 Sept. 1912.	47	53	1	101	27	28	...	55	57·4	52·8	...	54·4
58° 10' 30" N. 2° 35' 30" W.	21 Nov. 1912.	26	24	1	51	15	12	...	27	57·7	50·	...	52·9
58° 10' N. 2° 35' W.	27 Mar. 1913.	9	21	...	30	5	5	...	10	55·5	23·8	...	33·3
58° 10' N. 2° 30' W.	27 Mar. 1913.	22	48	2	72	11	26	...	37	50·	54·2	...	51·4
58° 10' N. 3° 2' W.	11 Nov. 1913.	51	49	...	100	16	18	...	34	31·4	36·7	...	34·
	Totals.	296	402	9	707	148	184	4	336	50·	45·7	44·4	47·4

The total number of plaice marked and liberated was 707, comprising 296 males, 240 females, and 9 whose sexes were not ascertained. The total number recaptured was 336, or 47·4 per cent., of which 148 (50 per cent.) were males, 184 (45·7 per cent.) were females, and 4 (44·4 per cent.) were of unknown sex.

## EXPERIMENT I.

18th February 1912.

In this experiment, 42 plaice, consisting of 21 males and 21 females, were marked and liberated at the position 58° 10' 30" N.; 2° 55' 30" W., in a depth of 20 fathoms,

which is on the Bank at the southern edge. The males measured from 23·5 to 42·5 cm., and 13 were under adult size on liberation; the sizes of the females ranged from 26 to 61 cm., and 14 were under the adult size when liberated.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 56-60·5	cm. 61-65·5	Total.
F. Lib. . . . .	6	5	5	2	1	1	1	21
F. Recap. . . . .	3	3	2	2	—	1	1	12
M. Lib. . . . .	11*	7	2	1	—	—	—	21
M. Recap. . . . .	5	4	1	1	—	—	—	11

\* One at 23·5 and 1 at 24·5 cm.

The fish used in this experiment were trawled by the "Goldseeker," on the same day, in Burchhead Bay, on the south shore of the Moray Firth.

The number recaptured was 23, or 54·8 per cent., namely, 11 males (52·4 per cent.) and 12 females (57·1 per cent.). Nine of the males were of adult size on recapture, ranging from 34 to 45 cm., and averaging 37·8 cm., as compared with a range of from 26·5 to 42·5 cm. and an average of 34·2 cm. on liberation; they were at liberty for from 40 to 476 days, the mean being 210 days; they migrated distances of from 1½ to 122 miles, the average being 40·9 miles, and the mean rate of movement 1·8 miles. Two of the males were under adult size, averaging 28 cm., as compared with 27·7 cm. when liberated; 1 migrated 23½ and the other 46 miles, the mean rate of travel being 4·5 miles. Five of the females were of adult size when recaptured, averaging 50·8 cm., as against 47·8 cm.; they were at liberty for a mean period of 214 days, and migrated distances of from 1 to 23½ miles, the average being 12·8 miles, and the mean rate of movement ·5 mile. Seven were under adult size on recapture, averaging 34·5 cm., as compared with 31·1 cm. on liberation; they were free for from 32 to 832 days, the mean being 196 days; they moved distances of from 1½ to 70 miles, the mean being 31·1 miles, and the average rate 1·5 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—One male and 2 females were taken in March, the male 13 miles to the north and east, off Noss Head, both of the females to the south and west, 1 in Burchhead Bay (where it was originally captured), at a distance of 32 miles, the other in Dornoch Firth, near Embo, at 35 miles distant.

In April, 2 males and 5 females were recaptured, 1 of the males 7½ miles to the north and west, off Berriedale Ness, the other 46 miles to the south and west, close inshore, near Fort George. The position of 1 of the females was not ascertained. Of the others, 1 was taken 7 miles to the south and west, 1 on Smith Bank, 1½ miles to the north and east, the third, also on Smith Bank, 1 mile to the south and east, and the last to the north of Banff, 14½ miles to the south and east.

A male was recaptured in May, 23½ miles to the north and west, close inshore, north of Tarbet Ness.

In this quarter, 11, or 47·8 per cent., of the marked plaice were recovered, but the position of 1 was unknown. Of the remaining 10, or 43·5 per cent., 4 were taken to the south and west, and 2 each to the south and east, north and east, and north and west.

*Second Quarter.*—In June, a male was got on Smith Bank, 1½ miles to the south and east.

In July, a male and a female were recaptured by foreign trawlers, and landed at Ostend, with the record "caught in the Moray Firth."

In August, a male was also landed at Ostend, and "caught in the Moray Firth." In these cases, the locality cannot, of course, be determined.

In the second quarter, therefore, 4 fish, or 17·4 per cent. were recaptured, but, as stated, the positions were ascertained only for 1 of them.

*Third Quarter.*—In September, a female was taken 35 miles to the south and west, in the Dornoch Firth, and a male in the "Moray Firth" (precise position unknown).

None was taken in October and November.

*Fourth Quarter.*—In December, a male was recaptured 24½ miles N.E. ½ E. of Cape Wrath and landed at Grimsby; the distance migrated was about 86 miles in a north-westerly direction.

In February 1912, a male was captured 16 miles E.N.E. ½ N. of the Butt of Lewis, at a distance of 122 miles to the north and westward. This fish was landed at Hull.

Within the 12 months after liberation, 19 plaice, or 82·6 per cent., were recaptured, but the place of capture of 5 was not ascertained. Of the remaining 14, or 60·9 per cent., 5 were taken to the south and west, 3 to the south and east, and the others to the north and west.

Of the remaining fish from the experiment, 3 were taken in 1912, and 1 in 1913.

In April 1912, 2 females were got in the Moray Firth, near Noss Head, 1 at a distance of 12½ miles, and the other at 23½ miles to the northward. In June, a male was recovered off Wick Bay, 15 miles to the north and west.

The last fish from this experiment to be recaptured was a female taken in May 1913, which obviously had migrated in an unusual direction. It is described as having been found 5 miles S.S.E. from Cruden Bay, or 70 miles distant from the station, to the southwards; it was landed at Aberdeen.

*Distances travelled—10 miles and under.*—Five of the marked plaice, or 27·8 per cent., were recaptured at distances of from 1 to 7½ miles, 2 males and 3 females, the males an average distance of 4·5 miles, and the females, 3·2 miles. One male and 1 female were found to the south and east, 1 male to the north and west, 1 female to the south and west and 1 to the north and east.

*10 to 20 miles.*—Four, or 22·2 per cent., were recaptured at distances of from 12½ to 15 miles, 2 males with a mean of 14 miles, and 2 females with a mean of 13½ miles. One male and 1 female were found to the north and east, the other male to the north and west, and the other female to the south and east.

Thus, 9 of the fish, or 50 per cent., were recaptured at distances under 20 miles.

*20 to 50 miles.*—Six fish, or 33·3 per cent., were got at distances of from 23½ to 46 miles, 2 males with an average of 34·7 miles, and 4 females with an average of 31·4 miles. One of the males and 3 of the females were found to the south and west, 1 male to the north and west, and 1 female to the north and east.

*50 to 100 miles.*—Two fish, or 11·1 per cent., were recaptured, a male at 86½ miles to the north and west, and 1 female 70 miles to the south and east.

*Over 100 miles.*—Only 1 fish exceeded 100 miles; it was taken at 122 miles distant to the north and west, off the Butt of Lewis.

#### MATURITY.

*Males.*—Of the 11 recaptured, the condition of the testes was ascertained in only 2; both were “immature.”

*Females.*—The condition of the ovaries was recorded for 5 of the 12 recaptured. Two were described as “spent,” 1 taken in April 1911, 14½ miles to the south and east, the other in April 1912, 23½ miles to the north and east. All the others were “immature.”

#### EXPERIMENT II.

14th March 1911.

In this experiment, 60 plaice, 27 males and 33 females, were marked and liberated at 58° 10' N.; 2° 55' W., the males measuring from 21 to 36·5 cm., and 21 were under adult size on liberation. The sizes of the females ranged from 22 to 50 cm., and 27 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, are shown in the accompanying table:—

	cm. 20-24·5	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	Total.
F. Lib.	4	11	9	5	1	3	33
F. Recap.	1	6	6	2	1	2	18
M. Lib.	5	11	10	1	—	—	27
M. Recap.	1	4	8	1	—	—	14

The fish used in this experiment were trawled by the "Goldseeker" in Dornoch Firth on the same day.

The number recaptured was 32, or 53·3 per cent., 14 males (51·8 per cent.) and 18 females (54·5 per cent.). Nine of the males were of adult size, averaging 38·4 cm., as compared with 32·5 cm. on liberation; they were at liberty for a mean period of 485 days, and migrated distances of from 3 to 57 miles, the average being 19·8 miles, and the mean rate ·3 mile. Five males were under adult size, averaging 28·1 cm., as against 28·4 cm. on liberation; they were free for an average period of 37 days, and travelled distances of from 6 to 53 miles, the mean being 21·2 miles, and the average rate, 9 miles per 10 days. Eight of the females were of adult size, averaging 43·4 cm., as against 39·1 cm. on liberation; they were at liberty for a mean period of 266 days, and moved from 3 to 72 miles, the mean being 26 miles, and the mean rate ·9 mile. Ten were under adult size, the average being 32·5 cm., as compared with 30·4 cm. on liberation; they were at liberty for an average period of 106 days, and migrated distances of from 7 to 44 miles, the average being 20·7 miles, and the mean rate of movement 1·7 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the remainder of March, 2 males and 4 females were recovered; the position of 1 of the males was not ascertained; the other was taken north-east of Rattray Head, at a distance of 53 miles to the south and east; 1 of the females was caught by a foreign trawler, and landed abroad, the place of recapture being given as "Moray Firth"; another is described as having been caught to the north-east of Rattray Head, at 72 miles distant to the south and east; the third was got 7 miles to the north and west, near Clythness; and the last, 12 miles to the south and west, off Berriedale Head.

In April, 3 males and 4 females were recaptured, 2 of the males to the south and west, at 6 and 16 miles respectively, the other male 10 miles to the north and east, off Clythness; 3 of the females were taken to the north and east, south-east of Noss Head, at distances of 21, 25, and 27 miles respectively; the remaining female was recovered on Smith Bank, at a distance of 3 miles to the south and east.

Thus, in this quarter, 13 of the marked plaice, or 40·6 per cent., were recaptured, the positions of 2 not being ascertained. Of the remaining 11, 4 were found to the north-east, 3 each to the south-east and south-west, and 1 to the north-west.

*Second Quarter.*—In June, a male and a female were recaptured "in the Moray Firth" and landed at foreign ports.

In July, a female was taken, and recorded under similar circumstances.

Three fish, or 9·4 per cent., represent the catches for this quarter.

*Third Quarter.*—A male and a female were got in September, the female in the Dornoch Firth, the exact position not being recorded, and the male in the "Moray Firth," and landed at foreign ports.

*Fourth Quarter.*—In January 1912, a male was recaptured 15½ miles to the north and west, south-east of Berriedale Ness.

In February, a female was taken in the "Moray Firth," and landed at a foreign port.

Thus, in the 12 months after liberation, 20 of the marked fish, or 62·5 per cent., were found, but the positions of capture of 8 were not recorded. Of the remaining 12, or 37·5 per cent., 4 were taken to the north and east, 2 to the north and west, and 3 each to the south and east, and south and west.

Of the remaining fish recaptured from this experiment, 9 were taken in 1912 and 3 in 1913.

Three females were caught in March 1912, 1, 10 miles to the south and west, and 2, 9 miles and 31 miles to the north and east. In April, 2 females were recaptured, 1, 20 miles to the north and east, and the other on the north coast of Scotland, north-east of Holburn Head, at a distance of 34 miles. In May, a male was taken 4½ miles to the north and east, and a female 20 miles in the same direction. In September, a male got in the "Moray Firth" was landed at a foreign port, and in December, another male was recaptured 19 miles to the north and east.

In March 1913, 2 males were recovered, 1, 3 miles to the north and west, the

other on the north coast, off Strathie Point, at a distance of 57 miles. The last fish to be taken was a male, found 20 miles to the north and east, in April 1913.

*Distances travelled*—10 miles and under.—Eight fish, or 34·8 per cent., were recaptured at distances of from 3 to 10 miles, 4 males, with an average of 5·9 miles, and 4 females, with an average of 7·2 miles. One of the males and 1 of the females were found to the north and west, 2 of the males and 1 of the females to the north and east, and 1 male and 1 female to the south and east.

10 to 20 miles.—Four, or 17·4 per cent., were recaptured at distances of from 12 to 19 miles; 3 males, with an average of 16·8 miles, and 1 female at 12 miles. One of the males and the female were found to the south and west, 1 male to the north and west, and 1 to the north and east.

Thus, 12 of the fish, or 52·2 per cent., were recaptured at distances under 20 miles.

20 to 50 miles.—Eight fish, or 34·8 per cent., were got at distances of from 20 to 44 miles, 1 male at 20 miles from the station, and 7 females (53·8 per cent.) at a mean distance of 27 miles. All these fish were found to the north and east.

50 to 100 miles.—Three fish, or 13 per cent., were recaptured at distances of from 50 to 100 miles, 2 males at 53 and 57 miles, and 1 female at 72 miles. One male and the female went to the south and east, and the other male to the north and east.

None was taken at distances over 100 miles.

#### MATURITY.

*Males*.—The condition of the reproductive organs was ascertained in only 3 of the 14 males recaptured. One was described as “spawning”; it was taken in March 1913, after 746 days, off Strathie Point, on the north coast of Scotland, at a distance of 57 miles to the north and west.

One was described as “ripe”; it was captured in January 1912, 15 miles to the north and west. One was “nearly ripe”; it was taken in December 1912, 19 miles to the north and east.

*Females*.—The condition of the ovaries was recorded for only 3 out of 18 fish recaptured. One, taken in April 1912, 20 miles to the north and east, was said to be “nearly ripe.” Another, found in March 1912, 33 miles to the north and east, was described as “spent.” The third was “immature.”

#### EXPERIMENT III.

19th April 1911.

In this experiment, 50 marked plaice, viz. 20 males and 30 females, were liberated at the same place as in the last experiment, the males measuring from 23·5 to 43·5 cm., and 17 being under adult size when liberated. The females varied from 26 to 56 cm., and 19 were under adult size on liberation. The fish used were taken in the Dornoch Firth on the 17th, and were marked and kept in tubs until the 19th, owing to the rough weather, when they were set at liberty.

The numbers liberated and recaptured, arranged in 5-cm. groups, are shown in the following table:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	cm. 56-60·5	Total.
F. Lib.	9	7	5	2	1	5	1	30
F. Recap.	1	5	2	—	1	1	1	11
M. Lib.	13*	4	1	2	—	—	—	20
M. Recap.	3	—	—	—	—	—	—	3

\* Two at 23·5 cm.

The number recaptured was only 14, or 28 per cent., 3 males (15 per cent.) and 11 females (36·7 per cent.). Two of the males were of adult size on recapture, and 1 was under that size. Six of the females were of adult size, averaging 48·2 cm., as against 43·7 cm. on liberation. Five of the females were under adult size, averaging 34·3 cm., as compared with 31·6 cm. on liberation.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In May, 2 females were recaptured, the position of 1 being vaguely indicated as "Moray Firth"; the other was taken 20 miles to the north-east, off Noss Head.

In June, a female was recovered, the place of capture being still more vague, namely, "North Sea"; it was landed at Geestemünde.

*Second Quarter.*—In September, 5 females were taken, the position of 3 being given as "Moray Firth"; the fourth was found 20 miles to the north-east, off Noss Head, and the fifth, 36 miles to the south and west, at Burghead.

In October, a female was recaptured in Cromarty Firth, at 45 miles distant to the south and west.

*Third Quarter.*—In December, a female was recaptured in the "Moray Firth," and landed at a foreign port.

*Fourth Quarter.*—In February 1912, a male was taken 10 miles to the north and west, off Clythness, and a female was got on Smith Bank, in the place where it was liberated.

A male was recaptured in March 1912, 36 miles to the south and west, in the Dornoch Firth.

Thus, within the 12 months following liberation, 13 of the fish, or 92·8 per cent., were recaptured, the positions being known for only six, or 42·8 per cent.

The 1 remaining fish from the experiment was got in September 1912, in Burghead Bay, 35 miles to the south and west.

*Distances travelled.*—Only 1 fish went a distance of 10 miles, and none was found between 10 and 20 miles. Six fish (85·7 per cent.) were recaptured at distances of from 20 to 45 miles, 2 males and 4 females. The males and 2 of the females were found to the south and west, the other 2 females to the north and east.

## MATURITY.

*Males.*—The condition of the testes was recorded for 2 of the males. One was "ripe"; it was taken in February 1912, 10 miles to the north-west. The other was "very immature," although captured in March 1912, and measuring 29-34·5 cm.; it was taken in the Dornoch Firth, 36 miles to the westward.

*Females.*—The condition of the ovaries was ascertained in 4 of the 11 recaptured. One, taken in September 1911, 20 miles to the north and east, was described as "half ripe." All the others were "immature."

## EXPERIMENT IV.

19th September 1911.

In this experiment, 101 plaice were marked and liberated, viz. 36 males, 63 females, and 2 whose sexes were not ascertained. The males measured from 29 to 48 cm., and 5 were under adult size on liberation. The females ranged from 29 to 76 cm., and 15 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	cm. 56-60·5	cm. 61-65·5	Total.
F. Lib.	2	6	17	7	14	9	3	5*	63
F. Recap.	1	3	8	3	5	3	—	1	24
M. Lib.	3	10	13	9	1	—	—	—	36
M. Recap.	2	9	7	3	1	—	—	—	22
? Lib.	—	—	—	2	—	—	—	—	2
? Recap.	—	—	—	2	—	—	—	—	2

\* One at 66·5 and 1 at 76 cm.

Some of the fish used in this experiment were recaptured by the "Goldseeker" in Dornoch Firth, and marked, on the 18th between 5.30 and 6 p.m., but most were taken on the 19th in Burghead Bay; they were liberated about 6 p.m. on the 19th.

The number recaptured was 48, or 47·5 per cent., viz. 22 males (61·1 per cent.), 24 females (38·1 per cent.), and the 2 of unknown sex. Twenty-one of the males were of adult size on recapture, averaging 38·6 cm., and ranging from 33·2 to 47·6 cm., as compared with a range of from 30 to 48 cm. and a mean of 36·2 cm. on liberation; they were at liberty for from 53 to 883 days, the average being 267 days; they migrated distances of from 3 to 188 miles, the mean being 40 miles, and the mean rate 1·4 miles. Eighteen of the females were of adult size, ranging from 38 to 55·1 cm., and averaging 46·2 cm., as against a range of from 34·5 to 55 cm., and an average of 44·1 cm. on liberation; they were at liberty for from 39 to 606 days, averaging 210 days; they travelled distances of from 3 to 59 miles, the mean being 23·3 miles, and the average rate 1 mile. Six were under adult size, averaging 33·8 cm., as against a mean of 35 cm. on liberation; they were free for a mean period of 91 days, and migrated from 3½ to 44 miles, the mean being 23·6 miles, and the average rate 2·6 miles.

Twenty-six of the recaptured fish were landed by foreign trawlers at Ostend Ymuiden, Geestemünde, and Cuxhaven, the place of capture being stated, in some cases, merely as "Moray Firth," or not recorded.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In September, one of unknown sex was landed at Ostend, the place of capture unrecorded.

In October, a female was taken 5 miles to the north and west, and another in the "Moray Firth," and landed at Ostend.

In November, 2 males and 6 females were found; 1 of the males was taken 7 miles to the north and east, and the other 8 miles to the south and east; 2 of the females were recovered together, north-east of Kinnaird Head, at a distance of 44 miles to the south and east, and 2 others near the same place, 1 at a distance of 45 miles, and the other at a distance of 41 miles; of the 2 remaining females, 1 was got in the "Moray Firth" by a Belgian trawler, and the other was taken on Smith Bank, at a distance of 3½ miles to the south and east.

In December, 2 males and 3 females were recaptured, 1 of the males in the "Moray Firth," by a German trawler, and the other 25 miles to the north and east of Noss Head; 2 of the females were taken on Smith Bank, on the same day, at a distance of 8 miles to the south and east, the third being captured 21 miles to the north and east, off Noss Head.

In this quarter, 16 of the marked plaice, or 33·3 per cent., were recaptured, the position being known for 12 (25 per cent.), and of these, 8 (66·6 per cent.) were found to the south and east, 3 to the north and east, and 1 to the north and west.

*Second Quarter.*—A male and a female were taken in January 1912, the female 17 miles to the north and east, off Noss Head, and the male, which was "ripe," on the north coast, off Strathie Point, at a distance of 64 miles to the northwards and westwards.

Four males and 1 female were recaptured in February 1912, the female 5 miles to the north and west, off Clythness, and 2 of the males in the same locality, at 3½ and 6½ miles; another male was taken by a Belgian trawler in the "Moray Firth," and the remaining male, which was "ripe," on the north coast, off Strathie Point, at a distance of 67 miles.

Two males, 2 females, and 1 of unknown sex were taken in March, 1 female 10 miles to the south and west, and the other 9 miles to the north and east, off Noss Head; one of the males was also found off Noss Head, at a distance of 9 miles to the north and east, and the other 25 miles to the south and east, north of Kinnaird Head; the fish whose sex was not recorded was captured offshore, near Auskerry, Orkney Isles, at 65 miles to the north and east.

In the second quarter, therefore, 12 fish, or 25 per cent., were recaptured, the position of 1 being unknown. Of the remaining 11, or 22·9 per cent., 7 (63·6 per cent.) were found to the north and east, 2 to the north and west, and 1 each to the south and east and south and west.

*Third Quarter.*—2 males and a female were taken in April, the position of 1 of the males not known, the other male off Noss Head, 12 miles to the north and east, the female in the Dornoch Firth, at 36 miles distant to the south and west.



In May, 4 males and 3 females were recaptured; the place of capture of 1 of the females was not recorded; the other females were taken to the north and west, 1 at a distance of  $3\frac{1}{2}$  miles, and the other at 7 miles; 1 of the males was recaptured 3 miles to the north and west, another on the north coast, off Dunnet Head, at a distance of 48 miles to the north and west, another at 62 miles to the north and east, to the west of the Orkney Isles; the remaining male is described as having been recaptured at a distance of 188 miles to the east and south (Lat.  $58^{\circ} 12' N.$ ; Long.  $3^{\circ} 15' E.$ ).

In June, 2 females were taken, both to the north and east, off Auskerry, Orkney Isles, one at  $50\frac{1}{2}$  and the other at 59 miles.

Thus, in this quarter, 12 of the marked plaice, or 25 per cent. were recaptured, the position of capture of 2 being unrecorded. Of the remaining 10, or 20.8 per cent., 5 (50 per cent.) were found to the north and east, 3 to the north and west, and 1 each to the south-east and south-west.

No other fish was recaptured until October 1912, so that, within a twelvemonth of liberation, 40 of the marked fish, or 83.3 per cent. were taken, but the position of recapture was recorded for only 33 or 68.7 per cent. Of these, 15 (45.4 per cent.) were found to the north and east, 10 (30.3 per cent.) to the south and east, 6 (18.2 per cent.) to the north and west, and 2 to the south and west.

Of the remaining fish, 2 were taken in 1912, 5 in 1913, and 1 in 1914.

In October 1912, a female was recaptured 35 miles to the north and east, off-shore, east of Noss Head. A male was got in November, in the "Moray Firth," and landed at Cuxhaven.

In March 1913, a male and a female were recovered, the male at 5 miles distant to the north and east, and the female  $19\frac{1}{2}$  miles to the north and west, north of Tarbet Ness. In April, a male was recaptured off the Butt of Lewis, on the west coast, at a distance of 140 miles to the north and west. In May, a female was taken 20 miles to the north-east, and in July, a male 7 miles to the north and west.

The last fish to be taken was a male in February 1914,  $8\frac{1}{2}$  miles to the north and west.

*Distances travelled*—10 miles and under.—Eighteen fish, or 45 per cent., were taken at distances of from 3 to 10 miles, viz. 9 males (50 per cent.), with an average of 6.4 miles, and 9 females (42.8 per cent.), with a mean of 6.5 miles. Four of the males and 4 of the females were taken to the north and west, 1 of the males and 3 of the females to the south and east, 4 males and 1 female to the north and east, and 1 female to the south and west.

10 to 20 miles.—Three fish, or 7.5 per cent., were recaptured at distances of from 12 to  $19\frac{1}{2}$  miles, viz. 1 male and 2 females.

Thus, 21 fish, or 52.5 per cent., were found at distances under 20 miles, 10 males (55.5 per cent.), with an average of 6.9 miles, and 11 females (52.3 per cent.), with an average of 8.6 miles.

20 to 50 miles.—Eleven fish, or 27.5 per cent., were recaptured at distances of from 20 to 48 miles, 3 males (16.6 per cent.), with an average of 32.8 miles, and 8 females (38.1 per cent.), with an average of 36 miles. Two of the males and 3 of the females were found to the northward, 1 of the males and 4 of the females to the south and east, and 1 of the females to the south and west.

50 to 100 miles.—Six fish, or 15 per cent., were recaptured at distances of from  $50\frac{1}{2}$  to 68 miles, 3 males (16.6 per cent.), with an average of 64.8 miles, 2 females (9.5 per cent.), with a mean of 54.7 miles. All these fish were got to the northward, as was also 1 whose sex was unknown.

Over 100 miles.—Two fish, or 5 per cent., were found at distances of 140 miles to the north and westward, and 184 miles to the south and east. Both were males.

#### MATURITY.

*Males*.—The condition of the testes was ascertained in 9 of the 22 recaptured. Four were described as "ripe," 1 caught in February 1912, on the north coast, off Strathie Point, at a distance of 67 miles, another, also off Strathie Point, in January 1912, at a distance of 64 miles, the third 12 miles to the north and east in April 1912, and the fourth, in February 1914,  $8\frac{1}{2}$  miles to the north and west, off Clythness. Two were "nearly ripe," both taken in February 1912, one  $3\frac{1}{2}$  miles to the north

and east, and the other  $6\frac{1}{2}$  miles to the north and west. A male, caught in December 1911, 25 miles to the north and east, was "half ripe."

*Females.*—The condition of the ovaries was recorded for only 5 of the 24 females. One, captured in December 1911, 21 miles to the north and east, was "nearly ripe"; another, taken in January 1912, 17 miles to the north and east, was "spent," and the third, recaptured in June 1912, off Auskerry, Orkneys, 59 miles to the north and east, was described as "apparently spent."

#### EXPERIMENT V.

11th October 1911.

In this experiment, 100 marked plaice were liberated, 37 males, 60 females, and 3 whose sex was not determined. The males ranged in size from 24.5 to 40 cm., and 8 were under adult size; the females measured from 26 to 56 cm., and 31 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25-30.5	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	cm. 56-60.5	Total.
F. Lib.	2	17	24	5	6	5	1	60
F. Recap.	—	9	14	3	1	3	—	30
M. Lib.	5*	17	15	—	—	—	—	37
M. Recap.	1	13	10	—	—	—	—	24
? Lib.	—	2	1	—	—	—	—	3
? Recap.	—	2	—	—	—	—	—	2

\* One at 24.5 cm.

The fish used in this experiment were taken by the "Goldseeker" on the 10th October, in the Dornoch Firth, and marked before 4 p.m. They were liberated the next day at 9 p.m.

The number recaptured was 56, or 56 per cent., 24 males (64.9 per cent.), 30 females (50 per cent.), and 2 of unknown sex (66.6 per cent.). On recapture, 23 of the males were of adult size, ranging from 33.4 to 43.4 cm., and averaging 37.2 cm., as compared with a range of from 31 to 40 cm., and a mean of 35.5 cm. on liberation; they were at liberty for from 15 to 594 days, the average being 237 days; they migrated distances of from  $2\frac{1}{2}$  to  $89\frac{1}{2}$  miles, the mean being 23.6 miles, and the average rate .9 mile. Sixteen of the females were of adult size on recapture, averaging 44.8 cm., and varying from 38.1 to 55.5 cm., as against a range of from 34 to 55.5 cm., and an average of 41.1 cm. on liberation; they were at liberty for from 32 to 521 days, the mean being 298 days; they travelled distances of from  $2\frac{1}{2}$  to 106 miles, the mean being 31.7 miles and the mean rate .97 mile. Fourteen of the females were under adult size on recapture, ranging from 34 to 37.9 cm., and averaging 36.2 cm., against an average of 36.1 cm., and a range of from 38.5 to 41 cm. on liberation; they were at liberty for from 11 to 237 days, the mean being 97 days; they moved from  $3\frac{1}{2}$  to 82 miles, the average being 33.2 miles, and the mean rate of movement 3.3 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—In the remainder of October, 1 male and 2 females were recaptured, the male and 1 of the females in "the Moray Firth," and landed respectively at Ostend and Geestemünde; the other female was taken north-east of Kinnaird Head, at  $43\frac{1}{2}$  miles distant to the east and south.

In November, 6 females and 1 of unknown sex were recaptured; 1 female was taken in the "Moray Firth," and landed at Ostend; 3 were recovered on Smith Bank, 1 at a distance of  $3\frac{1}{2}$  miles to the south and east, and the other 2 at 8 miles in the same direction; the fish whose sex was not ascertained was also captured on Smith Bank, at a distance of 8 miles to the south-east; of the other 2 females,

1 was caught off Noss Head, 24 miles to the north and east, and the other north-east of Kinnaird Head, 43 miles to the south and east.

In December, a female was recaptured on Smith Bank, at a distance of 8 miles to the south and east.

In this quarter, 11 of the marked plaice, or 19·6 per cent., were recovered, positions being known for 8, or 14·3 per cent., and of these, 7 (87·5 per cent.) were taken to the south and east, and 1 to the north and east. The migration lines on the chart all pass from the station towards the outer waters to the eastwards, none going towards the coast.

*Second Quarter.*—In January 1912, a female was recaptured far offshore, 82 miles to the north and east.

In February, 5 males and 1 female were recaptured, the female in the Dornoch Firth, 33 miles to the south and west; 1 of the males was also taken to the south and west, at a distance of 10 miles; 2 of the males were recaptured on the same day, off Clythness, 5 miles to the north and west; a male was taken on the north coast, north-west of Dunnet Head, at a distance of 58 miles to the north and west; the remaining male was recaptured  $5\frac{1}{2}$  miles E.  $\frac{1}{2}$  N. of Cape Wrath, at  $89\frac{1}{2}$  miles distant.

Four males and 5 females were caught in March, the place of capture of 1 male and 1 female not being ascertained, and 1 of the females being vaguely described as having been recaptured in the "Moray Firth," and landed at Ostend; 1 male was captured on Smith Bank, at a distance of 3 miles to the north and west; another was taken 23 miles to the westward, north of the Dornoch Firth; the remaining male was captured at the mouth of the Dornoch Firth,  $28\frac{1}{2}$  miles to the south and west; 2 females were taken in the Dornoch Firth, 36 miles to the south and west, and the remaining female off Duncansby Head, 31 miles to the north and east.

In the second quarter, therefore, 16 fish, or 28·6 per cent., were recaptured, the position being known for 13, or 23·2 per cent. Of these, 5 (38·4 per cent.) were found to the south and west, 4 (30·8 per cent.) to the north and east, 3 (23·1 per cent.) to the north and west, and 1 directly westward. The migration chart shows the opposite condition from that for the first quarter, only 1 of the fish having migrated eastward, all except 3 being found nearer the coast than the station where they were liberated.

*Third Quarter.*—In April, 5 males and 4 females were recaptured, the position of capture of 1 of the males not being ascertained. One male was taken 13 miles to the north and east, off Noss Head; 1 of the males was got 6 miles to the south-west, and the other 2,  $2\frac{1}{2}$  and  $13\frac{1}{2}$  miles to the north and west; all the females were caught to the north and east, 2 at a distance of  $2\frac{1}{2}$ , 1 at 20 miles, and the other 45 miles, south-east of Auskerry.

In May, 2 males and a female were recaptured: 1 of the males was got north-east of Kinnaird Head, at a distance of 47 miles to the south and east; the female was recaptured 22 miles to the north-east, off Noss Head, and the other male north-east of Auskerry, at a distance of 63 miles to the north and east.

In June, a female was recovered south-east of Auskerry, 52 miles to the north-east, and a female 15 miles to the north-east, off Noss Head.

In this quarter, 14, or 25 per cent., were taken, the position being known for 13, or 23·2 per cent. Of these, 9 (69·2 per cent.) were found to the north and east, 2 (15·4 per cent.) to the north and west, 1 to the south and east, and 1 to the south and west. The predominating feature of the migration lines in this period was a movement to the northward of the station.

*Fourth Quarter.*—None of the marked plaice was recaptured during these 3 months, so that, in the first year following the liberation, 41 fish, or 73·2 per cent., were recaptured, the position being known for 34 (60·7 per cent.). Of these, 14 (41·2 per cent.) were taken to the north and east, 8 (23·5 per cent.) to the south and east, 5 to the north and west, 6 to the south and west, and 1 to the west.

Of the remaining fish, 5 were recaptured in the remainder of 1912, and 10 in 1913.

In October 1912, a male was taken 5 miles to the south and west, and a female 34 miles to the north and east. In November, 3 females were found, 1 on Smith Bank, 8 miles to the south and east, and the other 2 to the north and east, 1 north-east of Noss Head, at a distance of 30 miles, and the other 4 miles E. by S. from Start Point, Orkney Isles, at a distance of 70 miles.

In February 1913, 3 females and a male were taken, the male 9 miles to the north and west, 2 of the females to the south and west, to near Tarbet Ness, 31 and 39 miles distant; the remaining female was recaptured 11 miles W.S.W. of Cape Wrath, 106 miles to the north and west. Three males and a female were recovered in March 1913, 1 of the males north-east of Tarbet Ness, 15½ miles to the south and west, another in the Dornoch Firth, 36½ miles to the south and west, the third 21 miles to the north and east, off Noss Head, while the female was taken off Tarbet Ness, 22 miles to the south and west. In May, a male was got north-east of Kinnaird Head, at a distance of 39 miles to the south and east. The last fish of the experiment to be recaptured was a male which was landed at Altona by a German trawler, and said to have been caught to the south-east of Great Fisher Bank, about Lat. 56° 52' N.; Long. 4° 34' E., or some 257 miles to the south and east of the station of liberation; it is, however, not improbable that the fish was taken in the Moray Firth, since no less than 20 of the recaptures from this experiment were landed at foreign ports, the foreign trawlers being at liberty to fish in the Moray Firth.

*Distances travelled*—10 miles and under.—Sixteen, or 32·6 per cent., were recaptured at distances of from 2½ to 10 miles, 8 males (38·1 per cent.), with an average of 5·7 miles, and 7 females (26·9 per cent.), with an average of 5·8 miles. Five of the males were taken to the north and west, 3 males to the south and west, 5 females to the south and east, and 2 to the north and east.

10 to 20 miles.—Four fish, or 8·2 per cent., were recaptured at distances of from 13 to 15½ miles. All were males (19 per cent.), 2 being taken to the north and east, 1 to the south and west, and 1 to the north and west.

Thus, 20 fish, or 40·8 per cent., were taken at distances under 20 miles, 12 males (57·1 per cent.), with an average of 8·5 miles, and 7 females (26·9 per cent.), with an average of 5·8 miles.

20 to 50 miles.—Twenty-one, or 42·9 per cent., were got at distances of from 20 to 47 miles, viz. 6 males (28·6 per cent.), with an average of 32·6 miles, and 15 females (57·7 per cent.), with an average of 32·7 miles. Two of the males and 2 of the females were found to the south and east; 2 of the males and 6 of the females to the south and west; 1 male and 7 females to the north and east, and 1 male to the west.

50 to 100 miles.—Six fish, or 12·2 per cent., were taken at distances of from 52 to 89½ miles, 3 males (14·3 per cent.), with an average of 70·3 miles, and 3 females (11·5 per cent.), with an average of 68·2 miles. One of the males was taken on the north coast, 1 off Cape Wrath, and the third off Auskerry; 1 female was taken off Auskerry, 1 off Start Point, Orkneys, and the third far offshore, to the eastward.

Over 100 miles.—Two fish, or 4·1 per cent., were recaptured at distances over 100 miles, 1 female W.S.W. of Cape Wrath, and a fish of unknown sex, represented to have been got by a German trawler near the Great Fisher Bank.

#### MATURITY.

*Males*.—The condition of the testes was recorded for only 9 of the 24 males recaptured. One was described as "spawning"; it was taken in February 1913, 9 miles to the north and west. Three were said to be "ripe"; 2 were taken in February 1912, 1, 5 miles to the north and west, and the other 10 miles to the south and west; the third was recaptured in March 1912, 23 miles to the westward. Two were "spent," 1 taken in March 1913, 15½ miles to the south and west, and 1 in May 1913, 39½ miles to the south and east. One, caught in February 1912, 5 miles to the north and west, was described as "three-quarters ripe."

*Females*.—The condition of the ovaries was recorded in 10 of the 30 recaptured. One was "spawning"; it was found in February 1913, 31 miles to the south and west, off Tarbet Ness. Two were "ripe," 1 taken in February 1913, 39 miles to the south and west, near Tarbet Ness, the other in March 1912, 31 miles to the north and east, off the Pentland Skerries. Three were described as "nearly ripe," 1 taken in November 1911, 24 miles to the north and east, another in November 1912, off Start Point, Orkney, 70 miles to the north and east, the third in February 1913, near Cape Wrath, 06 miles to the north and west.

## EXPERIMENT VI.

20th September 1912.

In this experiment, 101 plaice were marked and liberated, at a slightly different position, viz.  $58^{\circ} 5' N.$ ;  $2^{\circ} 30' W.$ , 47 being males, 53 females, and 1 of unknown sex. The males measured from 31 to 41 cm., and 3 were under adult size when liberated; the sizes of the females ranged from 32.5 to 59 cm., and 20 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 31-35.5	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	cm. 56-60.5	Total.
F. Lib.	10	27	8	3	2	3	53
F. Recap.	4	12	7	3	1	1	28
M. Lib.	18	28	1	—	—	—	47
M. Recap.	9	17	1	—	—	—	27
? Lib.	—	1	—	—	—	—	1
? Recap.	—	—	—	—	—	—	—

The fish used were taken by the "Goldseeker" in the Dornoch Firth, some hours before they were marked and liberated.

The number recaptured was 55, or 54.4 per cent., viz. 27 males (57.4 per cent.) and 28 females (52.8 per cent.). Twenty-five of the males were of adult size on recapture, measuring from 34.7 to 44 cm., and averaging 37.6 cm., as compared with a range of from 33.5 to 41 cm. and a mean of 36.8 cm., on liberation; they were free for from 19 to 524 days, the mean being 163 days; they migrated distances of from 0 to 88 miles, the average being 28.6 miles, and the mean rate 1.7 miles. Twenty-one of the females were of adult size on recapture, averaging 43.8 cm., and ranging from 39 to 59.3 cm., as against a range of from 32.5 to 59 cm., and an average of 42.4 cm. on liberation; they were at liberty for from 20 to 507 days, the mean being 160 days; they migrated distances of from 11 to  $63\frac{1}{2}$  miles, the mean being 23.4 miles, and the average rate 1.5 miles. Seven were under adult size, averaging 36.2 cm., as against 35.9 cm. on liberation; they were at liberty for a mean period of 127 days, and migrated from 7 to 44 miles, the mean being 19.2 miles, and the mean rate being 1.5 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—None was taken in September, but in October, 6 males and 5 females were recaptured; 1 of the males was taken at the place where it was liberated, after 30 days; 2 males were found off Noss Head by a German trawler, and landed at Geestemünde; another male was taken 7 miles to the north and west, and 1,  $13\frac{1}{2}$  miles to the north and east, and 1, 11 miles to the north and east; of the females, 3 were found at 11, 18, and 29 miles to the north and east; 2 females were taken to the north and west, at 7 and 13 miles respectively.

In November, 3 males and 5 females were got; 1 male was taken 27 miles to the north and west, near Noss Head, another 20 miles to the north and east, south-east of Noss Head, while a third was recaptured in an unusual position, near Tod Head, on the east coast, 88 miles to the southwards, having migrated at the mean rate of 15.2 miles per 10 days; of the females, 3 were taken to the north and west, 2 at 14 and 1 at  $28\frac{1}{2}$  miles, the latter close to Noss Head; 1 was recaptured 14 miles to the north and east, and 1, 32 miles to the south and east, near Rattray Head.

In December, 3 males and 4 females were recaptured, the position of 1 of the females not being recorded. Of the others, 2 were taken to the north and east at distances of  $15\frac{1}{2}$  and 25 miles, the fourth female being recaptured on the north coast at 63 miles distant, and the 3 males at  $15\frac{1}{2}$ , 16, and 25 miles distant to the north-east.

In this quarter, 26 fish, or 47.3 per cent., were recaptured; the positions were

known for 22, or 40 per cent., of which 12 (54·5 per cent.) were taken at the mean distance of 17·8 miles in the mean direction N. 26° E.; 8 (36·4 per cent.) at the mean distance of 22 miles, in the mean direction N. 33° W. The remaining 2 were recaptured to the south and east. An examination of the migration chart shows that the great majority of the fish were recaptured northward of the place of liberation, most of them to the south-east of Noss Head.

*Second Quarter.*—In January 1913, a male and a female were recovered, the female 15½ miles to the north and west; the male was got on the north coast, off Dunnet Head, at a distance of 60½ miles to the north and west.

Four males and 3 females were taken in February, all but 1 female to the north and west. Three were recaptured in the Dornoch Firth, 2 males and a female, at distances of 42 and 44 miles to the westwards; a male was got a little north of the Dornoch Firth, at a distance of 32 miles, and another off Clythness, at 24 miles distant; a female was recaptured off Noss Head, 24½ miles distant to the northward; the remaining female was taken to the east and south, at a distance of 26 miles.

In March, 2 males and 2 females were recaptured, the 2 males in the Dornoch Firth, at distances of 40 and 43½ miles to the westward; the 2 females were taken off Clyth Ness, 16 miles and 16½ miles north and west.

In this quarter, 13 of the marked plaice, or 23·6 per cent., were recovered, 12 (92·3 per cent.) at an average distance of 34 miles in the mean direction N. 55° W., and 1 to the south and east. The lines on the migration chart show a great difference from that for the first quarter, spreading, as they do, shorewards, from Tarbet Ness to Duncansby Head.

*Third Quarter.*—In April, 4 males and 2 females were recaptured, 1 of the males and 1 of the females being taken by foreign trawlers in the "Moray Firth"; the remaining female was got 11½ miles to the north and east, 1 of the males 18 miles to the north and west, off Clythness, another 14 miles to the north and east, and the last in Burchhead Bay, 40 miles to the south and west.

In May, a female was recovered in the Dornoch Firth, at a distance of 43 miles to the westward.

In June, a male and a female were found, the former 23 miles to the north and west, near Noss Head, the latter 16 miles in the same direction, off Clythness.

Thus, in this quarter, 9 fish were recaptured, or 16·4 per cent., the position being known for 7 (12·7 per cent.); 4 (57·1 per cent.) were found to the north and west, 2 to the north and east, and 1 to the south and west.

*Fourth Quarter.*—In July, a female was taken 14 miles to the north and west, and in August, another female almost in the same position.

Only 2, or 3·6 per cent., were taken in the fourth quarter.

In the 12 months following liberation, 50 of the fish, or 90·9 per cent., were recovered, the position being known for 44 (80 per cent.), and of those 26 (59·1 per cent.) migrated to the north and west, 14 (31·8 per cent.) to the north and east, 3 to the south and east, and 1 to the south and west.

Of the remaining fishes recaptured, a female was caught in December 1913, 21 miles to the north and west, and in February 1914, 3 males and a female were taken; the female was recaptured off Tarbet Ness, 31 miles to the south and west, 1 of the males north-east of Tarbet Ness, 38 miles to the north and west, and the other 2 males at 23 and 30 miles to the north and west.

*Distances travelled*—10 miles and under.—Two fish, or 4·1 per cent., went distances of 7 miles to the north and west, a female and a male.

10 to 20 miles.—Twenty fish, or 40·8 per cent., were found at distances of from 11 to 18 miles, 6 males (26·1 per cent.), with an average of 14·7 miles, and 14 females (53·8 per cent.), with an average of 14·5 miles. Five of the males and 5 of the females went to the north and east, 1 of the males and 9 of the females to the north and west.

Thus, 22 fish, or 44·9 per cent., were got at distances under 20 miles, 7 males (30·4 per cent.), with an average of 13·6 miles, and 15 females (57·7 per cent.) with an average of 14 miles.

20 to 50 miles.—Twenty-four fish, or 48·9 per cent., migrated from 20 to 44 miles, 14 males (60·9 per cent) with an average of 32·4 miles, and 10 females (38·5 per cent.), with an average of 30·5 miles. Eleven of the males and 5 of the females went

to the north and west, 2 of the males and 2 of the females to the north and east, 1 male and 1 female to the south and west, and 2 females to the south and east.

50 to 100 miles.—Three, or 6·1 per cent., were found within these limits, 2 males (8·7 per cent.), with an average of 74·25 miles, and 1 female (3·8 per cent.), which went 63·5 miles. The female and one of the males were found on the north coast to the north and west, and 1 male to the south and east, off Tod Head.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 16 of the 27 recaptured. Two were “spawning,” both taken in February 1913, to the north and west, 1 at 44 and the other at 24 miles distant. Seven were described as “ripe,” 1 caught in January 1913, on the north coast, off Dunnet Head, at a distance of 60½ miles to the north and west; 2 in February 1913, 32 miles and 42 miles to the north and west; 1 in March 1913, 40 miles to the north and west; 1 in April 1913, 14 miles to the north and east, 1 in February 1914, 38 miles to the north and west, and one in November 1912, 27 miles to the north and west. Three were said to be “nearly ripe,” all taken to the north and east, 1 in October, at a distance of 11 miles, 1 in November, at 20 miles, and 1 in December 1912, at a distance of 16 miles.

*Females.*—Of the 28 females recaptured, the condition of the ovaries was recorded only for 12. One was described as “ripe”; it was taken in August 1913, 14 miles to the north and west. One was “spent”; it was taken in April 1913, 11½ miles to the north and east. Seven were “nearly ripe”; 3 were found in October 1912, at 11, 18, and 29 miles to the north and east; 3 were recovered in November 1912, 1 at 14 miles north and east, 1 at 28 miles to the north and west, and 1 at 32 miles to the south and east; 1 was recaptured in December 1912, 15 miles to the north and east.

#### EXPERIMENT VII.

21st November 1912.

In this experiment, 51 plaice, viz. 26 males, 24 females, and 1 of unknown sex, were marked and liberated at 58° 10' N.; 2° 35' W. The males measured from 22 to 39·5 cm., and 9 were under adult size on liberation; the females ranged from 24·5 to 46 cm., and 17 were under adult size when liberated.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	Total.
F. Lib. . . . .	7*	6	10	—	1	24
F. Recap. . . . .	2	2	8	—	—	12
M. Lib. . . . .	5†	13	8	—	—	26
M. Recap. . . . .	1	8	6	—	—	15
? Lib. . . . .	—	—	1	—	—	1
? Recap. . . . .	—	—	—	—	—	0

\* One at 24·5 cm.

† One at 22 cm.

The fish used in the experiment were trawled by the “Goldseeker” in the Dornoch Firth on the 21st November, and were liberated later on the same day.

The number recaptured was 27, or 52·9 per cent., viz. 15 males (57·7 per cent.) and 12 females (50 per cent.). All the males recaptured were of adult size, ranging from 33·3 to 44·6 cm., and averaging 37·3 cm., as against a range of from 25·5 to 39·5 cm. and an average of 34·6 cm. on liberation; they were at liberty for from 0 to 830 days, the mean being 194 days; they travelled distances of from 11 to 58 miles, the average being 27·7 miles, and the mean rate 1·4 miles. Six of the females were of adult size on recapture, averaging 41·2 cm., as against 38·6 cm. on liberation; they were at liberty for a mean period of 218 days, and migrated distances of from 12½ to 49½ miles, at a mean rate of 1·6 miles. Six were under adult size, averaging 32·5 cm., against 32·1 cm.; they were free for a mean period of 120 days, and moved from 8 to 45 miles, the average being 22·2 miles, and the mean rate 1·9 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Two males and a female were recaptured in November, the female and 1 of the males to the north and east, at  $14\frac{1}{2}$  and 15 miles, and the other male in the Dornoch Firth, 38 miles to the south and west.

Two males were taken in December, both at the same place, on the north coast, off Dunnet Head, at a distance of 58 miles to the north and west, the rate of movement, per 10 days, in these cases being 41·4 miles.

A male and a female were recaptured in January 1913, the female 8 miles to the north and east, and the male near Tarbet Ness, 37 miles to the south and west.

In February, a male was taken to the north of Kinnaird Head, 24 miles to the south and east, and a female  $8\frac{1}{2}$  miles to the north and west, off Clythness.

In this quarter, including the 3 taken in November, 9 of the marked plaice, or 33·3 per cent., were recaptured, 3 to the north and east, 3 to the north and west, 2 to the south and west, and 1 to the south and east.

*Second Quarter.*—In March 1913, 3 males and 3 females were found, the males all to the north and west, at 11, 17, and 18 miles, off Clythness; 1 of the females was taken  $12\frac{1}{2}$  miles to the north and west, another in the Dornoch Firth, 45 miles to the south and west, and the third to the northwards, off Auskerry, Orkneys, at a distance of  $49\frac{1}{2}$  miles to the north and east.

In April, 1 male and 3 females were taken, 1 of the females in the "Moray Firth," precise position unknown, another near Banff, 29 miles to the south and west, and the third at Burghead Bay,  $38\frac{1}{2}$  miles to the south and west; the male was recaptured 17 miles to the north and west, off Noss Head.

In May, a male and a female were taken to the north and west, the male at a distance of 18 miles and the female at 11 miles.

Twelve, or 44·4 per cent., were recaptured in this quarter, the positions being known for 11, or 40·7 per cent.; of those, 7 (63·6 per cent.) were got to the north and west, 3 to the south and west, and 1 to the north and east.

During the remainder of the 12 months, only a single fish was recovered, a male, 23 miles to the north and west, so that, in the 12 months following liberation, the number recaptured was 22, or 81·5 per cent., the positions being known for 21, or 77·7 per cent., of which 11 (52·4 per cent.) were found to the north and west, 5 (23·8 per cent.) to the south and west, 4 to the north and east, and 1 to the south and east.

Of the 5 remaining plaice, 4 were taken in 1914 and 1 in 1915. A male and a female were found in February 1914, the male 20 miles to the westwards, in the direction of the Dornoch Firth; the female is described as having been taken at "Klen Ness," Moray Firth, which possibly means Clyth Ness. In March, a male was recaptured 23 miles to the north and west, and a female 29 miles to the south and west, near Tarbet Ness. In March 1915, a male was taken near Tarbet Ness, at the mouth of the Dornoch Firth, 39 miles to the south and west.

*Distances travelled*—10 miles and under.—Two fish, or 8 per cent., were recaptured under 10 miles, both being females (20 per cent.), 1 taken to the north and east, and the other to the north and west.

10 to 20 miles.—Nine of the marked plaice, or 36 per cent., were found at distances of from 11 to 18 miles, 6 males (40 per cent.), with an average of 16 miles, and 3 females (30 per cent.), with a mean of 12·8 miles. Five of the males and 2 of the females were found to the north and west, 1 of the males and 1 of the females to the north and east.

Thus, 11 fish, or 44 per cent., were taken under 20 miles, 6 males and 5 females.

20 to 50 miles.—Twelve, or 48 per cent., were taken at distances of from  $20\frac{1}{2}$  to  $49\frac{1}{2}$  miles, 7 males (46·6 per cent.), with an average of 29·2 miles, and 5 females (50 per cent.) with a mean of 38·3 miles. Three of the males and 4 of the females were recaptured to the south and west, 2 of the males to the north and west, a male to the south and east, and another directly west, and a female to the north and east.

50 to 100 miles.—Two males were taken on the north coast, each at a distance of 58 miles.

## MATURITY.

*Males.*—The condition of the testes was recorded for 8 of the 15 recaptured. Four were "spawning"; 1 was taken in February 1913, north of Kinnaird Head,



24 miles to the south and east; 1 was got in March 1913, 18 miles to the north and west, south of Clyth Ness, and 1 in March 1915, 39 miles to the south and west, at the entrance to the Dornoch Firth; the fourth was recovered in February 1914, 20 miles to the west, south-east of Berriedale Ness. One was described as "ripe"; it was taken in December 1912, off Dunnet Head, on the north coast, at a distance of 58 miles to the north and west. One, recaptured in January 1913, near Tarbet Ness, 37 miles to the south and west, was "nearly ripe."

*Females.*—The condition of the ovaries was described in 4 of the 12 recaptured. All were "immature."

#### EXPERIMENT VIII.

##### 27th March 1913.

In this experiment, 30 plaice were marked and liberated at 58° 10' N.; 2° 35' W., viz. 9 males and 21 females. The males measured from 31·5 to 36·5 cm., and 2 were under adult size. The females measured from 32 to 44·5 cm., and 15 were under adult size.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	Total.
F. Lib. . . . .	5	13	3	21
F. Recap. . . . .	2	2	1	5
M. Lib. . . . .	8	1	—	9
M. Recap. . . . .	4	1	—	5

The fish used were taken by the "Goldseeker" in the Firth of Forth, at Station VI., off St. Monans, on the afternoon of the 26th March, and they were liberated, after 21 hours in running water, all being in good condition.

The number recaptured was 10, or 33·3 per cent., 5 males (55·5 per cent.) and 5 females (23·8 per cent.). Four of the males were of adult size, averaging 38·3 cm. as against 33·6 cm. on liberation; they were at liberty for a mean period of 329 days, and migrated from 22 to 92 miles, the average being 65·2 miles, and the mean rate was 2 miles. Three of the females were of adult size, averaging 42·1 cm., as compared with 39·3 cm.; their periods of freedom averaged 177 days, and they travelled from 16 to 20 miles, the mean being 18 miles, and the average rate ·9 mile.

#### THE EXTENT AND DIRECTION OF MIGRATION.

A male and a female were recaptured in April, the male 10 miles to the north and east, and the female 13 miles to the north and west, off Berriedale Ness. A female was taken in June, 17 miles to the north and east, and in July another female was found, but its exact position was not ascertained. In September, a male went 18 miles W.N.W. of Stack Skerry (Lat. 59° 3' N.; Long. 5° 5' W.), 92½ miles to the north and west. Two females were taken in October, 1, 16 miles to the south and west, and the other 20 miles to the north and east.

In March 1914, 2 males were recaptured, 1 by a foreign frawler in the "Moray Firth," and the other 8 miles E. by N. of Sule Skerry (Lat. 59° 15' N.; Long. 4° 30' W.) 80 miles to the north and west. The last fish to be recaptured was a male, in June 1914, 22 miles to the north and west.

*Distances travelled.*—None was taken under 10 miles from the station, but between 10 and 20 miles there were 4, or 50 per cent., 1 male and 3 females, the male and 1 of the females to the north and east, a female to the north and west, and 1 to the south and west. Two were caught between 20 and 50 miles, a male 22 miles to the north and west, and a female 20 miles to the north and east. Two migrated between 50 and 100 miles, both males, which moved to the north and then westwards, distances of 80 and 92½ miles.

## MATURITY.

The condition of the testes was not ascertained in any of the males recaptured; the condition of the ovaries of 3 of the females was recorded. One, taken in October 1913, 20 miles to the north and east, was "nearly ripe"; the others were "immature."

## EXPERIMENT IX.

27th March 1913.

On the same day, 72 plaice, consisting of 22 males, 48 females, and 2 of unknown sex, were liberated at 58° 10' N.; 2° 30' W. They were part of the lot taken in the Firth of Forth on the previous day. The males measured from 29·5 to 37·5 cm., and 9 were under adult size on liberation; the females measured from 31 to 43 cm., and 31 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, are as follows:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	Total.
F. Lib. . . . .	—	24	19	5	48
F. Recap. . . . .	—	10	12	4	26
M. Lib. . . . .	2	16	4	—	22
M. Recap. . . . .	1	8	2	—	11
? Lib. . . . .	—	2	—	—	2
? Recap. . . . .	—	—	—	—	0

The number recaptured was 37, or 51·4 per cent., 11 males (50 per cent.) and 26 females (54·2 per cent.). All the males were of adult size when recaptured, measuring from 34 to 42·5 cm., and averaging 36·3 cm., as compared with a range of from 29·5 to 37·5 cm., and an average of 33·5 cm. on liberation; they were at liberty for from 24 to 485 days, the mean being 199 days; they travelled from 13 to 39 miles, the average being 23·5 miles, and the mean rate 1·1 miles. Twenty of the females were of adult size, averaging 43·5 cm., and ranging from 38·7 to 51·3 cm., as against a range of from 32·5 to 43 cm., and an average of 38·2 cm. on liberation; they were free for from 6 to 1098 days, the average being 310 days; they migrated from 7 to 69 miles, the mean being 25·7 miles, and the mean rate ·8 mile. Six of the females were under adult size, the average being 34 cm., as compared with 34·2 cm. on liberation; they were at liberty for a mean period of 30 days, and travelled from 13 to 45 miles, the mean being 19·3 miles, and the mean rate 6·3 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—One male and 6 females were recaptured in April; the position of the male was recorded merely as "Moray Firth"; all the females were taken to the north and west, at distances of from 10½ to 19 miles, mostly towards Clyth Ness, or Berriedale Ness.

Two males and 3 females were recaptured in May, 1 male 14 miles to the north and west, and the other 30 miles to the south and west, near Buckie; 2 of the females were taken to the north and east, at 13 and 14 miles, south-east of Noss Head; and the third was caught in Burghead Bay, 45 miles to the south and west.

None was taken in June, so that the total recaptures in the first quarter were 12, or 32·4 per cent., the place of capture being known for 11, or 29·7 per cent.; of those, 7 were taken to the north and west, and 2 each to the north and east and south and west.

*Second Quarter.*—In July, a female was taken near Noss Head, 24 miles to the north and west, and in August 2 females at 7 and 9 miles to the north and east.

Two males and a female were taken in September, the place of capture of the female being somewhat uncertain, but it was landed at Cromarty, in the Moray Firth; the males were taken together, 14 miles to the north and west, south-east of Clyth Ness.

Six, or 16·2 per cent., were taken in this quarter, the position being known for 5, of which 3 were taken to the north and west, and 2 to the north and east.

*Third Quarter.*—A male and 3 females were taken in October, the male 15 miles to the north and west, and 2 of the females at 25 miles to the north and west, near Noss Head; the third female was caught north-east of Kinnaird Head, 29 miles to the south and east.

Two males were recaptured in November, 34 miles to the north and west, off Brora.

In this quarter, 6 fish, or 16·2 per cent., were taken, 5 to the north and west, and 1 to the south and east.

*Fourth Quarter.*—In January 1914, a female was taken 7 miles to the north and west, and in February, 2 females, one near Tarbet Ness, 33 miles to the south and west, and the other on the north coast, off Dunnet Head, 48 miles to the north and west.

One male and 4 females were caught in March; the place of capture of one of the females was not recorded; all the others were taken to the north and west, one off Berriedale Ness, at a distance of 15 miles; the other 2 females were recovered on the north coast, off Strathie Point, at distances of 68 and 69 miles.

In this quarter, 8 fish, or 21·6 per cent., were recaptured, the position being known for 7 (18·9 per cent.), and 6 of those were found to the north and west, and 1 to the south and west.

Altogether, within the 12 months after liberation, 32 of the marked plaice, or 86·5 per cent., were recaptured, the position being known for 29 (78·4 per cent.), of which 21 (72·4 per cent.), were found to the north and west, 4 to the north and east, 3 to the south and west, and 1 to the south and east.

Of the remaining 4 fishes which were recaptured, a female was taken in May 1914, 18 miles to the north and east, a male in July 39 miles to the south and west near Tarbet Ness, and 2 females in March 1916, one 17 miles to the north and west, and the other, after 1098 days, close to Clyth Ness, 24 miles to the north and west.

*Distances travelled*—10 miles and under.—Three fish, or 8·8 per cent., were taken under 10 miles, all females (12·5 per cent.), with an average of 8 miles; two went to the north and east, and 1 to the north and west.

10 to 20 miles.—Sixteen, or 47 per cent., were recaptured at distances of from 10½ to 19 miles, 5 males (50 per cent.), with an average of 14 miles, and 11 females, (45·8 per cent.), with an average of 15 miles; all the males and 8 of the females were found to the north and west, and 3 of the females to the north and east. Thus, 19, or 55·9 per cent., were recaptured at distances under 20 miles, 5 males, with an average of 14 miles, and 14 females (58·3 per cent.), with a mean of 13·4 miles.

20 to 50 miles.—Thirteen, or 38·2 per cent., were recaptured at distances of from 24 to 48½ miles, 5 males (50 per cent.), with an average of 33·1 miles, and 8 females (33·3 per cent.), with a mean of 31·7 miles; 3 of the males and 5 of the females were found to the north and west; 2 of the males and 2 of the females to the south and west, and 1 female to the south and east.

50 to 100 miles.—Two fish, or 5·9 per cent., were got between these distances; both were females (8·3 per cent.), which were taken on the north coast, at 68 and 69 miles respectively.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in only 1 case; it was "immature."

*Females.*—The condition of the ovaries was recorded for 11 of the 26 females taken. Two were "spawning," one in March 1914, on the north coast, at a distance of 69 miles, and the other in March 1916, 24 miles to the north and west, near Clyth Ness. One was described as "ripe"; it was caught in February 1914, on the north coast off Dunnet Head, 48 miles to the north and west. Two were described as "spent," one found in March 1914, on the north coast, at a distance of 68 miles to the north and west, and the other in May 1914, 18 miles to the north and east, off Rattray Point.

## EXPERIMENT X.

11th November 1913.

In this experiment, 100 plaice were marked and liberated at 58° 10' N.; 3° 2' W., viz. 51 males and 49 females. The males measured from 23·5 to 46 cm., and 13 were under adult size; the females ranged from 25 to 55 cm., and 14 were under adult size on liberation.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	Total.
F. Lib.	7	4	14	12	9	3	49
F. Recap.	1	3	8	2	2	2	18
M. Lib.	9*	6	18	17	1	—	51
M. Recap.	—	1	6	9	—	—	16

\* One at 23·5 cm.

The fish used in this experiment were taken by the "Goldseeker" in Burghead Bay, on the same day as they were liberated.

The number recaptured was 34, or 34 per cent.—a very small proportion—viz. 16 males (31·4 per cent.) and 18 females (36·7 per cent.). All the males recaptured were of adult size, measuring from 38·8 to 44 cm., and averaging 41·4 cm., as compared with a range of from 32·5 to 43·5 cm. and a mean of 41·2 cm. on liberation; they were at liberty for from 87 to 822 days, the mean being 186 days; they migrated distances of from 3½ to 28½ miles, the mean being 18·3 miles, and the average rate ·9 mile. Of the females, 14 were of adult size, measuring from 38 to 55·2 cm., the average being 44·1 cm., as against a range of from 35·5 to 55 cm., and an average of 43 cm. on liberation; they were at liberty for from 89 to 695 days, the average being 217 days; they travelled distances of from 4 to 277 miles, the mean being 60·4 miles, and the average rate 2·8 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Only 1 fish was recaptured in this quarter, a male, which was taken in January 1914, 4½ miles to the north and west.

*Second Quarter.*—Eight males and 3 females were taken in February, but the place of capture of 1 male was unknown. Of the other 7, 6 were found to the south and west, 1 at 11 miles, and 5 near Tarbet Ness, at the entrance to the Dornoch Firth, at distances of 24, 26, and 27 miles; the remaining male was captured farther to the north, south-east of Berriedale Ness, at a distance of 11 miles; the 3 females were all taken to the south and west, 2 to the east of Tarbet Ness, at distances of 21 and 29 miles, and 1 at Burghead, at a distance of 28 miles.

Four males and 4 females were taken in March; the place of capture of 1 of the males was unknown; 2 were taken to the south and west, at Burghead, and near Tarbet Ness, distances of 28 and 25 miles; the remaining male was taken on Smith Bank, 3½ miles to the south and east; 2 of the females were recaptured to the south and west, at Burghead, distances of 29 and 34 miles; 1 was taken 4 miles to the north and west, and 1, 6½ miles to the north and east.

Three females were recaptured in April, 1, 5 miles to the north and west 1. 27 miles to the south and west, off Tarbet Ness, and 1, 16 miles south of Sule Skerry, off the north coast, 76 miles to the north and westwards.

In this quarter, 22 of the marked plaice, or 64·7 per cent., were recaptured, the place being known for 20 (58·8 per cent.), and of those, 14, or 70 per cent. were taken to the south and west, at an average distance of 26 miles, in the mean direction S. 63° W., 3 to the north and west, 2 to the north and east, and 1 to the south and east.

*Third Quarter.*—Three females were taken in May, all to the northwards, 1 close to Noss Head, 19 miles to the north and east, 1 at the Pentland Skerries, 37 miles to the north and east, and the third on the west coast of Scotland, 7 miles W.S.W. of Dubh Artach (Lat. 56° 3' N.; Long. 6° 47' W.), a distance of 277 miles,

first to the northwards, then westwards, and then southwards; in this case the mean rate of movement, per 10 days, was 16.1 miles.

Two females and a male were taken in June, the male 10 miles to the north and east, both females to the north and west, at distances of 18 and 25 miles to the south of Berriedale Ness.

In this quarter, 6 fish, or 17.6 per cent., were recaptured, 4 to the northwards, and 2 to the westwards and northwards.

*Fourth Quarter.*—None was recovered during this period, so that the total for the year was 29, or 85.3 per cent., the position being known for 27, or 79.4 per cent., of which 6 had moved towards the north and east, 6 to the north and west, 14 to the south and west (51.8 per cent.), and 1 to the south and east.

Of the remaining fish, 3 were taken in 1915, and 1 in 1916. In February 1915, a female was caught on the bank opposite "Traigh Mhor," Aisaig, on the west coast of Inverness (Lat. 55° 56' N.; Long. 5° 54' W.), and landed at Oban; the distance migrated was 217 miles, and the mean rate of movement 4.7 miles. In March a male was recaptured 5 miles to the north and west, and in October, a female, at Burghead, 34 miles to the south and west. The last fish to be taken, a male, was found in February 1916, after 822 days, off Brora, in the Dornoch Firth, 26 miles to the south and west. One of the marked plaice, a male, was landed at Hull, in March 1914, and said to have been caught "off East Horne, Iceland."

The chart showing the lines of migration represents the great majority of the fish as having moved to the south and west, from the south of Berriedale Ness to a little east of Burghead. Eight were taken in the Dornoch Firth, or near it, and 5 in the vicinity of Burghead.

*Distances travelled—10 miles and under.*—Seven, or 22.6 per cent., were found at distances of from 3½ to 10 miles, 4 males (28.6 per cent.), with an average of 5.7 miles, and 3 females (17.6 per cent.), with an average of 5.2 miles; 2 of the males and 2 of the females were found to the north and west, 1 male and 1 female to the north and east, and a male to the south and east.

*10 to 20 miles.*—Four, or 12.9 per cent., were taken at distances of from 11 to 19 miles, 2 males (14.3 per cent.), with an average of 11 miles, and 2 females (11.8 per cent.), with an average of 18.75 miles; a male and a female were got to the north and west, a male to the south and west, and a female to the north and east.

Eleven, or 35.5 per cent., were thus recaptured under 20 miles, 6 males (42.8 per cent.), with a mean of 7.5 miles, and 5 females (29.4 per cent.), with a mean of 10.6 miles.

*20 to 50 miles.*—Seventeen, or 54.8 per cent., moved from 21½ to 37 miles, 8 males (57.1 per cent.), with an average of 26.4 miles, and 9 females (52.9 per cent.), with an average of 29.5 miles; all the males and 7 of the females were found to the south and west, and 1 female to the north and east, and 1 to the north and west.

*50 to 100 miles.*—One fish, or 3.2 per cent., was got at a distance of 76 miles to the north and then west; it was a female (5.9 per cent.).

*Over 100 miles.*—Two, or 6.45 per cent., were taken on the west coast, both females (11.8 per cent.), at 217 and 277 miles respectively.

#### MATURITY.

*Males.*—The condition of the testes was recorded for 10 of the 16 recaptured. Of these, no less than 7 were described as "spawning"; 6 were recaptured in February 1914, 5 to the south and west, 1 at a distance of 11 miles, and 4 at the outer part of the Dornoch Firth, 24, 26, 27, and 27 miles distant; the fifth was taken 11 miles to the north and west, south of Berriedale Ness; 1 was got in March 1914, near Tarbet Ness, at the mouth of the Dornoch Firth; all these males were well over adult size, measuring from 38.8 to 42.7 cm.; 1 was found in January 1914, 4½ miles to the north and west, and was described as "nearly ripe," and another, caught in February 1914, was "spent," but the place of capture was not ascertained.

*Females.*—The condition of the ovaries was recorded in 9 of the 18 recaptured. None was "spawning" or "ripe." Four were described as "spent," 1 in March

1914, 34 miles to the south and west, near Burghead, 1 in April 1914, 27½ miles to the south and west, in the Dornoch Firth, another in May 1914, taken at Dubh Artach, on the west coast of Scotland, at a distance of 277 miles, and the fourth in October 1915, 34 miles to the south and west, near Burghead. A female, measuring 40·40·8 cm., was taken in March 1914, 6½ miles to the north and east, and was "immature."

EXPERIMENTS 15 MILES E. ½ N. OF TARBET NESS, MORAY FIRTH.

On three occasions, marked plaice were liberated at a position 15 miles E. ½ N. of Tarbet Ness (57° 58' N. ; 3° 21' W.), the depth of water being 21 fathoms.

Place.	Date.	Liberated.				Recaptured.				Percentages Recaptured.			
		♂	♀	(?)	Total.	♂	♀	(?)	Total.	♂	♀	(?)	Total.
15' E. ½ N. of Tarbet Ness, (Moray Firth).	14 Mar. 1911.	21	29	...	50	9	10	...	19	42·9	34·5	...	38·
	19 April 1911.	20	26	...	46	12	9	...	21	60·	34·6	...	45·7
	15 Sept. 1911.	60	65	...	125	30	33	...	63	50·	50·8	...	50·4
	Totals.	101	120	...	221	51	52	...	103	50·	43·	...	47·

EXPERIMENT I.

14th March 1911.

The first experiment was made on 14th March 1911, when 50 marked plaice were liberated. They comprised 21 males, varying from 17 to 32·5 cm. in length, all being under adult size, and 29 females, of from 22 to 53·5 cm., of which 24 were under adult size.

The fish used in this experiment were taken in the Dornoch Firth on the same day.

The number recaptured was 19, or 38 per cent., namely 9 males (42·9 per cent.) and 10 females (34·5 per cent.). Six of the males were of adult size, averaging 37·35 cm. ; they had been at liberty for an average period of 475 days, and had migrated from 13 to 116 miles, the mean being 42·5 miles. Three of the males were under adult size on recapture, averaging 27·2 cm., and being at liberty for a mean period of 39·6 days, having travelled a mean distance of 17·6 miles. Three of the females were of adult size, averaging 44·5 cm. ; they were free for an average period of 522 days, and had travelled a mean distance of 77·6 miles. Seven of the females were under adult size, averaging 32·9 cm. ; they were at liberty for a mean period of 154 days, and had moved an average distance of 18·2 miles.

THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Three males and 4 females were taken in April 1911, 2 of the males off Embo Point, at 18 and 19 miles distant, and the third off Tarbet Ness, 15 miles to the south and west ; 1 of the females was found in the Dornoch Firth, 18 miles to the north and west ; another 2 miles off Golspie, also 18 miles to the north and west ; the third off Burghead, 7½ miles to the south and west ; and the fourth east of Clyth Ness, 27 miles to the north and east.

Thus, 7, or 36·8 per cent., were taken in the first quarter, 4 to the north and west, 2 to the south and west, and 1 to the north and east.

*Second Quarter.*—In this period, only 1 fish was recaptured, a male, caught in August off Embo Point, 20 miles to the north and west.

*Third Quarter.*—One was taken in November, a female, at an unspecified locality in the Moray Firth.

*Fourth Quarter.*—In the fourth quarter, 3 fish were recaptured, a male in December, on Smith Bank, 20 miles to the north and east. In January 1912, a female was taken 13 miles to the south and east, and in February 1912, another female off Golspie, 18 miles to the north and west.

In the 12 months following liberation, 12 fish, or 63·2 per cent., were recovered, positions being known for 11, of which 6 were taken to the north and west, 2 each to the north and east and south and west, and 1 to the south and east.

Of the remaining fish, 5 were found in 1912, 1 in 1913, and 1 in 1914.

In March 1912, a male was caught at an unspecified position in the Moray Firth. In April, another male was got in the Moray Firth, also at a position unrecorded, and a female 19 miles to the north and west, off Dunrobin Castle. A female was taken in June, 84 miles to the north and east, off Start Point, Orkney. The next fish to be recaptured was a male, which was taken in November 1912, in the Dornoch Firth, 13 miles to the north and west; then, a female in May 1913, off Foula, 136 miles to the north and east; and the last, a male, in January 1914, after 1028 days, 8 miles south-west of Cape Wrath, at a distance of 116 miles.

*Distances travelled*—10 miles and under.—Only 1, or 6·25 per cent., was got within this distance, a female (11·1 per cent.) taken  $7\frac{1}{2}$  miles to the south and west.

10 to 20 miles.—Nine, or 56·25 per cent., were found at distances of from 13 to  $19\frac{1}{2}$  miles, viz. 4 males (57·1 per cent.), with an average of 16·5 miles, and 5 females (55·5 per cent.), with a mean of 17·5 miles. Three of the males and 4 of the females were found to the north and west. 1 male to the south and west, and 1 female to the south and east.

Thus, 10, or 62·5 per cent., were recaptured within distances of 20 miles, 4 males and 6 females.

20 to 50 miles.—Three, or 18·75 per cent., were found at distances of from 20 to 27 miles, 2 males (28·6 per cent.), 1 to the north and east, and 1 to the north and west, and a female to the north and east.

50 to 100 miles.—Only 1, a female, was taken within these limits, 84 miles to the north and west, off Start Point, Orkneys.

Over 100 miles.—A male was taken off Cape Wrath, at a distance of 116 miles, and a female at Foula, Shetland, at a distance of 136 miles to the north and west.

#### MATURITY.

*Males.*—The condition of the testes was ascertained in 4 out of the 9 recaptured. None was “spawning” or “ripe,” but 1, caught in January 1914, near Cape Wrath, at a distance of 116 miles, was “nearly ripe.”

*Females.*—The condition of the ovaries of 5 of the 10 recovered was recorded. The nearest to the ripe condition was 1, “three-quarters ripe,” taken in January 1912, 13 miles to the south and east.

#### EXPERIMENT II.

19th April 1911.

In this experiment, 46 marked plaice were liberated, at the same position as in Experiment I., 15 miles E.  $\frac{1}{2}$  N. of Tarbet Ness, viz. 20 males and 26 females. The males ranged in size from 24·5 to 44·5 cm., and 12 were under adult size; the sizes of the females were from 24 to 62 cm., and 12 were under adult size on liberation.

The fish were taken by the “Goldseeker” in the Dornoch Firth on the 17th April, and kept in tubs until the 19th, owing to rough weather; only 1 of the fish died in the interval.

The number recaptured was 21, or 45·7 per cent., viz. 12 males (60 per cent.) and 9 females (34·6 per cent.). Nine of the males were of adult size, averaging 39 cm., and ranging from 34·6 to 45·5 cm.; they were free for from 170 to 1073 days, the mean period being 368 days; they travelled an average distance of 51·6 miles, the mean rate being 1·3 miles. Three were under the adult size on recapture, averaging 32·1 cm.; they were free for a mean period of 236 days, and travelled an average distance of 12·3 miles, at a mean rate of ·5 mile per 10 days. Six of the females were of adult size, varying from 39·5 to 52·8 cm., and averaging 47·1 cm.; they were at liberty for a mean period of 478 days, and had moved an average

distance of 15.9 miles at the mean rate of .3 mile. Three were below the adult size, averaging 32.5 cm., and were free for a mean period of 191.6 days.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Only 1 fish, a male, was taken in this quarter, viz. in May, 16½ miles to the south and west, near Portmahomack.

*Second Quarter.*—In September, a female was got at an unspecified place in the Moray Firth, and in October, a male off Burghead, 15½ miles to the south and west.

*Third Quarter.*—Two females were found in November, 1 at an unspecified place in the Moray Firth, and the other in the Dornoch Firth, 23 miles to the westwards. A male was taken in December, at Smith Bank, 18 miles to the north and east, and another male in January 1912, recorded as caught in the "Moray Firth." Only 4, therefore, were recaptured in this quarter.

*Fourth Quarter.*—Three males and 2 females were recaptured in February 1912, 2 of the males and the 2 females to the north and west, at distances of from 12 to 19 miles, a female and 1 of the males in the Dornoch Firth, close inshore, and 1 of the males south-west of Berriedale Ness; the remaining male had taken a long journey, and was recaptured 16 miles W.S.W. of Cape Wrath, at a distance of 131½ miles. Three males were taken in March, all to the northwards, 1 at a distance of 9 miles, off Berriedale Ness, 1 off Strathie Point, Orkneys, at 85 miles, and the third on the north-west coast, 8 miles N.W. of Loch Inchard, at a distance of 128 miles. A male was recovered in April, 11½ miles to the north and west, at the mouth of the Dornoch Firth.

In the 12 months following liberation, 16 of the marked plaice, or 76.2 per cent., were taken, positions being known for 13, or 61.9 per cent.; 5 had moved to the north and east, 5 to the north and west, 2 to the south and west, and 1 to the west.

A female was recaptured in July 1912, 13 miles to the north and west, off Berriedale Ness. In February 1913, 3 females were taken, the position of capture of 1 being unknown; the other 2 were found to the north and west, in the Dornoch Firth, at 15½ and 17 miles. The last fish to be taken was a male caught in March 1914, after 1073 days, only 7½ miles distant, to the south and west.

*Distances travelled—10 miles and under.*—Two, both males, were taken under 10 miles, 1 to the north and east, and the other to the south and west.

*10 to 20 miles.*—Eleven, or 64.7 per cent., were taken at distances of from 12 to 19 miles, 6 males (54.5 per cent.), with an average of 14.7 miles, and 5 females (83.3 per cent.), with a mean of 15.9 miles; 3 of the males and all the females were found to the north and west, 1 male to the north and east, and 2 to the south and west.

*20 to 50 miles.*—Only 1, a female, was recaptured within these limits, 23 miles to the westwards.

*50 to 100 miles.*—A male was taken 85 miles to the north and east.

*Over 100 miles.*—Two males were recaptured on the west coast, 1 north and east of Cape Wrath, at a distance of 131 miles, and the other off Loch Inchard, at a distance of 128 miles.

#### MATURITY.

*Males.*—The condition of the testes was recorded for 3 of the 12 recaptured. One, caught in March 1914, after 1073 days, 7½ miles to the south and west, was "spawning," and another, taken in March 1912, off Strathie Point, north coast, at a distance of 85 miles to the north and east, was "ripe."

*Females.*—The condition of the ovaries was ascertained in 6 of the 9 recaptured. One was "spawning"; it was taken in February 1913, 15½ miles to the north and west, in the Dornoch Firth; another, found in February 1912, 15 miles to the north and west, in the Dornoch Firth, was "nearly ripe," and the third, recaptured in February 1912, in the Dornoch Firth, at a distance of 19 miles to the north and west, was "spent."

#### EXPERIMENT III.

15th September 1911.

In this experiment, 125 plaice were marked and liberated on the 15th September 1911, 60 males and 65 females. The males ranged in size from 25 to 48 cm., and



33 were under adult size ; the sizes of the females varied from 23 to 58·5 cm., and 42 were under adult size.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows :—

	cm. 20-24·5	cm. 25-30·5	cm. 31-35·5	cm. 36-40·5	cm. 41-45·5	cm. 46-50·5	cm. 51-55·5	cm. 56-60·5	Total.
F. Lib.	2	19	16	14	5	3	4	2	65
F. Recap.	—	10	7	11	1	—	3	1	33
M. Lib.	—	22	27	7	2	2	—	—	60
M. Recap.	—	9	14	4	1	2	—	—	30

The fish were taken by the "Goldseeker" in the Dornoch Firth on the 14th September ; they were marked between 3 and 4 p.m. and liberated next day between 4 and 5 p.m. ; none of the fish died while in the tanks.

Twenty-four of the males were of adult size on recapture, ranging from 33 to 47·3 cm., and averaging 37·8 cm. ; they were free for from 33 to 910 days, the mean being 299 days ; they migrated distances of from 3½ to 124 miles, the mean being 26·6 miles, and the average rate ·85 mile per 10 days. Six of the males were under adult size, averaging 30·3 cm., as compared with 29·5 cm. on liberation ; they were at liberty for from 35 to 176 days, the mean being 108 days, and they travelled distances of from 19 to 24 miles, the mean being 21 miles, and the average rate 1·8 miles. Fifteen of the females were of adult size on recapture, averaging 44·4 cm., and ranging from 39 to 58·3 cm., as compared with a range of from 36 to 58·5 cm. and a mean of 42·1 cm. on liberation ; they were free for from 141 to 583 days, the average being 242 days ; they travelled distances of from 11 to 122 miles, the mean being 42·1 miles, and the average rate 1·9 miles. Eighteen of the females were under adult size, averaging 32·8 cm., and ranging from 29 to 37·7 cm., as against a range of from 26 to 36 cm., and an average of 30·6 cm. on liberation ; they were at liberty for from 58 to 593 days, the mean period being 223 days ; they migrated distances of from 7 to 25 miles, the mean being 18·9 miles, and the mean rate ·9 mile.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—Three males were recaptured in October, 1 at an unspecified position in the Moray Firth, and 2 far into the Dornoch Firth, at 20½ and 21 miles to the north and west. Three males and 5 females were taken in November, a male and a female simply in the "Moray Firth" at unspecified localities. One male and 3 females were found far into the Dornoch Firth, in the same region as those taken in October, at 20 miles to the north and west ; 1 male and 1 female were got south-east of Clyth Ness, at 16½ miles to the north and east. In December, a female was caught on Smith Bank, 25 miles to the north and east.

Thus, in this quarter, 12, or 19 per cent., were taken, the position of capture being known for 9, or 14·3 per cent. ; 6 were found to the north and west, and 3 to the north and east ; 6 of the fish, or 67 per cent., returned to the Dornoch Firth.

*Second Quarter.*—A female was recaptured in January 1912, far into the Dornoch Firth, off Embo, 20 miles to the north and west. In February, 9 males and 6 females were taken, 7 of the males and 5 of the females in the Dornoch Firth, at distances of from 11 to 25 miles, and the other 3, 2 males and a female, at, or near, Smith Bank, 25 and 26 miles to the north and east. Five males and 6 females were recaptured in March, 1 female at an unspecified place in the Moray Firth, 3 males and 2 females in the Dornoch Firth, at distances of from 11 to 21 miles, 1 female close to Clyth Ness, 20 miles to the north and east, and a male to the south-east of Clyth Ness ; another female was taken south-east of Berriedale Head, 14 miles to the north and east, and another on the north coast of Scotland, off Strathie Point, at a distance of 80 miles.

Twenty-seven were taken in the second quarter, or 42·8 per cent., the positions of all but 1 being known (41·3 per cent.) ; 15 were found to the north and west, 7 to the north and east ; 18 of the fish, or 69 per cent., had returned to the Dornoch Firth.

*Third Quarter.*—One male and 5 females were recaptured in April, 1 female within the Dornoch Firth, off Embo, at a distance of 18 miles; all the other fish had migrated to the north and east; the male was taken south-east of Noss Head, at a distance of  $31\frac{1}{2}$  miles; 2 females farther north and nearer shore, at distances of 37 and 40 miles; another female on the north coast, at Stormy Bank, a distance of 74 miles; and the last on the west coast, 14 miles W.S.W. of Cape Wrath, at a distance of 122 miles. A male was taken in May north-west of Kinnaird Head, 33 miles to the eastwards, and in June, a female, off the north coast, north-west of Stroma, 76 miles distant.

Thus, in this quarter, 8 of the marked plaice, or 12·7 per cent., were recovered 6 of them to the north and east.

*Fourth Quarter.*—None was taken in July and August, but a male and 3 females were recaptured in September, all of them to the westward, within the Dornoch Firth, at distances of from 13 to 25 miles.

Within 12 months of liberation, 51 of the marked plaice, or 80·9 per cent., were recaptured, the positions being known for 47, or 74·6 per cent.; 25 (53·2 per cent.) were got to the north and west, 16 to the north and east, and 2 each to the south and east, south and west, and directly west.

Of the remaining fish recaptured, 2 were taken in the remainder of 1912, 8 in 1913, and 2 in 1914.

In October 1912, a female was taken in the Dornoch Firth,  $18\frac{1}{2}$  miles to the north and west, and in December, a male,  $36\frac{1}{2}$  miles to the north and east, north-west of Rattray Head.

In January 1913, a male was caught on the north coast, off Dunnet Head, at a distance of 66 miles. In February, a female off Clythness,  $17\frac{1}{2}$  miles to the north and east; in March, 2 males  $3\frac{1}{2}$  and  $5\frac{1}{2}$  miles distant, east of Taret Ness; and in April a male and 3 females, the male south and east of Clyth Ness,  $22\frac{1}{2}$  miles to the north and east, 1 of the females 7 miles to the north and east, another at an unspecified place in the Moray Firth, and the third probably in the Dornoch Firth, as it was forwarded from Embo, but the place of capture was not ascertained.

In February 1914, a male was taken off Lybster, Caithness, 13 miles to the north and east, and in March another male on the west coast, 16 miles W.S.W. of Cape Wrath, at a distance of 124 miles.

*Distances travelled*—10 miles and under.—Three, or 5·3 per cent., were found at distances of 10 miles and under, viz. 2 males, with an average of 4·5 miles, to the south and west, and 1 female to the north and east.

10 to 20 miles.—Twenty-one, or 36·8 per cent., were recaptured at distances of from 11 to  $19\frac{1}{2}$  miles, 10 males (35·7 per cent.), with an average of 14·05 miles, and 11 females (37·9 per cent.), with a mean of 16 miles. Six of the males and 8 of the females were found to the north and west; 2 males and 3 females to the north and east; and 2 males to the south and west.

Thus, 24 of the marked plaice, or 42·1 per cent., were recaptured at distances under 20 miles, 12 males and 12 females.

20 to 50 miles.—Twenty-six, or 45·6 per cent., were recaptured at distances of from 20 to  $40\frac{1}{2}$  miles, 13 males (46·4 per cent.), with an average of 25·1 miles, and 13 females (44·8 per cent.), with an average of 24·4 miles. Five of the males and 7 of the females were found to the north and west; 5 of the males and 5 of the females to the north and east; 2 of the males to the south and east; and 1 male and 1 female directly west.

50 to 100 miles.—Five, or 8·8 per cent., were caught at distances of from 51 to 80 miles, 2 males (7·1 per cent.), with an average of 58·5 miles, and 3 females (10·3 per cent.), with an average of 76·8 miles; they all moved northwards along the coast.

Over 100 miles.—Two, or 3·5 per cent., were found at distances over 100 miles, a male and a female, both taken near Cape Wrath, at 124 and 122 miles respectively.

#### MATURITY.

*Males.*—The condition of the testes of 19 of the 30 males recaptured was ascertained. Two were "spawning," 1 taken in January 1913, off Dunnet Head, north coast, at a distance of 66 miles, and the other in March 1914, near Cape Wrath, at

a distance of 124 miles. Four were "ripe," 3 recaptured in February 1912, all at the mouth of the Dornoch Firth, at distances of 11, 11, and  $15\frac{1}{2}$  miles, and 1 in March 1912, in the same locality, at a distance of  $15\frac{1}{2}$  miles. Two were described as "spent," 1 found in March 1912, and 1 in February 1914, the former at the entrance to the Dornoch Firth, at a distance of  $11\frac{1}{2}$  miles, and the other 13 miles to the north and east. Two were "nearly ripe," 1 taken in February 1912, 26 miles to the south and east, and the other in December 1912, 36 miles to the north and east.

*Females.*—The condition of the ovaries of 21 of the 33 females was recorded. One was "spawning"; it was caught in February 1913, off Clyth Ness, 17 miles to the north and east, and it measured only 37.7 cm., and would have been classified as under the adult size. Two were "ripe," both caught in March 1912, 1, 11 miles to the north and west, and the other on the north coast, off Strathie Point, 80 miles distant. Three were "spent," all got in April 1912, 1 off Noss Head, 37 miles to the northwards, another off the north coast, at Stormy Bank, at a distance of 74 miles, and the third near Cape Wrath, on the west coast, at a distance of 122 miles.

#### EXPERIMENT NEAR BURGHEAD, MORAY FIRTH.

12th December 1913.

On 12th December 1913, 100 plaice were marked and liberated off Burghead, on the south coast of the Moray Firth, at a position  $2\frac{1}{2}$  miles N.W. by W.  $\frac{1}{2}$  W. (Lat.  $57^{\circ} 42' N.$ ; Long.  $3^{\circ} 34' W.$ ) in a depth of 6 fathoms. The males ranged in size from 38 to 46.5 cm., and all were thus of adult size. The females varied from 39 to 56 cm., all being of adult size.

The numbers liberated and recaptured, arranged in 5-cm. groups, were as follows:—

	cm. 36-40.5	cm. 41-45.5	cm. 46-50.5	cm. 51-55.5	cm. 56-60.5	Total.
F. Lib. . . . .	4	29	16	2	1	52
F. Recap. . . . .	3	15	7	—	—	25
M. Lib. . . . .	9	36	3	—	—	48
M. Recap. . . . .	5	20	3	—	—	28

The fish used were taken in Burghead Bay by the "Goldseeker."

The number recaptured was 53, or 53 per cent., viz. 28 males (58.3 per cent.) and 25 females (48.1 per cent.). The sizes of the males ranged from 38.5 to 47 cm., and averaged 42.6 cm., as compared with a range of from 38 to 46.5 cm., and a mean of 42.5 cm. on liberation; they were at liberty for from 13 to 441 days, the average being 123 days; they travelled distances of from  $2\frac{1}{2}$  to 187 miles, the mean being 29.3 miles, and the average rate was 2.3 miles. The females ranged in size from 38.5 to 53.5 cm., and the average was 46.5 cm., as against a variation of from 39 to 50 cm., and an average of 44.3 cm. on liberation; they were free for from 12 to 965 days, the mean being 283 days: they migrated from 2 to 139 miles, the average being 31.2 miles, and the mean rate was 1.1 miles.

#### THE EXTENT AND DIRECTION OF MIGRATION.

*First Quarter.*—A male and 2 females were recaptured in the remainder of December, all 12 miles to the northwards, to the mouth of the Dornoch Firth.

In January 1914, 3 males were captured, but the position of 1, which was landed at Grimsby, was given merely as "Moray Firth"; the other 2 were found to the northwards, 1 off Tarbet Ness, near the entrance to the Dornoch Firth, at 11 miles distant, and the other at a distance of 40 miles, off Clyth Ness, near the edge of Smith Bank. Ten males and 5 females were got in February; 5 of the males and a female were taken near Tarbet Ness, towards the Dornoch Firth, 4 at a distance of 11 miles, 1 at  $13\frac{1}{2}$  miles, and another at 14 miles; a male and a female were recaptured south-east of Berriedale Head, at 23 and 24 miles to the northwards; a male a little farther to the north, south of Lybster, 30 miles distant, a female

south-east of Noss Head, 48 miles to the northwards, and another near Noss Head, at a distance of 50 miles; another female was recaptured about 5 miles off Sule Skerry, on the north coast, at a distance of 106 miles; and the remaining fish, a male, was taken near the shore, off Nairn, 9 miles to the south and west.

In this quarter, 21, or 39·6 per cent., were recaptured, the positions being known for 20, or 37·7 per cent., of which 16 (80 per cent.) were found to the northwards and eastwards, 3 to the north and west, and 1 to the south and west.

*Second Quarter.*—Six males and 6 females were recaptured in March, 2 of the males and a female near the entrance of the Dornoch Firth, 16 miles to the northwards, 2 males to the eastwards of Berriedale Ness, at a distance of 30 miles, a female a little farther north at 37 miles, a female off Helmsdale, 23 miles to the northwards, 2 males and a female off Burghead, 2½ and 3 miles to the north and east, a female on the north coast, off Whiten Head, at a distance of 105 miles, and another on the west coast at Loch Inchard, a distance of 139 miles; the mean rates of movement of the 2 last were respectively 11·8 and 14·9 miles per 10 days. Two males and a female were taken in April, both males, at 38 miles to the north and east, in the neighbourhood of Smith Bank, and the female off the north coast, 16 miles E. by N. of Sule Skerry, at a distance of 107 miles. A female was recaptured in May, but the position was not ascertained.

In this quarter, 16 of the marked plaice were recovered, or 30·2 per cent., positions being given for 15 or 28·3 per cent., of which 14 (93·3 per cent.) were found to the north and east, and 1 to the north and west.

*Third Quarter.*—Two, or 3·8 per cent., were taken in this quarter, a male in June, 3¼ miles from Trodday Isle, Skye, west coast, at a distance of 187 miles, the rate of movement being 9·5 miles per 10 days, and a female in July, at a position not ascertained.

*Fourth Quarter.*—No fish was caught in September, October, and November.

Thus, in the 12 months, 39, or 73·6 per cent., were recaptured, the positions being known for 35, or 66 per cent. Of these, 29 (82·8 per cent.) were found to the north and east, 5 (14·3 per cent.) to the north and west, and 1 to the south and west.

Of the remaining fish, 1 was taken in 1914, and 10 in 1915.

In December 1914, a male was captured on the north coast, off Whiten Head, at a distance of 111 miles.

In January 1915, a male was taken off Nairn, 10 miles to the south-west, and in February, another male south-east of Berriedale Head, 27 miles to the north and east; a female was captured off Findhorn, 2 miles to the south and west, in April; and 4 females, all in the same locality, off Findhorn, in May, at distances of from 2½ to 5 miles to the south and west; 2 females were caught in June, also off Findhorn, at a distance of 2 miles, and in October, a male off Burghead, 3 miles to the south and west. All the females taken in April, May, and June, off Findhorn, are described as "spent."

*Distances travelled*—10 miles and under.—Fifteen or 31·2 per cent., were recaptured at distances of from 2 to 10 miles, 5 males (20 per cent.), with an average of 5·4 miles, and 10 females (43·5 per cent.), with an average of 2·6 miles; 3 males and 8 females were taken to the south and west, 2 males and 1 female to the north and east, and 1 female to the north and west.

10 to 20 miles.—Thirteen fish, or 27·1 per cent., were found at distances of from 11 to 16½ miles, 9 males (36 per cent.), with an average of 12·8 miles, and 4 females (17·4 per cent.), with an average of 12·9 miles. Four of the males and all the females were taken to the north and east, and 5 of the males to the north and west.

Thus, 28 fish, or 58·3 per cent., were got at distances under 20 miles, 14 (56 per cent.) males, with an average of 10·2 miles, and 14 females (60·9 per cent.), with an average of 5·6 miles.

20 to 50 miles.—Fifteen fish, or 31·2 per cent., were recaptured at distances of from 23 to 50 miles, 10 males (40 per cent.), with an average of 32·2 miles, and 5 females (21·7 per cent.), with an average of 36·2 miles; all the fish were taken to the north and east.

No fish was recovered between 50 and 100 miles, but 6 were taken at distances over 100 miles, namely, 2 males (8 per cent.), with an average of 149 miles, and 4 females (17·4 per cent.), with an average of 114·5 miles.

## MATURITY.

*Males.*—The condition of the testes was ascertained in 20 of the 28 recaptured. Seven were described as “spawning”; 3 were taken in February 1914, all to the north and east, at 11, 14, and 28 miles respectively; 2 in March 1914, 1, 16 miles to the north and west, and 1, 16 miles to the north and east; the remaining 2 were recaptured in February 1915, 1, 13½ miles to the north and west, and the other 27 miles to the north and east; all but 2 of these spawning males were taken at the mouth of the Dornoch Firth, the two exceptions being got farther along the coast. Six were “ripe,” 1 captured in January 1914, at an unspecified locality, in the Moray Firth, 2 in February 1914, 1, 24 miles and the other 37 miles to the north and east, 2 in March 1914, off Burghead, and the remaining fish in April 1914, 38 miles to the north and east. One was described as “spent”; it was caught in February 1914, 11 miles to the north and west. Another, taken in December 1914, on the north coast, off Whiten Head, was “nearly ripe.”

*Females.*—The condition of the ovaries was determined in 20 of the 25 females recaptured. Two were “spawning,” 1 taken in February 1914, 11 miles to the north and east, at the mouth of the Dornoch Firth, and the other in March 1914, off Whiten Head, on the north coast, at a distance of 105 miles. Four were described as “ripe,” 1 caught in July 1914, at an unknown place; another, in February 1914, on the north coast, off Sule Skerry, at a distance of 106 miles; a third in April 1914, also off Sule Skerry, at a distance of 107 miles; and the fourth, in December 1913, 12 miles to the northward, at the mouth of the Dornoch Firth. Eleven were said to be “spent”; all but 1 were recaptured in the locality, at distances between 2 and 5 miles, the exception being taken at the mouth of the Dornoch Firth, at a distance of 16½ miles; another female, caught in December 1913, at the mouth of the Dornoch Firth, was described as “not quite ripe.”

## EXPERIMENT AT NAIRN BAY, STATION II.

12th November 1913.

On 12th November 1913, 50 marked plaice, comprising 25 males and 25 females, were liberated in Nairn Bay, in the Moray Firth (Lat. 57° 37' N.; Long. 3° 54' W.). The males ranged in size from 24·5 to 44 cm., and 10 were under adult size on liberation. The females were from 26 to 58·5 cm., and 17, when liberated, were under adult size. These fish were captured partly at Burghead Bay and partly at Nairn Bay, on the same day.

Nineteen, or 38 per cent., were recaptured, namely, 12 males (48 per cent.) and 7 females (28 per cent.). Eight of the males were of mature size on recapture, averging 40·2 cm., as against 38·7 cm., on liberation; they were at liberty for from 83 to 1185 days, the mean being 321 days; they migrated distances of from 7½ to 46 miles, the average being 24·2 miles, and the mean rate ·6 mile. Four of the males were of immature size, averging 28·8 cm., and migrating a mean distance of 5 miles. Two of the females were of adult size, and 5 under, on recapture, the latter travelling from 2½ to 4 miles, the average being 3·2 miles.

## THE EXTENT AND DIRECTION OF MIGRATION.

None of the fish was recaptured in the first, third, or fourth quarters, but 14 were taken in February, March, and April, the second quarter.

Eight males and 1 female were taken in February, the female 3 miles to the south and east, off Nairn, 2 of the males 2 miles to the south and west, off Fort George; a third, 13 miles to the south and east, in Burghead Bay; a fourth, 8 miles W. by S. of Burghead, at a distance of 7½ miles; 2 were got off Brora, Dornoch Firth, at 22 and 23 miles distant; the seventh, south-east of Clyth Ness, at 46 miles to the north and east; and the eighth, at an unspecified locality in the Moray Firth. One male and 3 females were taken in March, the male off Nairn, at a distance of 3 miles; 2 of the females off Nairn, at 2½ and 4 miles; and the third at Fort George, 2½ miles to the north and west. In April, a female was recovered off Nairn, 4 miles to the north and west.

Thus, 14, or 73·7 per cent., were recaptured in the second quarter, 5 to the north and east, 3 to the north and west and south and east respectively, 2 to the south and west, and 1 at an unknown locality.

The next fish to be recaptured were taken in May 1915, a female off Nairn, at a distance of 1 mile, and the other, also a female, 10 miles to the north and east, off Findhorn. In June, a male was taken in the same locality as the last. The next recapture was in February 1917, after 1185 days; it was a male, taken 5 miles to the north of Tarbet Ness. One male, which had gone 39 miles to the north and east, had no date of recapture.

*Distances travelled*—10 miles and under.—Twelve fish, or 66·6 per cent., were found at distances under 10 miles, 5 males (45·4 per cent.), with an average of 4·9 miles, and 7 females (100 per cent.), with a mean of 3·8 miles.

10 to 20 miles.—Only 1, a male, was recaptured between 10 and 20 miles, namely, 13 miles to the south and east.

20 to 50 miles.—Five, or 27·7 per cent., were got within these limits. All were males (45·4 per cent.), taken to the north and east.

#### MATURITY.

*Males*.—Of the 12 recaptured, the condition of the testes was recorded for 8. Three were "spawning," all taken in February 1914, 2 off Brora, Dornoch Firth, at 22 and 23 miles to the north and east, 1 off Clyth Ness, 46 miles to the north and east. One was "ripe"; it was taken in February 1917, after 1185 days, at the mouth of the Dornoch Firth, 22 miles to the north and east.

*Females*.—The condition of the ovaries of each of the 7 females recaptured was recorded. Two were "spent," both taken in May 1915, 1 at a distance of 1 mile, and the other 10 miles to the eastward, off Findhorn.

#### OTHER EXPERIMENTS.

##### MORAY FIRTH.

I. On 22nd April 1910, 57 plaice were marked and liberated in the Dornoch Firth (57° 58' N.; 3° 45' W.) in a depth of 7–9 fathoms; they comprised 29 males and 28 females. Only 6 (10·5 per cent.) were recaptured, 4 males and 2 females. The date and place of capture of 1 of the males were not ascertained; another was found on the market at Ymuiden, in May 1911, but the position of capture was not ascertained; the third male was taken in January 1911, 15 miles to the north and east, off Golspie; and the fourth, in February 1911, 2 miles south-west of the Souters of Cromarty, 23 miles to the south and west; 1 of the females was caught at an unspecified place in the Moray Firth, and landed at Ostend; the other was taken in February 1911, off Dornoch village, 10 miles to the south and west.

II. On 23rd April 1910, 32 marked plaice were liberated in the Dornoch Firth, at 57° 54' N.; 3° 52' W. in a depth of from 10–15 fathoms. They comprised 11 males, 20 females, and 1 of unknown sex. Seven, or 21·9 per cent., were recaptured, 5 males and 2 females; 3 of the males were caught at unspecified places in the Moray Firth, and landed at Ostend, in February 1911, April 1911, and September 1910; of the other 2, 1 was taken in March 1911, 8 miles to the south and east, and the other in June 1911, at N. Ronaldshay, Orkneys, 119 miles to the north and east; 1 of the females was landed in January 1911, at Ostend, the place of capture being recorded merely as "Moray Firth"; the other was taken in March 1911, 8 miles to the south and east. This fish, and the male, caught close together near Tarbet Ness, were "partly spent."

III. On 25th April 1910, 35 plaice—20 males, 14 females, and 1 of undetermined sex—were liberated in the Moray Firth, near Findhorn (57° 42' N.; 3° 37' W.) in a depth of 6 fathoms. Only 4, or 11·4 per cent., were recaptured, viz. 3 males and the fish whose sex was not ascertained. One of the females was taken in February 1911, 3 miles to the south and east, and 2 were found in March 1911, 1, 8 miles to the south and west, off Nairn, and the other 1 mile to the north and west. The fish of unknown sex was also taken at this position, 1 mile to the north and west, in March 1911.

IV. In the Moray Firth, at  $57^{\circ} 47' N.$ ;  $3^{\circ} 17' W.$ , where the depth is 13–15 fathoms, 10, consisting of 3 males, 5 females, and 2 whose sexes were not determined, were liberated on 26th April 1910. Three were recaptured, viz. a male in June 1910, in the Pentland Firth, 79 miles to the northwards; and 2 females, 1 in March 1911, off Tarbet Ness, 13 miles to the north and west, and the other in April 1911, in the vicinity of Tarbet Ness, 6 miles to the north and west.

V. On 26th April 1910, 22 were set free in the Moray Firth, at  $57^{\circ} 53' N.$ ;  $3^{\circ} 14' W.$ , in a depth of 28–32 fathoms; they consisted of 11 males, 8 females, and 3 of undetermined sex. Five, or 22·7 per cent., were recaptured, 3 males, 1 in January 1911, at a place unknown; another in March 1911, 13 miles to the north and west, and the third in July 1911, at a place unknown. Two of undetermined sex were caught at unspecified localities in the Moray Firth in July and September 1910. The fish about which particulars are absent were caught by foreign trawlers and landed at Ostend.

VI. On 27th July 1910, 1 male and 2 females were marked and liberated at  $57^{\circ} 51' N.$ ;  $3^{\circ} 16' W.$ , and the male, alone, was recaptured, on March 1911, in the North Minch, on the west coast, at a distance of 152 miles, the rate of movement being 6·5 miles per 10 days. This fish measured 38·5–38·6 cm., and was "spawning" when captured.

#### DOGGER BANK.

On 15th October 1913, 2 females were marked and liberated at  $54^{\circ} 52' N.$ ;  $0^{\circ} 57' E.$ , west of the Dogger Bank, in 41 fathoms, and both were recaptured, 1 in October 1913, after only 9 days, at a position given as 166 miles E.S.E. of the Longstone Light, 91 miles N.  $80^{\circ} E.$ , which is evidently wrong; the other was recaptured in June 1914, 5 miles to the north and east.

#### NORTH-WEST OF GREAT FISHER BANK.

On 17th June 1913, 4 marked female plaice were set free at a position 127 miles E. by S.  $\frac{1}{2}$  S. of Buchanness ( $57^{\circ} 30' N.$ ;  $2^{\circ} 10' E.$ ), in a depth of 36 fathoms. One was got in December 1913, 48 $\frac{1}{2}$  miles E. by S. of the Isle of May, 130 miles to the west and south; it was landed by an English trawler at Boston.

#### OFF KINNAIRD HEAD.

On 29th July 1910, 12 marked plaice, consisting of 6 males, 1 female, and 5 of unknown sex, were liberated, 2 off Kinnaird Head ( $57^{\circ} 41' N.$ ;  $1^{\circ} 55' W.$ ) in a depth of 5 fathoms. Four were recovered, 3 males and 1 of undistinguished sex. The latter was taken in September 1911, 6 miles to the south and east; 2 of the males were recaptured in March 1911, both in the Moray Firth, one off Buckie, 33 miles to the north and west, and the other off Tarbet Ness, 62 miles to the north and west; the third male appears to have been taken in Morecambe Bay, Lancashire, at the beginning of April 1911. The mark and wire were sent to me by Dr. J. Johnstone, with a note from Captain Wignall of the Lancashire S.F.D. Committee Steamer "James Fletcher," to the effect that the mark was taken from the fish on the Fleetwood Landing Stage on 6th April 1911. It could not be ascertained which boat caught the fish, but "it was caught in Morecambe Bay." Dr. Johnstone kindly informed me that the trawlers speak of the area between Morecambe Bay, the coast between Cumberland and Ribble and the Isle of Man, as "Morecambe Bay," and he was of opinion that the fish was probably caught on the Lancashire coast. The distance between the place of liberation and Morecambe Bay is about 470 miles, and, as the interval between the date of liberation and recapture was 248 days, the mean rate of movement per 10 days would be 19 miles.

#### OFF TOD HEAD, KINCARDINESHIRE.

On 6th July 1912, 6 plaice, 3 males and 3 females, were marked and liberated 27 miles E.S.E.  $\frac{1}{2}$  S. of Tod Head ( $56^{\circ} 48' N.$ ;  $1^{\circ} 24' W.$ ) in a depth of 34 fathoms. Five were recaptured, 2 males and 3 females. One male was taken in February 1913, south and east of Aberdeen, 38 miles to the north and east, and the other in

December 1914, after 898 days, 9 miles to the north and east; 1 of the females was got in August 1912, 14 miles to the north and east, another in June 1913, 12 miles to the north and east, and the third in August 1913,  $3\frac{1}{2}$  miles to the north and east.

On the same day, 2 marked plaice, a male and a female, were liberated 53 miles S.E.  $\frac{1}{2}$  E. of Tod Head ( $56^{\circ} 34' N.$ ;  $0^{\circ} 44' W.$ ) in 47 fathoms, and they were recaptured, the male on 4th August 1912, 8 miles to the south and east, and the female in October 1913, 36 miles to the north and west.

On 9th July 1912, 2 plaice, both females, were liberated at a position  $57^{\circ} 7' N.$ ;  $0^{\circ} 21' W.$ , but none was recaptured.

On 25th June 1910, 3 plaice, all females were liberated in Kirkcaldy Bay, but none was recaptured.



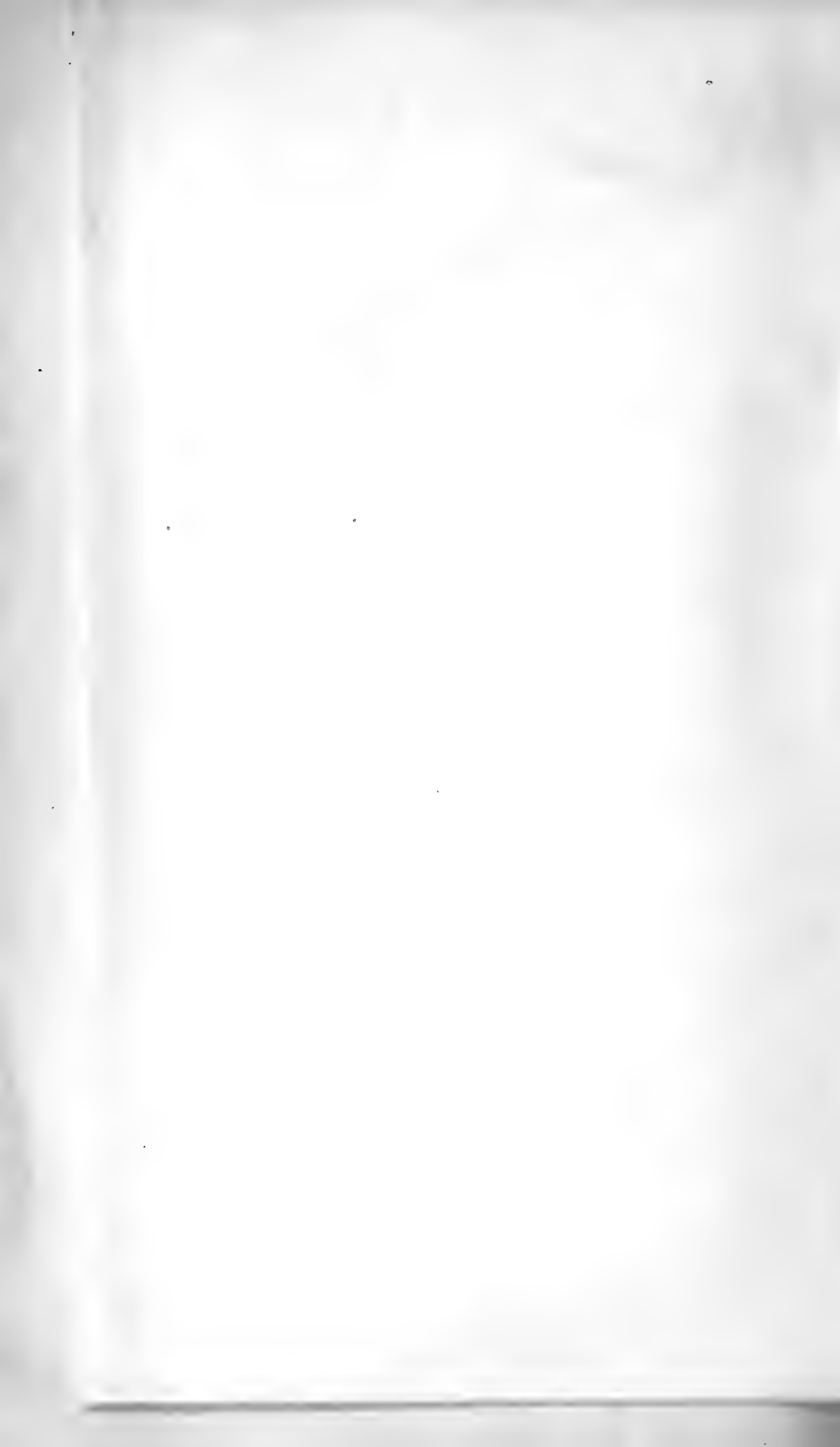


### EXPLANATION OF PLATES.

- Plate I. . . . 20 miles E. of Isle of May, Experiment IX., 6th December 1912.
- Plate II. . . . Same Experiment. Showing the migratory movements in the 1st Quarter, December 1912 to February 1913.
- Plate III. . . . Same Experiment. Showing the migratory movements in the 2nd Quarter, March to May.
- Plate IV. . . . Same Experiment. Showing the migratory movements in the 3rd Quarter, June to August.
- Plate V. . . . Same Experiment. Showing the migratory movements in the 4th Quarter, September to November.
- Plate VI. . . . Firth of Forth. Midway between Elie and Fidra, Experiment VIII., 24th April 1912.
- Plate VII. . . . Aberdeen Bank. Experiment I, 10th June 1910.
- Plate VIII. . . . Moray Firth. S.E. of Smith Bank, 20th September 1912.
- Plate IX. . . . 19 miles E.S.E. of Fair Isle, 15th September 1910.
- Plate X. . . . Showing the Distribution of the "Spawning" Fish of all Experiments.





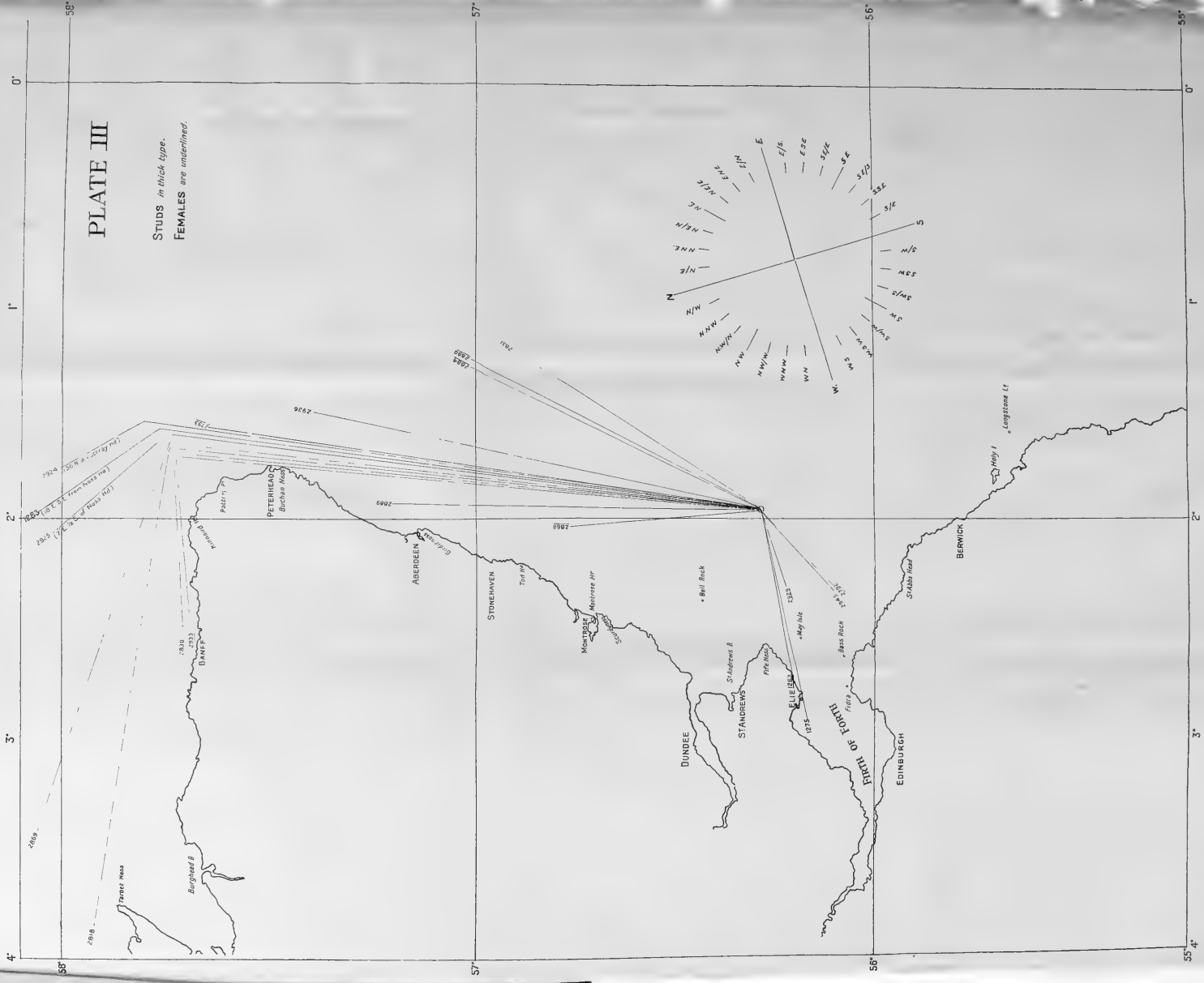


# PLATE II

STUDS in thick type  
 FEMALES are underlined>

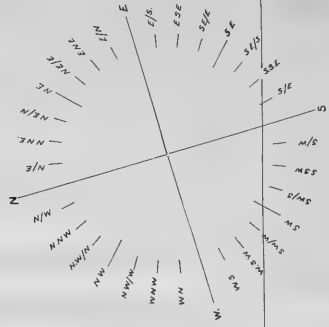






# PLATE III

STUDS in thick type.  
 FEMALES are underlined.



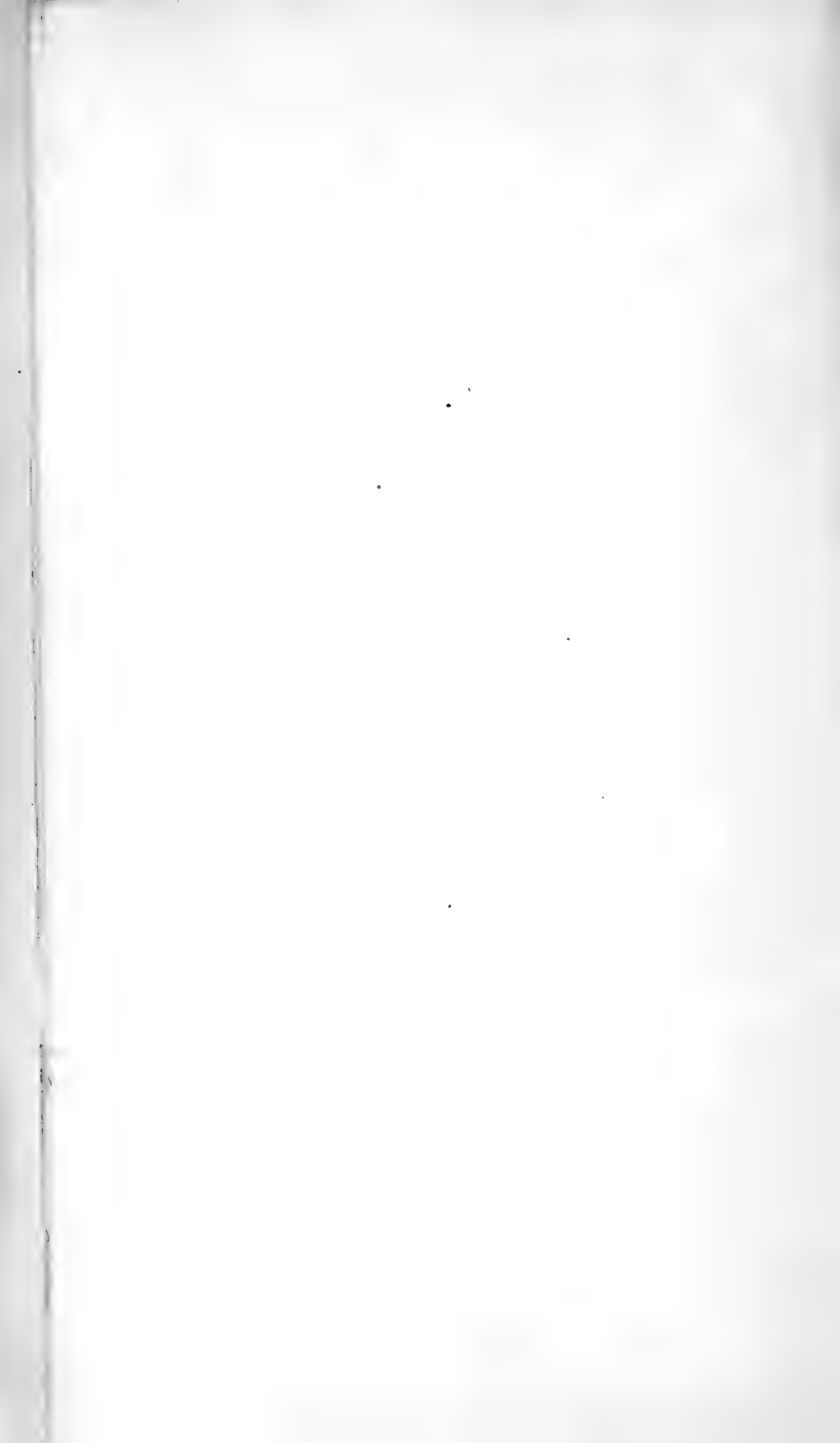




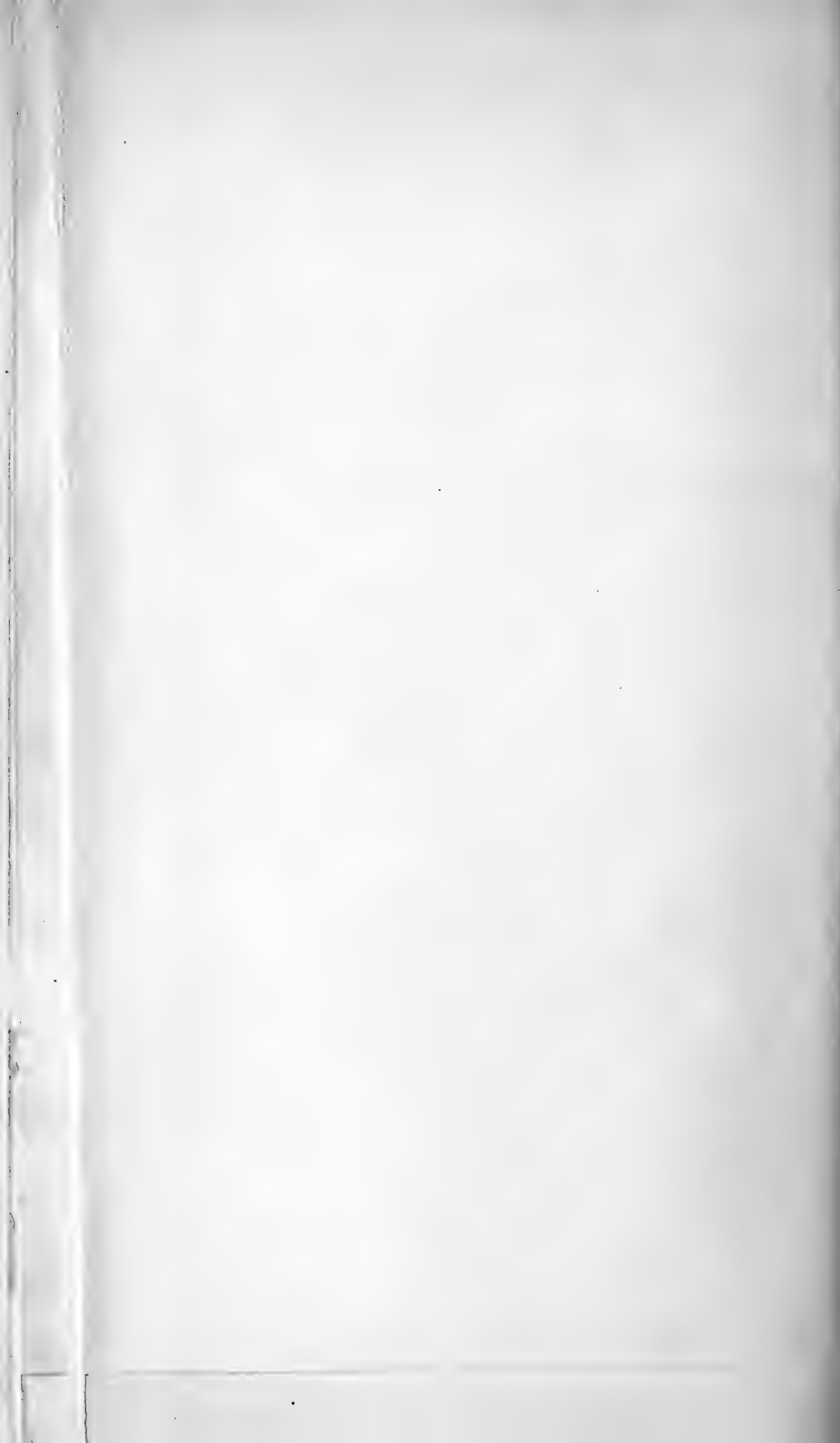
# PLATE IV

STUDS in *thick type*.  
 FEMALES are *underlined*.







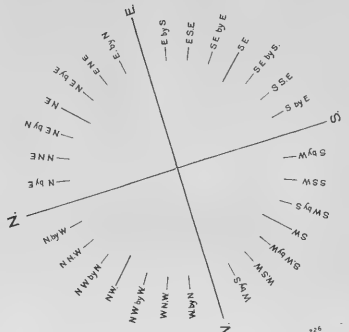






# PLATE VII

STUDS *in thick type.*  
 FEMALES *are underlined.*



11  
 (54° 26' 30" N, 5° 14' W)





# PLATE VIII

STUDS in thick type.  
 FEMALES are underlined>

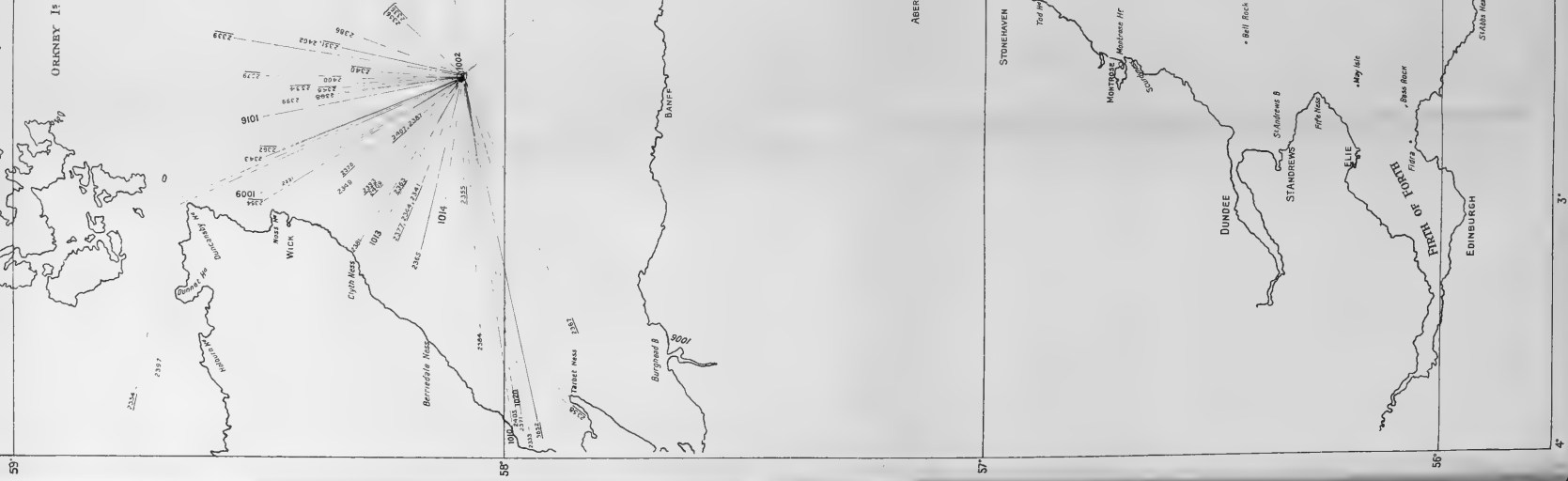
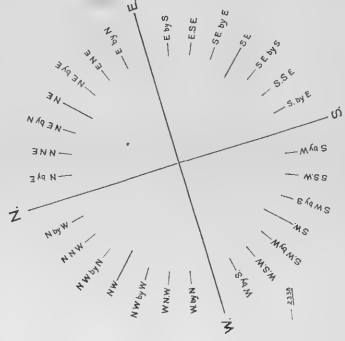




PLATE IX

FEMALES UNDERLINED.  
*dhua* 055











TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 14th April 1910. Liberated, N.-W. of Great Fisher Bank, 57° 18' N.; 3° 43' E. Depth, 35 Fms.												
3251	M.	37.	38.	19/7/10	200' N.-E. of Spurn,	56° 25' N.; 3° 10' E.	42	S.T.	London.	—	—	Sound.
3281	F.	42.	41.	10/6/10	142' E./S. $\frac{1}{2}$ S. of Aberdeen.	57° 8' N.; 2° 20' E.	42	"	London.	—	—	Decomposed.
Date, 15th April 1910. Liberated, N.-W. of Great Fisher Bank, 57° 11' N.; 3° 52' E. Depth, 35 Fms.												
3260	M.	37.5	Label only.	11/5/11	220' E.-S.-E. $\frac{1}{4}$ S. of Aberdeen.	56° 20' N.; 4° 30' E.	34	S.T.	Hull.	—	—	—
Date, 15th April 1910. Liberated, on Great Fisher Bank, 56° 59' N.; 4° 10' E. Depth, 35 Fms.												
3226	M.	42.	43.7	8/7/11	185' E./S. $\frac{1}{4}$ S. of May Island.	56° 25' N.; 3° 0' 5" E.	39	S.T.	Hull.	—	—	Sound.
Date, 22nd April 1910. Liberated, Station 4, Dornoch Firth, 57° 58' N.; 3° 45' W. Depth, 7-9 Fms.												
3276	M.	26.	27.8	—	Place unknown.	—	—	S.T.	—	—	Imm.	—
3289	M.	23.5	36.8	27/5/11	Found on market, Ymuiden.	—	—	"	Ymuiden.	—	?	Gutted, good.
3483	F.	26.	32.5	9/4/11	Moray Firth.	—	47	"	Ostend.	—	—	Fairly good.
3489	M.	30.	30.8	24/1/11	1' off Golspie.	58° 10' N.; 3° 30' W. (about).	8	Line.	Golspie.	—	Imm.	Rather poor.
1857	F.	30.	29.7	18/2/11	1' off Dornoch.	57° 53' N.; 4° W. (about).	5	"	Embo.	—	Imm.	Fair.
1704	M.	26.	30.7	3/2/11	2' S.-W. of Souther of Cromarty.	57° 39' N.; 4° 3' W.	8	"	Lossiemouth	—	Quite imm.	Fair.



Date, 23rd April 1910.	Liberated, Station 6, Dornoch Firth, 57° 54' N.; 3° 52' W. Depth, 10-15 Fms.													
2957	F. 36	39.6	9/3/11	4' S.-E. of Tarbet Ness.	57° 50' N.; 3° 40' W.	10	Cod Nets	Lossiemouth	Partly spent.	Good.				
2899	M. 35.5	40.5	14/4/11	Moray Firth	—	49	S.T.	Ostend.	—	—				
2983	M. 35	39	20/2/11	Moray Firth.	—	49	"	Ostend.	—	—				
2822	M. 32.5	36	30/9/10	Moray Firth.	—	40½	"	Ostend.	—	—				
2784	M. 36.5	41.7	24/6/11	21' N.N.-W. of N. Ronaldshay.	59° 40' N.; 2° 36' W.	58	Cod Nets	Aberdeen.	Imm.	Fair.				
2975	M. 42	43.7	8/3/11	4½' S.-E. of Tarbet Ness Light.	57° 50' N.; 3° 39' W.	10	Cod Nets	Burghhead.	Partly spent.	Good.				
2733	F. 32.5	37	3/1/11	Moray Firth.	—	49	S.T.	Ostend.	—	—				
Date, 25th April 1910. Liberated, Findhorn S.S.-W., 2', 57° 42' N.; 3° 37' W. Depth, 6 Fms.														
2824	M. 22	27.1	13/2/11	2' W.-S.-W. of Burghhead	57° 41' N.; 3° 30' 30" W.	4	Small Lines.	Burghhead.	Imm.	Fair (head damaged).				
2747	M. 27.5	27.6	11/3/11	Off Findhorn.	57° 42' N.; 3° 38' W. (about).	6	Line.	Nairn.	Imm.	Poor (head damaged).				
2611	M. 23.5	29.1	16/3/11	Off Old Bar, Nairn.	57° 38' N.; 3° 51' W. (about).	6	"	Nairn.	Imm.	Fair.				
2674	?	30.3	24/3/11	Off Old Bar, Findhorn.	57° 42' N.; 3° 38' W. (about).	6	"	Nairn.	Rotten.	Fairly good.				
Date, 26th April 1910. Liberated, Station 10, Moray Firth, 57° 47' N.; 3° 17' W. Depth, 15-13 Fms.														
2994	F. 33	34.3	4/3/11	Vicinity of Tarbet Ness.	57° 50' N.; 3° 40' W. (about).	10	Cod Nets	Lossiemouth	Imm.	Fair.				
2930	F. 41	41.4	5/4/11	11' E.-S.-E. of Tarbet Ness.	57° 51' N.; 3° 25' W.	22	S.T.	Ymuiden.	—	Salted.				
2600	M. 31	32	22/6/10	Pentland Firth.	58° 40' N.; 3° 40' W.	35	"	Grimbsy.	—	Fair.				
Date, 26th April 1910. Liberated, Station 9, Moray Firth, 57° 53' N.; 3° 14' W. Depth, 28-32 Fms.														
2720	?	39	9/7/10	Moray Firth.	—	47	S.T.	Ostend.	—	—				
2853	M. 38.5	39.1	30/3/11	7' S. of Ord Head.	58° 3' N.; 3° 29' W.	29	Cod Nets	Buckie.	—	Good.				
2868	M. 35	36.6	20/1/11	—	—	40.5	S.T.	Ostend.	—	Sound.				
2951	?	39	30/9/10	Moray Firth.	—	—	—	—	—	—				
2942	M. 44	45.0	Prior to 27/7/11	Unknown.	—	—	—	London.	—	Sound.				

TABLE I.—PLAICE.

No. of Tab.	Sex.	PARTICULARS OF RECAPTURE.									
		Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.	Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.	
Date, 10th June 1910. Liberated, 33½ miles S.-E./E. ½ S. of Aberdeen, 56° 55' N.; 1° 8' W. Depth, 34 Fms.											
Sc. A. 10											
25	M.	33·4	3/10/10	12' S./E. of Aberdeen.	57° 3' N.; 1° 44' W.	44	S. T.	Aberdeen.	Imm.	—	
28	F.	36·6	13/8/10	32' S.-E. of Aberdeen.	56° 53' 30" N.; 1° 12' W.	35	"	Aberdeen.	Imm.	—	
29	F.	35·4	7/3/12	20' S.-E. of Aberdeen.	56° 57' 36" N.; 1° 30' W.	35	"	Aberdeen.	Imm.	Good.	
30	M.	35·5	27/10/10	30' S.-E. of Aberdeen.	56° 53' 48" N.; 1° 14' 15" W.	30	"	Aberdeen.	Imm.	Good.	
32	F.	36·5	48/27/5/14	18' S.-E. of Aberdeen.	56° 55' N.; 1° 42' W.	35	"	Aberdeen.	Spent.	Good.	
34	M.	31·1	30·8	21/7/10	36' S.-E. of Aberdeen.	56° 41' 30" N.; 1° 23' W.	31	"	Aberdeen.	Imm.	Fresh.
36	M.	34·5	30·8	11/8/10	24' S.-E./S. of Aberdeen.	56° 52' N.; 1° 30' 59" W.	38	"	—	Imm.	—
37	F.	39·4	2/2/11	1 m. off Banff Head.	57° 42' N.; 2° 31' W.	14	Set Nets.	Whitehills.	Nearly ripe.	Rather thin.	
38	F.	36·8	11/8/11	50' E.-S.-E. ½ S. off St. Abb's Head	55° 45' N.; 0° 40' W.	45	S. T.	N. Shields.	—	Sound.	
41	M.	30·3	22/2/11	13' S.-W./W. from Cape Wrath.	58° 26' 30" N.; 5° 14' W.	38	"	Aberdeen.	Ripe.	Good.	
42	M.	37·1	14/6/11	25' S.-E./E. of Aberdeen.	57° 1' N.; 1° 20' W.	34	"	Aberdeen.	Imm.	Good.	
43	M.	37·3	14/9/10	8' S.-E. of Buchaness.	57° 23' 23" N.; 1° 35' W.	43	"	—	Imm.	—	
44	M.	31·0	1/7/10	70' E.-N.-E. of May Island.	56° 54' N.; 0° 52' 25" W.	38	"	—	—	—	
49	M.	32·3	23/5/11	6' S.-E. of Buchaness.	57° 24' N.; 1° 38' 50" W.	42	"	Aberdeen.	Imm.	Good.	
50	F.	36·5	37/2/7/10	40' S.-E. of Aberdeen.	56° 48' 24" N.; 1° 0' W.	39	"	—	—	—	
52	M.	33·5	33/3/11	27' N.-E./E. of May Island.	57° 4' 55" N.; 1° 11' W.	34	"	—	—	—	
53	F.	31·1	23/3/11	27 m. S.-E./E. ½ E. fr. Aberdeen.	57° 2' 40" N.; 1° 15' W.	34	"	Aberdeen.	Imm.	Good.	
54	F.	32·3	8/12/10	25' E. of May Island.	56° 18' N.; 1° 50' W.	29	"	Leith.	Imm.	Good.	
55	F.	33·3	12/6/10	27' S.-E. ¾ S. of Aberdeen.	56° 53' 48" N.; 1° 24' 30" W.	35	"	—	—	—	
57	F.	33·3	14/6/10	70' N.-E./E. of May Island.	57° 4' 55" N.; 1° 11' W.	35	"	—	—	—	
58	M.	36·3	1/10/10	15' E.-S.-E. of Bell Rock.	56° 24' 5" N.; 1° 55' W.	24	"	—	—	—	
60	M.	33·5	11/8/10	24' S.-E. of Aberdeen.	56° 49' 48" N.; 1° 34' 28" W.	38	"	Dundee.	?	Fair, gutted.	
65	M.	33·3	8/5/11	28' S.-E. of Aberdeen.	56° 55' N.; 1° 18' W.	35	"	Aberdeen.	Imm.	Good.	
66	F.	33·3	8/7/10	30' S.-E. of Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	32	"	Aberdeen.	Imm.	Good.	
67	M.	34·8	1/2/11	5 m. E./S. from Tod Head.	56° 53' N.; 2° 4' 40" W.	27	"	—	Imm.	Good.	

68	F.	29-	5/ 7/10	33° S.-E. of Aberdeen.	56° 43' 48" N.; 1° 25' 40" W.	32	"	Aberdeen.	—	Good.	
69	F.	28-5	6/ 6/12	16° S.-E. of Bell Rock.	56° 18' N.; 1° 57' 30" W.	26	"	Dundee.	Imm.	Good.	
73	F.	33-	7/ 9/10	40° S.-E. of Aberdeen.	56° 48' 24" N.; 1° W.	40	"	Aberdeen.	Imm.	Good.	
79	F.	28-	7/ 6/11	28° S.-E./E. of Aberdeen.	57° 0' 15" N.; 1° 14' 20" W.	28	"	Aberdeen.	Imm.	Good.	
81	F.	33-5	11/ 6/11	24° S.-E. from Aberdeen.	56° 57' 42" N.; 1° 26' W.	37	"	Aberdeen.	Imm.	Good.	
84	F.	37-5	12/ 8/10	25° S.-E./E. of Aberdeen.	57° 0' 30" N.; 1° 20' W.	39	"	—	Imm.	—	
88	M.	30-	7/ 6/11	Off May Island.	—	29	"	Granton.	Imm.	Fair.	
89	M.	29-2	18/ 7/10	35° S.-E./E. of Aberdeen.	56° 58' N.; 1° 2' W.	36	"	Aberdeen.	Imm.	Dry.	
90	M.	28-5	31-8	9/ 3/11	36 m. E.-S.-E. of Aberdeen.	57° 4' N.; 0° 57' W.	38	"	Aberdeen.	Imm.	Good.
92	M.	32-	35-	22/ 3/11	Moray Firth.	57° 56' 30" N.; 2° 59' W.	—	(Geestemünde)	—	Somewhat dry.	
95	F.	29-	16/ 2/13	24° S.-E. ½ E. from Aberdeen.	56° 59' 12" N.; 1° 23' W.	36	"	Aberdeen.	Spawn- ing.	Good.	
96	F.	29-	34-6	21/ 8/11	Bell Rock bearing S.W. Scurdy- ness N. ½ E.	56° 28' N.; 2° 21' W.	18	Dundee.	Imm.	Good.	
98	M.	29-	33-6	8/ 3/12	5° S. from Brora.	57° 56' N.; 3° 48' W.	16	Brora.	Ripe.	Good.	
99	F.	27-5	29-9	27/12/10	8 m. S.-E. of Stonehaven.	56° 54' 10" N.; 2° W.	32	Aberdeen.	Imm.	Fair.	
100	M.	27-	28-6	11/10/10	8° S.-E. of Bell Rock.	56° 21' 55" N.; 2° 10' 55" W.	30	Leith.	—	—	
102	F.	36-	40-1	29/11/10	80° E.-N.-E. of Bell Rock.	57° 17' N.; 0° 26' W.	34	—	—	—	
107	F.	24-5	29-6	23/ 3/11	28° E.-N.-E. of Noss Head.	58° 25' N.; 2° 10' W.	41	N. Shields.	Imm.	Sound.	
108	F.	34-5	38-3	6/ 3/11	60 yds. from Black Dog, Abdn.	57° 13' N.; 2° 3' W.	5	Aberdeen.	Spent or imm.	Good.	
109	M.	29-	30-7	13/ 9/10	27° E. S. of Aberdeen.	57° 11' N.; 1° 13' W.	33	—	Imm.	—	
110	F.	30-5	32-7	13/11/10	5° E.-S.-E. of Stonehaven.	56° 57' N.; 2° 3' W.	35	Aberdeen.	—	—	
111	M.	28-5	30-9	2/12/10	14° E. ½ S. of Aberdeen.	57° 11' 30" N.; 1° 38' W.	40	—	Imm.	—	
116	M.	33-	35-2	23/11/10	38° N.-E. of Bell Rock.	56° 59' 30" N.; 1° 51' W.	36	—	Well de- veloped.	—	
117	F.	32-	39-1	1/ 5/12	3° S. of Tod Head.	56° 50' N.; 2° 11' W.	29	Gourdon.	Imm.	Good.	
120	F.	33-	35-	1/ 2/11	30° S.-E. from Aberdeen.	56° 54' N.; 1° 15' W.	40	Aberdeen.	Imm.	Good.	
123	F.	28-	28-5	28/ 7/10	40° E./N. of Bell Rock.	56° 44' 30" N.; 1° 19' W.	34	—	—	—	
124	F.	31-5	33-6	30/ 9/10	40° S.-E. of Aberdeen.	56° 49' N.; 0° 58' W.	36	Aberdeen.	Imm.	—	
125	F.	26-5	31-8	6/ 4/11	No. 1 Buoy of Tay.	56° 28' N.; 2° 38' W.	5½	Bro. Ferry.	Imm.	Fair.	
126	F.	27-	29-3	3/11/10	18 to 20 miles N.-E. of Bell Rock.	56° 17' N.; 1° 52' W.	29	—	Imm.	—	
127	M.	30-5	38-9	26/ 6/12	10 to 12 miles E./S. of Aberdeen.	57° 10' N.; 1° 40' W.	37	Aberdeen.	Nearly ripe.	Good.	
130	M.	31-	34-1	11/ 3/11	24° S.-E. from Aberdeen.	56° 57' N.; 1° 22' W.	50	Aberdeen.	Imm.	Good.	
131	F.	36-5	38-9	26/ 4/11	40° S.-E. of Aberdeen.	56° 49' N.; 0° 58' W.	40	Aberdeen.	Imm.	Good.	
132	M.	32-	Mark only.	6/ 3/11	About 1½-off Banff.	57° 41' 30" N.; 2° 30' W.	14	Whitehills.	?	?	

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Date, 10th June 1910. Liberated, 56° 55' N. ; 1° 8' W.— <i>continued.</i>											
Sc. A. 10											
133	M.	35.4	28/7/10	28° S.S.E. of Aberdeen.	56° 47' N. ; 1° 30' W.	34	S.T.	Aberdeen.	Imm.	Fair.	
135	F.	37.3	2/7/11	10° E.-N.-E. of May Island.	56° 18' N. ; 2° 19' W.	29	"	Granton.	Imm.	Fair.	
136	F.	40.8	23/2/11	14° S.S.-E. from Buchanness.	57° 18' N. ; 1° 30' W.	47	"	Aberdeen.	Partly spent.	Good.	
139	F.	32.	24/6/11	35° S.-E./E. $\frac{1}{2}$ S. of Aberdeen.	56° 55' N. ; 1° 5' W.	36	"	Hartlepool.	Imm.	Sound.	
145	M.	34.	35.7	6/10/10	28° S.-E. of Buchanness.	35	"	Aberdeen.	Imm.	—	
146	M.	30.5	30.	14/6/10	70° N.-E./E. of May Island.	47	"	Aberdeen.	—	—	
147	F.	30.	38.5	23/5/11	43° E./S. $\frac{1}{2}$ S. of May Island.	26	"	N. Shields.	Imm.	Sound.	
148	F.	34.	43.4	7/7/11	25° S.-E./S. of Aberdeen.	33	"	Aberdeen.	Imm.	Good.	
152	M.	30.	37.9	11/11/11	17° S.-E. of Noss Head.	30	"	Aberdeen.	Nearly ripe.	Good.	
153	F.	29.	40.9	2/4/12	23° E. $\frac{1}{2}$ S. of May Island.	29	"	Newhaven.	Imm.	Good.	
159	F.	32.	33.2	22/11/10	10° E. of Bell Rock.	28	"	Leith.	$\frac{1}{2}$ Ripe.	—	
160	F.	25.	34.7	8/2/12	4' off May Island.	29	"	Leith.	Imm.	Good.	
164	F.	34.	41.7	1/8/11	30° S.-E. of Aberdeen.	37	S.T.	Aberdeen.	Imm.	Good.	
169	F.	33.5	34.8	26/9/10	23° S.-E. of Aberdeen.	30	"	Aberdeen.	Imm.	—	
171	F.	33.	43.1	7/7/11	28° S.-E./E. of Aberdeen.	33	"	Aberdeen.	Imm.	Good.	
173	M.	34.	41.8	26/12/11	18° S.-E. $\frac{1}{2}$ E. of Aberdeen.	50	"	Aberdeen.	Nearly ripe.	Good.	
174	M.	32.	32.3	21/7/10	36° S.S.-E. of Aberdeen.	44	"	Aberdeen.	Imm.	Good.	
175	M.	37.5	40.0	14/4/11	Moray Firth.	49	"	Ostend.	—	—	
176	M.	35.	38.4	31/3/11	57° N. $\frac{1}{2}$ E. from Ratray Point.	40	"	Aberdeen.	Nearly spent.	Good.	
178	F.	34.	40.4	31/5/11	36° E.-S.-E. of Aberdeen.	35	"	Aberdeen.	Imm.	Good.	
179	F.	36.	28.5	23/11/10	70° E.-N.-E. of Flay Buoy.	36	"	Aberdeen.	Imm.	—	
182	F.	37.	41.5	9/7/11	43° E.-S.-E. of Aberdeen.	36	"	Aberdeen.	Imm.	Good.	

183	M.	35-	Mark only.	27/ 8/12	No particulars to be got.	—	—	—	N. Shields.	—	—
190	M.	36-5	38-1	28/12/10	Found in Rothesay shop.	—	—	—	Aberdeen.	Nearly ripe.	Good.
191	M.	34-	—	18/11/10	Only mark got.	—	—	—	Granton.	Imm.	—
195	M.	34-	34-7	17/ 9/10	50° E. $\frac{1}{2}$ S. of Aberdeen	57° 18' N.; 0° 33' W.	37	S.T.	Aberdeen.	Imm.	Good.
197	F.	30-5	40-1	14/ 9/11	80° N.-E. from Tyne.	56° 11' N.; 0° 17' W.	48	"	Aberdeen.	Imm.	Good.
198	F.	29-	29-	4/ 7/10	3 $\frac{1}{2}$ ' off Bervie.	56° 49' N.; 2° 10' W.	29	"	—	Nearly ripe.	Good.
199	F.	32-	42-3	11/ 2/12	Auskerry N., Copinshay. W.N.W.	58° 54' N.; 2° 29' W.	40	"	Aberdeen.	Fish decayed.	Very thin.
200	M.	26-5	26-7	25/ 8/10	45° E. of May Island.	56° 24' N.; 1° 15' W.	35	"	—	Running	Very thin.
201	M.	37-5	37-5	19/ 1/11	1' off Banff.	57° 41' 30" N.; 2° 30' W.	14	Set Nets.	Whitehills.	Partly ripe.	Rather thin.
203	M.	32-	36-4	25/ 2/11	1' off Banff.	57° 41' 30" N.; 2° 30' W.	14	"	Whitehills.	Partly ripe.	Decomposed.
204	M.	32-5	32-8	1/ 8/10	32° S.-E. of Girdleness.	56° 59' N.; 1° 6' W.	35	S.T.	Granton.	—	Good.
208	F.	36-0	36-5	11/ 7/10	6° S.-E. of Girdleness.	57° 5' N.; 1° 52' W.	40	Line.	Aberdeen.	—	—
210	F.	33-5	34-8	3/12/10	40° N.-E. of Tay Buoy.	56° 38' N.; 1° 27' W.	32	S.T.	Dundee.	—	—
214	F.	33-	—	6/ 5/11	26° S.-E. of Aberdeen.	57° 2' N.; 1° 18' W.	34	"	Aberdeen.	—	—
215	M.	24-5	13-5	31/10/11	Bullers Bay, Aberdeenshire.	57° 23' 30" N.; 1° 51' W.	10	Line.	Longhaven.	—	—
216	F.	27-	37-6	15/10/11	27° E.-S.-E. of Aberdeen.	57° 5' N.; 1° 15' W.	32	S.T.	Aberdeen.	Imm.	Good.
217	M.	21-	42-2	6/ 5/13	45° E. $\frac{1}{2}$ S. of Aberdeen.	57° 12' N.; 0° 41' W.	37	"	Aberdeen.	Spent.	Good.
219	F.	29-5	33-9	-/12/10	—	—	—	—	—	Imm.	Good.
221	M.	37-5	38-7	17/ 4/11	19° S. E. from Aberdeen.	56° 51' N.; 1° 46' W.	49	S.T.	Aberdeen.	Ripe.	Good.
223	F.	38-5	48-1	24/12/12	38° E.-S.-E. from Aberdeen.	57° 5' N.; 0° 53' W.	38	"	Aberdeen.	Near spawning	Fair.
224	M.	29-	34-3	14/ 2/11	South Bay, Peterhead.	57° 28' N.; 1° 47' W.	22	Line.	Peterhead.	Quite.	Fair.
226	M.	37-	43-2	3/ 9/12	28° N.N.-E. of Rattray.	58° 5' N.; 1° 45' W.	38	S.T.	Aberdeen.	Imm.	Good.
228	M.	35-	38-6	2/ 5/11	16° S.-E. of Noss Head.	58° 21' N.; 2° 36' W.	30	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
229	M.	27-	28-6	9/ 9/10	5° S.-E. of Bell Rock.	56° 24' N.; 2° 15' W.	28	"	Leith.	—	Partly decomposed.
Stud No. 3	M.	35-	39-5	19/ 3/11	14° N.-E. $\frac{1}{2}$ N. Kinnaid Head.	57° 55' N.; 1° 50' W.	30	"	Ymuiden.	—	Sound.
—	F.	34-	34-8	11/11/10	14-15° E. of Aberdeen.	57° 12' 30" N.; 1° 38' 20" W.	37	"	Aberdeen.	—	—
7	F.	32-	45-9	6/ 9/12	15° S.-E. of Tod Head.	56° 45' 10" N.; 1° 48' 20" W.	30	"	Aberdeen.	Nly. ripe.	Good.
9	M.	35-	38-6	25/ 7/11	25° S.-E. of Aberdeen.	56° 56' 30" N.; 1° 23' W.	37	"	Aberdeen.	Imm.	Wound discharging.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Length Cm.	Length Cm.									
Date, 10th June 1910. Liberated, 56° 55' N.; 1° 8' W.— <i>continued.</i>												
Stud. No.												
13	F.	32.5	37.2	30/10/11	108° E. $\frac{3}{4}$ S. of St. Abb's Head.	56° 10' N.; 1° 5' E.	46	S.T.	Hartlepool.	?	Sound.	
14	F.	30.5	43.0	28/5/13	94° E.-S.-E. of Aberdeen.	57° N.; 0° 50' E.	45	"	N. Shields.	—	Sound.	
22	M.	34.	34.	27/1/11	22° S.S.-E. from Aberdeen.	56° 51' N.; 1° 38' W.	56	"	Aberdeen.	Imm.	Good.	
23	M.	34.	34.1	29/7/10	30° S.S.-E. from Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	32	"	Aberdeen.	Imm.	Good.	
24	M.	32.	33.7	27/9/10	32° S.S.-E. from Aberdeen.	56° 44' 24" N.; 1° 28' 20" W.	37	"	Leith.	Imm.	Good.	
25	F.	29.5	32.3	3/2/11	5' S.-E. from Buchanness.	57° 25' 24" N.; 1° 38' W.	30	"	Aberdeen.	Imm.	Fair.	
27	M.	36.5	44.4	8/4/14	6' E./N.-E. of Clyth Ness.	58° 20' N.; 3° 2' W.	—	Cod Net.	Lossiemouth.	Ripe.	Good.	
28	M.	34.5	36.6	25/6/10	6' E.-N.-E. from Aberdeen.	57° 12' N.; 1° 55' W.	33	S.T.	Aberdeen.	Spent.	Good.	
29	M.	28.	?	14/6/10	60' E.-N.-E. of May Island.	56° 48' 25" N.; 1° 6' 55" W.	36	"	—	—	—	
34	M.	34.5	?	27/12/11	40' E. $\frac{3}{4}$ S. of Aberdeen.	57° 15' N.; 0° 50' W.	42	"	N. Shields.	?	Sound.	
36	M.	34.	35.3	21/9/10	47° S.S.-E. of Aberdeen.	56° 32' N.; 1° 9' 40" W.	37	"	Aberdeen.	Imm.	Good.	
38	F.	42.5	42.8	26/10/10	27° S.-E./E. of Aberdeen.	57° 0' 30" N.; 1° 17' 24" W.	33	"	Aberdeen.	$\frac{1}{2}$ Dev.	Good.	
39	M.	38.9	38.9	14/2/11	2 m. off Banff Head.	57° 43' N.; 2° 31' W.	17	Set Net.	Whitehills.	Ripe	Thin; large ulcerated hole.	
40	F.	56.	57.6	16/7/11	3 $\frac{3}{4}$ ' S.-E./E. $\frac{1}{2}$ E. of Slains Castle.	57° 23' N.; 1° 45' W.	35	S.T.	Aberdeen.	Spent.	Good.	
41	F.	33.5	Mark only.	14/9/10	50' E.-N.-E. of May Island.	56° 41' 20" N.; 1° 22' 10" W.	39	"	Leith.	?	—	
44	M.	31.	32.9	8/10/10	40' S.-E. $\frac{3}{4}$ S. of Aberdeen.	56° 46' 12" N.; 1° 4' 35" W.	40	"	Aberdeen.	Imm.	—	
45	M.	32.	35.2	15/2/11	$\frac{1}{2}$ m. off Black Dog, Aberdeen Bay.	57° 12' 40" N.; 2° 2' W.	40	Line.	Aberdeen.	Imm.	Good.	
48	F.	34.	35.8	5/11/10	5' S.-E. of Water Sound, Orkney.	58° 48' N.; 2° 45' W.	4	S.T.	Aberdeen.	Imm.	—	
50	F.	34.	Mark only.	9/2/11	$\frac{1}{2}$ m. from Bullers of Buchan.	57° 25' N.; 1° 47' W. (about).	10	L. lines.	Cruden.	—	Good.	
51	M.	30.5	33.7	1/2/11	Montrose Bay, $\frac{3}{4}$ m. from shore.	56° 44' N.; 2° 25' W. (about).	4	S. lines.	Montrose.	Imm.	Good.	
52	F.	32.5	33.	7/10	50' S.-E./S. from Aberdeen.	56° 35' 45" N.; 0° 55' W.	36	S.T.	Aberdeen.	—	—	
60	F.	32.	42.0	3/5/12	(From Glasgow.)	—	—	"	Newhaven.	Spent.	—	
63	M.	37.	37.	18/10/10	27° S.-E./E. of Aberdeen.	57° 0' 30" N.; 1° 17' 24" W.	38	"	Aberdeen.	Imm.	—	

	F.	36.	37-3	23/ 1/11	100 yds. N. of Buchanness and $\frac{1}{2}$ m. from land.	14	Line.	Peterhead.	Imm.	Good.
67	M.	30-5	35.	24/ 5/11	$56^{\circ} 41' 20''$ N.; $1^{\circ} 22' 10''$ W.	31	S.T.	Granton.	Imm.	Good.
68	F.	36-5	41-6	12/ 6/11	$57^{\circ} 27' 15''$ N.; $1^{\circ} 32' 55''$ W.	38	"	Aberdeen.	Imm.	Good; slight ulcer at mark.
71	M.	33-5	35-3	13/10/10	$57^{\circ} 11' 11''$ N.; $1^{\circ} 3' 40''$ W.	40	"	Aberdeen.	Not well preserved	—
73	M.	30-5	43.	12/ 3/12	$57^{\circ} 46' 7''$ N.; $2^{\circ} 55' 7''$ W.	18 $\frac{1}{2}$	"	Gaestemünde	—	—
75	M.	31.	36-8	20/ 8/11	$56^{\circ} 25' 2''$ N.; $1^{\circ} 25' 7''$ W.	36	"	N. Shields.	Imm.	Sound.
76	F.	37.	43-1	26/ 7/10	$56^{\circ} 52' 30''$ N.; $1^{\circ} 29' 40''$ W.	34	"	Aberdeen.	Spent	Wound healed.
78	F.	32-5	38-4	13/ 3/11	$57^{\circ} 23' 23''$ N.; $1^{\circ} 35' 7''$ W. (abt.)	38	"	Aberdeen.	or imm.	Good.
81	M.	28-5	31-8	20/11/10	$56^{\circ} 47' 7''$ N.; $2^{\circ} 15' 7''$ W.	28	"	Aberdeen.	Imm.	—
82	F.	32.	35-4	12/ 3/11	$56^{\circ} 59' 7''$ N.; $1^{\circ} 25' 7''$ W.	33	"	Aberdeen.	Imm.	Good.
83	M.	27.	29-3	1/11/10	$56^{\circ} 25' 7''$ N.; $2^{\circ} 26' 30''$ W.	15	"	Leith.	Imm.	Poor and thin.
85	M.	26-5	30-5	7/12/10	$57^{\circ} 11' 45''$ N.; $1^{\circ} 55' 27''$ W.	30	"	Aberdeen.	Imm.	Good.
87	M.	30.	29-6	16/ 7/10	$56^{\circ} 54' 30''$ N.; $0^{\circ} 47' 50''$ W.	47	"	Aberdeen.	Imm.	Ulcerated at mark.
88	M.	32-5	32.	1/ 7/10	$57^{\circ} 4' 55''$ N.; $1^{\circ} 18' 30''$ W.	35	"	Aberdeen.	—	—
94	F.	30-5	35-2	25/12/10	$57^{\circ} 12' 50''$ N.; $1^{\circ} 52' 7''$ W.	35	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
96	F.	36.	43-5	2/ 7/12	$57^{\circ} 10' 7''$ N.; $2^{\circ} 5''$ E.	49	"	N. Shields.	—	Sound.
97	F.	33.	36-6	25/ 3/11	$57^{\circ} 0' 30''$ N.; $1^{\circ} 17' 50''$ W.	34	"	Aberdeen.	Imm.	Good.
98	M.	27-?	32-7	22/ 9/10	$57^{\circ} 27' 10''$ N.; $1^{\circ} 31' 7''$ W.	38	"	Aberdeen.	Imm.	Fairly good.
99	F.	35.	39 6	14/ 5/11	$56^{\circ} 50' 7''$ N.; $1^{\circ} 41' 7''$ W.	56	"	Montrose.	Imm.	Good; slight ulcer at mark.
101	M.	35.	35.	25/ 6/10	$57^{\circ} 0' 30''$ N.; $1^{\circ} 34' 7''$ W.	49	"	—	Imm.	Good.
106	M.	37.	39-1	30/ 9/10	$57^{\circ} 0' 30''$ N.; $1^{\circ} 17' 50''$ W.	33	"	Aberdeen.	Imm.	Good.
109	M.	38.	39-1	20/ 8/10	$56^{\circ} 51' 50''$ N.; $1^{\circ} 19' 30''$ W.	36	"	Aberdeen.	Imm.	Good.
112	F.	41.	54-8	24/ 9/12	$56^{\circ} 52' 7''$ N.; $1^{\circ} 26' 7''$ W.	34	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
113	F.	40-2	40-2	7/10/10	$57^{\circ} 0' 15''$ N.; $1^{\circ} 14' 7''$ W.	39	"	Aberdeen.	$\frac{1}{2}$ Ripe.	—
114	F.	37-5	39-2	1/ 4/11	$58^{\circ} 10' 7''$ N.; $3^{\circ} 5' 7''$ W.	30	"	Ymuiden.	—	Sound.
116	F.	37-5	34-8	29/ 9/11	$56^{\circ} 47' 45''$ N.; $1^{\circ} 56' 5''$ W.	31	"	Granton.	Imm.	Fair.
117	F.	30-5	39.	17/ 6/10	$56^{\circ} 51' 20''$ N.; $1^{\circ} 8' 45''$ W.	33	"	Dundee.	Imm.	Good.
121	F.	35.	37.	18/ 9/10	$56^{\circ} 30' 7''$ N.; $1^{\circ} 20' 7''$ W.	35	"	N. Shields.	—	—
122	F.	34-5	36-4	8/ 7/10	$56^{\circ} 45' 48''$ N.; $1^{\circ} 29' 10''$ W.	32	"	Aberdeen.	Imm.	—
124	F.	28.	38-2	13/ 2/12	$56^{\circ} 12' 20''$ N.; $2^{\circ} 56' 7''$ W.	10	Line.	Anstruther.	Imm.	Good.
127	F.	29-5	29-8	18/ 7/10	$56^{\circ} 38' 7''$ N.; $2^{\circ} 2' 7''$ W.	26	S.T.	Granton.	—	Slightulceratio)

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Lin.									
Date, 10th June 1910. Liberated, 56° 55' N.; 1° 8' W.— <i>continued</i> .												
Stud No.												
128	F.	34	35.2	2/10/10	40' S.-E./E. of Aberdeen.	56° 56' N.; 0° 53' W.	38	S.T.	Aberdeen.	Imm.	—	—
129	F.	36	39.8	16/4/11	40 m. E.-N.-E. from May Island.	56° 35' N.; 1° 37' 40" W.	32	"	Leith.	Imm.	Good.	Good.
131	M.	36	38	30/9/10	26' S.-E./E. of Aberdeen	57° 0' 30" N.; 1° 17' 50" W.	33	"	Aberdeen.	Imm.	—	—
132	F.	34	40	6/5/11	35' S.-E. of Aberdeen.	56° 41' N.; 1° 22' W.	24	"	Aberdeen.	Imm.	Good.	Good.
135	M.	36.5	38.1	7/10/10	27' S.-E./E. of Aberdeen.	57° 0' 30" N.; 1° 17' 24" W.	36	"	Aberdeen.	Imm.	Good.	Good.
137	M.	33.5	33.8	21/7/10	35' S.-E./S. from Aberdeen.	56° 46' N.; 1° 15' W.	38	"	Aberdeen.	Imm.	Fair.	Fair.
141	F.	32.5	40.4	3/8/11	28' S.-E. of Aberdeen.	56° 55' N.; 1° 18' W.	35	"	—	—	—	—
142	M.	34.5	35.6	28/11/10	43' E. of Bell Rock.	56° 37' 50" N.; 1° 9' 20" W.	37	"	Aberdeen.	Imm.	Good.	Good.
143	F.	32.5	39.9	13/8/11	7' E.-S.-E. of Tod Head.	56° 52' N.; 5° W.	32	"	—	—	?	?
145	F.	32.5	Mark only	30/9/10	35' E. of Stonehaven.	57° 7' N.; 1° 10' W.	31	"	Leith.	—	—	—
150	F.	35	43.5	6/9/11	15' S.-E. of Tod Head.	56° 45' 10" N.; 1° 48' 20" W.	48	"	Dundee.	About ½ Ripe.	Good.	Good.
154	M.	37	38.1	15/12/10	26' E.-S.-E. of Aberdeen	57° 6' N.; 1° 15' W.	34	"	Aberdeen.	Almost ripe.	Good; no ulcer.	Good; no ulcer.
155	F.	35	36	10/7/10	37' E.-N.-E. of Tay Fairway Buoy.	56° 49' N.; 1° 45' W.	49	"	—	—	—	—
156	F.	39	—	7/10/10	27' S.-E./S. of Aberdeen.	56° 50' 45" N.; 1° 25' W.	35	"	Aberdeen.	½ Ripe.	Good.	Good.
158	F.	33.5	33	16/6/10	50' E.-N.-E. of Aberdeen.	57° 39' 12" N.; 0° 50' 10" W.	60	"	Aberdeen.	Imm.	—	—
161	M.	27	31.3	17/12/10	48' S.-E./E. ½ E. from Aberdeen.	56° 53' N.; 0° 36' W.	44	"	Aberdeen.	Almost ripe.	Fairly good.	Fairly good.
163	M.	33.5	39	17/2/11	1' off Scotston Head.	57° 11' 30" N.; 2° 2' W.	11	Line.	Peterhead.	Spent.	Good.	Good.
165	F.	32.5	42.1	16/4/12	26' E.-S.-E. from Aberdeen.	57° 6' N.; 1° 15' W.	34	S.T.	Aberdeen.	Partly spent.	Good.	Good.
166	F.	29	30.2	19/8/10	40' S.-E./E. of Aberdeen.	56° 58' N.; 0° 53' W.	37	"	Aberdeen.	Imm.	—	—
169	M.	33	34	30/6/10	Aberdeen Bank.	56° 55' N.; 1° 8' W. (about).	34	"	—	—	—	—
171	M.	28.5	34.4	10/7/11	24' E. ½ S. from May Island.	56° 15' N.; 1° 49' 50" W.	29	"	Granton.	—	Fair.	Fair.
172	F.	37	42.1	20/7/11	27' S.-E./S. of Aberdeen.	56° 50' 45" N.; 1° 25' W.	35	"	Aberdeen.	Imm.	—	Good.



173	M.	33-	23/ 9/10	23' S.-E. of Aberdeen.	56° 57' 48" N.; 1° 27' 50" W.	30	"	Aberdeen.	?	Gutted.
174	M.	29-	25/ 3/11	26 m. S.-E./E. from Aberdeen.	57° 0' 30" N.; 1° 17' 50" W.	34	"	Aberdeen.	Imm.	Good.
176	F.	35-5	1/10/10	15' E.-S.-E. of Bell Rock.	56° 24' 5" N.; 1° 55' W.	27	"	Dundee.	?	?
177	F.	37-5	21/ 5/11	5' E.-S.-E. from Buchanness.	57° 27' 20" N.; 1° 37' W.	43	S.T.	Aberdeen.	Imm.	Good; slight ulcer at mark.
180	M.	36-5	18/10/10	27' S.-E./E. of Aberdeen.	57° 0' 30" N.; 1° 17' 24" W.	38	"	Aberdeen.	?	—
181	F.	33-5	13/ 9/10	51' E./S. $\frac{1}{2}$ S. of May Island.	56° 10' N.; 1° 0' W.	37	"	N. Shields.	Ovary	Very stale.
183	F.	25-5	28/ 1/12	40' N. from Ratray.	58° 15' 15" N.; 2° 12' W.	37	"	Aberdeen.	Partly spent.	Good.
186	F.	36-5	24/ 6/10	20' E.-S.-E. of Aberdeen.	57° 6' N.; 1° 26' 58" W.	50	"	—	Imm.	Good.
187	F.	36-5	14/ 6/10	70' N.-E./E. of May Island.	57° 4' 55" N.; 1° 11' W.	31	"	—	—	—
189	F.	37-7	6/10/10	28' E.-S.-E. of Aberdeen.	57° 4' 55" N.; 1° 12' 50" W.	32	"	Aberdeen.	$\frac{1}{4}$ Ripe.	—
190	M.	35-9	15/ 8/10	45-50' E./S. of Aberdeen.	57° 13' N.; 0° 41' W.	38	"	Aberdeen.	Imm.	Fair.
193	M.	32-	2/ 7/11	27' E.-S.-E. of Aberdeen.	57° 5' N.; 1° 15' 20" W.	32	"	Aberdeen.	Has been ripe.	Good; slight ulcer.
194	F.	36-	16/ 6/10	60' E.-N.-E. of Bell Rock.	57° 3' 10" N.; 0° 58' 50" W.	36	"	—	Imm.	Good.
195	F.	28-5	24/ 5/12	40' S.-E. from Aberdeen.	56° 48' 24" N.; 1° 0' W.	40	"	Aberdeen.	Spent.	Good.
196	M.	32-5	11/11/10	14-15' E. of Aberdeen.	57° 12' 20" N.; 1° 38' 20" W.	37	"	Aberdeen.	$\frac{1}{2}$ Ripe.	—
197	F.	38-5	21/ 6/10	37' S.-E. of Aberdeen.	56° 50' 45" N.; 1° 1' 40" W.	40	"	Aberdeen.	Imm.	Good.
199	F.	35-5	7/10/10	27' S.-E./S. of Aberdeen.	56° 50' 40" N.; 1° 25' W.	35	"	Aberdeen.	$\frac{1}{2}$ Ripe.	—
200	M.	32-	12/ 4/11	23-25 m. E.-N.-E. from Buchanness	57° 45' 50" N.; 1° 10' 10" W.	42	"	Aberdeen.	Ripe.	Good.
Date, 16th June 1910. Liberated, N.-W. of Fisher Bank, 57° 25' N.; 3° 35' E. Depth, 34 Fms.										
Tab. No.	Sc. A. 10									
48	F.	34-5	25/10/10	190' E. $\frac{2}{3}$ S. of Aberdeen.	57° 40' N.; 3° 50' E.	38	S.T.	Altona.	—	Dried.
51	M.	36-	4/ 7/10	195' E./S. of Aberdeen.	57° 25' N.; 4° E.	35	"	London.	—	Sound; fresh.
75	M.	35-5	5/ 8/10	213' E./S. $\frac{1}{2}$ S. of Aberdeen.	57° 10' N.; 4° 31' E.	35	"	Hull.	?	Sound; fresh.
77	M.	36-	7/ 7/10	Found at Billingsgate.	—	37	S.T.	London.	—	Sound; fresh.
83	?	32-5	23/ 5/11	195' E./S. $\frac{1}{2}$ S. of Aberdeen.	57° 20' N.; 4° E.	37	"	London.	—	—
87	M.	36-	4/ 7 10	199' E./S. of Aberdeen.	57° 27' N.; 4° 10' E.	36	"	Hull.	—	Salted and partly dried. Head nearly severed from body.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.				Depth, Fms.	Vessel.	Port Landed.	E. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.	Length Cm.					
Date, 16th June 1910. Liberated, 57° 25' N.; 3° 35' E.— <i>continued</i> .											
Sc. A. 10											
94	F.	36.	10/ 5/11	177' E. $\frac{3}{4}$ S. of Aberdeen. Found on Pontoon.	57° 32' N.; 3° 24' E.	34	S.T.	Hamburg. Grimsby.	? Testes swollen	Dry. Sound.	
128	M.	36.5	38.			—	—				
129	M.	31.5	35.	25/ 5/11	—	—	—				
154	M.	36.5	36.2	4/ 7/10	195' E./S. of Aberdeen.	35	S.T.	London.	—	Sound. Fresh.	
161	F.	35.5	Label only.	Approx. 29/ 8/11	228' E./S. $\frac{1}{4}$ S. of St. Abb's Head.	27	" "	London.	—	—	
172	M.	37.	39.8	24/ 5/11	185' E. $\frac{3}{4}$ S. of Aberdeen.	36	" "	London.	—	Sound.	
189	F.	38.	38.	7/11/10	167' E./S. of Aberdeen.	36	" "	Hamburg.	—	Dried.	
234	F.	35.	35.2	28/ 6/10	182' E./S. of Aberdeen.	38-40	" "	London.	—	Sound.	
238	F.	37.	41.7	15/ 5/11	165' E. $\frac{3}{4}$ S. of Aberdeen.	39	" "	Hull.	—	Sound.	
239	F.	40.	12 ins. of Feb. 1911.	Middle of Feb. 1911.	152' E./S. $\frac{1}{4}$ S. of Noss Head.	70	" "	London.	—	—	
241	F.	36.	Label only.	19/10/12	135' E.-S.-E. $\frac{1}{2}$ S. of Aberdeen.	41	" "	Hull.	—	—	
243	F.	33.	32.7	4/ 7/10	199' E./S. $\frac{1}{4}$ S. of Aberdeen.	34-36	" "	London.	—	Sound; fresh.	
244	F.	35.	37.	3/12/10	216' E. $\frac{1}{2}$ S. of Aberdeen.	40	" "	Hamburg.	—	Stale.	
246	M.	36.	41.4	13/ 8/11	170' E. of Aberdeen.	35	" "	Aberdeen.	Imm.	Good.	
248	F.	35.	Label only.	25/ 5/11	178' E./S. $\frac{1}{4}$ S. of Aberdeen.	39	" "	London.	—	—	
250	M.	37.	37.	22/11/10	" Borkum Riff."	18	" "	Altona.	—	Rather dry.	
252	M.	37.	36.	21/11/10	168' E. $\frac{1}{4}$ S. of Ratray Point.	38	" "	Altona.	—	Rather dry.	
253	F.	35.5	43.0	2/ 5/12	4' N.-W./W. $\frac{3}{4}$ W. of Dunnet Hd.	35	" "	Grimsby.	—	(Fish lost in transit).	
259	M.	36.	36.	5/11/10	194' E. $\frac{3}{4}$ S. of Aberdeen.	36	" "	Altona.	—	Stale.	
260	F.	35.5	34.	20/ 6/10	70' E. $\frac{3}{4}$ S. of Aberdeen.	38	" "	Cuxhaven.	—	Stale.	

261	M.	37.	5/12/10	225' E. $\frac{3}{4}$ S. of Aberdeen.	57° 35' N.; 5° E.	S.T.	Grimsby.	Ripe.	Sound.
262	F.	35.5	12/ 5/12	205' E./S. $\frac{1}{2}$ S. of Tod Head.	56° 50' N.; 4° 5' E.	"	London.	?	Sound; gutted.
264	M.	41.	24/ 5/11	177' E./S. of Aberdeen.	57° 30' N.; 3° 25' E.	"	London.	—	Sound.
266	M.	34.	35.5	152' E. $\frac{3}{4}$ S. of Rattray Point.	58° N.; 2° 50' E.	S.T.	Hull.	Imm.	Partly dry.
267	F.	36.5	7/ 8/10	174' E. $\frac{1}{4}$ S. of Aberdeen.	57° 40' N.; 3° 20' E.	"	London.	Imm.	Sound.
279	F.	33.5	7/ 7/10	192' E./S. $\frac{1}{2}$ S. of Aberdeen.	57° 10' N.; 3° 50' E.	"	—	—	Sound.
280	M.	38.5	10/ 7/10	172' E. $\frac{3}{4}$ S. of Aberdeen.	57° 30' N.; 3° 15' E.	"	—	—	Sound; gutted.
283	F.	36.	18/ 1/13	229' E./S. of Aberdeen.	57° 30' N.; 5° E.	"	(Grimsby.	—	Rather stale.
286	F.	37.	8/11/10	—	57° 25' N.; <sup>?</sup>	"	Altona.	—	Somewhat dry.
287	M.	35.	13/ 1/11	202' E./S. $\frac{1}{4}$ S. of Rattray Point.	57° 48' N.; 4° 30' E.	"	Bremerhaven	—	—
292	F.	33.	1/ 5/11	142' E./S. $\frac{1}{4}$ S. of Rattray Point.	57° 43' N.; 2° 34' E.	"	Hull.	—	—
294	F.	37.	16/11/10	39' N./W. $\frac{1}{4}$ W. of Hangstholm.	57° 40' N.; 8° E.	"	Altona.	—	—
297	F.	32.5	Mark Prior to 27/10/11	227' E.-S.-E. $\frac{1}{2}$ S. of St. Abb's Hd.	55° N.; 5° E. (about).	"	—	—	—
301	M.	35.	43.6	180' E./S. $\frac{3}{4}$ S. of Peterhead.	57° 20' N.; 3° 50' E.	S.T.	London.	Mature.	Sound; gutted.
303	F.	37.5	4/ 7/10	193' E./S. of Aberdeen.	57° 25' N.; 4° E.	"	London.	Imm.	Fresh.
306	F.	34.	33.3	169' E./S. $\frac{1}{2}$ S. of Peterhead.	57° 30' N.; 3° 30' E.	"	London.	Imm.	Sound.
308	F.	38.5	Label only.	174' E./S. $\frac{3}{4}$ S. of Tod Head.	56° 50' N.; 3° 4' E.	"	Hull.	—	—
310	F.	34.	32.5	183' E.-S.-E. of St. Abb's Head.	55° 40' N.; 3° 25' E.	"	Hull.	—	Salted and dried.
315	M.	37.	45.3	139' E.-S.-E. of Tod Head.	56° 40' N.; 2° E.	"	Hull.	Mature.	Sound; gutted.
319	M.	35.5	36.	131' E./S. of Rattray Point.	57° 55' N.; 2° 16' E.	"	Hamburg.	—	Dry and stale.
320	F.	36.	35.	186' E./S. of Aberdeen.	57° 28' N.; 3° 45' E.	"	—	—	—
321	M.	35.5	37.	16/11/10	57° 20' N.; 5° 10' E.	"	Hamburg.	—	Good.
335	F.	34.	32.8	183' E./S. $\frac{1}{4}$ S. of Aberdeen.	57° 10' N.; 3° 40' E.	"	Hull.	—	Salted and partly dried.
336	F.	37.	40.3	159' E./S. $\frac{1}{4}$ S. of Buchanness.	57° 30' N.; 3° 10' E.	"	Hull.	—	Sound.
338	F.	38.	43.	28/10/12	57° 50' N.; 2° 25' E.	"	Hull.	?	—
339	M.	33.	45.6	30' S.-E./E. from Aberdeen.	56° 59' N.; 1° 10' W.	"	Aberdeen.	Ripe.	Good.
342	F.	36.	36.2	26/ 7/10	175' E.-S.-E. of Peterhead.	"	Hull.	Imm.	Sound; stale.
344	M.	35.5	34.2	170' E.-S.-E. of Buchanness.	57° 10' N.; 3° 40' E.	"	Hull.	—	Salted and partly dried.
345	M.	38.	Label only.	168' E.-S.-E. of Girdleness.	56° 50' N.; 3° 10' E.	"	Hull.	—	—
354	M.	35.5	33.0	27/ 6/10	174' E./S. $\frac{3}{4}$ S. of Buchanness	"	Hull.	—	Salted and dried.
355	F.	38.5	43.0	168' E. $\frac{1}{2}$ S. of Rattray Point.	58° 10' N.; 3° 20' E.	"	Hull.	—	Dried.

TABLE I.—PLAICE.

No. of Tab.		Sex.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Date, 16th June 1910. Liberated, 57° 25' N.; 3° 35' E.— <i>continued.</i>												
Sc. A. 10												
357	F.	37-	40-5	22/ 5/11	167° E./S.-E. $\frac{1}{2}$ S. of St. Abb's Hd.	55° 20' N.; 2° 50' E.	15-17	S.T.	London.	—	—	Sound.
358	F.	35-5	37-	9/ 8/10	162° E./S. $\frac{1}{2}$ S. of Peterhead.	57° 28' N.; 3° 16' E.	35	"	—	—	—	—
360	F.	39-	Label only	17/ 5/11	161° E./S. $\frac{1}{4}$ S. of Peterhead.	57° 25' N.; 3° 15' E.	34	"	Hull.	—	—	—
			17 $\frac{1}{2}$ in.									
363	F.	36-	Label only	5/ 7/10	199° E./S. $\frac{1}{4}$ S. of Aberdeen.	57° 15' N.; 4° 10' E.	37	"	"	Hull.	—	—
367	F.	37-5	Label only	8/ 7/10	164° E./S. $\frac{3}{4}$ S. of Peterhead.	57° 25' N.; 3° 20' E.	34	"	"	Hull.	—	—
369	F.	35-5	40-0	27/ 5/11	165° E. from Aberdeen.	57° 54' N.; 2° 51' 10" E.	36	"	"	Aberdeen.	Imm.	Good.
370	M.	35-	36-	25/ 5/11	184° E./S. $\frac{1}{4}$ S. of Aberdeen.	57° 15' N.; 3° 40' E.	34	"	"	London.	—	Sound.
372	M.	35-5	35-6	4/ 7/10	200° E./S. of Aberdeen.	57° 25' N.; 4° E.	35	"	"	London.	—	Fresh.
375	F.	32-5	33-	25/10/10	201° E. $\frac{3}{4}$ S. of Aberdeen.	57° 30' N.; 4° E.	38	"	"	Hamburg.	—	Partly decomposed.
377	F.	34-	37-	24/ 4/11	205° E./S. of Aberdeen.	57° 20' N.; 4° 10' E.	38	"	"	Hamburg.	—	Sound; dry.
380	M.	37-	38-5	20/ 5/11	177° E./S. $\frac{1}{2}$ S. of Buchanness.	57° 35' N.; 3° 45' E.	39	"	"	London.	—	Sound.
382	M.	40-	41-4	9/ 4/11	45m. E. $\frac{3}{4}$ S. from Aberdeen.	57° 14' N.; 0° 40' 55" W.	36	"	"	Aberdeen.	Ripe.	Good.
384	F.	35-	34-5	4/ 7/10	187° E./S. $\frac{1}{4}$ S. of Aberdeen.	57° 10' N.; 3° 40' E.	33	"	"	Hull.	—	Salted and partly dried.
387	F.	38-5	42-4	18/ 5/11	183° E./S. of Aberdeen.	57° 20' N.; 3° 30' E.	34	"	"	London.	—	Sound.
389	F.	37-	35-8	6/ 7/10	191° E./S. $\frac{1}{4}$ S. of Aberdeen.	57° 10' N.; 3° 45' E.	35	"	"	Hull.	—	Salted and dried.
390	F.	39-5	Label only	22/ 6/10	174° E./S. $\frac{1}{4}$ S. of Buchanness.	57° 27' N.; 3° 32' E.	34	"	"	Hull.	—	—
392	F.	35-5	35-	7/ 8/10	215° E./S. of Aberdeen.	57° 23' N.; 4° 30' E.	30	"	"	—	Imm.	—
394	F.	35-	43-3	11/11/11	163° E./S. $\frac{1}{4}$ S. of Buchanness.	57° 35' N.; 3° 20' E.	36	"	"	London.	—	Sound.

395	F.	41-5	27/ 6/10	182' E./S. of Aberdeen.	57° 30' N.; 3° 30' E.	34	"	London.	Mature.	Sound.
398	F.	37-	16/ 5/11	120' E./S. $\frac{1}{2}$ S. of Peterhead.	57° 30' N.; 2° E.	47	"	Hamburg.	—	Somewhat dry.
402	F.	39.	10/ 6/12	190' E./S. $\frac{1}{2}$ S. of Peterhead.	57° 30' N.; 4° 10' E.	37	"	Hull.	—	—
404	M.	35-5	6/ 7/10	187' E./S. $\frac{1}{2}$ S. of Aberdeen.	57° 10' N.; 3° 50' E.	34	"	London.	—	Sound.
407	F.	35-	Label. Prior to 30/ 5/11	—	—	—	"	London.	—	—
408	F.	37-5	40- 9/ 8/10	162' E./S. $\frac{1}{2}$ S. of Peterhead.	57° 28' N.; 3° 16' E.	35	"	—	—	—
409	F.	35-	Label 25/ 5/11	158' E./S. $\frac{1}{2}$ S. of Peterhead.	57° 30' N.; 3° 10' E.	36	"	Hull.	—	—
411	M.	34-5	16 $\frac{1}{2}$ in. Mark 29/11/11	228' E./S. $\frac{1}{4}$ S. of St. Abb's Head.	56° 5' N.; 4° 40' E.	29	—	London.	—	—
413	M.	35-	40-2	151' E. of Kinmaird Head.	58° 25' N.; 2° 30' E.	56	S.T.	Grimsb.	—	Sound.
414	F.	35-5	24/ 5/11	169' E./S. $\frac{1}{2}$ S. of Peterhead.	57° 30' N.; 3° 30' E.	36	"	London.	—	Sound.
415	F.	32-	Prior to 4/ 8/11	210' E.-S.-E. of Aberdeen.	56° 30' N.; 4° 30' E.	34	"	Grimsb.	—	—
416	M.	34-3	34-6	185' E./S. $\frac{3}{4}$ S. of Peterhead.	57° 25' N.; 4° E.	35	"	London.	—	Fresh.
422	M.	37-	Label 26/ 5/11	165' E.-S.-E. of Buchanness.	57° 10' N.; 3° 20' E.	33	"	London.	—	—
424	M.	33-5	16 $\frac{3}{4}$ in. 36-1	215' E./S. of Aberdeen.	57° 26' 30" N.; 4° 39' 10" E.	39	"	Aberdeen.	Matur- ing. ?	—
426	F.	32-	38-5	160' E. $\frac{3}{4}$ S. of St. Abb's Head.	56° 20' N.; 2° 40' E.	41	"	Hull.	—	Sound; gutted.
427	F.	37-	26/ 6/10	190' E./S. $\frac{1}{2}$ S. of Peterhead.	57° 25' N.; 4° 10' E.	39	"	Hamburg.	—	—
428	M.	35-	34-8	182' E./S. of Aberdeen.	57° 30' N.; 3° 30' E.	34	"	London.	—	Sound.
429	F.	35-	36-	167 1/10 39' N./W. $\frac{1}{2}$ W. of Hanstholm.	57° 40' N.; 8° E.	42	"	Altona.	—	Dry.
431	F.	35-	37-	16/ 5/11	124' E./S. $\frac{1}{2}$ S. of Buchanness.	47	"	Hamburg.	?	Dry.
435	F.	41-5	41-6	4/ 7/10	206' E. $\frac{3}{4}$ S. of Aberdeen.	37	"	London.	—	Fresh.
437	M.	34-5	39-5	27/ 7/11	146' E. $\frac{1}{2}$ S. of Rattray Point.	34	"	Hull.	—	Sound.
438	F.	40-	39-	27/ 6/10	181' E./S. $\frac{1}{2}$ S. of Aberdeen.	34	"	Hull.	—	Salted and partly dried.
439	F.	40-	39-	27/11/10	224' N.-E./E. $\frac{1}{2}$ E. of Noss Head.	68	"	Hamburg.	—	Very stale.
440	M.	38-5	41-4	24/ 5/11	170' E. of Aberdeen.	38	"	Aberdeen.	Spent.	Good.
441	F.	34-	32-	21/ 6/10	163' E./S. of Buchanness.	37	"	Hull.	—	Dried.
442	M.	37-5	38-2	4/ 7/10	190' E./S. $\frac{1}{2}$ S. of Buchanness.	35	"	London.	—	Fresh.
444	M.	35-	35-2	27/ 6/10	182' E./S. of Aberdeen.	34	"	London.	—	Sound.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 16th June 1910. Liberated, 57° 25' N.; 3° 35' E.— <i>continued.</i>												
Sc. A. 10												
450	M.	32·2	32·2	4/7/10	190' E./S. 1/2 S. of Buchanness.	57° 25' N.; 4° E.	35	S.T.	London.	—	—	Fresh.
457	F.	36·5	38·3	19/11/10	146' E. 3/4 S. of Ratray Point.	57° 57' N.; 2° 45' E.	38-43	"	Grimby.	Imm.	—	Sound.
458	M.	35·5	39·7	24/5/11	172' E./S. 1/2 S. of Peterhead.	57° 35' N.; 3° 35' E.	36	"	London.	—	—	Sound.
459	M.	37·5	43·	6/6/12	196' E./S. 1/2 S. of Peterhead.	57° 40' N.; 4° 20' E.	38	"	Hull.	—	—	Gutted.
461	F.	37.	40·	25/5/11	153' E.-S. E. 1/4 E. of Peterhead.	57° 20' N.; 3° E.	40	"	Hamburg.	—	—	Somewhat dry.
463	F.	38.	40·	End of 4/11	173' E./S. 1/4 S. of Peterhead.	57° 35' N.; 3° 40' E.	35	"	Hamburg.	—	—	Somewhat dry.
464	F.	35·5	35·8	27/6/10	169' E./S. 1/2 S. of Peterhead.	57° 30' N.; 3° 30' E.	34	S.T.	London.	Imm.	—	Sound.
467	F.	37.	37.	29/10/10	184' E./S. 1/2 S. of Peterhead.	57° 30' N.; 4° E.	38	"	—	—	—	—
468	F.	35.	Label	27/6/10	169' E./S. 1/2 S. of Peterhead.	57° 30' N.; 3° 30' E.	34	"	London.	—	—	—
469	F.	34.	only.	27/6/10	169' E./S. 1/2 S. of Peterhead.	57° 30' N.; 3° 30' E.	34	"	London.	Imm.	—	Sound.
470	M.	31·5	Label.	3/7/10	195' E.-S. E. 1/4 E. of Peterhead.	57° 20' N.; 4° 20' E.	37	"	Hull.	—	—	—
472	M.	33.	only.	26/6/10	190' E./S. 1/2 S. of Peterhead.	57° 25' N.; 4° 10' E.	39	"	Hamburg.	—	—	—
473	F.	32·5	33·	25/4/13	—	57° 35' N.; 7° W.	52	"	Ymuiden.	—	—	Sound.
474	M.	32.	39·0	5/5/12	161' E./S. 1/4 S. of Peterhead.	57° 40' N.; 3° 15' E.	39	"	London.	—	—	Gutted; sound.
Date, 17th June 1910. Liberated, N.-W. Fisher Bank, 57° 20' N.; 3° 39' E. Depth, 35 Fms.												
Sc. A. 10												
484	?	40·5	40·	9/8/10	162' E./S. 1/4 S. of Buchanness.	57° 28' N.; 3° 16' E.	25	S.T.	—	—	—	—
493	M.	42.	43·6	18/5/11	178' E./S. 1/4 S. of Aberdeen.	57° 20' N.; 3° 30' E.	34	"	London.	—	—	Sound.

Date, 21st June 1910. Liberated. S.-W. Fisher Bank, 56° 37' N.; 3° 42' E. Depth, 36 Fms.									
Sd. A. 10									
552	M.	42.3	2/ 7/10	162' E. $\frac{2}{3}$ S. of May Island.	56° 30' N.; 2° 20' E.	43	S.T.	London.	Fresh.
553	M.	46.5	8/ 2/11	137' E.-S.-E. of St. Abb's Head.	55° 40' N.; 2° E.	42	"	London.	"
556	F.	51.5	Label 8/10/11 only.	209' E./S. of St. Abb's Head.	56° 4' N.; 4° 10' E.	31	"	Hull.	"
Date, 27th July 1910. Liberated, Covesea Light, S.-W./S. 8'; 57° 51' N.; 3° 16' W. Depth, 24 Fms.									
708	M.	38.5	17/ 3/11	North Minch.	58° 10' N.; 5° 50' W. (about).	50-60	S.T.	Hull.	Sound.
Date, 29th July 1910. Liberated, 57° 41' N.; 1° 55' W. Kinnaird Head, W.-N.-W. 2'. Depth, 5 Fms.									
714	M.	39.2	10/ 3/11	30 m. N.-E. from Buckie Harbour.	58° 6' N.; 2° 34' W.	35	Cod Nets	Buckie.	Good.
716	M.	41.2	20/ 3/11	5 m. N. from Tarbet Ness.	57° 56' 35" N.; 3° 50' W.	18	"	Buckie.	Good.
717	?	33.	6/ 9/11	1' S. of Rattrayhead Lighthouse.	57° 34' 55" N.; 1° 49' W.	9	"	Peterhead.	"
718	M.	44.	Label 3/ 4/11 only.	Morecambe Bay, Lancashire.	—	—	"	—	"
Date, 15th September 1910. Liberated, 19' E.S.E. of Fair Isle, 59° 30' N.; 1° W. Depth, 65-70 Fms.									
741	F.	47.5	52.	11/ 6/11	8' S.-E./E. from Foula.	46	S.T.	Aberdeen.	Good.
745	F.	37.	36.9	11/10/10	90' N.N.-E. of Buchanness.	65	"	Aberdeen.	—
746	M.	37.5	37.1	12/10/10	69' E. $\frac{1}{2}$ S. of Noss Head.	63	"	Hull.	Sound; stale.
747	F.	44.	40.	10/ 7/11	9' S./E. from N. Light of Fair Is.	55	"	Aberdeen.	Good.
748	F.	37.5	40.	22/ 4/11	44' E.-N.-E. $\frac{3}{4}$ N of Noss Head.	43	"	N. Shields.	Sound.
750	?	36.5	—	1/11/10	5' S.-E./E. of Fair Isle.	52	"	Leith.	—
751	F.	39.	46.5	11/ 7/11	91' N.N.-E. of Rattray.	48	"	Aberdeen.	Good.
752	F.	38.	38.2	22/ 1/11	12 m. S.-E./S. from Noss Head.	35	"	Aberdeen.	Good.
753	F.	39.	43.9	22/ 5/11	—	34	"	Aberdeen.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Date, 15th September 1910. Liberated, 59° 30' N.; 1° W.— <i>continued.</i>											
Sec. A. 10											
755	M.	38.5	16/9/10	50° N.-N.-E. of Buchanness.	58° 19' 30" N.; 1° 35' 50" W.	55	S. T.	Aberdeen.	Imm.	—	—
757	M.	38.5	11/6/11	Sule Skerry.	59° 2' N.; 4° 20' W.	26	"	Aberdeen.	Ripe.	Good.	—
761	F.	34.	19/5/11	Moray Firth.	—	52	"	Ostend.	—	—	—
765	M.	40.	Label only.	95° E.-N.-E. of Spurn Head.	54° 10' N.; 2° 42' E.	12	"	Hull.	—	—	—
768	M.	39.	3/6/11	14° E.-S.-E. from Auskerry.	59° 1' 30" N.; 2° 8' 10" W.	45	"	Aberdeen.	Spent.	Good.	Good.
775	M.	36.5	22/4/11	6m. N. from Loch Eriboll.	58° 39' N.; 4° 40' W. (about).	45	"	Aberdeen.	Ripe.	Good; slight ulcer at mark.	—
776	F.	34.5	41.	Moray Firth?	—	58	"	Ostend.	—	—	—
778	F.	38.	42.3	16/6/11	15° E. $\frac{1}{2}$ S. of Auskerry.	49	"	Aberdeen.	—	—	—
779	F.	34.5	47.6	22/5/13	4° S.-W. of Foutla.	43	"	N. Shields.	—	—	—
780	M.	35.5	35.9	18/1/11	45 m. N./W. from Rattray Head.	47	"	Aberdeen.	Almost ripe.	—	—
782	F.	37.	37.8	4/3/11	In a consignment of fish from Granton.	—	—	—	Imm.	Thin.	—
783	F.	35.5	35.9	28/1/11	5 m. N.-E./E. from Auskerry.	40	S. T.	Aberdeen.	Imm.	Good.	—
789	F.	34.5	34.3	30/9/10	109° E./N. $\frac{1}{2}$ N. of Noss Head.	64	"	Hull.	Imm.	Sound.	—
791	F.	39.	39.9	25/12/13	16° S. of Bell Rock.	32	—	Dundee.	Nearly ripe.	Good.	—
795	F.	37.5	37.8	24/1/11	7 m. E./N. from Pentland Skerries.	42	S. T.	Aberdeen.	Imm.	Good.	—
796	F.	40.5	49.3	15/10/11	6°-S.-W. of Sumburgh Head.	56	"	Aberdeen.	Roe dev. Nearly ripe.	Good.	—
803	F.	41.5	41.1	19/9/10	4° E. of Fetlar, Shetland.	54	"	Aberdeen.	$\frac{1}{2}$ Ripe.	—	—
806	F.	36.5	46.7	21/1/13	7° N.-N.-W. fr. Holburn Hd.	41	"	Aberdeen.	Spent.	Good.	—
807	F.	39.5	39.8	24/1/11	7 m. E./N. fr. Pentland Skerries.	42	"	Aberdeen.	About $\frac{1}{4}$ ripe.	Good.	—





TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Length Cm.	Date.	PLACE.	PARTICULARS OF RECAPTURE.			Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
						LATITUDE AND LONGITUDE.							
Date, 15th September 1910. Liberated, 59° 38' N.; 0° 57' W.— <i>continued.</i>													
Sc. A. 10													
854	F.	40·1	40·1	13/10/10	48° N.-E. $\frac{1}{2}$ N. of Buchanness.	58° 12' 45" N.; 1° 10' 50" W.		60	S.T.	Aberdeen.	Maturing imm.	—	
855	M.	36·	35·9	4/11/10	90° N.-E. of Ratray Head.	58° 56' 10" N.; 0° 28' 15" W.		75	"	Aberdeen.	Appar. imm.	—	
856	F.	36·5	40·9	21/ 5/11	8' S./E. of Fair Isle.	59° 25' 50" N.; 1° 26' 20" W.		42	"	Aberdeen.	Appar. imm.	Good.	
858	F.	39·	38·7	6/11/10	24' E.-S.-E. of Sumburgh Head.	59° 48' 50" N.; 0° 29' 5" W.		75	"	Aberdeen.	$\frac{1}{2}$ Ripe.	—	
860	F.	36·5	36·6	1/ 2/11	11 m. E.-S.-E. from N. Light, Fair Isle.	59° 31' 20" N.; 1° 14' 15" W.		31	"	Aberdeen.	Almost quite ripe.	Good.	
861	F.	46·5	50·5	28/ 4/12	108 m. E. $\frac{3}{4}$ S. of Sumburgh Head.	59° 40' N.; 2° 20' E.		70	"	Blyth.	Imm.	Sound; gutted.	
865	M.	37·	38·3	31/ 1/11	Sinclair Bay, 1 m. off Ackergill.	58° 29' N.; 3° 5' W.		9	Line.	Wick.	Imm.	Good.	
866	F.	35·	35·1	1/10/10	5' S.-E./E. of Fetlar (Shetland).	60° 34' N.; 0° 35' 55" W.		60	S.T.	Aberdeen.	$\frac{1}{2}$ Ripe.	—	
868	F.	37·	37·2	19/10/10	70' E. $\frac{3}{4}$ N. of Noss Head.	59° N.; 1° 3' W.		72	"	Hull.	Ovary 3 cm.	Sound.	
870	M.	32·	Label only.	18/12/10	72' E.-N.-E. $\frac{1}{2}$ N. of Kinnaird Hd.	58° 35' N.; 0° 30' W.		68	"	Hull.	?	?	
872	M.	41·5	42·5	27/ 4/11	4 m. S.-E. from Stack Skerry.	59° N.; 4° 30' W. (about).		40	"	Aberdeen.	Spent.	Good.	
875	M.	35·5	40·8	20/ 5/12	6' E./N. $\frac{1}{2}$ N. from Anskerry.	59° 6' N.; 2° 23' 30" W.		42	"	Aberdeen.	Spent.	Good.	
878	F.	36·	35·4	21/ 9/10	10-12' S.-E. of Fair Isle.	59° 27' 5" N.; 1° 15' W.		63	"	Aberdeen.	$\frac{1}{2}$ Ripe.	—	
880	F.	37·	40·2	3/ 6/11	Fair Isle in W. and Sumburgh Head in N.	59° 34' N.; 1° 20' W.		52	"	Aberdeen.	Appar. imm.	Good; slight ulcer at mark.	
881	F.	42·	41·6	17/10/10	15' S.-E. of Fair Isle.	59° 25' 40" N.; 1° 10' W.		45	"	Aberdeen.	$\frac{1}{2}$ Ripe.	—	
884	F.	38·5	38·9	29/11/10	60' N.N.-E. of Buchanness.	58° 27' 50" N.; 1° 34' W.		57	"	Aberdeen.	$\frac{1}{2}$ Ripe.	—	
887	F.	37·5	42·6	1/ 7/11	15' E.-S.-E. of Anskerry.	59° 0' 30" N.; 2° 6' W.		43	"	Aberdeen.	Imm.	Good.	
888	F.	45·	45·4	17/11/10	4' S.-E. of Roseness, Orkney.	58° 53' 30" N.; 2° 35' W.		22	"	Aberdeen.	$\frac{1}{2}$ Ripe.	—	
889	F.	34·5	40·5	9/ 7/11	18' S.-E. of Noss Head.	58° 19' 10" N.; 2° 32' W.		30	"	Aberdeen.	Imm.	Good.	
891	M.	36·5	37·8	14/ 4/11	42' N.-E./E. of Noss Head.	50° 2' N.; 2° 15' W.		44	"	N. Shields.	—	Sound.	



TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Cm.									
Date, 15th September 1910. Liberated, 59° 30' N.; 1° W.— <i>continued</i>												
Se. A. 10												
949	M.	35.5	35.3	11/ 1/11	1½ m. off Knock Head.	57° 41' 30" N.; 2° 30' W.		20	Set Nets	Whitchills.	App. immaturity	Good.
953	M.	38.	40.	24/ 1/11	Moray Firth.			52	S.T.	Ostend.	¼ Ripe.	—
954	M.	38.	37.7	6/11/10	8' S.S.-W. of Sumburgh Head.	59° 43' 10" N.; 1° 18' 15" W.		55	"	Aberdeen.	—	—
955	?	39.	42.	18/11/11	6' N.-E. ½ E. of Peterhead.	57° 35' N.; 1° 40' W.		35-48	"	Grimby.	—	Sound; gutted.
956	F.	44.5	44.6	20/ 1/11	10 m. S. of Fair Isle.	59° 23' N.; 1° 29' 55" W.		48	"	Aberdeen.	Almost qu. ripe	Good.
959	F.	38.	37.5	22/ 9/10	10' E.-S.-E. of Fair Isle.	59° 31' 55" N.; 1° 15' 50" W.		46	"	Aberdeen.	¾ Ripe.	—
960	F.	39.5	44.6	17/ 6/11	Auskerry Light, bearing W./N., Fair Isle, N.-E.	59° 3' N.; 2° 8' 40" W.		45	"	Aberdeen.	Seems to be imm.	Good.
962	F.	37.	41.	12/ 7/11	9.-10' S. ½ E. of Fair Isle.	59° 23' 40" N.; 1° 28' 20" W.		58	"	Aberdeen.	Imm.	Good.
964	M.	33.5	34.1	10/ 3/11	8' S.-E./S. ½ S. from Buchanness.	57° 23' 23" N.; 1° 35' W.		40	"	Aberdeen.	Imm.	Good.
965	M.	38.	42.	28/ 4/12	5' E.-S.-E. from Foula.	60° 6' 10" N.; 1° 52' 5" W.		42	"	Aberdeen.	Ripe.	Good.
966	F.	42.	41.5	6/ 6/11	18' E.-S.-E. of Auskerry.	59° N.; 1° 58' W.		46	"	Aberdeen.	Imm.	Good; slight ulcer at mark.
968	M.	38.5	37.9	4/11/10	22' E./S. of Sumburgh Head.	59° 53' 45" N.; 0° 33' 30" W.		70	"	Aberdeen.	—	—
969	F.	39.	38.5	12/10/10	10' N.-N.-W. of S. Light, Fair Isle.	59° 38' 5" N.; 1° 52' W.		58	"	Aberdeen.	¼ Ripe.	—
973	F.	38.	38.4	30/ 9/10	90' N.N.-E. of Buchanness.	58° 57' 30" N.; 1° 26' 5" W.		60	"	Aberdeen.	¾ Ripe.	—
976	M.	37.	Mark only	28/10/11	95' N. ½ E. of Buchanness.	59° 0' 40" N.; 2° 26' 10" W.		41	"	Aberdeen.	—	—
979	F.	40.5	41.4	9/10/10	7' S.S.-E. of N. Light, Fair Isle.	59° 27' 20" N.; 1° 25' 40" W.		52	"	Aberdeen.	About ¼ matd.	—
982	F.	40.5	41.8	22/ 5/11	14' E./S. of Aaus Rempon.	—		37-38	"	Aberdeen.	Imm.	Good
983	F.	37.	32.0	10/ 5/13	6' E./S. of Foula.	60° 5' N.; 1° 55' W.		45	"	Hull	—	Sound.
984	M.	36.5	40.8	23/ 7/11	10' S.S.-E. from Fair Isle.	59° 24' 40" N.; 1° 23' 15" W.		44	"	Aberdeen.	Ripe.	Good.
986	F.	35.5	35.0	17/ 2/11	40' E./N. of Fair Isle.	59° 37' N.; 0° 20' W.		79	"	N. Shields.	Imm.	Sound.
987	M.	36.	36.2	27/ 1/11	5' E.-N.-E. from Pentland Skerries.	58° 44' N.; 2° 46' 30" W.		39	"	Aberdeen.	Amt. ripe	Good.

	F.	38-	37-9	25/ 2/11	1 m. off Banff.	57° 41' 30" N.; 2° 30' W.	14	Set Nets.	Whitehills.	On the point of spawn.	Good.
990	F.	42.	47-9	28/ 6/12	18' S.-E. from Noss Head.	58° 19' 10" N.; 2° 32' W.	30	S.T.	Aberdeen.	Appar.	Good.
991	F.	39-5	43-8	29/ 6/11	6' N.-E. off Aukerry.	59° 6' 50" N.; 2° 28' 20" W.	45	"	Aberdeen.	Appar. spent.	Good; slight ulcer.
993	M.	33-5	37-2	6/ 6/11	7'E.-S.-E. of Copinshay.	58° 53' N.; 2° 26' W.	41	"	Aberdeen.	Imm.	Good; slight ulcer at mark.
995	M.	35-5	37-2	2/12/10	6' N./E. ½ E. of Stumburgh Head.	59° 58' N.; 1° 12' W.	55	"	—	—	—
999	F.	40.	41-6	5/ 6/11	8' S. from Fair Isle.	59° 25' N.; 1° 30' 25" W.	43	"	Aberdeen.	Ripe.	Good.

## Date, 15th September 1910. Liberated, Fair Isle, N.-W./W. ½ W., 13'; 59° 26' N.; 1° 14' W. Depth, 70 Fms.

	M.	40.	Label only.	6/ 6/12 <th>16' N. ½ W. of Banff. <th>57° 55' N.; 2° 40' W. <th>29 <th>S.T. <th>Grimsby. <th>— <th>? </th></th></th></th></th></th></th>	16' N. ½ W. of Banff. <th>57° 55' N.; 2° 40' W. <th>29 <th>S.T. <th>Grimsby. <th>— <th>? </th></th></th></th></th></th>	57° 55' N.; 2° 40' W. <th>29 <th>S.T. <th>Grimsby. <th>— <th>? </th></th></th></th></th>	29 <th>S.T. <th>Grimsby. <th>— <th>? </th></th></th></th>	S.T. <th>Grimsby. <th>— <th>? </th></th></th>	Grimsby. <th>— <th>? </th></th>	— <th>? </th>	?
1001	M.	40.	38-5	30/10/10	19' N. ½ E. of N. Ronaldshay.	59° 41' 10" N.; 2° 32' 40" W.	55	"	Aberdeen.	—	—
1003	F.	39.	45-9	6/ 9/11	8' S.-E. from Fair Isle.	59° 28' 30" N.; 1° 21' 35" W.	58	"	Aberdeen.	Imm.	Good.
1004	F.	40-5	45-3	29/ 5/11	10' S./W. of Aukerry.	58° 52' N.; 2° 32' W.	41	"	Aberdeen.	Imm.	Good.
1009	M.	37-5	39-5	23/ 5/11	5-6' E.-S.-E. of Foula.	60° 5' N.; 1° 53' W. (about).	42	"	Aberdeen.	Ripe.	Good.
1010	F.	37.	—	—	Montrose W. and Tod Head N. ½ E.	56° 45' 20" N.; 2° 10' W.	33	"	—	—	?
1014	M.	35-5	Label only.	16/ 6/11	4' E.-N.-E. of Cape Wrath.	58° 40' N.; 4° 55' W.	25	"	Grimsby.	?	?
1016	F.	39.	39-7	7/ 4/11	44' N.-E./E. ¼ E. of Noss Head.	59° 1' N.; 2° 5' W.	43	"	N. Shields.	Spent.	Sound.
1018	F.	39-5	41-3	26/ 4/11	16 m. E.-S.-E. from Aukerry.	59° N.; 2° 2' 10" W.	42	"	Aberdeen.	Spawning.	Good.
1019	F.	38-5	50-8	6/11/11	7-8' S.-E./E. of N. Light, Fair Isle.	59° 30' 40" N.; 1° 21' W. (abt.)	52	"	Aberdeen.	About.	Good.
1020	F.	40-5	40-4	17/10/10	25' S. ½ E. of Fair Isle.	59° 8' N.; 1° 30' W.	65	"	Aberdeen.	½ Ripe.	—
1022	M.	37-5	36-9	30/ 1/11	1 m. off Whitehills.	57° 41' 30" N.; 2° 33' W.	14	Set Nets.	Whitehills.	½ Ripe.	Thin.
1023	F.	35-5	35-7	5/11/10	24'E.-S.-E. of Stumburgh Head.	59° 48' 50" N.; 0° 39' 5" W.	70	S.T.	Aberdeen.	½ Ripe.	—
1024	F.	35-5	40-1	11/ 6/11	10' S.S.-E. of Fair Isle.	59° 24' 40" N.; 1° 23' 15" W.	48	"	Aberdeen.	Appears to be imm.	Good.
1025	M.	36.	32.	5/ 6/11	17' N./W. ¾ W. of Banff.	57° 54' N.; 2° 50' W.	23	"	Geestmünde.	imm.	Dry.
1026	M.	35.	Mark only.	19/ 4/11	12' S.-E. from Fair Isle.	59° 27' N.; 1° 14' 25" W.	62	"	Aberdeen.	—	—
1027	F.	37.	41.	21/ 6/11	18' E./S. of Aukerry.	59° 3' N.; 1° 57' 35" W.	39	"	Aberdeen.	Imm.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs	Condition.
		Cm.	Cm.									
Date, 15th September 1910. Liberated, Fair Isle, N.-W./W. $\frac{1}{2}$ W., 13'.— <i>continued.</i>												
Sc. A. 10												
1028	F.	41	42.9	21/ 5/11	10' N.-E. of Whiten Head.	58° 45' N.; 4° 5' W.	39	S.T.	Aberdeen.	Spent.	Good; slight ulcer at mark	
1030	M.	34	36.5	—	—	—	—	—	Aberdeen.	About $\frac{1}{2}$ ripe.	Good.	
Date, 15th September 1910. Liberated, Fair Isle, N.-W./W. $\frac{1}{2}$ W., 7'; 59° 28' N.; 1° 26' W. Depth, 60 Fms.												
1034	M.	37	41.8	4/ 7/11	20' S.-W./S. from Fair Isle.	59° 13' N.; 1° 48' W.	45	S.T.	Aberdeen.	Imm.	Good.	
1037	M.	33.5	41.3	26/ 5/12	5 $\frac{1}{2}$ ' E.-N.-E. from Foula.	60° 10' 50" N.; 1° 53' 15" W.	48	"	Aberdeen.	Partly spent.	Good.	
1039	F.	36.5	39.8	6/ 6/11	10' E.-N.-E. from Auskerry.	59° 8' 10" N.; 2° 20' 30" W.	40	"	Aberdeen.	Spent.	Good.	
1041	M.	37	40.4	3/ 6/11	Fair Isle in W.; Sumburgh Head in N.	59° 34' N.; 1° 18' W.	52	"	Aberdeen.	Ripe.	Good.	
1044	F.	35.5	38.5	5/ 6/11	8' W./N. from Loch Ineard.	58° 27' 5" N.; 5° 22' 30" W.	36	"	Aberdeen.	Imm.	Good.	
1045	F.	38.5	44.4	17/ 7/11	13-14' S.-E./S. of N. Light of Fair Isle.	59° 24' N.; 1° 17' 50" W.	55	"	Aberdeen.	Imm.	Good.	
1048	M.	33	33.2	17/ 3/11	25' E. $\frac{2}{3}$ N. of Noss Head.	58° 40' N.; 2° 18' W.	40	"	Aberdeen.	Ripe.	Good.	
1049	F.	40.5	40.8	13/11/10	12' S.-E. of S. Light of Fair Isle.	59° 24' 50" N.; 1° 17' 50" W.	55	"	Aberdeen.	$\frac{1}{4}$ Ripe.	—	
1051	F.	35.5	45.5	17/ 8/12	62' E. $\frac{1}{2}$ S. from Aberdeen.	59° 20' N.; 0° 10' W.	44	"	Aberdeen.	Spent.	Good.	
1053	F.	37	37.3	10/10/10	90' N.-E. of Buchanness.	58° 57' 30" N.; 1° 26' 5" W.	63	"	Aberdeen.	$\frac{1}{4}$ Ripe.	—	
1054	M.	32.5	32.7	15/ 9/10	12' S.-E. of Fair Isle.	59° 20' N.; 1° 30' W.	62	"	Aberdeen.	Imm.	—	
1057	M.	33	38	26/ 7/12	217' E. $\frac{3}{4}$ S. of May Isle.	56° 40' N.; 4° E.	39	"	Cuxhaven.	—	—	
1059	M.	36.5	38.6	15/ 6/11	18' E.-S.-E. of Auskerry.	59° N.; 1° 58' W.	42	S.T.	Aberdeen.	Has been ripe.	Good.	
1061	F.	36.5	36.6	27/10/10	12' S.-E. of Fair Isle.	59° 27' N.; 1° 14' 25" W.	44	"	Aberdeen.	$\frac{1}{4}$ Ripe.	Thin.	

Date, 21st October 1910. Liberated, on Aberdeen Bank, 56° 55' N.; 1° 8' W. Depth, 34 Fms.

1063	M.	37-	40-3	8/ 2/12	16' S.-E./E. from Tod Head.	56° 47' 50" N.; 1° 46' W.	48	S.T.	Granton.	Nly. ripe	Good.
1065	F.	36-5	37-7	27/ 3/11	27 m. S.-E. from Aberdeen.	56° 55' 40" W.; 1° 20' W.	36	"	Aberdeen.	Spent.	Good.
1066	?	40-	42-	25/ 4/11	17' N.-E. $\frac{1}{2}$ N. of Kinnaird Head.	57° 57' N.; 1° 45' W.	37	"	N. Shields.	—	Sound.
1068	F.	40-5	41-1	8/ 3/11	22 m. S.-E./S. from Aberdeen.	56° 53' 50" N.; 1° 31' 50" W.	34	"	Aberdeen.	Spent	Good.
1069	M.	36-	45-2	2/ 3/13	5' N. from Sandside, Caithness.	58° 39' N.; 3° 49' W.	45	"	Aberdeen.	Spawning.	Good.
1070	M.	40-	39-8	10/ 2/11	About 1' off Banff.	57° 41' 30" N.; 2° 31' W.	14	Set Nets,	Whitehills.	Running ripe.	Rather thin.
1071	M.	39-5	44-	28/ 7/11	30' E./S. $\frac{1}{2}$ S. of Aberdeen.	57° 7' 48" N.; 1° 7' 30" W.	35	S.T.	Aberdeen.	Very imm.	Good.
1072	F.	41-	41-3	12/12/10	35' E.-S.-E. of Aberdeen.	57° 4' 10" N.; 1° W.	37	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
1074	F.	39-5	44-4	5/ 7/11	34' S.-E./E. of Aberdeen.	56° 57' 50" N.; 1° 3' 10" W.	32	"	Aberdeen.	Imm.	Good; slight ulcer at mark
1076	?	39-	42-7	6/ 6/11	26' S.S.-E. of Aberdeen.	56° 48' N.; 1° 34' W.	35	"	Aberdeen.	Imm.	—
1077	M.	34-5	39-	31/ 5/11	Moray Firth.	—	49	"	Ostend.	—	—
1078	F.	42-5	46-9	3/ 8/11	20' E./S. of Auskerry.	59° 3' 15" N.; 1° 55' W.	53	"	Aberdeen.	Imm.	Good.
1079	F.	34-5	43-4	18/ 6/12	30' S.S.-E. of Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	30	"	Aberdeen.	Imm.	Good.
1080	M.	37-5	37-8	9/ 2/11	8 m. S.-E. from Berrisdale Head.	58° 7' N.; 3° 16' W.	28	Cod Nets	Lossiemouth.	Partly spent.	Good.
1081	M.	31-	31-2	21/ 3/11	20 m. S.-E. from Aberdeen.	56° 59' N.; 1° 31' W.	37	S.T.	Aberdeen.	Imm.	Good.
1082	M.	36-5	36-4	12/11/10	$\frac{1}{2}$ fr. Black Dog (Aberdeen Bay).	57° 13' N.; 2° 3' W.	5	Line.	—	Imm.	—
1085	M.	34-5	44-	8/ 8/11	Moray Firth.	—	50	"	Ostend.	—	—
1088	?	35-5	Mark	30/12/10	1 $\frac{1}{2}$ m. off Whitehills.	57° 41' N.; 2° 31' W.	18	Set Nets,	Whitehills.	—	—
1090	F.	41-	41-	3/ 7/11	12' S.-E./E. $\frac{1}{2}$ S. of Clythness.	58° 15' N.; 2° 50' W.	23	S.T.	Geesstemünde.	?	Rather dry.
1092	M.	37-5	37-6	25/ 2/11	1 m. off Banff.	57° 41' 30" N.; 2° 30' W.	14	Set Nets,	Whitehills.	Ripe, running.	Rather thin.
1094	M.	36-5	49-2	8/ 6/14	10' S.-E. of Fair Isle.	59° 23' N.; 1° 25' W.	50	S.T.	Aberdeen.	Spent.	Good.
1096	F.	39-5	38-	28/ 3/11	Moray Firth, off Noss Head.	58° 28' N.; 2° 48' W.	29-36	"	Geesstemünde.	—	Somewhat dry.
1097	F.	36-	36-6	29/ 4/11	25' E.-S.-E. from Aberdeen.	57° 5' 50" N.; 1° 18' W.	35	"	Aberdeen.	Imm.	Good.
1099	F.	37-5	45-2	28/12/12	26' S.-E. from Aberdeen.	56° 55' 50" N.; 1° 22' W.	30	"	Aberdeen.	Nly.ripe.	Good.
1100	M.	33-2	33-2	13/ 2/11	$\frac{3}{4}$ m. off Banff.	57° 41' 30" N.; 2° 30' W.	14	Set Nets,	Whitehills.	Ripe and running.	Rather thin.
1102	F.	33-5	34-3	8/ 3/11	24 m. S.-E. $\frac{1}{2}$ E. from Aberdeen.	56° 59' 12" N.; 1° 23' W.	37	S.T.	Aberdeen.	Imm.	Good.
1103	M.	33-5	33-4	25/ 2/11	2 m. off Whitehills.	57° 42' N.; 2° 33' W.	17	Set Nets,	Whitehills.	Nearly ripe.	Thin.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Cm.									
Date, 21st October 1910. Liberated, 56° 55' N.; 1° 8' W.— <i>continued.</i>												
Se. A. 10												
1107	F.	38.	38.4	7/ 3/11	About 1½ miles off Banff.	57° 41' 30" N.; 2° 30' W.	17	Set Nets.	Whitehills.	Spawning.	Good.	
1108	F.	42.	42.	13/ 3/11	Moray Firth.	—	46	S.T.	Ostend.	Imm.	—	
1109	F.	39.5	49.	20/ 9/12	8' N.-W. from Fair Isle.	59° 36' 30" N.; 1° 50' W.	56	"	Aberdeen.	Just abt.	Good.	
1110	F.	42.5	42.5	1/ 2/11	10 m. E.-S.-E. from May Island.	56° 9' 50" N.; 2° 16' W.	32	"	Granton.	spawning.	Good.	
1111	M.	35.5	35.2	9/ 2/11	1 m. off Banff Head.	57° 41' 30" N.; 2° 30' W.	14	Set Nets.	Whitehills.	Ripe.	Rather thin.	
1112	F.	37.5	38.3	13/ 3/11	20 m. E.-N.-E. fr. Kinnaird Head.	57° 54' 20" N.; 1° 29' W.	45	S.T.	Aberdeen.	Spent.	Good.	
1113	M.	36.5	37.4	24/ 3/11	18 m. S.-E. from Aberdeen.	57° 0' 30" N.; 1° 34' W.	42	"	Aberdeen.	Spent.	Good.	
1114	F.	38.5	47.3	11/10/12	9' S.-E. from Fair Isle.	59° 28' 25" N.; 1° 20' 40" W.	57	"	Aberdeen.	Nearly ripe.	Good.	
1115	F.	32.	?	5/11/10	13' E. of Montrose.	56° 45' N.; 2° 5' W.	30	"	N. Shields.	?	?	
1117	F.	34.5	34.6	27/10/10	30' S.-E. of Aberdeen.	56° 53' 48" N.; 1° 14' 15" W.	35	"	Aberdeen.	Imm.	Good.	
1120	M.	36.	35.8	25/10/10	25-30' S.-E./E. of Aberdeen.	57° 0' 30" N.; 1° 17' 24" W.	35	"	Aberdeen.	½ Ripe.	Good.	
1123	F.	40.	40.8	29/ 4/11	14' N.-E. from Cape Wrath.	58° 51' N.; 4° 51' W.	45	"	Aberdeen.	Spent.	Good.	
1124	M.	39.	39.	10/ 2/11	8' S.-E. of Clythness.	58° 15' N.; 2° 59' W.	36	Line.	Wick.	Ripe.	Good.	
1125	F.	39.5	40.8	22/ 6/11	50' E.-S.-E. of Bell Rock	56° 19' 45" N.; 0° 52' 50" W.	49	S.T.	Dundee.	Spent.	Good.	
1126	M.	37.5	38.6	29/ 3/11	5½ m. N.-E./E. from Strathie Pt.	58° 40' 30" N.; 3° 54' W.	45	"	Aberdeen.	Ripe.	Good.	
1127	M.	33.	34.8	9/ 5/11	26' E. of Securdy Ness.	56° 49' N.; 1° 40' W.	32	"	Montrose.	Imm.	Fair.	
1129	F.	37.5	38.1	4/ 4/11	81 m. N.N.-E. from Buchanness.	58° 49' 45" N.; 1° 29' 40" W.	58	"	Leith.	Spent.	Good.	
1130	?	40.	43.	14/ 4/11	Moray Firth.	—	52	"	Ostend.	—	—	
1131	F.	32.	36.	30/ 3/12	Moray Firth.	—	21	"	Ostend.	—	—	
1132	F.	39.5	49.9	26/ 6/12	18' S.-E./E. from Noss Head.	58° 23' 25" N.; 2° 29' 55" W.	35	"	Aberdeen.	Spent.	Good.	
1135	M.	35.5	36.	28/ 1/11	Moray Firth.	—	49	"	Ostend.	—	—	



1140	F.	39.5	38.9	30/ 1/11	1 m. off Banff.	57° 41' 30" N.; 2° 30' W.	14	Set Nets.	Whitehills.	Almost ripe.	Good.
1141	?	39.5	Mark only.	8/ 2/12	6' off Ord of Caithness.	58° 4' 30" N.; 3° 25' 30" W.	26	Cod Nets	Buckie.	—	—
1142	F.	37.	40.5	20/ 9/11	9' S.-E. of Noss Head.	58° 24' N.; 2° 48' 10" W.	31	S.T.	Aberdeen.	Imm.	Good.
1143	F.	34.	34.5	25/12/10	10' S./E. from Noss Head.	58° 19' 40" N.; 2° 54' W.	40	"	Aberdeen.	Nearly ripe.	Fair.
1144	M.	35.5	39.2	28/ 1/12	36' N.N.-E. from Buchanness.	58° 4' 35" N.; 1° 38' 30" W.	37	"	Aberdeen.	—	Good.
1145	F.	41.	47.3	6/11/12	27' S.-E. from Aberdeen.	56° 55' 40" N.; 1° 20' W.	36	"	Aberdeen.	Nearly ripe.	Good.
1146	F.	39.	40.5	21/ 3/11	7-8 m. S.S.-E. from Buchanness.	57° 22' 30" N.; 1° 37' W. (abt.)	34	"	Aberdeen.	Spent.	Good.
1147	M.	33.	34.1	17/ 4/11	32 m. S.-E. from Aberdeen.	56° 52' 30" N.; 1° 12' W.	35	"	Aberdeen.	Imm.	Good.
1148	F.	38.	37.1	15/11/10	Montrose Bay.	56° 44' N.; 2° 25' W. (about)	3	Cod Nets	—	—	—
1149	F.	42.5	42.8	26/10/10	20' S.-E./E. of Aberdeen.	57° 2' 15" N.; 1° 27' 55" W.	43	S.T.	Aberdeen.	About $\frac{2}{3}$ Ripe.	Good.
1150	M.	27.	27.7	6/ 4/11	Outer Sand Buoy, River Tay.	56° 26' 30" N.; 2° 41' W. (about).	13	Line.	Broughty Ferry.	Imm.	Fair; head damaged.
1152	M.	33.	38.7	16/ 2/12	35 $\frac{1}{2}$ ' E.-S.-E. $\frac{3}{4}$ S. of Girdleness.	57° N.; 1° W.	38	S.T.	N. Shields.	?	Sound.
1155	F.	36.5	36.5	1/ 2/11	24 $\frac{1}{2}$ ' S.-E./S. from Aberdeen.	56° 52' N.; 1° 30' 59" W.	33	"	Aberdeen.	Imm.	Good.
1156	F.	27.	27.3	18/ 2/11	5' E.-N.-E. from Aberdeen.	57° 11' 45" N.; 1° 55' 27" W.	31	"	Aberdeen.	Imm.	Fair.
1157	M.	31.5	31.8	5/ 4/11	10' S./E. of Clythness	58° 10' N.; 3° 5' W.	30	"	Ymuiden.	—	Sound.
1158	F.	33.	35.2	11/ 4/11	5-6 m. E.-S.-E. fr. Cruden Bay.	57° 23' 30" N.; 1° 38' W.	34	"	Aberdeen.	Imm.	Good.
1159	F.	36.5	38.9	24/ 4/11	6 m. S.-S.E. from Buchanness.	57° 23' 20" N.; 1° 38' 50" W.	40	"	Aberdeen.	Imm.	Good.
1161	F.	36.5	37.2	3/ 2/11	$\frac{1}{4}$ m. off Donmouth, Aberdeen.	57° 10' 30" N.; 2° 3' W.	8	Line.	Aberdeen.	Imm.	Good.
1162	M.	37.	36.5	14/ 2/11	2 m. off Banff Head.	57° 43' N.; 2° 31' W.	17	Set Nets.	Whitehills.	ripe. dev.	Rather thin.
1164	M.	39.	43.	4/ 3/12	12' S.-E. from Aukerry.	58° 55' 50" N.; 2° 13' 15" W.	42	S.T.	Aberdeen.	Ripe, running.	Good.
1165	M.	32.	32.3	20/12/10	40' E.-N.-E. of Bell Rock.	56° 51' N.; 1° 26' W.	32	"	Aberdeen.	Imm.	Good.
1167	M.	39.	43.4	6/ 8/11	18' S.-E./S. of Noss Head.	58° 16' 50" N.; 2° 37' W.	28	"	Aberdeen.	Imm.	Good.
1168	F.	38.	47.5	18/10/11	40' E.-N.-E. of the May Isle.	56° 35' 5" N.; 1° 37' 40" W.	32	—	Granton.	—	—
1169	F.	36.	37.6	12/ 4/11	16' E. $\frac{3}{4}$ S. of Rattray Point.	57° 40' N.; 1° 20' W.	43	S.T.	N. Shields.	—	Sound.
1170	M.	34.5	37.6	2/ 8/11	30' S.S.-E. of Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	35	"	Aberdeen.	Imm.	Good.
1172	?	36.5	37.	24/11/10	24 $\frac{1}{2}$ ' S.-E./E. $\frac{1}{4}$ S. of Girdleness.	57° N.; 1° 20' W.	34	"	N. Shields.	—	Sound.
1173	M.	38.	38.4	30/ 3/11	18 m. S.-E./S. from Aberdeen.	56° 55' 30" N.; 1° 38' 55" W.	38-40	"	Aberdeen.	Spent	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Length Cm.	Length Cm.									
Date, 21st October 1910. Liberated, 56° 55' N.; 1° 8' W.— <i>continued.</i>												
Se. A. 10												
1174	F.	40.5	44.5	16/ 7/11	45° E. $\frac{3}{4}$ S. from Aberdeen.	57° 14' N.; 0° 40' 55" W.	35	S.T.	Aberdeen.	Spent.	Good.	
1175	F.	35.	41.5	3/ 3/12	23° S.-E. from Aberdeen.	56° 57' 48" N.; 1° 27' 50" W.	32	"	Aberdeen.	Partly spent.	Good.	
1178	F.	43.	43.5	7/ 3/11	7-8 m. S.S.-E. from Buchanness.	57° 23' 23" N.; 1° 35' W. (about).	42	"	Aberdeen.	Just beginning spawn.	Good.	
1180	F.	39.5	41.3	7/ 6/11	26° E.-S.-E. of Aberdeen.	57° 5' 20" N.; 1° 16' 20" W.	35	"	Aberdeen.	Imm.	Good.	
1181	F.	39.	38.9	1/12/10	28° S.-E./S. of Aberdeen.	56° 50' 20" N.; 1° 24' W.	38	"	Aberdeen.	Imm.	—	
1183	F.	37.5	37.8	1/ 2/11	23° S.S.-E. from Aberdeen.	56° 50' N.; 1° 37' W.	36	"	Aberdeen.	Ripe.	Fair.	
1185	F.	36.	36.4	9/ 3/11	5 m. E.-S.-E. from Cruden Scours.	57° 24' N.; 1° 41' W.	47	"	Aberdeen.	Imm.	Good.	
1186	M.	33.5	37.3	6/ 7/11	28° S.-E./E. of Aberdeen.	57° 0' 15" N.; 1° 14' 20" W.	33	"	Aberdeen.	Imm.	Good.	
1188	F.	32.5	34.1	25/ 4/11	5 m. E.-S.-E. from Cruden Bay.	57° 23' 30" N.; 1° 38' W.	32	"	Aberdeen.	Imm.	Good.	
1189	F.	37.	37.9	26/ 3/11	26 m. S.-E. from Aberdeen.	56° 55' 50" N.; 1° 22' W.	32	"	Aberdeen.	Spent.	Good.	
1190	F.	39.	41.7	13/ 3/11	26 m. E.-S.-E. from Aberdeen.	57° 3' 20" N.; 1° 16' 20" W.	33	"	Aberdeen.	Imm.	Good.	
1191	F.	41.5	41.6	11/ 1/11	2 off Whitehills.	57° 42' 30" N.; 2° 33' W.	17	"	Set Nets, Whitehills.	Almost ripe.	Good.	
1193	F.	38.	41.6	31/ 3/11	32° E.-S.-E. $\frac{3}{4}$ S. of Buchan Ness.	57° 20' N.; 0° 48' W.	41	S.T.	N. Shields.	—	Sound.	
1194	F.	36.	43.6	5/ 8/12	60° E. $\frac{1}{2}$ S. from Aberdeen.	57° 18' 45" N.; 0° 14' 55" W.	42	"	Aberdeen.	Spent.	Good.	
1195	F.	43.5	51.9	12/ 3/12	5° S.-E./S. $\frac{3}{4}$ S. of Berriedale Head	58° 7' N.; 3° 23' W.	30	"	Ymuiden.	?	Sound.	
1196	F.	39.	38.7	6/ 1/11	$\frac{3}{4}$ m. off Whitehills.	57° 41' 30" N.; 2° 31' W.	14	"	Set Nets, Whitehills.	Almost ripe.	Fairly good.	
1197	F.	37.	38.8	6/ 4/11	27 m. E.-S.-E. from Aberdeen.	57° 5' N.; 1° 15' 20" W.	32	S.T.	Aberdeen.	Spent.	Good.	
1198	F.	39.	38.5	1/ 3/11	41 $\frac{1}{2}$ ° S.-E./E. $\frac{3}{4}$ S. of Tod Head.	56° 35' N.; 1° 5' W.	39	"	N. Shields.	Spawning.	Sound.	
1200	F.	39.5	39.4	3/11/10	40° N.-E./E. of May Island.	56° 42' N.; 1° 46' W.	30-35	"	Granton.	† Ripe.	—	
1201	F.	37.5	40.8	15/ 8/11	30° E./S. of Aberdeen.	57° 11' 55" N.; 1° 6' 30" W.	34	"	Aberdeen.	Imm.	Good.	
1203	M.	32.5	33.	10/ 3/11	Moray Firth.	—	52	"	Ostend.	—	—	

1204	F.	37-5	19/ 6/11	45' E./N. of Bell Rock.	56° 46' 45" N.; 1° 9' W.	38	"	Dundee.	Imm.	Good.
1205	F.	37-5	2/ 5/11	36 m. E. of Bell Rock.	56° 35' 55" N.; 1° 19' W.	36	Cod Net.	Dundee.	Imm.	Good.
1207	F.	41-5	22/ 2/12	10' S.-E. of Holmsdale.	58° 2' N.; 3° 21' 30" W.	28	S.T.	Lossiemouth.	Ripe.	Good.
1208	F.	30.	7/ 6/11	26' E.-S.-E. of Aberdeen.	57° 5' 20" N.; 1° 16' 20" W.	35	"	Aberdeen.	Imm.	Good.
1210	M.	39.	23/11/11	8' N.-N.-W. from Cape Wrath.	58° 43' N.; 5' 11' W.	45	"	Aberdeen.	Nearly ripe.	Good.
1211	F.	32-5	24/ 6/12	26' S.-E./E. $\frac{1}{2}$ S. of Buchanness.	57° 20' N.; 1° 0' W.	41	?	Hartlepool.	?	?
1212	F.	39-6	4/ 3/11	5 m. N.N.-E. from Buchanness.	57° 33' 50" N.; 1° 45' W.	55	S.T.	Aberdeen.	Spent.	Good.
1213	M.	33-5	14/ 4/11	35 m. E./N. from May Isle.	56° 26' 30" N.; 1° 36' W.	27	"	Leith.	Imm.	Good.
1215	F.	36.	16/ 2/12	7' S.-E. from Aberdeen.	57° 4' 15" N.; 1° 51' W.	45	"	Aberdeen.	Spawning.	Very good.
1217	M.	35-5	28/11/10	43' E. of Bell Rock.	56° 37' 50" N.; 1° 9' 20" W.	36	"	"	Imm.	Good.
1218	F.	30.	26/12/10	3-4' S.-E. of Bell Rock.	56° 24' 55" N.; 2° 18' W.	28	"	Granton.	$\frac{1}{2}$ Ripe.	Thin.
1221	M.	35.	30/10/10	22' S.-E./E. of Aberdeen.	57° 1' 30" N.; 1° 25' W.	37	"	N. Shields.	—	Sound.
1222	F.	42-5	23/ 1/11	45' S.-E./E. of Tod Head.	56° 40' N.; 0° 55' W.	39	"	Aberdeen.	—	—
1225	M.	35.	30/11/10	95' S.-E. $\frac{1}{2}$ S. of Aberdeen.	56° 14' 30" N.; 0° 23' W.	50	"	Aberdeen.	Imm.	Good.
1226	F.	37.	13/ 9/11	36' E.-S.-E. of Aberdeen.	57° 4' N.; 0° 57' W.	37	"	Aberdeen.	Imm.	Good.
1228	F.	37.	8/ 7/11	24' S.-E./E. of Aberdeen.	57° 1' 30" N.; 1° 21' W.	31	"	Aberdeen.	Imm.	Good.
1229	M.	40-5	18/ 2/11	About 1 m. off Macduff.	57° 41' 30" N.; 2° 30' W.	18	Set Net.	Macduff.	Ripe.	Good.
1230	F.	37-5	7/ 4/11	34 m. E./N. from Aberdeen.	57° 25' N.; 1° 7' W.	38	S.T.	Aberdeen.	Spent.	Good.
1232	M.	37.	1/ 4/11	22' E./S. $\frac{1}{2}$ S. of Noss Head.	58° 30' N.; 2° 20' W.	71-74	"	Ostend.	—	—
1233	F.	35-9	3/ 3/11	24 m. S.-E./S. of Aberdeen.	56° 52' N.; 1° 30' 59" W.	37	"	Aberdeen.	Imm.	Fair.
1235	M.	36-2	12/ 2/11	45' S.-E./E. of Tod Head.	56° 40' N.; 0° 55' W.	39	"	N. Shields.	Mature	Sound.
1236	M.	38.	20/ 1/11	1 m. off Banff.	57° 41' 30" N.; 2° 31' W.	14	Set Net.	Whitehills.	Ripe and running.	Very thin.
1237	F.	37-5	29/ 4/11	25' E.-S.-E. of Aberdeen.	57° 7' N.; 1° 18' W.	35	S.T.	Aberdeen.	Imm.	Good.
1238	F.	40.	10/ 3/13	51' E./N. $\frac{1}{2}$ N. of Kinnaird Head.	58° 10' N.; 0° 40' W.	74	"	N. Shields.	—	Sound.
1239	M.	35-5	8/ 7/11	25' E.-S.-E. of Aberdeen.	57° 7' N.; 1° 18' W.	33	"	Aberdeen.	Imm.	Good.
1240	M.	38.	14/ 3/12	7' S.-E./S. from Buchanness.	57° 23' 50" N.; 1° 34' 40" W.	45	"	Aberdeen.	Ripe.	Good.
1242	M.	38.	25/ 3/11	10 m. W.-S.-W. from Cape Wrath.	58° 30' 30" N.; 5° 13' 30" W.	32	"	Aberdeen.	Ripe.	Good.
1244	F.	34.	16/ 2/12	35' E.-S.-E. $\frac{1}{2}$ S. of Girdleness.	57° N.; 1° 0' W.	38	"	N. Shields.	—	Sound.
1245	M.	37.	15/ 4/12	28' S.-E. $\frac{1}{2}$ E. of Aberdeen.	56° 56' 55" N.; 1° 15' W.	45	"	Aberdeen.	Spent.	Good.
1247	F.	32-5	28/11/10	43' E. of Bell Rock.	56° 37' 50" N.; 1° 9' 20" W.	36	"	—	Imm.	—
1249	M.	32.	16/ 2/12	5' S.-E. from Lybster.	58° 15' 30" N.; 3° 7' W.	30	Cod Nets	Wick.	About ripe.	Good.
1250	F.	42.	20/ 1/11	2 m. off Knoek Head.	57° 42' N.; 2° 30' W.	17	Line.?	Whitehills.	Almost ripe.	Very good;
1251	F.	40.	6/ 6/11	26' S.-E./E. of Aberdeen.	57° 0' 30" N.; 1° 17' 50" W.	34	S.T.	Aberdeen.	Imm.	fat. Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.					
Date, 21st October 1910. Liberated, 56° 55' N.; 1° 8' W.— <i>continued.</i>										
Sc. A. 10										
1252	F.	33.	30/ 7/11	Outside of May Island.	56° 31' N.; 1° 49' W.	29	S. T.	Granton.	—	—
1253	F.	38.5	24/ 4/11	20' E. of Bell Rock.	56° 32' N.; 1° 48' W.	26	"	Dundee.	Spent.	Good.
1254	M.	38.	13/12/10	8' S.-E. of Buchanness.	57° 24' 35" N.; 1° 32' W.	39	"	Aberdeen.	Almost ripe.	Good.
1255	F.	35.5	1/ 2/11	26 m. S.-E./S. from Aberdeen.	56° 51' 25" N.; 1° 26' 50" W.	32	"	Aberdeen.	Imm.	Good.
1256	M.	37.	28/ 1/11	Moray Firth.	—	49	"	Ostend.	—	—
1257	F.	37.5	21/ 3/13	9-10' E./N. from Stronsay.	59° 11' N.; 2° 15' W.	34	"	Aberdeen.	Spawng.	Good.
1258	M.	36.	16/ 6/11	Moray Firth.	—	50	"	Ostend.	—	—
1259	F.	36.	31/ 1/11	8' S.-E. from Collieston.	57° 21' N.; 1° 36' W.	40	"	Aberdeen.	Imm.	Good.
1262	M.	35.	17/ 2/11	17' N./E. of Lossiemouth.	58° 0' 30" N.; 3° 21' 30" W.	43	Cod Nets	Lossiemouth.	Ripe.	Good.
1263	M.	32.5	38.8	6/ 2/12	7' W.-N.-W. from Raekwick.	58° 56' N.; 3° 35' W.	46	S. T.	Aberdeen.	Good.
1264	F.	35.	35.4	11/ 2/11	50-60 yds. S.-E. from Black Dog, Donmouth.	57° 12' N.; 2° 2' W.	2	Sm. Lns.	Aberdeen.	Good.
1265	F.	36.	27/ 4/11	21' E.-S.-E. $\frac{3}{4}$ S. of Tod Head.	56° 50' N.; 1° 35' W.	32	S. T.	N. Shields.	—	Sound.
1266	M.	38.	38.7	30/ 3/11	12 m. E.-N.-E. from Aberdeen.	57° 15' 40" N.; 1° 46' 30" W.	37	"	Aberdeen.	Good.
1268	M.	34.5	35.5	29/ 3/11	57 m. N. $\frac{1}{2}$ E. from Ratray Head.	58° 32' N.; 2° 5' 50" W.	41	"	Aberdeen.	Good.
1270	M.	38.5	38.7	8/ 2/12	3' S.-S.-E. from Brora.	57° 58' N.; 3° 47' W.	16	Cod Nets	Lossiemouth.	Good.
1271	F.	40.5	41.2	6/ 5/11	10' N.-E. from Whiten Head.	58° 48' N.; 4° 5' W.	40	S. T.	Aberdeen.	Good.
1272	F.	44.5	44.6	8/ 4/11	3' off Whitehills.	57° 41' N.; 2° 31' W.	14	Set Nets.	Whitehills.	Thin.
1273	F.	34.	37.2	5/ 6/11	28' S.-E. $\frac{1}{2}$ E. of Aberdeen.	56° 56' 55" N.; 1° 15' W.	33	S. T.	Aberdeen.	Good.
1274	F.	35.	41.6	10/ 6/11	10' E./N. from Auskerry.	59° 6' 40" N.; 2° 17' W.	46	"	Aberdeen.	Spent.
1275	F.	40.	42.5	11/ 4/11	40 m. N.-E. of Bell Rock.	57° N.; 1° 47' 50" W.	40	"	?	Thin.
1278	M.	36.5	36.1	27/10/10	30' S.-E. of Aberdeen.	56° 53' 48" N.; 1° 14' 15" W.	35	"	Aberdeen.	Good.
1280	F.	37.	41.3	25/ 4/12	8' S.-E. from Pentland Skerries.	58° 37' N.; 2° 39' 55" W.	38	"	Aberdeen.	Spent.
1281	F.	37.	37.4	12/ 3/11	18 m. S.-E. from Aberdeen.	57° 0' 30" N.; 1° 34' W.	40	"	Aberdeen.	Spent.

1282	F.	39-	13/	30 m. S.S.-E. from Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	30	"	Aberdeen.	Imm.	Good.
1290	M.	34-	15/12/10	13' E.-S.-E. of Aberdeen.	57° 6' 50" N.; 1° 38' 50" W.	36	"	Aberdeen.	Imm.	Good.
1292	M.	36-	20/ 6/12	16' S.-E./E. from Auskerry.	58° 57' N.; 2° 4' W.	42	"	Aberdeen.	Imm.	Good.
1293	?	39-5	28/ 2/11	11½' W.-S.-W. of Cape Wrath.	58° 29' N.; 5° 15' W.	About 40	"	Grimaby.	Spawning.	Sound.
1294	M.	34-	36-2	25' S.-E. ½ E. of Aberdeen.	56° 58' N.; 1° 21' W.	33	"	Aberdeen.	¾ Ripe.	Good.
1295	M.	40-	41-2	14' E./S. Auss Rempon.	—	37/38	"	Aberdeen.	Ripe.	Good.
1296	M.	35-	3/ 3/11	About 1 m. off Banff.	57° 41' 30" N.; 2° 30' W.	14	Set Nets.	Whitehills.	Ripe.	Thin.
1297	F.	36-	36-6	6 m. W.-N. W. from Dunnet Head.	58° 40' 45" N.; 3° 35' W.	45	S.T.	Aberdeen.	spawning.	Good.
1298	F.	40-5	42-3	3/ 6/11	59° 6' 20" N.; 2° 7' 30" W.	45	"	Aberdeen.	Spent.	Good.
1300	F.	34-	38-4	23/ 5/11	57° 23' 20" N.; 1° 38' 50" W.	42	"	Aberdeen.	Imm.	Good.
1301	M.	33-	36-	22' N./E. ½ E. of Portknockie.	57° 54' N.; 2° 50' W.	23	Cod Set	Geeistemunde	—	Dry.
1302	M.	39-5	39-6	27/ 2/11	58° 6' N.; 3° 21' 30" W.	28	Nets.	Lossiemouth.	Ripe.	Good.
1304	M.	38-	37-3	3/11/10	57° 50' N.; 1° 20' W.	37	"	Leith.	—	Sound.
1305	M.	34-5	37-5	28/ 9/11	57° 16' 24" N.; 0° 44' 40" W.	42	S.T.	Aberdeen.	¾ Ripe.	Good.
1308	M.	36-	35-9	8/11/10	56° 12' N.; 1° 35' W.	26	"	—	—	—
1310	F.	40'	40-9	20 m. S.-E. from Aberdeen.	56° 57' 36" N.; 1° 30' W.	34	"	Aberdeen.	Almost spent.	Good.
1311	M.	39-	42-7	No record of capture to be found.	56° 58' 30" N.; 1° 21' W.	—	S.T.	Aberdeen.	Imm.	Good.
1312	M.	39-	40-1	25' S.-E. ½ E. of Aberdeen.	—	35	"	—	About ripe.	Good.
1313	M.	36-	35-7	¼ m. from land a little N. of Buchanhaven.	57° 30' N.; 1° 46' W.	15	Line.	Peterhead.	?	Fair.
1314	F.	36-5	41-2	6/ 7/11	57° 0' 50" N.; 1° 20' 5" W.	30	S.T.	Aberdeen.	Imm.	Good.
1315	F.	38-5	40-6	10/ 6/11	56° 46' 50" N.; 1° 31' W.	32	"	Aberdeen.	Spent.	Good.
1316	F.	40-5	40-7	29/10/10	56° 57' 20" N.; 1° 18' W.	33	"	Aberdeen.	—	—
1318	F.	39-	45-5	18/ 8/12	57° N.; 0° 55' W.	39	"	Hartlepool.	?	?
1319	M.	36-5	38-8	15/10/11	57° 30' 40" N.; 1° 30' W.	45	"	Aberdeen.	Nearly ripe.	Good.
1320	F.	34-5	35-3	26/10/10	57° 0' 30" N.; 1° 20' W.	33	"	Aberdeen.	Imm.	Good.
1321	F.	34-5	34-6	3/ 2/11	56° 53' 50" N.; 1° 31' 50" W.	38	"	Aberdeen.	Imm.	Good.
1322	F.	35-9	35-9	8/ 3/11	56° 59' 12" N.; 1° 23' W.	37	"	Aberdeen.	Imm.	Good.
1323	M.	33-5	33-5	30/10/10	57° 5' 20" N.; 1° 16' 20" W.	33	"	Aberdeen.	Imm.	Thin.
1324	F.	36-5	37-2	9/ 3/11	56° 59' N.; 1° 31' W.	37	"	Aberdeen.	Spent or imm.	Good.
1325	F.	34-5	42-6	10/ 5/12	57° 44' N.; 1° 30' 55" W.	45	"	Aberdeen.	Spent.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Length Cm.	Length Cm.									
Date, 21st October 1910. Liberated, 56° 55' N.; 1° 8' W.— <i>continued.</i>												
Sc. A. 10												
1326	F.	37-	36-9	24/ 1/11	15 m. N. from Buckie.	57° 55' N.; 3° 9' W.	45	Cod Nets	Buckie.	Almost ripe.	Good.	
1327	F.	30-	39-7	23/ 3/11	18 m. S.-E. from Aberdeen.	57° 0' 30" N.; 1° 34' W.	42	S.T.	Aberdeen.	Nearly spent.	Good.	
1331	F.	35-4	35-4	7/ 2/11	20' E. from Aberdeen.	57° 13' 30" N.; 1° 27' W.	40		Aberdeen.	Imm.	Good.	
1332	F.	40-5	40-2	16/ 2/11	1½ m. off Banff.	57° 41' 30" N.; 2° 30' W.	17	Set Nets.	Whitehills.	Almost ripe.	Good.	
1333	M.	37-5	38-3	8/ 8/11	24' S.-E./E. of Aberdeen.	57° 0' 50" N.; 1° 20' 5" W.	36	S.T.	Aberdeen.	Imm.	Good.	
1334	M.	36-	35-6	21/ 1/11	1 m. off Banff.	57° 41' 30" N.; 2° 30' N.	14	Set Nets.	Whitehills.	Ripe and running.	Rather thin.	
1335	M.	35-	39-9	13/ 7/11	30' S.-E./E. of Aberdeen.	56° 59' N.; 1° 11' W.	33	S.T.	Aberdeen.	Nearly ripe.	Good.	
1338	F.	38-5	43-6	8/12/11	20-25' S.S.-E. of Pentland Skerries.	58° 23' 50" N.; 2° 28' W.	35	"	Aberdeen.	Nearly ripe.	Good.	
1339	M.	32-5	34-	1/ 6/11	8' S.-E./S. from Buchanness.	57° 23' N.; 1° 33' 5" W.	42	"	Aberdeen.	Ripe.	Good.	
1341	M.	38-	38-6	13/ 2/11	7-8 m. off Berrisdale Head.	58° 5' N.; 3° 21' W.	28	Cod Nets	Lossiemouth.	Ripe.	Good.	
1343	F.	40-5	40-5	29/11/10	80' E.-N.-E. of Bell Rock.	57° 16' 30" N.; 0° 23' 45" W.	34	S.T.	"	"	Good.	
1344	F.	34-	38-	12/ 7/11	25' S.-E. of Aberdeen.	57° 0' 30" N.; 1° 20' W.	34	"	Aberdeen.	Imm.	Good.	
1347	M.	34-5	35-5	1/ 3/11	43' E./S. ¾ S. of May Island.	56° 10' N.; 1° 15' W.	30	"	N. Shields.	? Spawning	Sound.	
Date, 4th November 1910. Liberated, 22° S.-E. of Fair Isle, 59° 20' N.; 1° 3' W. Depth, 44 Fms.												
1354	F.	41-	46-3	7/ 5/11	11' E.-S.-E. ½ S. of Aukerry.	59° N.; 2° 12' W.	40	S.T.	N. Shields.	"	"	
1355	M.	36-	Label only. 15½ in.	13/ 6/11	Stack Skerries bearing W.-S.-W. 15°.	59° N.; 4° 30' W.	30	"	Hull.	"	"	

1356	M.	39-	47-8	14/ 7/12	20' N.-E. from Buchanness.	57° 45' 5" N.; 1° 27' 40" W.	35	"	Aberdeen.	Spent.	Good.
1357	F.	39-5	40-	2/12/10	Moray Firth.	60° 4' 40" N.; 1° 53' 50" W.	49	"	Ostend.	—	—
1360	M.	37-	44-4	20/ 6/12	5 S.-E. from Foula.	57° 6' N.; 1° 52' W.	47	"	Aberdeen.	Spent.	Good.
1361	F.	33-5	33-5	8/ 1/11	7 E./S. from Cove, Kincardine.	60° 44' N.; 1° 35' W.	35	"	Aberdeen.	Imm.	Good.
1363	F.	34-	35-6	16/ 4/11	8 m. N./W. from Ronasvoe.	58° 56' N.; 2° 20' W.	49	"	Aberdeen.	Imm.	Fair.
1366	F.	39-5	44-7	15/ 2/12	9½ S.S.-E. of Auskerry.	57° 56' 30" N.; 1° 19' W.	42	"	N. Shields.	?	Sound.
1368	F.	34-	35-6	25/ 4/11	25 m. N.-E./E. from Rattray.	60° 6' 5" N.; 1° 50' 50" W.	36	"	Aberdeen.	Imm.	Good.
1370	M.	32-5	36-7	2/ 6/11	6' E.-S.-E. from Foula.	59° 1' N.; 2° 7' W.	40	"	Aberdeen.	Imm.	Good; slight ulcer at mark.
1371	M.	34-5	37-4	22/ 6/11	14' E.-S.-E. of Auskerry.	58° 58' N.; 0° 50' W.	43	"	Aberdeen.	Spent.	Good.
1379	F.	35-	35-1	27/11/10	53' E.-S.-E. of Auskerry.	58° 3' N.; 1° 40' W.	65	"	Aberdeen.	—	—
1380	F.	34-	35-5	19/ 3/11	24' N.-E. of Kinnaird Head.	59° 27' 20" N.; 1° 26' 40" W.	49	"	N. Shields.	Partly spent.	Sound.
1383	F.	45-	51-	9/ 7/11	7-10' S.S.-E. of Fair Isle.	59° 24' 40" N.; 1° 23' 15" W.	58	"	Aberdeen.	Imm.	Good.
1385	F.	43-	50-5	3/11/12	8' E.-S.-E. from Pontland Skerries.	58° 40' 20" N.; 2° 39' W.	33	"	Aberdeen.	Imm.	Good.
1386	F.	32-5	32-5	5/11/10	16' S.S.-E. of North Light, Fair Is.	59° 20' 50" N.; 1° 16' 40" W.	55-62	"	Aberdeen.	—	—
1387	M.	38-5	Label only.	3/ 6/11	Stack Skerries, bearing W.-S.-W. 16'.	59° 12' N.; 4° 7' W.	29	"	Hull.	—	—
1389	M.	39-5	40-2	28/ 4/11	20' S.-E. ¼ S. of Auskerry.	58° 52' N.; 2° 0' W.	47	"	N. Shields.	—	Sound.
1391	F.	40-	40-6	9/ 4/11	12 m. W. ½ N. from Cape Wrath.	58° 34' N.; 5° 22' W.	24	"	Aberdeen.	Spent.	Good.
1392	M.	33-5	37-1	10/ 6/11	16' S.-E. from Auskerry.	58° 54' 20" N.; 2° 5' W.	47	"	Aberdeen.	Imm.	Good.
1393	M.	39-5	39-3	15/ 1/11	6 m. S.-E. from Tod Head.	56° 50' N.; 2° 3' W.	33	"	Aberdeen.	Ripe.	Good.
1394	M.	35-5	37-5	12/ 3/11	Moray Firth.	—	52	"	Ostend.	—	—
1395	M.	35-5	38-3	15/ 6/11	17' E.-S.-E. from Copinshay.	58° 52' 30" N.; 2° 7' W.	43	"	Aberdeen.	Imm.	Good.
1397	F.	36-5	47-6	15/ 3/12	8' E.-N.-E. from Whiten Head.	58° 42' N.; 4° 5' W.	47	"	Aberdeen.	Ripe.	Good.
1398	F.	38-5	46-7	27/ 6/12	16' E. from Auskerry.	59° 6' 55" N.; 2° 3' 55" W.	47	"	Aberdeen.	Spent.	Good.
1400	F.	37-5	48-4	23/ 5/12	6' S.-E. from N. Light of Fair Isle.	59° 29' 55" N.; 1° 24' W.	50	"	Aberdeen.	Spent.	Good.
1401	M.	39-5	44-	9/ 8/11	16' E.-S.-E. of Auskerry.	59° N.; 2° 2' 10" W.	46	"	Aberdeen.	Imm.	Good.
1402	M.	38-5	46-3	15/ 3/13	18½ S.-E./E. ½ S. of Auskerry.	58° 55' N.; 2° 0' W.	45	"	Blyth.	—	Sound.
1406	M.	33-5	37-5	10/ 7/11	15½ S.-E. of Auskerry.	58° 54' 30" N.; 2° 6' 30" W.	43	"	Aberdeen.	Spent.	Good.
1408	F.	35-	42-6	24/ 6/11	8' E.-S.-E. of Fair Isle.	59° 32' 10" N.; 1° 20' W.	56	"	Aberdeen.	Imm.	Good.
1409	M.	35-	43-3	2/ 6/12	14' E./S. ½ S. from Auskerry.	59° 2' N.; 2° 5' 50" W.	34	"	Aberdeen.	Partly spent.	Good.
1410	M.	38-	45-4	2/ 8/13	57½' E.-S.-E. of Tod Head.	56° 48' N.; 0° 28' W.	48	"	N. Shields.	Sound.	—
1412	F.	41-	41-	15/12/10	6' N.N.-E. of Noup Head.	59° 25' 45" N.; 3° 3' W.	46	"	Aberdeen.	Almost ripe.	—

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	In.									
Date, 4th November 1910. Liberated, 59° 20' N.; 1° 3' W.— <i>continued.</i>												
Sc. A. 10												
1415	F.	35.	34.8	16/ 1/11	8 m. E.-S.-E. from Pentland Skerries.	58° 40' 20" N.; 2° 39' W.	42	S.T.	Aberdeen.	Imm.	Good.	
1420	M.	36.	36.4	16/ 3/11	10 m. W.-S.-W. from Cape Wrath.	58° 30' 30" N.; 5° 14' W.	35	"	Aberdeen.	Ripe.	Good.	
1424	F.	40.5	40.2							Spent.	Sound.	
1425	M.	36.	43.3	7/ 2/12	16' W.-S.-W. ¼ S. of Cape Wrath.	58° 26' N.; 5° 20' W.	40	S.T.	Grimby.	Spent.	Sound.	
1426	F.	36.	40.	9/ 7/11	91' N.N.-E. of Rattray.	59° 6' 55" N.; 1° 31' 50" W.	48	"	Aberdeen.	Spent.	Good.	
1428	F.	40.	54.5	28/ 5/14	8' -9' S.S.-E. of S. Light, Fair Isle.	59° 24' N.; 1° 20' W.	42	"	Aberdeen.	Spent.	Good.	
1429	F.	38.5	38.7	28/ 1/11	5 m. N.-E./E. from Auskerry.	59° 5' 50" N.; 2° 28' 25" W.	40	"	Aberdeen.	Almost ripe.	Good.	
1432	F.	40.5	51.9	19/ 5/12	6' S.-E. from Foula.	60° 3' 30" N.; 1° 52' W.	46	"	Aberdeen.	Spent.	Good.	
1435	F.	34.5	39.6	5/ 6/11	8' S.-E. from Start Point.	59° 12' 25" N.; 2° 9' 55" W.	43	"	Aberdeen.	Appar. imm.	Good.	
1436	F.	37.5	39.5	16/ 4/11	14 m. E./S. from Auskerry.	59° 3' 30" N.; 2° 6' 30" W.	39	"	Aberdeen.	Imm.	Good.	
1437	F.	36.5	36.7	10/ 2/11	6' W. from Noup Head.	59° 27' 40" N.; 3° 17' W.	40	"	Aberdeen.	Imm.	Good.	
1438	M.	37.	43.7	14/ 3/12	24' N.N.-E. of Lossiemouth.	58° 7' N.; 3° 14' W.	32	Cod Nets	Lossiemouth.	Nearly ripe.	Good.	
1439	F.	38.	42.9	3/ 4/12	6' N. from Grimes Ness.	57° 43' N.; 3° 43' W.	47	S.T.	Aberdeen.	Spent.	Good.	
1441	M.	35.	38.2	8/ 7/11	12' S. from Fair Isle.	59° 20' 15" N.; 1° 30' W.	48	"	Aberdeen.	Imm.	Good.	
1443	F.	40.	39.8	4/ 5/11	8' E.-S.-E. ¾ S. of Auskerry.	59° 04' N.; 2° 20' W.	50	"	N. Shields.	"	"	
1444	M.	37.	Label	18/12/11	10 ½' N.-W./W. of Cape Wrath.	58° 40' N.; 5° 20' W.	58	"	Hull.	"	"	
			46.									
1448	M.	37.5	46.	28/ 2/12	7' N./W. ¾ W. of Butt of Lewis.	58° 36' N.; 6° 24' W.	50	Cod Nets	Hull.	"	Sound.	
1449	M.	34.	44.5	22/ 1/14	1 ½' off Whitehills.	57° 41' 30" N.; 2° 31' W.	17	"	Whitehills.	Spawning.	Good.	
1451	F.	35.	45.4	12/ 6/12	42' N./W. from Rattray.	58° 13' 25" N.; 2° 28' 15" W.	35	S.T.	Aberdeen.	Imm.	Good.	
1457	F.	34.5	35.	8/ 1/ 11	Moray Firth.	—	46.5	"	Ostend.	"	"	



1458	M.	35.	—	11/ 3/11	Between Glass Island and oppo- site Gairloch Hotel.	57° 43' N.; 5° 43' W. (about).	18	Cod Nets	Badachro, Gairloch, Aberdeen.	—	—
1459	F.	35-2	35-2	5/11/10	16' S.S.-E. of North Light, Fair Is.	59° 20' 50" N.; 1° 16' 40" W.	55-62	S.T.	Aberdeen.	—	—
1461	M.	38-9	38-9	23/ 2/11	8-10 m. S.S.-E. from Sule Skerry.	58° 58' N.; 4° 16' W.	47	"	Aberdeen.	Ripe.	Good; head damaged.
1462	F.	41-5	45	24/ 5/11	6' S. of South Light, Fair Isle.	59° 24' 50" N.; 1° 36' W.	45	"	Aberdeen.	Appar. imm.	Good; slight ulcer at mark.
1465	M.	34-5	36-3	2/ 4/11	Scourie Bank.	58° 20' N.; 5° 40' W. (about).	40	"	Aberdeen.	Partly spent.	Good.
1466	F.	37-5	52-8	9/ 6/14	8' S.-E. of N. Light, Fair Isle.	59° 29' N.; 1° 21' W.	40	"	Aberdeen.	Spent.	—
1469	F.	39-5	41-6	28/ 4/11	20' S.-E. $\frac{1}{2}$ S. of Auskerry.	58° 52' N.; 2° W.	47	"	Aberdeen.	Spent.	—
1471	M.	35-5	36-3	21/ 3/11	24' N.-E. of Kinnaird Head.	58° 3' N.; 1° 40' W.	49	"	N. Shields.	Spawning.	Sound.
1473	M.	37-	37-1	24/ 2/11	15-16' E.-S.-E. from Auskerry.	59° N.; 2° 9' 10" W.	46	"	Aberdeen.	Ripe.	Good.
1474	F.	35-	37-	14/ 4/11	Moray Firth.	—	49	"	Ostend.	—	—
1475	F.	43-5	43-4	Prior to 4/ 5/11	—	—	—	—	—	—	Sound.
1477	M.	38-	41-	7/ 7/11	6' S. from Foula.	60° 0' 55" N.; 1° 59' W.	48	S.T.	Aberdeen.	Ripe.	Good.
1478	F.	35-1	35-1	15/ 2/11	35' N.-E. of Buchanness.	57° 59' N.; 1° 14' W.	61	"	Dundee.	Imm.	Rather thin.
1479	M.	36-	38-	5/ 6/11	6' W.-S.-W. from Raekwick Bay.	58° 53' N.; 3° 30' W.	47	"	Aberdeen.	Imm.	Good.
1480	M.	35-5	35-8	17/ 4/11	14' E. $\frac{1}{2}$ S. of Auskerry.	59° 5' N.; 2° 5' W.	44	"	N. Shields.	—	Sound.
1481	F.	39-5	43-3	29/ 8/11	5' E.-S.-E. from Fair Isle.	59° 32' 45" N.; 1° 25' 30" W.	53	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
1485	M.	36-5	39-2	12/ 6/11	18' E.-S.-E. of Auskerry.	59° N.; 1° 58' W.	40	"	Aberdeen.	Ripe.	Good.
1486	M.	37-5	41-	30/ 7/11	20' S. from Fair Isle.	59° 13' 40" N.; 1° 24' 35" W.	54	"	Aberdeen.	Imm.	Good.
1487	F.	38-	39-4	—	—	—	—	—	Grimshy.	Does not appear	Sound.
1489	M.	39-	43-4	6/ 9/11	7' from South Light, Fair Isle.	59° 23' N.; 1° 40' W. (about).	45	S.T.	Aberdeen.	Spawning.	Good.
1490	F.	38-5	45-5	17/ 4/12	10 $\frac{1}{2}$ N.-E. $\frac{1}{2}$ E. of Cape Wrath.	58° 47' N.; 4° 50' W.	46	"	Blyth.	Imm.	—
1491	M.	34-	35-8	3/ 5/11	15 m. E.-S.-E. from Auskerry.	59° 0' 30" N.; 2° 4' W.	44	"	Aberdeen.	Spent.	Good.
1493	F.	39-5	39-7	7/12/10	15' S.-E./S. of Noss Head.	58° 18' 50" N.; 2° 41' 5" W.	33	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
1495	F.	39-	50-2	19/ 7/12	9' S.S.-E. from N. Light, Fair Isle.	59° 25' 50" N.; 1° 24' W.	50	"	Aberdeen.	Imm.	Good.
1496	F.	35-	35-	12/12/10	37' E./S. of Ratray Point.	57° 40' N.; 0° 40' W.	65	"	Grimshy.	No eggs visible.	—
1500	F.	40-5	49-	6/ 6/12	5' E.-S.-E. from Foula.	60° 6' 10" N.; 1° 52' 5" W.	45	"	Aberdeen.	Imm.	Sound.
										Appar.	Good.
										spent.	

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 4th November: 1910. Liberated, 59° 20' N.; 1° 3' W.— <i>continued.</i>												
Sc. A. 10												
1501	M.	36.5	41.7	29/ 2/12	7' N. from Strathie Point.	58° 43' N.; 4° 5' W.	52	S.T.	Aberdeen.	Fully ripe.	Good.	
1502	M.	38.	38.2	23/ 3/11	4½ m. N./W. from Sandside Bay.	58° 39' N.; 3° 50' W.	50	"	Aberdeen.	Spent.	Good.	
1503	M.	33.	35.	28/ 6/11	14' E.-S.-E. of Auskerry.	59° 0' 50" N.; 2° 6' 30" W.	43	"	Aberdeen.	Has been ripe.	Good.	
1504	F.	37.	38.5	17/ 4/11	15' E. ¾ S. of Auskerry.	59° 5' N.; 2° 5' W.	44	"	N. Shields.	—	Sound.	
1506	F.	37.5	39.2	3/ 5/11	20' E./N. ½ N. of Auskerry.	59° 13' N.; 2° 5' W.	47	"	N. Shields.	—	Sound.	
1507	F.	36.	48.6	18/ 7/12	15' S. from Fair Isle.	59° 18' 5" N.; 1° 28' W.	50	"	Aberdeen.	Imm.	Good.	
1508	F.	40.5	44.9	13/ 6/11	12' E. ¾ S. of Auskerry.	59° 4' N.; 2° 10' 20" W.	42	"	Aberdeen.	Unripe.	Good.	
1509	F.	37.5	39.8	22/ 4/11	12' E.-S.-E. ¾ S. of Auskerry.	59° N.; 2° 10' W.	43	"	N. Shields.	?	Sound.	
1511	F.	37.5	45.6	20/ 1/12	7-8' S. from Sumburgh.	59° 43' 55" N.; 1° 12' W.	45	"	Aberdeen.	?	Good.	
1512	M.	36.	36.3	20/ 1/11	6 m. S./E. from Copinshay.	58° 48' 30" N.; 2° 35' W.	37	"	Aberdeen.	Ripe.	Good.	
1513	F.	37.	39.	5/ 6/11	11½ m./E. ¾ E. of Portknockie.	57° 54' N.; 2° 50' W.	23	"	Geesstuninde	—	Dry.	
1514	F.	35.5	35.	12/ 3/11	Moray Firth.	57° 54' N.; 2° 50' W.	23	"	Geesstuninde	—	Dry.	
1515	M.	36.	41.8	28/ 6/11	18' E. ½ S. of Auskerry.	59° 5' N.; 2° W.	48	"	Aberdeen.	Small testes.	Somewhat dry.	
1516	F.	38.	42.7	2/ 7/11	Fair Isle, bearing W.-N.-W.; Sumburgh Head, bearing N./E.	59° 29' 20" N.; 1° 11' 15" W.	64	"	Aberdeen.	Spent.	Good; head sl. damaged.	
1517	F.	36.5	36.7	27/12/10	9 m. E.-S.-E. from Noss Head.	58° 27' N.; 2° 46' 10" W.	34	"	Aberdeen.	¼ Ripe.	Good.	
1519	M.	34.	38.9	14/ 6/11	15' E.-S.-E. of Auskerry.	59° 0' 30" N.; 2° 4' 30" W.	43	"	Aberdeen.	—	Good; slight ulcer.	
1521	M.	35.5	38.2	13/ 6/11	30' S.-W. from Fair Isle.	59° 6' N.; 2° 3' W.	38	"	Aberdeen.	—	Good.	
1522	M.	37.5	41.7	26/11/12	40' N.N.-E. of Ratray Head.	58° 16' 40" N.; 1° 42' W.	50	"	Leith.	Nearly ripe.	Good.	
1523	M.	35.5	40.3	13/ 6/11	12' E. ½ S. of Auskerry.	59° 4' 30" N.; 2° 10' 20" W.	42	"	Aberdeen.	Appears to be spent.	Good.	

1524	F.	33-	9/7/11	17' S. from S. Light of Fair Isle.	59° 14' N.; 1° 28' 30" W.	53	,,	Aberdeen.	Imm.	Good.
1525	M.	34-	15/4/11	16' E. of Bell Rock.	56° 30' 30" N.; 1° 54' 55" W.	28	,,	Dundee.	Imm.	Fair.
1527	M.	40-	5/11/10	16' S.S.-E. of North Light, Fair Is.	59° 20' 50" N.; 1° 16' 40" W.	55-62	,,	Aberdeen.	—	—
1528	M.	38-5	14/10/11	12' S.-E. of Fair Isle.	59° 24' 50" N.; 1° 17' 50" W.	44	,,	Aberdeen.	Nearly ripe.	Good.
1529	F.	40-5	10/6/11	10' E./N. of Auskerry.	59° 6' 40" N.; 2° 16' 30" W.	46	,,	Aberdeen.	Imm.?	Good.
1530	M.	33-5	36/8/11	10-12' E.-S.-E. of Auskerry.	59° 0' 35" N.; 2° 13' W.	42	,,	Aberdeen.	Ripe.	Good.
1531	M.	34-	34-3	8' S.-E. of Auskerry.	58° 58' N.; 2° 20' W.	42	,,	N. Shields.	—	Sound.
1533	F.	31-5	24/5/11	12' S. of Auskerry.	58° 50' N.; 2° 28' W.	39	,,	Aberdeen.	Imm.	Fairly good ; slight ulcer.
1534	F.	37-	23/3/12	20 $\frac{1}{2}$ ' N.; $\frac{1}{2}$ W. of Strathie Point.	59° N.; 4° 20' W.	42	,,	Blyth.	Spent.	Good.
1535	M.	40-	22/6/11	12 $\frac{1}{2}$ ' E.-S.-E. $\frac{1}{2}$ S. of Auskerry.	59° N.; 2° 10' W.	47	,,	Hartlepool.	—	Sound.
1540	F.	36-	3/1/11	Moray Firth.	—	49	,,	Ostend.	—	—
1541	F.	34-5	3/5/11	8' E.-S.-E. $\frac{2}{3}$ S. of Auskerry.	59° 04' N.; 2° 20" W.	40	,,	N. Shields.	—	Sound.
1545	F.	40-	18/5/11	10' S. from Sumburgh Head.	59° 41' 10" N.; 1° 10' 55" W.	59	,,	Aberdeen.	Imm.	Good.
1546	F.	41-5	25/1/12	10' S. from S. Light, Fair Isle.	59° 21' N.; 1° 33' W.	44	,,	Aberdeen.	Spent.	Good.
1548	M.	39-	2/4/11	8 m. E./N. from Whiten Head	58° 39' N.; 4° W.	50	,,	Aberdeen.	Partly spent.	Good.
1549	F.	39-5	7/5/11	13' S.-E./E. $\frac{2}{3}$ S. of Auskerry.	58° 56' N.; 2° 10' W.	47	,,	N. Shields.	—	Sound.
1550	F.	34-5	6/6/11	14' E. $\frac{1}{2}$ S. from Auskerry.	59° 5' N.; 2° 5' W.	45	,,	Aberdeen.	Appar. imm.	Good.
1551	F.	44-	17/4/11	5 m. S.-E. from Foula.	60° 4' 40" N.; 1° 53' 50" W.	46	,,	Aberdeen.	Spent.	Good.
1552	F.	36-5	7/5/11	25' S.S.-W. of Noss Head.	58° 4' N.; 3° 7' W.	23	,,	Ymuiden.	—	Good ; gutted.
1553	F.	42-	29/6/11	12' E./S. from Auskerry.	59° 2' 40" N.; 2° 10' 30" W.	43	,,	Aberdeen.	Imm.	Good.
1556	F.	39-	21/5/11	16' E.-S.-E. of Auskerry.	59° N.; 2° 10" W.	42	,,	Aberdeen.	Imm.	Good.
1557	F.	36-8	4/3/11	16 m. E.-S.-E. fr. Auskerry Light.	59° N.; 2° 2' 10" W.	46	,,	Aberdeen.	Imm.	Fish good.
1559	F.	33-7	28/5/11	178' E./S. of Aberdeen.	57° 20' N.; 3° 30' E.	39	,,	London.	—	Sound.
1560	M.	32-5	21/2/12	6' W.-N.-W. from Loch Laxford.	58° 25' N.; 5° 20" W.	30	,,	Ostend.	Ripe.	Good.
1562	F.	37-	9/4/11	Moray Firth.	—	47-49	,,	Aberdeen.	—	—
1563	F.	42-	5/7/11	7' S. from South Light, Fair Isle.	59° 23' 40" N.; 1° 34' 40" W.	46	,,	Aberdeen.	Imm.	Good ; slight ulcer at mark.
1564	F.	46-5	18/1/11	4 $\frac{1}{2}$ m. N. $\frac{1}{2}$ E. from Whiten Head.	58° 40' N.; 4° 12' W.	43	,,	Aberdeen.	Almost quite ripe.	Good.
1566	F.	40-	15/6/11	12' E./S. of Auskerry.	59° 2' 40" N.; 2° 10' 30" W.	40	,,	Aberdeen.	Spent.	Good.
1567	M.	34-	11/6/11	18' E./S. from Auskerry.	59° 4' N.; 1° 57' 35" W.	39	,,	Aberdeen.	Ripe.	Good.
1568	M.	36-5	21/1/11	12 m. E.-S.-E. from Noss Head.	58° 27' 30" N.; 2° 40" W.	37	,,	Aberdeen.	Ripe.	Good.
1569	M.	36-9	9/3/11	4-5 m. N.-E. from Rabbit Isle.	58° 37' N.; 4° 23' W.	40-42	,,	Aberdeen.	Partly spent.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.							Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.									
Date, 4th November 1910. Liberated, 59° 20' N.; 1° 3' W.— <i>continued.</i>														
Sc. A. 10														
1570	M.	33.1	19/12/10	19' S.-E. $\frac{1}{2}$ E. of Noss Head.	58° 20' 55" N.; 2° 29' W.				31	S.T.	Aberdeen.	Almost ripe.	Fairly good.	
1571	M.	43.7	13/11/11	12' E.-S.-E. of Pentland Skerries.	58° 39' 50" N.; 2° 30' W.				37	"	Aberdeen.	Nearly ripe.	Good.	
1572	F.	48.5	29/4/13	31' N.-E. from Strathie Point.	58° 39' N.; 3° 58' W.				28	"	Aberdeen.	Spawng. Imm.	Good.	
1573	F.	34.8	25/11/10	6' S. of South Light, Fair Isle.	59° 24' 50" N.; 1° 35' W.				53	"	Aberdeen.	Partly spent.	Good.	
1574	M.	35.2	10/3/11	4-5 m. N.N.-E. from Rabbit Isle.	58° 37' N.; 4° 23' W.				40-42	"	Aberdeen.	Imm.	Good.	
1577	F.	43.	12/6/11	25 $\frac{1}{2}$ E.-S.-E. of Auskerry	59° N.; 1° 45' W.				59	"	Hull.	—	Sound.	
1579	F.	39.	9/4/11	38 m. N. $\frac{1}{2}$ E. from Kinnaird Hd.	58° 19' N.; 2° 14' 5" W.				30	"	Aberdeen.	Imm.	Good.	
1581	M.	37.	1/4/11	22' E./S. of Noss Head.	58° 30' N.; 2° 20' W.				71-74	"	Ostend.	—	—	
1584	F.	33.9	6/11/10	12' S.-E./E. of Fair Isle.	59° 25' N.; 1° 16' W.				50	"	Aberdeen.	Imm.	—	
1588	M.	37.5	12/2/11	Moray Firth.	—				46	"	Ostend.	—	—	
1589	F.	32.	17/8/12	2 $\frac{1}{2}$ S.-E. of Wick.	58° 25' N.; 3° W.				33	"	Grimbsy.	—	Gutted.	
1590	M.	34.7	27/12/10	5-6 m. E.-S.-E. of Stonehaven.	56° 56' 55" N.; 2° 4' 50" W. (about).				32	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.	
1591	F.	37.	26/5/11	5 $\frac{1}{2}$ N.N.-E. of Cape Wrath.	58° 43' N.; 5° W.				45	"	Grimbsy.	—	Sound.	
1594	M.	35.3	7/4/11	12 m. N.-E. from Auskerry.	59° 12' N.; 2° 24' W.				40	"	Aberdeen.	Spent.	Good.	
1596	M.	35.	22/3/11	5 m. S.-E. from Dunrobin Castle	57° 52' N.; 3° 48' W.				18	Line.	Helmsdale.	—	—	
1597	F.	41.	2/5/11	5 m. N. from Strathie Point.	58° 41' N.; 4° 4' W.				49	S.T.	Aberdeen.	Spent.	Good.	
1598	M.	35.5	16/4/12	7 E.-S.-E. from Stack Skerry.	59° 1' N.; 4° 16' W.				40	"	Aberdeen.	Spent.	Good.	
1599	F.	39.5	8/3/12	27' N.-E. $\frac{3}{4}$ E. of Butt of Lewis	58° 55' N.; 5° 50' W.				42	"	Grimbsy.	—	Sound.	

Date, 25th November 1910. Liberated, 56° 8' N.; 2° 48' W. about Midway between Fidra and Elie. Depth, 27 Fms.

1604	M.	38.3	20/ 2/11	8' E.-S.-E. from Buchanness.	57° 27' 15" N.; 1° 30' 5" W.	38	S.T.	Aberdeen.	—	Good.
1605	M.	38.7	10/ 2/11	15' E. of May Isle.	56° 15' 5" N.; 2° 7' W.	27	"	Granton.	Ripe.	Fair.
1606	F.	47.6	19/ 2/11	6' E.-N.-E. from Aberdeen.	57° 12' N.; 1° 55' W.	32	"	Aberdeen.	Nearly spent.	Good.
1607	F.	53.6	17/ 3/11	20 m. E.-N.-E. of May Isle.	56° 23' 5" N.; 2° 3' 30" W.	30	"	Granton.	Ripe.	Fine.
1609	F.	31.	10/ 3/11	4 m. E.-N.-E. from Inchkeith.	56° 4' 25" N.; 3° 1' W.	15	Line.	Cockenzie.	Imm.	Fair; mouth sl. damaged.
1610	M.	39.7	14/ 3/12	7' S.S.-E. from Buchanness.	57° 22' N.; 1° 37' W.	42	S.T.	Aberdeen.	Ripe.	Good.
1612	F.	40.	39.9	30 m. E. $\frac{1}{2}$ N. from May Isle.	56° 22' 30" N.; 1° 42' 30" W.	34	"	Granton.	Imm.	Good.
1614	F.	41.	43.5	50' E.-N.-E. of Whitby.	55° N.; 0° 30' E.	35	"	Grimshby.	?	Sound.
1615	F.	54.5	6/ 2/14	24' E./S. of Hartlepool.	54° 43' N.; 0° 25' W.	33	"	Scarborough.	Spawning.	—
1617	F.	55.3	10/12/14	30' S.E. of Aberdeen.	56° 54' N.; 1° 14' 30" W.	32	"	Aberdeen.	About $\frac{3}{4}$ ripe.	Go. d.
1618	F.	37.5	11/ 8/11	75' E. $\frac{1}{2}$ S. of Aberdeen.	57° 23' N.; 0° 14' E.	44	"	Aberdeen.	Imm.	Good.
1620	F.	31.	24/ 2/11	10' E.-N.-E. of May Isle.	56° 16' 45" N.; 2° 20' 50" W.	29	"	Granton.	Imm.	Fair.
1621	F.	33.5	38.2	Near Bell Rock.	56° 26' N.; 2° 22' W. (about).	15	"	Newhaven.	Imm.	Good.
1622	F.	41.5	44.2	5' off Bervie.	56° 48' N.; 2° 8' W. (about).	29	"	Montrose.	$\frac{1}{2}$ Mature.	Good.
1625	F.	36.	11/ 3/13	16' E./S. of May Isle.	56° 12' 5" N.; 2° 4' W.	25	"	Granton.	Nearly ripe.	Good.
1627	M.	36.5	22/ 2/13	26' N. from Buckie.	58° 5' N.; 3° 15' W.	43	Cod Nets	Buckie	Partly spent.	Good.
1628	M.	31.	28/ 3/11	1 m. off Buckhaven.	56° 10' N.; 3° W.	8 $\frac{1}{2}$	Line.	Anstruther.	Imm.	Fair.
1629	F.	43.2	—	—	—	—	S.T.	Newhaven.	Spawning.	Good.
1632	M.	38.	19/ 1/11	1 m. off Banff.	57° 41' 30" N.; 2° 30' W.	14	Set Nets.	Whitehills.	Running.	Rather thin.
1635	M.	37.	9/ 3/11	Moray Firth.	—	49	S.T.	Ostend.	—	—
1636	M.	35.7	13/ 3/11	8-9 m. S.S.-E. from Buchanan-ness.	57° 22' N.; 1° 36' W.	38	"	Aberdeen.	Imm.	Good.
1639	M.	41.8	19/ 3/11	6' W. $\frac{1}{4}$ N. of Loch Incheard.	58° 25' N.; 5° 15' W.	36	"	Grimshby.	Partly spent.	Sound.
1641	F.	33.	3/11/13	39' S.-E./E. $\frac{1}{2}$ S. of Tod Head.	56° 40' N.; 1° 7' W.	38	"	N. Shields.	—	Sound.
1642	M.	34.	13/ 4/11	40 yds. E. of Inchkeith.	56° 2' 30" N.; 3° 7' W.	1 $\frac{3}{4}$	Crab Net.	Leith.	Imm.	Good.
1645	F.	38.7	3/ 1/11	27' S.-E. from Ham Sound.	58° 39' N.; 2° 3' W.	40	S.T.	Aberdeen.	Dev. ab.	Good.
1646	M.	38.2	25/ 9/12	28' E. of May Isle.	56° 18' 30" N.; 1° 44' W.	29	"	Newhaven.	Imm.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	PARTICULARS OF RECAPTURE.										
		Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.	
<b>Date, 25th November 1910. Liberated, Midway between Fidra and Elie.—continued</b>												
Sc. A. 10												
1647	F.	40.5	10/ 6/11	30' N.N.-E. of Rattray.	58° 6' 30" N.; 1° 44' W.	34	S.T.	Aberdeen.	Imm.	Good ; slight ulcer mark.		
1648	F.	44.	7/ 2/11	4-5' E.-N.-E. from Aberdeen.	57° 11' 45" N.; 1° 55' 27" W. (about).	33	"	Aberdeen.	On point of spg. Nearly ripe.	Good.		
1650	M.	31.5	23/ 2/12	4' N. of Tarbet Ness.	57° 56' 5" N.; 3° 50' W.	16	Cod Net.	Lossiemouth.	Nearly ripe.	Good.		
1651	F.	41.5	26/ 3/12	16' E.-N.-E. from Aberdeen.	57° 18' 10" N.; 1° 39' 20" W.	45	S.T.	Aberdeen.	Spawng. Partly spent.	Good.		
1652	M.	37.5	9/ 3/11	17 m. N.N.-E. from Lossiemouth.	58' N.; 3° 15' W.	26	Cod Nets	Lossiemouth.	Nearly ripe.	Good.		
1655	F.	36.5	23/12/12	40' E. May Isle.	56° 21' 45" N.; 1° 22' 5" W.	34	S.T.	Granton.	Nearly ripe.	Good.		
1658	M.	40.5	24/ 5/12	On Stormy Bank, 26' N.-W./N. from Dunnet Head.	58° 56' N.; 4° 1' W.	28	"	Aberdeen.	Ripe.	Good.		
1659	M.	31.5	15/11/12	30' E. of Aberdeen.	57° 16' 15" N.; 1° 9' W.	45	"	Dundee.	Nearly ripe.	Fair.		
1661	F.	36.	6/ 7/11	28' S.-E./E. of Aberdeen.	57° 0' 15" N.; 1° 14' 20" W.	33	"	Aberdeen.	Imm.	Good.		
1662	F.	34.	17/ 7/11	Caught in St. Andrew's Bay.	56° 22' N.; 2° 42' W. (about).	6	"	—	Appar. decomposed.	Wound small.		
1665	F.	39.	18/ 5/11	27' E.-N.-E. of May Island.	56° 28' N.; 1° 55' 5" W.	26	"	Newhaven.	Spent.	Fair.		
1667	F.	36.5	3/ 7/12	14' E. S. from Aukerry.	59° 5' N.; 2° 8' W.	47	"	Aberdeen.	Spent.	Good.		
1668	F.	30.	24/12/10	3 m. E.-N.-E. from St. Andrews.	56° 22' 30" N.; 2° 43' W.	8	Line.	St. Andrews	Imm.	Rather thin.		
1669	M.	35.	21/ 2/12	18' E.-S.-E. from Aberdeen.	57° 6' 30" N.; 1° 30' W.	42	S.T.	Aberdeen.	Nearly ripe.	Good.		
1670	F.	37.	27/12/11	7' S.-E. of Buchanness.	57° 25' N.; 1° 33' 30" W.	42	"	Aberdeen.	Nearly ripe.	Good.		

1671	F.	36.5	23/ 9/12	30' S.-E./E. $\frac{1}{2}$ S. of Buchanness.	57° 17' N.; 0° 53' W.	37	N. Shields.	Imm.	—
1672	F.	39.7	30/12/10	5-6 m. S.S.-E. from Aberdeen.	57° 4' N.; 1° 57' W.	39	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
1673	M.	37.	11/ 3/11	8 m. N.-E. from Whiten Head.	58° 42' N.; 4° 28' W.	55	Aberdeen.	Partly spent.	Good.
1674	M.	42.	17/11/11	6' E. of Bell Rock.	56° 27' 50" N.; 2° 13' W.	28	Dundee.	Nearly ripe.	Good.
1675	F.	32.	26/ 3/11	52' N.-E. $\frac{1}{2}$ E. of Rattray Pt.	58° 20' N.; 1° E.	36	Geestemünde	—	Somewhat dry.
1676	F.	40.5	8/ 3/12	10' E.-N.-E. of May Isle.	56° 16' 45" N.; 2° 20' 50" W.	29	Leith.	Nearly ripe.	Good.
1677	M.	34.5	25/ 3/11	$\frac{1}{2}$ m. off Pittenweem.	56° 12' N.; 2° 43' W. (about).	10	Anstruther.	Partly spent.	Good.
1678	M.	36.5	19/ 3/11	6' W. $\frac{1}{2}$ N. of Loch Inchart.	58° 25' N.; 5° 15' W.	36	Grimsby.	Spawng.	Sound.
1679	F.	38.5	17/ 5/11	30 m. E. of May Island.	56° 19' 5' N.; 1° 40' W.	29	Leith.	Imm.	Good.
1680	F.	29.	17/10/11	30' outside of May Island.	56° 19' N.; 1° 40' W. (about).	39	Granton.	?	Good.
1681	M.	39.	18/ 7/11	6' N.-E. of Whiten Head.	58° 42' N.; 4° 4' W.	44	Aberdeen.	Has been ripe.	Good.
1682	F.	39.5	1/ 6/11	26' S.S.-E. of Aberdeen.	56° 48' N.; 1° 34' W.	32	Aberdeen.	Spent.	Good.
1683	F.	36.	3/ 3/12	18' E.-S.-E. from Aberdeen.	57° 5' 55" N.; 1° 29' 5" W.	47	Aberdeen.	About ripe.	Good.
1684	F.	40.	7/11/11	40' N. of Rattray.	58° 15' 15" N.; 2° 12' W.	36	Aberdeen.	Imm.	Good.
1685	F.	46.1	14/ 7/12	30 E./S. $\frac{1}{2}$ S. from Aberdeen.	57° 7' 48" N.; 1° 7' 30" W.	33	Aberdeen.	Spent.	Good.
1686	F.	38.8	1/12/10	Bell Rock, S./W. Arbroath, N.-W.	56° 30' N.; 2° 24' W.	24	Dundee.	$\frac{1}{2}$ Ripe.	Good.
1687	M.	36.	29/12/11	10' S.-E. of May Isle.	56° 7' N.; 2° 16' W.	32	Granton.	?	?
1689	?	39.5	9/ 1/11	2 $\frac{1}{2}$ ' off Knock Head.	57° 43' N.; 2° 30' W.	30	Whitehills.	?	?
1690	F.	39.	3/ 2/11	5' S.-E. from Buchanness	57° 25' 24" N.; 1° 38' W.	30	Aberdeen.	Matur- ing abt. $\frac{1}{2}$ .	Good.
1691	?	32.5	28/ 6/11	30' E.-S.-E. from May Island.	56° 7' N.; 1° 38' W.	39	Granton.	—	—
1695	F.	37.	4/ 7/11	13' E. $\frac{1}{2}$ N. of Aberdeen.	57° 13' 5' N.; 1° 41' 20" W.	36	Aberdeen.	Appar. imm.	Good; slight ulcer.
1696	M.	33.	19/ 3/12	2' off Banff.	57° 42' N.; 2° 30' W.	17	Whitehills.	Ripe.	Good; slight ulcer.
1697	F.	41.5	31/ 3/13	1 $\frac{1}{2}$ ' off Banff.	57° 41' 30" N.; 2° 30' W.	14	Whitehills.	Spawng.	Good.
1698	M.	33.5	31/ 3/11	26 m. S.-E./E. from Aberdeen.	56° 59' 50" N.; 1° 15' 30" W.	37	Aberdeen.	Spent.	Good.
1699	M.	33.5	5/ 5/11	35 m. E.-N.-E. of May Island.	56° 32' N.; 1° 43' W.	26	Leith.	Imm.	Fair.
1700	?	39.	4/ 3/11	Moray Firth.	—	47	Ostend.	—	—

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.					
Date, 28th November 1910. Liberated, 56° 17' N.; 1° 58' W.; 20' E. of May Island. Depth, 30 Fms.										
Sc. A. 10										
1701	F.	36.5	42.4	2/9/12	10' S.-E. of N. Light, Fair Isle.	58° 26' 30" N.; 1° 19' 50" W.	S. T.	Aberdeen.	Spent.	Good.
1702	M.	40.	39.9	2/3/11	18 m. N.N.-E. off Lossiemouth.	58° 1' N.; 3° 15' W.	Cod Nets	Lossiemouth.	Ripe.	Good.
1703	F.	35.5	Mark only.	27/11/11	50' E.-S.-E. off Aberdeen.	57° 2' N.; 0° 29' 40" W.	S. T.	Aberdeen.	—	—
1705	F.	38.5	53.1	13/3/15	25' E.-S.-E. of May Isle.	56° 8' N.; 1° 47' W.	"	Granton.	Spent.	Good.
1706	M.	35.	41.9	21/12/12	18' E. S. of May Isle.	56° 13' 50" N.; 2° 2' W.	"	Granton.	Nly. Ripe	Good.
1709	F.	37.5	37.5	31/1/11	11' E./N. ½ N. from Aberdeen.	57° 14' 50" N.; 1° 46' W.	"	Aberdeen.	Imm.	Good.
1710	M.	38.	43.	24/10/11	5' S.-E. of Bervie.	56° 47' N.; 2° 8' W.	"	Aberdeen.	Nearly ripe.	Good; slight ulcer.
1712	M.	37.5	38.	20/3/11	9' E.-S.-E. of Berrisdale Ness.	58° 10' N.; 3° 12' W.	"	Ymuiden.	—	Sound.
1714	M.	37.5	Mark only.	5/1/11	6½ m. E. of May Isle.	56° 13' N.; 2° 21' 10" W.	"	Granton.	—	—
1715	F.	39.5	39.6	27/1/11	7' E.-S.-E. from Stonehaven.	56° 57' N.; 2° W.	"	Aberdeen.	About ¼ ripe.	Good.
1717	F.	45.5	47.	12/5/11	Moray Firth.	—	"	Ostend.	—	—
1719	F.	43.5	43.6	8/12/10	7' E.-N.-E. of Aberdeen.	57° 12' 50" N.; 1° 52' W.	"	Aberdeen.	Nearly ripe.	Very good.
1721	F.	44.5	44.3	23/12/10	10 m. E.-S.-E. of May Isle.	56° 9' 50" N.; 2° 16' W.	"	Granton.	Almost ripe.	Good.
1723	M.	35.5	44.4	20/9/13	6' S.S.-E. of Fair Isle.	59° 25' 30" N.; 1° 30' 30" W.	"	Aberdeen.	Imm.	Good; gutted.
1725	M.	35.5	35.7	10/4/11	10' N.N.-E. ¾ E. of Burghead.	57° 51' N.; 3° 25' W.	"	Ymuiden.	—	Sound.
1725	M.	35.	41.1	10/11/11	17' E. of May Isle.	56° 16' N.; 2° 3' W.	"	Granton.	Nearly ripe.	Good; slight ulcer.
1726	F.	53.	53.7	21/2/11	4-5' E.-N.-E. of Aberdeen.	57° 11' 45" N.; 1° 55' 27" W. (about).	"	Aberdeen.	Almost quite ripe.	Good.



1727	F.	(19 <sup>4</sup> )	15/ 8/11	1' off Aberlady Burn, Forth.	56° 2' N.; 2° 52' W.	4				
1728	F.	44-5	12/ 7/11	Moray Firth.	—	49	S.T.	Cockenzie.	—	—
1729	F.	44-5	12/ 3/13	8' S.-E./S. of Auskerry.	58° 57' N.; 2° 21' W.	40	"	Granton.	Spawng.	Good.
1732	F.	35-	3/ 5/11	26 m. E./N. of May Island.	56° 22' 5" N.; 1° 50' W.	34	"	Leith.	Imm.	Good.
1733	F.	38-5	17/ 1/11	17 m. E.-N.-E. of Bell Rock.	56° 36' 20" N.; 1° 58' 5" W.	19	"	Granton.	Imm.	Good.
1734	F.	34-5	4/ 3/12	? (Unknown).	—	—	"	Hartlepool.	—	—
1738	M.	36-	12/10/12	45' N. from Rattray.	58° 20' N.; 2° 14' W.	35	"	Aberdeen.	Imm.	Good.
1739	M.	36-5	22/ 2/11	7' E./S. from Tod Head.	56° 54' N.; 1° 50' W.	36	"	Aberdeen.	Imm. or spent.	Good.
1740	M.	37-	8/ 2/12	4' S./W. from Brora.	57° 56' N.; 3° 49' 30" W.	16	Cod Nets	Lossiemouth.	Nearly ripe.	Good.
1741	F.	35-	13/ 6/12	18' E./N. from May Island.	56° 19' 30" N.; 2° 4' W.	29	S.T.	Newhaven.	Spent.	Good.
1743	F.	44-5	8/ 8/11	24' S.-E./E. of Aberdeen.	57° 0' 50" N.; 1° 2' W.	36	"	Aberdeen.	Imm.	Good.
1744	M.	33-2	5/ 4/11	43 m. E.-N.-E. of May Island.	56° 37' 10" N.; 1° 30' 15" W.	30	"	Leith.	Imm.	Fair.
1746	F.	36-	20/ 3/11	2' off Banff.	57° 42' N.; 2° 30' W.	17	Cod Nets	Whitehills.	Spawng.	Good.
1747	F.	41-	26/ 4/11	5 m. S.-E./S. from Cruden Bay.	57° 22' N.; 1° 43' W.	31	S.T.	Aberdeen.	Spent.	Good.
1748	M.	39-	25/ 2/11	2' off Whitehills.	57° 42' N.; 2° 31' W.	17	Set Nets.	Whitehills.	Nearly spent.	Thin.
1750	F.	42-5	6/ 1/12	8' N.-E./E. $\frac{1}{2}$ E. from Aberdeen.	57° 13' 5" N.; 1° 51' 50" W.	38	S.T.	Aberdeen.	Some-what imm.	Good.
1751	F.	32-	1/12/10	20' E./S. of May Island.	56° 12' 30" N.; 1° 54' 55" W.	26	"	Granton.	Imm.	Fair.
1752	M.	40-	10/ 6/11	25' N.-E. $\frac{1}{2}$ E. fr. Kinnaird Head.	58° 2' 30" N.; 1° 33' W.	34	"	Aberdeen.	Ripe.	Good.
1753	M.	39-	22/ 3/11	5 m. off Whalgie.	60° 1' N.; 1° 7' W. (about).	30	Cod Net.	Wick.	Spent.	Good.
1754	F.	35-6	27/ 1/11	36 m. E. $\frac{1}{2}$ S. from May Island.	56° 18' N.; 1° 27' 50" W.	24	S.T.	Granton.	Imm.	Good.
1756	F.	34-5	2/11/11	35' N.-E./E. $\frac{1}{2}$ E. of At. Abb's Hd.	56° 20' N.; 1° 25' W.	35	"	N. Shields.	?	Sound.
1757	F.	36-5	2/12/10	18' E. $\frac{3}{8}$ N. of May Island.	56° 17' 50" N.; 2° 1' W.	29	"	Granton.	?	Good.
1758	F.	40-	9/ 7/12	6' S.-E. of Tod Head.	56° 50' N.; 2° 3' W.	26	"	Dundee.	Imm.	Good.
1759	F.	43-	14/12/11	28' E.-N.-E. of May Island.	56° 27' 50" N.; 1° 52' W.	26	"	Granton.	Almost ripe.	Good.
1760	F.	33-5	13/ 6/12	47' E. $\frac{3}{8}$ S. from Aberdeen.	57° 17' 30" N.; 0° 38' W.	37	"	Aberdeen.	Imm.	Good.
1761	F.	38-	26/ 1/11	6 m. S.-E./S. from Aberdeen.	57° 4' 30" N.; 1° 55' W.	30	"	Aberdeen.	Imm. $\frac{1}{4}$ devel.	Good.
1763	F.	41-5	7/ 3/13	4-5' S.-E. from Buchanness.	57° 25' 24" N.; 1° 38' W. (abt.)	40	"	Aberdeen.	Nearly ripe.	Good.
1765	M.	33-5	13/ 1/11	5 m. S.-E. of Montrose.	56° 40' 15" N.; 2° 19' 30" W.	26	"	Granton.	Maturing	Good, but thin.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.									
			Length Cun.	Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Date, 28th November 1910. Liberated, 20' E. of May Island— <i>continued</i> .												
Se. A. 10												
1766	F.	38.	41.7	12/10/11	45' E. $\frac{1}{2}$ S. of Aberdeen.	57° 16' 24" N.; 0° 44' 40" W.	36	S.T.	Aberdeen.	Imm.	Good.	
1767	F.	40.5	40.2	1/5/13	42' E./S. $\frac{1}{2}$ S. of Aberdeen.	57° 7' 30" N.; 0° 45' W.	42	"	Aberdeen.	Spent.	Good.	
1768	F.	43.	43.5	30/6/11	A few miles from May Island limits known as the "rails."	56° 12' N.; 2° 21' W. (about).	29	"	Newhaven.	Imm.	Good.	
1770	F.	36.	36.1	6/3/11	4 m. S.-E. of the Bell Rock.	56° 24' N.; 2° 16' 30" W.	28	"	Leith.	Imm.	Good; mouth slightly damaged.	
1771	M.	37.5	37.4	11/1/11	Off Tod Head.	56° 53' N.; 2° 10' W. (about).	16	"	Dundee.	Almost ripe.	Rather thin.	
1772	M.	35.	35.2	18/1/11	12 m. E./N. from Aberdeen.	57° 14' 30" N.; 1° 42' 45" W.	29	"	Aberdeen.	Almost ripe.	Good.	
1773	M.	35.	35.6	18/2/11	7' E.-S.-E. from Aberdeen.	57° 7' 15" N.; 1° 49' 5" W.	39	"	Aberdeen.	Ripe.	Good.	
1774	F.	43.5	43.4	21/2/11	About 1' off Banff.	57° 41' N.; 2° 30' W.	14	Set Nets.	Whitehills.	On the point of spawning.	Good.	
1775	F.	36.5	38.5	17/5/11	12' E./S. of Buchanness.	57° 29' 5" N.; 1° 22' 5" W.	43	S.T.	Aberdeen.	Imm.	Good.	
1776	M.	34.5	35.	18/3/11	9-10 m. E.-S.-E. from Fair Isle.	59° 31' 55" N.; 1° 15' 50" W.	44	"	Aberdeen.	Imm.	Good.	
1781	F.	37.	46.	4/6/13	16' E./N. $\frac{1}{2}$ N. of Noss Head.	58° 38' N.; 2° 38' W.	35	"	Hartlepool.	Imm.	—	
1783	F.	38.	42.5	30/6/11	—	—	—	"	Aberdeen.	Appar. imm.	Good; slight ulcer.	
1786	F.	39.	39.5	29/3/11	30 m. S.-E. of May Island.	55° 57' 30" N.; 1° 44' 30" W.	44	"	Granton.	Spent.	Good.	
1787	M.	40.5	40.6	17/12/10	8 m. E./N. of May Island.	56° 14' 30" N.; 2° 20' 45" W.	27	"	Granton.	Almost ripe.	Good.	
1788	F.	32.5	Label only.	23/12/10	16' E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 13" W.	27	"	Granton.	? ?	? ?	
1789	F.	32.5	47.8	19/7/13	14' N.-E. from Rattray.	57° 48' 55" N.; 1° 37' W.	42	"	Aberdeen.	—	—	



TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Length Cm.		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Label	only.									
Date, 8th February 1911. Liberated, Midway between Elie and Fidra— <i>continued</i>													
Sc. A. 10													
1824	M.	34.5	36.2		13/ 7/11	7' S.S.-E. of Buchanness.	57° 22' N.; 1° 37' W.	40	S.T.	Aberdeen.	Imm.	Fair.	
1825	F.	37.5	Label 41. only.		12/ 4/11	Kirkcaldy Bay.	56° 6' N.; 3° 7' W. (about).	8	Line.	Kirkcaldy.	?	Splendid.	
1828	F.	33.	41.		21/ 6/13	4' E./N. $\frac{1}{4}$ N. of Lossiemouth.	57° 46' N.; 3° 10' W.	15	S.T.	Grimshy.	Imm.	—	
1829	F.	37.5	41.2		18/ 6/11	18' S.-E. of Noss Head.	58° 19' 10" N.; 2° 32' W.	30	"	Aberdeen.	Seems to be imm.	Good.	
1830	F.	33.5	45.		14/ 3/12	Moray Firth.		21	"	Ostend.	—	—	
1832	F.	37.	40.5		24/ 7/11	14' N.-E. of Bell Rock.	56° 37' 50" N.; 2° 10' 25" W.	40	"	Granton.	Imm.	Good.	
1833	F.	33.	32.1		25/ 3/11	4 $\frac{1}{2}$ m. S.-E. from Downies.	57° N.; 2° W.	34	"	Aberdeen.	Imm.	Good.	
1835	M.	35.	40.5		5/ 3/12	4 $\frac{1}{2}$ of Pennan Head.	57° 45' N.; 2° 12' W.	24	Line ?	Rosehearty.	Ripe.	Good.	
1836	F.	44.	44.		22/ 2/11	10' E.-N.-E. of May Isle.	56° 16' 45" N.; 2° 20' 50" W.	28	S.T.	Granton.	Spent.	Good.	
1841	F.	37.	45.		5/ 9/12	22' N.-E./E. from Buchanness.	57° 44' 30" N.; 1° 18' 5" W.	57	"	Aberdeen.	$\frac{2}{3}$ Ripe.	Good.	
1842	?	35.	35.2		31/ 3/11	32' E.-S.-E. of Longstone Light.	55° 35' N.; 0° 40' W.	38	"	Sunderland.	Partly spent.	Sound.	
1844	F.	36.	40.1		21/ 8 11	10' S.-E. from Bell Rock.	56° 20' 35" N.; 2° 7' 15" W.	29	"	Dundee.	Imm.	Good; slight ulcer at mark.	
1846	F.	34.	45.2		2/ 12/12	30' E.-S.-E. from Bell Rock.	56° 22' N.; 1° 28' 50" W.	26	"	Granton.	Imm.	Good.	
1847	M.	31.	?		29/12/11	10' S.-E. of May Isle.	56° 5' 30" N.; 2° 17' W.	30	"	Granton.	?	?	
1848	M.	32.5	37.		March 1912	7' N.N.-E. $\frac{1}{2}$ E. of Troup Head.	57° 48' N.; 2° 15' W.	40-50	"	Geestemünde	?	?	
1849	F.	34.	43.7		1/12/11	14' E./S. $\frac{3}{4}$ S. of Newbiggin.	55° 10' N.; 1° 5' W.	40	"	Sunderland.	?	Sound.	
1850	M.	34.5	38.2		19/ 2/12	26' S.-E./E. from Aberdeen.	56° 59' 50" N.; 1° 15' 30" W.	33	"	Aberdeen.	About ripe.	Good.	



TABLE I.--PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 18th February 1911. Liberated, Smith Bank, 58° 10' 30" N.; 2° 55' 30" W. Depth, 20 Fms.												
Sc. A. 10 1851	F.	27.5	37.3	20/ 9/11	Dornoch Firth at Fairway Buoy.	57° 52' N.; 3° 54' W. (about).	8	Line.	Embo.	—	—	Good; mouth slightly damaged. Sound.
1856	M.	33.5	34.0	30/ 3/11	8' S.S.-E. of Noss Head.	58° 23' N.; 2° 53' W.	35	S.T.	Ymuiden.	—	—	Sound.
1858	F.	33.5	33.5	2/ 4/11	13' S.-E./E. $\frac{1}{2}$ S. of Berrisdale Ness.	58° 6' N.; 3° 6' W.	32	"	Ymuiden.	—	—	Sound.
1860	M.	30.5	34.9	22/ 7/11	Moray Firth.	—	51	"	Ostend.	—	?	—
1863	F.	61.	64.5	29/ 4/12	7' S./E. $\frac{1}{2}$ E. of Noss Head.	58° 23' N.; 2° 56' W.	36	"	Ymuiden.	—	—	Sound.
1864	F.	57.5	57.4	29/ 4/11	24 m. E.-N.-E. from Lossiemouth.	57° 58' N.; 2° 42' W.	38	Cod Nets	Lossiemouth.	—	Spent.	Good; slight ulceration at mark.
1867	M.	42.5	45.	27/ 6/11	Moray Firth, Smith Bank.	58° 10' N.; 2° 53' W. (about).	18-20	S.T.	Hamburg	—	—	Tail broken.
1868	F.	35.	37.4	17/ 4/11	Smith Bank (Moray Firth).	58° 12' N.; 2° 55' W.	20	"	Ymuiden.	—	—	Sound.
1870	F.	36.	36.4	30/ 3/11	Off Burghead.	57° 44' N.; 3° 30' W. (about).	8	Sm. Line.	Nairn.	—	Imm.	Good; head damaged.
1872	M.	35.5	39.9	28/ 9/11	Moray Firth.	—	46	S.T.	Ostend.	—	—	—
1873	F.	26.	26.	22/ 3/11	About 1 $\frac{1}{2}$ m. off Embo shore.	57° 54' N.; 3° 56' W.	3 $\frac{1}{2}$	Line.	Embo.	—	Imm.	Fair.
1874	M.	28.	27.8	24/ 4/11	1 $\frac{1}{2}$ m. E. of Fort George.	57° 36' N.; 3° 55' W.	8	"	Ymuiden.	—	Imm.	Fair.
1876	F.	36.	38.1	26/ 4/11	20' S.-W. of North Head.	—	23	S.T.	Ymuiden.	—	—	Sound.
255	M.	27.5	28.2	17/ 5/11	2' W. of Golspie.	58° 5' N.; 3° 40' W.	13	Line.	Helmsdale.	—	Imm.	Fair.
256	F.	26.	33.8	30/ 5/13	5' S.S.-E. from Cruden Bay.	57° 20' N.; 1° 45' W.	32	S.T.	Aberdeen.	—	Imm.	Good.
259	M.	26.5	34.4	8/ 6/12	2' S.S.-W. $\frac{1}{2}$ W. of Wick Bay.	58° 25' N.; 3° 5' W.	30	"	Ymuiden.	—	?	Sound; gutted
262	M.	35.5	39.	8/ 2/12	16' E.-N.-E. $\frac{1}{2}$ N. of Butt of Lewis.	58° 44' N.; 5° 55' W.	63-65	"	Hull.	—	—	Sound; gutted
264	F.	34.	37.	24/ 7/11	Moray Firth.	—	54	"	Ostend.	—	—	—
266	F.	43.5	45.8	20/ 4/11	Smith Bank, Moray Firth.	58° 10' N.; 2° 55' W.	26	"	Ymuiden.	—	—	Sound.
273	M.	30.5	34.	17/ 8/11	Moray Firth.	—	54	"	Ostend.	—	—	—

Stud.No.

Date,	M.	35-41-38	5/4/11	10° E.-S.-E. of Berniedale Ness. 10° S.S.-E. fr. Pentland Skerries. Prior to 24½° N. E. ½ E. of Cape Wrath.	58° 10' N.; 3° 10' W. 58° 53' 10" N.; 2° 43' W. 59° N.; 4° 40' W.	27 30 41	Y.muiden. Aberdeen. Grimsby.	Spent. ?	Sound. Good. Sound; gutted
274	M.	35-	5/4/11	10° E.-S.-E. of Berniedale Ness.	58° 10' N.; 3° 10' W.	27	Y.muiden.	—	Sound.
277	F.	41-	27/4/12	10° S.S.-E. fr. Pentland Skerries.	58° 53' 10" N.; 2° 43' W.	30	Aberdeen.	—	Good.
278	M.	38-	4/12/11	24½° N. E. ½ E. of Cape Wrath.	59° N.; 4° 40' W.	41	Grimsby.	—	Sound; gutted
<b>1911.</b>									
279	F.	25-	25/2/12	Liberated, 15 E. ½ N. of Tarbet Ness, 2' off (olspic).	57° 58' N.; 3° 21' W. 58° 5' N.; 3° 40' W. (about).	8	Golspie.	Imm.	Fair.
282	M.	25-	26/4/11	About 2m. off Embo.	57° 54' N.; 3° 55' W.	7	Embo.	Imm.	Fair; head slightly damaged.
286	F.	34-5	19/1/12	14' N. from Cullen.	57° 55' N.; 2° 57' W.	32	Buckie.	3 Ripe.	Good.
288	F.	36-5	7/10/5/13	7° E.-S.-E. of Fofula.	60° 4' N.; 1° 50' W.	50	Hardiepool.	Imm.	—
292	M.	27-4	26/4/11	3m. E.-S.-E. of Embo.	57° 53' N.; 3° 54' W.	8	Embo.	Imm.	Fair.
298	F.	31-	6/4/12	1' off Dunrobin Castle.	57° 58' N.; 3° 55' W.	7	Helmisdale.	Imm.	Fair.
300	M.	26	5/1/14	8' S.-W. of Cape Wrath.	58° 30' N.; 5° 10' W.	35	Aberdeen.	N/y ripe.	Good.
*302	M.	30-5	21/11/12	Stn. IV. Dornoch Firth.	57° 58' N.; 3° 45' W.	14-16	" " " " " " " "	—	—
<b>Sc. A. 10</b>									
1880	M.	30-5	6/12/11	Smith Bank, Moray Firth.	58° 12' N.; 2° 55' W. (about)	27	Ostend.	—	Sound.
1881	M.	29-5	16/4/11	1' S.S.-E. of Tarbet Ness.	57° 51' N.; 3° 46' W.	24	Y.muiden.	—	—
1883	F.	31-5	17/11/11	Moray Firth.	—	33	Ostend.	?	?
1880	F.	27-	6/4/11	2 m. off Golspie.	58° 5' N.; 3° 40' W. (about).	7	Golspie.	—	—
1891	M.	30-	30/3/12	Moray Firth.	—	22	Ostend.	Imm.	Fair.
1892	M.	27-	14/8/11	3' off Embo.	57° 54' N.; 3° 54' W.	10	Embo.	?	Good.
1893	F.	32-	12/4/11	3 m. E. Embo Pier, Dornoch Firth.	57° 54' N.; 3° 54' W.	10	Embo.	—	Somewhat dry.
1897	F.	26-	3/11/11	12' E./S. of Clyth Ness.	58° 20' N.; 2° 50' W.	37	Geesstemünde	Imm.	Good.
1898	F.	34-	22/6/12	8' S.-E. from Start Point, Orkney.	59° 12' 25" N.; 2° 9' 55" W.	39	Aberdeen.	—	Good.
1899	F.	33-5	5/4/11	9' N.-E./N. of Burghhead.	57° 51' N.; 3° 25' W.	21-22	Y.muiden.	—	Salted.
1900	M.	28-5	20/4/12	Moray Firth.	—	23	Ostend.	—	—
<b>1911.</b>									
304	M.	31-5	1/3/13	Liberated, 58° 10' N.; 2° 55' W. (Smith Bank).	58° 10' N.; 3° W.	24	Y.muiden.	—	Sound.
305	M.	27-	16/4/11	11' S./E. ¾ E. of Clyth Ness.	57° 55' N.; 3° W.	37	Y.muiden.	?	Sound.
306	F.	36-5	8/2/12	13½° N. ¾ W. of Portknockie.	—	27	Ostend.	?	Sound.
307	M.	24-	4/11	Moray Firth.	—	32	Y.muiden.	?	Sound.
309	M.	36-5	15/4/11	16½° S.-E./E. ½ S. of Berniedale Ness.	58° 5' N.; 3° W.	20	Y.muiden.	?	Sound.
310	F.	28-5	15/5/12	9½° S.-E./E. ¾ S. of Clyth Ness.	58° 14' N.; 2° 56' W.	27	Geesstemünde	—	Somewhat dry.
312	M.	35-	7/9/11	12' E./S. of Noss Head.	58° 30' N.; 2° 40' W.	52	Ostend.	—	—

Nos. 1851 A. 10-1876 A. 10 were captured in Burghhead Bay. Date, 18th February 1911.

Nos. 252/10-278/10 were captured in Burghhead Bay on 18th February 1911.

The fish liberated off Tarbet Ness were taken in the Dornoch Firth, 9-12 fms. Date, 14th March 1911.

\*Again liberated, 58° 10' N.; 2° 35' W. 21/11/12.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
313	F.	30.5	30.5	1/4/11	23° E./S. $\frac{1}{4}$ S. of Noss Head.	58° 30' N.; 2° 20' W.	71-74	S. F.	Ostend.	?	?	?
315	M.	34.	35.5	26/1/12	6' off Ord of Caithness.	58° 6' N.; 3° 24' W.	27	Cod Nets	Buckie.	Ripe.	?	Good.
316	F.	49.5	47.	24/3/11	44° E./N. $\frac{1}{2}$ N. of Ratray Point.	58° N.; 0° 40' W.	23	?	Cuxhaven.	?	?	Somewhat dry.
318	F.	34.5	39.	25/3/12	14° S.-E. $\frac{3}{4}$ S. of Berrisdale Ness.	58° 1' N.; 3° 5' W.	23	S. T.	Ymuiden.	?	?	Sound.
319	F.	38.	41.9	20/4/12	14° E.-S.-E. of Noss Head.	58° 26' 30" N.; 2° 34' 30" W.	35	"	Aberdeen.	Scarcely mature.	?	Good.
320	M.	31.	39.5	21/12/12	47° N. $\frac{1}{2}$ W. from Ratray.	58° 20' N.; 2° 22' 50" W.	35	"	Aberdeen.	Nearly ripe.	?	Good.
322	F.	33.5	43.	20/3/12	7° E.-S.-E. fr. Pentland Skerries.	58° 40' 40" N.; 2° 41' 50" W.	38	"	Aberdeen.	Spent.	?	Good.
328	M.	29.5	37.1	8/4/13	5° E. of Noss Head.	58° 30' N.; 2° 55' W.	38	"	Grimsbj.	—	—	Sound.
332	F.	34.	34.5	21/3/11	12° S.-E. of Berrisdale Ness.	58° 5' N.; 3° 10' W.	27	"	Ymuiden.	—	—	Sound.
*333	F.	50.	52.5	18/9/11	Donoch Firth.	—	—	"	" "Goldseeker"	—	—	—
Sc. A. 10												
1902	F.	26.5	38.	3/5/12	18° E.-S.-E. $\frac{1}{2}$ S. of Noss Head.	58° 25' N.; 2° 30' W.	38	"	N. Shields.	—	—	Sound.
1903	M.	30.	37.	30/9/12	Moray Firth.	—	52	"	Ostend.	—	—	—
1908	F.	30.5	33.?	8/3/12	10° S. of Noss Head.	58° 18' N.; 2° 55' 5" W.	20-25	"	Gestemünde	—	—	—
1910	F.	24.5	30.6	5/4/12	9° N.-E. of Holburn Head.	58° 45' N.; 3° 25' W.	45?	"	Aberdeen.	Imm.	—	Good.
1912	F.	44.	44.5	10/4/11	Smith Bank, Moray Firth.	58° 10' N.; 2° 50' W.	27	"	Ymuiden.	—	—	Sound.
1914	M.	34.	34.	24/3/11	—	58° N.; $\frac{1}{2}$ ° W. (?)	23	"	Cuxhaven.	—	—	Somewhat dry.
1915	M.	27.	27.	3/4/11	12° E. $\frac{3}{4}$ S. of Clyth Ness.	58° 20' N.; 2° 50' W.	37	"	Geestemünde	—	—	Somewhat dry.
1918	F.	29.	29.5	29/3/11	Moray Firth.	—	52	"	Ostend.	?	?	?
1919	F.	32.	36.5	16/6/11	Moray Firth.	—	54	"	Ostend.	—	—	—
1921	F.	32.	33.4	20/3/11	7° E.-S.-E. $\frac{1}{2}$ S. of Clyth Ness.	58° 17' N.; 3° 3' W.	35	"	Ymuiden.	—	—	Sound.
1923	F.	33.5	34.2	22/4/11	15° E. $\frac{1}{4}$ S. of Noss Head.	58° 32' N.; 2° 35' W.	40	"	N. Shields.	—	—	Sound.
1924	M.	31.	37.9	23/3/13	7° E.-N.-E. from Strathie Point.	58° 40' N.; 3° 50' W.	45	"	Aberdeen.	Spawng.	—	Good.
1926	M.	31.	30.5	23/3/11	33° N.-E./E. $\frac{1}{2}$ N. of Ratray Pt.	58° 3' N.; 1° 15' W. (about).	64	"	Göteborg.	Small.	—	—
1927	F.	29.5	35.	11/7/11	Moray Firth.	—	52	"	Ostend.	—	—	—
1929	M.	33.	32.	15/6/11	Moray Firth.	—	50	"	Ostend.	—	—	—

\*Again liberated at Smith Bank, 19th September 1911.



Date, 21st March 1911. Liberated, Midway between Fidra and Elie, 56° 8' N.; 2° 48' W. (abt.). Depth, 24 Fms.

Stud. No.	M.	F.	Sex	Length	Weight	Measurements	Locality	Depth	Line	Number	Remarks	Condition
334	M.	28.5	—	4/5/11	Off Pettycur.	56° 3' N.; 3° 13' W.	Granton.	7	Line.	7	Imm.	Fair.
335	F.	31.8	—	2/6/11	Off Pettycur.	56° 3' N.; 3° 13' W.	Leith.	7	"	7	Imm.	Fair.
336	M.	33.5	—	7/2/12	—	—	London	—	S.T.	—	Nearly ripe.	Good.
338	M.	38.9	—	5/12/11	S. W. of Bell Rock.	—	Dundee.	15	S.T.	—	Nearly ripe.	Good.
339	F.	38.3	—	21/9/11	18° E. S.-E. of May Island.	56° 8' 55" N.; 2° W.	Granton.	29	—	29	Imm.	Good.
341	F.	37.4	—	5/7/12	10° N.-E. of Bell Rock.	56° 35' N.; 2° 14' 20" W.	Granton.	27	S.T.	27	Imm.	Good.
343	M.	28.5	—	1/4/13	1½ E. from Whitehills.	57° 41' 30" N.; 2° 31' W.	Whitehills.	14	Cod Nets	14	Nearly spent.	Good.
346	M.	31.5	—	7/3/14	5' E. of Berrisdale Head.	58° 12' N.; 3° 20' W.	Lossiemouth.	—	Cod Net.	—	Spawning.	Good.
348	M.	30.3	—	10/4/11	Off Buckhaven.	56° 10' N.; 3° W.	Leith.	10	Line.	10	Imm.	Fair.
349	M.	29.5	—	4/3/13	4' off Occumster.	58° 19' N.; 3° 3' W.	Wick.	30	Cod Nets	30	Spawning.	Good.
351	F.	40.1	—	21/6/12	12° E./N. of May Isle.	56° 16' 10" N.; 2° 14' 5" W.	Newhaven.	28	S.T.	28	Imm.	Good.
353	M.	35. —	—	13/8/11	10° S.-E. of May Island.	56° 5' 30" N.; 2° 17' W.	Granton.	30	"	30	—	—
354	M.	34. —	Mask only.	19/8/14	10° E.-N.-E. of May Isle.	56° 18' N.; 2° 19' W.	Granton.	28	"	28	—	—
355	F.	33. —	—	14/8/11	Gosford Bay, Cockenzie, 2' off shore.	55° 59' N.; 2° 57' W.	Cockenzie.	9	Line.	9	?	?
356	M.	28. —	—	28/3/11	E. side of Largo Bay, close in shore.	56° 12' N.; 2° 54' W.	Anstruther.	10	Salmon Nets.	10	?	Fair.
357	M.	30.5	—	3/3/15	(From fishmonger, Edinburgh).	—	?	—	?	—	—	—
358*	M.	31. —	—	25/4/11	1' off St. Monans.	56° 12' N.; 2° 45' W.	S.T. "G oldseeker."	—	S.T.	—	Ripe.	Good.
Sc. A. 10	M.	30.5	—	3/3/15	(From fishmonger, Edinburgh).	—	?	—	?	—	—	—
1932	M.	32.5	—	13/9/11	18° E. ½ S. of May Island.	56° 13' 50" N.; 2° 2' W.	Granton.	26	S.T.	26	Imm.	Fair.
1933	F.	32.5	—	1/5/12	40° E.-S.-E. from Bass Rock.	56° N.; 1° 27' 50" W.	Granton.	34	"	34	Imm.	Good.
1934	M.	32. —	—	31/10/11	7° S.-E. ½ E. of Tod Head.	56° 50' N.; 2° 0' 30" W.	Aberdeen.	30	"	30	Nearly ripe.	Good.
1937	M.	31.5	—	7/3/12	½ off Pittenweem.	56° 14' N.; 2° 39' W.	Pittenweem.	4½	Line.	4½	Imm.	Good.
1938	F.	30. —	—	13/6/12	25° E./N. of May Island.	56° 21' 55" N.; 1° 51' 55" W.	Granton.	30	S.T.	30	—	—
1942	M.	33.5	—	25/1/12	22° E.-S.-E. ½ S. of Noss Head.	58° 25' N.; 2° 20' W.	Grimsby.	32	"	32	—	—
1943+	M.	34.5	—	19/6/11	1' off St. Monans	56° 12' N.; 2° 45' W.	S.T. "G oldseeker."	—	S.T.	—	—	—
1945	F.	29.5	—	5/5/11	About ½ m. S. from Largo.	56° 12' N.; 2° 55' W.	Lines.	4	Lines.	4	Imm.	Fair; damage.
1948	F.	36. —	—	21/2/12	1' of Pittenweem.	56° 14' N.; 2° 39' W.	Anstruther.	4	Line.	4	Imm.	Good.
1949	F.	34. —	—	33/3/12	¾ m. off Pittenweem.	56° 13' 30" N.; 2° 39' W.	Anstruther.	4½	"	4½	Imm.	Good.
1951	F.	37. —	—	40/9/12	16° E. of May Island.	56° 14' 50" N.; 2° 6' W.	Anstruther.	27	S.T.	27	Ripe.	Good.
1955	M.	31. —	—	29/10/11	20° N.-E. of Bell Rock.	56° 43' 40" N.; 2° 5' W.	Granton.	31	"	31	Nearly ripe.	Good; slight ulcer.
1956	M.	26.1?	—	1/5/11	Largo Bay.	56° 12' N.; 2° 55' W. (about).	Anstruther.	10	—	10	Imm.	Fair.

The fish given on this page were taken on Station VI., Firth of Forth. Date, 21st March 1911.  
 \*Again liberated, 25/4/11. 20 E. of May Isle.  
 + Again liberated on 19th June. See p. 62.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	E. Organs.	Condition.
		Cm.	Length, Cm.									
Date, 21st March 1911. Liberated, 56° 17' N.; 1° 58' W.; 20' E. of May Island. Depth, 26 Fms.												
Stud.No. 359	M.	37·	38·9	2/ 8/11	10' E.-S.-E. of May Island.	56° 9' 50" N.; 2° 16' W.	28	S.T.	Granton.	Very imm.	Good.	
360	F.	37·5	42·9	19/ 2/12	½' S./W. from Pittenweem.	56° 14' N.; 2° 39' W.	4½	Line.	Anstruther.	½ Ripe.	Good.	
361	F.	44·5	44·8	28/ 4/11	16 m. E. ½ S. from May Island.	56° 13' 5" N.; 2° 3' 15" W.	29	S.T.	Leith.	Imm.	Good; slight ulcer at mark.	
362	F.	33·5	40·	26/ 3/12	9' S.-E. from Buchanness.	57° 23' 30" N.; 1° 30' W.	46	"	Aberdeen.	Almost ripe.	Good.	
370	F.	36·	37·1	7/ 7/11	Bell Rock, bearing E. ½ S. 2'.	56° 26' N.; 2° 27' W.	19	"	Dundee.	Imm.	Fair; slight ulcer at mark.	
372	F.	35·5	48·1	11/ 3/13	7-8' E./S. of Buchanness.	57° 29' N.; 1° 31' W.	35	"	Aberdeen.	Nearly ripe.	Good.	
373	F.	37·5	39·	1/ 6/11	25' E.-N.-E. off May Island.	56° 25' 50" N.; 1° 56' W.	30	"	Granton.	Imm.	Fair.	
374	M.	32·5	34·7	7/ 5/11	?	—	—	"	Newhaven.	—	Good; slight ulcer at mark.	
375	M.	29·5	29·4	1/ 4/11	1½ m. off Pittenweem.	56° 13' N.; 2° 39' W.	15	Herring Nets.	Anstruther.	—	Fair.	
376	M.	35·5	38·1	4/ 7/11	16' E. ½ S. from May Island.	56° 14' N.; 2° 4' W.	27	S.T.	Granton.	Small testes.	Good.	
377	M.	33·5	34·4	7/ 6/11	3' E. from Bell Rock.	56° 26' 40" N.; 2° 17' 50" W.	25	"	Aberdeen.	Imm.	Good.	
378	F.	36·5	39·2	3/ 7/11	Caught off May Island.	—	26	"	Newhaven.	Imm.	—	
379	F.	38·5	41·5	28/ 9/11	15' of Bell Rock, S.-E./E.	56° 22' N.; 1° 57' W.	30	"	Newhaven.	Imm.	Good; slight ulcer.	
381	F.	37·5	41·6	11/ 8/11	16' E./S. of May Island.	56° 12' 5" N.; 2° 4' W.	27	"	Granton.	Imm.	Good.	
382	F.	31·	33·5	15/ 3/12	Embleton Bay, Northumberland.	55° 30' N.; 1° 35' W.	3	"	Newton-by-the-Sea.	Imm.	Fair.	
383	M.	32·	32·3	28/ 4/11	16 m. E. of May Island.	56° 14' 50" N.; 2° 6' W.	29	S.T.	Leith.	Imm.	Fair.	

Sc. A. 10	Stud. No.	Date, 11th April 1911.	Liberated, 22' S.-E. of Fair Isle, 59° 20' N.; 1° 3' W. Depth, 68 Fms.	40	Line.	Aberdeen.	Ripe.	Good.
*1810	M. 32.5	7/ 3/12	15' S.-E. from Auskerry.	9-10	"	Aberdeen.	Imm.	Good.
1958	F. 28	14/ 2/12	About ½ m. off Pittenweem.	40	S.T.	Anstruther.	Imm.	Fair.
1959	F. 38	31/ 5/12	22' S.-E. from Aberdeen.	36	"	Aberdeen.	½ Dev.	Good.
1962	M. 34	Mark 3/ 5/11	15 m. E. ½ S. of May Island.	26	"	Leith.	—	—
1963	M. 36.5	12/ 3/12	Moray Firth.	38	"	Ostend.	—	—
1964	F. 32.5	2/ 4/12	½ off Pittenweem.	4½	Line.	Pittenweem.	Rather imm.	Good.
1965	F. 34	2/ 5/11	Largo Bay, 1 m. S.-E. of Largo.	10	S.T.	Anstruther.	Imm.	Good.
1966	M. 36	28/4/12	24' E./S. of Tod Head.	34	—	N. Shields.	—	Sound.
1967	M. 33	6/10/11	16' E./S. of May Island.	28	—	Granton.	Nearly ripe.	Good.
1969	F. 36.5	1/ 26/ 1/12	½ off St. Monance, Firth of Forth.	12	Line.	St. Monans	Rather imm.	Fair.
1971	M. 33	17/ 4/12	30' E.-N.-E. of May Isle.	24	S.T.	Granton.	Ripe.	Good.
1972	F. 27.5	37-9 24/ 2/12	About 1' off shore between St. Monans and Pittenweem.	10	Line.	Anstruther.	Rather imm.	Good.
1973	F. 32	40-7 31/ 3/12	—	41	S.T.	N. Shields.	—	Sound.
1974	M. 37	42-4 29/ 2/12	3' N.N.-E. of Tarbet Ness.	16	Cod Net.	Lossiemouth.	Ripe.	Good.
1976	F. 41	45-1 28/ 2/12	17' E.-S.-E. from Aberdeen.	45	S.T.	Aberdeen.	Fully ½ ripe.	Good.
1977	F. 34.5	46-3 10/12/12	40' S.-E./E. from Aberdeen.	37	"	Aberdeen.	Ny. ripe.	Good.
1979	F. 50	50-5 6/ 3/12	8' S.S.-E. from Baddon Head.	45	"	Aberdeen.	Spent.	Good.
1980	F. 34	42-7 28/ 5/12	25' E.-N.-E. of Bell Rock.	40	"	Granton.	Imm.	Good.
1981	F. 38	38-9 18/ 5/11	16' E. ½ S. of May Island.	27	"	Granton.	Imm.	Good.
388	M. 33.5	11/ 9/11	10' E.-S.-E. from Fair Isle.	44	S.T.	Aberdeen.	Imm.	Good.
390	M. 35.5	37-8 17/ 8/11	8' S.-E. of Baltasound Light.	50	"	Aberdeen.	Imm.	Good.
392	M. 31.5	37-2 12/ 3/12	17' S.-E. from Noss Head.	24	"	Aberdeen.	Ripe.	Good.
393	F. 31	39-7 31/ 5/12	8' E.-N.-E. from Auskerry.	43	"	Aberdeen.	Imm.	Good.
395	M. 36	47-5 17/ 5/14	14' E./S. ½ S. of Auskerry.	42	"	N. Shields.	—	Good.
396	M. 32	34-8 10/11/11	10' E.-S.-E. of Auskerry.	41	"	Aberdeen.	Imm.	Sound; gutted
399	M. 29	45 20/12/14	9' E.-S.-E. of Buchanness.	44	"	Aberdeen.	Spawning.	Good.
404	M. 32.5	38-2 23/11/11	7' E.-S.-E. ½ S. of Pentland Skerries.	36	"	Grimby.	?	Good.
408	F. 32	13/11/11	10' E./S. of Auskerry.	43	"	Aberdeen.	Imm.	Fair.

The fish liberated off Fair Isle were taken in Dornoch Firth, 8th April 1911, and came through very bad weather before liberation.

\*1810 was previously caught by the "Goldseeker," see p. 45.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Date, 11th April 1911. Liberated, 59° 20' N.; 1° 3' W.— <i>continued.</i>											
Stud.No. 411	M.	29.5	5/ 7/11	7' S. from South Light, Fair Isle.	59° 24' 50" N.; 1° 35' W.	46	S. T.	Aberdeen.	Imm.	Sound.	
413	F.	41.	18/11/12	300 N.-E./N. ½ N. of Spurn.	56° 30' N.; 1° 19' E.	54	"	Hull.	?	Sound.	
414	F.	28.8	6/ 7/11	20' N.-E./E. of Buchanness.	57° 43' 20" N.; 1° 21' 5" W.	44	"	Aberdeen.	Imm.	Fair.	
Sc. A. 10 1982	M.	26.	14/ 3/12	Moray Firth.	—	41	"	Ostend.	—	—	
1983	M.	36.9	15/ 8/11	25' N.-E./N. of Buchanness.	57° 52' N.; 1° 32' W.	36	"	Aberdeen.	Very imm.	Good.	
1984	F.	67.	29/ 6/11	16' E. of Aukery.	59° 6' 55" N.; 2° 3' 55" W.	44	"	Aberdeen.	Appar. spent.	Fine fish.	
1985	F.	50.1	28/ 1/14	100' N.N.-E. of Buchanness.	59° 7' N.; 1° 29' W.	65	"	Aberdeen.	About ripe.	Fine fish.	
1987	F.	53.3	11/ 7/11	9' S.-E. of Fair Isle.	58° 28' 25" N.; 1° 20' 40" W.	56	"	Aberdeen.	Spent.	Good.	
1992	F.	48.	20/ 5/12	Rattray bearing W./N. and Buchanness S.-W./W.	57° 38' N.; 1° 32' W.	55	"	Aberdeen.	Spent.	Good.	
1993	F.	46.4	13/ 8/11	12' S.S.-E. of S. Light of Fair Isle.	59° 23' 15" N.; 1° 20' W.	62	"	Aberdeen.	Imm.	Good.	
1994	F.	55.2	7/ 7/11	10' S./E. ½ E. of N. Light, Fair Isle.	59° 24' 35" N.; 1° 25' 50" W.	62	"	Aberdeen.	Spent.	Good.	
1996	F.	52.	5/ 7/11	9 S.S.-E. of N. Light of Fair Isle.	59° 25' 50" N.; 1° 24' W.	52	"	Aberdeen.	Imm.	Good.	
1997	F.	47.5	14/ 4/12	5' S.S.-E. from Buchanness.	57° 24' 30" N.; 1° 39' 50" W.	35	"	Aberdeen.	Spent.	Good.	
1998	F.	32.	2/ 7/12	62' E./S. ½ S. of Buchanness.	57° 30' N.; 0° 10' E.	51	"	N. Shields.	—	—	
1999	F.	54.2	23/11/11	30' N. from Rattray.	58° 5' 30" N.; 2° 5' 5" W.	37	"	Aberdeen.	Nearly ripe.	Fine.	
1 Notch. 25	F.	48.5	21/10/11	16' S.-E. of Fair Isle.	59° 20' N.; 1° 16' W.	64	"	Aberdeen.	Fully ripe.	Good.	
30	F.	39.5	15/ 9/11	12' E.-S.-E. of Fair Isle.	59° 32' N.; 1° 11' 50" W.	55	"	Aberdeen.	About ½ ripe.	Good.	
34	F.	50.	12/11/11	8' S.-E. of Fair Isle.	59° 28' 30" N.; 1° 21' 35" W.	58	"	Aberdeen.	Nly. ripe.	Good.	

37	F.	53-9	27/6 /13	4½ E.-S.-E. from Belta.	60° 43' N.; 0° 40' W.	52	"	Aberdeen.	Spent.	Good.
43	M.	36-1	1/ 2/12	4' off Dumbeath, Cathness.	58° 14' N.; 3° 17' W.	24	Cod Nets	Buckie.	Imm.	Good.
60	F.	47-8	12/11/11	8' S.-E. of Fair Isle.	59° 28' 30" N.; 1° 21' 35" W.	52	S.T.	Aberdeen.	More than ½ ripe.	Good.
66	F.	41-5	14/ 7/11	8' S.-E. of North Light of Fair Isle.	59° 28' 30" N.; 1° 21' 35" W.	57	"	Aberdeen.	Imm.	Good.
Date, 19th April 1911. Liberated, 58° 10' N.; 2° 55' W. (Smith Bank). Depth, 20 Fms.										
Stud.No										
424	M.	28-5	27/ 9/12	2' W. of Burghead.	57° 42' N.; 3° 33' W.	4	Line.	Burghead.	—	Good.
432	F.	32-5	4/ 9/11	Moray Firth.	—	49	S.T.	Ostend.	—	Good.
433	M.	28-	16/ 2/12	5' S.-E. from Lybster.	58° 14' N.; 3° 11' W.	30	Cod Net.	Lossiemouth.	Ripe.	Good.
437	F.	32-	9/10/11	1' off North Sutor.	57° 41' N.; 3° 59' W.	8	—	Cromarty.	—	—
439	F.	31-3	21/ 9/11	2' S.-W. from Burghead Harbour Entrance.	57° 40' N.; 3° 31' W.	4	Line.	Burghead.	Very imm.	Fair; head damaged.
441	F.	31-	25/ 9/11	Moray Firth.	—	52	S.T.	Ostend.	—	—
445	M.	29-	23/ 3/12	2' E.-S.-E. of Embo Point.	57° 54' N.; 3° 55' W.	7	Line.	Embo.	Very imm.	Fair; head damaged.
447	F.	32-	17/ 9/11	Moray Firth.	—	49	S.T.	Ostend.	Imm.	—
448	F.	31-	About	" North Sea."	—	—	—	Geestemünde.	—	—
29/ 6/11										
1 Notch.										
84	F.	56-	14/ 5/11	Moray Firth.	—	About	S.T.	Ostend.	—	—
110	F.	49-	14/ 9/11	14' E.-S.-E. from Noss Head.	58° 26' 30" N.; 2° 34' 30" W.	32	"	Aberdeen.	½ Ripe.	Good.
111	F.	39-5	22/12/11	Moray Firth.	—	46	"	Ostend.	—	—
174	F.	36-2	9/ 5/11	4' E. of Noss Head.	58° 30' N.; 2° 56' W.	33	"	Aberdeen.	Imm.	Good; gutted.
203	F.	55-	11/ 2/12	Smith Bank, Moray Firth.	58 40' N.; 2° 55' W. (about).	21	"	Ostend.	—	—
Date, 19th April 1911. Liberated, 15° E. ½ N. of Tarbet Ness, 57° 58' N.; 3° 21' W. Depth, 24 Fms.										
204	M.	44-5	16/ 2/12	2' E. of Golspie.	58° 5' N.; 3° 40' W. (about).	13	Line.	Portmahomack	?	?
424	F.	48-5	5/ 2/12	4' S.-W. from Brora.	57° 57' N.; 3° 50' W.	8	Cod Net.	Lossiemouth.	Nearly ripe.	Good.

The fish liberated at Smith Bank were taken in Dornoch Firth, 17th April 1911, and kept till 19th April 1911.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 19th April 1911. Liberated, 57° 58' N.; 3° 21' W.— <i>continued</i> .												
1 Notch.												
750	F.	50.5	52.4	28/ 2/12	½ off Embo, Dornoch.	57° 54' N.; 3° 57' W.	2	Line.	Embo.		Spent.	Good.
755	M.	28.5	35.5	29/12/11	Near Smith Bank, Moray Firth.	58° 10' N.; 2° 55' W. (about).	21	S.T.	Ostend.		?	—
780	M.	35.	38.	16/ 3/12	8' N.-W. of Loch Inchar.	58° 30' N.; 5° 20' W.	30	"	Grimsby.		?	Sound.
782	M.	31.5	32.7	12/ 3/12	5½ S.S.-E. of Berrisdale Ness.	58° 7' N.; 3° 23' W.	24	"	Ynuiden.		?	Sound.
811	F.	40.5	52.8	13/ 2/13	6' N. of Tarbet Ness.	57° 57' 30" N.; 3° 51' W.	18	Cod Nets	Buckie.		Spawng.	Good.
830	M.	36.5	39.4	12/ 3/12	5' N. from Strathie Point.	58° 40' 30" N.; 4° 4' W.	52	S.T.	Aberdeen.		Ripe.	Good.
854	M.	40.	42.3	9/ 2/12	4' N. from Tarbet Ness.	57° 56' 5" N.; 3° 50' W.	17	Cod Nets	Buckie.		Ripe.	Good.
Stud. No.												
452	M.	27.5	Mark only.	3/ 5/11	Rockfield, Portmahomack.	57° 49' N.; 3° 48' W.	5½	Bag Net.	Rockfield.		?	?
457	M.	31.5	36.	8/ 1/12	Moray Firth.	—	47	S.T.	Ostend.		—	—
458	F.	29.	34.	11/11/11	Moray Firth.	—	28	"	Ostend.		—	—
459	M.	24.5	31.5	19/ 4/12	3½ N.-E. ½ E. of Tarbet Ness.	57° 55' N.; 3° 43' W.	29	"	Ynuiden.		?	Sound.
460	F.	36.	41.3	21/ 7/12	1½ S.-W. of Golspie.	58° 5' N.; 3° 42' W.	8	Line.	Golspie.		Imm.	Good.
462	M.	28.5	42.1	27/ 3/14	7' E. of Tarbet Ness.	57° 54' N.; 3° 34' W.	28	Cod Nets	Buckie.		Spawng.	Good.
464	M.	27.5	34.6	6/10/11	½ E. of Burghhead.	57° 43' N.; 3° 29' W.	8	"	Burghhead.		Vyimm.	Good.
465	F.	24.	30.6	11/11/11	1' E./S. of Dornoch.	57° 51' N.; 4° 1' W. (about).	5	Line.	Embo.		Imm.	Fair.
467	F.	32.5	45.	2/ 2/13	?	—	Got at	Manchester	from Aberdeen.		Imm.	Sound.
469	M.	33.	37.7	7/ 2/12	16' W.-S.-W. of Cape Wrath.	58° 26' N.; 5° 20' W.	40	S.T.	Grimsby.		?	Sound.
470	F.	35.	39.5	7/ 2/13	2' S.-E. of Dunrobin Castle.	57° 58' N.; 3° 54' W.	8	Line.	Golspie.		Imm.	Good.
471	F.	31.5	33.	29/ 9/11	Moray Firth.	—	41	S.T.	Ostend.		—	—
Date, 25th April 1911. Liberated, Midway between Elie and Fidra, 56° 8' N.; 2° 48' W. (about). Depth, 27 Fms.												
474	M.	29.	Mark only.	11/ 3/13	1½' off Banff.	57° 41' 30" N.; 2° 30' W.	14	Cod Net.	Whitehills.		—	—
475	F.	36.5	44.9	19/ 2/13	15' S.-E. of Bell Rock.	56° 19' N.; 1° 59' 30" W.	29	S.T.	Dundee.		Spawng.	Good.

476	F.	32.	14/ 4/12	20' S.-E. of May Isle.	56° 0' 40" N.; 2° 2' W.	30	"	Granton.	Imm.	Good.
477	F.	34.	23/11/11			—	"	Granton.	Imm.	Fair.
478	M.	37-1	5/ 7/12	10' E./S. of May Isle.	56° 11' N.; 2° 16' 40" W.	26	S.T.	Granton.	Imm.	Good.
479	M.	34.	21/ 2/13	22' S.-E. of Aberdeen.	56° 57' 5" N.; 1° 26' 5" W.	33-34	"	Aberdeen.	Ripe.	Good.
481	M.	32-5	15/ 2/12	7' W./S. from Strathie Point.	58° 33' N.; 4° 12' W.	44	"	Aberdeen.	Nearly ripe.	Good.
482	M.	29-5	21/ 4/12	"23' S. ½ E. of May Isle."*		?	"	Granton.	Nly. ripe.	Good.
484	F.	30.	23/ 5/12	30' E. ¾ N. of May Isle.	56° 22' 30" N.; 1° 42' 30" W.	30	"	Granton.	Imm.	Good.
485	M.	32.	13/ 6/12	35' N.-E./E. of May Isle.	56° 36' 50" N.; 1° 52' W.	25	"	Granton.	Abt. ½ dev.	Good.
486	M.	34-5	21/11/12	50' N.E. of May Island.	56° 54' 50" N.; 1° 48' 40" W.	36	"	Granton.	?	?
487	M.	32.	5/ 4/13	5' N. ½ E. of Buekie.	57° 45' N.; 3° 2' W.	17	"	Ymuiden.	—	Sound.
488	F.	34.	20/ 2/12	½ off Pittenweem.	56° 14' N.; 2° 39' W.	4	Line.	Anstruther.	Rather imm.	Good.
490	F.	47-1	9/ 8/13	30 m. E. of Bell Rock.	56° 34' N.; 1° 30' 56" W.	32	S.T.	Dundee.	Imm.	Good.
491	F.	35-5	6/ 6/11	Salmon net close inshore, E. side Largo Bay.	56° 12' N.; 2° 54' W.	2½	—	Anstruther.	—	—
494	M.	29-5	22/12/11	5' S.-E. from Tod Head.	56° 50' 40" N.; 2° 5' W.	29	S.T.	Aberdeen.	About ¾ ripe.	Good.
496	M.	31.	19/ 8/12	20' E./S. of May Isle.	56° 12' 30" N.; 1° 54' 55" W.	26	"	Granton.	Imm.	Good.
497	F.	35.	23/ 2/12	1' S.S.-W. Pittenweem.	56° 14' N.; 2° 39' W.	10	Line.	Anstruther.	Rather imm.	Good.
1 Notch.										
855	F.	32.	27/ 8/14	35' S.-E./E. from Aberdeen.	56° 58' N.; 1° 2' W.	39	S.T.	Aberdeen.	Imm.	Good.
860	F.	47-5	11/ 8/11				—	Granton.	Imm.	Good.
878	F.	39-5	7/ 2/12	18' S.-E. from Noss Head.	58° 19' 10" N.; 2° 32' W.	33	S.T.	Aberdeen.	Partly spent.	Good.
888	F.	42.	28/ 8/11	Between Pettycur and Burnt-island.	56° 2' N.; 3° 15' W. (about).	12	—	Newhaven.	¾ Mat.	Good.
917	F.	44.	15/ 3/12	7' S.S.-E. from Buchanness.	57° 22' N.; 1° 37' W.	45	S.T.	Aberdeen.	Partly spent.	Good.
925	F.	44-5	9/ 2/12	30' E. ¾ S. of Rattray Point.	57° 44' N.; 0° 56' W.	33	"	Hartlepool.	—	Sound.
Date, 25th April 1911. Liberated, 20' E. of May Island, 56° 17' N.; 1° 58' W. Depth, 30 Fms.										
Stud.No.										
501	F.	30-5	18/ 1/14	20' E. of Aberdeen.	57° 14' N.; 1° 26' W.	40	S.T.	Aberdeen.	Nearly ripe.	Good.
503	F.	29-5	2/ 6/11	25' E./S. of May Island.	56° 12' 55" N.; 1° 48' W.	26	"	Granton.	Imm.	Fair.

The fish liberated off Tarbet Ness were taken in Dornoch Firth, 17th April 1911, and kept till 19th April 1911.

The fish liberated between Elie and Fydra were taken on Station VI., Firth of Forth. Date, 25th April 1911.

\* This position is on land.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 25th April 1911. Liberated, 20' E. of May Island— <i>continued</i> .												
504	F.	32.	41.6	6/6/12	8' N.-E. of Bell Rock.	56° 33' 25" N.; 2° 23' 50" W.	20	S.T.	Granton.	Imm.	Good.	
506	F.	35.5	44.2	9/12/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	30	"	Granton.	Nly.ripe.	Good.	
507	F.	30.	41.1	17/6/13	18' E.-N.-E. of Buchanness.	57° 39' 35" N.; 1° 19' 50" W.	40	"	Aberdeen.	Imm.	Good; slight ulcer at mark.	
508	F.	35.	36.7	22/7/11	20' E. of May Island.	56° 17' N.; 1° 57' 56" W.	30	"	Granton.	—	Wound a little inflamed.	
509	M.	34.	34.4	22/6/11	7' E. of Bass Rock.	56° 6' 10" N.; 2° 25' W.	26	"	Granton.	Small testes.	Fair.	
511	F.	34.5	37.	6/10/11	14' E.-N.-E. of May Island.	56° 19' 35" N.; 2° 13' 50" W.	31	—	Granton.	About $\frac{1}{2}$ ripe.	Good; slight ulcer.	
514	M.	36.5	38.4	12/2/12	10' S.-E. from Start Point.	59° 11' 5" N.; 2° 5' W.	47	S.T.	Aberdeen.	Nearly ripe.	Good.	
515	M.	34.	35.1	1/6/11	16' E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	29	"	Granton.	Imm.	Fair.	
516	F.	33.5	35.1	2/5/11	30' off May Island.	—	39	"	Granton.	Appar. imm.	Fair; head damaged.	
517	F.	36.5	37.	13/7/11	About 1' off St. Monans.	56° 12' N.; 2° 45' W.	—	S.T.	"Goldseeker."	—	—	
518	F.	36.5	39.2	20/9/11	46' S.-E. $\frac{1}{2}$ S. of Aberdeen.	56° 43' N.; 0° 54' 20" W.	38	S.T.	Aberdeen.	Imm.	Good.	
519	F.	31.5	43.	10/5/13	200' E.-N.-E. of May Isle.	58° 12' 30" N.; 2° 8' 20" E.	39	"	Granton.	Spent.	Good.	
521	F.	29.	29.7	29/6/11	10' E. of Bell Rock.	56° 28' 30" N.; 2° 5' W.	30	—	Granton.	Imm.	Fair.	
522	M.	35.	42.4	2/4/14	180' N.-E. of N. Shields.	58° 11' N.; 1° 0' E.	47	S.T.	N. Shields.	—	Sound	
524	F.	29.	36.2	25/5/12	6' E.-S.-E. from Tod Head.	56° 50' 55" N.; 2° 2' W.	34	"	Aberdeen.	Imm.	Good.	
525	M.	30.	—	2/5/11	Found in box sent from Newhaven to Glasgow.	—	—	"	—	—	—	
Sc. A. 10												
1 Notch.	F.	44.	41.8	3/6/11	—	—	—	"	Newhaven.	Imm.	Good.	
1053	F.	38.5	—	12/8/11	16' E./S. from May Isle.	56° 12' 5" N.; 2° 4' W.	27	"	Newhaven.	—	—	
1054	F.	34.5	37.3	21/12/11	7' E.-N.-E. from Aberdeen.	57° 12' 55" N.; 1° 52' W.	29	"	Aberdeen.	$\frac{3}{4}$ Ripe.	Good.	



1082	M.	37	39.9	26/11/11	3½ E. of St. Andrews.	56° 20' 35" N.; 2° 40' W.	8	Line	St. Andrews.	Nearly ripe.	Good.
1092	M.	34.5	36.	28/ 2/12	Smith Bank, Moray Firth.	58° 10' N.; 2° 55' W. (about).	22	S.T.	Ostend.	Appar. imm.	Good.
1106	F.	37.	38.5	1/ 7/11	Off May Island.	?	—	"	Newhaven.	Imm.	Good.
1117	F.	42.5	43.4	1/ 6/11	16' E. ½ S. from May Island.	56° 13' 5" N.; 2° 3' 15" W.	27	"	Granton.	Imm.	Good.
1120	F.	38.	38.6	20/ 5/11	16' E./S. from May Island.	56° 12' 5" N.; 2° 4' W.	About 30	"	Granton.	Imm.	Good.
1130	M.	38.	39.1	—	—	—	—	—	—	—	Good.
Stud No. *224	F.	—	39.9	10/ 9/11	21' E. ¼ S. of May Isle.	56° 14' N.; 1° 54' W.	29	S.T.	Granton.	Imm.	Good.
Date, 19th June 1911. Liberated, Midway between Elie and Fidra, † 56° 8' N.; 2° 48' W. Depth, 24 Fms.											
Stud No.	M.	34.5	38.2	19/ 3/12	½ off Pittenweem.	56° 14' N.; 2° 39' W.	4½	Line.	Pittenweem.	Imm.	Good.
528	M.	32.5	35.5	13/12/11	4 m. N. of Bell Rock.	56° 29' 55" N.; 2° 26' W.	24	S.T.	Dundee.	Fully ripe.	Good; some ulceration.
530	M.	28.5	28.4	2/11/11	1' E. of Newhaven.	56°; 3° 10' W.	6	Line.	Newhaven.	Imm.	Fair.
532	F.	34.	38.9	24/ 1/12	15' S.-E./S. from Aberdeen.	56° 58' N.; 1° 43' W.	40	S.T.	Aberdeen.	Imm.	Good.
535	M.	31.	34.	18/ 6/13	13½ N.N.-E. ½ E. of Banff.	57° 54' N.; 2° 26' W.	26	"	Grimsby.	Imm.	—
542	F.	32.5	33.	13/ 7/11	1' off St. Monance	56° 12' N.; 2° 45' W.	"	"	"Goldseeker."	—	—
543	F.	30.5	43.5	20/11/14	15' S.S.-E. of Aberdeen.	56° 56' 30" N.; 1° 45' 30" W.	42	"	Aberdeen.	Fully ½ ripe.	Good.
544	M.	30.5	36.1	17/ 3/12	5' N.N.-E. from Strathie Point.	58° 41' N.; 4° W.	56	"	Aberdeen.	Ripe.	Good.
545	M.	33.	39.8	27/11/13	6' E./N. ½ N. from Aberdeen.	57° 12' N.; 1° 53' W.	33	"	Aberdeen.	Nly. ripe.	Good.
546	M.	36.	38.4	19/ 4/12	25' S.-E. from Aberdeen.	56° 55' N.; 1° 23' 10" W.	37	"	Aberdeen.	Spent.	Good.
550	M.	30.5	42.9	17/ 3/14	10' E.S.E. of Bell Rock	56° 25' N.; 2° 5' W.	27	"	Granton.	Spawning.	Good.
Sec. A. 10	F.	32.5	37.2	15/ 4/12	6' S.-E. from Tod Head.	56° 50' N.; 2° 3' W.	27	"	Aberdeen.	Imm.	Good.
3001	F.	42.	43.6	16/ 4/12	26' E.-S.-E. from Aberdeen.	57° 5' 20" N.; 1° 14' 55" W.	34	"	Aberdeen.	Ripe.	Good.
3003	F.	39.	48.4	20/12/13	10' E.-N.-E. of May Isle.	56° 18' N.; 2° 18' W.	29	"	Leith.	Ripe.	Good.
3004	M.	31.5	37.4	2/ 3/12	4' S.-E./S. from Buchanness.	57° 25' N.; 1° 39' W.	38	"	Aberdeen.	Ripe.	Good.
3007	M.	40.	44.1	10/ 3/12	7' S.S.-E. from Buchanness.	57° 23' N.; 1° 37' W.	40	"	Aberdeen.	Ripe.	Good.
3010	F.	45.	Mark only.	19/ 2/12	Bell Rock, bearing N.-W. 8 m.	56° 22' N.; 2° 11' W.	30	"	Dundee.	—	—
3012	M.	37.	40.9	21/12/11	4' S.S.-E. from Buchanness.	57° 27' N.; 1° 40' 30" W.	38	"	Aberdeen.	Nearly ripe.	Good.
3013	F.	40.5	47.	10/ 7/12	Moray Firth.	—	23	"	Ostend.	—	—

† The fish were taken on Station VI., Firth of Forth. Date, 19th June 1911.

\* See pp. 47, 51.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Length Cm.		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Length Cm.	Date.									
Date, 19th June 1911. Liberated, Midway between Elie and Fidra— <i>continued</i> .													
Sc. A. 10													
3015	F.	37.5	41.2	5/ 3/12	3/ off Pittenweem.	56° 14' N.; 2° 39' W.	4½	Line.	Pittenweem.	Imm.	Good.		
*3016	F.	40.	—	11/ 9/11	1/ off St. Monans.	56° 12' N.; 2° 45' W.	—	S.T. "Goldseeker."	Aberdeen.	Partly spent.	Good.		
3018	F.	35.5	38.7	30/ 1/12	6' E.-S.-E. to S.-E./E. from Buchanness.	57° 27' N.; 1° 34' W.	38	"	Granton.	Imm.	Good.		
3019	F.	38.	37.8	27/ 6/11	10' E.-S.-E. of May Island.	56° 9' 50" N.; 2° 16' W.	32	"	Dundee.	Partly spent.	Good.		
3020	F.	37.	41.3	17/11/12	60' E./N. of Bell Rock.	56° 53' 45" N.; 0° 47' W.	35	"	Leith.	Imm.	Good.		
3021	F.	40.5	42.3	9/ 2/12	10' E. May Island.	56° 13' 50" N.; 2° 15' W.	24	"	Aberdeen.	Imm.	Good.		
3023	F.	31.5	36.3	15/ 5/12	25' E.-N.-E. from Buchanness.	57° 43' 40" N.; 1° 10' W.	63	"	Aberdeen.	Imm.	Good.		
3025	M.	33.	36.6	3/ 7/12	50' N./W. from Ratray.	58° 20' 55" N.; 2° 31' 15" W.	34	"	Aberdeen.	Imm.	Good.		
Date, 19th June 1911. Liberated, 20 miles E. of May Island, † 56° 17' N.; 1° 58' W. Depth, 27 Fms.													
Stud. No.													
552	F.	33.5	37.	26/10/11	40' S.-E. of Girdleness.	56° 48' 24" N.; 1° W.	39	S.T.	Granton.	Imm.	Fair; slightly damaged.		
553	F.	32.5	34.5	20/ 7/11	16' E. ½ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	27	"	Granton.	Small testes.	Fair.		
555	M.	29.	29.4	4/ 7/11	16' E. ½ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	27	"	Aberdeen.	Partly spent.	Good.		
556	M.	35.5	37.3	19/ 4/12	19' E./S. from Aberdeen.	57° 9' 20" N.; 1° 26' 15" W.	45	"	Newhaven.	Imm.	Fair.		
558	F.	34.5	33.6	3/ 7/11	16' E. of May Island.	56° 14' 50" N.; 2° 6' W.	27	"	Granton.	Imm.	Fair.		
559	F.	26.	31.8	13/ 7/11	20' E.-S.-E. of May Island.	56° 8' N.; 1° 55' 30" W.	29	"	Granton.	Imm.	Fair.		
560	M.	32.5	32.8	14/ 8/11	16' E. ½ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	27	"	Granton.	Imm.	Fair.		

\*Again liberated, see p. 73.

†The first were taken on Station VI., Firth of Forth, on 19th June 1911.

561	M.	33-	33-6	21/ 7/11	—	—	56° 12' N.; 2° 3' W.	—	S.T.	—	Granton.	Decom- posed. Small testes.	Wound dis- charging. Fair.
562	M.	31-5	31-8	2/ 7/11	17° E./S. of May Island.	—	—	—	S.T.	—	Dundee N. Shields.	—	Tail absent.
563	M.	30-	(25-7)	14/ 8/11	No particulars.	—	58° 25' N.; 2° 35' W.	—	S.T.	—	Dundee	—	Sound.
566	M.	31-5	34-4	2/ 5/12	15° S.-E. of Noss Head.	—	56° 26' 50" N.; 2° 21' W.	—	"	—	Dundee.	Imm.	Good.
567	F.	32-	35-7	13/ 4/12	1½ E./N. of Bell Rock.	—	56° 13' 5" N.; 2° 3' 15" W.	—	"	—	Granton.	Imm.	Good.
568	F.	34-5	35-7	30/12/11	16° E. ½ S. Isle of May.	—	56° 21' 5" N.; 1° 55' W.	—	"	—	Newhaven.	Imm.	Good.
569	M.	36-	41-8	15/ 7/13	23 m. E./N. of May Isle.	—	—	—	"	—	—	Imm.	Fair.
570	F.	32-	31-8	2/ 7/11	—	—	56° 32' 55" N.; 1° 42' W.	—	S.T.	—	Granton.	Imm.	Good.
571	F.	35-	38-7	21/ 5/12	36° E.-N.-E. of May Isle.	—	56° 13' 5" N.; 2° 3' 15" W.	—	"	—	Granton.	Imm.	Good.
572	F.	32-	33-5	3/10/11	16° E. ½ S. of May Island.	—	56° 21' 55" N.; 1° 51' 55" W.	—	"	—	Granton.	Imm.	Fair.
574	M.	36-5	36-6	9/ 8/11	25° E./N. of May Island.	—	56° 12' 5" N.; 2° 4' W.	—	"	—	Granton.	—	—
575	F.	35-5	Mark	14/ 8/11	16° E./S. of May Island.	—	—	—	"	—	—	—	—
576	M.	32-5	35-2	12/11/11	16° E. ½ S. of May Island.	—	56° 13' 5" N.; 2° 3' 15" W.	—	"	—	Granton.	Nearly ripe.	Fair.
S.C. A. 10	F.	35-5	43-2	5/10/12	24° E.-S.-E. of Bell Rock.	—	56° 23' 20" N.; 1° 40' W.	—	"	—	Aberdeen.	About ¾ ripe.	Good.
3026	—	43-	Mark	2/ 5/13	45° E.-N.-E. of May Island.	—	56° 38' 15" N.; 1° 29' 40" W.	—	"	—	Granton.	—	—
3027	—	37-5	only.	2/ 7/11	Near Bell Rock.	—	56° 25' N.; 2° 25' W. (about).	—	"	—	Newhaven.	Small testes.	Good.
3028	M.	37-5	37-5	2/ 7/11	Near Bell Rock.	—	56° 25' N.; 2° 25' W. (about).	—	"	—	Newhaven.	Small testes.	Good.
3029	F.	34-5	36-8	14/ 9/11	17° S.-E./E. ¼ E. of May Island.	—	56° 6' 5" N.; 2° 3' W.	—	"	—	Granton.	Imm.	Fair.
3030	F.	34-5	34-2	5/ 7/11	16° E./S. of May Island.	—	56° 12' 5" N.; 2° 4' W.	—	"	—	Granton.	Imm.	Good.
3033	M.	41-	43-4	7/ 4/12	—	—	58° 28' N.; 4° W. ?	—	"	—	Ymuiden.	?	Sound.
3034	F.	39-	40-7	13/ 9/11	31° E./S. of Bass Rock.	—	56° 7' 10" N.; 1° 43' 30" W.	—	"	—	Granton.	Imm.	Good.
3036	F.	36-5	36-6	2/ 7/11	16° E. of May Island.	—	56° 14' 50" N.; 2° 6' W.	—	"	—	Granton.	Imm.	Good.
3038	F.	38-	44-7	3/10/13	21½ E./N. ¼ N. of St. Abb's Head.	—	56° 6' N.; 1° 35' W.	—	"	—	N. Shields.	—	Sound.
3040	M.	36-	38-4	28/ 2/12	8' off Ord of Caithness.	—	58° 7' N.; 3° 20' W. (about).	—	Cod Nets	—	Buckie.	Ripe.	Good.
3041	M.	36-	35-	20/ 6/11	17° E./S. ½ S. of May Isle.	—	56° 10' 20" N.; 2° 3' W.	—	S.T.	—	Granton.	Small testes.	Good.
3042	M.	37-	37-3	2/ 7/11	17° E./S. of May Island.	—	56° 12' N.; 2° 3' W.	—	"	—	Granton.	Ripe.	Fair.
3043	M.	37-	37-7	13/ 8/11	16° E./S. of May Island.	—	56° 12' 5" N.; 2° 4' W.	—	"	—	Granton.	Imm.	Fair.
3044	M.	35-	36-	30/11/11	36° S.-E./E. off Aberdeen.	—	56° 58' N.; 1° 3' W.	—	"	—	Aberdeen.	About ¾ ripe.	Good.
3045	F.	34-5	34-5	14/11/11	7° E./S. of Bass Rock.	—	56° 5' 15" N.; 2° 25' W.	—	—	—	Granton.	Imm.	Fair; tail curled up.
3046	F.	38-5	38-2	2/ 7 11	17° E./S. of May Island.	—	56° 12' N.; 2° 3' W.	—	S.T.	—	Granton.	Imm.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.			Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
					Liberated, 20 miles E. of May Island— <i>continued</i> .							
Date, 19th June 1911.												
Sc. A. 10 3047	M.	40·8	21/12/11	7° E.-N.-E. of Aberdeen.	57° 12' 50" N.; 1° 52' W.	29	S.T.	Aberdeen.	Nearly ripe.	Good.		
3048	F.	30·5	7/ 7/11	15° E. of May Island.	56° 15' 5" N.; 2° 7' W.	27	"	Granton.	Imm.	Fair.		
3050	M.	34·7	23/ 1/12	Sent from Fishmonger, Edinburgh.						Good; gutted.		
*1943	M.	38·6	21/12/11	12' off Montrose.	56° 40' N.; 2° 5' W.	29	S.T.	Montrose.	¾ Ripe.	Good.		
Date, 13th July 1911.												
Sc. A. 10				Liberated, † 40' E. of May Island, 56° 23' N.; 1° 23' W.	Depth, 29 Fms.							
3053	M.	36·9	10/ 8/11	32' E./S. of Bell Rock.	56° 28' 30" N.; 1° 24' 5" W.	35	S.T.	Dundee.	—	Good; tail dry		
3057	F.	35·	30/ 4/13	31' E./N. of St. Abb's Head.	56° 10' N.; 1° 20' W.	32	"	Blyth.	?	?		
3061	F.	43·8	29/11/11	35' S.-E./E. of Girdleness.	57° N.; 1° W.	38	"	N. Shields.	?	Sound.		
3062	M.	45·8	8/ 9/11	30' E.-½ S. of May Island.	56° 16' N.; 1° 40' W.	30	"	Granton.	About ½ ripe.	Good; tail dry.		
3063	M.	39·5	3/ 3/13	5' E.-N.-E. of Stonehaven.	57° 1' N.; 2° 3' 55" W.	32	"	Aberdeen.	Spg.	Good.		
3064	M.	33·5	8/ 9/11	30' E. ½ S. of May Island.	56° 16' N.; 1° 40' W.	30	"	Granton.	Imm.	Good.		
3065	M.	34·	21/ 3/12	32' E.-S.-E. ½ S. of Spurn Point only.	53° 30' N.; 1° 0' 5" E.	12	"	Grimshby.	—	—		
3066	F.	39·	1/ 8/11	30' S.S.-E. of Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	37	"	Aberdeen.	Imm.	Fair; tail dry.		
3067	F.	34·	10/ 7/13	49' E.-½ S. from Aberdeen.	57° 16' 55" N.; 0° 33' W.	38	"	Aberdeen.	Spent.	Good; gutted.		
3068	M.	33·	19/ 8/12	16' E.-S.-E. of May Isle.	56° 8' 40" N.; 2° 4' W.	28	"	Granton.	Imm.	Good.		
3069	F.	35·	12/ 8/13	9 m. N.-E. from Rattray.	57° 44' 50" N.; 1° 40' 30" W.	40	"	Aberdeen.	Imm.	Good.		

\* See p. 51.

† The fish were taken on Station II., Firth of Forth (Kirkcaldy Bay). Date, 13th July 1911.

3070	M.	33-	41-7	13/ 9/12	35° S.-E./S. from Aberdeen.	56° 46' N.; 1° 15' W.	35	"	Aberdeen.	Imm.	Good.
3071	M.	32-5	34-5	3/10/11	16° E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	34	"	Granton.	Imm.	Good; tail slightly damaged; slight ulcer.
3072	M.	35-	35-2	21/10/11	10° E.-S.-E. of May Island.	56° 9' 50" N.; 2° 16' W.	34	—	Granton.	Imm.	Fairly good.
3073	M.	37-	37-1	7/12/11	—	—	—	—	Granton.	Nearly ripe.	
3076	F.	36-5	44-	5/12/12	12° N.-E./E. from Rattray.	57° 45' 40" N.; 1° 34' W.	40	S.T.	Aberdeen.	Imm.	Good.
3077	F.	33-	32-1	22/ 9/11	40° E./S. $\frac{1}{2}$ S. of May Island.	56° 10' 5" N.; 1° 20' W.	28	"	Granton.	Imm.	Fair; tail somewhat damaged.
3078	M.	34-	33-3	28/ 7/11	36° E./N. of Bass Rock.	56° 21' N.; 1° 42' W.	29	"	Granton.	Imm.	Fair; tail rather dry.
3079	M.	35-5	40-3	8/ 7/12	7° S.-E. from Buchanness.	57° 25' N.; 1° 33' 30" W.	37	"	Aberdeen.	Imm.	Good.
3080	F.	35-	40-6	18/ 3/13	27° S.-E./E. from Aberdeen.	57° 0' 30" N.; 1° 17' 24" W.	34	"	Aberdeen.	Imm.	Good.
3085	F.	32-	32-7	28/ 8/11	37° E.-S.-E. of Longstone Light.	55° 35' N.; 0° 30' W.	36	"	N. Shields.	;	Sound.
3086	M.	32-	38-6	12/ 9/12	12° E. of May Island.	56° 14' N.; 2° 12' 20" W.	30	"	Granton.	Imm.	Good.
3087	M.	30-5	34-5	20/ 3/13	24° S.-E. $\frac{1}{2}$ E. from Aberdeen.	56° 59' 12" N.; 1° 23' W.	35	"	Aberdeen.	Partly spent.	Good.
3088	F.	31-5	33-2	14/ 2/12	7° S.-E. of Bell Rock.	56° 22' N.; 2° 12' W.	31	"	Dundee.	Imm.	Fair.
Stud No. 580	F.	29-	38-5	13/ 7/12	8° S.-E. from Tod Head.	56° 49' N.; 2° 1' W.	29	"	Dundee.	Appar. spent.	Good.
587	F.	28-	29-2	28/ 9/11	22° E./N. of May Island.	56° 22' N.; 1° 58' W.	30	"	Granton.	Very imm.	Fair.
588	M.	30-5	30-5	5/10/11	16° E./N. of May Island.	56° 18' 5" N.; 2° 8' W.	28	"	Granton.	Imm.	Fair.
589	M.	27-	29-6	8/ 3/12	1° S. of Anstruther.	56° 12' N.; 2° 41' W.	10	Lane.	Anstruther.	Imm.	Fair.
592	F.	28-5	30-8	26/ 7/12	26° E.-S.-E. of Bass Rock.	56° 1' 45" N.; 1° 52' W.	28	S.T.	Granton.	Imm.	Good.
593	M.	28-	30-2	8/ 1/12	2° E.-N.-E. from St. Andrews.	56° 21' 5" N.; 2° 44' W.	8	Caught in a Flounder Net.	St. Andrews.	Very imm.	Fair.
594	M.	29-5	30-4	5/ 3/12	$\frac{1}{2}$ ° N. of Newhaven.	56° N.; 3° 10' W.	34	Line.	Newhaven.	Imm.	Fair.
596	F.	26-5	27-	24/ 8/11	$\frac{1}{2}$ ° S.-E. of Collieston.	57° 20' N.; 1° 45' W.	29	S.T.	Aberdeen.	Very imm.	Fair.
597	F.	29-5	31-5	19/ 9/11	7° E. of May Island.	56° 12' 50" N.; 2° 20' 45" W.	29	"	Granton.	Imm.	Good.
598	M.	32-5	37-2	28/ 2/13	25° S.-E./E. of Gardleness.	57° N.; 1° 20' W.	36	"	Blyth.	—	Sound.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cn.									
<b>Date, 13th July 1911. Liberated, 40' E. of May Island—continued.</b>												
Stud.No.												
600	F.	30.5	40.	15/ 7/13	28' E./S. of May Island.	56° 13' N. ; 1° 42' W.	25	S.T.	Granton.	Imm.	Good.	
602	F.	30.5	32.3	27/10/11	7' E.-N.-E. of May Island.	56° 15' 40" N. ; 2° 23' W.	29	—	Granton.	Imm.	Fair.	
603	F.	28.5	28.8	25/12/11	No information.	—	—	—	Granton.	Very imm.	Good.	
605	F.	29.5	30.2	14/12/11	27' E.-S.-E. of Bell Rock.	56° 22' 50" N. ; 1° 35' W.	29	S.T.	Granton.	Imm.	Fair.	
608	M.	32.	37.	4/12/11	16' E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N. ; 2° 3' 15" W.	34	—	Granton.	Very imm.	Good.	
<b>Date, 14th July 1911. Liberated, N.-W. of Gt. Fisher Bank, 57° 25' N. ; 3° 35' E. Depth, 35 Fms.</b>												
Sc. A. 10												
3089	M.	30.	41.3	22/ 5/14	165' E. of Aberdeen.	57° 56' N. ; 2° 53' E.	35	S.T.	Aberdeen.	Nearly spent.	Good.	
3092	M.	31.	36.7	13/ 5/12	Not given.	—	—	" ?	Hull.	—	Sound.	
3093	M.	34.5	35.	10/11/11	270' N.-N.-W. of Helligoland.	57° 44' N. ; 3° 27' E.	35	" ?	Cuxhaven.	? Imm.	Rather dry.	
3094	F.	44.	46.	1/ 7/13	77' E.-N.-E. $\frac{1}{2}$ N. of Rattray Point.	58° 28' N. ; 0° 2' W.	61	S.T.	N. Shields.	Imm.	—	
3100	M.	38.5	38.	24/ 7/12	167' E. $\frac{3}{4}$ S. of Girdleness.	57° 35' N. ; 3° 0' E.	37	"	Hamburg.	Spawng.	Good.	
3102	F.	33.5	44.5	22/ 1/14	170' E.-N.-E. of Aberdeen.	58° 53' N. ; 2° 2' E.	75	"	Aberdeen.	Spawng.	Gutted ; sound	
3106	M.	37.	39.5	18/10/11	172' E./S. of Aberdeen.	57° 24' N. ; 3° 15' E.	35	"	Grimsby.	Appar.	Good.	
3108	F.	39.	44.1	1/ 6/12	175' E. $\frac{1}{2}$ S. from Aberdeen.	57° 39' 10" N. ; 3° 19' 55" E.	37	"	Aberdeen.	Appar. spent.	Good.	
3111	F.	39.5	42.	16/ 1/13	? 320' N.-E./N. $\frac{1}{2}$ N. of Spurn.	58° 30' N. ; 2° 2' E.	63	"	Grimsby.	Ripening.	Very stale.	
3113	F.	41.5	Label only.	1/12/13	156' E. of Rattray Point.	58° 20' N. ; 2° 50' E.	50	"	Grimsby.	—	—	

3114	F.	40-	16/ 6/12	160° E. ½ S. from Aberdeen.	57° 37' N.; 2° 51' E.	33	Aberdeen.	Spent.	Good.
3117	F.	28-5	23/ 5/13	206° E./S. ½ S. of Girdleness.	57° 16' N.; 4° 27' E.	38	Hull.	Sound.	—
3118	M.	36-5	9/11/12	94° N.-W. ¼ W. of Blavaand Point, Denmark.	56° 10' N.; 5° 30' E.	28	Cuxhaven.	—	—
3119	F.	39-5	15/ 1/14	240° N.-E. of N. Shields.	59° 10' N.; 2° E.	55	N. Shields.	Ripening	—
3126	M.	40-	18/10/11	204° E./S. ½ S. of Aberdeen.	57° 10' N.; 4° 29' E.	38	London.	?	Gutted; sound.
3128	F.	37-	18/10/12	192° E./S. ½ S. of Aberdeen.	57° 50' N.; 2° 55' E.	33	Hull.	?	Salted.
3130	M.	40-2	30/ 4/12	195° E./S. of Buchanness.	56° 50' N.; 7° 40' E. (about).	22	Altona.	?	Rather dry.
3131	M.	36-	3/11/11	165° E. ½ S. of Jutland Bank.	57° 40' N.; 2° 59' E.	35	Aberdeen.	Nly. ripe.	Good.
3132	M.	40-3	23/11/11	222° E./S. of Aberdeen.	56° 20' N.; 4° 10' E.	34	London.	—	Gutted; sound
3133	F.	Label only.	1/12/13	157° E. ¼ N. of Buchanness.	58° 2' N.; 2° 35' E.	50	Grimsby.	—	—
3134	?	35-	2/10/11	25° W./N. ¾ N. of Hanstholm (Jutland).	57° 10' N.; 7° 50' E.	27	Hamburg.	?	?
3137	F.	34-	22/ 1/14	248° E./S. ½ S. of Aberdeen.	56° 50' N.; 5° 35' E.	32	Ymuiden.	—	—
3139	M.	34-5	4/ 8/14	174° E./S. of Aberdeen.	57° 25' N.; 3° 17' E.	35	Aberdeen.	Imm.	(Good.
314	M.	37-	8/ 9/11	195° E./S. of Aberdeen.	57° 25' N.; 4° E.	35-36	Cuxhaven.	?	?
314	F.	45-8	28/ 3/13	?	—	?	London.	?	Sound.
314	F.	34-5	20/ 9/13	176° E./S. ½ S. of Aberdeen.	57° 7' 55" N.; 3° 31' E.	33	Aberdeen.	¾ Ripe.	(Good.
3144	M.	34-	26/11/13	160° E. ½ N. of Aberdeen.	58° 8' 30" N.; 2° 34' E.	43	Aberdeen.	Nearly ripe.	(Good.
3145	M.	34-5	28/ 8/11	208° E./S. of Aberdeen.	57° 29' N.; 4° 25' E.	38	Hamburg.	?	?
3146	M.	36-	29/10/12	160° E./S. from Aberdeen.	57° 21' 30" N.; 2° 56' 55" E.	38	Aberdeen.	¾ Ripe.	(Good.
3148	M.	35-	9/12/13	150° E./N. of Aberdeen.	58° 16' N.; 2° 3' E.	53	Aberdeen.	Nearly ripe.	(Good.
3150	F.	36-5	22/10/12	30° N.-E. of Sumburg Head.	60° 17' 5" N.; 0° 48' 30" W.	66	Hull.	?	Sound; gutted
3155	M.	32-	9/ 9/11	193° E./S. ½ S. of Aberdeen.	57° 16' N.; 3° 55' E.	35-36	Cuxhaven.	?	?
3158	M.	42-5	19/10/13	205° E./S. ½ S. of Tod Head.	56° 50' N.; 4° 15' E.	34	Grimsby.	?	Sound.
3162	M.	33-5	Prior to 15/11/11	Caught in Moray Firth and sent to London from Ostend.	—	—	—	?	Sound.
3164	M.	32-5	28/ 8/11	217° E./S. ¼ S. of Aberdeen.	57° 16' N.; 4° 42' E.	38	Hamburg.	?	?
3166	F.	33-	14/10/11	216° E./S. ¼ S. of Aberdeen.	57° 16' N.; 4° 40' E.	35	Hull.	?	Dried hard.
3169	M.	31-5	12/ 5/12	207° E./S. ¼ S. of Aberdeen.	56° 50' N.; 4° 17' E.	29	London.	?	Tail stunted.
3173	F.	31-	16/11/12	290° N.-E./N. of Spurn.	58° 54' N.; 3° 1' E.	45	Grimsby.	?	Sound.
3176	F.	31-	19/10/11	203° E./S. ½ S. of Aberdeen.	57° 10' N.; 0° 28' E.	42	London.	?	Dried hard.
3181	M.	Mark only.	28/ 8/11	225° E./S. ½ S. of Buchanness.	57° 28' N.; 5° 17' E.	36	Hamburg.	—	—
3184	F.	29-5	8/11/11	20° West of List, Northern part of Sylt, Germany.	54° 56' N.; 7° 49' E.	15	Altona.	?	Rather dry.

Nos. 3089-3105 and 3178-3190 taken in Station II., Firth of Forth, 3106-3177 from Station VI. Date, 13th July 1911.

TABLE I.—PLAICE.

No. of Tab.		Sex.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.	Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Date, 14th July 1911. Liberated, 57° 25' N.; 3° 35' E.— <i>continued</i> .											
Sc. A. 10											
3186	F.	32.	23/11/11	209 E./S. $\frac{1}{2}$ S. of Tod Head.	56° 40' N.; 4° 20' E.	34	S.T.	London.		?	Gutted; Sound
3187	F.	28.	13/9/13	200' E./S. $\frac{1}{4}$ S. of Aberdeen.	56° 56' 50" W.; 4° 15' E.	30-32	"	Aberdeen.		—	Good; ulcer at mark.
Date, 15th July 1911. Liberated, N.-W. of Gt. Fisher Bank,* 57° 25' N.; 3° 35' E. Depth, 35 Fms.											
Sc. A. 10											
3193	F.	37.	16/10/12	207' E./S. $\frac{1}{2}$ S. of Buchanness.	57° 30' N.; 4° 55' E.	40	S.T.	London.		Mature.	Sound; gutted.
3194	F.	51.	18/1/12	159' E. $\frac{2}{3}$ S. of Spurn Head.	54° N.; 5° 15' E.	22	"	Grimsby.		—	Gutted; sound
3197	F.	47.	5/10/12	179' E./S. $\frac{1}{4}$ S. of Childness.	57° 20' N.; 3° 30' E.	38	"	Geesstemünde		—	Somewhat dry.
3198	F.	47.5	12/11/11	131' E./S. $\frac{1}{2}$ S. of St. Abb's Head.	55° 55' N.; 1° 50' E.	44	"	Hull.		—	Sound.
3206	M.	42.5	1/3/12	170' E./S. of Longstone Light.	56° N.; 3° 25' E.	37	"	Hull.		—	Salted and dried; about 2.5 of tail missing
3210	F.	46.	26/2/12	215' E. $\frac{1}{2}$ S. of Spurn Head.	54° 05' N.; 5° 50' E.	20	"	Grimsby.		—	Sound.
Date, 19th July 1911. Liberated, Aberdeen Bank, † 56° 55' N.; 1° 8' W. Depth, 35-36 Fms.											
3217	F.	36.	13/2/12	24' S.-E./E. of Aberdeen.	57° 0' 50" N.; 1° 20' 5" W.	33	S.T.	Aberdeen.		Rather imm.	Good.

\* Obtained on Fisher Bank, and liberated there.

† The fish were taken in Cruden Bay, 18th July 1911.



3218	F.	40-	39-5	1/ 8/11	32' S.S.-E. of Aberdeen.	56° 44' 24" N.; 1° 28' 20" W.	37	S.T.	Aberdeen.	Imm.	Good.
3220	F.	36-5	46-4	22/10/12	35' E.-N.-E. of May Isle.	56° 32' N.; 1° 43' W.	28-30	"	Granton.	Nearly $\frac{3}{4}$ ripe.	Good.
3222	F.	38-5	42-	5/11/12	61' E. $\frac{3}{4}$ S. of Bell Rock.	56° 35' N.; 0° 33' W.	54	"	N. Shields.	Mature.	Gutted.
3223	F.	36-5	35-6	20/ 9/11	14' S.-E. of Aberdeen.	57° 0' 55" N.; 1° 41' W.	47	"	Aberdeen.	Imm.	Good.
3225	F.	42-5	42-8	19/10/11	46' E. $\frac{1}{2}$ S. of May Island.	56° 20' 5" N.; 1° 10' W.	37	"	Granton.	Nearly ripe.	Good; tail damaged.
3226	M.	41-	41-2	3/ 8/11	25' S.-E. of Aberdeen.	56° 56' N.; 1° 23' 10" W.	39-40	"	Aberdeen.	Imm.	Good.
3227	F.	39-5	42-1	23/ 4/12	45' E. $\frac{1}{2}$ S. of Aberdeen.	57° 16' N.; 0° 40' 40" W.	38	"	Aberdeen.	Rather imm.	Good.
3228	F.	34-	36-4	23/11/11	30' S.-E. of Aberdeen.	56° 53' 48" N.; 1° 14' 15" W.	35	"	Aberdeen.	Imm.	Good.
3229	F.	38-5	45-1	13/ 9/12	30' S.-E./S. of Aberdeen.	56° 48' 35" N.; 1° 21' W.	35	"	Aberdeen.	About $\frac{1}{2}$ ripe.	Good.
3230	F.	37-	45-4	2/ 2/13	12' N.-W. from Fair Isle.	53° 38' 50" N.; 2° 56' W.	36	"	Aberdeen.	Rather imm.	Good.
3232	M.	34-	44-8	18/12/13	25' E. $\frac{1}{2}$ N. of May Isle.	56° 21' N.; 1° 51' W.	30	"	Leith.	Nearly ripe.	Good.
3237	F.	42-5	42-8	16/11/11	10' E./S. of Aberdeen.	57° 8' 50" N.; 1° 44' 5" W.	37	"	Aberdeen.	Nearly ripe.	Good; slight ulcer.
3238	M.	36-5	38-1	13/ 5/12	12' S.S.-E. from Noss Head.	58° 18' 50" N.; 2° 49' W.	28	"	Aberdeen.	Spent.	Good.
3240	F.	39-	39-5	25/ 8/11	30' S.-E. of Aberdeen.	56° 53' 48" N.; 1° 14' 15" W.	37	"	Aberdeen.	Imm.	Good.
3241	M.	34-5	35-3	3/ 8/11	38' S.-E./S. of Aberdeen.	56° 43' 40" N.; 1° 10' 40" W.	36	"	Aberdeen.	Imm.	Good.
3242	F.	34-5	38-6	18/ 6/12	30' S.S.-E. of Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	30	"	Aberdeen.	Imm.	Good.
3243	M.	35-5	42-	15/10/13	30' N.N.-E. from Buchanness.	57° 57' N.; 1° 40' W.	45	"	Aberdeen.	Nearly ripe.	Good.
3244	M.	28-5	30-8	25/ 2/12	28' E./S. from Aberdeen.	57° 10' N.; 1° 11' W.	41	"	Aberdeen.	Very imm.	Fair.
3247	M.	29-5	31-8	28/ 1/12	40' E.-N.-E. from May Isle.	56° 35' 5" N.; 1° 37' 40" W.	32	"	Granton.	$\frac{3}{4}$ Ripe.	Fair.
3249	F.	37-5	36-8	30/ 7/11	23' E./S. $\frac{1}{2}$ S. of Tod Head.	56° 55' N.; 1° 30' W.	34	"	Hartlepool.	—	Sound.
3253	F.	34-5	34-5	6/ 9/11	30' S.-E. of Aberdeen.	56° 53' 48" N.; 1° 14' 15" W.	37	"	Aberdeen.	Imm.	Good.
3258	F.	41-5	42-2	6/11/11	10' E./N. of Aberdeen.	57° 12' 50" N.; 1° 47' W.	35	"	Aberdeen.	Nearly ripe.	Good.
3259	F.	38-	39-2	25/ 2/12	22' S.-E. of Aberdeen.	56° 57' 5" N.; 1° 26' 5" W.	34	"	Aberdeen.	Fully ripe.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.					Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	Length Cm.	PLACE.	LATITUDE AND LONGITUDE.	PLAICE.					
Date, 19th July 1911 (2 a.m.). Liberated, 56° 55' N.; 1° 8' W.— <i>continued.</i>												
3261	F.	40·	40·4	4/ 8/11	30' S.S.-E. of Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	32	S.T.	Aberdeen.	Imm.	Good.	
3262	F.	47·5	43·3	19/ 6/13	6' N.-E. of Tod Head.	56° 58' 30" N.; 2° 8' 40" W.	15	"	Granton.	Spent.	Good.	
3263	F.	37·5	40·	17/ 4/12	24' E.-S.-E. from Aberdeen.	57° 5' N.; 1° 19' W.	34	"	Aberdeen.	Spent.	Good.	
3264	F.	41·	Label only.	2/ 9/11	4' N.-W. of Bell Rock.	56° 27' 55" N.; 2° 31' 30" W.	13	"	Dundee.	?	?	
3265	F.	37·5	40·4	25/ 4/12	26' S.-E. $\frac{1}{2}$ E. from Aberdeen.	56° 57' 20" N.; 1° 18' W.	35	"	Aberdeen.	Imm.	Good.	
3266	F.	39·	40·4	13/12/11	27' S.-E./E. from Aberdeen.	56° 51' N.; 1° 24' W.	33	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.	
3268	F.	42·	46·9	15/ 6/12	62' E.-N.-E. from Bell Rock.	57° 5' N.; 0° 55' W.	40	"	Dundee.	Imm.	Good.	
3269	M.	37·5	38·3	11/ 2/12	23' S.-E. from Aberdeen.	56° 57' 48" N.; 1° 27' 50" W.	37	"	Aberdeen.	?	Good.	
3271	F.	41·5	41·6	7/10/11	10' E. of Aberdeen.	57° 10' 40" N.; 1° 44' W.	35	"	Aberdeen.	Rather imm.	Good.	
Stud.No. 611	M.	32·5	38·1	15/11/12	120' E. $\frac{1}{2}$ N. from Aberdeen.	57° 53' 5" N.; 1° 25' E.	50	"	Aberdeen.	About $\frac{1}{2}$ ripe.	Good.	
614	M.	33·	30·3	11/ 8/11	15' E.-S.-E. off Bell Rock	56° 24' 5" N.; 1° 55' W.	30	"	Granton.	Imm.	Fair; tail damaged.	
615	F.	35·	41·3	21/ 2/13	22' S.-E./S. from Aberdeen.	56° 53' 50" N.; 1° 31' 50" W.	37	"	Aberdeen.	Imm.	Good.	
617	M.	29·	40·2	10/ 6/13	35' E.-N.-E. of May Island.	56° 32' N.; 1° 43' W.	26	"	Granton.	Imm.	Good; some ulcer at mark.	
619	M.	23·5	23·8	22/ 9/11	30' E.-N.-E. of May Island.	56° 29' 30" N.; 1° 50' W.	30	"	Granton.	Imm.	Fair; dry.	
620	M.	26·5	27·	15/ 8/11	30' E.-N.-E. of Bell Rock.	56° 44' 10" N.; 1° 41' 5" W.	35	"	Dundee.	Very imm.	Fair.	
621	M.	26·5	28·	30/ 7/11	23' E./S. $\frac{1}{2}$ S. of Tod Head.	56° 55' N.; 1° 30' W.	34	"	Hartlepool.	Imm.	Sound.	
625	M.	29·5	33·7	12/ 4/12	25' S.-E./E. from Aberdeen.	57° 0' 30" N.; 1° 10' W.	37	"	Aberdeen.	Imm.	Good.	
626	F.	31·	40·8	13/ 4/13	30' E./S. $\frac{1}{2}$ S. of Hartlepool.	54° 40' N.; 0° 20' W.	34	"	Hartlepool.	Nearly ripe.	Sound.	

627	F.	25.	24/11/11	6' off Montrose.	56° 41' N.; 2° 14' W.	29	"	Dundee.	Very imm.	Fair.
629	M.	26.	3/ 8/11	28' S.-E. of Aberdeen	56° 55' N.; 1° 18' W.	35	"	Aberdeen.	Very imm.	Fair.
631	F.	24.5	29/ 7/11	42' S.-E./E. of Tod Head.	56° 40' N.; 1° 0' W.	37	"	Hartlepool.	—	Sound.
635	M.	28.	6/ 6/12	14' E.-N.-E. from Aberdeen.	57° 17' N.; 1° 42' 10" W.	35	"	Aberdeen.	Imm.	Good.
637	M.	28.	13/ 9/11	6' N.-N.-E. of Carr Light.	56° 24' N.; 2° 33' W.	14	"	Granton.	Very imm.	Fair.
639	M.	28.	1/ 8/11	35' S.S.-E. of Aberdeen.	56° 41' N.; 1° 22' W.	40	"	Aberdeen.	Very imm.	Fair.
640	F.	27.	30/11/11	Between 3' & 4' off Montrose.	56° 42' N.; 2° 20' W.	16	"	Montrose.	Very imm.	Fair; tail damaged.
643	M.	26.	31/10/11	12' S.-E. of Bell Rock.	56° 19' 40" N.; 2° 4' 35" W.	29	"	Granton.	Very imm.	Fair.
645	F.	29.	18/ 7/11	35' S./E. of Buchanness.	56° 56' 40" N.; 1° 14' W.	34	Drift net.	Peterhead.	—	Good.
647	M.	30.	28/ 7/11	25' S.-E. of Aberdeen.	56° 56' N.; 1° 23' 10" W.	37	"	Aberdeen.	Very imm.	Fair.
648	M.	34.5	17/11/11	22' S.S.-E. of Aberdeen.	56° 51' N.; 1° 39' 49" W.	33	"	Aberdeen.	About $\frac{1}{2}$ ripe.	Good.
649	F.	36.5	28/10/11	28' S.-E./E. of Aberdeen.	57° 0' 15" N.; 1° 14' 20" W.	34	"	Aberdeen.	Nearly ripe.	Good.
650	F.	27.5	28/ 9/11	16' E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	"	Granton.	Very imm.	Fair.
654	M.	26.5	8/ 8/11	7' S.-E./E. of Tod Head.	56° 50' 55" N.; 2° 0' W.	28	"	Aberdeen.	Very imm.	Fair.
661	F.	27.	9/11/11	16' E./S. of May Island.	56° 12' 5" N.; 2° 4' W.	26	"	Aberdeen.	Imm.	Fair.

## Date, 7th September 1911. Liberated, Midway between Elie and Fidra, 56° 8' N.; 2° 48' W.

Depth, 27 Fms.

S.C. A. 10

3377	F.	33.5	31/ 3/13	24' S.-E./S. of Aberdeen.	56° 52' N.; 1° 30' 59" W.	33	S.T.	Aberdeen.	Imm.	Good.
3378	F.	35.	5/ 6/13	10' E.-S.-E. of Bass Rock.	56° 3' 40" N.; 2° 20' W.	28	"	Granton.	Spent.	Good.
3382	F.	37.	4/ 3/12	About 1 $\frac{1}{2}$ off Largo.	56° 10' N.; 2° 56' W.	4	Line.	Anstruther.	Imm.	Good.
3384	—	33.5	22/ 5/13	3' off river Ugie.	57° 32' N.; 1° 46' W.	13	"	Peterhead.	Imm.	Good.
3385	F.	35.	14/ 6/12	25' S.S.-E. of Aberdeen.	56° 48' N.; 1° 33' 30" W.	32	S.T.	Aberdeen.	Imm.	Good.
3386	M.	35.	26/12/11	8' E./N. of Tod Head.	56° 57' N.; 2° 0' W.	38	"	Aberdeen.	Very imm.	Good.
3389	M.	34.5	2/ 8/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	25	"	Granton.	Imm.	Good.

The fish liberated between Elie and Fidra were taken in Kirkcaldy Bay, 6th September 1911

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.		PLACE.	LATITUDE AND LONGITUDE.	Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Length Cm.	Date.							
Date, 7th September 1911 (8.30 a.m.). Liberated, Midway between Elie and Fidra— <i>continued</i> .											
Sc. A. 10											
3391	—	33.5	37.9	15/ 2/13	20' S.-E. from Aberdeen.	56° 57' 36" N.; 1° 30' W.	38	S.T.	Aberdeen.	Spawng.	Good.
3392	M.	34.	40.7	27/ 1/13	26' S.-E./E. from Aberdeen.	57° 0' 30" N.; 1° 17' 50" W.	33	"	Aberdeen.	Nly. ripe.	Good.
3394	F.	30.5	37.5	11/ 9/12	16' E. of May Isle.	56° 14' 50" N.; 2° 6' W.	30	"	Granton.	Imm.	Good.
3396	—	30.5	39.5	26/ 6/13	Caught by "Goldseeker."	—	?	—	—	—	—
Stud No.											
667	?	29.5	11 ins.	11/10/11	Off Dysart.	56° 7' N.; 3° 4' W.	5	Line.	Kirkcaldy.	—	—
668	F.	25.5	26.	16/ 3/12	$\frac{1}{2}$ ' off Leven.	56° 8' N.; 3° 4' W.	8	"	Leven.	Imm.	Fair.
675	F.	24.5	25.6	8/ 4/12	$\frac{1}{2}$ ' W. of Bo'ness Harbour.	56° 1' N.; 3° 38' W.	2	"	Newhaven.	Imm.	Fair.
676	—	25.	11 ins.	15/ 3/12	Seafield, 2 $\frac{1}{2}$ ' W. of Kirkcaldy.	56° 6' N.; 3° 8' W.	6	"	Kirkcaldy.	?	?
686	—	31.	37.9	10/10/13	50' off Bell Rock.	—	38	—	Dundee.	Imm.	Good.
Sc. A. 10											
3400	F.	40.	40.7	28/ 6/12	35' N.-E./E. $\frac{1}{4}$ N. of Scarborough.	54° 43' N.; 0° 15' E.	36	?	Scarborough.	?	?
3401	F.	36.5	39.9	20/ 5/12	30' E. of Buoy of Tay.	56° 36' N.; 1° 46' W.	31	S.T.	Dundee.	Imm.	Good.
3402	M.	37.	40.5	28/ 8/12	4' N.-E. from Noup Head.	59° 23' 5" N.; 3° 1' 5" W.	33	"	Aberdeen.	Imm.	Good.
3404	F.	37.	39.	21/ 2/12	$\frac{1}{2}$ ' off Pittenween.	56° 15' N.; 2° 38' W.	4 $\frac{1}{2}$	Line.	Anstruther.	Rather imm.	Good.
3407	M.	34.5	35.	Prior to 10/ 1/12	Not given.	—	—	S.T.	London.	?	Sound.
3409	F.	37.5	44.1	11/ 3/13	16' E./S. of May Isle.	56° 12' 5" N.; 2° 4' W.	25	"	Granton.	Imm.	Good.
3410	M.	34.	36.2	15/ 2/13	24' S.-E. from Aberdeen.	56° 57' 42" N.; 1° 26' W.	34	"	Aberdeen.	Ripe.	Good.
3411	M.	34.	39.	6/ 2/14	Whithy Grounds.	54° 43' N.; 0° 25' W. (about).	36	"	Hartlepool.	Mature.	—
3412	M.	32.5	33.6	6/ 4/12	3-4' N.-E. from Bell Rock.	50° 28' 55" N.; 2° 22' 15" W. (about).	18	"	Granton.	Imm.	Good.
3416	M.	34.	35.3	8/ 3/12	1' S.-W. of Elie.	56° 9' 30" N.; 2° 50' W.	10	Line.	Cockenzie.	Imm.	Good.
3419	M.	35.	35.3	12/ 2/12	5' S.S.-E. from Collieston.	57° 21' N.; 1° 43' W.	34	S.T.	Aberdeen.	Fully $\frac{1}{2}$ ripe.	Good.

3422	M.	35.	12/ 9/12	12' E. of May Isle.	56° 14' N.; 2° 12' 20" W.	30	Aberdeen.	Imm.	Good
3428	M.	36-4	27/ 3/13	29' E./S. $\frac{1}{2}$ S. of Tod Head.	56° 52' N.; 1° 20' W.	36	Blyth.	?	Sound.
687	M.	31.	21/ 4/13	2' S.S.-W. from Largo.	56° 11' N.; 2° 57' W.	4	Anstruther.	Imm.	Good.
688	F.	28-5	8/12/11	200 yds. off Largo Harbour.	56° 10' 8" N.; 2° 57' W.	10	Largo.	Very imm.	Fair; slight ulcer.
693	M.	28-5	14/ 9/11	$\frac{1}{2}$ off Ravensraig Castle, Kirk-caldy.	56° 6' N.; 3° 9' W.	4	Kirkcaldy.	—	—
695	F.	29.	4/10/12	$\frac{1}{4}$ off shore between Craik and Anstruther.	50° 15' N.; 2° 39' W.	4 $\frac{1}{2}$	Anstruther.	Imm.	Fair.
697	M.	26.	4/ 3/12	1 $\frac{1}{2}$ off Largo Bay.	56° 10' N.; 2° 56' W. (about).	8-18	Largo.	Imm.	Fair.
698	M.	23.	6/ 3/12	200 yds. N. Portobello Pier.	55° 58' N.; 3° 4' 30" W.	3-4	Newhaven.	?	?
Date, 12th September 1911. Liberated, 40 miles E. of May Island, 56° 22' N.; 1° 22' W. Depth, 34-35 Fms.									
Sc. A. 10									
3431	F.	42-5	1/ 8/12	80' E. from Buchanness.	57° 51' 10" N.; 0° 20' 20" E.	45	Aberdeen.	About $\frac{1}{2}$ ripe.	Good.
3433	F.	40.	9/ 2/12	35' S.-E./E. $\frac{1}{2}$ E. of Aberdeen.	57° N.; 1° W.	36	N. Shields.	—	Sound.
3435	F.	43.	26/ 3/13	1' off between St. Monans and Pittenween.	56° 12' N.; 2° 44' W.	10-13	Anstruther.	Spent.	Good.
3437	F.	41.	30/ 4/12	40' E.-N.-E. of May Island.	56° 35' 5" N.; 1° 37' 40" W.	30	Granton.	Imm.	Good.
3442	F.	41-5	7/ 3/13	26' E. $\frac{1}{2}$ S. of Scarborough.	54° 23' N.; 0° 20' E.	30	Grimshy.	?	Sound.
3445	F.	37-5	24/10/11	40' N.-E. of May Island.	56° 45' N.; 1° 57' W.	33	Granton.	Fully $\frac{1}{2}$ ripe.	Good.
3446	M.	39.	4/10/11	12' E./N. of May Island.	56° 16' 10" N.; 2° 14' 5" W.	29	Granton.	Nearly $\frac{1}{2}$ ripe.	Good.
3451	F.	40.	18/10/11	72' N.-E./E. $\frac{1}{2}$ E. of May Island.	57° 0' 25" N.; 1° W.	36	Granton.	Fully $\frac{1}{2}$ ripe.	Good.
3452	F.	39.	Mark only sent.	30' E. of May Island.	56° 19' 5" N.; 1° 40' W.	30	—	—	—
3453	F.	40-5	13/ 6/12	26' S.S.-E. of Aberdeen.	56° 48' N.; 1° 32' W.	31	Aberdeen.	Imm.	Good.
3454	F.	38-5	11/ 6/12	20' E./N. of May Island.	56° 20' N.; 2° W.	29-30	Newhaven.	Appears spent.	Good.
3455	F.	54-1	10/11/11	5' N.-E. of Carr Lightship.	56° 24' N.; 2° 28' W.	18	Granton.	Nearly ripe.	Fine.

The fish liberated 40' E. of May Island were taken on Station VI. (Fluke Hole), Firth of Forth. Date, 11th September 1911.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.					
Date, 12th September 1911. Liberated, 40' E. of May Island— <i>continued.</i>										
Sc. A. 10										
3456	M.	40.8	13/ 2/12	35' S.-E./E. $\frac{1}{4}$ E. of Aberdeen.	57° N.; 1° W.	36	S.T.	N. Shields.	—	Sound.
3457	F.	41.5	11/ 3/12	8' S.S.-E. from Buchanness.	57° 23' 23" N.; 1° 35' W.	45	"	Aberdeen.	Ripe.	Good.
3460	F.	44.	23/ 1/12	10' E.-S.-E. from Aberdeen.	57° 6' 50" N.; 1° 43' 55" W.	46	"	Aberdeen.	Nearly ripe.	Good.
3461	F.	40.5	25/ 2/14	6' E./N. of Aberdeen.	57° 11' N.; 1° 52' W.	36	"	Aberdeen.	Spawng.	Good.
3462	F.	40.5	7/ 6/12	45' N.-E. of Bell Rock.	57° 5' N.; 1° 48' 25" W.	46	"	Dundee.	Imm.	Good.
3463	F.	40.	Prior to 4/ 3/12	?	?	?	?	Grimshy.	?	Sound.
3464	M.	35.	4/12/11	27' E. $\frac{1}{2}$ S. of May Island.	56° 15' 50" N.; 1° 44' W.	30	—	Granton.	—	—
3465	F.	42.	7/10/12	35' E.-N.-E. of May Island.	56° 32' N.; 1° 43' W.	30	S.T.	Granton.	Imm.	Good.
3466	F.	40.	15/9/11	29' E. $\frac{1}{2}$ S. of May Island.	56° 16' N.; 1° 39' 50" W.	30	"	Newhaven.	Imm.	Good.
3467	F.	34.5	19/ 9/11	26' E.-S.-E. of May Island.	56° 7' 20" N.; 1° 45' W.	25-26	"	Granton.	Imm.	Good.
3468	F.	39.5	19/ 9/11	35' E./S. of May Island.	56° 13' 30" N.; 1° 30' W.	24-28	"	Granton.	Imm.	Good.
3469	F.	44.3	18/10/12	81' S.-E./E. $\frac{1}{2}$ E. of May Island.	55° 53' N.; 0° 8' W.	38	"	N. Shields.	—	Sound.
3472	F.	38.	14/11/11	18' N.-E./N. of Whitby.	54° 45' N.; 0° 25' W.	34	"	Hartlepool.	—	Sound.
3478	M.	38.4	29/12/11	12' E. of May Isle.	56° 14' N.; 2° 12' 20" W.	26	"	Leith.	Nearly ripe.	Fair.
3479	F.	41.	24/ 6/12	48' E.-S.-E. from Aberdeen.	57° 2' N.; 0° 35' 5" W.	35	"	Aberdeen.	$\frac{1}{4}$ Dev.	Good.
3480	F.	40.3	6/11/11	14' off May Isle.	—	26	"	Granton.	Fully $\frac{1}{2}$ ripe.	Good.
3481	F.	34.	15/ 2/12	16' E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	"	Granton.	$\frac{1}{4}$ Ripe.	Good.
3482	F.	39.5	21/ 8/12	33' N.-E./N. from Buchanness.	57° 59' 35" N.; 1° 26' 55" W.	38	"	Aberdeen.	Imm.	Good.
3483	?	42.5	9/10/11	4' N.-E. of Dunbar.	56° 3' 20" N.; 2° 27' W.	22	"	Granton.	—	Good; bad ulcer.
3484	F.	39.5	22/ 7/12	18' E. from Aberdeen.	57° 13' N.; 1° 29' 40" W.	43	"	Aberdeen.	Imm.	Good.

3485	F.	44-5	44-	9/10/11	35° S.-E. of May Island.	55° 54' N.; 1° 37' W.	42	"	Granton.	Nearly ripe.	Fine.
3486	F.	39-5	41-	26/ 4/12	15° E.-S.-E. of Buchanness.	57° 26' 25" N.; 1° 16' 5" W.	58	"	Aberdeen.	Imm.	Good.
3491	F.	36-	37-7	21/ 4/12	20° E. of May Isle.	56° 16' 25" N.; 1° 57' 50" W.	30	"	Granton.	Imm.	Good.
3495	F.	38-	40-9	35/ 4/12	35° N.-E./E. of Bell Rock.	56° 53' 10" N.; 1° 42' 30" W.	40	"	Granton.	Imm.	Good.
3496	F.	36-	36-6	14/12/11	16° E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	26	"	Granton.	—	—
3497	F.	42-	Mark only.	4/12/11	16° E. $\frac{1}{2}$ S. off May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	—	Granton.	—	—
3499	M.	39-	Label only.	24/ 4/12	11° S.-S.-W. of Sule Skerry.	58° 55' N.; 4° 25' W.	28-35	S.T.	Grimsby.	—	—
3502	M.	33-5	37-9	20/ 3/13	18° E.-S.-E. from Noss Head.	58° 26' 30" N.; 2° 28' W.	45	"	Aberdeen.	Spent.	Fair.
3505	M.	33-5	31/ 5/12	42° E. of May Island.	56° 20' N.; 1° 20' W.	58° 20' N.; 1° 20' W.	36	"	N. Shields.	—	—
3506	F.	35-5	46-2	5/12/13	27° E./S. $\frac{1}{2}$ S. of Noss Head.	58° 27' N.; 2° 11' W.	41	"	N. Shields.	Imm.	Sound.
3507	M.	36-5	39-2	22/ 9/12	38° E. of Aberdeen.	57° 18' 10" N.; 0° 54' W.	35	"	Aberdeen.	Spent.	Good.
3508	F.	38-	41-1	8/ 7/13	25° E. of May Island.	56° 18' N.; 1° 48' W.	30	"	Granton.	Spent.	Good; slight ulcer at mark.
3509	F.	41-	43-2	28/ 8/12	50° N.-N.-E. from Buchan Ness.	58° 17' N.; 1° 36' 50" W.	65	"	Aberdeen.	$\frac{3}{4}$ Ripe.	Good.
3511	F.	40-	40-	23/ 2/12	2° off Whitehills.	57° 43' 10" N.; 2° 35' W.	22	Cod Nets	Whitehills.	Ripe.	Good.
3512	M.	35-	37-8	29/ 2/12	38° S.-E. of Aberdeen.	56° 50' N.; 1° W.	39	S.T.	N. Shields.	—	Sound.
3513	M.	35-	34-8	13/12/11	26° E./S. from May Isle.	56° 13' N.; 1° 45' W.	26	"	Granton.	Nearly ripe.	Good.
3515	F.	37-5	39-3	17/ 3/12	38° S.-E. $\frac{3}{4}$ E. of Tod Head.	56° 40' N.; 1° 10' W.	35	"	N. Shields.	—	Sound.
3517	M.	36-	35-8	6/10/11	27° E. $\frac{1}{2}$ S. of May Island.	56° 15' 50" N.; 1° 44' W.	30	—	Granton.	Imm.	Good.
3520	F.	38-5	39-	3/ 2/12	5° N.-E./E. from Pentland Skerries	58° 45' N.; 2° 49' 10" W.	35	S.T.	Aberdeen.	Nearly ripe.	Good.
3521	F.	40-	39-4	15/ 9/11	29° E. $\frac{1}{2}$ S. from May Island.	56° 16' N.; 1° 39' 50" W.	30	"	Newhaven.	Imm.	Good.
3522	F.	37-	37-1	28/ 9/11	10° E. of May Island.	56° 13' 50" N.; 2° 16' W.	26-29	"	Granton.	Imm.	Good.
3524	F.	38-5	38-1	7/12/11	23° E. of May Island.	56° 17' 15" N.; 1° 52' W.	26-30	—	Granton.	Imm.	Good; slight ulcer.
3525	F.	40-	42-7	22/ 9/12	40° E. from May Island.	56° 21' 45" N.; 1° 22' 5" W.	30	S.T.	Granton.	Nearly ripe.	Good.
3526	M.	34-	38-	14/ 6/12	35° E. $\frac{3}{4}$ S. of May Island.	56° 15' N.; 1° 30' W.	29	"	N. Shields.	Mature.	Stale.
3527	F.	36-5	43-4	16/11/12	62° S.-E./S. of Aberdeen.	56° 28' N.; 0° 37' W.	40	"	N. Shields.	?	Sound.
3528	M.	36-5	39-5	30/ 5/12	45° E.-S.-E. from Aberdeen.	57° 4' N.; 0° 41' W.	36	"	Aberdeen.	Imm.	Good.
3529	M.	39-5	39-2	18/ 9/11	16° E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	"	Granton.	Imm.	Good.
3530	M.	36-	37-6	11/ 2/12	10° E./N. of Hardlepool.	54° 47' N.; 0° 56' W.	33	"	Hartlepool.	—	Sound.
*3016	F.	—	42-3	25/11/11	8° S.-E./E. of May Isle.	56° 8' N.; 2° 2' W.	30	"	Granton.	Imm.	Good.

\* See p. 60.





3558	M.	35-5	23/10/12	24° S./E. from Aberdeen.	56° 57' N.; 1° 25' W.	35	"	Aberdeen.	Nearly ripe.	Good.
3559	F.	37-4	15/11/11	16° E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	—	Granton.	Nearly ripe.	Good; slight ulcer.
3560	F.	41-2	10/10/12	Consigned from Aberdeen to London.	—	—	—	?	—	Sound.
3562	F.	40-5	6/10/12	18° E.-S.-E. from May Island.	56° 8' 55" N.; 2° W.	25	S.T.	Granton.	Spent.	Good.
3564	M.	37-	25/ 4/12	6° S.-E./S. from Cruden Scours.	57° 21' N.; 1° 42' W.	37	"	Aberdeen.	Imm.	Good; slight ulcer.
3565	F.	37-5	4/10/11	—	—	—	"	Granton.	—	Good.
3566	M.	35-	18/ 9/11	16° E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	"	Granton.	Imm.	Good.
3568	F.	35-4	3/10/11	16° E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	"	Granton.	Imm.	Good.
3570	F.	37-5	23/ 6/12	30° S.-E. from Aberdeen.	56° 53' 48" N.; 1° 14' 15" W.	37	"	Aberdeen.	Imm.	Good.
3572	F.	35-5	6/10/11	16° E./S. of May Island.	56° 12' 5" N.; 2° 4' W.	26	—	Granton.	—	Good.
3573	F.	36-9	3/10/11	26° E.-N.-E. of May Island.	56° 27' N.; 1° 54' 5" W.	30-31	—	Granton.	Imm.	Good.
3574	F.	33-1	4/12/11	16° E. $\frac{1}{2}$ S. off May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	—	Granton.	Partly spent.	Good.
3576	M.	35-7	6/ 4/12	14° W.-S.-W. from Cape Wrath.	58° 27' 30" N.; 5° 19' W.	40	S.T.	Aberdeen.	Imm.	Good.
3579	F.	38-4	10/11/11	17° E. of May Island.	56° 16' N.; 2° 4' W.	26	"	Granton.	Imm.	Good; slight ulcer.
3580	M.	37-	5/10/11	16° E./S. of May Island.	56° 12' 5" N.; 2° 4' W.	26	"	Granton.	Nearly ripe.	Good.
3581	F.	39-5	24/ 1/12	8-9° S.-E./E. from Aberdeen.	57° 5' 50" N.; 1° 46' W.	46	"	Aberdeen.	Imm.	Good; slight ulcer.
3582	M.	37-	—	—	—	—	—	—	—	Good.
3584	F.	41-8	23/11/12	43° E./S. of Aberdeen.	57° 14' N.; 0° 45' W.	54	S.T.	N. Shields.	?	Sound.
3589	F.	36-6	9/ 4/12	4° E.-S.-E. of Tod Head.	56° 52' 30" N.; 2° 7' W.	27	"	Aberdeen.	Imm.	Good.
3590	F.	34-5	1/12/11	3° N.-E. from St. Andrews.	56° 22' 40" N.; 2° 44' 55" W.	7	Line.	St. Andrews.	Very im.	Good.
3591	F.	34-	About	Found at Fishmonger, Greenock.	(From Dundee).	—	—	—	Imm.	Good.
3592	M.	35-	22/ 1/12	9-14° N.N.-E. of Kinnaird Head.	57° 52' 40" N.; 1° 57' W.	50	S.T.	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
3593	M.	35-4	4/10/12	26° E./S. of May Island.	56° 14' N.; 1° 45' W.	26	—	Granton.	Imm.	Fair.
3594	M.	37-	8/ 6/12	8° E./N. of May Island.	56° 15' N.; 2° 20' W.	30	S.T.	Newhaven.	?	Guffed.
3595	M.	34-1	28/ 9/11	10° E. of May Island.	56° 13' 50" N.; 2° 15' W.	26-29	"	Granton.	Nearly $\frac{1}{2}$ ripe.	Good.
3596	F.	38-	4/10/11	—	—	—	"	Granton.	Nearly $\frac{1}{2}$ ripe.	Good; slight ulcer.
3599	M.	38-6	29/ 5/12	20° E. $\frac{1}{2}$ N. of May Isle.	56° 18' 50" N.; 1° 58' 40" W.	28	"	Granton.	Imm.	Good.
3600	F.	40-5	13/12/11	20° E. of Bass Rock.	56° 10' N.; 2° 4' 5" W.	25	"	Leith.	Nearly ripe.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Cm.									
Date, 11th September 1911. Liberated, 20 miles E. of May Island— <i>continued.</i>												
3601	M.	36.5	36.5	13/12/11	4 m. N. from Bell Rock.	56° 29' 55" N.; 2° 26' W.	17-18	S.T.	Dundee.	Nearly ripe.	Good.	
3603	F.	33.5	38.4	20/6/12	60' E.-N.-E. of Buoy of Tay.	57° 4' 40" N.; 1° 12' W. (abt.)	43-46	"	Dundee.	Imm.	Good.	
3604	F.	37.	37.	10/11/11	1' off Gosford.	56° N.; 2° 54' 30" W. (about).	4	Line.	Granton.	Imm.	Fair.	
3606	F.	37.	40.1	28/4/12	—	—	65-78	S.T.	Aberdeen.	Imm.	Good.	
3607	F.	37.5	39.2	4/12/11	16' E. $\frac{1}{2}$ S. off May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	—	Granton.	Imm.	Good.	
3608	F.	35.	35.	30/10/11	16' E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	—	Granton.	—	—	
3609	M.	35.	38.6	17/6/12	30' S.S.-E. from Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	34	S.T.	Aberdeen.	Imm.	Good.	
3611	M.	34.	36.4	4/6/12	24' S.-E. from Aberdeen.	56° 57' 42" N.; 1° 26' W.	34	"	Aberdeen.	Partly spent.	Good.	
3612	F.	36.5	36.	18/9/11	?	—	—	"	Granton.	Imm.	Good.	
3614	M.	35.	34.5	—	—	—	—	—	—	Imm.	Good.	
3615	M.	39.	38.2	3/2/12	2' off Brora.	58° 1' N.; 3° 46' W.	13	Cod Net.	Burghead.	$\frac{3}{4}$ Ripe.	Good; tail damaged.	
3619	M.	40.	Mark only.	10/6/12	27' E./S. $\frac{1}{2}$ S. of Bass Rock.	56° 4' N.; 1° 49' 55" W.	28	S.T.	Granton.	—	—	
3620	F.	33.5	34.	24/2/12	1' off between St. Monans and Pittenweem.	56° 13' N.; 2° 38' W.	10-13	Line.	Anstruther.	Rather imm.	Good.	
3622	M.	37.5	38.2	14/3/12	7' E.-S.-E. from Buchan Ness.	57° 27' 10" N.; 1° 31' W.	46	S.T.	Aberdeen.	Nly. ripe.	Good.	
3623	F.	35.5	35.3	18/9/11	16' E. $\frac{1}{2}$ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	26	"	Granton.	Imm.	Good.	
3624	F.	37.5	37.6	13/2/12	32' E./N. $\frac{1}{2}$ N. from Kinnaird.	58° 0' N.; 1° 10' W.	62	"	N. Shields.	—	Sound.	
Stud No.	F.	27.5	28.	27/2/12	1 $\frac{1}{2}$ ' from the mouth of the Ugie.	57° 31' N.; 1° 47' W. (about).	13	Line.	Peterhead.	Imm.	Fair.	
711	M.	31.5	31.5	26/9/11	10' N.-N.-E. of St. Abb's Head.	56° 5' N.; 2° 7' W.	34	S.T.	Newhaven.	Very imm.	Fair; slight ulcer.	

## Date, 15th September 1911.

## Liberated, \* 15° E. ½ N. of Tarbet Ness, 57° 58' N.; 3° 21' W.

## Depth, 25 Fms.

No.	Date	Time	Locality	Coordinates	Depth	Species	Condition	Remarks
3627	30/4/13	37.2	18' N.-E. of Tarbet Ness.	58° 5' N.; 3° 25' W.	25	Ymuiden.	—	Sound.
3628	30/4/13	36.5	Moray Firth.	—	—	Geestemünde	—	—
3629	12/4/12	34.1	3' S.-E. of Golspie.	57° 55' N.; 3° 55' 30" W.	7	Golspie.	Imm.	Good.
3630	10/2/12	41.	Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W. (about).	33	Ostend.	—	—
3634	4/6/12	44.8	28' N.-W. ½ N. from Stroma.	58° 56' N.; 3° 52' W.	35	Aberdeen.	Imm.	Good.
3635	4/6/12	41.2	2' N.-E. of Embo.	57° 56' 3" N.; 3° 56' 7" W.	2-7	Embo.	Imm.	Good.
3638	20/3/12	58.5	6' N.-E. of Tarbet Ness.	57° 57' N.; 3° 43' W.	18	Cod Nets.	Ripe.	Good.
3639	6/3/12	52.7	8' N. from Strathio Point.	58° 44' N.; 4° 8' W.	50	S.T.	Ripe.	Good.
3640	10/2/12	45.9	4' N. from Tarbet Ness.	57° 56' 5" N.; 3° 50' W.	17	Cod Nets	Ripe.	Good.
3644	Mark	Mark	—	—	—	—	?	?
3646	3/2/12	54.5	7' E.-S.-E. of Dunrobin Castle.	57° 58' W.; 3° 43' W.	22	Helmsdale.	?	?
3649	6/3/12	39.	Moray Firth.	—	22	Ostend.	—	—
3653	20/9/12	53.5	Dornoch Firth, Station IV.	57° 58' N.; 3° 45' W.	13	" " " " Goldsecker."	—	(good.
3653	18/10/11	40.	Moray Firth.	—	50	Ostend.	—	—
3656	5/2/12	47.3	4' off Tarbet Ness.	57° 56' 5" N.; 3° 50' W.	17	Cod Nets	Ripe.	Good.
3658	5/2/12	42.	4' off Tarbet Ness.	57° 56' 5" N.; 3° 50' W.	17	Buckie.	Ripe.	Good.
3659	4/4/12	40.3	14' E.-S.-E. from Noss Head.	58° 26' 30" N.; 2° 36' 30" W.	35	Buckie.	Ripe.	Good.
3661	12/11/11	35.5	Moray Firth.	—	49	Ostend.	Spent.	(good.
3662	22/4/12	45.3	S.-E. corner of Stormy Bank.	58° 55' N.; 3° 51' W.	34	Aberdeen.	Spent	Good.
3665	4/11/11	36.5	31' E./N. ½ N. of Tarbet Ness.	58° 10' N.; 3° 3' W.	32	Grimsbay.	—	—
3671	5/3/12	38.	2' E. ½ S. of Clyth Ness.	58° 19' N.; 3° 10' W.	31	Ostend.	—	—
3672	24/12/12	42.	45' N. ½ W. from Ratray.	58° 17' 55" N.; 2° 21' 50" W.	37	Aberdeen.	Nearly ripe.	Good.
3673	23/3/12	36.6	5' N.-E. of Tarbet Ness.	57° 56' N.; 3° 43' W.	18	Cod Nets	Spent.	Good.
3676	27/2/13	37.7	7' off Clyth Ness.	58° 18' N.; 3° 3' W. (about).	38	Wiek.	Spawning.	Good.
3677	20/10/11	34.6	1' S.-E. of Embo Point.	57° 54' N.; 3° 58' W.	3 ½	Embo.	Nearly ripe.	Fair.
3678	17/2/12	33.	4' off Golspie.	57° 55' N.; 3° 55' 30" W.	7	Helmsdale.	Imm.	Good.
3679	34.5	38.	Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W. (abt.).	23	Ostend.	—	—
3680	6/4/12	43.7	14' W.-S.-W. from Cape Wrath.	58° 27' 20" N.; 5° 44' W.	40	Aberdeen.	Spent.	Good.
3684	8/2/12	Mark	4' S./W. from Brora.	57° 56' 55" N.; 3° 50' W.	14-16	Cod Nets	Lossiemouth.	?
3685	13/3/12	35.2	5' N. of Tarbet Ness.	57° 56' 35" N.; 3° 50' W.	18	Buckie.	Ripe.	Good.
3686	22/5/12	34.	21' N./W. ¼ W. of Kinnauld Hd.	58° N.; 2° 20' W.	26	Geestemünde	?	?
3687	22/3/12	37.3	15' S. ½ W. of Noss Head.	58° 14' N.; 2° 57' W.	35	Ymuiden.	?	Sound.

\* Taken in Dornoch Firth, 14th and 15th September 1911.

† Again liberated in Dornoch Firth, 20th September 1912.

See p. 117.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Length Cm.	Date.	PLACE.					
Date, 15th September 1911 (7 p.m.) Liberated, 57° 58' N.; 3° 21' W.— <i>continued</i>										
Sc. A. 10 3688	F.	36.	Label only.	4/11/11	18" S./W. of Noss Head.	58° 10' N.; 3° W.	S.T.	Grimsby.	—	?
3689	M.	32.5	37.3	20/ 4/12	45' N./W. from Rattray.	58° 16' 55" N.; 2° 29' 40" W.	"	Aberdeen.	Imm.	Good.
3690	F.	32.	33.	20/12/11	Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W. (about).	"	Ostend.	?	—
3698	F.	40.	41.6	12/ 3/12	8' S. ½ W. of Dunbeath.	58° 7' N.; 3° 23' W.	"	Ymuiden.	Nearly ripe.	Sound.
3699	M.	35.	36.3	16/ 2/12	28' N.-E. from Buckie.	58° 4' 10" N.; 2° 36' 30" W.	Cod Nets	Buckie.	—	Good.
3700	F.	36.5	39.9	27/ 4/12	20' E.-S.-E. from Noss Head.	58° 26' N.; 2° 24' 30" W.	S.T.	Aberdeen.	—	Good.
Stud No. 721	F.	27.	29.	12/11/11	Dornoch Firth, 1' from shore.	57° 55' N.; 3° 57' W. (about).	Line.	Embo.	Imm.	Fair; tail slightly damaged.
722	M.	28.	34.6	14/ 3/13	12' E. ¼ S. from Tarbet Ness.	57° 55' N.; 3° 26' W.	S.T.	Ymuiden.	—	Sound.
727	F.	29.5	30.5	21/ 2/12	¼ off Embo.	57° 55' N.; 3° 57' W.	Line.	Embo.	Imm.	Fair.
728	M.	28.5	29.5	9/ 3/12	¼ off Embo.	57° 55' N.; 3° 57' W.	"	Embo.	Very imm.	Fair.
730	F.	30.5	37.3	24/ 4/13	Sent from Embo.	57° 56' N.; 3° 43' W.	"	—	Imm.	Good.
733	M.	32.	Mark only.	15/ 2/12	5' N.-E. from Tarbet Ness.	57° 56' N.; 3° 43' W.	Cod Nets	Buckie.	?	?
734	F.	31.5	30.2	16/ 2/12	¼ E./S. of Embo Point.	57° 55' N.; 3° 57' W.	Line.	Embo.	Imm.	Fair.
736	M.	30.	33.	11/ 3/12	15' E.-S.-E. of Pentland Skerries.	58° 40' N.; 2° 25' W.	S.T.	Geestmünde	—	—
737	F.	30.5	32.	22/ 2/12	2' off Little Ferry.	57° 50' N.; 4° 5' W.	Cod Nets	Helmsdale.	Imm.	Good.
742	M.	29.5	30.7	23/11/11	1' from Embo Point.	57° 54' N.; 3° 58' W.	Line.	Embo.	Very imm.	Fair.
743	M.	27.5	27.8	1/ 2/12	¼ off Dunrobin Castle.	57° 58' N.; 3° 55' W.	"	Golspie.	Very imm.	Fair.

744	M.	28-5	29-8	20, 10/11	1' out from Embo.	57° 55' 5" N.; 3° 57' 5" W.	3½	S.T.	Embo.	Imm.	Fair.
746	M.	30-	40-3	13/ 3/14	16' W.-S.-W. of C. Wrath.	58° 27' N.; 5° 23' W.	39	"	Aberdeen.	Spawning.	Good.
747	F.	28-	29-2	31- 1/12	1' off Embo Point.	57° 54' N.; 3° 58' W.	3½	"	Embo.	Very imm.	Fair.
749	F.	29-5	29-8	13/11/11	1' off Embo.	57° 54' N.; 3° 58' W.	3½	"	Embo.	Very imm.	Fair.
750	M.	31-5	32-	18/11/11	Moray Firth.	—	29	S.T.	Ostend.	—	—
752	F.	27-	33-	8/10/12	2' off Golspie.	57° 47' N.; 3° 52' W.	7	Line.	Golspie.	Imm.	Fair.
753	M.	31-5	32-	26/ 2/12	1' off the river Fleet.	57° 57' N.; 4° 4' W.	1	"	Dornoch.	Imm.	Fair.
755	M.	28-	35-	24/ 1/13	10' N.-W./N. from Dunnet Hd.	58° 46' 40" N.; 3° 38' W.	40-50	S.T.	Aberdeen.	Partly spent.	Good.
761	M.	28-	34-	10/ 4/13	36' E./N. ½ N. from Tarbet Ness.	58° 13' N.; 2° 50' W.	26	"	Ymuiden.	—	Sound.
763	F.	26-	34-5	24/ 9/12	1' off Embo.	57° 55' N.; 3° 57' W.	3½	Line.	Embo.	Imm.	Fair.
764	F.	29-	29-3	14/ 3/12	4' off Golspie.	57° 54' N.; 3° 55' 30" W.	7	Cod Nets	Helmsdale.	Imm.	Fair.
765	M.	31-	37-3	29/ 3/13	15' S. of Ord Ness.	57° 54' 30" N.; 3° 26' W.	23	"	Buckie.	Imm.	Good.
766	M.	31-5	34-5	12/ 9/12	S.-E. of Little Ferry.	57° 50' N.; 4° 5' W. (about).	2½	Line.	Golspie.	Imm.	Good.
768	F.	32-5	33-	15/11/11	2' S.-E. of Embo Point.	57° 53' 10" N.; 3° 56' 5" W.	1½-3½	"	Embo.	Imm.	Fair; head damaged.
770	M.	31-	37-8	?/ 2/14	8' S. of Lybster.	58° 20' N.; 3° 15' W.	26	S.T.	Grimshy.	Spent.	—

Date, 19th September 1911.		Liberated,* Smith Bank (Moray Firth), 58° 10' N.; 2° 55' W. †		Depth, 20-22 Fms.							
S.c. A. 10				S.T.							
3703	F.	51-5	54-	17/10/12	32' E./S. ¼ S. of Noss Head.	58° 30' N.; 2° W.	36	"	Geestemünde	—	Somewhat dry.
3704	F.	46-5	46-5	17/ 5/12	—	58° 44' N.; 4° 5' W.	23-30	"	Ymuiden.	?	Gutted; sound
3706	M.	48-	47-6	28/ 2/12	7' N./W. of Strathie Point.	—	50	"	Aberdeen.	Ripe.	Good; tail damaged.
3709	F.	46-5	46-5	25/ 3/12	24' E. ¼ N. of Tarbet Ness.	58° 1' N.; 3° 5' W.	23	"	Ymuiden.	?	Sound.
3710	F.	53-	54-	30/ 5/12	5½' S.-E. (S. of Clyth Ness.	58° 15' N.; 3° 5' W.	32	"	Ymuiden.	?	Sound; gutted.
3713	M.	43-	44-	6/ 2/12	Moray Firth.	—	31	"	Ostend.	—	—
3717	F.	38-	39-2	21/ 1/12	18' S.-E. ¼ E. from Noss Head.	58° 21' 10" N.; 2° 31' W.	27	"	Aberdeen.	Spent.	Good.
3718	M.	37-	38-	5/ 4/12	—	—	30	"	Ymuiden.	?	—
3719	M.	35-5	35-9	21/ 2/12	6' S.-E. of Clyth Ness.	58° 16' N.; 3° 2' W.	31-36	Cod Nets	Ymuiden.	Nly. ripe.	Sound.
3720	F.	36-	35-	4/10/11	(Moray Firth) 8' S.-E. of Clyth Ness.	58° 15' N.; 3° W.	23	S.T.	Geestemünde	—	Good.
3722	F.	63-5	Label only.	8/11/11	Prior to 28' N.-E. ¼ E. of Kinnaid Head.	58° 5' N.; 1° 30' W.	60	"	Grimshy.	?	Dry.
3726	F.	55-	55-1	8/12/11	20-25' S.-E. of Pentland Skerries.	58° 23' 50" N.; 2° 28' W.	35	"	Aberdeen.	Nearly ripe.	Good.

\* 3701 A. 10-3731 A. 10 taken in Dornoch Firth, 18th September 1911.

† 3732 A. 10-3790 A. 10 and Studs 771-780 taken in Burchhead Bay, 19th September 1911.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cent.	Line.									
Date, 19th September 1911 (6 p.m.). Liberated, 58° 10' N.; 2° 55' W.— <i>continued.</i>												
3729	F.	44	46.5	26/ 3/13	15° N.-E. $\frac{1}{2}$ E. of Farbet Ness.	58° 5' N.; 3° 30' W.	27	S.T.	Ymuiden.	—	—	Sound.
3733	M.	44.2	49.1	26/ 5/12	14° W.-N.-W. from Roray Head.	58° 54' N.; 3° 54' W.	38	"	Aberdeen.	Imm.	—	Good.
3738	F.	46.5	49.1	24/ 6/12	14° E./S. from Auskerry.	59° 3' N.; 2° 8' W.	48	"	Aberdeen.	Appar. spent.	—	Good.
3739	F.	35	37	19/11/11	Smith Bank, Moray Firth.	58° 10' N.; 2° 49' W.	24	"	Ostend.	—	—	—
3741	F.	49	49	6/11/11	Moray Firth.	—	39	"	Ostend.	—	—	—
3748	F.	45	46	28/12/11	Near Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W. (abt.)	21	"	Ostend.	—	—	—
3749	F.	42	43	28/12/11	Near Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W. (abt.)	21	"	Ostend.	—	—	—
3753	F.	46.5	47	5/ 2/12	15° S./W. of Noss Head.	58° 13' N.; 3° 03' W.	35	"	Ostend.	—	—	—
3755	F.	38	38.4	17/11/11	17° N.-E. $\frac{3}{4}$ E. of Kinnaird Head.	57° 55' N.; 1° 40' W.	48	"	Grimshy.	—	—	Sound.
3756	?	41	41	20/9/11	Moray Firth.	—	52	"	Ostend.	—	—	—
3758	M.	35.5	38	23/11/11	Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W. (abt.)	21	"	Ostend.	—	?	?
3759	M.	40.5	?	11/12/11	Moray Firth.	—	24	"	Ymuiden.	—	?	?
3760	M.	36	37.4	11/ 5/12	18° S./W. $\frac{1}{4}$ W. of Noss Head.	58° 11' N.; 3° 2' W.	27	"	Hull.	—	—	Sound.
3766	?	44.5	Mark	13/ 3/12	About 4° S./E. of Start Point, Orkney.	59° 12' 5" N.; 2° 20' 35" W. (about)	40	"	—	—	—	—
3767	M.	38.5	38	11/11/11	13° S./E. of Noss Head.	58° 17' N.; 2° 52' W.	24	"	Geestemünde	—	—	Rather dry.
3768	M.	43	22	10/ 3/12	10° S. of Noss Head.	58° 19' N.; 2° 57' 5" W.	20-25	"	Geestemünde	—	—	Size as given by captain.
3772	F.	39	48.8	17/ 5/13	7° E. $\frac{1}{2}$ S. of Noss Head.	58° 30' N.; 2° 50' W.	32	"	Grimshy.	—	—	Sound.
3773	M.	38.5	39.3	19/ 1/12	7° N. from Strathie Point.	58° 44' N.; 4° 2' W.	50	"	Aberdeen.	Ripe.	—	Good.
3774	M.	39	40.4	22/ 4/12	15° S.-E./S. from Noss Head.	58° 18' 50" N.; 2° 41' 5" W.	45	"	Aberdeen.	Ripe.	—	Good.
3776	F.	36.5	42.3	29/ 6/12	16° S.-E. from Auskerry.	58° 54' 30" N.; 2° 6' W.	47	"	Aberdeen.	Imm.	—	Good.
3778	F.	36.5	37	8/11/11	33° N.-E. of Kinnaird Head.	58° 10' N.; 1° 30' W. (abt.)	50-60	"	Grimshy.	?	—	Gutted.
3779	M.	33.5	37	2/ 5/12	5° N.-W. $\frac{1}{4}$ W. of Dunnet Head.	58° 42' N.; 3° 30' W.	35	"	Grimshy.	—	—	Fish lost.
3782	M.	36.5	39	10/ 3/12	20° N. of Kinnaird Head.	58° N.; 2° 10' W.	30	"	Geestemünde	—	—	—

3783	M.	34-5	35-1	9/12/11	8-9° S.S.-E. of Pentland Skerries.	58° 34' 35" N.; 2° 44' W.	35	"	Aberdeen.	Fully $\frac{1}{2}$ ripe.	Good
3784	F.	34-5	36-3	8/11/11	33° N.-E. of Kinnaird Head.	58° 10' N.; 1° 30' W.	50-60	"	Grimsby.	—	Gutted.
3785	F.	38-	38-	28/10/11	Moray Firth.	—	49	"	Ostend.	—	—
3786	F.	37-5	" 25"	9/3/12	10° S. of Noss Head.	58° 19' N.; 2° 57' W.	20-25	"	Geestmünde	—	—
3787	F.	34-5	42-	14/5/12	18° S./W. $\frac{1}{2}$ W. of Noss Head.	58° 11' N.; 3° 2' W.	27	"	Ymuiden.	?	Sound.
3788	M.	33-5	44-2	18/2/14	8° S./W. of Clyth Ness.	58° 11' N.; 3° 11' W.	30	Cod Nets	Buckie.	Ripe.	Good.
3789	M.	33-5	34-9	14/2/12	12-14° S.-E. of Clyth Ness.	58° 12' 30" N.; 2° 50' 40" W.	23	"	Wick.	Nearly ripe.	Good.
Stud.No.											
771	F.	30-5	32-	2/4/12	$\frac{1}{2}$ off Embo.	57° 55' N.; 3° 57' W.	3 $\frac{1}{2}$	Line.	Embo.	Imm.	Fair.
774	M.	33-	36-2	6/3/13	14° S. of Noss Head.	58° 15' N.; 2° 55' W.	26	S.T.	Ymuiden.	—	Sound.
777	M.	32-	37-	17/7/13	13° S.S.-W. of Noss Head.	58° 15' N.; 3° 5' W.	25	"	Grimsby.	Imm.	—
778	M.	30-5	33-2	5/5/12	178° E. $\frac{1}{2}$ N. of Aberdeen.	58° 12' N.; 3° 15' E.	32	"	Ymuiden.	?	Sound.
779	M.	30-	35-3	5/4/13	9° N.-W. $\frac{1}{4}$ N. of Butt of Lewis.	58° 35' N.; 6° 30' W.	46	"	Hull.	—	Sound.
780	M.	33-	38-	17/11/12	Moray Firth.	—	22	"	Cuxhaven.	—	—

Date,	11th	October	1911.	Liberated,*	Smith Bank (Moray Firth),	58° 10' N.; 2° 55' W.	Depth, 20 Fms.	"	"	"	"
3792	M.	37-8	37-8	5/5/12	14° E./N. of Kinnaird Head.	57° 48' N.; 1° 35' W.	33	S.T.	Grimsby.	?	Gutted; sound.
3793	F.	34-5	36-5	25/4/12	9° S. $\frac{1}{2}$ E. of Aukerry.	58° 53' N.; 2° 27' W.	37	"	Blyth.	—	Gutted; sound.
3794	F.	41-	45-5	15/3/13	10° E.-N.-E. of Tarbet Ness.	57° 59' N.; 3° 31' W.	16	"	Ymuiden.	—	Sound.
3798	M.	40-	40-3	18/2/12	5 $\frac{1}{2}$ ° E. $\frac{1}{2}$ N. of Cape Wrath.	58° 40' N.; 4° 50' W.	35	"	Grimsby.	—	Sound.
3799	F.	41-5	44-3	20/4/12	16° S. $\frac{1}{4}$ W. of Noss Head.	58° 12' N.; 2° 58' W.	24-37	"	Grimsby.	?	Sound.
3801	F.	36-	44-1	19/2/13	11° W.-S.-W. of Cape Wrath.	58° 29' 40" N.; 5° 15' W.	36	"	Aberdeen.	Nearly ripe.	Good.
3802	M.	33-5	35-4	17/4/12	9° S.-E./S. of Noss Head.	58° 23' N.; 2° 50' W.	36	"	Ymuiden.	?	Sound.
3803	?	—	—	7/9/13	S.-E. of Gt. Fisher Bank.	56° 52' N.; 4° 24' E. (about).	35	"	Altona.	—	—
3804	F.	33-5	34-	23/11/11	Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W. (about).	22	"	Ostend.	—	—
3805	F.	55-5	55-5	23/11/11	50° N. from Rattray.	58° 24' 50" N.; 2° 18' 30" W.	37	"	Aberdeen.	Nearly ripe.	Good.
3806	M.	34-	35-	31/5/12	18° S./W. $\frac{1}{4}$ W. of Noss Head.	58° 10' N.; 3° 0' W.	11	"	Geestmünde.	—	—
3808	F.	38-	40-3	12/5/12	15° E./S. of Noss Head.	58° 30' N.; 2° 35' W.	35	"	N. Shields.	—	Sound.
3809	F.	34-	36-	19/3/12	Moray Firth.	—	25	"	Ostend.	—	—
3813	F.	35-5	36-2	2/3/12	$\frac{1}{2}$ off Embo.	57° 55' N.; 3° 57' W.	3 $\frac{1}{2}$	Lines.	—	—	Good.
3815	F.	35-	45-2	12/11/12	Pentland Firth.	58° 40' N.; 2° 50' W.	29-37	S.T.	Grimsby.	?	Sound.
3816	F.	38-	37-	19/11/11	Smith Bank.	58° 10' N.; 2° 49' W.	23	"	Ostend.	—	—
3817	F.	34-5	42-	18/11/12	$\frac{1}{4}$ E./S. from Start Point.	59° 17' 30" N.; 2° 15' W.	28	"	Aberdeen.	Nearly ripe.	Good.

\* Fish taken in Dornoch Firth, 10th October 1911

TABLE I.—PLAICE.

No. of Tab.	Sex.	PARTICULARS OF RECAPTURE.									
		Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.	Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.	
Date, 11th October 1911. Liberated, 58° 10' N.; 2° 55' W.— <i>continued.</i>											
Se. A. 10											
3818	M.	37.5	6/3/12	4 S.S.-W. from Helmsdale.	58° 3' N.; 3° 38' 30" W.	17	Cod Net.	Lossiemouth.	Ripe.	Good.	
3819	F.	36-	4/6/12	4 S.-E. from Aiskerry.	58° 59' 15" N.; 2° 26' 30" W.	35	S.T.	Aberdeen.	Imm.	Good.	
3822	F.	36.5	11/3/12	½ off Embo, Dornoch Firth.	57° 55' N.; 3° 57' W.	3½	Line.	Embo.	Imm.	Good.	
3823	F.	38-	20/12/11	Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W. (about).	22	S.T.	Ostend.	?	—	
3825	M.	35-	5/4/12	—	—	30	Cod Nets	Ymuiden.	?	Sound.	
3826	M.	34-	Mark only.	5 N.N.-E. of Tarbet Ness.	57° 57' N.; 3° 43' W.	19	Cod Nets	Buckle.	—	—	
3828	F.	52.5	12/11/11	Moray Firth.	58° 18' N.; 30° 3' W. (about).	44	S.T.	Ostend.	—	—	
3830	M.	35-	21/2/13	5' off Occumster.	—	13-17	Cod Nets	Wick.	Partly spent.	Good.	
3831	F.	34-	29/4/12	20' S.-E. from Noss Head.	58° 22' 25" N.; 2° 26' 30" W.	38	S.T.	Aberdeen.	Imm.	Good.	
3832	M.	37-	29/6/12	15' S.-E. from Noss Head.	58° 21' 30" N.; 2° 38' 35" W.	32	"	Aberdeen.	Imm.	Good.	
3833	M.	36-	39-1	16' N.-E. from Kinnaird Head.	57° 55' 50" N.; 1° 45' W.	62	"	Aberdeen.	Spent.	Good.	
3834	F.	34-	23/11/11	Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W. (abt.).	22	"	Ostend.	?	—	
3836	M.	33.5	27/3/12	—	—	31	"	Ymuiden.	?	Sound.	
3837	M.	34-	?/3/13	10' E. ¾ S. of Noss Head.	58° 30' N.; 2° 45' W.	32-37	"	Grimsby.	—	Sound.	
3838	F.	36-	8/11/11	33' N.-E. of Kinnaird Head.	58° 10' N.; 1° 30' W. (abt.).	50-60	"	Grimsby.	?	?	
3840	M.	34-	3/4/12	27' E./N. of Tarbet Ness.	58° 5' N.; 3° W.	22-28	"	Ymuiden.	?	Sound.	
3841	M.	35.5	26/10/11	Moray Firth.	—	39	"	Ostend.	—	—	
3842	F.	36-	22/10/11	Moray Firth.	—	35	"	Geesteimunde	—	—	
3843	F.	37-	28/4/12	16' S. ¾ W. of Noss Head.	58° 13' N.; 2° 58' W.	34-37	"	Grimsby.	—	Sound.	
3845	M.	34.5	22/10/12	S.-E. of Smith Bank.	58° 5' N.; 2° 55' W.	23	"	Grimsby.	?	Sound.	
3846	F.	35-	26/10/11	28' N.-E. of Smith Bank.	58° 5' N.; 1° 30' W. (about).	60	"	Grimsby.	—	Sound.	
3847	M.	35-	26/3/13	10' S.-E. of Helmsdale.	58° 2' N.; 3° 21' 30" W.	27-28	Cod Nets	Lossiemouth	Spent.	Fair.	
3848	M.	36-	14/2/12	8' S.-E. of Clyth Ness.	58° 15' N.; 2° 59' W.	36	"	Wick.	¾ Ripe.	Good.	
3850	M.	38-	14/2/12	9' S.-E. of Lybster.	58° 13' 20" N.; 3° 1' 20" W.	34	"	Wick.	Ripe.	Good.	



3853	M.L.	39-5	?	24/4/12	Moray Firth, 4' W.-S.-W. of Clyth Ness.	58° 16' 5" N.; 3° 18' 30" W.	33	S.T.	Geestemünde	—	—
3855	?	33-5	25/11/11	Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W. (about).	26	"	Ostend.	—	—	—
3859	F.	37-	3/2/12	4' off Dunrobin Castle.	57° 55' N.; 3° 53' W.	14	Cod Nets	Helmsdale.	Immn.	—	Good.
3862	F.	37-5	4/2/13	8' S.-W. of Tarbet Ness.	57° 45' N.; 3° 53' 40" W.	9	"	Wick.	Ripe.	—	Good.
3863	M.L.	38-5	38-7	14/2/12	10' S.-E. of Bernisdale Head.	58° 6' 10" N.; 3° 12' 30" W.	29	"	Buckie.	Ripe.	Good.
3865	M.	36-	37-8	28/4/12	16' S. $\frac{3}{4}$ W. of Noss Head.	58° 12' N.; 2° 58' W.	34-37	S.T.	Grimsby.	?	Sound; gutted.
3867	F.	52-	51-	3/11/12	Smith Bank.	58° 10' N.; 2° 40' W. (about).	22-24	"	Bremerhaven	?	?
3870	F.	41-	37-4	25/1/12	81' E. $\frac{3}{4}$ S. of Noss Head.	58° 40' N.; 0° 30' W.	67	"	Hull.	—	Sound.
3871	F.	36-5	44-	17/10/12	32' E./S. $\frac{1}{2}$ S. of Noss Head.	58° 30' N.; 2° W.	36	"	Geestemünde	—	Gutted; sound.
3872	M.L.	35-	35-5	25/2/12	16' N.-W. $\frac{3}{4}$ N. of Dunnet Head.	58° 50' N.; 3° 50' W.	54	"	Grimsby.	?	Sound.
3873	F.	49-	49-	30/3/12	?	—	54	"	Grimsby.	?	Sound.
3875	F.	43-4	43-4	27/2/13	1' E. from Tarbet Ness.	57° 51' 55" N.; 3° 45' W.	21	Cod Nets	Buckie.	Spawng.	Good.
3877	F.	40-	40-4	9/3/12	7' E.-S.-E. fr. Pentland Skerries.	58° 40' 40" N.; 2° 41' 50" W.	24	S.T.	Aberdeen.	Ripe.	Good.
3884	M.L.	27-5	30-8	15/3/13	$\frac{1}{2}$ E. of Embo Point.	57° 55' N.; 3° 57' W.	3 $\frac{1}{2}$	Lane.	Embo.	Immn.	Fair.
3886	M.L.	31-	35-	14/5/12	11 $\frac{1}{2}$ N.-E./E. $\frac{3}{4}$ E. of Auskerry.	59° 10' N.; 2° 17' W.	36	S.T.	Hartlepool.	—	Sound.
Date, 12th October 1911. Liberated, * 35' E. of Fair Isle, 59° 44' N.; 0° 33' W. Depth, 71 Fms.											
3893	F.	48-5	51-2	3/8/12	18' E.-S.-E. from Auskerry.	59° N.; 1° 58' W.	42	S.T.	Aberdeen.	Spent.	Good.
3895	F.	44-5	44-7	28/10/11	105' N.-E. $\frac{3}{4}$ N. of Buchanness.	59° 7' N.; 0° 37' 55" W.	73	"	Aberdeen.	Fully ripe.	Good.
3897	F.	47-5	49-6	26/5/12	12-14' E./S. from Noss Head.	58° 29' 40" N.; 2° 38' 5" W.	35	"	Aberdeen.	Spent.	Good.
3898	F.	43-5	43-2	29/11/11	165' E.-N.-E. of Aberdeen.	58° 50' 5" N.; 1° 55' E.	73	"	Aberdeen.	Nearly ripe.	Good.
3899	F.	41-5	45-5	13/6/12	14' E. from Auskerry.	59° 6' N.; 2° 7' 30" W.	42	"	Aberdeen.	Immn.	Good.
3900	F.	47-5	49-7	7/9/12	94' N.-E. $\frac{1}{2}$ E. from Buchanness.	58° 46' N.; 0° 46' W.	65	"	Aberdeen.	Nearly ripe.	Good.
3901	F.	51-	52-1	8/5/12	8' S.-E. from Pentland Skerries.	58° 37' N.; 2° 39' 55" W.	40	"	Aberdeen.	T.S.	Good.
3904	F.	39-	40-1	12/3/12	9' N./W. from Ronasvoe.	60° 44' N.; 1° 34' W.	66	"	Aberdeen.	Spent.	Good.
3906	F.	42-	46-8	8/11/12	18' S.-E. of Noss Head.	58° 20' N.; 2° 33' W.	42	"	Aberdeen.	spent.	Good.
3908	F.	39-5	39-7	16/2/12	5' S.-E. from Clyth Ness.	58° 16' 20" N.; 3° 4' W.	31	"	Wick.	Nearly ripe.	Good.
3909	?	40-	40-	17/6/13	21' E./S. $\frac{1}{2}$ S. of St. Abb's Head.	55° 55' N.; 1° 32' W.	44	"	N. Shields.	Rather imm.	—

\* The fish were taken in Burghhead Bay on 11th October 1911.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.					Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.							
Date, 12th October 1911 (5.30 p.m.). Liberated, 59° 44' N.; 0° 33' W.— <i>continued.</i>												
Sc. A. 10												
3911	F.	39.	45-5	31/ 3/13	2' N.-E. of Cullen.	57° 43' 30" N.; 2° 48' W.	15	Cod Nets	Buckle.	Spent.	Good.	
3912	M.	40-5	44-5	11/ 4/13	8' N.-E. $\frac{1}{2}$ N. of Burchhead.	57° 50' N.; 3° 25' W.	25	S.T.	Yrnideen.	—	Sound.	
3913	?	50.	50-5	15/12/13	Off Holburn Head.		31	"	Grimsby.	—	Sound; gutted.	
3916	M.	43.	48-2	12/ 3/14	5' N./W. of Ru Stoer.	58° 20' N.; 5° 28' W.	42	"	Aberdeen.	Spawning.	Good.	
3917	M.	44-5	44-4	29/11/11	4' S. of Auskerry.	58° 57' 30" N.; 2° 32' W.	40	"	Aberdeen.	Nearly ripe.	Good.	
3920	F.	55.	58-2	22/ 9/12	7' S.-E./S. of North Light, Fair Isle.	59° 27' N.; 1° 30' W.	47	"	Aberdeen.	About $\frac{3}{4}$ ripe.	Good.	
3925	F.	35-5	40.	18/10/12	120' N.-E. $\frac{1}{2}$ N. from Grimsby.	55° 24' 20" N.; 1° 17' E.	44	"	Aberdeen.	Imm.	Good.	
3926	M.	37.	37.	6/ 2/12	4' W.-S.-W. from Noup Head.	59° 17' N.; 3° 6' W.	42	"	Aberdeen.	$\frac{3}{4}$ Ripe.	Good.	
3928	M.	41.	41-3	3/ 5/12	7' E.-S.-E. from Foulca.	60° 4' N.; 1° 50' W.	32	"	Aberdeen.	Imm.	Good.	
3929	M.	37.	36.	25/ 5/12	9 $\frac{1}{2}$ ' E. $\frac{3}{4}$ S. of Noss Head.	58° 30' N.; 2° 45' W.	32	"	Grimsby.	—	Gutted.	
3931	F.	37-5	43.	Nov. '12	Loch Laxford.	58° 24' N.; 5° 5' W.	36	"	Grimsby.	Nearly ripe.	—	
3933	M.	41-5	41-4	1/ 3/12	1' W. of Cheymies Isles, Scalloway, Shetland.	60° 10' N.; 1° 30' W.	70	Cod Net.	Scalloway.	Partly spent.	Good.	
3935	M.	36.	43-9	11/11/12	14' S.S.-E. from N. Light, Fair Isle.	59° 21' 40" N.; 1° 18' W.	44	S.T.	Aberdeen.	Nearly ripe.	Good.	
3937	F.	40.	40-3	7/11/11	7' E.-S.-E. of Fair Isle.	59° 28' N.; 1° 28' W.	52	"	Aberdeen.	Nearly ripe.	Good.	
3938	M.	51.	50.	26/11/11	18' S.-E. from Noss Head.	58° 19' 10" N.; 2° 32' W.	28	"	Aberdeen.	Appar. ripe.	Fine; tail dry at tip.	
3943	F.	37.	39-3	22/ 3/13	7' E. $\frac{1}{2}$ N. of Auskerry.	59° 5' N.; 2° 22' W.	40	"	Blyth.	—	Sound.	
3948	F.	37-5	37-1	24/12/11	130' E.-N.-E. of Aberdeen.	58° 32' N.; 1° 4' E.	62	"	Aberdeen.	Imm.	Good.	
3950	M.	45.	44-9	27/10/11	8' S.S.-E. of Stumburgh Head.	59° 44' 50" N.; 1° 5' 55" W.	37	"	Aberdeen.	Nearly ripe.	Good.	

3951	M.	41-5	8/11/11	12° E.-S.-E. of Auskerry.	59° 1' N.; 2° 10' W.	45	"	Aberdeen.	Nearly ripe.	Good.
3956	F.	40-5	27/11/11	14° S.-E. of Noss Head.	58° 22' N.; 2° 39' W.	33	"	Aberdeen.	Rather imm.	Good.
3957	M.	35-	21/1/12	18° S.-E./E. from Aberdeen.	57° 2' 45" N.; 1° 31' W.	27	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
3958	F.	34-5	26/5/12	11° S.-E./E. fr. Pentland Skerries.	58° 37' 45" N.; 2° 35' 20" W.	37	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
3962	M.	34-	4/3/12	Sylt, Outer Ground.	55° N.; 8° E. (about).	8-10	"	Hamburg.	Imm.	Fair; gutted.
3964	F.	36-9	1/3/12	30° E./S. from Rattray Head.	57° 39' N.; 0° 52' W.	60	"	Dundee.	Fully ripe.	Good.
3965	M.	36-9	8/1/12	18° S.-E. of Noss Head.	58° 19' 10" N.; 2° 32' W.	33	"	Aberdeen.	$\frac{1}{2}$ ripe.	Good.
3973	F.	53-	29/1/12	12° E.-S.-E. from Fair Isle.	59° 26' N.; 1° 15' W.	62	"	Aberdeen.	Nearly ripe.	Good.
3976	F.	47-5	17/7/12	10° S.-E. from No. Light, Fair Is.	59° 25' N.; 1° 19' W.	62	"	Aberdeen.	Spent.	Good.
3980	F.	49-	20/5/13	$\frac{1}{2}$ S.-E. from Auskerry.	58° 59' N.; 2° 26' W.	41	"	Aberdeen.	Imm.	Good.
3981	F.	31-	9/9/12	4 $\frac{1}{2}$ ° E.-S.-E. from Balta.	60° 46' N.; 0° 40' W.	53	"	Aberdeen.	?	Sound.
3982	F.	30-5	1/4/12	7° E. $\frac{1}{2}$ S. of Clyde Noss.	58° 20' N.; 3° W.	24	"	Ymuiden.	?	Sound.
3989	F.	31-	1/1/12	118° E./N. $\frac{1}{2}$ N. of Rattray Point.	58° 40' N.; 1° 20' E.	75	"	Grimsby.	?	Gutted; sound.
Date, 6th March 1912. Liberated. * Midway between Elie and Fidra, 56° 8' N.; 2° 48' W. (abt.). Depth, 27 Fms.										
3998	F.	41-	2/4/13	2 $\frac{1}{2}$ ° E./N. from Tarbet Ness.	57° 53' N.; 3° 44' W.	15	Cod Nets	Lossiemouth.	Spawng.	Good.
4001	F.	35-5	7/1/13	7° E.-S.-E. from Noss Head.	58° 27' 50" N.; 2° 49' 35" W.	38	S.T.	Aberdeen.	Imm.	Good.
4007	F.	59-5	23/12/12	2° off Whitehills.	57° 43' N.; 2° 32' W. (about).	14	Cod Net.	Whitehills.	—	—
4013	F.	38-	13/5/12	16° E./S. of May Island.	56° 12' 5" N.; 2° 4' W.	30	S.T.	Granton.	Spent.	Good.
4018	F.	37-5	8/3/12	1° off St. Monans.	56° 13' N.; 2° 38' W.	13-14	Net.	St. Monans.	Imm.	Good.
4022	F.	40-5	22/2/13	25° S.-E./E. of Aberdeen.	57° 0' 40" N.; 1° 19' W.	38-40	S.T.	Aberdeen.	Spent.	Good.
4024	F.	39-5	6/6/14	40° N.-E. of Longstone.	56° 17' N.; 1° 25' W.	35	"	N. Shields.	Mature.	—
+ 4028	F.	43-5	23/4/12	1° off St. Monans.	56° 13' N.; 2° 38' W.	13-14	S.T. "G oldseeker"	"	—	—
4038	F.	42-5	29/7/12	6° N.-E. of Bell Rock.	56° 31' 20" N.; 2° 17' W.	25	S.T.	Granton.	Imm.	Good.
4115	F.	39-5	28/2/13	27° S.-E./E. from Aberdeen.	57° 0' 30" N.; 1° 17' 24" W.	37	"	Aberdeen.	Spent.	Good.
4117	M.	36-	19/9/13	47° N. $\frac{1}{2}$ W. from Rattray Head.	58° 20' N.; 2° 22' 50" W.	36	"	Aberdeen.	Imm.	Good.
4119	M.	35-5	15/3/13	26 $\frac{1}{2}$ ° E.-S.-E. of Copinslay.	58° 52' N.; 1° 50' W.	43	"	Blyth.	Imm.	Sound.
4121	F.	39-	14/11/13	16° E./N. from Aberdeen.	57° 16' N.; 1° 36' W.	43	"	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.
4124	F.	41-5	27/1/13	6° E.-S.-E. from Buchanness.	57° 27' 15" N.; 1° 32' 55" W.	38-45	"	Aberdeen.	Spent.	Good.
4125	F.	35-	20/4/12	1° off Elie.	56° 11' N.; 2° 50' W.	10	Line.	Anstruther.	Imm.	Good.
4127	F.	37-5	27/3/14	25° E.-N.-E. of May Isle.	56° 27' N.; 1° 57' W.	30	S.T.	Granton.	Spent.	Good.

† Again liberated. See p. 98.

\* The fish were taken on Station VI, Firth of Forth, 6th March 1912.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
PARTICULARS OF RECAPTURE.											
Liberated, Midway between Elie and Fidra— <i>continued.</i>											
6th March 1912.											
4128	F.	41.5	26/ 2/13	1' off shore, St. Monans.	56° 13' N.; 2° 37' W.		7	Lines.	Anstruther.	Spent.	Good.
4129	F.	39.5	20/ 6/13	2½' E./N. ¼ N. of Noss Head.	58° 30' N.; 3° 0' W.		33	S.T.	N. Shields.	—	—
4130	F.	39.	4/ 3/14	1' off Whitehills.	57° 41' N.; 2° 31' W.		7	Line.	Whitehills.	Spawng.	Good.
4133	F.	41.5	13/11/14	8' E.-S.-E. of Aberdeen.	57° 7' 30" N.; 1° 48' W.		30	S.T.	Aberdeen.	¾ Ripe.	Good.
* 4134	F.	38.5	18/ 3/12	" Outside Granton Harbour."			3	"	Granton.	Spent.	Good.
4135	M.	36.5	20/ 3/13	30' E.-S.-E. of Start Point.	59° 13' N.; 1° 24' 10" W.		50	"	Aberdeen.	Spawng.	Good.
4136	F.	33.5	3/ 4/12	¾ off Pittenweem.	56° 15' N.; 2° 36' W.		4½	Line.	Pittenweem	Imm.	Good.
4139	F.	38.5	3/ 7/12	12' E./N. from May Island.	56° 16' 10" N.; 2° 14' 5" W.		28	S.T.	Newhaven.	Imm.	Good.
4141	M.	36.	3/ 4/13	33' E./S. ¼ S. of Noss Head.	58° 30' N.; 2° W.		47	"	N. Shields.	—	—
4143	F.	36.	25/ 2/14	Moray Firth.			48	"	Gee-stom unde	—	—
4145	M.	38.5	13/ 5/13	26' E.-N.-E. of May Isle.	56° 28' N.; 1° 56' W.		30	"	Granton.	Spent.	Good.
4146	F.	37.5	16/ 9/12	43' E.-N.-E. of May Isle.	56° 37' 10" N.; 1° 30' 15" W.		30	"	Granton.	Imm.	Good.
4148	F.	34.	27/ 2/13	7' S.-E. of Buchan Ness.	57° 25' N.; 1° 33' 30" W.		40	"	Aberdeen.	Imm.	Good.
4150	F.	36.5	21/ 6/12	12' E./N. from Isle of May.	56° 16' 10" N.; 2° 14' 5" W.		28	"	Newhaven.	Imm.	Good.
4151	M.	36.5	14/ 4/12	35' S.-E. from Aberdeen.	56° 51' 20" N.; 1° 8' 45" W.		34	"	Aberdeen.	Imm.	Good.
4152	M.	34.	21/ 6/13	26' S.-E./E. from Aberdeen.	57° 0' 30" N.; 1° 17' 50" W.		34	"	Aberdeen.	Imm.	Good.
4154	F.	33.	23/ 5/13	7' S.-E./E. from Buchan Ness.	57° 26' N.; 1° 33' W.		40	"	Aberdeen.	Spent.	Good.
4155	F.	36.	26/ 2/13	26' S.-E./E. from Aberdeen.	57° 0' 30" N.; 1° 17' 50" W.		35	"	Aberdeen.	Spawng.	Good.
4156	F.	37.	15/ 3/12	9' E.-N.-E. of May Isle.	56° 16' 15" N.; 2° 18' W.		28	"	Granton.	Imm.	Good.
4158	F.	37.	4/ 7/12	8' N.-E. of Bell Rock.	56° 33' 30" N.; 2° 19' 55" W.		30	"	Granton.	Imm.	Good.
4159	F.	56.	9/ 4/12	3' S.-E. of Buchhaven.	56° 9' N.; 2° 57' 30" W.		18	Nets.	Buckhaven.	?	?
only.											
4160	F.	40.	24/ 5/13	20' E./S. ¼ S. of Buchan Ness.	57° 30' N.; 1° 10' W.		54	S.T.	N. Shields.	Sound.	—
4161	F.	36.	12/ 6/13	3' E. of Bell Rock.	56° 26' 40" N.; 2° 18' W.		26	"	Newhaven.	Imm.	Good.
4162	F.	44.	20/ 8/13	50' E. ½ S. from Aberdeen.	57° 17' 6" N.; 0° 34' 55" W.		45	"	Aberdeen.	Imm.	Fine.
4163	M.	33.5	6/10/13	14' E.-N.-E. of May Isle.	56° 19' 35" N.; 2° 13' 50" W.		26	"	Granton.	Imm.	Good.

4164	M.	32.5	—	5/12/12	64' N.N.-E. of Souther Point,	56° 2' N.; 1° 10' W.	37	Sunderland.	—	Good.
4166	M.	34.	37-8	22/ 7/12	8' E.-N.-E. of May Isle.	56° 15' 30" N.; 2° 20' 5" W.	30	Granton.	Imm.	Good.
4167	F.	33.	33-6	16/ 5/12	Off Kinghorn.	56° 4' N.; 3° 9' W.	10	Kinghorn.	Imm.	Good.
4170	M.	35.	34-7	7/ 5/12	8' E./N. of May Isle.	56° 14' 30" N.; 2° 20' 45" W.	30	Granton.	Spent.	Good.
4171	F.	36.	42-6	15/ 5/13	12' E.-N.-E. of Aberdeen.	57° 16' N.; 1° 46' W.	29	Aberdeen.	Imm.	Good.
4172	F.	39.5	39-8	3/ 4/12	¾ off Pittenweem.	56° 15' N.; 2° 37' W.	4½	Pittenweem.	Imm.	Good.
4173	F.	33.5	33-8	14/ 3/12	¾ off Pittenweem.	56° 15' N.; 2° 37' W.	4½	Pittenweem.	Imm.	Good.
4174	F.	37.	45-2	21/ 4/14	24' S.S.-E. of Aberdeen.	56° 50' N.; 1° 35' W.	33	Aberdeen.	Spent.	Good.
4175	M.	34.5	35-6	28/ 5/12	7' E.-S.-E. from Tod Head.	56° 52' N.; 2° 0' W.	34	Aberdeen.	Imm.	Good.
Stud. No.										
791	M.	31.5	39-9	25/12/13	16' S. of Bell Rock.	56° 10' N.; 2° 15' W.	31	Dundee.	Nly. ripe.	Good.
792	M.	26.	25-5	13/ 3/12	Off Methil Pier.	56° 11' N.; 2° 59' W.	2½	Leven.	Imm.	Fair.
793	M.	29.5	35-5	30/12/12	16' E. of May Isle.	56° 15' 30" N.; 2° 5' W.	28	Leith.	Imm.	Fair.
794	M.	29.5	35.	17/ 7/13	Moray Firth.	—	20	Grimshby.	Imm.	—
795	F.	30.	30-1	15/ 3/12	A little W. of Buckhaven.	56° 9' 20" N.; 3° 3' W.	6	Buckhaven.	Imm.	Good; head damaged.
796	F.	31.	32-7	20/ 6/12	5-6' N.-E. of Bell Rock.	56° 31' 20" N.; 2° 18' W.	20	Granton.	Imm.	Good.
797	F.	30.5	34.5	29/10/12	At Bell Rock.	56° 26' N.; 2° 23' W.	?	Dundee.	Imm.	Good.
799	F.	31.	37-8	24/ 3/14	26' S.-E./E. ½ E. of Aberdeen.	57° 3' N.; 1° 16' W.	34	Aberdeen.	Spent.	Good.
801	M.	32.5	35.	26/ 2/13	26' S.-E./E. of Aberdeen.	56° 59' 50" N.; 1° 15' 30" W.	34	Aberdeen.	Spawning.	Good.
802	M.	30.5	36-6	21/ 2/13	22' S.-E./S. from Aberdeen.	56° 53' 50" N.; 1° 31' 50" W.	34	Aberdeen.	Spawning.	Good.
+ 803	M.	29.5	34.	5/12/12	—	—	—	S.T. "Goldseeker"	—	—
804	F.	30.	38-3	8/ 7/13	10' E. of Bass Rock.	56° 7' N.; 2° 21' W.	28	Granton.	Imm.	Good.
805	M.	30.5	36-4	19/ 3/14	24' S.-S.-E. of Aberdeen.	56° 50' N.; 1° 35' W.	34	Aberdeen.	Spawning.	Good.
806	F.	30.5	—	4/ 3/13	7' S.S.-E. of Buchan Ness.	57° 22' N.; 1° 37' W.	40	Aberdeen.	—	—
807	F.	33.5	Mark	31/ 3/15	16' E. ½ S. of May Isle.	56° 14' 30" N.; 2° 5' W.	30	Granton.	—	—
			only.							
809	M.	34.5	36-7	2/11/12	4½' E.-N.-E. of Aberdeen.	57° 10' 30" N.; 1° 56' 20" W.	28	Aberdeen.	Imm.	Good.
Date, 7th March 1912. Liberated, † 20 miles E. of May Island, 56° 17' N.; 1° 58' W. Depth, 26 Fms.										
Sc. A. 10										
4179	F.	38.5	38-5	15/ 4/12	50' E./N. from Aberdeen.	57° 31' 5" N.; 0° 39' W.	49	Aberdeen.	Imm.	Good.
4181	F.	44.	47-9	17/ 2/13	23' S.-E. ½ E. from Aberdeen.	56° 59' N.; 1° 25' W.	33	Aberdeen.	Ripe.	Good.
4182	F.	36.	41-1	11/ 9/12	16' E./S. of May Isle.	56° 12' 5" N.; 2° 4' W.	30	Granton.	½ Ripe.	Good.
4183	F.	59.	59-8	14/ 2/13	20-25' E.-S.-E. of Tod Head.	56° 50' 50" N.; 1° 30' W.	56	Granton.	Spawning.	Good.
§ 4184	F.	38.	42-5	5/12/12	Station IV., Firth of Forth.	56° N.; 2° 58' W.	5-7	S.T. "Goldseeker"	¾ Ripe.	—

\* Probably caught outside Isle of May.

† The fish were taken on Station VI., Firth of Forth, 6th March 1912.

‡ Again liberated, 20 miles E. of Isle of May, 6th December 1912.

§ Again liberated, 20' E. of May, 5/12/12.

TABLE. I—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Date, 7th March 1912 (10 a.m.). Liberated, 20 miles E. of May Island— <i>continued</i> .											
Se. A. 10											
4187	F.	39.5	27/ 5/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	26	S.T.	Granton.	Spent.	Good.	
4188	F.	35.	27/ 5/12	16' E./S. of May Isle.	56° 12' 5" N.; 2° 4' W.	30	"	Granton.	Imm.	Good.	
4192	F.	38.7	9/ 5/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	18	"	Granton.	Imm.	Good.	
4194	F.	34.4	3/ 5/12	6' S.-E. from Bell Rock.	56° 22' 30" N.; 2° 14' 20" W.	30	"	Aberdeen.	Imm.	Fair.	
4195	F.	40.	20/ 5/12	30' E. of Tay Buoy.	56° 36' N.; 1° 45' W.	30	"	Dundee.	Imm.	Good.	
4196	F.	40.	27/ 5/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' W.	26	"	Granton.	Imm.	Good.	
4197	F.	37.5	9/ 5/12	4' N.-E. of Bell Rock.	56° 30' N.; 2° 20' W.	15	"	Granton.	Imm.	Good.	
4198	M.	41.	7/ 7/12	7' N.-E. of Bell Rock.	56° 32' 15" N.; 2° 18' W.	28	"	Granton.	Imm.	Good.	
4199	F.	39.	12/ 5/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	25	"	Granton.	Imm.	Good.	
4200	M.	48.5	1/ 3/13	$\frac{1}{2}$ off between St. Monans and Pittenweem.	56° 14' N.; 2° 38' W.	10	Lines.	Anstruther.	Spent.	Good.	
4201	F.	37.	8/11/13	100' S.-E. from Aberdeen.	56° 39' N.; 0° 53' E.	48	S.T.	Aberdeen.	$\frac{1}{2}$ Ripe.	Good.	
4202	F.	33.5	15/ 3/12	9' E.-N.-E. of May Isle.	56° 16' 15" N.; 2° 20' W.	29	"	Granton.	Imm.	Good.	
4206	F.	38.5	3/ 2/13	33' E. $\frac{1}{2}$ S. of St. Abb's Head.	56° 2' N.; 1° 12' W.	32	"	N. Shields.	Imm.	Sound.	
4207	F.	39.	9/ 4/12	5' S.-E. from Tod Head.	56° 50' 40" N.; 2° 4' W.	32	"	Aberdeen.	Imm.	Good.	
4210	F.	34.	12/ 3/12	16' off Bell Rock.	56° 27' N.; 2° 5' W. (about).	30	"	Montrose.	Imm.	Good.	
4211	M.	35.8	15/ 4/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	25	"	Granton.	Imm.	Good.	
4212	F.	46.	13/ 6/12	16' E.-N.-E. of May Isle.	56° 20' 50" N.; 2° 8' 45" W.	35	"	Granton.	Appar. spent.	Good.	
4213	F.	38.5	1/ 7/12	5' E.-S.-E. of Tod Head.	56° 54' N.; 2° 3' W.	24	"	Dundee.	Imm.	Good; tail incomplete.	
4214	F.	41.	12/ 3/12	10' off Bell Rock.	56° 27' N.; 2° 5' W. (about).	30	"	Montrose.	$\frac{1}{2}$ Ripe.	Good.	
4215	F.	40.	4/ 4/12	11' E./S. of May Island.	56° 11' 50" N.; 2° 12' 45" W.	27	"	Granton.	Imm.	Good.	
4216	F.	38.	16/ 2/13	25' S.-E. $\frac{1}{2}$ E. from Aberdeen.	56° 57' 55" N.; 1° 20' W.	35	"	Aberdeen.	Nearly ripe.	Good.	
4217	F.	37.	26/ 6/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	16-17	"	Granton.	Imm.	Good.	

4219	M.	36:	14/	5/12	21' E. of May Isle.	56° 17' N.; 1° 56' W.	30	"	Grannton.	Imm.	Good.	
4223	F.	36-	12/	4/12	Sent from Edinburgh.	58° N.; 2° 55' W.	24	S.T.	Ymuiden.	Imm.	Fair.	
4224	F.	37-	15/	3/13	20' N.-E. of Buckle,	56° 8' N.; 1° 55' 30" W.	29	"	Grannton.	Imm.	Sound.	
4225	M.	32-5	15/	8/12	20' E.-S.-E. of May Isle.	56° 28' 25" N.; 2° 16' W.	30	"	Grannton.	Imm.	Good.	
4226	F.	35-	3/10/12	5' E./N. of Bell Rock.	56° 1' 30" N.; 2° 1' 40" W.	28	"	Grannton.	Imm.	Good.		
4227	F.	33-4	8/	3/12	20' S.-E. of May Isle.	56° 15' 50" N.; 2° 1' W.	34	"	Leith.	Imm.	Good.	
4229	F.	33-5	9/	3/12	18' E. of May Isle.	56° 1' 30" N.; 2° 1' 40" W.	30	"	Grannton.	Imm.	Good.	
4230	F.	37-	14/	4/12	20' S.-E. of May Isle.	56° 10' N.; 2° 55' W. (abt.)	10	"	Ansstruther.	Imm.	Good.	
4231	F.	34-	3/	9/13	Largo Bay.	56° 37' 10" N.; 1° 59' W.	27-30	"	Grannton.	Imm.	Good.	
4233	F.	35-	31/	5/12	18' E.-N.-E. from Bell Rock.	56° 29' 30" N.; 1° 50' W.	20-25	"	Grannton.	Imm.	Good.	
4234	F.	36-5	3/	6/12	30' E.-N.-E. of Bell Rock.	56° 32' 30" N.; 2° 8' 30" W.	30	"	Grannton.	Imm.	Good.	
4235	F.	32-	5/	7/12	10' E.-N.-E. of May Isle.	56° 16' N.; 2° 21' W.	29	"	Grannton.	Imm.	Good.	
4237	F.	31-	15/	3/12	8' E.-N.-E. from May Isle.	56° 30' N.; 2° 19' W.	15	"	Grannton.	Rather imm.	Good.	
4238	F.	40-	2/	5/12	4' N.-E. of Bell Rock.	56° 17' 30" N.; 2° 18' 30" W.	29	"	Grannton.	Imm.	Good.	
4239	M.	33-5	13/	3/12	10' E.-N.-E. from May Isle.	56° 1' 30" N.; 2° 1' 40" W.	28	"	Grannton.	Imm.	Good.	
4240	M.	32-5	12/	3/12	20' S.-E. of May Isle.	56° 25' 15" N.; 2° 9' 10" W.	26	"	Grannton.	Imm.	Good.	
4241	M.	34-	35-8	21/	8/12	8' E.-S.-E. of Bell Rock.	56° 15' 40" N.; 2° 5' W.	25	"	Grannton.	Imm.	Good.
4242	F.	32-	33-3	22/	4/12	16' E. of May Isle.	56° 12' 5" N.; 2° 4' W.	28	"	Grannton.	Imm.	Good.
4247	F.	38-	37-7	14/	3/12	16' E./S. of May Isle.	57° 43' N.; 2° 31' W.	10	Cod Nets	Whitehills.	Ripe.	Good.
4249	M.	34-	39-1	26/12/12	About 1' N.-E. of Whitehills.	56° 13' 5' N.; 2° 3' 15" W.	28	S.T.	Grannton.	Imm.	Good.	
4251	F.	40-5	46-	17/	9/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 17' 30" N.; 2° 18' 30" W.	30	"	Grannton.	Imm.	Good.
4253	M.	34-5	38-4	6/	9/12	10' E.-N.-E. of May Isle.	56° 16' N.; 2° 21' W.	27	"	Grannton.	Imm.	Good.
4254	F.	34-5	34-4	12/	3/12	8' E.-N.-E. from May Isle.	56° 28' N.; 2° 29' W. (about).	12	"	Newhaven.	Imm.	Good.
4255	F.	43-	43-8	30/	4/12	N.-W. of Bell Rock.	56° 14' N.; 2° 39' W.	19	Line.	Cockenzie.	Imm.	Good.
4257	F.	33-5	33-8	8/	9/12	1' off Pittenweem.	56° 53' N.; 2° 4' 40" W.	32	S.T.	Aberdeen.	Imm.	Good.
4260	F.	33-5	39-8	8/	9/12	5' E./S. from Tod Head.	56° 57' 55" N.; 1° 20' W.	35	"	Aberdeen.	Partly spent.	Good.
4261	M.	32-5	34-8	16/	2/13	25' S.-E. $\frac{1}{2}$ E. from Aberdeen.	59° 6' 35" N.; 2° 9' 50" W.	44	"	Aberdeen.	Spawing.	Good.
4262	F.	38-	43-3	23/	3/13	6' E.-S.-E. from Lamb Head, Stronsay.	56° 12' 30" N.; 2° 24' W.	29	"	Grannton.	Imm.	Good.
4263	F.	36-	40-4	12/	8/12	5' E. from May Island.	56° 13' 5" N.; 2° 3' 15" W.	24	"	Grannton.	Imm.	Good.
4264	F.	40-5	43-2	28/	5/12	16' E. $\frac{1}{2}$ S. of May Isle.	(Label only sent).		"			
4265	F.	39-	—	About		Got in Glasgow Fish Market.						
4266	F.	34-5	39-2	13/	8/12	30' E.-S.-E. of Bell Rock.	56° 23' N.; 1° 28' 50" W.	32	S.T.	Grannton.	Imm.	Good.
4267	F.	33-5	33-3	12/	3/12	20' S.-E. of May Isle.	56° 1' 30" N.; 2° 1' 40" W.	38	"	Grannton.	Imm.	Good.
4268	F.	33-	33-7	25/	4/12	28' E. $\frac{1}{2}$ S. of May Isle.	56° 15' 40" N.; 1° 41' 40" W.	25-30	"	Grannton.	Imm.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 7th March 1912. Liberated, 20' E. of May Island— <i>continued</i> .												
Sc. A. 10												
4269	F.	33.5	42.	17/ 7/13	35' E./S. 1/2 S. of May Island.	56° 13' N.; 1° 29' W.	29	S.T.	N. Shields.	Imm.	—	Good.
4271	F.	35.5	36.4	15/ 4/12	16' E. 1/2 S. from May Isle.	56° 13' 5' N.; 2° 3' 15" W.	25	"	Granton.	Imm.	—	Good.
4273	F.	45.5	48.1	4/10/12	20' E./N. from Rattray Head.	57° 46' N.; 1° 15' W.	53	"	Aberdeen.	Imm.	—	Good.
4275	F.	40.	39.9	17/ 4/12	16' E. of Buchan Ness.	57° 32' 35" N.; 1° 16' W.	49	"	Newhaven.	Imm.	—	Good.
4276	F.	34.5	38.8	20/ 2/13	Largo Bay, 2' E.-S.-E. from Largo	56° 12' N.; 2° 55' W.	10	Lines.	Largo.	Imm.	—	Good.
4277	F.	37.5	40.1	24/ 6/12	16' E./S. of May Isle.	56° 12' 5" N.; 2° 4' W.	25	S.T.	Granton.	Imm.	—	Good.
4278	M.	37.5	37.1	15/ 3/12	16' E. 1/2 S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	27	"	Granton.	Imm.	—	Good.
Date, 8th March 1912. Liberated, * 22' S.S.-E. from Cruden Scaurs, or 57° 6' N.; 1° 25' W. Depth, 43 Fms.												
4279	F.	43.	Mark not on fish, but caught on a line about 1' off Banff, embedded in a mass of tubes of Sabellaria.			57° 41' 30" N.; 2° 31' W.	14	—	—	—	—	—
4283	M.	34.5	40.3	27/ 2/13	6-7' S.-W. from Rackwick Bay.	58° 52' N.; 3° 27' W.	54	S.T.	Aberdeen.	Spawng. Spent.	—	Good.
4284	F.	34.5	40.4	31/ 3/13	4' E./N. of Tarbet Ness.	57° 54' N.; 3° 40' W.	15	Cod Nets	Lossiemouth.	Spent.	—	Good.
4286	M.	34.	49.	5/ 7/14	15' E./S. of Ausherry.	59° 4' N.; 2° 4' W.	45	S.T.	Aberdeen.	Spent.	—	Good.
4287	F.	47.	49.6	5/ 7/12	50' N. 1/2 W. from Hoy Head.	59° 46' N.; 3° 40' W.	55	"	Aberdeen.	Spent.	—	Good.
4288	M.	34.5	39.5	11/ 3/13	14' off Banff.	57° 42' N.; 2° 30' W.	10	Cod Nets	Whitehills.	Spawng.	—	Good.
4289	F.	33.5	35.2	13/ 6/12	14' E./N. from Bennaachie.	57° 29' N.; 1° 20' W. (about)	42	S.T.	Aberdeen.	Imm.	—	Good.
4290	M.	34.	38.4	15/ 2/13	3-4' off Latheron Wheel.	58° 16' N.; 3° 14' W.	—	Cod Nets	Wick.	Ripe.	—	Good.
4292	F.	33.	39.5	18/10/12	Between Black Dog and Cruden Bay.	57° 18' N.; 1° 56' W. (about).	9	S.T.	Aberdeen.	Imm.	—	Good.
4293	M.	34.5	35.2	3/ 4/12	Near Harbour, Collieston.	57° 24' N.; 1° 49' W.	10	Line.	Collieston.	Imm.	—	Good; head damaged.



4294	F.	33-5	16/ 4/12	1° S.-E. from Black Dog, Collieston.	57° 24' N.; 1° 49' W. (about).	6	"	Collieston.	Imm.	Good.
4295	F.	33-	17/10/12	Between Black Dog and Cruden.	57° 18' N.; 1° 56' W. (about).	9	S.T.	Aberdeen.	Imm.	Good.
4296	M.	33-5	8/ 3/13	10° S.-E. of Ord Head, Caithness.	58° 4' N.; 3° 18' W.	39	Cod Nets	Buckie.	Ripe.	Good.
4297	F.	34-	18/ 3/13	14° E.-S.-E. of Anskerry.	59° 0' 40" N.; 2° 6' W.	44	S.T.	Aberdeen.	Spawning.	Good.
4302	F.	34-5	41-	18° E.-S.-E. of Tarbet Ness.	58° N.; 3° 15' W.	26	"	Y muiden.	Imm.	Sound.
4305	F.	32-	40-4	23/12/12	4½° E.-N.-E. from Aberdeen.	57° 1' 30" N.; 1° 57' W.	29	"	Aberdeen.	Good.
4306	F.	33-5	42-8	27/ 1/14	1° off Whitehills.	57° 41' N.; 2° 32' W.	10	Whitehills.	Nly. ripe.	Good.
4308	F.	33-	42-4	15/ 3/14	10° E.-N.-E. of Lybster.	58° 25' N.; 3° 2' W.	31-36	Cod Nets	Imm.	Good.
4310	M.	34-5	34-8	10/ 3/12	19° S.-E./S. from Aberdeen.	56° 55' 45" N.; 1° 36' 55" W.	45	"	Imm.	Good.
4311	F.	33-5	43-2	15/ 1/14	1° off Whitehills.	57° 41' 30" N.; 2° 33' W.	10	Whitehills.	¾ Ripe.	Good.
4312	F.	33-5	43-2	19/ 1/13	12° E.-S.-E. from Buchan Ness.	57° 26' 50" N.; 1° 23' W.	49	Aberdeen.	Imm.	Good.
4316	F.	34-	35-1	11/ 7/12	35° E.-N.-E. of May Isle.	56° 32' N.; 1° 43' W.	28	Granton.	Imm.	Good.
4317	F.	42-5	52-8	4/12/14	14° S.-S.-E. of Fair Isle.	59° 20' N.; 1° 20' W.	65-66	Aberdeen.	Sly. so.	Good.
4318	F.	34-5	44-8	6/ 2/14	6° N.-E./E. of Kinnaid Head.	57° 46' 30" N.; 1° 53' W.	56	Aberdeen.	Nly. ripe.	Good.
4321	F.	35-5	—	24/ 2/14	20° N./W. of Buckie.	57° 58' N.; 3° 15' W.	—	Buckie.	—	Good.
4322	M.	33-5	36-5	3/ 4/13	Scourie Bank, 5-7° N.-W. from Crow Island.	58° 20' N.; 5° 40' W. (about).	30	Aberdeen.	Spent.	Good.
4325	F.	44-	44-4	25/ 3/12	7° E.-S.-E. from Buchan Ness.	57° 27' 30" N.; 1° 32' 30" W.	45	Aberdeen.	Spent.	Good.
4326	F.	42-5	42-7	14/ 3/12	23° S.-E. ½ S. from Aberdeen.	56° 54' 30" N.; 1° 27' 10" W.	38	Aberdeen.	¾ Mat.	Good.
4328	F.	33-5	45-	22/ 5/14	26° E. ½ N. of May Isle.	56° 21' N.; 1° 50' W.	25	Granton.	Spent.	Good.
4329	F.	40-5	42-9	27/ 5/12	16° E. ½ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	26	Granton.	Spent.	Good.
4330	F.	40-	44-5	17/ 7/13	¾ E. from Tay Buoy.	56° 27' N.; 2° 36' W.	19-20	Aberdeen.	—	Good.
4331	M.	35-	41-3	26/12/12	About 1° N.-E. of Whitehills.	57° 41' 30" N.; 2° 32' W.	10	Whitehills.	Ripe.	Good.
4332	F.	36-	48-7	8/10/13	45° N. ½ W. of Rattra.	58° 17' 55" N.; 2° 21' 50" W.	32	Aberdeen.	Imm.	Good.
4333	M.	34-	39-7	3/ 4/13	Scourie Bank, 5-7° N.-W. from Crow Island.	58° 20' N.; 5° 40' W. (about).	38	Aberdeen.	Spent.	Good.
4335	M.	33-5	35-4	12/ 9/12	41° E.-N.-E. May Isle.	56° 36' N.; 1° 34' 5" W.	40	Granton.	Imm.	Good.
4336	F.	34-	34-2	6/ 4/12	Off Collieston.	57° 24' N.; 1° 48' W.	10	Collieston.	Imm.	Fair.
4342	F.	46-5	46-9	13/ 4/12	1° N.-E. of Collieston.	57° 25' N.; 1° 48' W.	10	Collieston.	¾ Ripe.	Good.
4344	F.	34-5	38-7	1/11/12	14° S.-E. from Aberdeen.	57° 1' 30" N.; 1° 40' 30" W.	34	Aberdeen.	¾ Ripe.	Good.
4345	F.	34-	37-1	12/ 6/12	24° S.-E./E. from Aberdeen.	57° 0' 50" N.; 1° 20' 5" W.	38	Aberdeen.	Imm.	Good.
4346	F.	33-	38-1	15/ 4/13	Found Y muiden Market.	—	—	Y muiden.	Imm.	Sound.
4347	F.	33-	37-2	7/ 2/13	25° N.-E. from Buckie.	58° 5' N.; 3° 5' W.	28	Buckie.	Imm.	Sound.
4348	F.	39-5	45-8	18/ 3/14	9° S.-E./E. of Bell Rock.	56° 24' N.; 2° 8' W.	24	—	Spawning.	Good.
4349	F.	35-	?	29/ 3/12	Near Harbour, Collieston.	57° 24' N.; 1° 48' W.	10	Collieston.	Gutted.	Head cut off.
4350	F.	34-5	39-5	19/ 5/13	25° E.-N.-E. of May Isle.	56° 27' N.; 1° 57' W.	18	Granton.	Imm.	Good.
4351	F.	33-5	39-1	25/11/12	30° S./E. from Aberdeen.	56° 41' 40" N.; 1° 37' W.	31	Aberdeen.	Imm.	Good.

\* These fish were taken from Aberdeen Bay, 8th March 1911.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.	Place.	LATITUDE AND LONGITUDE.	Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Date, 8th March 1912. Liberated, 22' S.S.-E. from Cruden Scours, or 57° 6' N.; 1° 25' W.— <i>continued.</i>										
Sc. A. 10										
4352	F.	34	2/1/13	1½ off Banff Bay	57° 41' 30" N.; 2° 30' W.	14	Cod Nets	Whitehills.	—	—
4354	F.	35	13/4/12	13' S. of Cruden Scours.	57° 11' N.; 1° 50' W.	33	Line.	Collieston.	Imm.	Good.
4355	F.	34	20/11/12	Between Old Castle and Collieston	57° 23' N.; 1° 50' W. (about).	9	"	Collieston.	¾ Ripe.	Good.
4357	F.	37	16/4/13	40' E.-S.-E. of Aberdeen.	57° 3' 40" N.; 0° 50' 15" W.	42	S.T.	Aberdeen.	Spent.	Good.
4358	F.	33	21/10/12	25' E.-N.-E. of May Isle.	56° 27' N.; 1° 57' W.	30	"	Granton.	Imm.	Good.
4359	F.	33	19/4/12	N. of Old Slains Castle, Collieston.	57° 23' N.; 1° 50' W. (about).	9	Line.	Collieston.	Imm.	Fair; gutted.
4360	F.	37	2/5/13	28' E.-S.-E. of Aberdeen.	57° 4' 55" N.; 1° 19' 50" W.	33	S.T.	Aberdeen.	Spent.	Good.
4361	M.	33	2/5/13	4' E.-N. ½ N. of Tarbet Ness.	57° 54' N.; 3° 40' W.	21	"	Ymuiden.	—	Sound.
4363	M.	35	7/3/13	About 1½ off Banff.	57° 41' 30" N.; 1° 30' W.	14	Cod Nets	Whitehills.	Ripe.	Good.
4364	F.	40	21/9/13	8' N.-E. from Buchan Ness.	57° 35' 5" N.; 1° 37' 5" W.	43	S.T.	Aberdeen.	Fully	Good.
4365	F.	41	26/6/12	9' S.-E. from Buchan Ness.	57° 23' 40" N.; 1° 31' 30" W.	45	"	Aberdeen.	Imm.	Good.
4366	F.	34	18/2/13	9' N.-E. from Buckie.	57° 48' N.; 2° 52' W.	32	Cod Nets	Buckie.	Ripe.	Good.
4367	F.	38	19/2/13	7' S.-E. from Buchan Ness.	57° 25' N.; 1° 33' 30" W.	37	S.T.	Aberdeen.	—	—
4368	F.	35	3/5/13	1' S.-E. from Forvie Ness, Collies- ton.	57° 25' N.; 1° 48' W.	9	Line.	Collieston.	Imm.	Good.
4369	F.	33	28/2/13	25' S.-E./E. of Aberdeen.	57° 1' N.; 1° 19' 20" W.	36	S.T.	Aberdeen.	Imm.	Good.
4370	M.	33	2/1/13	1½ off Banff Bay.	57° 41' 30" N.; 2° 30' W.	14	Cod Nets	Whitehills.	Nearly ripe.	Good.
4372	F.	32	15/4/12	1' off Cruden Bay.	57° 24' N.; 1° 48' W.	10	Line.	Port Errol.	Imm.	Good.
4374	F.	41	10/1/13	1' off Macduff.	57° 41' N.; 2° 30' W.	10	"	Macduff.	Almost ripe.	Good.
4375	M.	33	6/2/13	4' S. from Brora	57° 56' 30" N.; 3° 49' W.	17	Cod Nets	Buckie.	Partly spent.	Good.

4376	F.	35-5	48-7	21/12/13	50° N. ½ W. of Ratray Head.	58° 21' N.; 2° 26' W.	30	S.T.	Aberdeen.	Nearly ripe.	Good.
4377	F.	40-5	40-6	27/ 3/12	4' S.S.-E. of Collieston.	57° 21' 30" N.; 1° 45' W.	37	"	Aberdeen.	Spent.	Good.
Date, 24th April 1912. Liberated, * Midway between Elie and Fidra, 56° 8' N.; 2° 48' W. Depth, 27 Fms.											
4379	M.	40-5	Label only.	25/ 4/13	5½' S.-E. ¼ E. of Copinshay.	58° 51' 40" N.; 2° 30' W.	44	S.T.	N. Shields.	—	—
4381	F.	38.	41-3	28/11/12	7' E. of May Isle.	56° 12' 50" N.; 2° 20' 45" W.	30	"	Granton.	Nly. ripe.	Good.
4382	M.	38-5	41-3	1/ 2/13	13' E./S. of St. Abb's Head.	55° 55' 35" N.; 1° 44' W.	30	"	Granton.	Ripe.	Good.
4383	F.	34-5	39-6	4/ 5/13	47' E. ½ S. from Aberdeen.	57° 16' 50" N.; 0° 35' 40" W.	37	"	Aberdeen.	Spent.	Good.
4384	F.	35-5	43-2	20/ 3/14	7' N.-E. of Bell Rock.	56° 33' N.; 2° 17' W.	—	"	Leith.	Ripe.	Good.
4387	F.	30.	36-2	21/ 2/13	¾ off Pittenweem.	56° 14' N.; 2° 39' W.	15	Line.	Cockenzie.	Imm.	Good.
4388	M.	35-5	37-7	21/ 9/12	28' S.-E. of Aberdeen.	59° 55' N.; 1° 18' W.	35	S.T.	Aberdeen.	Imm.	Good.
4392	F.	34.	38-8	3/ 4/13	7' S.S.-E. from Aberdeen.	57° 2' 5" N.; 1° 55' W.	30	"	Aberdeen.	Imm.	Good.
4393	M.	36-5	38-8	11/ 9/12	7' E. May Isle.	56° 12' 50" N.; 2° 20' 45" W.	29	"	Granton.	Imm.	Good.
4396	F.	33-5	38.	27/ 2/13	1' off Largo.	56° 12' N.; 2° 55' W.	10	Line.	Anstruther.	Imm.	Good.
4398	F.	40.	49.	25/ 2/14	5'-6' N.-E. ½ E. of Strathlie Pt.	58° 44' N.; 3° 54' W.	43	S.T.	Aberdeen.	Spawning.	Good.
4399	F.	32.	Mark only.	29/ 8/13	10' E.-S.-E. of May Isle.	56° 9' 50" N.; 2° 16' W.	26	"	Leith.	—	—
4402	M.	33-5	38-5	18/10/12	25' N.-E./E. of May Isle.	56° 30' N.; 2° 4' 40" W.	26	"	Granton.	½ Ripe.	Good.
4403	F.	32-5	32-2	8/ 5/12	Off Elie.	56° 11' N.; 2° 50' W.	4	Salmon Net.	Elie.	Imm.	Good.
4406	M.	32.	33-4	26/ 3/13	5' N.-W. from Hundia, Orkney.	58° 53' N.; 3° 8' W.	36-40	S.T.	Aberdeen.	Spawning.	Good.
4407	M.	38-5	39-7	6/ 2/13	10' S.S.-E. from Helmsdale.	57° 50' N.; 3° 26' W.	24	Cod Net.	Buckie.	Ripe.	Good.
4409	M.	34.	37-5	30/ 1/13	20' N./E. from Buckie.	58° N.; 3° 4' 30" W.	22	Cod Nets	Buckie.	Spawning.	Good.
4410	M.	36.	37-5	5/ 9/12	9' E. of May Isle.	56° 13' 40" N.; 2° 17' W.	28	S.T.	Granton.	Imm.	Good.
4411	F.	47.	49-5	22/ 1/14	1¾ off Whitehills, Banff.	57° 42' N.; 2° 32' W.	14	Cod Nets	Whitehills.	Spawning.	Good.
4412	F.	35-5	38-1	21/ 2/13	17' E. of May Isle.	56° 15' N.; 2° 4' W.	29	S.T.	Leith.	Imm.	Fair.
4414	F.	35.	39-3	10/ 4/13	4' E./N. of Farbet Ness.	57° 54' N.; 3° 40' W.	21	"	Ynuiden.	—	Sound.
4415	M.	35.	39-1	30/12/12	4¾ E.-N.-E. from Aberdeen.	57° 11' 30" N.; 1° 57' W.	29	"	Aberdeen.	Imm.	Good.
4416	F.	39-5	39-4	12/ 6/12	16' E.-S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	30	"	Granton.	Imm.	Good.
4417	M.	34-5	37-3	17/ 1/13	70' E.-S.-E. fr. Pentland Skerries.	58° 34' 45" N.; 0° 39' W.	37	"	Aberdeen.	Nearly ripe.	Good.
4418	M.	38-5	40-9	25/ 4/13	7' N.N.-E. of St. Abb's Head.	56° 3' N.; 2° 7' W.	84	"	Granton.	Spent.	Good.
4421	F.	43-5	44-6	24/ 7/12	6' E./S. of Bass Rock.	56° 5' 10" N.; 2° 27' W.	28	"	Granton.	Imm.	Good.
4422	F.	32-5	36-2	10/ 2/13	1½ off Whitehills.	57° 42' N.; 2° 32' W.	14	Cod Nets	Whitehills.	½ Mature	Good.

\* The fish were taken on Station VI., Firth of Forth, 23rd April 1912.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.					
Date, 24th April 1912. Liberated. Midway between Elie and Fidra— <i>continued.</i>										
Sc. A. 10.										
4424	F.	41.5	30/ 7/13	26½' S.-E./E. ½ E. from Aberdeen.	57° 1' 55" N.; 1° 14' 55" W.	S.T.	Aberdeen.	Spent.	Good.	
4425	F.	33.	2/12/12	¾ off Montrose Bay.	56° 43' N.; 2° 26' W.	Cod Nets	Montrose.	Nearly ripe.	Good.	
4426	M.	36.	16/ 9/12	27' N.-E./E. of May Isle.	50° 31' 4" N.; 2° 2' W.	S.T.	Montrose.	Nearly ripe.	Good.	
4428	M.	39.	18/ 4/14	183' N.-E. of Caithness.	—	"	Dundee.	Ripe.	Good.	
4429	M.	37.	26/ 2/13	26' S.-E./E. from Aberdeen.	57° 1' N.; 1° 19' 30" W.	"	Aberdeen.	Partly spent.	Good.	
4430	F.	34.5	3/ 5/12	1' off Elie.	56° 11' N.; 2° 50' W.	Line.	Elie.	Imm.	Fair.	
4432	M.	33.	16/ 6/13	7' S.-E. from Pentland Skerries.	58° 37' 40" N.; 2° 42' W.	S.T.	Aberdeen.	Imm.	Good; slight ulcer at mark.	
4433	F.	45.	17/12/12	E. Goodwin Light, S.W. 2 miles.	51° 14' 30" N.; 1° 38' 30" E.	"	Ramsgate.	Nearly ripe.	Fresh.	
4434	M.	34.	16/ 2/13	24½' S.-E./E. from Aberdeen.	57° 1' 10" N.; 1° 20' W.	"	Aberdeen.	Spawning.	Good.	
4435	F.	45.	15/ 5/13	Largo Bay.	56° 12' N.; 2° 55' W (about).	Line.	Anstruther.	Spent.	Good.	
4436	F.	39.	26/ 7/12	12' E./S. of Bass Rock.	56° 5' 55" N.; 2° 17' 15" W.	S.T.	Granton.	Imm.	Good.	
4437	M.	35.5	37-4	30/ 1/13	22' N./E. from Buckle.	Cod Nets	Buckle.	Spawning.	Good.	
4438	F.	37.	46-5	21/ 5/14	24' S.-E. of Noss Head.	S.T.	Aberdeen.	Spent.	Good.	
4441	F.	33.	38-1	21/ 2/13	1' off Elie.	Line.	Anstruther.	Imm.	Good.	
4442	F.	42.5	44-1	1/ 7/12	16' E./S. of May Isle.	S.T.	Granton.	½ Dev.	Good.	
4443	M.	35.5	39-1	7/ 6/13	30' S.-E./S. from Aberdeen.	"	Aberdeen.	Spent.	Good.	
4444	F.	35.	41-5	22/ 5/13	18' N.-E. from Buchan Ness.	"	Aberdeen.	Spent.	Good.	
4445	M.	35.	39-5	27/ 3/13	26' S.-E./S. of Aberdeen.	"	Aberdeen.	Spawning.	Good.	
4446	F.	40.5	Mark only.	22/ 8/12	23' S.-E./E. of St. Abb's Head.	"	Granton.	?	?	
4447	M.	34.	38-6	5/ 5/13	8' S.-E. of May Isle.	"	Granton.	Spent.	Good.	

4449	F.	44-39-5	29/ 5/12	1' off Pittenweem.	56° 14' N. ; 2° 38' W.	4½	Line.	Pittenweem.	Spent.	Good.
4450	—	38-5	13/ 3/14	16' E.-N.-E. of May Isle.	56° 22' N. ; 2° 10' W.	20	S.T.	Granton.	Ripe.	Good.
4451	M.	32	25/ 4/13	40' E.-S.-E. of Bass Rock.	56° N. ; 1° 27' 50" W.	30	"	Granton.	Imm.	Good.
4452	M.	35-	23/12/12	About 1' off Banff Head.	57° 41' 30" N. ; 2° 30' W.	10	Cod Net	Whitehills.	Nly. ripe.	Good.
4453	M.	40-5	26/ 6/13	30' E. ½ S. from Aberdeen.	57° 13' 5" N. ; 1° 8' W.	43	S.T.	Aberdeen.	Imm.	Good.
4454	F.	44-	49-2	4' off Pennan.	57° 45' N. ; 2° 13' W.	32	Line.	Macduff.	Spawng.	Good.
4455	F.	34-	4/ 5/12	1' off Elie.	56° 10' N. ; 2° 50' W.	4½	"	Elie.	Imm.	Fair.
4457	M.	34-	16/ 2/13	24½ S.-E./E. of Aberdeen.	57° 1' 10" N. ; 1° 20' W.	34	S.T.	Aberdeen.	Spawng.	Good.
4458	M.	40-	37-2	26' S.-E./E. from Aberdeen.	57° 0' 50" N. ; 1° 18' W.	35	"	Aberdeen.	Spawng.	Good.
4459	M.	32-	26/ 2/13	26' S.-E./E. from Aberdeen.	56° 52' N. ; 1° 59' W.	26	"	Aberdeen.	About ¾ ripe.	Fine.
4460	F.	35-5	4/11/13	7-8 miles E.-S.-E. from Tod Head.	57° 6' N. ; 1° 16' W.	31	"	Aberdeen.	Spent.	Good.
Stud No.										
811	F.	33-	1/ 4/14	26' E.-S.-E. of Aberdeen.	56° 28' N. ; 2° 15' 50" W.	30	"	Granton.	Imm.	Good.
812	F.	32-5	3/ 7/13	5' E. ½ N. of Bell Rock.	56° 20' N. ; 2° 29' W.	25	"	Leith.	—	—
813	M.	31-5	Mark	3' E. of Carr.			"			
815	M.	27-	26/ 2/13	30' S.-E./E. of Aberdeen.	56° 58' N. ; 1° 9' 50" W.	38	"	Aberdeen.	Partly spent.	Fair.
816	F.	31-5	21/ 8/13	16' E. ½ S. of May.	56° 13' 5" N. ; 2° 3' 15" W.	24	"	Granton.	Imm.	Good.
820	M.	31-0	3/ 4/15	8' E.-S.-E. of May Isle.	56° 10' 30" N. ; 2° 19' 30" W.	27	"	Granton.	Spawng.	Good.
822	M.	33-5	16/ 8/12	8' E.-N.-E. of May Isle.	56° 16' N. ; 2° 21' W.	32	"	Granton.	Imm.	Good.
823	M.	32-5	21/ 7/14	50' E.-S.-E. of Aberdeen.	57° 3' N. ; 0° 31' W.	43	"	Aberdeen.	Spent.	Good.
824	F.	32-	27/ 2/13	10' S.-E. of Bell Rock.	56° 20' 35" N. ; 2° 7' 15" W.	30	"	Dundee.	Imm.	Good.
825	F.	32-	35-5	25/10/12	56° 16' N. ; 2° 23' W.	28	"	Leith.	Imm.	Good.
826	F.	33-	12/ 7/12	7' E.-N.-E. of May Isle.	56° 8' N. ; 2° 27' W.	30	"	Granton.	Imm.	Good.
827	F.	34-5	20/10/12	12' E.-N.-E. from Aberdeen.	57° 16' N. ; 1° 46' 30" W.	40	"	Aberdeen.	Imm.	Good.
829	F.	33-5	29/11/13	16' E.-S.-E. of Bell Rock.	56° 24' N. ; 1° 54' W.	30	"	Dundee.	¾ Ripe.	Good.
830	M.	37-	5/ 3/14	5' S. of Buchanness	57° 25' N. ; 1° 43' W.	40	"	Aberdeen.	Spawng.	Good.
Date, 24th April 1912. Liberated, * 20' E. of May Island, 56° 17' N. ; 1° 58' W. Depth, 29 Fms.										
Sc. A. 10										
4462	M.	39-5	16/ 4/14	20' E.-N.-E. of May Isle.	56° 24' N. ; 2° 5' W.	30	S.T.	Granton.	Ripe	Good.
4463	M.	35-5	4/ 6/12	27' E.-N.-E. of May Isle.	56° 28' N. ; 1° 54' W.	26	"	Granton.	Imm.	Good.
4464	F.	40-5	5/10/12	16' E. ½ S. of May Isle.	56° 13' 5" N. ; 2° 3' 15" W.	30	"	Granton.	¾ Ripe.	Good.
4465	F.	38-5	31/ 7/12	17' E./S. of May Isle.	56° 12' 30" N. ; 2° 2' W.	30	"	Granton.	Imm.	Good.
4466	F.	35-5	20/ 5/13	25' E.-N.-E. of May Isle.	56° 25' 50" N. ; 1° 56' W.	30	"	Granton.	Imm.	Good.
4467	F.	37-5	24/ 7/12	10' E./N. of Bell Rock.	56° 30' 50" N. ; 2° 7' 50" W.	26	"	Granton.	Imm.	Good.

\* The fish were taken on Station VI., Firth of Forth, 23rd April 1912.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Length Cm.	Date.	PLACE.					
<b>Date, 24th April 1912. Liberated, 20' E. of May Island—continued.</b>										
Sc. A. 10										
4468	F.	36	Mark only.	1/10/12	20' E./S. $\frac{1}{2}$ S. of May Isle.	56° 11' N.; 1° 56' W.	S.T.	Granton.	—	—
4469	F.	39	40.5	2/9/12	10' N.-E. of Longstone Light.	55° 48' N.; 1° 28' W.	"	Granton.	Imm.	Good.
4470	F.	43.5	—	16/12/12	27' E./S. of Bass Rock.	56° 7' N.; 1° 49' 40" W.	"	Granton.	?	?
4472	F.	41.5	42.5	29/5/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	"	Granton.	Imm.	Good.
4473	F.	44	44	1/5/12	33' E. $\frac{1}{2}$ S. from May Isle.	56° 16' 50" N.; 1° 33' 40" W.	"	Granton.	Imm.	Good.
4474	F.	52	53.1	1/8/12	16' E. $\frac{1}{2}$ S. from May Isle.	56° 13' 5" N.; 2° 3' 15" W.	"	Granton.	Nearly ripe.	Good.
4475	F.	40.5	49.9	9/9/14	10' E. of May Isle.	56° 14' N.; 2° 16' W.	"	Granton.	$\frac{1}{2}$ Ripe.	Good.
4477	F.	40	46	14/2/13	2' N.-E. of Whitehills.	57° 43' N.; 2° 32' W.	Cod Nets	Whitehills.	Spent.	Fair.
4478	F.	38.5	41.6	21/11/12	10' E./S. of May Isle.	56° 12' N.; 2° 14' 40" W.	S.T.	Granton.	Imm.	Good.
4479	F.	35	39.2	25/1/13	7' S.-E. from Buchan Ness.	57° 25' N.; 1° 33' 30" W.	"	Aberdeen.	Nly. ripe.	Good.
4480	M.	33	36.9	16/3/13	26' S.-E./E. of Aberdeen.	56° 59' 50" N.; 1° 15' 30" W.	"	Aberdeen.	Spawing.	Good.
4481	F.	37.5	39.1	10/6/12	25' E./N. from May.	56° 21' 55" N.; 1° 51' 55" W.	"	Granton.	Imm.	Good.
4486	F.	39.5	41.7	2/8/12	16' S.-E. of May Isle.	56° 3' 20" N.; 2° 8' W.	"	Granton.	About $\frac{1}{2}$ ripe.	Good.
4487	F.	39.5	Mark only.	5/6/12	12' E./S. of May Isle.	56° 12' N.; 2° 11' W.	"	Newhaven.	—	—
4490	M.	35	36.6	8/12/12	Outside May Isle.	56° 12' N.; 2° 23' W. (about.)	Abt. 30	Granton.	Nearly ripe.	Good
4491	F.	44	49.6	20/8/13	17' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 40" N.; 2° 3' W.	"	Granton.	Imm.	Fine.
4492	F.	40	43	15/6/13	53' E./S. of Bell Rock.	56° 29' N.; 0° 45' W.	"	N. Shields.	—	—
4493	F.	34.5	41.4	24/6/13	40' E.-N.-E. of May Isle.	56° 35' 5" N.; 1° 37' 40" W.	"	Granton.	Imm.	Good.
4494	F.	39	39.8	18/7/12	24' E. $\frac{1}{2}$ N. of May Isle.	56° 20' N.; 1° 50' 20" W.	"	Granton.	Imm.	Good.
4495	M.	35.5	36	6/6/12	20' E./S. of May Isle.	56° 12' 30" N.; 1° 54' 55" W.	"	Granton.	Imm.	Good.
4496	M.	40	40.2	18/1/13	43' E. $\frac{1}{2}$ S. of Aberdeen.	57° 15' N.; 0° 45' W.	"	N. Shields.	—	Sound.

4497	M.	39	41-7	21/	1/13	76° N.-E. of Kinnaid Head.	58° 40' N.; 0° 30' W.	67	"	N. Shields.	Sound.
4499	M.	36	36-5	5/10/12	16° E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	27	Imm.	Granton.	Good.	
4500	F.	41-5	46-5	1/	4/13	24° S.-E. $\frac{1}{2}$ E. of Aberdeen.	56° 59' 12" N.; 1° 23' W.	31	Imm.	Aberdeen.	Good.
4501	F.	62-5	64	13/	7/13	Between Cockenzie and May Isle.	56° 6' N.; 2° 48' W. (abt.).	17-19	Nearly ripe.	Cockenzie.	Good.
4502	F.	34	35-7	19/	7/12	27° E. $\frac{1}{2}$ N. of May Isle.	56° 21' N.; 1° 46' W.	28	Imm.	Granton.	Good.
4503	M.	35	40-7	14/10/13	8° S.-E. of Bell Rock.	56° 21' 55" N.; 2° 10' 55" W.	25	About $\frac{1}{2}$ ripe.	Granton.	Good.	
4504	F.	35	36-5	12/	6/12	16° E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	30	Imm.	Granton.	Good.
4505	M.	36	36-7	27/	5/12	16° E./S. of May Isle.	56° 12' 5" ; 2° 4' W.	30	Imm.	Granton.	Good.
4508	M.	37	39-2	18/10/12	19° S.S.-E. from Aberdeen.	56° 52' 50" N.; 1° 40' W.	37	Nearly ripe.	Aberdeen.	Good.	
4509	F.	39-5	39-4	28/	5/12	Found in catch of vessel at Granton.	56° 27' N.; 1° 54' 5" W.	—	Spent.	Granton.	Good.
4510	M.	37	38-2	19/	6/12	26° E.-N.-E. of May Isle.	57° 29' 55" N.; 1° 38' W.	24	Imm.	Granton.	Good.
4511	F.	37	41-3	11/	3/13	4° E. of Buchan Ness.	56° 9' 30" N.; 2° 4' W.	22	Ripe.	Dundee.	Good.
4513	F.	32	35-9	10/	9/12	16° E.-S.-E. of May Isle.	56° 9' 30" N.; 2° 4' W.	30	Imm.	Granton.	Good.
4514	F.	35-5	40-3	19/	2/13	12° E.-S.-E. of Bell Rock.	56° 25' N.; 2° 1' 15" W.	25	Imm.	Granton.	Good.
4515	F.	34	37-1	4/10/12	18° E. $\frac{1}{2}$ S. of May Isle.	56° 13' 50" N.; 2° 0' W.	28	Imm.	Granton.	Fair.	
4516	F.	36-5	38-2	22/	7/12	5° E. of Bell Rock.	56° 27' N.; 2° 15' W.	28	Imm.	Granton.	Good.
4518	F.	39	39-3	27/	5/12	16° E. $\frac{1}{2}$ S. of May Isle.	56° 12' N.; 2° 3' W.	28	Imm.	Granton.	Good.
4519	M.	33	35-2	3/	8/12	17° E./S. of May Isle.	56° 15' 40" N.; 2° 4' 50" W.	27	Imm.	Granton.	Good.
4522	F.	37	40-9	21/	1/13	16° E. of May Isle.	56° 5' 50" N.; 1° 20' 55" W.	28	Imm.	Granton.	Good.
4524	F.	39	39-2	8/	5/12	40° E.-S.-E. of May Isle.	53° 40' N.; 5° 15' E.	16	Spent.	Grimshy.	Good.
4525	F.	35	45-6	22/	2/14	180° E./S. of Grimshy.	57° 0' 15" N.; 1° 14' 20" W.	35	Imm.	Aberdeen.	Good.
4526	F.	37-5	42-5	19/	9/12	28° S.-E. of Aberdeen.	57° 16' 50" N.; 0° 35' 40" W.	35	Appar.	Aberdeen.	Good.
4527	F.	39-5	44-9	10/	7/13	47° E. $\frac{1}{2}$ S. from Aberdeen.	56° 13' 50" N.; 2° 0' W.	25-30	spent.	Granton.	Good.
4528	F.	35	40	21/12/12	18° E. $\frac{1}{2}$ S. of May Isle.	57° 45' N.; 1° 14' W.	53	Ripe.	Aberdeen.	Good.	
4530	M.	36	39-8	9/	4/13	N.-E. $\frac{1}{2}$ E. of Aberdeen.	58° 21' N.; 1° 52' W.	70	Nearly ripe.	Aberdeen.	Good.
4531	F.	41	44-9	12/	1/13	40° N.N.-E. of Kinnaid Head.	56° 20' N.; 1° 50' 30" W.	30	Imm.	Granton.	Good.
4533	M.	34	35-1	13/	6/12	24° E. $\frac{1}{2}$ N. of May Isle.	56° 14' N.; 2° 39' W.	4 $\frac{1}{2}$	Imm.	Pittenweem.	Good.
4534	F.	42	42-1	6/	5/12	$\frac{3}{4}$ off Pittenweem.	56° 27' N.; 2° 6' W.	30	Imm.	Granton.	Good.
4535	M.	33	34-3	5/	7/12	10° E./S. of Bell Rock.	56° 12' 30" N.; 1° 54' 55" W.	29	Imm.	Newhaven.	Good.
4536	F.	33-5	33-6	7/	6/12	20° E./S. of May Isle.	56° 16' N.; 2° 14' W.	30	Imm.	Granton.	Fair.
4539	F.	34-5	38-4	10/	9/12	12° E./N. of May Isle.	56° 16' N.; 1° 48' W.	25-30	Imm.	Granton.	Good.
4540	F.	35	35-4	6/	5/12	25° E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	30	Nearly ripe.	Granton.	Good.
4542	F.	40	43-9	9/12/12	16° E. $\frac{1}{2}$ S. of May Isle.						

TABLE I.—PLAICE.

No of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
PARTICULARS OF RECAPTURE.												
Date, 24th April 1912. Liberated, 20' E. of May Island— <i>continued</i> .												
Sc. A. 10												
4543	F.	48.5	27	5/12	16' E./S. of May Islo.	56° 12' 5" N.; 2° 4' W.	30	S.T.	Granton.		Spent.	Good.
4545	F.	34-	26	7/12	17' E. $\frac{1}{2}$ S. of May Islo.	56° 13' 40" N.; 2° 3' W.	27	"	Granton.		Imm.	Good.
4547	M.	32-	40.8	12/12/13	19' S.-E. of Noss Head.	58° 20' N.; 2° 31' W.	35	"	Aberdeen.		Ripe.	Good.
4548	F.	40-	40.4	8/5/12	40' E.-S.-E. of May Islo.	56° 5' 50" N.; 1° 20' 55" W.	28	"	Granton.		Imm.	Good.
4549	F.	39.5	39.8	3/5/12	23' E. of May Islo.	56° 17' 15" N.; 1° 52' W.	29	"	Granton.		Imm.	Good.
4551	F.	36-	40.3	11/9/12	10' E. of May Islo.	56° 13' 50" N.; 2° 16' W.	27	"	Newhaven.		$\frac{1}{2}$ Ripe.	Good.
4552	M.	34-	36.8	10/4/13	50' E.-N.-E. of May Islo.	56° 41' 20" N.; 1° 22' 10" W.	34	"	Granton.		Imm.	Good.
4553	F.	41.5	40.8	10/5/12	25' E.-S.-E. of May Islo.	56° S' 20" N.; 1° 47' W.	30	"	Newhaven.		Imm.	Good.
4554	M.	36-	44.3	17/2/14	?	?	?	"	Ymuichen.		—	Gutted.
4555	M.	38-	39.7	3/3/13	25' S.-E./E. from Aberdeen.	57° 0' 40" N.; 1° 19' W.	35	"	Aberdeen.		Spawning.	Good.
4456	M.	35-	41-	—	8' E./N. of Pentland Skerries.	58° 40' N.; 2° 50' W.	28	"	Grimsby.		$\frac{1}{2}$ Ripe.	Good.
4557	F.	42.5	43-	1/6/12	20' S.-S.-E. from Tod Head	56° 36' 40" N.; 1° 50' W.	28	"	Dundee.		Spent.	Good.
4558	F.	43.5	43.3	17/6/12	16' E.-S.-E. of May Islo.	56° 9' 30" N.; 2° 4' W.	25-30	"	Granton.		Spent.	Good.
4559	F.	40.5	45.4	1/4/13	16' E. $\frac{1}{2}$ S. of May Islo.	56° 13' 5" N.; 2° 3' 15" W.	28-30	"	Granton.		Imm.	Good.
4560	?	36.	Mark only.	12/6/12	28' E./N. $\frac{1}{2}$ N. of May Islo.	56° 26' 5" N.; 1° 49' 24" W.	26	"	Granton.		—	—
*4028	F.	44.5	44.9	14/5/12	16' E./N. of May Islo.	56° 19' N.; 2° 7' W.	30-40	"	Granton.		Imm.	Good.
Date, 9th May 1912. Liberated, † Midway between Elie and Fidra, 56° 8' N.; 2° 48' W. Depth, 27 Fms.												
4561	M.	35.5	39.4	18/3/13	4' W.-N.-W. of Bell Rock.	56° 27' N.; 2° 30' 15" W.	18	S.T.	Aberdeen.		Ripe.	Good.
† 4563	F.	33.5	35-	5/7/12	Kirkcaldy Bay.	56° 7' N.; 3° 6' W.	—	S.T.	"Goldseeker"		—	—
4565	M.	32.5	35-	14/2/13	25' E.-S.-E. from Aberdeen.	57° 5' 50" N.; 1° 17' W.	34-35	S.T.	Aberdeen.		Ripe.	Good.
4568,	M.	28-	33.4	1/3/13	$\frac{3}{4}$ off St. Monans and Pittenweem	56° 14' N.; 2° 39' W.	9	Line.	Anstruther.		Imm.	Good.
4570	F.	53.5	42.8	16/9/13	28' E./N. of May Island.	56° 23' 15" N.; 1° 48' 30" W.	31	S.T.	Granton.		—	Good.



\$ 4577	F.	30.	12/ 6/12	Kirkcaldy Bay.	56° 7' N.; 2° 6' W.	S.T.	'Goldseeker'	Good.
4580	M.	35-3	3/ 5/13	17-18' E.-S.-E. from Auskerry.	59° N.; 1° 58' W. (about).	S.T.	Aberdeen.	Spent.
4581	M.	34-5	26/10/12	60' E./S. of Bell Rock.	56° 31' N.; 0° 33' 35" W.	"	Dundee.	Imm.
4585	F.	36-8	30/ 8/12	25' E.-S.-E. of May Island.	56° 7' 30" N.; 1° 47' W.	"	Granton.	Imm.
4591	F.	43.	1/ 7/13	10' E.-S.-E. of Bass Rock.	56° 3' 40" N.; 2° 20' W.	"	Granton.	Spent.
4593	M.	30.	37-4	16/ 1/14	20' S.-E. of Aberdeen.	"	Aberdeen.	Ripe.
4594	F.	36-5	Mark only.	26/ 7/12	15' E.-S.-E. of Bell Rock.	"	Granton.	?
4595	M.	33.	39-8	2' W. of May Isle.	56° 24' 5" N.; 1° 55' W.	Herring Nets.	Anstruther.	Nearly ripe.
4599	F.	46.	47-2	2/12/12	About 30' beyond May Isle.	S.T.	Granton.	Nearly ripe.
4604	M.	27.	32-5	4/ 4/13	3' off Pittenweem.	Line.	Anstruther.	Imm.
4605	F.	34.	37-4	27/ 9/12	7' E.-S.-E. of St. Abb's Head.	S.T.	Leith.	Imm.
4606	M.	32.	38-4	17/ 9/12	25' E. ½ S. of May Isle.	"	Granton.	Imm.
4612	M.	38.	39-1	19/ 2/13	10' S.-E. of Bell Rock.	"	Dundee.	Ripe.
4613	M.	37.	40-2	6/10/13	14' E.-E. of May Island.	"	Granton.	Imm.
4616	F.	37-5	39-8	9/ 8/12	Off West Wemyss, Firth of Forth.	Line.	Anstruther.	—
4618	M.	38.	41.	24/12/13	12' E.-N.-E. of N. Shields.	S.T.	N. Shields.	—
4619	F.	42-5	49-2	15/ 1/14	20' E.-S.-E. of Bass Rock.	"	Granton.	Ripe.
4621	F.	38-5	44-1	3/ 9/13	30' S.S.-E. from Aberdeen.	"	Aberdeen.	About ½ ripe.
4622	M.	33-5	Mark only.	27/12/12	9' S.-E. from May Isle.	"	Granton.	—
4623	F.	33.	34-6	31/ 8/12	7' E.-N.-E. of Aberdeen.	"	Aberdeen.	Imm.
4626	M.	44.	45.	25/12/12	13' E. of May Isle.	"	Granton.	Nly. ripe.
4627	F.	36.	41.	22/ 1/14	1½' off Whitehills, Banff.	Cod Nets	Whitehills.	Fully ½ ripe.
4628	M.	28.	33-8	7/ 4/13	1' off Pittenweem.	Line.	Anstruther.	Imm.
4629	F.	32-5	35-2	10/ 9/13	1' off Pittenweem.	"	Anstruther.	Imm.
4631	M.	27-5	31-6	19/ 2/13	9' S.-E. of Bell Rock.	S.T.	Dundee.	Imm.
4635	M.	31-5	32.	13/ 6/12	22½' S.-E./E. ½ S. of Tod Head.	"	N. Shields.	Spent.
4638	M.	33-5	35-9	25/ 5/13	9' S.-E. from Buchan Ness.	"	Aberdeen.	Imm.
4639	M.	34-5	38-3	22/11/12	2' S./W. of Largo.	Line.	Anstruther.	Imm.
4640	F.	39.	41-4	11/ 2/13	2' off Largo.	"	Cockenzie.	Imm.
4642	M.	42.	42-4	9/ 1/14	3' S.-E. of Bell Rock.	"	Granton.	Nly. ripe.
4643	F.	38-5	39-4	3/ 7/12	6' E. of May Isle.	S.T.	Granton.	Imm.
4647	F.	29.	32-5	26/ 3/13	Station VI., Forth.	S.T.	'Goldseeker.'	—

\* Liberated, 6th March 1912 between Elie and Fidra, 43-5; recaptured 23rd April 1912 on Station VI. (the original ground), and re-liberated as above.

20' E. of May Island).

† The fish were taken in Kirkcaldy Bay, 8th May 1912.

‡ Again liberated, 40 miles E. of May Isle, 12th June 1912.

† Again liberated at 56° 24' N.; 1° 6' W. 6th July 1912.

‡ Again liberated at 58° 10' N.; 2° 30' W. 27/3/13.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.					
Date, 9th May 1912. Liberated, Midway between Elie and Fidra— <i>continued</i> .										
Sc. A. 10.										
4648	M.	28	21/ 2/13	Off Wemyss.	56° 8' N.; 3° 4' W.	10	Line.	Dysart.	Very imm.	Good.
4649	M.	33.5	22/ 2/13	Off Leven.	56° 11' N.; 3° W. (about).	9	"	Anstruther.	Imm.	Good.
4651	M.	30	8/11/12	20° E.-N.-E. from Aberdeen.	57° 21' N.; 1° 35' W.	40	S.T.	Aberdeen.	Imm.	Good.
4652	M.	28	20/ 4/13	2° S.-W. from Buckhaven.	56° 9' N.; 3° 3' W.	8	Line.	Anstruther.	Imm.	Fair.
4655	M.	30	11/ 2/13	24° E.-S.-E. from Aberdeen.	57° 5' N.; 1° 19' W.	34-35	S.T.	Aberdeen.	Partly spent.	Good.
4656	M.	34	8/ 2/13	5' off Carr Lightship.	(56° 19' N.; 2° 23' W.)	28	"	Dundee.	Partly spent.	Good.
4657	M.	30.5	27/ 2/13	18° E. ½ S. of Tod Head.	56° 56' N.; 1° 40' W.	46	"	N. Shields.	—	Sound.
Date, 10th May 1912. Liberated, * 20' E. of May Island, 56° 17' N.; 1° 58' W. Depth, 29 Fms.										
4662	M.	34	6/ 9/12	10° E.-S.-E. of May Isle.	56° 9' 50" N.; 2° 16' W.	30	S.T.	Granton.	Spent.	Good.
4663	F.	37.5	9/ 2/13	40° E.-N.-E. of May Isle.	56° 35' 5" N.; 1° 37' 40" W.	32	"	Newhaven.	Imm.	Good.
4665	M.	29.5	21/ 8/13	12° S.-E. of Bell Rock.	56° 22' N.; 2° 3' W.	25	"	Granton.	Spent.	Good.
4668	F.	33	17/ 7/12	20° N.-E. of May Isle.	56° 28' N.; 2° 16' 30" W.	22	"	Granton.	Imm.	Fair.
4670	M.	33.5	24/ 7/12	24° E. of May Isle.	56° 17' N.; 1° 52' 55" W.	26	"	Granton.	Imm.	Good.
4671	F.	39	5/ 7/12	10° E. of Bell Rock.	56° 28' 30" N.; 2° 5' W.	20-25	"	Granton.	Imm.	Good.
4674	F.	44	16/ 5/12	20° E./S. of May Isle.	56° 12' 30" N.; 1° 54' 55" W.	25-30	"	Granton.	Spent.	Good.
4677	F.	34	20/ 1/13	16° E. ½ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	25	"	Granton.	Imm.	Good.
4679	F.	27.5	29/ 6/12	24° E./N. of May Isle.	56° 22' N.; 1° 55' 30" W.	25-27	"	Granton.	Imm.	Fair.
4680	F.	40	26/ 2/13	50° E.-N.-E. of Girdle Ness.	57° 39' 12" N.; 0° 50' 10" W.	60	"	Granton.	Imm.	Good.
4683	M.	34	5/ 6/12	10° E./N. of May Isle.	56° 15' 5" N.; 2° 18' W.	35	"	Granton.	Imm.	Good.

4685	M.	33.	10/ 5/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	28-30	"	Granton.	Imm.	Good.
4686	F.	30.	18/ 6/12	12' E./S. of May Isle.	56° 12' N.; 2° 11' W.	30	"	Granton.	Imm.	Fair.
4687	F.	44.	17/ 5/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	36	"	Granton.	Spawng.	Good.
4688	M.	37.	26/ 2/13	24' S.-E. $\frac{1}{2}$ E. of Aberdeen.	56° 59' 12" N.; 1° 23' W.	30	"	Aberdeen.	Imm.	Good.
4690	F.	33.	7/ 6/12	18' E.-N.-E. of May Isle.	56° 22' N.; 2° 7' W.	30	"	Newhaven.	—	Good.
4694	M.	30-5	3/ 3/13	163' E. $\frac{1}{2}$ N. of Flamborough Head.	56° 5' N.; 4° 10' E.	26	"	Grimshby.	—	Sound.
4695	M.	30.	20/ 3/14	16' S.-E. of Bell Rock.	56° 5' 19" N.; 1° 57' W.	30	"	Dundee.	Imm.	Good.
4696	F.	32-5	19/ 9/14	?	?	?	"	London.	—	—
4698	F.	50-5	11/ 5/12	16' E.-S.-E. of May Isle.	56° 8' 40" N.; 2° 4' W.	28	"	Newhaven.	Spent.	Good.
4701	F.	31-5	5/ 8/12	10' E./S. of May Isle.	56° 12' N.; 2° 15' W.	30	"	Granton.	—	Good.
4702	M.	34.	34-7	28/ 5/12	56° 13' 5" N.; 2° 3' 15" W.	18	"	Granton.	Imm.	Good.
4704	M.	33.	7/10/12	10' E.-N.-E. of May Isle.	56° 16' 45" N.; 2° 20' 50" W.	28	"	Granton.	Imm.	Good.
4706	M.	34.	13/ 8/12	12' E. of May Isle.	56° 14' N.; 2° 12' 20" W.	28	"	Granton.	Imm.	Good.
4707	M.	37.	10/ 6/12	39' E.-S. $\frac{1}{2}$ S. of May Isle.	56° 10' N.; 1° 50' W.	20-25	"	Hartlepool.	?	?
4708	M.	39.	7/ 3/13	39' E.-S.-E. $\frac{1}{2}$ S. of Aberdeen.	57° N.; 0° 53' W.	39	"	Granton.	Imm.	Good.
4713	M.	35-5	29/ 7/12	6' N.-E. of Bell Rock.	56° 31' 40" N.; 2° 17' 40" W.	25	"	Granton.	Imm.	Good.
4715	F.	33-5	11/ 6/12	23' E./S. of May Isle.	56° 12' N.; 1° 50' 5" W.	30	"	Granton.	Imm.	Good.
4716	F.	28-5	12/ 5/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	25	"	Granton.	Imm.	Good.
4718	F.	37-5	15/ 6/12	12' E. $\frac{1}{2}$ S. of May Isle.	56° 12' N.; 2° 11' W.	32	"	Newhaven.	Imm.	Good.
4719	M.	29-5	14/ 2/13	$\frac{1}{2}$ off Pittenweem.	56° 14' N.; 2° 39' W.	10	"	Anstruther.	Imm.	Good.
4720	M.	28-5	12/10/13	45' E./S. of Aberdeen.	57° 13' N.; 0° 44' W.	38	"	Granton.	—	Good.
4721	F.	32.	8/ 7/13	6-8' N. of Bell Rock.	56° 32' 35" N.; 2° 27' W.	25	"	Granton.	Imm.	Good.
4723	F.	29-5	3/ 7/12	10' E./S. of Bass Rock.	56° 5' N.; 2° 19' 35" W.	30	"	Newhaven.	Imm.	Fair.
4724	F.	32-5	25/ 4/13	30' S.S.-E. of Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	30	"	Aberdeen.	Imm.	Good.
4725	M.	37-5	30-3	3-4' E. of Carr Lightship.	56° 20' N.; 2° 25' W.	20	"	Granton.	Spawng.	Good.
4726	F.	39.	31/ 7/12	10' E.-S.-E. of May Isle.	56° 9' 50" N.; 2° 16' W.	28	"	Newhaven.	Imm.	Good.
4727	F.	41-5	1/ 8/12	Landed at Granton.	—	?	"	Granton.	—	(Mark sent from Glasgow).
4728	M.	33-5	17/12/12	4' E.-N.-E. from Aberdeen.	57° 11' N.; 1° 58' W.	29-31	"	Aberdeen.	Fully $\frac{1}{2}$ Ripe.	Good.
4729	F.	34.	4/ 8/12	17' E./S. of Isle of May.	56° 12' N.; 2° 3' W.	28	"	Granton.	Imm.	Good.
4730	F.	35.	30/ 7/12	7' S.-E. of May Isle.	56° 8' N.; 2° 21' W.	35	"	Granton.	Imm.	Good.
4732	F.	33.	5/10/12	24' E.-S.-E. of Bell Rock.	56° 23' 20" N.; 1° 40' W.	30	"	Granton.	—	Good.
4733	M.	34-5	18/ 3/13	26' S.-E. of Aberdeen.	57° 0' 30" N.; 1° 17' 50" W.	34	"	Aberdeen.	Ripe.	Good.
4735	M.	30.	24/ 7/12	30' E. $\frac{1}{2}$ S. of May Isle.	56° 16' N.; 1° 40' W.	28	"	Granton.	Imm.	Good.
4736	F.	30-5	3/10/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	30	"	Granton.	$\frac{1}{2}$ Ripe.	Good.
4737	F.	34.	14/ 6/13	28' E./N. $\frac{1}{2}$ N. of May Island.	56° 26' 5" N.; 1° 49' 35" W.	27	"	Granton.	Spent.	Good.

\* The fish were taken in Kirkcaldy Bay, 8th and 9th May 1912.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Length Cm.		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Snout.	Tail.									
Date, 10th May 1912. Liberated, 20' E. of May Island— <i>continued.</i>													
Sc. A. 10													
4739	F.	31.	34.5		7/10/12	6' E.-N.-E. of Bell Rock.	56° 29' 40" N.; 2° 13' 25" W.	33	S.T.	Granton.	Imm.	Good.	
4740	F.	37.5	39.5		17/9/12	16' E. of May Isle.	56° 14' 50" N.; 2° 6' W.	27	"	Newhaven.	Imm.	Good.	
4742	M.	32.	32.5		21/6/12	18' E./N. $\frac{1}{2}$ N. of May Isle.	56° 21' N.; 2° 5' W.	25	"	Granton.	Imm.	Good.	
4743	F.	32.	—		1/3/14	15' E. of May Isle.	56° 15' N.; 2° 7' W.	27	"	Leith.	—	—	
4744	F.	42.	43.5		1/7/12	18' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 50" N.; 2° 2' W.	26	"	Granton.	$\frac{1}{2}$ Dev.	Good.	
4746	M.	36.	37.6		31/7/12	10' E.-S.-E. of May Isle.	56° 9' 50" N.; 2° 16' W.	28	"	Granton.	Imm.	Good.	
4747	M.	35.	36.8		17/7/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	15	"	Granton.	Imm.	Fair.	
4748	M.	34.	37.2		7/10/12	35' E.-N.-E. of May Isle.	56° 32' N.; 1° 43' W.	30	"	Granton.	Imm.	Good.	
4751	F.	35.	38.6		14/8/12	10' N.-E. from St. Abb's Head.	56° 3' 15" N.; 1° 58' W.	26	"	Granton.	Imm.	Good.	
4757	M.	34.5	34.3		24/5/12	14' E.-N.-E. of May Isle.	56° 19' 35" N.; 2° 13' 50" W.	30	"	Granton.	Spent.	Good.	
4758	M.	35.	35.4		3/6/12	26' E./N. of May Isle.	56° 22' 5" N.; 1° 50' W.	26	"	Granton.	Imm.	Good.	
4759	F.	39.	42.2		11/3/13	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	28-30	"	Granton.	Imm.	Good.	
4760	F.	35.	38.6		19/9/12	20' E./S. of May Isle.	56° 12' 30" N.; 1° 54' 55" W.	25	"	Granton.	Imm.	Good.	
Date, 12th June 1912. Liberated, * 40' E. of May Island, 56° 22' 30" N.; 1° 22' 30" W. Depth, 33 Fms.													
4761	M.	36.	40.6		10/7/13	4m. S.-E. of Bell Rock.	56° 24' N.; 2° 16' 40" W.	28	S.T.	Newhaven.	Imm.	Good; gutted.	
4762	F.	44.5	49.3		23/10/14	23' E./S. of Bass Rock.	56° 6' 30" N.; 1° 57' W.	30	"	Granton.	$\frac{1}{2}$ Ripen.	Good.	
4763	F.	42.	45.3		4/4/13	45' E. of May Isle.	56° 23' 10" N.; 1° 15' 25" W.	37	"	Granton.	Spent.	Good.	
4764	M.	37.5	38.5		5/2/13	25' E./N. $\frac{1}{2}$ N. of Flamborough Head.	54° 20' N.; 0° 30' E.	31-33	"	Grimsby.	—	Sound.	
4766	M.	32.5	39.2		2/10/13	$\frac{1}{2}$ off Pittenweem.	56° 12' N.; 2° 43' 30" W.	7	Line.	Anstruther.	$\frac{1}{2}$ Ripen.	Good.	
4767	M.	33.	41.9		10/7/14	32' S.-E./E. of Aberdeen.	56° 59' N.; 1° 7' W.	32	S.T.	Aberdeen.	Imm.	Good.	
4771	F.	42.	44.7		13/2/14	35' N.-E. of Flamborough Head.	54° 35' N.; 0° 22' E.	37	"	Hull.	—	—	
4774	M.	33.	38.		24/7/13	6' S.-E. of Bell Rock.	56° 22' 30" N.; 2° 14' 20" W.	19	"	Granton.	—	—	
4776	M.	32.	32.4		23/12/12	25' E. of May Isle.	56° 18' 30" N.; 1° 49' W.	30	"	Granton.	Imm.	Fair.	

4777	F.	31-5	36-1	20/ 1/13	(Not known).	56° 14' N.; 2° 15' W.	---	"	Newhaven.	Imm.	Fair.
4778	F.	33-5	37-3	17/ 3/14	10° E. of May Isle.	56° 26' 30" N.; 1° 36' W.	24	"	Dundee.	Imm.	Good.
4781	M.	35-	34-6	29/ 6/12	35° E./N. of May Isle.	56° 25' N.; 1° 20' W.	25-30	"	Granton.	Imm.	Good.
4782	F.	41-5	41-5	15/ 8/12	35° E./S. $\frac{1}{2}$ S. of Bell Rock.	56° 3' N.; 1° 32' W.	35	"	N. Shields.	Imm.	---
4785	F.	32-	35-	17/ 7/13	22° E. $\frac{1}{2}$ N. of St. Abb's Head.	59° 15' N.; 3° 30' W.	29	"	N. Shields.	Nly.spt.	---
4787	M.	32-	35-2	25/ 4/12	30° E.-N.-E. of Sute Skerry.	56° N.; 1° 19' W.	30	"	Blyth.	Imm.	---
4788	F.	34-	37-5	20/ 11/12	44° E.-S.-E. of Bass Rock.	57° 7' 20" N.; 1° 47' 30" W.	35	"	Granton.	Imm.	Good.
4789	F.	38-	40-8	4/ 2/13	8° E.-S.-E. of Aberdeen.	57° 42' N.; 2° 32' W.	30	"	Aberdeen.	Imm.	Good.
4790	F.	35-	46-8	10/ 3/15	About 1 $\frac{1}{4}$ off Banff.	56° 48' N.; 1° 34' W.	14	Cod Nets	Whitehills.	Spawing.	Good.
4791	F.	31-	33-3	5/ 2/13	26° S.-E. from Aberdeen.	57° 5' 50" N.; 1° 17' W.	32	"	Aberdeen.	Imm.	Good.
4792	F.	34-	37-2	24/ 3/13	25° E.-S.-E. from Aberdeen.	56° 12' N.; 2° 22' W.	33	"	Aberdeen.	Imm.	Good.
4793	F.	34-5	38-8	10/ 6/13	6° E. $\frac{1}{2}$ S. of May Island.	56° 13' N.; 1° 45' W.	30	"	Granton.	Imm.	Good.
4797	F.	35-	35-	12/ 7/12	26° E./S. of May Isle.	56° 20' 50" N.; 2° 8' 45" W.	30	"	Granton.	Imm.	Good.
4800	M.	31-	32-5	30/12/12	16° E.-N.-E. of May Isle.	56° 16' N.; 1° 48' W.	30	"	Leith.	Very imm.	Fair.
4801	F.	38-	37-5	27/ 7/12	36° E. $\frac{3}{4}$ N. of St. Abb's Head.	56° 12' N.; 1° 10' W.	36	"	N. Shields.	?	Sound.
4802	M.	36-5	37-8	12/ 9/12	23° E./S. of May Isle.	56° 12' N.; 1° 50' 5" W.	25	"	Granton.	Imm.	Good.
4803	F.	30-5	33-5	30/ 5/13	4° S.-E. of Collieston.	57° 19' N.; 1° 49' W.	35	"	Aberdeen.	Imm.	Good.
4804	?	34-	43-0	4/ 5/14	20° S.-E. of Bell Rock.	56° 17' N.; 1° 52' W.	28	"	Aberdeen.	Spent.	Good.
4805	F.	32-	34-3	24/ 9/12	25° E./S. of May Isle.	56° 12' 55" N.; 1° 48' W.	30	"	Dundee.	Imm.	Good.
4807	M.	34-	37-2	27/ 2/13	24° S.-E. $\frac{1}{2}$ E. from Aberdeen.	56° 59' 12" N.; 1° 23' W.	34	"	Granton.	Imm.	Good.
4812	F.	41-5	41-6	26/ 2/13	10° E.-N.-E. of May Isle.	56° 16' 45" N.; 2° 20' 50" W.	28	"	Aberdeen.	Spawing.	Good.
4816	F.	37-	37-1	24/ 7/12	15° E.-N.-E. of the Bell Rock.	56° 35' 40" N.; 2° 2' W.	28	"	Newhaven.	Spent.	Good.
4817	F.	32-5	32-9	18/ 7/12	25° E. $\frac{1}{2}$ S. of May Isle.	56° 16' N.; 1° 48' W.	28	"	Leith.	Imm.	Good.
4818	F.	32-	33-	20/ 2/13	Off Wemyss.	56° 8' N.; 3° 4' W.	30	"	Granton.	Imm.	Good.
4819	M.	31-	40-3	18/ 2/14	23° S.-E. from Aberdeen.	56° 50' 30" N.; 1° 37' W.	35-36	Line.	Dysart.	Imm.	Good.
4821	F.	39-0	49-0	28/10/14	35° N.N.-E. of Buchanness.	58° 3' N.; 1° 39' 30" W.	60	S.T.	Aberdeen.	Imm.	Good.
4824	F.	32-	31-7	19/ 7/12	8° E. of May Isle.	56° 12' 55" N.; 2° 18' W.	30	"	Aberdeen.	Ab stripe	Good.
4826	M.	35-5	37-3	28/ 5/13	15° N.-E. of Bell Rock.	56° 38' 52" N.; 2° 9' 30" W.	40	"	Granton.	Imm.	Good.
4827	F.	35-	Label only.	26/ 8/12	38° E.-S.-E. $\frac{1}{2}$ S. of Longstone Lt.	55° 30' N.; 0° 30' W.	37	"	Leith.	Spent.	Good.
4828	F.	38-	37-3	22/ 7/12	28° E./N. of May Isle.	56° 23' 15" N.; 1° 48' 30" W.	30	"	N. Shields.	---	---
4829	M.	30-5	39-	19/ 5/14	40° S. of Aberdeen.	56° 30' N.; 1° 42' W.	27	"	Granton.	Imm.	Good.
4833	F.	37-5	41-7	15/ 5/13	35° E.-N.-E. of May Isle.	56° 32' N.; 1° 43' W.	35	"	Aberdeen.	?	Good.
4834	F.	31-	30-6	11/ 7/12	28° E. of May Isle.	56° 18' 30" N.; 1° 44' W.	24	"	Granton.	Imm.	Good.
4837	F.	35-5	36-	19/ 7/12	30° E./S. $\frac{1}{2}$ S. of St. Abb's Head.	55° 56' N.; 1° 15' W.	38	"	Blyth.	Imm.	---
4839	F.	34-5	33-1	27/ 6/12	30° E.-S.-E. of Bell Rock.	56° 22' N.; 1° 28' 50" W.	28	"	Granton.	Imm.	Fair; end of tail nibbled.
Stud No.	F.	30-5	33-5	6/ 5/13	10° S.-E. of May Isle.	56° 5' 30" N.; 2° 17' W.	25	"	Granton.	Imm.	Fair.
834											

\* The fish were taken in Kirkcaldy Bay, 11th June 1912.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.				Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.						
Date, 12th June 1912. Liberated, 40' E. May Island— <i>continued</i> .											
835	?	—	Label	25/10/13	N. of Great Fisher Bank.	57° 18' N.; 4° 2' E.	37	S.T.	Hull.	—	—
838	F.	29-	31-	6/ 9/12	25' E.-N.-E. of St. Abb's Head.	56° 10' 5" N.; 1° 31' 20" W.	40	"	Newhaven.	Imm.	Good.
842	F.	38-5	38-8	8/ 7/12	30' E.-S.-E. from Bass Rock.	56° 0' 50" N.; 1° 44' 50" W.	30-35	"	Granton.	Imm.	Good.
843	F.	28-5	30-9	15/ 2/13	3' N./E. of St. Andrews.	56° 22' 50" N.; 2° 49' 40" W.	6	Flounder	Dundee.	Imm.	Fair.
844	F.	28-	29-4	15/10/12	30' E.-S.-E. of Bass Rock.	56° 0' 50" N.; 1° 44' 50" W.	35	Nets.	Granton.	Imm.	Fair.
847	F.	30-5	32-4	16/ 9/12	9' E.-S.-E. of May Isle.	56° 8' 50" N.; 2° 15' 50" W.	30	S.T.	Granton.	Imm.	Fair.
877	F.	33-	32-5	13/ 6/12	23½ S.-E. ½ E. of Tod Head.	56° 43' N.; 1° 35' W.	36	"	N. Shields.	Spent.	Stale.
849	F.	30-	32-1	4/11/12	16' E. ½ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	28	"	Granton.	Imm.	Fair.
Date, 12th June 1912. Liberated, * 56° 40' N.; 0° 21' E.; 100 miles E. of May Island.											
Sc. A. 10.							Depth, 43 Fms.				
4841	M.	34-	38-5	15/ 5/13	35' E.-N.-E. of May Isle.	56° 32' N.; 1° 43' W.	35	S.T.	Granton.	Imm.	Good.
4844	M.	38-	38-4	5/10/13	47' E.-S.-E. of Aberdeen.	57° 4' N.; 0° 36' W.	42	"	Hartlepool.	—	Sound.
4849	M.	38-	35-	16/11/12	106' E. ½ N. of Ratray Point.	58° 15' N.; 1° 13' E.	62	"	Geestmünde	?	?
4850	F.	54-	53-3	4/ 7/12	5' S.-E. from Tod Head.	56° 50' 40" N.; 2° 5' W.	29	"	Dundee.	Spent.	Good.
4853	F.	45-	44-	16/ 9/12	39' S.-E. ½ E. of Longstone Light.	55° 25' N.; 0° 30' W.	37	"	N. Shields.	—	—
4854	F.	39-	39-	21/ 8/12	21 E./S. ½ S. of Longstone Light.	55° 39' N.; 1° E.	47	"	Blyth.	Imm.	—
4857	F.	45-9	45-9	11/ 7/14	110' N.-N.-E. of Hartlepool.	56° 31' 30" N.; 0° 48' W.	—	"	Hartlepool.	—	Sound.
4862	M.	34-5	40-2	16/ 8/14	7¼ E. of Bell Rock.	56° 47' N.; 0° 14' W.	—	"	Dundee.	Imm.	Good.
4870	M.	35-	41-7	29/ 7/14	35' S.-E. of Aberdeen.	56° 52' N.; 1° 7' W.	36	"	Aberdeen.	Imm.	Good.
4872	F.	34-	37-8	25/ 6/13	24' E./S. of Aberdeen.	57° 10' 5" N.; 1° 19' W.	40	"	Aberdeen.	Imm.	Good.
4877	M.	32-	36-6	18/ 9/13	60' E./N. of Bell Rock.	56° 53' 45" N.; 0° 47' W.	35	"	Dundee.	Imm.	Good.
4880	M.	36-5	36-1	11/10/12	45' E.-S.-E. of Bell Rock.	56° 21' N.; 1° 1' W.	39	"	Dundee.	Imm.	Good.

4882	37-6	26/ 11/12/13	24' S.-E. from Aberdeen.	56° 57' 42" N. ; 1° 26' W.	34-36	„ Cod	Aberdeen.	Imm.	Good.
4888	33.	11/12/14	About 1' off Banff.	57° 41' N. ; 2° 31' W.	14	Nets.	Whitehills.	—	—
4889	35.	30/ 9/14	18' E./N. of May Isle.	56° 19' 30" N. ; 2° 5' W.	28	S.T.	Granton.	Imm.	Good.
4892	32.	17/ 7/13	2° S.-W./W. $\frac{1}{2}$ S. of Tees Buoy.	54° 38' N. ; 1° 10' W.	3	Salmon Sweeper.	Hartlepool.	Imm.	—
4897	34-5	20/ 8/12	52' E./S. of May Island.	56° 15' N. ; 1° W.	37	S.T.	N. Shields.	—	Good ; gutted.
4898	34-5	22/ 9/12	50' E. of Ball Rock.	56° 40' N. ; 0° 55' 25" W.	38	„	Dundee.	—	Sound.
4899	35.	20/10/13	90' E.-S.-E. $\frac{1}{4}$ S. of Tod Head.	56° 40' N. ; 0° 30' E.	39	„	N. Shields.	—	—
851	36.	18/ 6/13	24' E.-S.-E. $\frac{3}{8}$ S. of Girdleness.	57° 2' N. ; 1° 20' W.	35	„	N. Shields.	Imm.	—
853	29-5	22/ 7/12	25' E./S. of May Isle.	56° 12' 55" N. ; 1° 48' W.	28	„	Granton.	Imm.	Good.
857	30-5	27/ 9/12	60' E. of Tay Buoy.	56° 44' N. ; 0° 54' W.	39	„	Dundee.	Imm.	Fair.
862	31.	30/ 9/12	117' E./S. $\frac{3}{8}$ S. of Longstone Lt.	55° 40' N. ; 1° 55' E.	42	„	N. Shields.	—	Tail damaged.
871	36-5	24/ 5/13	3' S.S.-W. of Buckhaven.	56° 8' N. ; 3° 4' W.	8	Line.	Buckhaven.	Imm.	Good.
874	35.	13/ 5/13	40' E.-N.-E. of May Isle.	56° 35' 5" N. ; 1° 37' 40" W.	33	S.T.	Granton.	Imm.	Fair.
880	30.	7/ 9/12	28' E. of May Isle.	56° 18' 30" N. ; 1° 44' W.	29	„	Granton.	Imm.	Fair.
881	28.	14/10/13	12' E. of May Island.	56° 14' N. ; 2° 12' 20" W.	23	„	Granton.	Imm.	Fair.
887	27-5	18/10/12	33' E./N. $\frac{1}{2}$ N. of May Isle.	56° 29' N. ; 1° 42' W.	28	„	Granton.	Imm.	Fair.
889	30-5	21/ 4/14	50' E. $\frac{1}{2}$ S. of Aberdeen.	57° 18' N. ; 0° 32' W.	47	„	Aberdeen.	Imm.	Good.
Date, 13th June 1912. Liberated, † 57° 12' N. ; 4° E. (Great Fisher Bank). Depth, 34 Fms.									
4786	36-5	26/12/13	18' N. of Hansholm Light.	57° 25' N. ; 8° 30' E.	22	S.T.	Geestmünde	—	—
4903	48-	1/ 9/13	35' S. of Great Fisher Bank.	56° 12' N. ; 4° 15' E.	35	„	London.	Mature.	—
4907	32-5	3/ 3/13	N. of Great Fisher Bank.	57° 10' N. ; 4° E.	—	„	Hamburg.	—	—
4915	33-5	5/ 9/13	142' E. $\frac{1}{2}$ N. of Rattray Point.	58° 30' N. ; 2° 20' E.	40	„	London.	—	Sound.
4923	35.	9/ 4/14	S.-E. of Little Fisher Bank.	56° 30' N. ; 6° 40' E.	—	„	Ymuiden.	—	—
4925	31.	16/10/12	S. of Great Fisher Bank.	56° 50' N. ; 4° 25' E.	36	„	Grimsbj.	? Mat.	Sound.
4926	34-5	30/ 8/13	220' E.-S.-E. from Aberdeen.	56° 45' N. ; 4° 38' 55" E.	32-35	„	Aberdeen.	—	Good.
4936	41.	27/ 7/14	275' N.-E. $\frac{1}{4}$ E. from Spurn.	57° 15' N. ; 5° E.	30	„	Grimsbj.	—	—
4937	30-5	1/ 8/14	Great Fisher Bank.	57° 46' N. ; 2° 55' E.	34	„	Grimsbj.	—	—
4941	35-5	7/10/12	50' S. of Great Fisher Bank.	56° N. ; 4° 10' E.	31	„	Blyth.	—	Sound.
4948	33-5	5/ 8/14	Great Fisher Bank.	57° 50' N. ; 2° 55' E.	35	„	Grimsbj.	—	—
4874	29-5	9/ 6/13	About 20' S. of Great Fisher Bank.	56° 40' N. ; 4° 10' E.	37	„	Hull.	—	—
896	28.	1/ 5/13	Caught $\frac{1}{2}$ off Portobello.	55° 58' N. ; 3° 46' W.	3	Crab Net	Newhaven.	Imm.	Fair.
919	28-5	13/ 1/14	S.-W. of Little Fisher Bank.	56° 5' N. ; 5° 55' E.	32	S.T.	London.	—	Sound.

† Taken in Kirkcaldy Bay, 11th June 1912.

\* The fish were taken in Kirkcaldy Bay, 11th June 1912.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.	
<b>Date, 14th June 1912. Liberated, 15' N. of Gt. Fisher Bank; 57° 16' N.; 4° 8' E. Depth, 34 Fms.</b>												
Sc. A. 10 4956	F.	44.	9/ 7/12	About 15' N. of Gt. Fisher Bank.	57° 15' N.; 4° E.		37	S.T.	Hamburg.	?	Somewhat dry.	
<b>Date, 14th June 1912. Liberated, N. of Gt. Fisher Bank; 57° 19' N.; 4° E. Depth 37 Fms.</b>												
4922	F.	51.	2/11/13	205-210' E./S. $\frac{1}{2}$ S. fr. Aberdeen.	57° 7' N.; 4° 22' E.		34	S.T.	Aberdeen.	$\frac{2}{3}$ Ripe.	Good.	
4930	M.	42.5	4/ 9/13	abt. 225' E./S. $\frac{1}{2}$ S. from Aberdeen.	57° 7' N.; 4° 58' 50" E.		33	"	Aberdeen.	Nearly ripe.	Good; slight ulcer at mark.	
<b>Date, 14th June 1912. Liberated, N. of Gt. Fisher Bank; 57° 19' N.; 4° E. Depth 37 Fms.</b>												
4968	M.	46.5	" 44."		57° 23' N.; 4° 10' E.		38	S.T.	Hamburg.	?	Somewhat dry.	
4970	F.	38.	18/ 7/12	About 20' N. of Gt. Fisher Bank. About 20' N. of Gt. Fisher Bank.	57° 23' N.; 4° 10' E.		39	"	Hamburg.	?	Somewhat dry.	
<b>Date, 19th June 1912. Liberated, * 22' S.-E. of Fair Isle; 59° 20' N.; 1° 3' W. Depth, 74 Fms.</b>												
4974	F.	55.5	Label only	25/ 2/13	8' E.-S.-E. of Berriedale Head.	58° 10' N.; 3° 15' W.		27	S.T.	Grimsby.	—	—
4976	F.	45.5	47.5	1/ 4/13	7' W./N. of Foula.	60° 10' N.; 2° 20' W.		47	"	Hull.	—	Sound.
4977	F.	34.5	41.	9/ 6/13	47 m. N./W. from Ratray.	58° 18' 30" N.; 2° 31' 30" W.		30	"	Aberdeen.	Imm.	Good.
4978	F.	52.5	53.6	7/10/12	7' S.-E. from N. Light, Fair Isle.	59° 29' 10" N.; 1° 22' 50" W.		52	"	Aberdeen.	Nly. ripe.	Good.
4982	F.	42.5	50.2	13/ 1/14	14' E.-S.-E. of N. Light, Fair Isle.	59° 28' N.; 1° 10' W.		63	"	Aberdeen.	Nly. ripe.	Good.
4984	M.	35.	36.2	20/10/12	7' N.-E./N. from Fair Isle.	59° 39' 40" N.; 1° 31' 50" W.		66	"	Aberdeen.	?	Gutted; good.



4985	F.	41-	17/10/12	6-7 S.S.-E. from Buchanan Ness.	57° 24' N.; 1° 40' W.	40	"	Aberdeen.	Imm.	Good.
4986	F.	36-5	25/ 2/13	14' E.-S.-E. from Auskerry.	59° 0' 40" N.; 2° 6' W.	46	"	Aberdeen.	Spent.	Good.
4991	M.	38-5	? 2/14	Moray Firth.		34	"	Grimsby.	? Ripe.	—
4994	F.	49-	16/11/13	110' N.-E./N. from Buchanan Ness.	59° 9' N.; 0° 49' W.	67	"	Aberdeen.	Imm.	Good.
4996	F.	35-3	17/ 9/12	25' S.-E./E. from Buchanan Ness.	57° 24' N.; 0° 55' 10" W.	45	"	Aberdeen.	Spent.	Good.
4997	F.	40-5	10/ 5/13	10' S.-E. from Fair Isle.	59° 28' 5" N.; 1° 7' W.	44	"	Aberdeen.	Spent.	Good.
4998	F.	53-5	5/11/12	10' S.S.-E. from Fair Isle.	59° 24' 40" N.; 1° 23' 15" W.	68	"	Aberdeen.	Nearly ripe.	Good.
4999	F.	50-5	19/ 9/12	85' N.-E./N. from Aberdeen.	58° 30' N.; 1° 14' 45" W.	63	"	Aberdeen.	Nearly ripe.	Good.
2004	M.	33-5	Prior to	No particulars.		—	S.T.	Billingsgate.	—	Sound.
2005	M.	36-	14/ 2/13	7' S.-E./E. from Auskerry.	58° 59' N.; 2° 20' 5" W.	47	"	Aberdeen.	Partly spent.	Good.
2008	F.	34-5	10/ 6/13	12' S.-E. from Auskerry.	58° 55' 50" N.; 2° 13' W.	41	"	Aberdeen.	Spent.	Good.
2009	F.	35-5	2/ 9/12	7' S.-E. from Start Point.	59° 12' 15" N.; 2° 10' 25" W.	36	"	Aberdeen.	—	Good.
2010	F.	58-	10/ 5/14	6' S.-E./E. of Foulie.	60° 5' N.; 1° 44' W.	35	"	Aberdeen.	Spent.	Good.
2012	F.	38-5	10/ 3/14	45' N. $\frac{1}{4}$ W. of Ratray.	58° 18' N.; 2° 23' W.	36	"	Aberdeen.	Spent.	Good.
2013	M.	35-5	3/ 3/13	11 $\frac{1}{2}$ S.-E./S. of Clyth Ness.	58° 12' N.; 2° 55' W.	31	"	Ymuiden.	—	Sound.
2014	M.	36-	6/12/13	5' S.-E. from Suteskerry.	59° 2' N.; 4° 20' W.	26	"	Aberdeen.	Nearly ripe.	Good.
2015	F.	62-1	26/ 2/13	10' E. from Auskerry.	59° 4' 14" N.; 2° 14' 15" W.	45	"	Aberdeen.	Spawning.	Fair.
2016	F.	40-	16/ 3/13	12' S.-E./E. from Auskerry.	58° 57' 55" N.; 2° 12' 50" W.	45	"	Aberdeen.	Imm.	Fair.
2020	F.	32-5	34-7	90' N.N.-E. of Buchanan Ness.	58° 57' 30" N.; 1° 26' 5" W.	63	"	Aberdeen.	Imm.	Good.
2021	F.	34-	26/ 5/13	5' S.-W./W. of Start Point.	59° 11' 50" N.; 2° 30' 5" W.	36	"	Dundee.	Imm.	Good.
2021	F.	34-	17/11/14	8' S.S.-W. of Stumburgh Head.	59° 43' N.; 1° 18' W.	52	"	Aberdeen.	$\frac{1}{4}$ Ripe.	Good.
2026	F.	34-4	22/10/12	126' N.-E./E. from Buchanan Ness.	59° 5' 30" N.; 0° 42' E.	67	"	Aberdeen.	Imm.	Good.
2028	F.	49-5	2/ 2/13	110' E.-S.-E. of Auskerry.	59° 11' N.; 2° E.	68	"	Aberdeen.	—	Sound.
2033	F.	39-	13/ 8/13	On Great Fisher Bank.	57° N.; 4° E. (about).	36	"	Hull.	—	—
2035	F.	38-	17/11/12	Moray Firth.		48	"	Cuxhaven.	? ?	?
2037	F.	34-	16/ 9/12	25' N.N.-E. from Buchanan Ness.	57° 52' 40" N.; 1° 40' 40" W.	50	"	Aberdeen.	Imm.	Good; gutted.
2038	F.	35-5	15/12/12	6' S.S.-E. from Roseness.	58° 52' N.; 2° 41' W.	40	"	Aberdeen.	Imm.	Good; gutted.
2039	F.	61-5	25/ 7/13	6' S.-E. from Stronsay.	59° 4' 5" N.; 2° 22' W.	62	"	Aberdeen.	Spent.	—
2040	F.	38-8	11/10/12	85' N.-E./N. from Buchanan Ness.	58° 49' 55" N.; 0° 56' 5" W.	23	"	Aberdeen.	Imm.	Good.
2041	F.	35-	25/10/12	18' N.-E./N. from Ratray Head.	57° 54' N.; 1° 39' W.	50	"	Aberdeen.	Imm.	Good.
2043	F.	50-5	4/ 4/13	3 $\frac{1}{2}$ S.S.-E. from Start Point.	59° 13' 15" N.; 2° 19' W.	33	"	Aberdeen.	Spent.	Good.
2044	F.	42-5	11/11/12	14' S.S.-E. from N. Light, Fair Isle.	59° 21' 40" N.; 1° 18' W.	44	"	Aberdeen.	Nly. ripe.	Good.
2045	F.	41-5	27/ 2/13	16' E.-S.-E. $\frac{1}{4}$ S. of Berrisdale Ness.	58° 8' N.; 3° W.	23	"	Ymuiden.	—	Sound.
2049	M.	38-5	9/ 6/13	11' E.-N.-E. $\frac{1}{2}$ N. of Auskerry.	59° 10' N.; 2° 19' W.	33	"	Hull.	Imm.	—

\* The fish were taken in Dornoch Firth, and marked 18th June 1912.

TABLE I.—PLAICE.

No. of Tab.		Sex.	PARTICULARS OF RECAPTURE.			Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Length	Length	Date.	PLACE.	LATITUDE AND LONGITUDE.						
Cm.	Cm.									
Date, 19th June 1912. Liberated, 59° 20' N.; 1° 3' W.— <i>continued</i> .										
908	32-	18/12/13	16' S.-E. ½ E. of Noss Head.	58° 22' N.; 2° 35' W.	26	S.T.	Aberdeen.	Imm.	Good.	
923	32-5	14/ 5/13	6' N./E. of Cullen.	57° 48' N.; 2° 50' W.	42	"	Grimsby.	—	Sound.	
928	32-	13/ 8/12	16' S.-E. of Bell Rock. (?)	56° 18' N.; 1° 57' W.	29	"	Dundee.	Imm.	Fair.	
929	30-5	14/ 5/13	12' E.-S.-E. from Aukerry.	59° 0' 20" N.; 2° 12' W.	42	"	Aberdeen.	Imm.	Good.	
931	32-	17/10/12	55' N.N.-E. from Buchan Ness.	58° 23' 40" N.; 1° 36' W.	58	"	Aberdeen.	Imm.	Good.	
937	32-	4/ 3/14	6' S.-E. of Berriedale Head.	58° 8' N.; 3° 19' W.	31	Cod Nets	Lossiemouth.	Spawing.	Good.	
Date, 6th July 1912.* Liberated, about 50' E. of May Island, 56° 24' N.; 1° 6' W. Depth, 36 Fms.										
2052	52-	20/ 3/13	18' E.-S.-E. from Noss Head.	58° 26' 30" N.; 2° 28' W.	45	S.T.	Aberdeen.	—	—	
2053	36-5	12/12/12	37' E.-S.-E. of Bell Rock.	56° 22' N.; 1° 15' 35" W.	37	"	Dundee.	¾ Ripe.	Good.	
2054	38-5	22/ 2/13	1½' S./E. from Buckhaven.	56° 9' N.; 3° W.	7	Lines.	Anstruther.	Imm.	Good.	
2056	35-5	14/ 2/13	24' S.-E./E. from Aberdeen.	57° 0' 50" N.; 1° 20' 5" W.	33-36	S.T.	Aberdeen.	Partly spent.	Good.	
2057	34-5	10/ 8/13	35' E.-N.-E. of May Isle.	56° 32' N.; 1° 43' W.	27	"	Newhaven.	Imm.	Good.	
2058	34-2	22/ 9/12	40' E. of May Isle.	56° 21' 45" N.; 1° 22' 5" W.	30	"	Granton.	Imm.	Good.	
2060	31-5	32-	15/ 8/12	8' E. of May Isle.	26	"	Granton.	Imm.	Good.	
2063	34-5	21/10/12	20' S.-E./E. from Noss Head.	58° 23' 25" N.; 2° 26' 30" W.	28	"	Dundee.	Imm.	Good.	
2064	38-5	4/ 4/14	28' E.-N./N. ½ N. of Longstone.	56° 7' N.; 1° 26' W.	33	"	Aberdeen.	Spent.	Good.	
2065	34-	20/ 7/13	45' S.-E. from Aberdeen.	56° 45' 45" N.; 0° 50' 45" W.	38	"	Aberdeen.	Imm.	—	
2067	31-2	14/ 8/12	16' E.-S.-E. of May Isle.	56° 8' 40" N.; 2° 4' W.	28	"	Granton.	Imm.	Fair.	
2070	38-	23/ 6/13	30' E.-S.-E. of St. Abb's Head.	55° 50' N.; 1° 15' W.	42	"	N. Shields.	Imm.	—	
2071	33-	28/ 2/13	½ off Püttenveen.	56° 14' N.; 2° 39' W.	7	Lines.	Anstruther.	Imm.	Good.	
2072	40-	11/12/12	?	?	30	S.T.	Granton.	Imm.	Good.	
2074	37-5	18/12/12	32' E./N. ¼ N. of St. Abb's Head.	56° 12' N.; 1° 20' W.	32	"	N. Shields.	?	?	

2076	M.	45-	Label	28/10/12	64° E.-S.-E. of Longstone Light.	55° 30' N.; 0° 18' E.	39	"	N. Shields.	—
		only.								
2079	F.	33-6	5/10/12	24' E.-S.-E. of Bell Rock.	56° 23' 20" N.; 1° 40' W.	30			Granton.	(Good.
2081	F.	34-	13/ 5/13	36' E.-N.-E. of May Isle.	56° 32' 55" N.; 1° 42' W.	35			Granton.	(Good.
2082	F.	33-	29/11/12	26' E./S. of Bass Rock.	56° 6' 15" N.; 1° 51' 55" W.	28-30			Granton.	(Good.
2083	F.	42-8	8/11/12	28' S.-E. $\frac{1}{2}$ E. of Aberdeen.	56° 56' 55" N.; 1° 15' W.	28			Aberdeen.	(Good.
2084	M.	31-5	5/ 9/12	10' E.-N.-E. of May Isle.	56° 16' 45" N.; 2° 20' 50" W.	30			Granton.	(Good.
2085	M.	32-5	28/ 5/13	45' E.-N.-E. of May Isle.	56° 38' 15" N.; 1° 29' 40" W.	30			Granton.	(Fair.
2089	M.	36-5	20/11/12	44' E.-S.-E. of Bass Rock.	56° 59' 40" N.; 1° 18' 45" W.	35			Granton.	(Good.
2090	M.	38-	14/ 2/13	24' S.-E. from Aberdeen.	57° 0' 50" N.; 1° 20' 5" W.	33-36			Aberdeen.	(Good.
2091	M.	35-9	3/ 5/13	5' N./W. from Rona.	59° 11' 20" N.; 5° 55' W.	48			Aberdeen.	(Good.
2092	M.	33-5	36-	16' 5/13	69' E./S. of Buchanan Ness.	57° 35' N.; 0° 20' E.	50		N. Shields.	(Good.
2095	M.	34-	35-9	4/ 2/13	2' off Whitehills.	57° 43' N.; 2° 32' W.	14		Whitehills.	(Good.
2099	M.	33-	32-6	15/ 7/12	45' E.-S.-E. of May Isle.	56° 5' N.; 1° 11' 35" W.	28		Granton.	(Fair.
2101	F.	30-5	31-	20/ 9/12	28' E. $\frac{1}{2}$ S. of May Isle.	56° 15' 55" N.; 1° 41' 56" W.	35		Granton.	(Fair.
2102	M.	37-	37-6	18/ 2/14	Eddrachilles Bay, Sutherland.	58° 21' N.; 5° 16' W.	45		Hull.	(Almost spent.
2103	F.	34-5	38-3	23/ 6/13	7-8' E./N. $\frac{1}{2}$ N. of Bell Rock.	56° 30' 5" N.; 2° 10' 35" W.	25		Granton.	(Good.
2104	F.	33-5	42-9	12/ 9/13	30' S.-E. of Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	33		Aberdeen.	(Good.
2108	F.	34-5	36-5	6/ 6/13	35' E./N. $\frac{1}{2}$ N. of May Island.	56° 30' N.; 1° 38' W.	32		Newhaven.	(Good.
2109	M.	35-	34-7	8-10/12	45' E./S. of May Island.	56° 15' N.; 1° 11' W.	36		N. Shields.	(Sound.
2112	M.	35-5	42-	25/ 1/14	18' E.-S.-E. of Flamborough Head	54° 22' N.; 0° 20' E.	30		Hartlepool.	(Sound.
2114	M.	32-5	31-6	23/ 7/12	36' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 50" N.; 1° 27' 50" W.	28		Granton.	(Good.
2116	M.	30-5	38-	6/ 2/14	Whitby Ground.	54° 43' N.; 0° 25' W.	36		Hartlepool.	(Mature.
2118	M.	37-5	37-1	30/ 7/12	8-9' N.-E. of St. Abb's Head.	56° 2' N.; 2° W. (about).	30		Granton.	(Good.
2120	M.	37-5	37-6	15-12/12	22' S.-E. of Aberdeen.	57° 1' 30" N.; 1° 25' W.	35		Aberdeen.	(Partly spent.
2121	M.	34-5	38-	28/ 9/13	73' E.-S.-E. of Tod Head.	56° 42' N.; 0° E.	40		N. Shields.	(Sound.
2122	F.	34-5	33-1	24/ 7/12	31' E./S. of May Isle.	56° 15' 15" N.; 1° 36' W.	29		Newhaven.	(Good.
2123	F.	41-	41-9	21/ 2/13	22' S.-E. of Aberdeen.	56° 57' 5" N.; 1° 26' 5" W.	33-34		Aberdeen.	(Good.
2125	F.	32-	33-7	14/ 3/13	18' S.-E. from Aberdeen.	57° 0' 30" N.; 1° 34' W.	36-37		Aberdeen.	(Fair.
2127	F.	37-5	37-6	23/11/12	5' S.-E. from Stonehaven.	56° 55' N.; 2° 3' W.	34		Aberdeen.	(Good.
2129	M.	34-	37-8	6/ 6/13	10' E./S. of May Isle.	56° 12' N.; 2° 15' W.	30		Granton.	(Good.
2130	F.	32-	37-6	15/ 8/13	16' N.-E. from May Isle.	56° 25' N.; 2° 18' 5" W.	27		Granton.	(Good.
2131	F.	39-5	41-2	11/12/12	30' E. of Bell Rock.	56° 34' N.; 1° 30' 55" W.	30		Dundee.	(Good.
Stud.No.										
942	M.	30-	33-2	9/ 4/13	1' off Pittenweem.	56° 14' N.; 2° 39' W.	7		Cockenzie.	(Good.
946	F.	29-	29-5	30/ 7/12	16' E. $\frac{1}{2}$ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	23		Granton.	(Good.

\* The fish were caught in Kirkcaldy Bay, and marked 5th July 1912.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.					
Date, 6th July 1912. Liberated, 56° 24' N; 1° 6' W.— <i>continued.</i>										
Stud.No.										
948	F.	29	32.4	15/ 5/ 13	40' E.-N.-E. of May Isle.	56° 35' 5" N.; 1° 37' 40" W.	S.T.	Granton.	Imm.	Fair.
949	F.	30.5	32.2	1/ 4/ 13	28' S.S.-E. of Aberdeen.	56° 47' N.; 1° 31' 50" W.	"	Aberdeen.	Imm.	Good.
953	F.	31.5	30.7	23/ 7/ 12	44' E.-S.-E. of Bass Rock.	55° 59' 40" N.; 1° 19' 30" W.	"	Newhaven.	Imm.	Good.
955	F.	29	34.2	14/ 7/ 13	24' E. $\frac{1}{2}$ S. of May.	56° 15' N.; 1° 49' 50" W.	"	Granton.	Imm.	Good.
957	M.	31.5	33.4	18/ 11/ 12	33' E. $\frac{1}{2}$ S. of Bass Rock.	56° 10' 30" N.; 1° 39' 10" W.	"	Granton.	Imm.	Fair.
958	M.	31	32.2	14/ 8/ 12	12' E.-S.-E. of May Isle.	56° 10' N.; 2° 10' 30" W.	"	Granton.	Imm.	Fair.
959	M.	30.5	38.5	17/ 3/ 14	Smith Bank, Moray Firth.	58° 12' N.; 2° 58' W.	"	Ymuiden.	—	—
960	F.	30.5	33.8	25/ 3/ 13	1' off between St. Monans and Pittenweem.	56° 14' N.; 2° 40' W. (about).	"	Lines.	Imm.	Good.
Sc. A. 10										
4563	F.	35	35.5	15/ 9/ 12	60' E./S. from Aberdeen.	57° 14' N.; 0° 13' W.	S.T.	Aberdeen.	Imm.	Good.
Date, 6th July 1912. Liberated,* on Aberdeen Bank, 56° 55' N.; 1° 8' W. Depth, 38 Fms.										
Stud.No.										
961	F.	30	32.9	4/ 2/ 13	1' N.-E. of St. Andrews.	56° 20' 50" N.; 2° 46' W.	Cod Nets	Dundee.	Imm.	Fair.
963	M.	30.5	30	8/ 7/ 12	45' E./S. $\frac{3}{4}$ S. of Tod Head.	56° 50' N.; 0° 50' W.	S.T.	Hartlepool.	Imm.	—
965	M.	30	30.3	7/ 10/ 12	6' E.-N.-E. of Bell Rock.	54° 29' 40" N.; 2° 13' 25" W.	"	Granton.	Imm.	Good.
966	M.	30	32.5	9/ 4/ 13	$\frac{1}{2}$ off Belhelvie.	57° 17' N.; 1° 58' W.	Line.	Aberdeen.	Imm.	Good.
967	F.	31	31.8	3/ 7/ 13	30' E./N. of May Isle.	56° 24' 5" N.; 1° 45' 30" W.	S.T.	Granton.	Imm.	Fair.
972	M.	29	33.5	29/ 8/ 13	8' E.-S.-E. of May Isle.	56° 10' 20" N.; 2° 18' W.	"	Granton.	Imm.	Good.
973	F.	29.5	34.2	27/ 5/ 13	35' E. $\frac{1}{2}$ S. of May Isle.	56° 16' N.; 1° 29' W.	"	Granton.	Imm.	Good.
974	M.	32	36.7	9/ 2/ 14	11' E./S. $\frac{1}{4}$ S. of Tarbet Ness.	57° 52' N.; 3° 30' W.	"	Ymuiden.	—	Gutted.
Sc. A. 10										
2132	M.	36	36	11/ 7/ 12	18' S.S.-E. from Aberdeen.	56° 54' N.; 1° 43' W.	"	Aberdeen.	Imm.	Good.

2133	M.	35-	13/12/12	27' E. ½ S. of Hartlepool.	54° 45' N.; 0° 25' W.	35	Hartlepool.	?	Rather dry.
2134	F.	35-5	10/ 9/13	10' E.-N.-E. of Tod Head.	56° 59' N.; 1° 58' W.	36	Granton.	Imm.	Fair.
2135	M.	34-	18/ 3/13	30' S.-E./E. of Aberdeen.	56° 58' N.; 1° 0' 50" W.	34	Aberdeen.	Imm.	Good.
2136	F.	30-5	11/ 9/12	5-6' E.-S.-E. from Tod Head.	56° 52' N.; 2° 3' W.	28	Aberdeen.	Imm.	Fair.
2137	M.	34-5	6/10/12	6' E.-S.-E. from Tod Head.	56° 52' N.; 2° 3' W.	32	Aberdeen.	Imm.	Fair.
2138	M.	32-	4/11/12	6' E.-S.-E. from Tod Head.	56° 54' 10" N.; 2° 2' W.	31	Aberdeen.	Imm.	Good.
2139	F.	46-	6/ 9/12	15' S.-E. from Tod Head.	56° 45' 10" N.; 1° 48' 20" W.	30	Aberdeen.	Imm.	Good.
2141	F.	32-5	29/ 8/12	2' W. of Bell Rock.	56° 25' N.; 2° 26' 30" W.	19	Leith.	Imm.	Good.
2142	F.	33-5	22/ 4/13	2' S. of East Wemyss.	56° 10' N.; 2° 48' W.	15	Buckhaven.	Imm.	Good.
2144	M.	33-5	9/ 1/13	42' E.-S.-E. ½ S. of Longstone Light.	55° 29' N.; 0° 23' W.	38	N. Shields.	—	—
2146	M.	34-	23/ 3/13	35' E. ½ N. of Flamborough Head.	54° 20' N.; 0° 50' E.	32	Grimsby.	—	Sound.
2147	M.	32-	5/ 2/13	16' N.-W. from Buckie.	57° 54' N.; 3° 15' W.	24	Buckie.	Ripe.	Good.
2148	M.	37-5	28/ 1/14	27' S.-E./E. from Aberdeen.	57° 1' N.; 1° 15' W.	34	Aberdeen.	Ripe.	Good.
2149	F.	32-5	6/ 9/12	20' E./S. of Bass Rock.	56° 6' N.; 2° 1' 35" W.	27	Granton.	Imm.	Good; end of tail wanting.
2150	F.	34-	30/ 5/13	31' E.-N.-E. of Aberdeen.	57° 27' 40" N.; 1° 17' 35" W.	54	Aberdeen.	Imm.	Good; end of tail wanting.
2153	F.	37-	3/ 4/13	27' S.-E. of Aberdeen.	56° 46' 50" N.; 1° 31' W.	30	Aberdeen.	Imm.	Good.
2154	F.	35-5	3/ 8/12	2 ½' E. of outside Fairway Buoy, Tay.	56° 27' 30" N.; 2° 33' W.	13	Newhaven.	—	—
2155	F.	31-	23/ 8/12	8' S.-E. of Bell Rock.	56° 21' 55" N.; 2° 10' 55" W.	28	Dundee.	—	Fair; gutted and dry.
2157	M.	34-5	14/ 5/13	16' E.-S.-E. from Noss Head.	58° 26' 30" N.; 2° 31' 15" W.	32	Aberdeen.	Spent.	Good.
2158	F.	34-5	21/10/13	70' E. ½ S. of Longstone Light.	55° 53' N.; 0° 29' E.	41	Aberdeen. N. Shields.	—	—
2160	F.	32-0	25/ 1/15	30' E.-N.-E. of Aberdeen.	57° 27' N.; 1° 20' 30" W.	47	Aberdeen.	Imm.	Good.
2162	M.	39-5	7/ 3/13	7' S.-E. of Ord of Caithness.	58° 3' N.; 3° 26' W.	26	Buckie.	Spawning.	Good.
2163	F.	33-	20/ 1/13	Off St. Monans.	56° 14' N.; 2° 40' W. (about).	7	St. Monans.	Imm.	Fair.
2166	M.	37-5	20/11/12	23' E./N. of May Isle.	56° 21' 5" N.; 1° 55' W.	28	Granton.	Nearly ripe.	Good.
2167	M.	35-	7/ 1/13	About 1 ½' off Whitehills.	57° 42' N.; 2° 32' W.	14	Whitehills.	Nearly ripe.	Fair.
2168	F.	59-3	14/ 8/12	30' E. of Bell Rock.	56° 34' N.; 1° 30' 55" W.	30	Granton.	Spent.	Good.
2169	F.	40-	20/ 5/13	8' S. from Buchan Ness.	57° 20' 10" N.; 1° 41' 15" W.	40	Aberdeen.	Spent.	Good.
2172	F.	39-	11/ 9/13	80' E./S. of Aberdeen.	57° 14' 50" N.; 0° 25' E.	40	Aberdeen.	Imm.	Good; gutted.
2173	F.	31-5	30/ 3/15	36' S. of Aberdeen.	56° 35' N.; 1° 44' W.	30	Aberdeen.	Imm.	Good.
2174	M.	33-	16/10/12	40' E.-N.-E. of May Isle.	56° 35' 5" N.; 1° 37' 40" W.	32	Granton.	Imm.	Fair.

\* The fish were taken in Kirkcaldy Bay, 5th July 1912.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.					
Date, 6th July 1912. Liberated, 56° 55' N.; 1° 8' W.— <i>continued.</i>										
Se. A. 10										
2176	F.	38.5	24/ 9/ 12	65' S.-E./S. from Aberdeen.	56° 27' N.; 0° 31' 30" W.	S.T.	Aberdeen.	Imm.	Good.	
2177	M.	29.5	25/ 2/ 14	3' N.-N.-E. from Tarbet Ness.	57° 55' N.; 3° 47' W.	Cod Nets	Buckie.	—	Good.	
2179	F.	46.5	28/ 2/ 13	25' S.-E. from Aberdeen.	56° 56' N.; 1° 23' 10" W.	S.T.	Aberdeen.	Almost ripe.	Good.	
2182	F.	39.2	24/ 9/ 12	26' S.-E./S. from Aberdeen.	56° 51' 25" N.; 1° 26' 50" W.	"	Aberdeen.	Imm.	Good.	
2184	M.	33.5	41/ 1	1/ 5/ 14 26' S.-E./E. 1/2 E. of Aberdeen.	57° 3' N.; 1° 17' W.	"	Aberdeen.	Ripe.	Good.	
2185	M.	34.5	34.8	7/ 2/ 13 1 1/2 off Whitehills.	57° 42' N.; 2° 32' W.	Cod Nets	Whitehills.	Ripe.	Good.	
2187	M.	34.	35.	22/ 9/ 12 50' E. of Bell Rock.	56° 40' N.; 0° 55' 25" W.	S.T.	Dundee.	Imm.	Gutted; good.	
2190	F.	60.	60.2	12/ 12/ 13 4' W.-N.-W. of Bell Rock.	56° 26' 30" N.; 2° 30' W.	"	Granton.	Nly.ripe.	Good.	
2191	F.	50.5	50.2	20/ 2/ 13 3' S.-E. of Clyth Ness.	58° 17' N.; 3° 8' W.	Cod Nets	Wick.	About ripe.	Good.	
2192	M.	38.5	22/ 2/ 13	3' off Clyth Ness.	58° 17' N.; 3° 8' W.	"	Wick.	Partly spent.	Good.	
2193	M.	41.	20/ 12/ 12	6-12' S.-E./E. of Aberdeen.	57° 5' 50" N.; 1° 46' W. (abt.)	S.T.	Aberdeen.	Nly.ripe.	Good.	
2195	F.	35.5	24/ 6/ 13	24' S.S.-E. from Aberdeen.	56° 49' 48" N.; 1° 34' 28" W.	"	Aberdeen.	Imm.	Good.	
2196	M.	34.5	44.	6/ 10/ 14 35' S.-E. of Aberdeen.	56° 52' N.; 1° 7' W.	"	Aberdeen.	Fully ripe.	Good.	
2197	F.	44.5	46.	15/ 10/ 12 41' E.-N.-E. of May Isle.	56° 36' N.; 1° 34' 5" W.	"	Granton.	Imm.	Good.	
2198	M.	35.	35.	8/ 1/ 13 8' E. 1/2 S. of Tynemouth.	55° 2' N.; 1° 12' W.	"	N. Shields.	Mature.	Tail dry.	
2199	F.	52.	51.4	22/ 11/ 12 7-8' E./S. of Bass Rock.	56° 5' 15" N.; 2° 25' W. (abt.)	"	Granton.	Nly.ripe.	Good.	
2202	F.	36.	37.4	9/ 4/ 13 40' S.-E. from Aberdeen.	56° 48' 24" N.; 1° W.	"	Aberdeen.	Imm.	Good.	
2203	M.	34.	37.6	15/ 12/ 13 10' E. of Aberdeen.	57° 11' N.; 1° 46' W.	"	Aberdeen.	Nly.ripe.	Good.	
2204	M.	35.	35.	18/ 8/ 12 38' E.-S.-E. 1/2 S. of Girdleness.	57° N.; 0° 55' W.	"	Hartlepool.	" ?	?	
2205	F.	33.5	36.5	25/ 1/ 13 22' S.-E./E. from Aberdeen.	57° 1' 30" N.; 1° 25' W.	"	Aberdeen.	Imm.	Good.	
2207	M.	33.5	33.5	19/ 11/ 12 45' N.-E./E. of May Isle.	56° 45' 25" N.; 1° 40' 40" W.	"	Granton.	Imm.	Good.	
2210	M.	33.5	40.0	10/ 3/ 14 25' N.-E. of Kinnaird Head.	58° 4' N.; 1° 39' W.	"	Aberdeen.	Spawning.	Good.	

## Date, 6th July 1912. Liberated, \* 50' E. of May Island, 56° 24' N.; 1° 6' W. Depth, 35 Fms.

2213	F.	44-	43-	7/ 9/12	28' E., N. ½ N. of Longstone Light.	55° 55' N.; 0° 55' W.	41	S.T.	N. Shields.	—	—
2214	M.	40	40-	4/ 5/13	40' E. ½ N. of St. Abb's Head.	56° 10' N.; 1° 0' W.	40	"	N. Shields.	Spent.	—
2215	M.	37-	37-	13/ 9/12	27' E.-S.-E. of Tod Head.	56° 50' N.; 1° 25' W.	32	"	N. Shields.	—	—
2216	F.	39-	40-	10/12/12	28' N.-E. of Longstone Light.	56° 3' N.; 1° 10' W.	32	"	N. Shields.	—	Tail dry.
2217	M.	39-5	41-4	26/ 2/13	21' S.-E. from Aberdeen.	56° 57' N.; 1° 29' W.	35	"	Aberdeen.	Spawning.	Good.

## Date, 6th July 1912. Liberated, 53' S.-E. ½ E. of Tod Head, 56° 34' N.; 0° 44' W. Depth, 47 Fms.

2218	M.	41-5	41-5	4/ 8/12	63' E. ¾ S. of Bell Rock.	56° 35' N.; 0° 30' W.	54	S.T.	N. Shields.	—	Sound.
2219	F.	48-	49-4	6/10/13	25' E.-S.-E. ¾ S. of Girdleness.	57° 3' N.; 1° 18' W.	35	"	N. Shields.	—	Sound.

## Date, 7th July 1912. Liberated, † off Rattray Head, 57° 38' N.; 1° 25' W. Depth, 40 Fms.

2222	M.	38-5	38-	15/ 9/12	51' E.-S.-E. of Tod Head.	56° 48' N.; 0° 40' W.	37	S.T.	Hartlepool.	—	—
2223	M.	36-5	36-2	2/ 1/13	1 ½' off Banif Bay.	57° 41' 30" N.; 2° 30' W.	14	Cod Net	Whitehills.	—	Good.
2224	F.	36-5	36-3	8/10/12	4 ½' S.-E. from Collieston.	57° 23' N.; 1° 43' W.	32	S.T.	Aberdeen.	—	Good; tail im-
2226	M.	32-	34-8	1/11/12	4' E.-S.-E. from Cruden Bay.	57° 24' N.; 1° 42' W.	30	"	Aberdeen.	Imm.	perfect.
2230	F.	35-	45-8	14/ 6/13	8' E.-N.-E. from Rattray.	57° 42' N.; 1° 37' 50" W.	50	"	Aberdeen.	Imm.	Good.
2238	F.	33-	34-8	26/ 4/13	300 yds. off Red Rocks, Aberdeen Bay.	57° 10' N.; 2° 4' W.	14	Line.	Aberdeen.	Imm.	Good.
2239	M.	33-5	43-0	—	No Information.	—	—	S.T.	Grim-by.	—	—
2240	F.	35-5	46-1	21/ 1/14	8' N.-E./E. from Aberdeen.	57° 15' N.; 1° 54' W.	35	S.T.	Aberdeen.	Imm.	Good.
2241	F.	36-5	39-7	29/ 5/13	9' S.S.-W. from Foula.	59° 57' 55" N.; 2° 5' 15" W.	48	"	Aberdeen.	Appar.	Good.
2244	M.	33-5	34-	14/ 3/13	5 ½' S.-E. ¾ S. of Helmsdale.	58° 4' N.; 3° 30' W.	32	"	Ymuiden.	—	Sound.
2245	M.	36-5	37-2	2/ 8/12	20' N.-E./E. from Aberdeen.	57° 23' N.; 1° 37' 5" W.	40	"	Aberdeen.	Imm.	Good.
2246	M.	34-	35-8	14/ 4/13	2' E./N. from Tarbet Ness.	57° 52' 40" N.; 3° 43' W.	12	Cod Net.	Lossiemouth.	Imm.	Good.
2247	M.	36-	40-1	31/ 3/14	6' S./E. of Clyth Ness.	58° 13' N.; 3° 9' W.	35	S.T.	Wick.	Spawning.	(Good.)
2249	F.	35-5	37-	16/ 8/13	50' E.-S.-E. ¾ S. of Tod Head.	56° 45' N.; 0° 43' W.	40	"	Hartlepool.	Imm.	—
2250	M.	33-	32-1	18/ 2/13	1 ½' S. of Rattray Head Lightho.	57° 34' 5" N.; 1° 48' 50" W.	9	"	Rattray Hd.	Imm.	Fair.
2252	F.	40-5	41-5	9/ 8/12	10' E.-S.-E. of Buchan Ness.	57° 26' 48" N.; 1° 28' 5" W.	45	S.T.	Aberdeen.	Imm.	Good.
2253	F.	31-	28-1	19/ 9/12	5' S.-E./E. from Collieston.	57° 24' N.; 1° 41' W.	30	"	Aberdeen.	Imm.	Fail.
2254	F.	37-	38-3	17/12/12	7' S. from S. light, Fair Isle.	59° 23' 40" N.; 1° 34' 40" W.	47	"	Aberdeen.	Imm.	Good.
2255	F.	33-5	36-5	24/ 5/13	Fraserburgh Bay.	57° 41' N.; 1° 59' W.	4	Line.	Fraserburgh.	Imm.	Good.

\* The fish were liberated in exactly the same place as they were taken.

† The fish were taken in Kirkcaldy Bay.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Length Cm.	Date.	PLACE.					
Date, 7th July 1912. Liberated, 57° 38' N.; 1° 25' W.— <i>continued</i> .										
2258	M.	33-	33-7	—	—	—	—	Peterhead.	About $\frac{2}{3}$ ripe. Imm.	Fair; some ulcer at mark.
2259	F.	32-5	32-7	11/ 3/13	1 $\frac{1}{2}$ ' off Banf.	57° 41' 30" N.; 2° 30' W.	Cod Nets	Whitehills.	Imm.	Fair.
2260	F.	39-	40-	10/ 1/13	1' off Macduff.	57° 41' 30" N.; 2° 30' W.	Nets.	Macduff.	Imm.	Good.
2261	M.	34-	Label only.	24/11/12	7' N.N.-E. $\frac{2}{3}$ E. of Buckie.	57° 47' N.; 2° 58' W.	S.T.	Grimaby.	—	—
2262	F.	31-	33-	1/11/12	1' from Slains Castle.	57° 24' N.; 1° 50' W.	Line.	Port Errol.	Imm.	Fair.
2263	M.	35-0	40-8	15/ 7/14	35' S.-E. of Aberdeen.	56° 52' N.; 1° 7' W.	S.T.	Aberdeen.	Imm.	Good.
2264	F.	32-5	32-9	31/ 3/13	1 $\frac{1}{2}$ S.-E. from Brora.	57° 50' N.; 3° 49' W.	Cod Nets	Lossiemouth.	Imm.	Good.
2265	M.	35-5	35-7	26/ 4/13	12' E. $\frac{2}{3}$ S. of Clyth Ness.	58° 20' N.; 2° 50' W.	S.T.	Grimaby.	—	Sound.
2267	F.	33-	33-8	2/ 9/12	5' S.S.-E. from Buchan Ness.	57° 24' 30" N.; 1° 39' 50" W.	"	Aberdeen.	Imm.	Fair.
2268	M.	31-	32-8	18/ 1/13	6' off Lossie.	57° 47' N.; 3° 11' W.	Cod Nets	Lossiemouth.	Nly. ripe. Good.	Good.
2272	M.	45-5	45-9	15/ 1/14	24' S.-E. of Aberdeen.	56° 57' N.; 1° 24' W.	S.T.	Aberdeen.	Imm.	Good.
2273	F.	37-	39-8	15/ 2/13	1' off Rattray.	57° 37' N.; 1° 46' W. ?	Line.	Peterhead.	Imm.	Good.
2274	F.	33-5	33-7	18/ 7/12	9' S.S.-E. from Buchan Ness.	57° 20' 10" N.; 1° 34' 20" W.	S.T.	Aberdeen.	Imm.	Good.
2275	F.	33-5	38-5	12/ 2/13	2' N./E. of Rattray.	57° 39' N.; 1° 49' 25" W.	Line.	St. Combs.	Imm.	Good.
2277	M.	34-	39-5	11/ 7/13	12' E./N. from Kinnaird Head.	57° 47' 20" N.; 1° 39' 10" W.	S.T.	Aberdeen.	Imm.	Good.
2278	M.	32-5	32-5	20/ 7/12	14' E. from Kinnaird Head.	57° 45' 35" N.; 1° 34' 5" W.	"	Aberdeen.	Imm.	Good.
2281	F.	37-5	43-7	8/ 9/13	32' N.N.-E. from Buchan Ness.	58° N.; 1° 39' 50" W.	"	Aberdeen.	Imm.	Good.
2282	F.	36-	38-	14/ 5/13	6' N./E. of Cullen.	57° 48' N.; 2° 50' W.	"	Aberdeen.	Imm.	Good.
2283	M.	32-	35-5	15/11/12	Old Castle Bay, Collieston.	57° 25' N.; 1° 48' W.	Line.	Grimaby.	—	Sound.
2286	F.	38-	39-5	2/12/12	10' S./E. from Buchan Ness.	57° 19' N.; 1° 37' W.	S.T.	Port Errol.	Imm.	Good.
2291	F.	41-	40-8	24/ 7/12	18' E./S. of Aberdeen.	57° 10' N.; 1° 29' W.	"	Aberdeen.	Imm.	Good.



2292	F.	38-5	40-	24/11/12	6' S.-E. from Buchanan Ness.	57° 24' 25" N. ; 1° 35' 40" W.	36	"	Aberdeen.	Imm.	Good.
2294	F.	38-	38-5	15/ 8/12	6' S.-E. from Buchanan Ness.	57° 24' 25" N. ; 1° 35' 40" W.	40-42	"	Aberdeen.	Imm.	Good.
2297	F.	35-	36-8	17/10/12	5' S.-E. from Collieston.	57° 22' 30" N. ; 1° 41' W.	32	"	Aberdeen.	Imm.	Good.
2298	M.	33-	33-8	17/ 2/13	6' E.-S.-E. from Buchanan Ness.	57° 27' 15" N. ; 1° 32' 55" W.	38	"	Aberdeen.	Imm.	Good.
2299	M.	34-5	36-	19/11/12	15' E.-N.-E. from Aberdeen.	57° 17' 35" N. ; 1° 40' 45" W.	35	"	Aberdeen.	Imm.	Good.
Stud.No.											
982	F.	31-	31-7	26/ 3/13	1½' N. of Ratray Head.	57° 38' N. ; 1° 50' 25" W.	8	Lines.	Peterhead.	Imm.	Fair.
983	F.	30-	29-9	26/ 9/12	16' N.-E. of Ratray Head.	57° 50' 10" N. ; 1° 34' W.	40	S.T.	Aberdeen.	Imm.	Fair.
984	M.	29-	Label only.						Grimsby.		
986	M.	30-5	31-3	22/ 8/12	5' S.-E./S. from Old Slains Castle.	57° 20' N. ; 1° 44' W.	35	S.T.	Aberdeen.	Imm.	Fair.
993	M.	30-	31-	28/10/12	5' E.-N.-F. from Aberdeen.	57° 11' 45" N. ; 1° 55' 27" W.	32	"	Aberdeen.	Imm.	Good.
997	M.	30-	34-	?	15½' E./S. ½ S. of Berriedale Head.	58° 10' N. ; 3° W.	20	"	Grimsby.	Imm.	
Date, 6th July 1912. Liberated, 27' E.-S.-E. ½ S. of Tod Head, 56° 48' N. ; 1° 24' W. Depth, 34 Fms.											
Sc. A. 10											
2301	M.	51-5	38-9	18/ 2/13	45' E. ½ S. from Aberdeen.	57° 16' 24" N. ; 0° 44' 40" W.	43	S.T.	Aberdeen.	Partly spent.	Good.
2302	F.	41-	43-5	30/ 6/13	On the Aberdeen Bank.	56° 55' N. ; 1° 8' W.	33-36	"	Newhaven.	Spent.	Good.
2304	F.	48-5	52-3	31/ 8/13	27' S.-E./S. of Aberdeen.	56° 50' 45" N. ; 1° 25' W.	34	"	Aberdeen.	Nly. ripe.	Fine.
2305	F.	39-5	40-	24/ 8/12	27½' S.-E./E. of Aberdeen.	57° N. ; 1° 15' W.	37	"	N. Shields.	Imm.	
2306	M.	38-	46-1	21/12/14	25' S.-E. of Aberdeen.	56° 56' 30" N. ; 1° 23' W.	—	"	Aberdeen.	¾ Ripe.	Good.
Date, 20th September 1912. Liberated, S.-E. of Smith Bank, 58° 5' N. ; 2° 30' W. Depth, 33.90 Fms.											
2331	M.	34-	44-	Before			36	S.T.	Grimsby.	—	Gutted.
2332	F.	49-	47-	13/ 6/13	5½' S.-E. ¾ S. of Noss Head.	58° 25' N. ; 2° 55' W.	—	"	Grimsby.	?	?
2333	M.	39-	38-9	5/ 2/13	1½' off Golspie.	57° 57' N. ; 3° 55' W.	7	Lines.	Helmsdale.	Partly spent.	Good.
2334	F.	47-	47-4	16/10/12	15-16' S.-E./E. from Noss Head.	58° 23' 20" N. ; 2° 32' 50" W.	28	S.T.	Aberdeen.	Nearly ripe.	Good.
2336	F.	59-	59-3	10/10/12	40' N. ½ W. from Ratray.	58° 13' 50" N. ; 2° 8' W.	31	"	Aberdeen.	Nearly ripe.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 20th September 1912. Liberated, 58° 5' N.; 2° 30' W.— <i>continued</i> .												
S.c. A. 10												
2338	F.	42	42.6	18/ 2/13	29' N.-E. $\frac{1}{2}$ N. of Kinnaird Head.	58° 9' N.; 1° 40' W.		30	S.T.	Ymuiden.	—	Sound.
2339	F.	43	43.3	30/10/12	60' N. from Rattray Head.	58° 34' N.; 2° 22' W.		40	"	Aberdeen.	Nearly ripe.	Good.
2340	F.	46	46.7	30/ 4/13	46' N./W. from Rattray Head.	58° 16' 55" N.; 2° 29' 30" W.		30	"	Aberdeen.	Spent.	Good.
2341	F.	41	40	3/11/12	Smith Bank.	58° 10' N.; 2° 55' W.		22-24	"	Bremerhaven	?	?
2343	M.	40	39.1	11/12	7 F. $\frac{3}{4}$ S. of Noss Head.	58° 30' N.; 2° 50' W.		37	"	Grimshy.	Mature.	Sound.
2344	F.	45	44	3/11/12	Smith Bank.	58° 10' N.; 2° 55' W.		22-24	"	Bremerhaven	?	?
2346	F.	41	41	8/11/12	18' S.-E. from Noss Head.	58° 19' 10" N.; 2° 32' W.		42	"	Aberdeen.	Nearly ripe.	Good.
2349	M.	37	38.1	4/ 4/13	Smith Bank, North Side.	58° 18' N.; 2° 55' W.		30	"	Ymuiden.	Nly. ripe.	Sound.
2351	F.	40	40.1	9/12/12	47' N. $\frac{1}{2}$ W. from Rattray.	58° 20' N.; 2° 22' 50" W.		47	"	Aberdeen	Ripening.	Good.
2354	F.	39.5	39	4/12/12	Off Dunnet Head.	58° 45' N.; 3° 45' W.		38-44	"	Grimshy.	—	?
2355	F.	35.5	35.2	22/10/12	S.-E. of Smith Bank, Moray Firth.	58° 5' N.; 2° 55' W.		23	"	Grimshy.	?	Sound.
2356	M.	41	40.8	28/10/12	40' N. $\frac{1}{2}$ W. from Rattray Head.	58° 13' 50" N.; 2° 8' W.		39	"	Aberdeen.	Nly. ripe.	Good.
2358	F.	37.5	37.8	19/ 2/13	13' N./W. of Portmahomack, Dornoch.	57° 51' N.; 3° 50' W.		4	Line.	Embo.	Imm.	Good.
2359	F.	38.5	44.0	20/ 4/13	Moray Firth.	—		—	S.T.	Geestemünde	—	—
2362	F.	38.5	39.2	20/ 2/13	7 $\frac{1}{2}$ E.-S.-E. of Noss Head.	58° 28' N.; 2° 48' W.		30	"	Ymuiden.	—	Sound.
2363	F.	43.5	47	21/ 8/13	Smith Bank, Moray Firth.	58° 12' N.; 2° 54' W.		22	"	Grimshy.	Mature.	—
2364	F.	39	39.2	16/11/12	Off Noss Head.	58° 29' N.; 3' W.		33	"	Aberdeen.	Nly. ripe.	Good.
2365	M.	40.0	40.7	2/ 2/14	8' S. of Lybster.	58° 10' N.; 3° 13' W.		26	"	Grimshy	—	Gutted.
2366	M.	36.5	35	31/10/12	Noss Head, N./E.	—		20-26	"	Geestemünde	—	—
2367	F.	37.5	46.0	9/ 2/14	11' E./S. $\frac{1}{2}$ S. of Tarbet Ness.	57° 52' N.; 3° 25' W.		23	"	Ymuiden	—	Sound.
2371	M.	39.5	38.7	19/ 2/13	4' E.-S.-E. of Golspie.	57° 58' N.; 3° 51' W.		16	Line.	Golspie.	Ripe.	Good.
2376	F.	40.5	40.9	4/ 3/13	12' E./S. $\frac{3}{4}$ S. of Clyth Ness.	58° 18' N.; 2° 50' W.		24	S.T.	Ymuiden.	—	Sound.

2377	F.	37-9	7/7/13	Smith Bank, Moray Firth.	58° 10' N.; 2° 55' W.	18-22	"	Grimsby.	—	Gutted.
2379	F.	35-	2/12/13	20' S.S.-E. of Pentland Skerrie.	58° 30' N.; 2° 30' W.	30	"	Grimsby.	?	?
2381	M.	38-7	2/12/13	2' S.-E. of Clyth Ness.	58° 18' N.; 3° 9' W.	29	Cod Nets	Wick.	Spawning.	Good.
2384	M.	38-5	6/2/13	5' S.S.-E. of Helmsdale.	58° 3' N.; 3° 33' W.	21	"	Buckie.	Ripe.	Good.
2386	M.	37-5	9/10/12	45' N. $\frac{1}{2}$ W. from Rattray.	58° 17' 55" N.; 2° 21' 50" W.	50	S.T.	Aberdeen.	Nearly ripe.	Good.
2387	M.	?	12/10/12	5' E. of Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W.	24-26	"	Grimsby.	?	?
2389	M.	37-2	17/11/12	8' S.-E. from Tod Head.	56° 50' 5" N.; 1° 57' 55" W.	26	"	Aberdeen.	Nearly ripe.	Good.
2392	M.	Label only.	18/4/13	—	—	—	—	Ostend.	—	Good.
2393	F.	38-5	25/6/13	N. of Smith Bank, Moray Firth.	58° 15' N.; 2° 55' W.	21	S.T.	Grimsby.	—	Sound.
2396	M.	35-2	31/10/13	Noss Head, N./E.	—	20-26	"	Geestemünde	—	—
2397	M.	35-5	23/1/13	8' N.-W. from Dunnet Head.	58° 42' N.; 3° 38' 30" W.	38	"	Aberdeen.	Ripe.	Good.
2398	M.	36-1	16/12/12	16' S.-E. from Noss Head.	58° 20' 50" N.; 2° 36' 40" W.	33	"	Aberdeen.	Nearly ripe.	Good.
2399	M.	34-5	30/11/12	47' N. $\frac{1}{2}$ W. from Kinnaid Head.	58° 25' N.; 2° 32' 5" W.	47	"	Aberdeen.	Nearly ripe.	Good.
2400	M.	36-8	12/4/13	18' S.-E. from Noss Head.	58° 19' 10" N.; 2° 32' W.	34	"	Aberdeen.	Ripe.	Good.
2402	M.	34-7	21/12/12	47' N. $\frac{1}{2}$ W. from Rattray.	58° 20' N.; 2° 22' 50" W.	35	"	Aberdeen.	Imm.	Good.
2405	M.	35-5	21/3/13	2' S.S.-W. from Brora.	57° 59' N.; 3° 47' W.	17	Cod Nets	Buckie.	Ripe.	Fair.
2406	F.	41-	11/11/12	4' N. from Rattray.	57° 40' 50" N.; 1° 51' W.	23	S.T.	Aberdeen.	Nearly ripe.	Good.
2407	F.	Label only.	27/10/12	E. Side Smith Bank, Moray Firth.	58° 10' N.; 2° 40' W.	24-26	"	Grimsby.	—	—
2409	F.	36-	5/3/13	Noss Head, 14 m. N.	58° 41' 35" N.; 3° 10' 5" W.	25	"	Ymuiden.	—	Sound.
1002	M.	35-8	20/10/12	Smith Bank, Moray Firth.	58° 5' N.; 2° 30' W.	18	"	Grimsby.	?	Sound.
1006	M.	34-9	2/4/13	2' S.-W. of Burchhead.	57° 40' N.; 3° 30' W.	24	"	Grimsby.	—	Sound.
1009	M.	32-5	15/2/14	3' N.E./N. $\frac{1}{2}$ E. from Noss Head.	58° 30' N.; 3° 2' W.	30	"	Vlaardingen.	—	Gutted.
1010	M.	40-5	31/3/13	2' off Golspie.	57° 59' N.; 3° 54' W.	7	Line.	Golspie.	Imm.	Fair; head damaged.
1013	F.	32-5	27/12/13	6' from Lybster.	58° 15' 30" N.; 3° 6' W.	33	S.T.	Grimsby.	Imm.	Sound.
1014	F.	34-1	30/1/13	In Moray Firth.	58° 7' N.; 3° W.	26	"	Ymuiden.	—	Sound.
1016	M.	33-5	6/12/12	Off Noss Head.	58° 30' N.; 2° 40' W.	36	"	Grimsby.	?	Tail abraded.
1020	M.	34-0	26/2/14	7' E. /S. of Dunrobin.	57° 59' N.; 3° 44' W.	18	Line	Golspie.	Ripe	Good.
Sc. A. 10	F.	55-	15/5/13	Dornoch Firth, 3 $\frac{1}{2}$ S.S.-E. from Dunrobin.	57° 56' N.; 3° 52' W.	13	S.T. "Goldseeker."	—	—	—

\* This fish had been liberated on 20th September 1912 in Dornoch Firth, where all the fish for marking were taken.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.					
Date, 21st September 1912. Liberated, Aberdeen Bank, 56° 55' N.; 1° 8' W. Depth, 36 Fms.										
So. A. 10										
2417	F.	39-	28/11/12	120' N.-N.-E. of N. Shields.	57° 37' N.; 1° 9' W.	36	S.T.	N. Shields.	Ripening	?
2420	F.	47-5	14/9/14	50' N.-E./E. of Aberdeen.	57° 47' N.; 1° 4' W.	—	"	Aberdeen.	Imm.	Good.
2421	F.	40-0	27/3/14	25' S.-E./E. of Aberdeen.	57° 1' N.; 1° 21' W.	35	"	Aberdeen.	Spent.	Good.
2422	F.	43-	22/10/12	22' S.-E./S. from Aberdeen.	56° 53' 50" N.; 1° 31' 50" W.	33	"	Aberdeen.	Imm.	Good.
2423	F.	38-5	38/13/4/13	—	—	—	—	Got in a London shop.	Imm.	Good.
2427	F.	38-5	44-7	26' S.-E./E. ½ E. of Aberdeen.	57° 3' N.; 1° 14' W.	34	S.T.	Aberdeen.	Spent.	Good.
2431	M.	36-8	22/2/13	24' S.-E./E. from Aberdeen.	57° 0' 50" N.; 1° 20' 5" W.	38	"	Aberdeen.	Spawning.	Good.
2434	M.	37-	23/10/12	25' S.-E./E. from Aberdeen.	57° 0' 30" N.; 1° 20' W.	35	"	Aberdeen.	½ Ripe.	Good.
2435	F.	38-	20/2/15	27' S.-E. of Aberdeen.	56° 55' 30" N.; 1° 19' W.	37	"	Aberdeen.	Spent.	Good.
2439	F.	38-3	16/10/12	36' S.-E. from Aberdeen.	56° 50' N.; 1° 6' W.	39	"	Aberdeen.	Imm.	Good.
2444	F.	45-	16/5/13	8' E./N. from Rattray.	57° 40' N.; 1° 34' 50" W.	49	"	Aberdeen.	Spent.	Good.
2446	M.	36-3	24/1/13	6-7' E.-S.-E. of Buchan Ness.	57° 27' 15" N.; 1° 32' 55" W.	38-39	"	Aberdeen.	Ripe.	Good.
2447	F.	37-8	3/3/13	26' S.-E./E. of Aberdeen.	57° 0' 30" N.; 1° 17' 50" W.	36	"	Aberdeen.	Rather imm.	Good.
2449	M.	36-5	4/2/14	8' E.-N.-E. of Aberdeen.	57° 14' N.; 1° 52' W.	32	"	Aberdeen.	Spawning.	Good.
2451	M.	37-	17/10/12	28' S.-E. ½ S. from Aberdeen.	56° 51' 50" N.; 1° 22' 30" W.	37	"	Aberdeen.	Imm.	Good.
2454	F.	35-	7/8/13	40' m. E.-S.-E. of Aberdeen.	57° 3' 40" N.; 0° 50' 15" W.	45	"	Aberdeen.	Imm.	Good; slight ulcer at mark.
2455	M.	35-5	17/12/12	40' E.-N.-E. of May Isle.	56° 35' 5" N.; 1° 37' 40" W.	30	"	Granton.	Nly. ripe.	Good.
2456	F.	36-	10/4/13	28' S.-E./E. of Aberdeen.	57° 0' 15" N.; 1° 14' 20" W.	29	"	Aberdeen.	Imm.	Good.
2457	F.	32-	6/11/13	15' E./N. from Kinnaird Head.	57° 49' N.; 1° 35' 30" W.	38	"	Aberdeen.	½ Ripe.	Good.
2458	M.	34-5	9/4/13	30' S.S.-E. of Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	29	"	Aberdeen.	Imm.	Good.
2459	F.	36-	9/11/12	60' E.-N.-E. of Bell Rock.	57° 3' 10" N.; 1° 0' 58' 50" W.	40	"	Dundee.	Imm.	Fair.
2462	F.	42-5	1/8/13	25' E./S. ½ S. of Aberdeen.	57° 8' N.; 1° 18' W.	36	"	N. Shields.	—	Destroyed.
2466	F.	44-	21/2/13	18' S.-E./E. of Aberdeen.	57° 2' 40" N.; 1° 31' W.	38	"	Aberdeen.	Spawning.	Good.

2469	F.	38-	6/12/12	60° N. N.-E. of Longstone.	56° 38' N.; 1° 22' W.	34	"	N. Shields.	?	?	?
2471	F.	39-5	20/1/13	30° E./S. of Bell Rock.	56° 28' 40" N.; 1° 27' 5" W.	34	"	Dundee.	—	—	Good.
2473	F.	37-5	8/10/12	45° E.-N.-E. of May Isle.	56° 38' 15" N.; 1° 29' 40" W.	33	"	Granton.	½ Ripe.	—	Good.
2479	M.	36-5	4/4/13	26° E.-S.-E. from Aberdeen.	57° 5' 20" N.; 1° 15' W.	35	"	Aberdeen.	Imm.	—	Fair.
2481	F.	40-	26/10/14	35° S.-E. of Aberdeen.	56° 52' N.; 1° 7' W.	39	"	N. Shields.	—	—	Good.
2482	F.	42-	26/12/12	26° S.-E./S. from Aberdeen.	56° 51' 25" N.; 1° 26' 50" W.	29	"	Aberdeen.	Near spawning.	—	Good.
2483	F.	42-5	21/3/13	26° S.-E./E. from Aberdeen.	57° 0' 30" N.; 1° 17' 50" W.	31	"	Aberdeen.	Spawning.	—	Good.
2486	F.	43-	14/3/13	Landed at Newhaven, and sent from Sawyers, Glasgow.	—	—	"	—	Spent.	—	—
2489	F.	39-	9/4/13	26° S.-E./S. of Aberdeen.	56° 51' 25" N.; 1° 26' 50" W.	35	S.T.	Aberdeen.	Imm.	—	Good.
2490	F.	46-	4/12/12	22° S.-E. from Aberdeen.	56° 51' N.; 1° 39' 40" W.	37	"	Aberdeen.	Nearly ripe.	—	Good.
1022	F.	34-	26/12/12	27° E. ½ S. of May Isle.	56° 15' 50" N.; 1° 44' W.	28-30	"	Granton.	Imm.	—	Fair.
1023	F.	34-5	11/11/13	37° E.-S.-E. of Tod Head.	56° 50' N.; 1° 5' W.	40	"	N. Shields.	—	—	Sound.
1030	M.	33-	31/7/13	40° E. of Bell Rock.	56° 37' N.; 1° 13' W.	47	"	Dundee.	Imm.	—	Good.
1033	M.	31-5	28/8/13	27° S.-E. of Aberdeen.	57° 0' 30" N.; 1° 16' W.	40	"	Aberdeen.	Imm.	—	Good.
1037	F.	33-5	18/1/14	26° S.-E./E. from Aberdeen.	57° 1' N.; 1° 16' 30" W.	37	"	Aberdeen.	¾ Ripe.	—	Good.
1040	F.	33-	1/7/13	16° E. ½ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	27	"	Granton.	Imm.	—	Good.

Date, 21st September 1912. Liberated, about 50' E. of May Island, 56° 24' N.; 1° 6' W. Depth, 35 Fms.

2491	F.	40-	22/10/12	45° E.-N.-E. of Bell Rock.	56° 54' N.; 1° 18' 55" W.	35	S.T.	Dundee.	½ Ripe.	—	Good.
2492	F.	40-5	17/7/13	45° E.-S.-E. of May.	56° 5' N.; 1° 11' 35" W.	30	"	Granton.	Spent.	—	Good.
2496	F.	37-5	28/9/13	30° E. ½ S. of Tod Head.	56° 57' N.; 1° 19' W.	37	"	N. Shields.	—	—	Sound.
2497	F.	51-	50-5	26° E.-S.-E. of Tod Head.	56° 50' N.; 1° 25' W.	36	"	N. Shields.	—	—	Sound.
2498	F.	44-	43-3	13/10/12	56° 21' N.; 0° 47' W.	45	"	Granton.	¾ Ripe.	—	Good.
2502	F.	38-5	13/11/12	30° S.-E./S. of Aberdeen.	56° 58' 35" N.; 1° 8' 25" W.	34	"	Aberdeen.	Imm.	—	Good.
2503	F.	40-0	20/4/14	4' from Buekie.	57° 44' N.; 3° W.	20	"	Grimsby.	—	—	Gutted.
2504	M.	36-5	12/10/12	53° E. of St. Abb's Head.	56° 10' N.; 0° 35' W.	34	"	N. Shields.	—	—	Sound.
2509	F.	43-	6/7/13	52° E./S. of Tod Head.	56° 56' N.; 0° 38' W.	40	"	Scarboro'.	Imm.	—	Sound.
2510	F.	40-	31/7/13	35° E./S. ½ S. of May Island.	56° 12' N.; 1° 29' W.	29	"	N. Shields.	—	—	Sound.
2516	F.	36-5	36-8	23° N.-E./N. of Bass Rock.	56° 26' 50" N.; 2° 26' 5" W.	30	"	Granton.	Imm.	—	Good.
2517	M.	41-2	19/7/14	32° N.-E. ¼ N. of May Isle.	56° 40' N.; 2° 8' W.	42	"	Hartlepool.	—	—	Sound.
2521	M.	35-5	16/1/14	26° S.-E. ¾ S. from Aberdeen.	56° 53' N.; 1° 24' W.	40	"	Aberdeen.	Nly. ripe.	—	Good.

Sc. A. 10.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.		PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Length Cm.	Date.								
Date, 21st September 1912.* Liberated, 56° 24' N.; 1° 6' W.— <i>continued.</i>												
Sc. A. 10												
2523	F.	38.	44.4	5/ 9/13	10' N.-E. of Longstone.	55° 48' N.; 1° 28' W.	40	S. T.	Leith.	Imm.	Good.	
2524	F.	45.	45.3	26/ 3/13	23½ E./S. ¾ S. of Tod Head.	56° 52' N.; 1° 20' W.	36	"	Blyth.	Imm. ?	Good.	
2530	F.	42.5	43.	18/ 2/13	24 S.-E./E. of Aberdeen.	57° 0' 50" N.; 1° 20' 5" W.	35	"	Aberdeen.	Nly ripe.	Good.	
2532	F.	40.	42.5	22/ 8/13	40 E. of Bell Rock.	56° 37' N.; 1° 13' W.	47	"	Dundee.	Spent.	Good; gutted.	
2535	F.	34.5	35.8	20/ 5/13	18-20' N.-E./E. of Bell Rock.	56° 40' 50" N.; 2° 1' W.	30	"	Granton.	Imm.	Good.	
2537	M.	36.	36.5	19/ 2/13	15' S.-E. from Bell Rock.	56° 18' 10" N.; 1° 59' 50" W.	29	"	Dundee.	Ripe.	Good.	
2539	F.	41.	45.	21/12/13	28' N.-E./N. of Longstone.	56° 6' N.; 1° 22' W.	31	"	N. Shields.	—	—	
2543	F.	39.0	50.0	27/ 4/14	40' E. of Tay Buoy.	56° 38' N.; 1° 28' W.	28	"	Dundee.	Imm.	Good.	
2544	F.	33.5	39.9	10/10/13	16' E.-S.-E. of May.	56° 8' 40" N.; 2° 4' W.	30	"	Granton.	Imm.	Fair.	
2545	M.	37.5	38.9	26/ 3/13	20' E.-S.-E. of May Isle.	56° 7' 50" N.; 1° 56' W.	30	"	Granton.	Ptly. spt.	Good.	
2546	F.	34.5	Mark only.	11/10/12	40' E. ¾ S. of May Isle.	56° 17' N.; 1° 20' 50" W.	40	"	Granton.	—	—	
2550	M.	37.5	37.2	15/10/12	50' E. ¾ S. of May Isle.	56° 19' N.; 1° 3' 5" W.	45	"	Granton.	Imm.	Fair.	
2553	F.	35.	Mark only.	About 22/12/13	Glasgow market.	—	—	—	—	—	—	
2554	M.	36.5	41.0	3/ 6/14	120' N. of Scarborough.	56° 12' N.; 1° 20' W.	27	S. T.	Scarboro'.	Imm.	—	
2556	M.	33.	33.4	10/10/12	28' E. ½ S. of May Isle.	56° 15' 55" N.; 1° 41' 55" W.	40-45	"	Granton.	Imm.	Good.	
2566	M.	36.	42.7	3/ 2/14	12' E.-S.-E. of May Isle.	56° 10' N.; 2° 10' 20" W.	32	"	Leith.	Ripe.	Good.	
2568	F.	43.	45.4	22/ 8/13	40' E. of Bell Rock.	56° 37' N.; 1° 13' W.	47	"	Dundee.	Spent.	Good; gutted.	
Stud. No.												
1043	F.	33.	36.2	16/ 2/14	2' off St. Andrews.	Abt. 56° 20' N.; 2° 40' W.	7	Line.	St. Andrews.	Imm.	Good.	
1045	M.	33.5	34.1	2/ 3/15	38 S.-E. of Aberdeen.	56° 50' 30" N.; 1° 3' W.	40	S. T.	Aberdeen.	Spawning.	Good.	
1048	M.	31.	32.1	5/10/13	15' S.-E./E. from Girdleness.	57° 3' 5" N.; 1° 36' 5" W.	53	"	Aberdeen.	—	Fair; slight ulcer at mark.	
1052	F.	32.5	45.2	12/ 6/14	82' N.N.-E. of N. Shields.	56° 22' N.; 1° 10' W.	36	"	N. Shields.	—	Sound.	
1053	M.	31.	30.4	20/ 1/13	16' E./S. of May Isle.	56° 12' 5" N.; 2° 4' W.	30	"	Granton.	Imm.	Fair.	
1059	F.	35.	40.5	16/ 9/13	28' E./N. of May.	56° 23' 15" N.; 1° 48' 30" W.	24	"	Granton.	Imm.	Good.	

Date,	21st November 1912.	Liberated, † E. of Smith Bank (Moray Firth), 58° 10' 30" N.; 2° 35' 30" W.	Depth, 30 Fms.	Cod Nets, S.T.	Buckie, Grimsby.	Spawning, —	Fair.
1194	M. 33-5	39° 18/ 2/14 12' off Ord Head, Caithness.	58° 4' N.; 3° 14' W.	35			
1197	F. 32.	Label 18/ 5/13 10' S.-E./E. ½ S. of Clyth Ness.	58° 15' N.; 2° 55' W.	21			
		only.					
1199	M. 25-5	1/ 3/15 4' N.-E. of Tarbet Ness.	57° 55' 30" N.; 3° 43' W.	—	Cod Nets	Spawning;	Fair.
1202	M. 31-0	7/ 3/14 4' S.-E. of Dunbeath.	58° 12' N.; 3° 20' W.	27	Cod Nets	Spawning;	Good.
1204	F. 27-5	5/ 4/13 Moray Firth.	—	3½	S.T.	Imm.	Fair.
1208	F. 30-	19/ 3/13 1' off Embo Point.	57° 55' N.; 3° 57' W.	38-44	S.T.	Ripening	?
1210	M. 34-5	5/12/12 Off Dunnet Head.	58° 45' N.; 3° 45' W.				
Sc. A. 10							
2572	M. 34-	14/ 5/13 4' S./E. of Clyth Ness.	58° 15' N.; 3° 9' W.	27		—	Sound.
2573	F. 33-5	6/ 1/13 47' N./W. from Rattray Head.	38° 18' 10" N.; 2° 31' 50" W.	30		Imm.	Fair.
2576	F. 37-	28/ 4/13 1½ off Whitehills.	57° 42' N.; 2° 32' W.	14	Cod Nets	?	Good.
2577	M. 35-	34-7 17/1/13 4' E./N. of Tarbet Ness.	57° 54' N.; 3° 40' W.	20		Nlv. ripe.	Good.
2579	M. 37-5	25/ 3/13 6' S.S.-E. of Lybster.	58° 13' N.; 3° 10' W.	30		Spawning	Good.
2580	M. 35-5	16/ 2/13 18' N.N.-E. from Kinnaid Head.	57° 59' N.; 1° 55' W.	38	S.T.	Spawning	Good.
2581	F. 38-5	8/ 3/13 12' S.-E./E. from Auskerry.	58° 26' N.; 2° 48' W.	46		Imm.	Good.
2582	M. 36-	18/ 4/13 8' S.-E./E. ¼ S. of Noss Head.	57° 43' N.; 3° 28' W.	28		—	Sound.
2583	F. 36-5	30/ 4/13 1' E. of Burchhead.	58° 20' N.; 2° 14' W.	8	Cod Nets	—	—
2584	F. 39-	28/11/12 45' N. from Rattray.	58° 20' N.; 2° 34' W.	35	S.T.	Imm.	Good.
2586	M. 33-5	4/ 3/13 5' E. of Clyth Ness.	58° 20' N.; 3° 4' W.	22		—	Sound.
2587	M. 36-5	5/12/12 Off Dunnet Head.	58° 45' N.; 3° 45' W.	38-44		Ripe.	?
2590	M. 32-5	33-3 5/ 3/13 Noss Head, 14' N.	58° 15' N.; 2° 55' W.	25		—	Sound.
2592	F. 40-5	47-2 12/ 3/14 12' off Burchhead.	57° 55' N.; 3° 30' W.	28		—	Gutted.
2593	F. 36	41-5 17/ 2/14 5' N.N.-W. of "Klem Ness," Moray Firth.	?	27		—	Gutted.
2594	M. 36-5	30/11/12 47' N. ½ W. of Kinnaid Head.	58° 25' N.; 2° 32' 5' W.	47		½ Ripe.	Good.
2595	F. 40-5	7/ 3/13 W. side Smith Bank, Moray Firth.	58° 10' N.; 3° W.	20		—	Sound.
2596	F. 37-5	18/ 2/13 Noss Head, 15' N./W. Moray Firth	58° 15' 30" N.; 2° 49' W.	23		—	Sound.
2597	M. 38-	44-6 15/10/13 2' E.-N.-E. of Noss Head.	58° 30' N.; 3° W.	27		—	Sound.
302	M. 39-5	21/11/12 Station IV., Dornoch Firth.	57° 58' N.; 3° 45' W.	14-16	S.T. "Goldseeker."	—	¾ Ripe.
Date, 22nd November 1912.							
2602	F. 36-5	45-7 3/ 4/14 6' S.-E./E. of Buchanness.	59° 20' N.; 1° 3' W.	71 Fms.		Spent.	Good.
2603	M. 36-0	44-5 14/ 6/14 20' E.-S.-E. of Auskerry.	57° 26' N.; 1° 33' W.	38	Aberdeen.	Imm.	Good.
2605	F. 39-	39-4 18/ 3/13 180' N.-E./E. of Aberdeen.	59° N.; 1° 54' W.	57-60	Aberdeen.	Imm.	Good.
2606	F. 33-5	51-4 4/10/14 Off Coptinslay, bearing N.N.-E.	58° 55' N.; 2° 40' W.	39	Aberdeen.	About ¾ ripe.	Good.
2609	F. 36-5	26/ 2/13 5½' N.-W. ½ N. of Fitful Head.	59° 57' 40" N.; 1° 32' W.	50	Aberdeen.	Imm.	Good.

\* Fish caught in Dornoch Firth, 21st September 1912.

† Captured Station IV., Dornoch Firth. Depth, 14-16 fathoms.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.				Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.						
Date, 22nd November 1912. Liberated, 59° 20' N.; 1° 3' W.— <i>continued.</i>											
Sc. A. 10											
2610	F.	42.9	6/3/14	16° S.-E. of Noss Head,	58° 21' N.; 2° 36' W.	—	S.T.	Aberdeen.	Spent.	Good.	
2611	M.	38.4	22/5/13	8° S.-E. from N. Light, Fair Isle.	59° 28' 30" N.; 1° 21' 35" W.	55	"	Aberdeen.	Spent.	Good.	
2623	M.	35.7	8/1/13	7° N.-E. Great Fisher Bank.	58° N.; 4° 55' E.	56	"	Grimsby.	—	Sound.	
2628	M.	34.5	7/3/13	Got in Manchester, came from Aberdeen.							
2635	F.	40.2	6/2/13	60° E./S. ½ S. of Copinshay		65	S.T.	Hull.	—	Sound.	
2636	M.	42.6	20/3/14	3° S. of Clyth Ness.		30	Cod Nets	Buckie.	Spawng.	Good.	
2637	F.	37.1	20/2/13	16° E.-S.-E. of Fair Isle.		65	S.T.	Aberdeen.	Imm.	Good.	
2639	M.	36.	2/7/13	9° S.-E. from Fair Isle.		57	"	Aberdeen.	Imm.	Good.	
2642	F.	42.	19/8/13	Smith Bank, Moray Firth.		22	"	Grimsby.	Mature	—	
2648	F.	38.5	20/1/13	80° E. ¾ S. of Noss Head.		67	"	N. Shields.	—	Sound.	
2650	M.	39.	7/9/13	7° E. ¾ S. of Noss Head.		33	"	Grimsby.	—	—	
2659	F.	43.	5/8/13	5 m. S. from Fair Isle.		45	"	Aberdeen.	Imm.	Good.	
2660	M.	33.5	2/2/13	S.-E. edge of Fair Isle Bank.		42-43	"	Aberdeen.	Ripe.	—	
2662	M.	35.	23/4/13	44° E. ¼ S. of Bell Rock.		38	"	Blyth.	—	Sound.	
2664	M.	40.5	19/12/12	80° N.-E. from Buchan Ness.		64	"	Aberdeen.	Nly. ripe.	Good.	
2666	F.	36.5	20/3/15	4-8° E.-S.-E. of Auskerry.		50	"	Aberdeen.	Imm.	Good.	
2667	M.	38.7	28/1/13	20° S.-E. of Noss Head.		30	"	Macduff.	Spent.	Good.	
2668	F.	38.0	44/9/14	16° E./S. of Auskerry.		34	"	Aberdeen.	Spent.	Good.	
2669	M.	36.5	30/3/13	15° N. of Lossiemouth.		20	"	Ymuiden.	Imm.	Sound.	
2671	F.	42.5	24/5/13	9° S.-E. from Fair Isle.		64	"	Aberdeen.	Imm.	Good.	
2672	F.	44.1	7/1/14	4° S.-W. from Gruting Voe.		45	"	Aberdeen.	Imm.	Good.	
2676	F.	44.7	29/6/14	12° S.-E. of S. Light, Fair Isle.		52	"	Aberdeen.	About ¾ ripe.	Good.	
Stud.No. 1217	M.	34.5	11/3/13	7° S.S.-E. of Buchan Ness.		45	"	Aberdeen.	Spawng.	Fair.	



1220	M.	33-5	33-7	26/ 2/13	13' E.-N.-E. of Aberdeen.	57° 17' N.; 1° 44' 30" W.	42	"	Aberdeen.	Partly spent, Very imm.	Good.
1221	M.	33-5	32-7	21/ 3/13	20' S.-E. from Auskerry.	58° 52' N.; 1° 59' W.	44	"	Aberdeen.	—	Fair.
1232	M.	33-	33-7	24/ 1/13	146' E./N. $\frac{3}{4}$ N. of Ratray Point.	59° 3' N.; 2° E.	66	"	Hull.	—	Sound.
Date, 5th December 1912. Liberated,* 56° 6' N.; 2° 44' W.; Fidra Light, S./W. 3 miles. Depth, 27 Fms.											
Sec. A. 10											
2707	M.	36-5	41-1	17/12/13	20' S.-E. $\frac{1}{2}$ E. of Noss Head.	58° 21' N.; 2° 27' W.	30	S.T.	Aberdeen.	About ripe.	Good.
2709	M.	40-	42-5	18/ 1/14	1' off Banff.	57° 41' 30" N.; 2° 31' W.	10	—	Whitehills.	Spawng.	Good.
2711	M.	36-5	39-9	28/10/13	11' E./S. from Noss Head.	58° 30' N.; 2° 43' W.	34	S.T.	Aberdeen.	Nly. ripe.	Good.
2712	F.	37-5	37-8	31/ 3/13	1 $\frac{1}{2}$ off Banff.	57° 42' N.; 2° 30' W.	14	Cod Nets	Whitehills.	Spent.	Fair.
2715	M.	35-	35-2	14/ 2/13	12' S.-W. of Bell Rock.	56° 14' 55" N.; 2° 32' 5" W.	13	S.T.	Dundee.	Spawng.	Fair.
2719	F.	40-	40-2	13/ 2/1	1 $\frac{1}{2}$ off Pittenweem.	56° 14' N.; 2° 39' W.	10	Herring Net.	Pittenweem.	Imm.	Good.
2721	M.	34-5	40-3	21/10/13	5-6' E. of Bell Rock.	56° 28' N.; 2° 13' W.	25	S.T.	Granton.	Imm.	Good.
2722	M.	34-5	35-8	4/ 3/13	W. side Smith Bank, Moray Fth.	58° 10' N.; 3° W.	23	"	Ymuiden.	?	Sound.
2724	F.	38-5	38-8	22/ 3/13	About 1 $\frac{1}{2}$ off Banff.	57° 42' N.; 2° 30' W.	14	Cod Nets	Whitehills.	Spent.	Good.
2726	F.	37-	39-6	28/10/13	6' S.-E. from Cruden Bay.	57° 21' N.; 1° 40' W.	40	S.T.	Aberdeen.	Imm.	Good.
2731	F.	46-	47-7	23/ 1/14	1' off Macduff.	57° 41' 30" N.; 2° 29' W.	10	Cod Nets	Macduff.	Nearly ripe.	Good.
2732	F.	45-	44-3	9/ 4/13	6' S.-E./S. of Helmsdale.	58° 3' N.; 3° 30' W.	19-20	S.T.	Grimshy.	—	Sound.
2734	F.	37-5	37-5	30/12/12	7' E.-N.-E. from Aberdeen.	57° 12' 50" N.; 1° 52' W.	31	"	Aberdeen.	Nearly ripe.	Good.
2735	M.	42-5	42-5	2/ 4/13	7' S./E. from Buchan Ness.	57° 22' N.; 1° 39' W.	37	"	Aberdeen.	Partly spent.	Good.
2736	F.	36-5	41-1	3/ 9/13	28' S./E. from Aberdeen.	56° 44' 5" N.; 1° 40' W.	26	"	Aberdeen.	?	Good.
2737	F.	37-5	39-8	22/ 5/13	24' E./S. of May.	56° 12' 5" N.; 1° 47' 35" W.	16	"	Granton.	Imm.	Good.
2739	F.	39-5	41-	11/ 5/13	6' E. of May Islc.	56° 12' 40" N.; 2° 22' W.	20	"	Granton.	Imm.	Good.

\* Captured, Station VI., Firth of Forth.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date	PLACE.	LATITUDE AND LONGITUDE.	Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.								
Date, 5th December 1912. Liberated, Fidra Light, S./W. 3 miles— <i>continued</i> .											
2740	F.	37.5	33.3	31/ 3/ 13	7° E.-N.-E. of May Isle.	56° 16' N.; 2° 22' 39" W.	30	S.T.	Granton.	Imm.	Good.
2741	M.	37.5	37.6	14/ 2/ 13	45° E. ½ S. from Aberdeen.	57° 18' 50" N.; 0° 41' 10" W.	35	"	Aberdeen.	Spawning.	—
2743	M.	39.	39.3	18/ 2/ 13	22° S.-E. ½ E. from Aberdeen.	56° 59' N.; 1° 24' 5" W.	37	"	Aberdeen.	Imm.	Good.
2744	F.	35.	35.2	28/ 1/ 13	Close in shore off Largo.	56° 10' N.; 2° 54' W. (about).	4	Herring Nets.	Anstruther.	Imm.	Good.
2745	F.	40.5	41.4	22/ 6/ 13	35° E.-N.-E. of May Isle.	56° 32' N.; 1° 43' W.	30	S.T.	Granton.	Imm.	Good.
2746	F.	36.5	43.7	3/ 1/ 14	8° E./N. of Aberdeen.	57° 12' N.; 1° 49' W.	36	"	Aberdeen.	Imm.	Good.
2748	F.	39.	39.4	1/ 3/ 13	½ off between Pittenweem and St. Monans.	56° 14' N.; 2° 40' W.	10	Lines.	Anstruther.	Imm.	Good.
2750	M.	34.5	36.8	16/ 11/ 13	10° E. from Tod Head.	56° 56' N.; 1° 55' W.	35	S.T.	Aberdeen.	Nearly ripe.	Good.
2751	F.	46.	45.8	3/ 4/ 13	1° W. off Pittenweem.	56° 14' N.; 2° 39' W.	14	Line.	Cockenzie.	Spent.	Good.
2752	M.	36.	39.7	22/ 10/ 13	14° S.-E. from Noss Head.	58° 22' N.; 2° 39' W.	40-42	S.T.	Aberdeen.	Imm.	Good.
2755	M.	35.5	38.3	30/ 6/ 13	50° E.-N.-E. of May Isle.	56° 41' 20" N.; 1° 22' 10" W.	25	"	Granton.	Imm.	Good.
2758	M.	39.	39.8	11/ 4/ 13	Peterhead Bay.	57° 30' N.; 1° 45' W.	13	Line.	Peterhead.	Imm.	Good.
2761	M.	37.	37.2	16/ 3/ 13	7° E.-S.-E. from Aukerry.	59° 1' 30" N.; 2° 20' W.	48	S.T.	Aberdeen.	Ripe.	Good.
2762	F.	42.5	42.7	5/ 5/ 13	45° E. ½ S. of Aberdeen.	57° 16' 24" N.; 0° 44' 40" W.	35	"	Aberdeen.	Spent.	Good.
2764	M.	36.	38.8	20/ 6/ 13	15° E./N. of Bell Rock.	56° 33' 15" N.; 1° 58' W.	30	"	Granton.	Imm.	Good ; slight ulcer at mark.
2765	F.	47.	46.6	26/ 12/ 12	7° E.-N.-E. from Aberdeen.	57° 12' 50" N.; 1° 54' W.	31	"	Aberdeen.	Nearly ripe.	Good.
2766	F.	39.5	44.	15/ 1/ 14	22° S.-E./E. of Aberdeen.	57° 2' N.; 1° 23' W.	36	"	Aberdeen.	Ripe.	Good.
2769	F.	41.5	43.5	13/ 6/ 13	20° N.-E./E. of Bell Rock.	56° 41' 10" N.; 1° 59' W.	30	"	Granton.	Imm.	Good ; slight ulcer at mark.
2770	F.	36.	37.9	14/ 5/ 13	7° E.-S.-E. from Buchan Ness.	57° 27' 10" N.; 1° 31' W.	34	"	Aberdeen.	Imm.	Good.
2772	M.	34.	33.9	28/ 2/ 13	10° off Dumbeath.	58° 14' 30" N.; 3° 7' W.	31	Cod Net.	Wick.	Partly spent.	Fair.



TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 6th December 1912. Liberated, 20 miles E. of May Island— <i>continued</i> .												
Se. A. 10												
2817	M.	36-	37-7	17/ 7/13	8' E. of Bass.	56° 6' 50" N.; 2° 23' 50" W.	30	S.T. Small Lines.	Granton. Helmsdale.	Imm. Spawning.	Good.	
2818	M.	36-5	35-9	8/ 3/13	5' off Dunrobin Castle.	57° 55' N.; 3° 50' W.	18	"	"	Imm.	Good.	
2820	F.	35-5	38-5	7/ 7/13	1 m. E. of Bell Rock.	56° 26' 10" N.; 2° 20' 40" W.	13	S.T.	Dundee.	Imm.	Good; gutted.	
2821	F.	45-5	45-4	22/ 2/13	6' S.S.-E. of Buchan Ness.	57° 23' 20" N.; 1° 35' 50" W.	44	"	Aberdeen.	Imm.	Good; tail damaged.	
2822	M.	35-5	37-	25/ 8/13	29' E./S. $\frac{1}{2}$ S. of Tod Head.	56° 52' N.; 1° 20' W.	36	"	N. Shields.	Imm.	—	
2824	F.	35-	35-3	17/ 1/13	15' E.-S.-E. from Buchan Ness.	57° 26' 20" N.; 1° 16' 5" W.	65	"	Aberdeen.	Imm.	Good.	
2825	F.	34-5	34-3	26/12/12	6' E.-S.-E. from Newburgh.	57° 18' 30" N.; 1° 49' 10" W.	36	"	Aberdeen.	Imm.	Good.	
2827	F.	37-	—	26/ 2/14	5' S.-E. from Brora.	57° 58' N.; 3° 42' W.	18	Cod Nets	Lossiemouth.	—	—	
2830	F.	39-5	40-3	14/ 4/13	2' off Whitehills.	57° 42' N.; 2° 32' W.	14	"	Whitehills.	Imm.	Good.	
2831	M.	39-5	39-9	9/ 4/13	30' S.-E. of Aberdeen.	56° 53' 48" N.; 1° 14' 15" W.	37	S.T.	Aberdeen.	Ripe.	Good.	
2832	F.	42-5	45-2	22/ 6/13	30' S.S.-E. from Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	33	"	Aberdeen.	Imm.	Good.	
2835	F.	44-	47-9	30/ 7/13	23' E. of May.	56° 17' 15" N.; 1° 52' W.	30	"	Granton.	$\frac{3}{4}$ Ripe	Good.	
2838	M.	33-5	33-8	17/ 1/13	1' W. of Bell Rock.	56° 25' 55" N.; 2° 23' 30" W.	30	"	Dundee.	Imm.	Fair.	
2840	M.	34-	38-7	3/ 9/13	16' E. $\frac{3}{4}$ S. of May.	56° 13' 5" N.; 2° 3' 15" W.	27	"	"	Imm.	Good.	
2841	F.	34-5	36-3	2/ 6/13	14' E./N. $\frac{1}{2}$ N. of May Isle.	56° 18' 50" N.; 2° 10' W.	23	"	Granton.	Imm.	Good.	
2842	F.	42-5	45-	24/ 6/13	63' N.-E./E. from Inchkeith.	56° 50' 50" N.; 1° 53' W.	31	"	Granton.	Imm.	Good.	
2844	F.	35-	39-2	1/12/13	6' S.S.-E. of Buchan Ness.	57° 23' 30" N.; 1° 39' W.	45	"	Aberdeen.	Nearly ripe.	Good.	
2845	F.	34-5	37-7	24/12/13	10' S.-E. of Buchan Ness.	57° 23' 30" N.; 1° 30' W.	42	"	Aberdeen.	Imm.	Good.	
2846	F.	50-5	51-4	2/12/13	1' off Marine Gardens, Portobello.	55° 57' N.; 3° 6' W.	3	Line	Newhaven.	$\frac{3}{4}$ Ripe.	Good.	
2847	F.	51-5	55-2	21/ 1/14	2' off Whitehills.	57° 42' N.; 2° 32' W.	14	Cod Nets	Whitehills.	Near spawning.	Good.	

2848	M.	39.	10/ 2/13	¾ W. of Bell Rock.	56° 26' N.; 2° 23' W.	18	S.T.	Granton.	Nearly ripe.	Good.
2854	F.	43.	6/ 2/13	10° E.-S.-E. of May Isle.	56° 9' 50" N.; 2° 16' W.	30	"	Granton.	Nearly ripe.	Good.
2856	F.	33-9	19/12/12	20° E./S. from May Isle.	56° 12' 30" N.; 1° 54' 55" W.	24	"	Granton.	Imm.	Fair.
2858	M.	35-6	18/ 1/13	10-12° S.-E. of Aberdeen.	57° 2' N.; 1° 44' 5" W.	50	"	Aberdeen.	Nearly ripe.	Good.
2860	M.	35-5	10/ 8/13	—	—	—	—	N. Shields.	—	—
2861	M.	33-5	8/ 1/13	S.-E. from St. Andrews.	—	—	Cod Nets	St. Andrews.	Imm.	Good.
2863	F.	40-43	21/ 1/14	2° off Whitehills.	57° 42' N.; 2° 32' W.	14	"	Whitehills.	¾ Ripe.	Good.
2865	M.	36-6	19/ 1/13	5° E.-N.-E. from Aberdeen.	57° 11' 45" N.; 1° 55' 27" W.	30	S.T.	Aberdeen.	—	Good.
2866	F.	40-	4/ 9/13	50° E. of Bell Rock.	56° 40' N.; 0° 55' 25" W.	31	?	Dundee.	Fully ripe.	Good, gutted.
2867	M.	36-	14/11/13	7° E.-S.-E. of Buchan Ness.	57° 28' N.; 1° 33' W.	38	S.T.	Grimsby.	—	Sound.
2868	F.	38-5	26/ 3/13	9° S.S.-E. of Tod Head.	56° 45' 50" N.; 2° 3' W.	32	"	Aberdeen.	Imm.	Good.
2869	M.	38-	15/ 3/13	8° S. of Berriedale Head.	58° 3' N.; 3° 35' W.	28	Cod Net.	Lossiemouth.	Spent.	Fair.
2873	M.	39-	20/ 1/13	10° S.S.-E. from Aberdeen.	37° N.; 1° 52' W.	55	S.T.	Aberdeen.	Rather imm.	Good.
2874	F.	39-5	21/ 2/13	¼ off Pittenweem.	56° 14' N.; 2° 39' W.	10	Lines.	Anstruther.	Rather imm.	Good.
2875	M.	35-2	28/ 2/13	15½° W.-N.-W. of Cape Wrath.	58° 38' 30" N.; 5° 30' W.	35	S.T.	Grimsby.	—	Sound.
2876	F.	35-	2/ 7/13	16° E. ½ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	30	"	Granton.	Imm.	Good.
2877	F.	41-5	29/ 6/13	51° E.-S.-E. ¾ S. of Tod Head.	56° 41' N.; 0° 43' W.	36	"	Hartlepool.	—	Sound.
2880	F.	40-5	4/ 4/13	26° S.-E./E. of Aberdeen.	57° 0' 30" N.; 1° 17' 50" W.	40	"	Aberdeen.	Imm.	Good.
2882	M.	34-	11/ 7/13	9° E./S. of May.	56° 12' N.; 2° 16' W.	25	"	Granton.	Imm.	Good.
2884	F.	40-	18/ 3/13	25° S.-E./E. of Aberdeen.	57° N.; 1° 20' W.	36	"	Blyth.	?	?
2887	F.	40-	19/ 2/13	19° S.-E. from Aberdeen.	56° 58' 45" N.; 1° 33' 5" W.	38	"	Aberdeen.	Partly spent.	Good.
2888	M.	37-5	27/ 2/13	3' N. ½ E. of Burghed.	57° 45' N.; 3° 30' W.	22	"	Grimsby.	?	?
2889	M.	35-5	12/ 5/13	5° E.-N.-E. from Aberdeen.	57° 11' 45" N.; 1° 53' 27" W.	32	"	Aberdeen.	Imm.	Good.
2894	F.	34-	10/ 6/13	4½ S.S.-E. from Collieston.	57° 22' N.; 1° 45' W.	32	"	Aberdeen.	Imm.	Good.
2895	M.	34-	17/ 6/13	23° N.-E. ½ N. of May Isle.	56° 32' N.; 2° 20' W.	30	"	Granton.	Imm.	Good.
2898	M.	35-5	13/ 2/13	27° E.-S.-E. from Aberdeen.	57° 5' N.; 1° 15' 20" W.	35	"	Aberdeen.	Spawning.	Good.
2899	M.	35-5	11/ 2/13	4' N. of St. Andrews.	56° 23' 25" N.; 2° 48' 5" W.	1	Flounder Net.	St. Andrews.	Ripe.	Good.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Length Cm.	Date.	PLACE.					
Date, 6th December 1912. Liberated, 20 miles E. of May Island— <i>continued</i> .										
Sc. A. 10										
2900	F.	46	16/ 2/13	24½' S.-E./E. of Aberdeen.	57° 0' 40" N.; 1° 20' W.	S.T.	Aberdeen.	Spawning. Nearly ripe.	Good.	
2902	M.	39	16/ 1/14	4' E. of Carr Light.	56° 19' 20" N.; 2° 27' W.	"	Granton.	Rather imm. Nearly ripe.	Good.	
2904	F.	37	18/12/12	20' E./S. of May Isle.	56° 12' 30" N.; 1° 54' 55" W.	"	Granton.	Imm. Nearly ripe.	Good.	
2906	M.	35.5	18/12/12	20' E./S. of May Isle.	56° 12' 30" N.; 1° 54' 55" W.	"	Granton.	Imm. Nearly ripe.	Good.	
2908	F.	41.5	16/ 2/14	4' off Macduff.	57° 44' 30" N.; 2° 30' W.	Cod Nets	Macduff.	Nearly ripe.	Good.	
2909	M.	35	31/10/13	16' E. of May.	56° 16' N.; 2° 5' W.	S.T.	Granton.	About ½ ripe.	Good.	
2910	M.	43	18/ 2/13	24' S.-E./E. from Aberdeen.	57° 1' N.; 1° 21' 30" W.	"	Aberdeen.	Partly spent.	Good.	
2911	M.	43	12/ 8/13	25' E./N. of Bell Rock.	56° 38' N.; 1° 41' 55" W.	"	Granton.	Ripe.	Good.	
2915	F.	33	21/12/12	2' S.-E. from St. Andrews ?	56° 20' N.; 1° 41' W.	Cod Nets	St. Andrews.	Imm.	Fair.	
2916	F.	33	17/12/13	30' E. of May Isle.	56° 20' N.; 1° 41' W.	S.T.	Granton.	Imm.	Good.	
2919	M.	36.5	18/10/13	6' S.-E. from Cruden Bay.	57° 21' N.; 1° 40' W.	"	Aberdeen.	Nearly ripe.	Good.	
2920	F.	37	11/ 2/13	12' E.-S.-E. from Dunbeath.	58° 13' 35" N.; 3° 2' 10" W.	Cod Nets	Lossiemouth.	ripe.	Good.	
2921	F.	35	16/ 9/13	16' E./S. of May Isle.	56° 12' 5" N.; 2° 4' W.	S.T.	Granton.	Imm.	Good.	
2922	M.	34.5	28/ 7/13	22' E.-N.-E. of May.	56° 24' 55" N.; 2° 1' W.	"	Granton.	—	—	
2924	F.	45	18/ 4/13	56' N. of Rattray Head.	58° 30' 50" N.; 2° 19' 50" W.	"	Dundee.	Spent.	Good.	
2925	F.	39	15/ 5/13	7' E. ¼ S. of Noss Head.	58° 30' N.; 2° 50' W.	"	Grimsby.	Sound.	—	
2928	F.	34	19/ 6/13	20' E.-N.-E. of May Island.	56° 23' 5" N.; 2° 3' 30" W.	"	Newhaven.	Imm.	Good.	
2929	F.	32.5	21/ 3/13	8' E. of May Isle.	56° 12' 55" N.; 2° 18' W.	"	Granton.	Imm.	Fair.	

2930	M.	38.	37-7	2/ 9/13	300 yds. off shore in Largo Bay.	56° 10' N.; 2° 55' W.	10	Line	Peterhead	Imm.	Good; some ulceration at mark.
2933	F.	34.	34-4	7/ 3/13	1½' off Banff.	57° 41' 30" N.; 2° 30' W.	14	Cod Nets	Whitehills.	Imm.	Good.
2936	M.	38-5	30-9	25/ 5/13	9' S.-E. from Buchan Ness.	57° 23' 50" N.; 1° 31' 30" W.	40	S.T.	Aberdeen.	Spent.	Good.
2937	M.	31-5	34-6	15/ 7/13	10' N.-E. of May Isle.	56° 20' N.; 2° 23' 40" W.	26	"	Granton.	Imm.	Good.
2938	F.	34.	36-4	6/ 6/13	10' E. of May Isle.	56° 13' 50" N.; 2° 15' W.	30	"	Granton.	Imm.	Good.
2940	F.	34.	37-5	8/ 7/13	3-4' W. of Bell Rock.	56° 25' N.; 2° 29' W.	25	"	Granton.	Imm.	Good.
2943	M.	37.	37-9	9/ 7/13	35' N.-E. of May Isle.	56° 42' N.; 2° 2' W.	25	"	Granton.	Imm.	Fair.
2945	M.	33.	33-4	26/ 3/13	9' S.-E. of May Isle.	56° 7' N.; 2° 18' W.	30	"	Granton.	Imm.	Good.
2946	F.	38.	44-3	12/11/13	16' E.-S.-E. from Aberdeen.	57° 7' N.; 1° 33' W.	45	"	Aberdeen.	Fully ripe.	Good.
4184	F.	42-5	45-5	22/ 6/13	35' E.-N.-E. from May Isle.	56° 34' N.; 1° 43' W.	30	"	Granton.	Spent.	Good.
Stud. No.	M.	31-5	39-7	26/ 1/14	1 m. off Whitehills.	57° 42' N.; 2° 32' W.	10	"	Whitehills.	Nearly ripe.	Good.
1254	F.	30-5	33-4	21/ 7/13	¾ S.S.-E. of Bell Rock.	56° 25' 20" N.; 2° 22' W.	25	"	Granton.	Imm.	—
1255	F.	33.	33.	12/ 3/13	16' N.-W. of Carr Lightship?	56° 10' N.; 2° 55' W.	27	"	Newhaven.	Imm.	Good.
1257	F.	28.	28.	27/ 2/13	1' off Largo.	56° 12' N.; 2° 45' W.	10	Lines.	Anstruther.	Imm.	Fair.
1260	F.	33.	34.	26/ 3/13	1' off St. Monans.	56° 59' 12" N.; 1° 23' W.	12	S.T. "Goldseeker"	—	—	—
* 1262	M.	32-5	32-8	27/ 2/13	24' S.-E. ¼ E. of Aberdeen.	56° 59' 12" N.; 1° 23' W.	34	S.T.	Aberdeen.	Very imm.	Good.
1266	F.	32.	37-8	41/12/13	18' E. ½ S. of May.	56° 15' N.; 2° W.	33	"	Leith.	Imm.	Good.
1267	F.	35-5	35-8	21/ 2/13	29' E. ¼ S. of Spurn Point.	53° 40' N.; 0° 55' E.	13	"	Grimsby.	—	Sound.
1268	M.	30-5	30-7	24/ 2/13	4' N.-E. of St. Andrews.	56° 24' N.; 2° 43' W.	9	Cod Nets	Dundee.	Very imm.	Tail slightly damaged; good
1270	M.	31-5	33-9	28/ 10/13	7' S.-E. from Buchan Ness.	57° 25' N.; 1° 35' W.	37	S.T.	Aberdeen.	Imm.	Good.
1271	F.	34.	39-2	19/10/13	4' S.-E. of Bell Rock.	56° 24' N.; 2° 17' W.	23	"	Granton.	Imm.	Good.
1273	M.	33.	34-7	28/ 4/13	1' off Largo.	56° 10' N.; 2° 55' W.	10	Line.	Anstruther.	Imm.	Good.
1275	M.	31-5	34-9	21/ 8/13	5-6' S. of Bell Rock.	56° 21' N.; 2° 20' W.	25	S.T.	Granton.	Imm.	Good.
1278	M.	30.	34-6	22/ 8/13	17' S.-E. from Buchan Ness.	57° 20' N.; 1° 18' 30" W.	50	"	Aberdeen.	Imm.	Good.
1280	F.	31-5	31-7	26/ 3/13	18' E.-S.-E. from Noss Head.	58° 26' 30" N.; 2° 28' W.	36	"	Aberdeen.	Imm.	Good.
1283	M.	32.	33-7	3/ 8/13	16 m. E./S. of May Island.	56° 12' 5" N.; 2° 4' W.	27	"	Granton.	Imm.	Good.
1286	M.	32.	32.	24/ 7/13	9' N.-E. of May.	56° 18' 50" N.; 2° 24' 35" W.	30	"	Granton.	—	—
1289	F.	29.	36-6	21/ 8/13	5-6' S. of Bell Rock.	56° 21' N.; 2° 20' W.	30	"	Granton.	Imm.	Good.
1290	F.	31-5	31-5	25/ 8/13	2' E. from Bell Rock.	56° 26' 40" N.; 2° 18' W.	18	"	Dundee.	Imm.	Good.
1292	F.	27-5	33-4	11/11/13	4-5' E. of Bell Rock.	56° 28' N.; 2° 14' W.	26	"	Granton.	Nearly ripe.	Good.

\* Again liberated, 58° 10' N.; 2° 30' W., on 27th March 1913.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 26th March 1913. Liberated, * 56° 8' N.; 2° 48' W.; between Elie and Fidra. Depth, 27 Fms.												
Sc. A. 10												
2959	F.	41·	41·5	24/ 6/13	4' E. of Bell Rock.	56° 26' 50" N.; 2° 16' 25" W.	25	S.T. Lines.	Granton.	Spent.	Good.	
2960	M.	33·	32·9	28/ 3/13	1' off Largo.	56° 12' N.; 2° 56' W.	4	"	Anstruther.	Imm.	Good.	
2961	M.	35·5	35·7	9/ 4/13	1' off Pittenweem.	56° 14' 30" N.; 2° 37' W.	4½	"	Cockenzie.	Imm.	Good.	
2964	F.	39·5	39·2	19/ 5/13	8' E. of May Isle.	56° 12' 55" N.; 2° 18' W.	20	S.T. Lines.	Granton.	Imm.	Good.	
2965	F.	37·	37·2	25/ 4/13	Largo Bay.	56° 12' N.; 2° 56' W. (about).	8	"	Anstruther.	Imm.	Good.	
2966	M.	34·5	35·2	19/ 5/13	Elie Bay.	56° 11' N.; 2° 49' W.	4	"	Anstruther.	Imm.	Fair.	
2969	F.	36·5	41·8	17/10/13	15-18' E.-N.-E. of May.	56° 22' N.; 2° 9' W.	28	S.T. Cod Nets	Granton.	Imm.	Good.	
2972	F.	33·5	41·3	20/ 2/14	1½' off Banff.	57° 41' 30" N.; 2° 30' W.	14	"	Whitehills.	Spent.	Good.	
2973	F.	40·	44·3	24/ 1/14	1' off Banff.	57° 41' 30" N.; 2° 30' W.	10	"	Whitehills.	¾ Ripe.	Good.	
2976	F.	35·5	37·7	17/ 7/13	Off Dysart Harbour.	56° 7' N.; 3° 6' W.	5	"	Dysart.	Imm.	Good.	
2979	M.	37·	37·	11/ 4/13	Off Pittenweem.	56° 14' 30" N.; 2° 37' W.	4½	Line.	Anstruther.	Imm.	Good.	
2981	M.	33·5	38·6	10/12/13	6' S.-E. from Buchan Ness.	57° 25' 30" N.; 1° 36' W.	43	S.T. Line.	Aberdeen.	Imm.	Good.	
2987	M.	35·5	35·5	31/ 3/13	1' N.-E. of Pittenweem.	56° 13' N.; 2° 42' W.	15	Line.	Cockenzie.	Imm.	Good.	
2989	F.	38·5	41·6	28/ 7/13	20' E. of May Island.	56° 16' 25" N.; 1° 57' 56" W.	27	S.T. "	Granton.	—	Good.	
2993	F.	36·	38·4	16/ 9/13	40' off May Island.	56° 17' N.; 1° 20' W.	35	"	Granton.	—	Good; gutted.	
2999	F.	42·	44·8	2/11/13	4 m. E. of Bell Rock.	56° 27' N.; 2° 15' W.	26	—	Dundee.	½ ripe. Fully ripe. ½ ripe.	Good.	
5003	M.	33·	—	25/ 2/14	4' N. ½ E. of Tarbet Ness.	57° 56' N.; 3° 48' W.	21	Cod Nets	Cromarty.	Imm.	—	
5008	F.	35·5	35·	1/ 5/13	11' E. of May Isle.	56° 14' 30" N.; 2° 13' W.	30	S.T. "	Granton.	Imm.	Good.	
5013	F.	35·5	39·8	18/ 2/13	5' E.-S.-E. from Aberdeen.	56° 8' N.; 1° 54' W.	35	"	Aberdeen.	Imm.	Good.	
5014	F.	42·5	44·	25/ 6/13	18' S.S.-F. from Aberdeen.	56° 54' N.; 1° 43' W.	34	"	Aberdeen.	Spent.	Good.	
5017	F.	37·5	40·5	3/11/13	10' S.S.-E. from Buchan Ness.	57° 20' N.; 1° 34' W.	42	"	Aberdeen.	Fully ripe.	Good.	
5018	F.	39·	39·9	25/ 6/13	20' E.-N.-E. of May Island.	56° 23' 5" N.; 2° 3' 30" W.	30	"	Granton.	¾ ripe.	Good.	
5020	M.	33·	35·5	20/ 8/13	8' E. of Carr Light.	56° 20' N.; 2° 20' W.	25	"	Granton.	Imm.	Good.	





TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.			Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Date.	PLACE.	LATITUDE AND LONGITUDE.					
Date, 26th March 1913. Liberated, 20 miles E. of May Island— <i>continued</i> .										
Sc. A. 10										
5080	F.	37.5	25/ 8/13	16° E.-N.-E. of May.	56° 21' N.; 2° 10' W.	S.T.	Granton.	—	Good.	
5085	F.	41.5	7/ 9/13	16° E./S. of May.	56° 12' 6" N.; 2° 4' W.	"	Granton.	Imm.	Good.	
5089	F.	37.1	10/ 7/13	3-4° W. of Bell Rock.	56° 24' 50" N.; 2° 30' W.	"	Granton.	Imm.	Good.	
5090	M.	34.5	22/ 8/13	10° E.-S.-E. Montrose.	56° 41' 50" N.; 2° 9' W.	"	Newhaven.	Imm.	Good.	
5091	M.	32.5	34.5	20/ 8/13	11° S.S.-E. from Tod Head.	"	"	Imm.	Good.	
5092	F.	35.5	39.9	2/ 12/13	27° E./S. of May.	"	"	Imm.	Good.	
5094	F.	34.5	38.	15/ 8/13	30° E. of May Island.	"	Leith.	Imm.	Good.	
5103	M.	41.5	42.	15/ 6/13	22° E.-N.-E. of May Island.	"	Granton.	Imm.	Good.	
5106	M.	37.5	38.8	20/ 8/13	8° E./S. from Aberdeen.	"	Granton.	Imm.	Good; gutted.	
5107	M.	33.8	32.8	9/ 4/13	5-6° E.-N.-E. of May Isle.	"	Aberdeen.	Imm.	Good.	
5113	M.	33.5	38.3	19/ 2/14	11° N.-W./N. of Covesea Light-house.	"	Granton.	Imm.	Good.	
					57° 50' N.; 3° 36' 30" W.	Cod Nets	Lossiemouth.	Ripe.	Good.	
5115	F.	34.5	26/ 9/13	Between May Island and Crail.	56° 14' N.; 2° 36' W. (about).	—	Anstruther.	Imm.	Good.	
5118	F.	35.5	15/ 5/13	8° E. of May Isle.	56° 12' 55" N.; 2° 18' W.	S.T.	Granton.	Imm.	Good.	
Stud.No.										
1314	F.	33	1/ 7/13	16° E. ½ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	"	Granton.	Imm.	Good.	
1315	M.	34	24/12/13	3° E.-S.-E. of Bell Rock.	56° 25' 40" N.; 2° 18' W.	"	Dundee.	Imm.	Good.	
1316	M.	32	31/ 7/13	16° E. 4 S. of May Isle.	56° 13' 15" N.; 2° 3' 15" W.	S.T.	Granton.	Imm.	Fair.	
1319	F.	32	36.1	28/ 8/13	43° E.-S.-E. of Bass.	"	Granton.	Imm.	Fair.	
1320	F.	33.5	35.	20/ 6/13	16 m. S.-E. from Aberdeen.	"	Dundee.	Imm.	Fair; gutted.	
1325	F	32.	3/ 8/13	16 m. E./S. of May Island.	57° N.; 1° 37' 55" W.	"	Dundee.	Imm.	Good; some ulcer at mark.	
					56° 12' 5" N.; 2° 4' W.	"	Granton.	Imm.	Good.	
1328	M.	34.5	18/ 6/13	15½ E. of May Island.	56° 15' N.; 2° 5' W.	"	Grimsby.	Imm.	—	
1329	F.	32.5	37.3	15/10/13	6° E. of Bell Rock.	"	Granton.	Imm.	Good.	
1330	M.	35.	14/ 7/13	30 m. E. of May Island.	56° 19' 5" N.; 1° 40' W.	"	Newhaven.	Imm.	Good.	
1333	M.	33.	7/ 4/13	8° N.-W. of Bell Rock.	56° 29' 45" N.; 2° 36' 40" W.	" ?	Dundee.	Imm.	Fair.	



TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.							R. Organs.	Port Landed.	Condition.
			Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.			
Date, 27th March 1913. Liberated, 56° 55' N.; 1° 8' W.— <i>continued</i> .												
So. A. 10												
5183	F.	35.	34.9	3/ 4/13	27' E.-S.-E. of Aberdeen.	57° 5' N.; 1° 15' 20" W.	32	S.T.	Aberdeen.	Imm.	Good.	
5184	F.	40.5	43.	5/ 8/13	60' N.-E. of May Isle.	57° 3' 5" N.; 1° 42' W.	46	"	Newhaven.	Rather imm.	Good.	
5185	F.	35.	34.8	6/ 4/13	37' S.S.-E. of Aberdeen.	56° 39' N.; 1° 21' W.	35	"	Aberdeen.	Imm.	Fair.	
5186	F.	36.5	39.3	12/ 8/13	33' E./N. of May Island.	56° 26' N.; 1° 40' W.	33	"	Granton.	Imm.	Good.	
5189	F.	38.5	38.7	25/ 5/13	45' E.-N.-E. of May Isle.	56° 38' 15" N.; 1° 29' 40" W.	38	"	Granton.	Imm.	Good.	
5190	M.	34.5	35.3	1/ 6/13	12-14' E.-S.-E. from Noss Head.	58° 26' 50" N.; 2° 41' W.; 58° 26' 30" N.; 2° 34' 30" W.	35	"	Aberdeen.	Imm.	Good.	
5192	F.	39.	39.1	12/ 4/13	25' S.-E./E. from Aberdeen.	57° 0' 40" N.; 1° 19' W.	34	"	Aberdeen.	Spent.	Good.	
5193	F.	34.	36.	27/ 6/13	20' E./S. of St. Abb's Head.	55° 58' N.; 1° 32' W.	35	"	N. Shields.	—	—	
5199	M.	35.	34.6	4/ 4/13	35' S.S.-E. of Girdle Ness.	56° 41' N.; 1° 22' W.	37	"	Granton.	Imm.	Good.	
5200	M.	37.5	40.7	3/ 9/13	26' E.-S.-E. from Aberdeen.	57° 6' N.; 1° 16' W.	34	"	Aberdeen.	Imm.	Good.	
5202	F.	32.	32.3	30/ 3/13	25' S.-E. from Aberdeen.	56° 56' N.; 1° 23' 10" W.	29	"	Aberdeen.	Imm.	Good.	
5203	M.	37.5	37.5	18/ 4/13	23' S.-E. from Aberdeen.	56° 55' N.; 1° 18' W.	33	"	Aberdeen.	Imm.	Good.	
Stud. No.												
1338	M.	35.	35.4	3/ 4/13	27' E.-S.-E. from Aberdeen.	57° 5' N.; 1° 15' 20" W.	32	"	Aberdeen.	Imm.	Good.	
1339	M.	32.	36.	10/12/13	10' E. from Aberdeen.	57° 11' 30" N.; 1° 45' W.	45	"	Aberdeen.	Imm.	Good.	
1340	F.	31.5	31.3	31/ 3/13	27' S.-E./E. from Aberdeen.	57° 0' 30" N.; 1° 17' 24" W.	34	"	Aberdeen.	Imm.	Fair.	
1341	F.	35.5	35.8	1/ 4/13	61' E./N. from Bell Rock.	56° 54' 55" N.; 0° 46' W.	35	"	Aberdeen.	Imm.	Good.	
1342	M.	29.5	39.9	10/10/13	50' off Bell Rock.	56° 30' N.; 0° 51' W. (about).	38	—	Dundee.	Imm.	Good.	
1344	F.	33.5	37.7	17/ 2/14	27' S. $\frac{1}{2}$ E. from Aberdeen.	56° 43' 30" N.; 1° 41' W.	32	S.T.	Aberdeen.	Imm.	Good.	
1345	F.	32.5	32.7	5/ 5/13	20' N.-E. of May Isle.	56° 28' N.; 2° 16' W.	27	"	Leith.	Imm.	Good.	
1347	F.	33.5	37.3	10/11/13	10' E.-S.-E. of Bell Rock	56° 25' N.; 2° 4' W.	32	"	Granton.	Imm.	Good.	
1352	F.	32.5	34.1	27/ 6/13	20' E. of Bell Rock.	56° 32' N.; 1° 48' W.	26	"	Dundee.	Imm.	Good.	
1353	F.	33.5	33.9	23/ 5/13	12' N.-E. of Bell Rock.	56° 35' 55" N.; 2° 12' 13" W.	25	"	Granton.	Imm.	Good.	

## Date, 27th March 1913. Liberated, E. of Smith Bank (Moray Firth), 58° 10' N.; 2° 35' W. Depth, 30 Fms.

Sc. A. 10	Date, 27th March 1913.	Liberated, E. of Smith Bank (Moray Firth), 58° 10' N.; 2° 35' W.	Depth, 30 Fms.	Imm.	Sound.
5214	F. 38-	16/10/13 19' N.-N.-E. from Buckie.	34	Buckie.	Good.
5217	M. 36.5	4 E. $\frac{1}{4}$ N. of Noss Head.	32	Grimsby.	Sound.
5219	F. 32.5	W. of Smith Bank (Moray Firth).	20	Geestemunde	—
5221	F. 41.5	11 m. E./S. from Noss Head.	34	Aberdeen.	Good.
5222	M. 35-	18 m. W.-N.-W. from Stack Skerry.	43	Aberdeen.	Good.
5223	M. 31.5	9/3/14 Moray Firth.	—	London.	Sound.
5224	F. 38.5	17/7/13 —	20	Grimsby.	—
5229	F. 35.5	2/6/13 12' E.-S.-E. from Noss Head.	35	Aberdeen.	Good.
5232	M. 33-	8/3/14 8' E./N. of Sule Skerry.	54	Grimsby.	Sound.
5240	M. 32.5	16/4/13 22' E./S. of Clyth Ness.	32	Grimsby.	?

## Date, 27th March 1913. Liberated, E. of Smith Bank (Moray Firth), 58° 10' N.; 2° 30' W. Depth, 30 Fms.

Sc. A. 10	Date, 27th March 1913.	Liberated, E. of Smith Bank (Moray Firth), 58° 10' N.; 2° 30' W.	Depth, 30 Fms.	Imm.	Sound.
5241	M. 33.5	?/11/13 8 $\frac{1}{2}$ ' E. of Brora.	28	Grimsby.	Sound.
5244	F. 39.5	4/9/13 $\frac{1}{2}$ ' off Land Castle, Cray Bank.	3	Cromarty.	Good.
5245	F. 38-	11/2/14 4 $\frac{1}{2}$ ' N. of Dunnet Head.	47	Aberdeen.	Good.
5246	F. 41.5	15/10/13 2 $\frac{1}{2}$ ' E.-N.-E. $\frac{1}{2}$ ' E. of Noss Head.	27	Grimsby.	Sound.
5247	M. 37.5	15/5/13 10' S.-E./E. $\frac{1}{2}$ ' S. of Clyth Ness.	25	Grimsby.	Sound.
5248	F. 43-	2/4/13 6' S.-E./S. $\frac{1}{2}$ ' S. of Clyth Ness.	25	Ymuiden.	Sound.
5251	F. 39.5	24/8/13 20' S.-E. from Noss Head.	30	Aberdeen.	Good.
5256	F. 34-	3/5/13 18' S.-E./E. of Noss Head.	35	Granton.	Good.
5258	F. 38-	11/7/13 5' E. of Noss Head.	32	Grimsby.	—
5261	M. 36-	? 18' E./S. $\frac{2}{3}$ ' S. of Berriedale Head.	18-22	Grimsby.	Griffed.
5264	F. 43-	15/10/13 2' E./N. $\frac{2}{3}$ ' N. of Noss Head.	27	Grimsby.	End of caudal broken off.
5269	M. 34.5	19/9/13 10' S.-E./E. of Clyth Ness.	24	Grimsby.	Sound.
5272	F. 33.5	16/8/13 45' N./W. from Ratray Head.	30	Aberdeen.	Good.
5278	F. 35-	4/4/13 12 m. S. of Noss Head.	29	Ymuiden.	Sound.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.			Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
					LATITUDE AND LONGITUDE.							
Date, 27th March 1913. Liberated, 58° 10' N.; 2° 30' W.— <i>continued.</i>												
Sc. A. 10												
5285	F.	38.5	1/ 5/13	32½' E./S. ¼ S. of Clyth Ness.	58° 20' N.; 2° 10' W.		25	S.T.	Ymuiden.	—	Sound.	
5286	F.	37.	27/ 4/13	14½' S.-E. ¼ S. of Clyth Ness.	58° 10' N.; 2° 50' W.		22	"	Ymuiden.	—	Sound	
5291	F.	37.	25/10/13	8' N.-E. from Kinnaird Head.	57° 40' N.; 1° 53' W.		59	"	Aberdeen.	Imm.	Good.	
Stud.No.												
1355	M.	34.2	?/11/13	4' S. ¼ E. of Helmsdale.	58° 3' N.; 3° 35' W.		28	"	Grimby.	—	Sound.	
1359	M.	31.	19/ 9/13	10' S.-E./E. of Clyth Ness.	58° 15' N.; 2° 55' W.		24	"	Grimby.	—	Sound.	
1364	M.	34.	26/ 5/13	5' N./E. ¼ E. of Buckie.	57° 45' N.; 3° W.		18	"	Grimby.	Imm.	—	
1374	F.	32.	17/ 5/13	2' E. from Findhorn.	57° 40' 30" N.; 3° 35' W.		4	In Sal- mon Net.	Findhorn.	—	—	
Date, 21st May 1913. Liberated,* on Aberdeen Bank, 56° 55' N.; 1° 8' W. Depth, 37 Fms.												
Sc. A. 10												
5365	F.	42.	26/ 6/13	20' E./S. of St. Abb's Head.	55° 57' N.; 1° 34' W.		35	S.T.	N. Shields.	—	—	
5366	F.	40.5	6/ 6/13	35' E./N. ¼ N. of May Island.	56° 30' N.; 1° 38' W.		29	"	Newhaven.	Spent.	Good.	
5367	M.	36.3	28/ 6/13	30' E. of Buoy of Tay.	56° 35' N.; 1° 45' W.		30	"	Dundee.	Spent.	Good.	
5370	F.	46.5	21/ 5/13	29' E./S. ¼ S. of Tod Head.	58° 51' N.; 1° 20' W.		36	"	Grimby.	—	Guffed.	
5376	M.	36.5	Before	40' E.-S.-E. from Bell Rock.	56° 20' 45" N.; 1° 10' 50" W.		35	"	Dundee.	Imm.	Good.	
5378	F.	53.	22/ 8/13					"				
			14/ 6/13	18' S.S.-E. from Aberdeen.	56° 54' N.; 1° 43' W.		41	"	Aberdeen.	Spent.	Good.	

5379	F.	39-	40-2	10/10/13	50' S.-E. of Aberdeen.	56° 24' 35" N.; 1° 21' 55" W.	33	"	Aberdeen.	Imm.	Good.
5380	F.	47-	46-5	21/ 5/13	29' E./S. $\frac{1}{2}$ S. of Tod Head.	56° 51' N.; 1° 20' W.	36	"	Grimsby.	Nearly ripe.	Sound; gutted
5382	M.	38-5	40-5	16/ 1/14	26' S.-E. $\frac{3}{4}$ S. of Aberdeen.	56° 53' N.; 1° 24' W.	40	"	Aberdeen.	Imm.	Good.
5384	F.	42-	43-9	3/ 9/13	35' E.-S.-E. from Aberdeen.	57° 4' 10" N.; 1° W.	45	"	Aberdeen.	Imm.	Good.
5385	M.	39-	39-6	12/ 9/13	40' E. of Bell Rock.	56° 37' N.; 1° 13' W.	47	"	Dundee.	Imm.	Fair; gutted.
5388	M.	37-	41-1	2/12/13	20' S.-E. from Aberdeen.	56° 58' N.; 1° 31' W.	40	S.T.	Aberdeen.	Nearly ripe.	Good.
5389	F.	36-5	36-2	21/ 5/13	29' E./S. $\frac{1}{2}$ S. of Tod Head.	56° 51' N.; 1° 20' W.	36	"	Grimsby.	—	Sound; gutted
5390	F.	36-5	36-5	29/ 6/13	20' E.-N.-E. of May Isle.	56° 23' 5" N.; 2° 30' W.	30	"	Granton.	Imm.	Good.
5392	F.	38-5	41-1	20/ 8/13	50' S.-E. of Tay Buoy.	56° 2' 30" N.; 1° 16' W.	31	"	Dundee.	Imm.	Good.
5393	F.	63-5	63-1	19/ 6/13	40' E./N. of May Isle.	56° 30' N.; 1° 28' W.	36	"	Granton.	Spent.	Good.
5394	F.	37-	39-1	28/11/13	19' S./E. $\frac{1}{2}$ E. of Aberdeen.	56° 52' N.; 1° 44' W.	40	"	Aberdeen.	$\frac{3}{4}$ Ripe.	Good.
5400	F.	40-	38-	15/ 6/13	13 $\frac{1}{2}$ E. $\frac{1}{2}$ S. of Noss Head.	58° 31' N.; 2° 38' W.	37	"	Hartlepool.	—	—
5401	M.	43-5	43-8	14/ 9/13	37' S.-E./E. $\frac{1}{2}$ S. of Tod Head.	56° 40' N.; 1° 9' W.	35	"	Hartlepool.	—	Sound.
5402	M.	38-	39-2	11/ 7/13	30' E. of Bell Rock.	56° 34' N.; 1° 30' 55" W.	32	"	Dundee.	Imm.	Good.
5404	F.	42-5	44-	25/ 8/13	50' E.-S.-E. $\frac{1}{2}$ S. of Tod Head.	56° 45' N.; 0° 43' W.	38	"	Hartlepool.	Imm.	Good.
5409	F.	43-	45-1	19/ 2/14	25' S.-E. from Aberdeen.	56° 56' N.; 1° 23' W.	36	"	Aberdeen.	Spawning.	Good.
5410	F.	38-	38-	13/ 7/13	91' E. of St. Abb's Head.	56° 20' N.; 0° 30' E.	35	"	Hartlepool.	Imm.	—
5411	M.	37-5	40-2	23/ 1/14	10' E. of Bass Rock.	56° 8' N.; 2° 20' W.	26	"	Granton.	Nearly ripe.	Fair.
5413	M.	35-	34-6	21/ 5/13	29' E./S. $\frac{1}{2}$ S. of Tod Head.	56° 51' N.; 1° 20' W.	36	"	Grimsby.	—	Sound; gutted
5416	M.	35-5	38-5	17/10/13	12' E./S. of Bell Rock.	56° 27' N.; 2° W.	28	"	Granton.	About $\frac{3}{4}$ ripe.	Good.
5422	F.	38-5	38-5	25/ 6/13	25' S.-E. from Aberdeen.	56° 45' 30" N.; 1° 40' W.	33	"	Aberdeen.	Imm.	Good.
5423	F.	44-5	45-8	16/ 1/14	26' S.-E. $\frac{3}{4}$ S. from Aberdeen.	56° 53' N.; 1° 24' W.	40	"	Aberdeen.	Nearly ripe.	Good.
5428	M.	37-5	36-8	4/ 6/13	30' E.-N.-E. of Carr.	56° 36' 30" N.; 1° 52' W.	30	"	Granton.	Imm.	Good.
5432	F.	42-5	44-3	1/10/13	30' E. of Bell Rock.	56° 34' N.; 1° 30' 55" W.	32	"	Dundee.	About $\frac{1}{2}$ ripe.	Good.
5433	M.	38-	38-3	21/ 6/13	27' E.-S.-E. of Girdle Ness.	57° 5' N.; 1° 15' 20" W.	35	"	Dundee.	Imm.	Good.
5435	F.	44-	44-9	22/ 8/13	40' E.-N.-E. of May Isle.	56° 35' 5" N.; 1° 37' 40" W.	60	"	Granton.	Spent.	Good.
5436	F.	39-	39-3	25/ 6/13	28' E.-S.-E. from Aberdeen.	57° 4' 55" N.; 1° 12' 50" W.	38	"	Aberdeen.	Spent.	Good.
5438	F.	40-5	43-6	10/ 9/13	30' S.-S.-E. from Aberdeen.	56° 45' 48" N.; 1° 29' 10" W.	38-40	"	Aberdeen.	About $\frac{1}{2}$ mature.	Good.
5443	F.	46-5	46-6	3/12/13	35' S.-S.-E. of Aberdeen.	56° 41' N.; 1° 23' W.	35	"	Aberdeen.	$\frac{3}{4}$ Ripe	Good.

\* Caught Dornoch Firth, 20th May 1913.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.	Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.								
Date, 21st May 1913. Liberated, 56° 55' N.; 1° 8' W.— <i>continued.</i>											
Stud.No.											
1377	M.	32.5	33.3	1/ 7/13	16'E. ½ S. of May.	56° 13' 5" N.; 2° 3' 15" W.	27	S.T.	Granton.	Imm.	Good.
1378	M.	33.5	38.	10/ 2/14	25' S./E. of Aberdeen.	56° 47' N.; 1° 40' W.	35	"	Aberdeen.	Ripe.	Good.
1381	F.	28.5	29.	About	27' E.-N.-E. from May Isle.	56° 28' N.; 1° 25' W.	26	"	Granton.	Imm.	Fair.
				17/ 6/13							
1388	M.	31.	31.1	16/ 6/13	½ N.-E. from Bell Rock.	56° 26' 30" N.; 2° 22' 45" W.	18	"	Dundee.	Imm.	Fair.
1389	M.	27.	31.	26/ 8/13	20' E. of May Isle.	56° 16' 25" N.; 1° 57' 50" W.	23	"	Granton.	Imm.	Fair.
1391	M.	31.	31.7	10/ 8/13	35' E.-N.-E. of May Island.	56° 33' N.; 1° 43' W.	31	"	Newhaven.	Imm.	Fair ; slight ulcer at mark
1392	M.	32.	32.	7/ 7/13	30' E. ¾ S. of Girdle Ness.	57° 12' N.; 1° 8' W.	35	"	N. Shields.	Imm.	—
1394	F.	31.5	32.1	30/ 6/13	36' E.-N.-E. of May Isle.	56° 34' N.; 1° 42' W.	31	"	Newhaven.	Imm.	Good.
Date, 30th May 1913. Liberated, 56° 6' N.; 2° 44' W.; Fidra Light, S.W. 3 miles. Depth, 27 Fms.											
Se. A. 10											
5496	F.	39.	41.1	2/ 2/14	1' off Whitehills, Banff.	57° 42' N.; 2° 32' W.	14	Lines.	Whitehills.	About ¾ ripe.	Good.
5504	F.	41.5	44.7	7/11/13	1' W. of Bell Rock.	56° 26' N.; 2° 25' W.	18	S.T.	Granton.	Imm.	Good.
5508	M.	33.	35.6	12/12/13	4' W.-N.-W. of Bell Rock.	56° 26' 30" N.; 2° 30' W.	20	"	Leith.	Nearly ripe.	Good.
5511	M.	31.	34.1	17/ 2/14	N./E. of Prestompan.	56° 3' N.; 3° W.	17	Line.	Granton.	Imm.	Good.



Date, 12th June 1913.	Liberated,*	56° 22' N.; 1° 22' 30" W.;	40 miles E. of May Island.	Depth, 35 Fms.	S.T.	Aberdeen.	Spawn- ing.	Good.	
5522	F.	34.5	37.6	16/ 1/14	26' S.-E. of Aberdeen.	56° 56' 10" N.; 1° 22' W.	39	Aberdeen.	Good.
5527	F.	36-	40.8	19/ 2/14	12' E. of May Isle.	56° 14' 30" N.; 2° 12' W.	30	Granton.	Good.
5535	M.	34.5	38.6	24/12/13	3½' E. of Bell Rock.	56° 27' N.; 2° 18' W.	26	Dundee.	Good
5542	F.	34.5	39.7	8/ 1/14	26' S.-E./E. of Aberdeen.	57° 0' 40" N.; 1° 16' 40" W.	34	Aberdeen.	Good.
5548	?	31.5	34-	24/12/13	28' N.-E./N. of Spurn Head.	54° 1' N.; 0° 23' E.	28	Grimsvy.	—
5557	M.	35-	—	9/ 1/14	1½' off Whitehills, Banff.	57° 42' N.; 2° 32' W.	14	Whitehills.	Tail damaged.
5562	M.	31.5	34.3	5/11/13	8-9' N.-E. of May Isle.	56° 19' N.; 2° 25' W.	30	Granton.	Fair.
5565	M.	31.5	36.3	6/ 2/14	24' S.-E. of Aberdeen.	56° 57' N.; 1° 24' W.	39	Aberdeen.	Good.
5570	M.	32.5	35.8	6/ 9/13	Off Wemyss Castle, Forth.	56° 8' N.; 3° 3' W.	15	Dysart.	Good.
5584	M.	40-	40-	3/ 9/13	27' S./E. from Aberdeen.	56° 44' 50" N.; 1° 41' W.	26	Aberdeen.	Good.
5593	F.	37-	40.7	27/10/13	70' E. ½ S. of May Isle.	56° 25' N.; 0° 29' W.	50	Granton.	Good.
5594	M.	42.5	42-	4/ 8/13	36' E./S. ½ S. of May Island.	56° 13' N.; 1° 28' W.	29	N. Shields.	Sound.
5601	F.	48.5	48.5	26/ 1/14	40' S.-E./E. from Aberdeen.	56° 56' 30" N.; 0° 53' W.	35	Aberdeen.	Good.
5602	F.	38.5	39.9	23/ 9/13	30' E. ½ S. of May Isle.	56° 16' N.; 1° 40' W.	28	Granton.	Good.
5608	F.	42.5	—	10/10/13	Off Portobello.	55° 58' N.; 3° 6' W.	3	Newhaven.	Good.
5617	M.	37-	38.2	19/ 8/13	16' E. ½ S. of May Isle.	56° 13' 5" N.; 2° 3' 15" W.	20	Granton.	Good.
5621	F.	34-	34-	12/ 7/13	37' E. ½ S. of May Island.	56° 18' N.; 1° 27' W.	34	N. Shields.	—
5624	F.	41-	40.5	3/10/13	18' E./S. of May Isle.	56° 13' N.; 2° W.	24	Granton.	Good.
5626	F.	44.5	44-	25/ 8/13	29' E./S. ½ S. of Tod Head.	56° 52' N.; 1° 20' W.	36	N. Shields.	—
5628	F.	42.5	42.5	16/ 7/13	48' E. ½ N. of St. Abb's Head.	56° 16' N.; 0° 50' W.	38	N. Shields.	—
5629	M.	45-	44.7	24/ 1/14	1' off Banff Head.	57° 41' 30" N.; 2° 30' W.	14	Whitehills.	Good.
5631	F.	51-	50.9	21/ 8/13	45' E.-S.-E. of Bass Rock.	55° 59' 5" N.; 1° 17' W.	28	Granton.	Good; gutted.
5634	F.	42.5	41-	30/ 8/13	37' E./S. ½ S. of Tod Head.	56° 55' N.; 1° 5' W.	38	Hartlepool.	—
5639	F.	38-	39.3	15/ 9/13	16' E. ½ S. of May Island.	56° 13' 5" N.; 2° 3' 15" W.	30	Granton.	Good.
5640	F.	36.5	37.3	8/ 8/13	32' E./S. of Bell Rock.	56° 28' N.; 1° 26' W.	36	N. Shields.	Sound.

\* Caught 40 miles E. of May Island.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Ln.									
Date, 12th June 1913. Liberated, 40 miles E. of May Island— <i>continued</i> .												
5654	F.	41.5	41.3	27/9/13	64' E. $\frac{1}{2}$ S. of Bell Rock.	56° 40' N.; 0° 30' W.	39	S.T.	Hartlepool.	—	—	Sound.
5657	F.	56.5	55.3	26/7/13	29' S. $\frac{1}{2}$ E. of Tod Head.	56° 43' N.; 1° 23' W.	32	"	N. Shields.	—	—	Sound.
5658	F.	44.	44.	16/8/13	50' E.-S.-E. $\frac{1}{2}$ S. of Tod Head.	56° 45' N.; 0° 43' W.	40	"	Hartlepool.	Imm.	Imm.	—
5664	F.	53.	52.7	11/7/13	45' N.-E./E. $\frac{1}{2}$ E. of May Isle.	56° 41' 55" N.; 1° 34' W.	24	"	Granton.	Spent.	Spent.	Good.
5668	F.	39.5	38.8	25/7/13	26' S.-E./E. $\frac{1}{2}$ S. of Aberdeen.	56° 58' N.; 1° 20' W.	36	"	N. Shields.	—	—	Sound.
Stud.No. 1420	M.	27.	26.8	11/7/13	14 $\frac{1}{2}$ ' E./N. from Eyemouth.	55° 59' N.; 1° 41' 30" W.	40	Herring Drift Net.	Anstruther.	Imm.	Imm.	Fair.
1427	M.	30.5	30.	23/8/13	24' E./N. of St. Abb's Head.	56° 6' N.; 1° 30' W.	41	S.T.	N. Shields.	Imm.	Imm.	—
1434	M.	27.5	29.7	17/10/13	6' E. of Bell Rock.	56° 28' N.; 2° 12' W.	26	"	Granton.	Imm.	Imm.	Fair.
Date, 13th June 1913. Liberated, 56° 40' N.; 0° 21' E.; 100 miles E. of May Island. Depth, 52 Fms.												
Sc. A. 10												
5693	F.	42.5	43.1	19/11/13	69' E.-S.-E. $\frac{1}{2}$ S. of Aberdeen.	56° 54' 30" N.; 0° 2' E.	47	S.T.	N. Shields.	—	—	Sound.
5694	F.	37.	38.8	10/11/13	100' E.-S.-E. of May.	56° 1' N.; 0° 30' E.	65	"	Granton.	Imm.	Imm.	Good.
5702	M.	38.5	39.	27/9/13	26 $\frac{1}{2}$ ' S.-E. of Aberdeen.	56° 57' N.; 1° 19' W.	37	"	N. Shields.	—	—	—
5705	F.	34.	34.	21/10/13	95' E. $\frac{1}{2}$ S. of May Isle.	56° 30' N.; 0° 19' W.	37	"	Granton.	Imm.	Imm.	Good.
5708	F.	40.	41.	11/12/13	23' E.-S.-E. from Aberdeen.	57° 6' N.; 1° 20' W.	44	"	Aberdeen.	Imm.	Imm.	Good.
5729	M.	34.	33.6	6/8/13	28 $\frac{1}{2}$ ' S.-E./E. $\frac{1}{2}$ S. of Tod Head.	56° 42' N.; 1° 25' W.	32	"	N. Shields.	—	—	Sound.
5735	F.	31.5	29.9	11/9/13	33' E.-S.-E. of Bass Rock.	56° 0' 50" N.; 1° 39' 50" W.	30	"	Granton.	Imm.	Imm.	Fair.

Date, 16th June 1913.	Liberated, 57° 15' N.; 3° 54' E.; 220 miles E. of May Island.	Depth, 37 Fms.	S.T.	Aberdeen.	Imm.	Good; gutted.
5791	F. 37-3	22/ 8/13	200-210 m. E./S. $\frac{1}{2}$ S. fr. Aberdeen	57° 6' 55" N.; 4° 21' 40" E.	33	Good.
5794	F. 45-3	11/10/13	190' E./S. $\frac{1}{2}$ S. from Aberdeen.	57° 7' 30" N.; 3° 53' 45" E.	34	Good.
5797	F. 35-0	10/ 2/14	104' N. $\frac{3}{4}$ E. of Cullen.	57° 52' N.; 2° 52' W.	40	—
5808	M. 34-5	—	Inner Shoal Water.	56° 50' N.; 4° E. (about).	30	Sound.
5829	M. 36-	8/ 9/13	220' E./S. $\frac{1}{2}$ S. from Aberdeen.	57° 6' 15" N.; 4° 48' E.	34	Good.
5831	F. 38-	27/ 8/13	215' E./S. $\frac{1}{2}$ S. from Aberdeen.	57° 6' 55" N.; 4° 40' 45" E.	31	Good.
5843	M. 37-	7/11/13	180' E.-S.-E. from Aberdeen.	56° 49' N.; 3° 34' E.	31	Good.
5849	M. 34-5	4/ 9/13	210 m. E.-S.-E. from Aberdeen.	56° 46' N.; 4° 21' 25" E.	33-36	Good.
5856	M. 32-5	19/ 9/13	190' E./S. of Aberdeen.	57° 24' 5" N.; 3° 53' 10" E.	35	Good.
5858	F. 32-5	20/ 9/13	195' E.-S.-E. of Aberdeen.	56° 47' 5" N.; 3° 56' 45" E.	30	Good.
5866	F. 37-5	12/ 9/13	200' E. of Aberdeen.	58° 3' 50" N.; 3° 53' 45" E.	35	Good.
Stud.No.						
1459	M. 34-	9/11/13	231' E. $\frac{1}{2}$ S. of May Island.	56° 40' N.; 4° 25' E.	34	—
1468	F. 32-	1/ 7/13	225' E./S. $\frac{1}{4}$ S. from Aberdeen.	57° 16' 50" N.; 4° 47' E.	33	Fair.
Date, 17th June 1913.	Liberated, * 127' E./S. $\frac{1}{2}$ S. of Buchan Ness, 57° 30' N.; 2° 10' E.	Depth, 36 Fms.				
Sc. A. 10						
5877	F. 42-5	4/12/13	48 $\frac{1}{2}$ ' E./S. of May Island.	56° 16' N.; 1° 5' W.	46	Sound.
Date, 15th October 1913.	Liberated, W. of Dogger Bank, 54° 52' N.; 0° 57' E.	Depth, 41 Fms.				
Sc. A. 10						
5882	F. 47-5	24/10/13	166' E.-S.-E. $\frac{3}{4}$ S. of Longstone Light.	55° 31' N.; 3° 20' E.	27	Sound.
5883	F. 40-5	13/6/14	90' N.-E. $\frac{1}{2}$ N. of Grimsby.	54° 57' N.; 0° 59' E.	20-22	Sound.
Date, 11th November 1913.	Liberated, † W. of Smith Bank (Moray Firth), 58° 10' N.; 3° 2' W.	Depth, 27 Fms.				
Sc. A. 10						
5914	M. 40-	25/ 2/14	4' N. $\frac{1}{2}$ E. of Tarbet Ness.	57° 56' N.; 3° 48' W.	21	—
5915	M. 39-5	25/ 2/14	7' S.-E. from Dunrobin.	57° 56' N.; 3° 45' W.	15	Good.

\* Caught 57° 30' N.; 2° 10' E. † Caught in Burchhead Bay. Date, 11th November 1913

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PARTICULARS OF RECAPTURE.							Port Landed.	R. Organs.	Condition.
			Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.	Depth. Fms.	Vessel.				
Date, 11th November 1913. Liberated, 58° 10' N.; 3° 2' W.— <i>continued</i> .												
Sc. A. 10 5938	M.	41.	6' 2/14	5' S.S.-E. of Berrisdale Head.	58° 7' N.; 3° 23' W.	38	Cod Nets	Helmsdale.	Spawning.	Good.		
5939	M.	42.	22/ 1/14	10' off Berrisdale Ness.	58° 9' N.; 3° 10' 30" W.	28	"	Buckie.	Nearly ripe.	Good.		
5940	M.	43.	42.7	19/ 2/14	4' N.-E./E. of Tarbet Ness.	57° 56' N.; 3° 40' 30" W.	13	"	Spawning.	Good.		
5982	M.	42.	17/ 2/14	7' off Dunrobin Castle.	57° 56' N.; 3° 45' W.	15	"	Helmsdale.	Partly spent.	Good.		
Stud.No. 1484	F.	26.8	13/ 2/14	4' N.-E. from Burghhead.	57° 46' N.; 3° 27' W.	Near Shore.	Line.	Lossiemouth.	Imm.	Fair.		
Date, 13th November 1913. Liberated, on Aberdeen Bank, 56° 55' N.; 1° 8' W. Depth, 37 Fms.												
Sc. A. 10 5989	M.	45.5	45.6	28/11/13	6-7' S.-E. of Bell Rock.	56° 23' N.; 2° 13' W.	30	S.T.	Leith.	Nearly ripe.	Good.	
5990	M.	37.5	37.7	18/ 2/14	2' E. of Macduff.	57° 41' N.; 2° 26' W.	14	Cod Nets	Whitehills.	Good.		
6017	F.	46.5	46.1	7/ 1/14	6' E./N. of Carr Light.	56° 22' N.; 2° 29' W.	20	S.T.	Leith.	Good.		
6020	F.	48.5	48.5	30/12/13	10' S.-E. of Aberdeen.	57° 3' N.; 1° 47' W.	34	"	Aberdeen.	Good.		
6022	F.	45.5	45.3	1/ 1/14	7' S.-E./E. of Buchan Ness.	57° 26' N.; 1° 32' W.	39	"	Aberdeen.	Good.		
6023	M.	48.5	48.5	15/ 1/14	30' S.-E. of Aberdeen.	56° 54' N.; 1° 14' W.	33	"	Aberdeen.	Good.		
6030	F.	40.	40.5	23/ 1/14	24' S.-E. from Aberdeen.	56° 57' N.; 1° 23' W.	37	"	Aberdeen.	Good.		
6032	F.	51.5	51.8	21/11/13	10' E.-S.-E. from Tod Head.	56° 52' N.; 1° 55' W.	30	"	Aberdeen.	Fine.		

6038	M.	41-5	19/ 2/14	25' S.-E. from Aberdeen.	56° 56' N.; 1° 23' W.	36	S.T.	Aberdeen.	Spawning.	Good.
6039	F.	42-	23/ 1/14	24' S.-E. from Aberdeen.	56° 57' N.; 1° 23' W.	37	"	Aberdeen.	Imm.	Good.
6042	F.	47-5	10/ 2/14	4' E.-N.-E. of Aberdeen.	57° 11' N.; 1° 58' W.	34	"	Aberdeen.	Nearly ripe.	Good.
6049	M.	41-	21/ 2/14	4' E. of Strathie Point.	58° 37' N.; 3° 54' W.	39	"	Mallaig.	Spawning.	Good.
6050	M.	36-	6/ 2/14	26' S.S.-E. of Aberdeen.	56° 48' N.; 1° 34' W.	34	"	Aberdeen.	Imm.	Good.
6068	F.	42-5	7/ 1/14	24' S.-E. of Aberdeen.	56° 57' N.; 1° 24' W.	37	"	Dundee.	Imm.	Good.
Date, 12th November 1913. Liberated, Naim Bay, Station II., 57° 37' N.; 3° 54' W. Depth, 8 Fms.										
6074	M.	37-5	24/ 2/14	4' off Brora	58° N.; 3° 43' W.	21	Cod Nets	Buckie.	Spawning.	Good.
6086	M.	40-	3/ 2/14	4' S.-E. of Brora.	57° 58' N.; 3° 44' W.	22	"	Buckie	Partly spawned.	Good.
6087	M.	40-5	20/ 2/14	10' off Lybster.	58° 14' N.; 2° 59' W.	40	"	Wick.	Spawning.	Good.
Stud.No.										
1523	M.	29-5	12/ 2/14	N. side Rift Bank, Fort George.	57° 36' N.; 3° 56' W. (abt.)	6	Line.	Andersier.	Imm.	Fair.
1526	M.	29-	7/ 2/14	2' S.-W. of Burghhead.	57° 41' N.; 3° 32' W.	13	"	Lossiemouth.	Imm.	Fair.
1534	M.	26-5	—	25/ 2/14	100 yds. N.-E. of Buoy, Fort George.	6	?	Lossiemouth.	—	—
Sc. A. 10										
6097	F.	33-5	19/ 2/14	Off Old Bar, Naim.	57° 36' N.; 3° 51' W.	3-4	Line.	Lossiemouth	Imm.	Fair.
Date, 3rd December 1913. Liberated, * 56° 23' N.; 2° 43' W. (abt.); St. Andrews Bay, Fairway Buoy, N.-E./E. 3 miles. Depth, 11 Fms.										
6197	M.	36-5	6/12/13	2' E.-N.-E. of St. Andrews.	56° 23° N.; 2° 40' W.	7	—	Dundee.	Nearly ripe.	Fair.
6200	M.	36-	25/12/13	2' N.-E. of St. Andrews.	56° 22' N.; 2° 45' W.	7	—	Dundee.	Imm.	Good.
6202	M.	36-5	17/12/13	1½' E.-N.-E. of St. Andrews.	56° 22' N.; 2° 46' W.	7	—	Dundee.	Nearly ripe.	Fair.
6210	M.	35-	25/12/13	5' N. of Bell Rock.	56° 31' N.; 2° 26' W.	23	—	Dundee.	Nly.ripe.	Good.
6215	F.	30-5	14/ 1/14	2' E./S. of St. Andrews.	56° 20' 40" N.; 2° 43' W.	8	FloUNDER Nets, S.T.	St. Andrews	Imm.	Fair.
6216	F.	29-	30/12/13	2' off St. Andrews.	56° 22' N.; 2° 45' W.	8	Nets, S.T.	St. Andrews	Imm.	Fair.
6217	F.	27-5	25/12/13	5' E.-S.-E. of N. Carr.	56° 17' 30" N.; 2° 25' W.	28		Granton.	Imm.	Fair.

\* Caught in Kirkealdy Bay. Date, 2nd December 1913.

TABLE I.—PLAICE.

No. of Tab.	Sex.	Length Cm.	PLACE.		LATITUDE AND LONGITUDE.	Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
			Length Cun.	Date.						
Date, 3rd December 1913. Liberated, St. Andrews Bay, Fairway Buoy, N.-E./E. 3 miles— <i>continued</i> .										
Se. A. 10										
6220	F.	31.5	17/ 2/14	6' E.-N.-E. of Carr Lightship.	56° 22' 30" N.; 2° 24' W.	26	?	Dundee.	Imm.	Fair.
6224	M.	37.5	25/12/13	St. Andrews Bay	56° 22' N.; 2° 45' W.	7	—	Dundee.	Imm.	Good.
Date, 12th December 1913. Liberated, * 57° 42' 30" N.; 3° 34' W.; Burchhead, S.-E./E. ½ E. 2½ miles. Depth, 6 Fms.										
6258	M.	39.5	Label 18/ 2/14 only.	3' E. from Tarbet Ness.	57° 53' N.; 3° 40' W.	15	Cod Nets	Lossiemouth.	—	—
6261	M.	42.5	42.2	4' E. of Tarbet Ness.	57° 53' 30" N.; 3° 39' W.	25	"	Lossiemouth.	¾ Ripe.	Good.
6271	M.	39.5	38.5	7' from Tarbet Ness.	57° 55' N.; 3° 40' W.	29	S.T.	Grimshy.	—	Sound; gutted.
6273	M.	42.	41.8	25' N.-E. of Buckie	58° 2' 30" N.; 2° 38' W.	28	"	Buckie.	Ripe.	Good.
6273	M.	43.5	43.2	4' E. from Tarbet Ness	57° 53' 30" N.; 3° 39' W.	24	"	Buckie.	Spawn- ing.	Good.
6292	M.	40.5	40.4	4' N.-E. from Tarbet Ness.	57° 55' 30" N.; 1° 43' W.	20	"	Lossiemouth.	Spawn- ing.	Good.
6305	F.	45.	45.1	4' E. from Tarbet Ness.	57° 53' 30" N.; 3° 39' W.	24	"	Buckie.	Spawn- ing.	Good.
6313	F.	42.5	44.	8' S.-E. from Ness Head	58° 24' 30" N.; 2° 49' W.	33	"	Aberdeen.	Imm.	Good.
6319	F.	44.5	44.3	7' E. of Tarbet Ness	57° 55' N.; 3° 40' W.	29	"	Grimshy.	Ripe.	Sound; gutted
6326	F.	45.5	45.3	7' from Tarbet Ness.	57° 55' N.; 3° 40' W.	29	"	Grimshy.	Not quite ripe.	Sound; gutted
6345	M.	46.	45.7	7' off Dunrobin Castle.	57° 56' N.; 3° 45' W.	15	Cod Nets	Helmsdale.	Spawn- ing.	Good.
6350	M.	39.5	38.8	7' S./E. of Berriedale Head.	58° 4' 30" N.; 3° 23' W.	29	"	Buckie.	Ripe.	Good.

\* Caught in Burchhead Bay.

TABLE II.—SUPPLEMENTARY LIST.\*

Date, 28th November 1910.	Liberated, 20' E. of May Island, 56° 17' N.; 1° 58' W.	Depth, 26 Fms.					
Sc. A. 10 1716	M. 36.5	45.	2 / 2 / 16	Found in London among fish from Scarborough.	—	S.T.	—
							Spawning.
Date, 19th June 1911.	Liberated, 20 miles E. of May Island, 56° 17' N.; 1° 58' W.	Depth, 29 Fms.					
3032	F. 37.	50.8	13 / 6 / 16	70' N.-E./N. of Longstone Light.	56° 45' N.; 1° 1' W.	40	S.T.
							Hartlepool.
Date, 7th September 1911.	Liberated, Midway between Elie and Fidra, 56° 8' N.; 2° 48' W.	Depth, 27 Fms.					
Stud No. 692	M. 22.5	37.7	28 / 1 / 16	21' E. of Flamborough Head.	54° 13' N.; 0° 30' E.	32	S.T.
696	F. 28.	44.2	15 / 4 / 16	35' E.-S.-E. of Bell Rock.	56° 22' N.; 1° 20' W.	35	"
							Grimsby.
							Dundee.
Date, 7th March 1912.	Liberated, 20' E. of May Island, 56° 17' N.; 1° 58' W.	Depth, 26 Fms.					
Sc. A. 10 4180	M. 39.	46.5	18 / 4 / 14	40' N.-E. of Buchan Ness.	58° 3' N.; 1° 10' W.	62	S.T.
4185	F. 56.5	57.5	23 / 3 / 14	1' off Pittenweem.	56° 14' N.; 2° 38' W.	6	Line.
4186	F. 59.	59.	6 / 4 / 14	30' E./N. of May Isle.	56° 26' N.; 1° 45' W.	20	S.T.
4191	F. 60.	61.6	17 / 5 / 14	5' E.-S.-E. of Tod Head.	56° 52' N.; 2° 4' W.	30	"
4222	F. 35.	35.	28 / 4 / 14	15'-16' E. of May Isle.	56° 16' N.; 2° 6' W.	27	"
							Dundee.
							Anstruther.
							Granton.
							Aberdeen.
							Granton.
							Good.
							Good.
							Spent.
							Spent.
							Good.
							Sound.

\* These fish were recaptured after Table I. had gone to press.

TABLE II.—SUPPLEMENTARY LIST.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cms.	Length Cm.									
Date, 9th May 1912. Liberated, Midway between Elie and Fidra, 56° 8' N.; 2° 48' W. Depth, 27 Fms.												
4574	F.	51.5	53.9	3/3/14	6' E. of Blyth.	55° 10' N.; 1° 18' W.	26	S.T.	N. Shields.	Not ripe.	Sound.	
4578	F.	35.5	43.7	6/3/15	20' E./S. of Bell Rock.	56° 27' 30" N.; 1° 47' 30" W.	31	"	Dundee.	Spawn- ing.	Good.	
4584	F.	31	37.3	20/1/14	90' N.-E./N. of Longstone Light.	57° 5' N.; 0° 35' W.	40	"	N. Shields.	Not ripe.	Good.	
4596	M.	35	44.1	29/3/15	25' S.-E./E. of Aberdeen.	57° 1' N.; 1° 18' 30" W.	37	"	Aberdeen.	Partly spent.	Good.	
4600	F.	38.5	43.5	18/3/14	17 S.-E. $\frac{1}{2}$ E. of Berrisdale Head.	58° 4' N.; 3° W.	28	"	Ymuiden.	—	Gutted.	
4611	M.	34	40	7/3/14	Off Flamborough Head.	54° 10' N.; 0° 15' E.	30	"	Grimsby.	—	Gutted.	
4624	F.	30	43.1	1/8/14	5' E./N. of Bell Rock.	56° 28' N.; 2° 15' W.	25	"	Granton.	Imm.	Good.	
4641	F.	33	34.3	27/2/14	$\frac{1}{2}$ off Pittenweem.	56° 12' N.; 2° 43' W.	6	Line.	Anstruther.	Imm.	Good.	
4646	M.	31.5	36.8	23/3/14	16' E.-N.-E. of May Isle.	56° 22' N.; 2° 10' W.	28	S.T.	Granton.	Ripe.	Good.	
4650	F.	27.5	38.1	7/4/14	7' S.-E./E. of Buchan Ness.	57° 26' N.; 1° 33' W.	41	"	Aberdeen.	Imm.	Good.	
4654	M.	34.5	37.5	30/3/14	20' E.-N.-E. of May Isle.	56° 24' N.; 2° 4' W.	30	"	Granton.	Spawn- ing.	Good.	
4658	F.	33.5	46	22/12/14	24' S.-E./E. of Aberdeen.	57° 1' 20" N.; 1° 21' W.	36	"	Aberdeen.	About $\frac{2}{3}$ ripe.	Good.	
Date, 12th June 1912. Liberated, about 40 miles E. of May Island, 56° 22' N.; 1° 22' 30" W. Depth, 35 Fms.												
Stud No. 836	M.	29.5	38.4	20/3/16	8' N.-N.-E. of Sarelet, Caithness.	58° 31' N.; 3° 4' W.	—	Cod Nets.	Buckie.	Imm.	Good.	





TABLE II.—SUPPLEMENTARY LIST.

No. of Tabs.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cms.	Length Ctn.									
Date, 5th December 1912. Liberated, Fidra Light, S./W. 3'; 56° 6' N.; 2° 44' W. Depth, 27 Fms.												
Sc. A. 10 2706	F.	47.	50.9	18 / 8 / 14	9' E. of May Isle.	56° 14' N.; 2° 18' W.	27	S.T.	Granton.	About $\frac{1}{2}$ ripe.	Good.	
2717	F.	50.	Mark only. 43	17 / 4 / 15	12' E. of May Isle.	56° 15' N.; 2° 12' W.	28	"	Granton.	—	—	
2720	F.	46.		28 / 3 / 14	14' E./S. of Bell Rock.	56° 28' N.; 1° 57' W.	28	"	Granton.	Spawning.	Good.	
2728	F.	37.5	47.6	28 / 7 / 14	12' N.-E. of Rattray Point.	57° 47' N.; 1° 38' W.	38	"	Aberdeen.	Imm.	Good.	
2729	F.	41.	44.	24 / 5 / 14	70' E.-S.-E. $\frac{1}{2}$ S. of Aberdeen.	56° 58' N.; 0° 5' E.	46	"	Hull.	Mature.	—	
2733	F.	40.5	49.1	8 / 8 / 17	16' S.-E. of Bell Rock.	56° 18' N.; 1° 58' W.	30	"	Dundee	Has been ripe.	Good.	
2738	M.	39.	40.7	30 / 3 / 14	Between Carr and Bell Rock.	56° 23' N.; 2° 27' W. (about).	18	"	Dundee.	Spent.	Good.	
2749	F.	38.	Mark only.	? / 10 / 14	Found in a box at Birmingham, and forwarded to the <i>Fish Trades' Gazette</i> .	—	—	"	Milford Haven.	—	Good.	
2754	F.	43.	48.3	18 / 8 / 14	9' E. of May Isle.	56° 14' N.; 2° 18' W.	27	"	Granton.	About $\frac{1}{2}$ ripe.	Good.	
2756	M.	47.5	—	3 / 1 / 16	Inside of May Isle.	?	—	"	Granton.	About $\frac{1}{2}$ ripe.	Good.	
2757	M.	37.	40.	2 / 3 / 14	20' E. of Bell Rock.	56° 31' N.; 1° 49' W.	24	"	Dundee.	Spawning.	Good.	
2759	M.	40.	43.5	22 / 6 / 15	5' E. of Buchanness.	57° 30' N.; 1° 37' W.	35	"	Aberdeen.	Spawning.	Good.	
2771	F.	39.5	47.9	15 / 4 / 14	25' S.-E./E. of Aberdeen.	57° 1' N.; 1° 19' W.	33	"	Aberdeen.	Spent.	Good.	
2775	F.	42.	50.1	22 / 3 / 15	6' S.-E. of Bell Rock.	56° 23' N.; 2° 14' W.	27	"	Dundee.	Spent.	Good.	
2778	F.	42.	44.3	10 / 3 / 14	24' E. $\frac{1}{2}$ S. of Hartlepool.	54° 46' N.; 0° 30' W.	34	"	Hartlepool.	Not yet ripe.	—	
2781	F.	44.5	48.9	6 / 3 / 14	10' E.-N.-E. of May Isle.	56° 18' N.; 2° 19' W.	28	"	Leith.	Imm.	Good.	

Stud.No. 1234	F. 32.	40-3	12/ 6/14	15' N.-E. of Kinnaird Head.	57° 55' N. ; 1° 47' W.	40	„	Aberdeen. Ymuiden. Aberdeen. Grimshy.	Imm. — Spent. —	Good. Sound. Good. Sound.
1235	M. 32.	35-7	19/ 3/14	Not known.	—	—	„	„	„	„
1236	F. 31-5	36-9	7/ 4/14	6' S.-E. of Buchan Ness.	57° 24' N. ; 1° 39' W.	44	„	„	„	„
1233	M. 30-5	34-8	31/12/13	“ Smith's Knoll.”	52° 50' N. ; 2° 15' E.	24	„	„	„	„
Date, 6th December 1912. Liberated, 20' E. of May Island, 56° 17' N. ; 1° 58' W. Depth, 29 Fms.										
Sc. A. 10										
2800	F. 41-5	50-8	29/ 7/15	24' S./E. of Aberdeen.	56° 47' N. ; 1° 43' W.	31	S.T.	Aberdeen. Geestemünde	Spent.	Good.
2816	F. 42.	45.	14/ 3/14	11' E. $\frac{2}{3}$ S. of Clyth Ness.	58° 20' N. ; 2° 52' W.	28	„	Aberdeen.	—	—
2826	F. 35-5	46.	23/12/14	10' E./N. of Aberdeen.	57° 13' N. ; 1° 47' W.	36	„	„	Near spawn- ing.	Good.
2828	F. 42-5	46-7	30/ 1/15	S.-E. of Bell Rock.	56° 25' N. ; 2° 20' W. (about).	—	„	Dundee.	Nearly ripe.	Good.
2837	F. 45.	51-4	1/ 4/15	E. side of Largo Bay.	56° 10' N. ; 2° 48' W. (about).	6	Line.	Anstruther.	Spent.	Good.
2849	M. 42-5	44-6	1/ 4/14	16' S.-E. of Bell Rock.	56° 18' N. ; 1° 58' W.	27	S.T.	Dundee.	Ripe.	Good.
2859	M. 36.	38-7	25/ 2/14	20' E. of Bell Rock.	56° 32' N. ; 1° 48' W.	26	„	Dundee.	Spawn- ing.	Good.
2871	F. 54-5	55-4	8/ 3/14	16' S./W. of Aberdeen.	56° 53' N. ; 2° W.	32	„	Aberdeen.	Ripe.	Good.
2872	F. 42.	45.	26/ 3/14	35' E.-S.-E. of N. Shields.	54° 37' N. ; 0° 27' W.	46	„	N. Shields.	Mature.	—
2878	F. 41-5	45-2	12/ 3/14	17' E. $\frac{1}{2}$ S. of May Isle.	56° 15' N. ; 2° 2' W.	30	„	Granton.	Spawn- ing.	Good.
2883	M. 37-5	Mark only.		Below Duncansby Head.	58° 38' N. ; 3° 1' W. (about).	35	„	Grimshy.	—	—
2890	F. 41.	45-6	8/ 7/14	28' S./E. of Aberdeen.	56° 44' N. ; 1° 39' W.	35	„	Aberdeen.	Spent.	Good.
2893	F. 39.	45.	3/ 2/14	158' E./S. of N. Shields.	55° 14' N. ; 3° 4' E.	28	„	N Shields.	Ripe.	—
2903	F. 36-5	42.	8/ 4/14	21' S.-E. $\frac{1}{2}$ S. of Buchan Ness.	57° 16' N. ; 1° 14' W.	23	„	Ymuiden.	—	Gutted.
2917	F. 35-5	42-9	21/ 5/14	8' E.-S.-E. of Pentland Skerries.	58° 40' N. ; 2° 38' W.	32	„	Aberdeen.	Spent.	Good.
2918	M. 40.	43-7	19/ 7/14	25' S.S.-E. of Aberdeen.	56° 49' N. ; 1° 34' W.	35	„	Aberdeen.	Imm.	Good.
2939	F. 32.	41-5	2/ 3/15	Off May Isle.	—	—	„	Leith.	Imm.	Good.
2944	M. 32-5	39-5	4/ 9/14	80' E. of Bell Rock.	56° 49' N. ; 0° 2' W.	46	„	Dundee.	Imm.	Good.
1239	M. 29-5	34-5	11/ 3/14	8' S.-E./E. $\frac{1}{4}$ E. of Helmsdale.	58 5' N. ; 3° 23' W.	35	„	Ymuiden.	—	Sound.
1264	M. 33-5	36-6	20/ 8/14	10' E.-N.-E. of May Isle.	56° 18' N. ; 2° 18' W.	25	„	Granton.	Imm.	Fair.

TABLE II.—SUPPLEMENTARY LIST.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cms.	Length Cm.									
Date, 6th December 1912. Liberated, 20' E. of May Island— <i>continued.</i>												
Stud. No.												
1279	F.	31.5	44.	16/ 6/14	30' E. of May Isle.	56° 20' N.; 1° 40' W.	29	S.T.	Leith.	Spent.	Good.	
1282	F.	32.5	40.5	22/ 4/14	5' E. of Carr Light.	56° 20' N.; 2° 25' W.	20	"	Granton.	Imm.	Good.	
1284	F.	32.	38.7	24/ 5/14	27' E. ½ N. of May Isle.	56° 22' N.; 1° 47' W.	27	"	Granton.	Imm.	Good.	
1285	M.	28.	35.7	7/10/14	5' S.-E. of Aberdeen.	57° 6' N.; 1° 55' W.	35	"	Aberdeen.	About ½ ripe.	Good.	
1288	M.	32.	30.	12/ 2/13	Moray Firth.	—	—	"	Cuxhaven.	—	—	
Date, 26th March 1913. Liberated, Midway between Elie and Fidra. 56° 8' N.; 2° 48' W. Depth, 27 Fms.												
Sc. A. 10												
2962	F.	38.5	47.5	3/ 7/14	20' E. of Buchan Ness.	57° 34' N.; 1° 10' W.	62	S.T.	Aberdeen.	Imm.	Good.	
2963	F.	35.	Mark only.	4/ 3/14	1' off Whitehills.	57° 41' N.; 2° 31' W.	13	Cod Net.	Whitehills.	—	—	
2968	F.	42.	44.9	6/ 3/14	35' S.-E./S. of North Shields.	54° 38' N.; 0° 40' W.	30	S.T.	N. Shields.	Imm.	—	
2970	F.	39.5	43.7	17/ 2/14	6' N.-E. of Longstone Light.	55° 44' N.; 1° 31' W.	35	"	N. Shields.	Imm.	Sound.	
2971	F.	33.	39.9	24/ 3/14	1' off Pittenweem.	56° 13' N.; 2° 38' W.	6	Line.	Anstruther.	Imm.	Good.	
2974	F.	59.5	61.9	26/ 2/14	2' off Macduff	57° 42' N.; 2° 30' W.	6	Cod Nets	Whitehills.	Spent.	Good.	
2977	M.	35.	41.6	4/ 3/14	25' N./E. of Buckie.	58° 5' N.; 3° 6' W.	22	"	Buckie.	Ripe.	Good.	
2994	M.	37.	16.5 ins.	12/ 3/14	Gairloch, Ross-shire.	57° 43' N.; 5° 44' W. (about).	15	"	Badaachro.	—	—	
2996	F.	39.	43.8	1/ 3/14	S. of Smith Bank, Moray Firth.	58° 8' N.; 2° 50' W. (about).	20	S.T.	Ymuiden.	—	Sound.	
2998	F.	35.5	41.	13/ 3/14	18' E.-N.-E. of May Isle.	56° 22' N.; 2° 7' W.	30	"	Granton.	Spawn- ing.	Good.	
3000	M.	35.5	40.4	5/ 3/14	23' N. ½ E. of Buckie.	58° 3' N.; 3° 10' W.	27	Cod Nets	Buckie.	Spawn- ing.	Good.	

5001	F.	43.5	48.	26 / 3 / 14	1' off Pittenweem.	56° 13' N.; 2° 38' W.	6	Line.	Anstruther.	Spent.	Good.
5004	F.	39.	44.8	27 / 5 / 14	7' S.-E. of Aberdeen.	57° 5' N.; 1° 51' W.	28	S.T.	Aberdeen.	Imm.	Good.
5015	F.	41.5	48.2	20 / 12 / 14	7 m. N.-E./E. ½ E. of Aberdeen.	57° 13' 30" N.; 1° 53' 30" W.	29	"	Aberdeen.	N.Y. ripe.	Good.
5019	F.	36.5	41.3	28 / 2 / 14	8' E.-N.-E. of Aberdeen.	57° 14' N.; 1° 50' W.	36	"	Aberdeen.	Imm.	Good.
5033	F.	37.5	Mark only.	7 / 7 / 14	35' N. ½ E. of Rattray Point.	58° 11' N.; 2° 2' W.	30-40	"	Aberdeen.	—	—
5037	M.	35.	39.5	13 / 1 / 14	40' S.-E. of Aberdeen.	56° 49' N.; 0° 48' W.	38	"	Aberdeen.	Imm.	Good.
Stud. No.											
1295	F.	31.	42.	29 / 4 / 14	7' S.S.-E. of Buchan Ness.	57° 23' N.; 1° 38' W.	40	"	Aberdeen.	—	Good.
1296	M.	33.	40.	9 / 4 / 14	25' N. of Kinnaird Head.	58° 6' N.; 2° 10' W.	30	"	Ymuiden.	—	Sound.
1302	F.	32.5	42.3	27 / 5 / 14	8' S.-E. of Auskerry.	58° 58' N.; 2° 19' W.	45-48	"	Aberdeen.	Imm.	Good.
1304	F.	34.5	40.8	1 / 8 / 14	8' S.-E. from Buchan Ness.	57° 25' N.; 1° 33' W.	35	"	Aberdeen.	Imm.	Good.
1310	M.	33.5	—	23 / 3 / 14	Moray Firth.		—	Consigned from Ostenf.			
Date, 26th March 1913. Liberated, 20' E. of May Island, 56° 17' N.; 1° 58' W. Depth, 29 Fms.											
Sc. A. 10											
5041	F.	37.5	46.8	? / 7 / 14	Not known.		—	S.T.	Grimsby.	Imm.	—
5042	F.	40.5	48.2	3 / 5 / 15	3' off Macduff.	57° 43' N.; 2° 28' 30" W.	20	Cod Nets	Whitehills.	Spent.	Good.
5044	M.	35.	38.8	24 / 8 / 14	9' N.-E. of May Isle.	56° 19' N.; 2° 25' W.	30	S.T.	Granton.	Imm.	Good.
5046	F.	40.5	48.6	7 / 4 / 14	6' S.S.-E. of Buchan Ness.	57° 23' 30" N.; 1° 39' W.	42	"	Aberdeen.	Imm.	Good.
5052	F.	39.5	46.2	21 / 5 / 14	28' E. ½ S. of May Isle.	56° 16' 30" N.; 1° 42' 30" W.	29	"	Granton.	Spent.	Good.
5056	M.	35.5	42.2	21 / 10 / 14	20' E. ½ S. of May Isle.	56° 15' N.; 1° 57' W.	28	"	Granton.	Imm.	Good.
5059	F.	36.5	46.	5 / 6 / 14	38' S.-E. / S. of Aberdeen.	56° 44' 30" N.; 1° 10' W.	34	"	Aberdeen.	Imm.	Good.
5061	F.	38.	42.1	4 / 3 / 14	½ off Kincraig Point.	56° 11' N.; 2° 48' W.	4	Line.	Anstruther.	Imm.	Good.
5062	F.	38.	43.	17 / 6 / 14	36' N.-E./E. ½ E. of May Isle.	56° 36' 30" N.; 1° 46' W.	24	S.T.	Granton.	Imm.	Good.
5063	M.	35.5	39.4	7 / 3 / 14	21' E. of Hartlepool.	54° 47' N.; 0° 37' W.	34	"	Searbort.	—	Sound.
5073	F.	34.	38.	19 / 2 / 14	40' N.N.-E. of Longstone Light.	56° 19' N.; 1° 28' W.	35	"	N. Shields.	—	Sound.
5075	F.	37.	44.8	19 / 3 / 14	24' N.-E. of Rattray Point.	58° 1' N.; 1° 53' W.	43	"	Aberdeen.	Imm.	Good.
5079	M.	35.5	43.6	9 / 10 / 14	12' S.-E. of Noss Head.	58° 23' N.; 2° 42' W.	31	"	Aberdeen.	N.Y. ripe.	Good.
5095	F.	34.	41.7	7 / 4 / 14	9' S.-E. of Cruden Bay.	57° 20' N.; 1° 35' W.	41	"	Aberdeen.	Spent.	Good.
5098	F.	35.5	43.5	27 / 7 / 14	36' E. ½ S. of St. Abbas Head.	56° 5' N.; 1° 5' W.	29	"	Hartlepool.	—	Stale.
5101	M.	32.5	42.1	24 / 9 / 15	23' S.E./E. of Aberdeen.	57° 1' N.; 1° 22' W.	40	"	Aberdeen.	N.Y. ripe.	Good.
5104	F.	33.5	40.6	22 / 5 / 14	35' E.-N.-E. of May Isle.	56° 33' N.; 1° 44' W.	28	"	Granton.	Imm.	Good.
5109	F.	33.	42.5	2 / 5 / 15	30' E.-S.-E. of Girdle Ness.	57° 5' N.; 1° 10' W.	35	"	Dundee.	Spent.	Good.
5111	F.	35.	47.2	23 / 9 / 15	30' S./E. of Aberdeen.	56° 42' N.; 1° 38' W.	35-40	"	Aberdeen.	½ ripe.	Good.
5116	M.	36.	39.3	4 / 3 / 14	9½' E. ½ S. of Clyth Ness.	58° 20' N.; 2° 55' W.	40	"	Vlaardinghen.	—	Sound.

TABLE II.—SUPPLEMENTARY LIST.

No. of Tab.		Length		Date.		PLACE.		LATITUDE AND LONGITUDE.		Depth, Fms.		Vessel.		Port Landed.		R. Organs.		Condition.			
Sex.		Cm.		Cm.		Date.		PLACE.		LATITUDE AND LONGITUDE.		Depth, Fms.		Vessel.		Port Landed.		R. Organs.		Condition.	
Date, 26th March 1913. Liberated, 20' E. of May Island— <i>continued</i> .																					
Sc. A. 10																					
5117	M.	35.	43.2	3/6/14	28'	E.-S.-E. of Aberdeen.	57° 5' 30" N.; 1° 12' W.	34	S.T.	Aberdeen.	Imm.	Good.									
Stud. No.																					
1317	F.	33.	42.	6/5/14	25'	E.-N.-E. of May Isle.	56° 27' N.; 1° 58' W.	30	"	Granton.	Spent.	Good.									
1323	M.	32.5	34.8	16/4/14	15'	N. of Kinnaird Head.	57° 56' N.; 2° 9' W.	40	"	Aberdeen.	Ripe.	Good.									
1324	F.	32.	39.8	21/6/14	45'	E. $\frac{1}{2}$ S. of Aberdeen.	57° 17' N.; 0° 42' 30" W.	37	"	Aberdeen.	Spent.	Good.									
Date, 27th March 1913. Liberated, Aberdeen Bank, 56° 55' N.; 1° 8' W. Depth, 35 Fms.																					
Sc. A. 10																					
5130	F.	39.5	47.9	20/9/14	141'	N.-E./N. $\frac{1}{2}$ N. of Tyne.	57° 19' 30" N.; 0° 32' W.	44	S.T.	N. Shields.	—	Sound.									
5141	M.	32.5	38.3	10/12/14	6'	S.-E. of Stonehaven.	56° 54' 30" N.; 2° 2' W.	30	"	Aberdeen.	About $\frac{3}{4}$ ripe.	Good.									
5144	F.	36.	45.9	23/3/17	16'	N. of Lossiemouth.	57° 59' N.; 3° 26' W.	26	Cod Net.	Lossiemouth.	Spent.	Good.									
5146	F.	33.	40.	8/5/14	40'	N.-E. of Buchan Ness.	58° 8' N.; 1° 38' W.	49	S.T.	Dundee.	Imm.	Good.									
5153	F.	34.	46.6	10/6/14	40'	S.-E. $\frac{1}{2}$ E. of Aberdeen.	56° 53' N.; 0° 55' W.	36	"	Aberdeen.	—	Good.									
5154	F.	37.	46.9	1/4/14	24'	S.-E./E. $\frac{1}{2}$ E. of Aberdeen.	57° 4' N.; 1° 20' W.	32	"	Aberdeen.	Spent.	Good.									
5155	M.	36.	43.8	30/6/14	18'	E.-S.-E. of Aberdeen.	57° 6' 30" N.; 1° 29' W.	38-40	"	Aberdeen.	Imm.	Good.									
5158	F.	32.	40.5	12/5/14	26'	E./N. of May Isle.	56° 23' 30" N.; 1° 52' 30" W.	28	"	Granton.	Imm.	Good.									
5161	F.	34.	45.4	30/6/14	25'	E. $\frac{1}{2}$ N. of Bell Rock.	56° 35' 30" N.; 1° 40' 41" W.	27	"	Aberdeen.	Spent.	Good.									
5171	F.	34.	44.2	12/4/14	22'	S.-E./E. of Aberdeen.	57° 2' N.; 1° 24' W.	33	"	Aberdeen.	Spent.	Good.									
5173	M.	37.	43.1	27/1/15	26'	S.-E. of Aberdeen.	56° 56' 30" N.; 1° 20' W.	36	"	Aberdeen.	Ripe.	Good.									

5174	M.	34.5	43.8	18/ 6/14	32' S.-E. (E. of Aberdeen.	55° 59' 30" N.; 1° 7' W.	34	Aberdeen.	Imm.	Good.
5177	M.	36.5	42.	23/ 5/14	6' N.-W. from Holburn Head.	58° 39' 45" N.; 3° 43' 30" W.	34	Aberdeen.	Imm.	Good.
5179	F.	37.5	46.8	21/ 6/14	45' E. $\frac{1}{2}$ S. of Aberdeen.	57° 17' 30" N.; 1° 42' W.	37	Aberdeen.	Imm.	Good.
5187	M.	33.5	37.6	29/ 3/14	24' S.-E. (E. of Aberdeen.	57° 1' 30" N.; 1° 20' 30" W.	33	Aberdeen.	Imm.	Good.
5188	F.	34.5	41.6	14/ 7/14	Aberdeen Ground.	56° 40' N.; 1° W.	40	Harlepool.	—	Sound.
5191	F.	38.5	41.6	22/ 4/14	13' W.-S.-W. of Cape Wrath.	58° 28' 30" N.; 5° 17' 30" W.	33	Grimsby.	—	Gutted.
5194	F.	40.	48.3	29/ 7/14	35' S.-E. of Aberdeen.	56° 52' 30" N.; 1° 7' W.	38	Aberdeen.	Imm.	Good.
5195	F.	38.5	46.3	28/ 1/15	22' S.-E. of Aberdeen.	56° 58' 30" N.; 1° 26' 30" W.	33	Aberdeen.	Imm.	Good.
5204	F.	39.	50.2	15/ 10/14	29' S.-E. of Aberdeen.	56° 55' N.; 1° 16' W.	36	Aberdeen.	About $\frac{1}{2}$ ripe.	Good.
Stud.No.										
1336	F.	32.	37.5	11/ 3/14	$\frac{1}{2}$ from Pittenweem.	56° 12' 30" N.; 2° 45' W. (abt.)	5	Anstruther.	Imm.	Fair.
1343	M.	32.5	40.3	10/ 9/14	24' S.-E. $\frac{1}{2}$ S. of Aberdeen.	56° 55' 30" N.; 1° 26' W.	35	Aberdeen.	Imm.	Good.
1349	M.	33.	40.4	19/ 3/14	22' S.-E. of Aberdeen.	56° 58' 30" N.; 1° 26' 30" W.	35	Aberdeen.	Imm.	Good.
Date, 27th March 1913. Liberated, Near Smith Bank, Moray Firth, 58° 10' N.; 2° 30' W. Depth, 30 Fms.										
Sc. A. 10										
5242	F.	37.	44.9	20/ 3/14	7' N. of Strathie Point.	58° 43' 30" N.; 4° 6' W.	55	Aberdeen.	Spent.	Good.
5255	F.	43.	45.	8/ 3/14	W. Smith Bank, Moray Firth.	58° 10' N.; 3° 10' W. (about).	23	Geestemünde	—	—
5257	F.	35.	50.8	29/ 3/16	2' off Lybster.	58° 17' N.; 3° 14' W.	13	Wick.	Spawning.	Good.
5259	F.	37.5	44.6	10/ 3/14	8' N. of Strathie Point.	58° 44' 30" N.; 4° 6' W.	50	Aberdeen.	Spawning.	Good.
5265	F.	38.	45.2	23/ 5/14	55' N. $\frac{1}{2}$ W. of Rattray Point.	58° 27' N.; 2° 29' 30" W.	35	Aberdeen.	Spent.	Good.
5267	M.	33.5	34	20/ 4/13	Moray Firth.	58° 13' N.; 2° 42' W.	30	Geestemünde	—	Sound.
5271	F.	34.5	51.3?	29/ 1/14	17' S.-E. $\frac{2}{3}$ E. of Clyth Ness.	58° 23' N.; 2° 50' W.	40	Aberdeen.	—	—
5273	F.	34.5	Mark	1/ 3/16	9' S.E. by S. of Noss Head.	58° 23' N.; 2° 50' W.	40	Aberdeen.	—	—
5275	M.	33.5	only.	20/ 10/13	N.-W. of Smith Bank.	58° 12' N.; 3° 2' W. (about).	30	Bremerhaven	—	—
5277	M.	33.	42.5	11/ 3/14	8' S.-E. (E. $\frac{1}{2}$ E. of Helmsdale.	58° 5' N.; 3° 22' 30" W.	35	Ymuiden.	—	Sound.
5279	F.	40.5	44.7	4/ 3/14	Not known.	58° 11' N.; 2° 55' W.	22-24	Ymuiden.	—	Sound.
5283	F.	38.5	37.	19/ 4/13	Smith Bank, Moray Firth.	58° 10' N.; 3° 10' W. (about).	32	Bremerhaven	—	—
5288	F.	35.	35.	28/ 4/13	W. of Smith Bank.	58° 10' N.; 3° 10' W. (about).	32	Geestemünde	—	—
Stud.No.										
1357	F.	32.5	42.5	24/ 2/14	11' E. of Tarbet Ness.	57° 55' N.; 3° 26' 30" W.	29	Ymuiden.	—	Sound.
1366	M.	29.5	35.5	25/ 7/14	4' off Tarbet Ness.	57° 53' N.; 3° 38' 30" W.	15	Cromarty.	—	—
1370	F.	31.	31.	28/ 4/13	W. of Smith Bank.	58° 10' N.; 3° 10' W. (about).	32	Geestemünde	—	—

TABLE II.—SUPPLEMENTARY LIST.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Length Cm.									
Date, 21st May 1913. Liberated, Aberdeen Bank, 56° 55' N.; 1° 8' W. Depth, 37 Fms.												
Se. A. 10												
5368	M.	37.5	41.7	28 / 5/14	26° E.-S.-E. of Aberdeen.	57° 6' 30" N.; 1° 15' 30" W.	35	S.T.	Aberdeen.	Partly spent.	Good.	
5369	F.	38	43.6	29 / 4/14	30° E./N. of May Isle.	56° 25' 30" N.; 1° 46' W.	28	"	Granton.	Spent.	Good.	
5374	F.	46	47	16 / 3/14	25° S./E. of Aberdeen.	56° 46' 30" N.; 1° 40' 30" W.	33	"	Aberdeen.	Partly spent.	Good.	
5377	F.	36.5	44.1	31 / 5/14	25° E./N. of May Isle.	56° 23' 30" N.; 1° 53' W.	25	"	Granton.	Imm.	Good.	
5381	F.	37.5	40	3 / 4/14	65° N.N.-E. of North Shields.	56° 5' 30" N.; 1° 16' W.	30	"	N. Shields.	—	—	
5387	F.	53	56.8	3 / 10/14	4° E./N. of Bell Rock.	56° 28' N.; 2° 16' W.	20	"	Aberdeen.	About $\frac{3}{4}$ ripe.	Good.	
5391	M.	38.5	41.7	18 / 6/14	25° S./E. of Aberdeen.	56° 46' 30" N.; 1° 40' 30" W.	32	"	Aberdeen.	Imm.	Good.	
5396	M.	36	39.3	16 / 8/14	50° E./N. from Buoy of Tay.	56° 50' N.; 1° 17' W.	35	"	Dundee.	Imm.	Good.	
5403	F.	43	46.6	16 / 2/15	25° S.-E. of Aberdeen.	56° 57' N.; 1° 22' W.	34	"	Aberdeen.	Spent.	Good.	
5406	M.	46	46	5 / 5/14	24° E./N. $\frac{1}{2}$ N. of May Isle.	56° 24' 30" N.; 1° 58' W.	30	"	Granton.	Spent.	Good.	
5412	M.	36	40.7	23 / 6/14	60° E. of Bell Rock.	56° 43' 30" N.; 0° 38' 30" W.	35	"	Dundee.	Imm.	Good.	
5414	F.	37.5	41	24 / 10/14	17° E. $\frac{1}{2}$ S. of May Isle.	56° 14' 30" N.; 2° 3' W.	23	"	Granton.	Imm.	Good.	
5415	F.	45.5	48.1	7 / 7/14	40° E. of Bell Rock.	56° 37' N.; 1° 13' W.	47	"	Dundee.	Imm.	Good.	
5424	M.	38	43.7	30 / 12/14	23° S.-E./E. $\frac{3}{4}$ E. of Aberdeen.	57° 4' N.; 1° 21' W.	34-35	"	Aberdeen.	Nly. ripe.	Good.	
5427	F.	38.5	42.5	8 / 5/14	23° E.-N.-E. of May Isle.	56° 26' N.; 2° 1' W.	28	"	Granton.	Imm.	Good.	
5431	M.	42	42.7	15 / 4/14	25° S.-E./E. of Aberdeen.	57° 1' N.; 1° 19' W.	35	"	Aberdeen.	Ripe.	Good.	
5440	M.	36.5	40	3 / 3/14	24° E.-S.-E. of May Isle.	56° 9' N.; 1° 50' W.	24	"	Granton.	Ripe.	Good.	
5441	M.	35.5	40.9	21 / 11/14	9° S.-E. of Bell Rock.	56° 22' N.; 2° 8' W.	29 <sup>o</sup>	"	Dundee.	Nearly ripe.	Good.	
Stud. No.												
1376	M.	34.5	38.9	10 / 5/14	30° E.-N.-E. of May Isle.	56° 30' 30" N.; 1° 51' W.	30	"	Granton.	Spent.	Good.	
1383	M.	33.5	42.4	22 / 12/15	18° E.-N.-E. of Aberdeen.	57° 20' N.; 1° 38' W.	39	"	Aberdeen.	Nly. ripe.	Good.	
1385	M.	29.5	36.1	23 / 4/14	Off Black Dog, Aberdeen Bay.	57° 12' 30" N.; 2° 1' 30" W.	35	"	Aberdeen.	Imm.	Good.	
1393	F.	32.5	44.5	27 / 7/14	10° E. of Tod Head.	56° 55' 30" N.; 1° 55' W.	28	S.T.	Aberdeen.	Imm.	—	



Date, 30th May 1913. Liberated, Fidra Light, S./W. 3 miles, 56° 6' N.; 2° 44' W. Depth, 27 Fms.

Sc. A. 10	F.	43.5	45.4	5/ 3/14	12' N.-E. of St. Abb's Head. 28' S.-E./E. ½ S. of N. Shields. 12' N.-E. of Bell Rock. Moray Firth. 6' N.-E. of Kinnaird Head.	56° 5' N.; 1° 58' W. 54° 52' N.; 0° 40' W. 56° 37' N.; 2° 13' W. 57° 47' N.; 1° 55' W.	S.T	26	Granton. Hartlepool. Dumdee. Ymuiden. Aberdeen.	Ripe. Imm. Gutted. — —	Good. Sound. Good. Sound. —
5501	F.	44.5	46.3	2/ 4/15	12' N.-E. of Bass Rock.	56° 15' N.; 2° 27' W.	"	30	Granton.	Spent.	Good.
5502	F.	34.5	42.1	23/ 8/15	40-10' E.-S.-E. of Bell Rock.	56° 25' N.; 2° 7' W.	"	42	Dumdee.	Imm.	Good.
5503	F.	34.5	37.7	11/ 1/15	43' E.-S.-E. of Aberdeen.	57° 4' N.; 0° 43' W.	"	42	Aberdeen.	Imm.	Good.
5504	M.	32.5	34.1	29/ 5/14	7-8' E. of Bass Rock.	56° 7' N.; 2° 25' W.	"	25	Granton.	Imm.	Good.
5505	F.	36	42.5	1/ 5/14	17' E. of Ratray Point.	57° 41' N.; 1° 18' 30" W.	"	37	Aberdeen.	Imm.	Good.
5506	F.	32.5	38.8	1/ 5/14	11' E. of Ratray Point.	57° 41' N.; 1° 31' W.	"	41	Aberdeen.	Imm.	Good.
5507	M.	36.5	43.5	22/ 4/15	68' E./N. of Grimsby.	54° 5' N.; 1° 55' E.	"	44	Grimsby.	?	Sound.
5508	F.	36.5	43.2	16/10/14	10' E. of May Isle.	56° 14' N.; 2° 16' W.	"	25	Granton.	About ¾ ripe.	Good.
5509	M.	34.5	39.7	15/ 4/14	16' E. ½ S. of May Isle.	56° 14' N.; 2° 5' W.	"	30	Granton.	—	Good.
5510	M.	33.5	34	14/ 4/14	6' E. of Noss Head.	58° 30' N.; 2° 52' W.	"	42	Grimsby.	—	Gutted.
5511	M.	32.5	38	25/ 2/14	4' E.-N.-E. of Aberdeen.	57° 10' N.; 1° 57' W.	"	30	Aberdeen.	Imm.	Good.
5512	M.	34	40.6	2/ 3/14	45' N.-E. of North Shields.	55° 44' N.; 1° 4' W.	"	36	N. Shields.	—	Sound.
5513	M.	32.5	36.6	21/ 8/14	5' E. of May Isle.	56° 13' N.; 2° 25' W.	"	25	Granton.	Imm.	Fair.
5514	F.	35	38.4	19/ 3/14	25' E.-S.-E. of Aberdeen.	57° 5' N.; 1° 16' W.	"	39	Aberdeen.	Imm.	Good.
5515	F.	32.5	38.5	30/ 3/14	¾ off Pittenweem.	56° 12' N.; 2° 43' W. (about).	"	37	Aberdeen.	Imm.	Good.
5516	F.	32	37.7	1/ 5/14	30' S.-E. of Aberdeen.	56° 54' N.; 1° 15' W.	"	3	Anstruther.	Imm.	Good.
5517	F.	32	34.9	27/ 2/14	1' off Kincairig Point.	56° 10' N.; 2° 53' W. (about).	"	6	Anstruther.	Imm.	Good.
5518	F.	32.5	39.5	27/ 4/14	57' S.-E. of May Isle.	56° 29' N.; 1° 54' W.	"	25	Granton.	Spent.	Good.
5519	M.	33	37.3	16/ 3/14	5' S.-E. of Buchan Ness.	57° 24' N.; 1° 41' W.	"	40	Aberdeen.	Imm.	Good.
5520	F.	31.5	38.7	3/ 7/14	17' E. ½ S. of Aberdeen.	57° 12' N.; 1° 30' W.	"	38	Aberdeen.	Imm.	Good.
5521	F.	34.5	41.6	22/ 9/14	22' E./S. ½ S. of Bass Rock.	56° 4' N.; 1° 57' W.	"	31	Granton.	Imm.	Good.
5522	F.	34	41.1	1/ 3/14	Midway bet. May Isle and Bell Rk.	56° 18' N.; 2° 28' W.	"	22-26	Granton.	Imm.	Good.
5523	M.	32.5	35	12/ 3/14	Between Carr and Bell Rock.	56° 22' N.; 2° 27' W.	"	18	Dumdee.	Ripe.	Good.
5524	F.	31.5	39.6	26/ 6/14	26' S.-E./E. of Aberdeen.	57° 1' N.; 1° 15' W.	"	36	Aberdeen.	Imm.	Good.
5525	M.	29.5	37.1	27/10/14	8' E. of Firth of Forth.	56° 8' N.; 3° 4' W. (about).	"	1½	Dumdee.	Imm.	Good.
5526	F.	28.5	36.1	26/ 3/15	¾ off Dysart.	54° 10' N.; 0° 40' E.	"	—	Granton.	Imm.	Fair.
5527	M.	29	39	5/ 2/16	27' E. ½ S. of Flamborough Head.	54° 10' N.; 0° 40' E.	"	30	Grimsby.	—	Sound.

Stud.No.

TABLE II.—SUPPLEMENTARY LIST.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessels.	Port Landed.	E. Organs.	Condition.
		Cm.	Length Cm.									
Date, 30th May 1913. Liberated, 56° 6' N.; 2° 44' W.— <i>continued.</i>												
Stud.No.												
1401	F.	30.5	27 / 3/14	1' off Buckhaven.	56° 9' N.; 3° W' (about).	8	Line.	Anstruther.	Imm.	Good.		
1403	M.	28.5	39.5	1/2' off Gosford.	56° N.; 2° 54' W.	3 1/2	Seine Net	Cockenzie.	Imm.	Good.		
1405	M.	27.5	34.5	1' off Pittenweem.	56° 12' N.; 2° 43' W.	6	Line.	Anstruther.	Imm.	Good.		
1409	M.	29.5	Mark	9' E. /S. of Bass Rock.	56° 5' N.; 2° 22' W.	25	S.T.	Granton.	—	—		
			only.									
1412	F.	29.	36.7	16' E. 1/2 S. of May Isle.	56° 14' N.; 2° 5' W.	25	"	Granton.	Imm.	Good.		
1413	M.	29.5	38.	1' off Largo, Fife.	56° 12' N.; 2° 56' W.	6	Line.	Anstruther.	Imm.	Fair.		
1414	F.	29.	33.2	1' off Buckhaven.	56° 9' N.; 3° W. (about).	8	"	Anstruther.	Imm.	Fair.		
Date, 12th June 1913. Liberated, 40' E. of May Island, 56° 22' N.; 1° 22' 30" W. Depth, 35 Fms.												
Sc. A. 10												
5586	F.	45.	48.8	6' E. of Cruden Scours.	57° 25' N.; 1° 39' W.	33	S.T.	Aberdeen.	1/2 ripe.	Good.		
5587	M.	39.5	40.8	20' N.-E. /E. 1/2 E. of Scarboro'.	54° 32' N.; 0 1' E.	36	"	Scarboro'.	—	Sound.		
5598	M.	36.	38.3	24' S.-E. /S. of Aberdeen.	56° 53' 30" N.; 1° 28' W.	35	"	Aberdeen.	Spawn- ing.	Good.		
5599	F.	39.5	43.3	40' E. /S. of Aberdeen.	57° 13' N.; 0° 50' W.	37	"	Hartlepool.	Imm.	Sound.		
5600	F.	45.5	48.6	30' E. 1/2 N. of May Isle.	56° 22' 30" N.; 1° 42' W.	33	"	Granton.	Imm.	Good.		
5603	F.	48.5	50.9	35' E.-N.-E. of May Isle.	56° 33' N.; 1° 44' W.	28	"	Granton.	Spent.	Good.		
5610	F.	40.5	41.5	68' N.N.-E. of North Shields.	56° 8' N.; 1° 12' W.	30	"	N. Shields.	—	Stale.		
5611	M.	40.	41.2	2' S.-E. of Brora.	57° 59' 30" N.; 3° 46' 20" W.	14	Cod Nets	Lossiemouth.	Spawn- ing.	Good.		
5612	F.	40.	48.2	22' S.S.-E. of Aberdeen.	56° 51' 30" N.; 1° 37' 30" W.	41	S.T.	Aberdeen.	Nearly ripe.	Good.		

5614	F.	39.5	41.5	14 / 5 / 14	10' E.-N.-E. of Aberdeen.	57° 13' 50" N.; 1° 48' 5" W.	33	Aberdeen.	Spent.	Good.
5616	F.	40.5	44.1	27 / 5 / 14	38' E. $\frac{3}{4}$ S. of St. Abb's Head.	56° 0' 30" N.; 1° 2' W.	40	Hartlepool.	Imm.	Good.
5619	M.	40.	40.	14 / 3 / 14	11' E. $\frac{3}{4}$ S. of Clyth Ness.	58° 20' N.; 2° 51' 30" W.	28	Geesstemünde	—	—
5627	M.	35.5	40.3	20 / 1 / 15	20' N.-E. / N. of Longstone Light.	55° 57' 30" N.; 1° 26' W.	35	N. Shields.	Ripe.	Sound.
5633	F.	46.5	51.6	2 / 6 / 14	27' E.-S.-E. of Aberdeen.	57° 6' N.; 1° 13' 30" W.	32	Aberdeen.	Imm.	Good.
5636	F.	41.	41.	26 / 2 / 16	Off Banff.	—	—	Whitehills.	—	—
5647	F.	39.	41.8	14 / 4 / 14	6' S.S.-E. of Buchan Ness.	57° 23' 30" N.; 1° 38' 30" W.	41	Aberdeen.	Spent.	Good.
5648	F.	43.5	44.6	7 / 3 / 14	4' E.-S.-E. of Ord Head.	58° 8' 40" N.; 3° 25' 30" W.	27	Buckie.	Spawning.	Good.
5651	F.	41.	43.5	12 / 5 / 14	5' S.-E. of Buchan Ness.	57° 26' 30" N.; 1° 37' 30" W.	40	Aberdeen.	Imm.	Good.
5653	F.	40.	44.1	5 / 11 / 15	60' S.E. / S. of Aberdeen.	56° 29' N.; 0° 39' W.	—	Aberdeen.	About	Good.
5656	F.	33.5	42.	15 / 8 / 14	4' E.-N.-E. of Aberdeen.	57° 11' 20" N.; 1° 56' W.	33	Aberdeen.	$\frac{3}{4}$ ripe.	Good.
5659	F.	48.	50.7	2 / 6 / 14	28' E. / N. of May Isle.	56° 24' 30" N.; 1° 48' 30" W.	28	Aberdeen.	Spent.	Good.
5660	F.	40	43.4	22 / 4 / 14	90' E.-N.-E. of Tay Buoy.	57° 23' N.; 0° 30' W.	43	Dundee.	Spent.	Good.
5671	F.	41.5	45.9	6 / 3 / 14	18' E.-N.-E. of May Isle.	56° 23' N.; 2° 8' W.	30	Granton.	Spawning.	Good.
5672	F.	42.5	46.1	6 / 6 / 14	37' E.-S.-E. of Aberdeen.	57° 5' N.; 0° 55' W.	33	Aberdeen.	Imm.	Good.
5673	F.	50.	53.7	24 / 11 / 14	4' S.-E. of Slains Castle.	57° 20' N.; 1° 47' 30" W.	35	Aberdeen.	Fully	Good.
1416	M.	31.5	36.5	15 / 4 / 14	3'-4' N.-E. / N. of Bell Rock.	56° 29' 30" N.; 2° 21' 30" W.	18	Granton.	$\frac{1}{2}$ ripe.	Good.
1425	F.	29.	38.8	15 / 5 / 15	16' E.-N.-E. of Bell Rock.	56° 36' N.; 2° W.	22	Dundee.	Imm.	Good.
1426	M.	36.5	39.8	1 / 6 / 14	27' E.-N.-E. of May Isle.	56° 28' 30" N.; 1° 56' W.	28	Granton.	Partly	Good.
1428	M.	30.	40.4	1 / 3 / 16	7 $\frac{1}{2}$ ' S. / E. of Clyth Ness.	58° 12' N.; 3° 6' W.	—	Wick.	spent.	Good.
1429	F.	27.5	30.3	28 / 6 / 14	300 yds. from shore at Leven, Fife.	56° 11' 30" N.; 2° 59' W.	3	Leven.	Imm.	Fair.
1432	M.	31.5	37.3	20 / 2 / 15	30' S.-E. / S. of Aberdeen.	56° 49' 30" N.; 1° 21' W.	30	Aberdeen.	Imm.	Good.
Date, 13th June 1913. Liberated, 100' E. of May Island, 56° 40' N.; 0° 21' E. Depth, 52 Fms.										
Sc. A. 10	M.	39.5	40.7	29 / 4 / 14	30' E. / N. of May Isle.	56° 25' 30" N.; 1° 45' 30" W.	28	Granton.	Imm.	Good.
5690	F.	31.5	31.5	7 / 5 / 14	$\frac{3}{4}$ ' from shore off Ross, Holy Isle.	55° 41' 30" N.; 1° 45' W.	5	Holy Island.	Imm.	Good.
5710	F.	44.5	48.8	13 / 5 / 16	104' E. by S. $\frac{1}{2}$ S. of Aberdeen.	57° 2' N.; 1° 12' E.	33	Scarboro'.	—	Sound.
5720	F.	43.5	47.	15 / 4 / 14	25' S.-E. / E. of Aberdeen.	57° 1' 30" N.; 1° 19' W.	33	Aberdeen.	Spent.	Good.

Stud.No.

TABLE II.—SUPPLEMENTARY LIST.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessels.	Port Landed.	R. Organs.	Condition.
		Length Cm.	Length In.									
Date, 13th June 1913. Liberated, 100' E. of May Island— <i>continued</i> .												
Sc. A. 10												
5731	F.	38.5	40.	2/ 5/14	42' E.-N.-E. of North Shields.	55° 26' 30" N.; 0° 30' W.	46	S. T.	N. Shields.	Imm.	—	—
5732	M.	30.5	38.	12/ 1/16	115' N.-N.-E. of Tynne.	56° 55' N.; 1° 7' W.	36	"	N. Shields.	Spawning.	—	—
5734	M.	31.5	36.2	29/ 7/14	35' S.-E. of Aberdeen.	56° 52' N.; 1° 6' W.	38	"	Aberdeen.	Imm.	—	Good.
5740	M.	33.5	35.7	23/11/14	30' E.-N.-E. of Longstone Light.	55° 57' 30" N.; 0° 57' W.	35	"	N. Shields	—	—	Sound.
5744	F.	40.5	41.	1/ 4/14	1' off Whitehills.	57° 42' N.; 2° 35' W.	6	Line.	Whitehills.	Spent.	—	Good.
5745	F.	30.5	39.	17/ 9/14	½ E. of Bambergh Castle.	55° 37' N.; 1° 40' 30" W.	1½	"	N. Sunderland	Imm.	—	Good.
5753	F.	31.	36.9	6/ 7/14	50' E.-S.-E. of Aberdeen.	57° 3' 30" N.; 0° 31' 30" W.	35	S. T.	Aberdeen.	Imm.	—	Good.
5755	F.	31.	30.	12/ 4/14	60 E. ½ S. of Spurn Point.	53° 47' N.; 1° 48' W.	18	"	Grimshy.	Imm.	—	Good.
5767	M.	28.	29.7	20/ 7/14	60' E. ¾ S. of May Isle.	56° 20' N.; 0° 45' W.	42	"	Hartlepool.	Spent.	—	Sound.
5784	F.	47	47.8	29/11/14	80' E. ¾ N. from Grimshy.	54° 5' N.; 2° 15' E.	35	"	Grimshy.	—	—	Sound.
1437	F.	29.	39.7	18/12/14	14' S.-E. of Aberdeen.	57° 2' N.; 1° 39' 30" W.	40	"	Aberdeen.	Imm.	—	Good.
1440	M.	26.5	—	9/10/14	74' N.-E./E. ¾ E. of Flamboro' Head.	54° 55' N.; 1° 30' E.	15	"	London.	—	—	Sound.
1443	M.	26.5	32.	6/11/14	10' S.-E. of Bell Rock.	56° 21' 30" N.; 2° 7' W.	29	"	Dundee.	Imm.	—	Fair.
1452	M.	28.5	30.7	4/ 4/14	5' S.-W. of Bell Rock.	56° 21' 30" N.; 2° 27' 30" W.	18	"	Dundee.	Imm.	—	Fair.
Date, 16th June 1913. Liberated, 220' E. of May Island, 57° 15' N.; 3° 54' E. Depth, 37 Fms.												
Sc. A. 10												
5820	F.	34.	40.	26/ 7/14	174' E. ¾ S. of Aberdeen.	57° 35' 30" N.; 3° 13' E.	32	S. T.	Aberdeen.	Imm.	—	—
5837	M.	35.5	40.3	15/ 7/14	270' N.-E./N. of Grimshy.	58° 0' N.; 3° 0' E.	43	"	Grimshy.	—	—	Sound.
5865	M.	32.5	38.8	18/ 7/14	180' E./S. ½ S. of Aberdeen.	57° 10' 30" N.; 3° 29' 30" E.	35	"	Aberdeen.	Spent.	—	Good.
5870	F.	39.5	43.6	30/ 8/14	20' E.-S.-E. of Flamboro' Head.	54° N.; 0° 25' E.	25	"	Grimshy.	—	—	Gutted.

## Date, 11th November 1913. Liberated, W. of Smith Bank, Moray Firth, 58° 10' N.; 3° 2' W. Depth, 50 Metres.

Sec. A. 10	41.5	41.4	28 / 2 / 14	17½ N.N.-E. of Lossiemouth.	58° 1' N.; 3° 14' 30" W.	26	Cod Nets	Lossiemouth.	Spawning.	Good.
5909	M.	38-	5 or 9 / 3 / 14	" Off East Horne, Iceland." (?)	—	—	S.T.	Hull.	—	—
5916	M.	39-	8 / 2 / 14	1' S. of Tarbet Ness.	57° 51' N.; 3° 46' W.	22	"	Ymuiden.	—	Sound.
5919	F.	53-	3 / 4 / 14	9¼ E.-S.-E. ¼ S. of Berriedale Head	58° 9' N.; 3° 13' 30" W.	30	"	Ymuiden.	—	Sound.
5924	F.	39-	24 / 4 / 14	7' S.-E. of Golspie.	57° 55' N.; 3° 47' W.	17	Line.	Golspie.	Spent.	Good.
5925	F.	45-2	—	Moray Firth.	57° 47' N.; 3° 35' W.	23	S.T.	Grimsby.	—	—
5931	M.	43-	1 / 3 / 14	5½ N./W. of Burghhead.	57° 53' 30" N.; 3° 39' 30" W.	23	Cod Nets	Ymuiden.	Spawning.	Sound.
5943	M.	38.8	11 / 3 / 14	4 E. of Tarbet Ness.	—	—	—	Lossiemouth.	—	Good.
5944	F.	55-2	11 / 3 / 14	Off Findhorn.	5° 40' 30" N.; 3° 38' W.	6	Line.	Nairn.	Spent.	Good.
5949	F.	37-	14 / 5 / 14	8' E./N. of Pentland Skerries.	58° 45' 30" N.; 2° 41' 5" W.	28	S.T.	Grimsby.	—	—
5951	F.	44.5	Mark 11 / 2 / 15	On Bank opposite "Traigh Mhor," Arisaig, Inverness-shire	56° 56' N.; 5° 54' W.	—	—	Oban.	—	—
5953	M.	43-	31 / 3 / 14	Smith Bank, Moray Firth.	58° 11' N.; 2° 55' W.	24	S.T.	Ymuiden.	—	Sound.
5958	F.	42.5	7 / 10 / 15	3' S.-W. of Burghhead.	57° 41' N.; 3° 35' W.	—	"	Lossiemouth.	Spent.	Good.
5959	F.	39-5	1 / 5 / 14	Off Noss Head.	58° 25' N.; 2° 55' W.	22	"	Grimsby.	Imm.	—
5960	M.	43-5	15 / 2 / 14	Not known.	58° 9' 30" N.; 3° 11' 30" W.	35	S.T.	London.	Spent.	Sound.
5961	F.	38-	20 / 3 / 14	10¼ E.-S.-E. of Berriedale Head.	58° 5' N.; 3° 25' W.	22	"	Ymuiden.	—	Sound.
5963	F.	41-2	21 / 6 / 14	Off Helmsdale.	57° 56' 30" N.; 3° 48' 30" W.	18	Cod Nets	Grimsby.	Spawning.	Sound.
5964	M.	40-	25 / 2 / 14	4' S. of Brora.	—	—	—	Lossiemouth.	—	Good.
5968	F.	33-	2 / 3 / 14	1' E. of Hopeman.	57° 43' N.; 3° 24' 30" W.	6	"	Lossiemouth.	Imm.	Good.
5972	F.	40-	24 / 3 / 14	5' S.-E. of Clyth Ness.	58° 16' N.; 3° 4' W.	45	"	Wick.	Imm.	Good.
5974	F.	40-	38 / 1 / 4 / 14	16' E./N. of Sula Skerry.	59° 13' N.; 3° 57' W.	47	S.T.	Grimsby.	Imm.	—
5976	M.	35.5	39-7	Off Lybster.	58° 20' N.; 3° 3' W.	36	"	Grimsby.	—	Sound.
5979	F.	48.1	2 / 5 / 14	7' W.-S.-W. of Dubh Artach.	56° 3' N.; 6° 47' W.	37	"	Aberdeen.	Spent.	Good.
5985	M.	42-	11 / 2 / 16	3' S.-E. of Brora	57° 59' N.; 3° 45' W.	—	Cod Net.	Brora.	Fully ripe.	Good.
5986	F.	36-	9 / 2 / 14	9' E./S. ½ S. of Tarbet Ness.	57° 52' N.; 3° 30' W.	23	"	Ymuiden.	—	Sound.
Stud. No. 1488	M.	32.5	Mark 19 / 3 / 15	6' S. of Clyth Ness.	58° 12' 30" N.; 3° 9' 30" W.	26	Cod Nets	Buckie.	—	—
1499	F.	31.5	37-3	3½' off Helmsdale Light.	58° 5' N.; 3° 30' W.	20	S.T.	Grimsby.	—	Sound.

TABLE II.—SUPPLEMENTARY LIST.

No. of Tab.	Sex.	Length		Date.	PLACE.	LATITUDE AND LONGITUDE.		Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
		Cm.	Cm.									
Date, 12th November 1913. Liberated, Nairn Bay, Station II., Moray Firth, 57° 37' N.; 3° 54' W. Depth, 8 Fms.												
Sc. A. 10												
6070	M.	44.	43.3	—	8' S. of Lybster.	58° 10' N.; 3° 12' W.	26	S.T.	Grimby.	—	—	—
6075	M.	38.5	37.	16/ 2/14	Moray Firth.	—	35-36	"	Greestemünde	—	—	—
6079	M.	43.	47.8	9/ 2/17	5' N. N.-E. from Tarbet Ness.	—	—	Cod Net.	Lossiemouth.	Ripe.	Good.	Good.
6080	M.	41.	41.3	5/ 2/14	8' W./N. ½ N. of Burghhead.	57° 42' N.; 3° 44' W.	25	S.T.	Ymuiden.	Imm.	Sound.	Sound.
6093	F.	32.	32.6	13/ 3/14	1' E. of Nairn Harbour.	57° 36' N.; 3° 50' W.	5	Cod Nets	Lossiemouth.	Imm.	Fair.	Fair.
6098	F.	37.	42.8	4/ 5/15	Off Nairn.	57° 37' N.; 3° 53' W.	6	Line.	Cromarty.	Spent.	Good.	Good.
Stud.No.												
1525	F.	28.5	28.4	1/ 4/14	Off Whithness Head, near Nairn.	57° 39' N.; 4° 0' W.	2½	Cod Nets	Lossiemouth.	Imm.	Fair.	Fair.
1527	M.	27.	27.8	17/ 3/14	Off Nairn.	57° 39' N.; 3° 51' W.	3	Cod Nets	Lossiemouth.	Imm.	Fair.	Fair.
1530	F.	27.	26.4	4/ 3/14	East end Riff Bank, Fort George.	57° 38' N.; 3° 58' W.	7	Cod Nets	Lossiemouth.	Imm.	Fair.	Fair.
1532	F.	26.5	30.	4/ 3/14	Off Whithness Head.	57° 39' N.; 4° 0' W.	3	Cod Nets	Lossiemouth.	Imm.	Fair.	Fair.
1535	M.	25.5	33.8	28/ 6/15	½ N.-E. of Findhorn.	57° 40' N.; 3° 37' W.	—	Net.	Lossiemouth.	Imm.	Fair.	Fair.
1537	F.	34.5	45.5	7/ 5/15	¼ N.-E. of River Findhorn.	57° 40' N.; 3° 36' W.	3	Lines.	Lossiemouth.	Spent.	Good.	Good.
Date, 13th November 1913. Liberated, Aberdeen Bank, 56° 55' N.; 1° 8' W. Depth, 37 Fms.												
Sc. A. 10												
5891	F.	38.5	41.2	22/ 4/14	30' E. ½ N. of May Isle.	56° 23' N.; 1° 44' W.	25	S.T.	Granton.	Imm.	Good.	Good.
5895	F.	48.5	Mark only.	11/ 5/14	27' E.-N.-E. of May Isle.	56° 28' 30" N.; 1° 56' W.	27	"	Aberdeen.	—	—	—
5997	F.	36.5	40.1	2/ 6/14	25' S./E. of Aberdeen.	56° 46' 30" N.; 1° 41' W.	34	"	Aberdeen.	Spent.	Good.	Good.
5998	M.	40.5	40.1	28/ 2/14	5' off Dunrobin Castle.	57° 56' N.; 3° 48' W.	15	Line.	Helmsdale.	Spawng.	Good.	Good.
6007	M.	37.5	38.7	17/ 7/14	24' E./N. of May Isle.	56° 22' 30" N.; 1° 54' 30" W.	26	S.T.	Granton.	Imm.	Good.	Good.
6009	M.	38.	38.9	22/ 9/14	22' E./S. ½ S. of Bass Rock.	56° 4' 30" N.; 1° 4' 30" W.	31	"	Granton.	Imm.	Good.	Good.

6011	F.	46-5	48-3	10 / 1 / 15	4' E.-N.-E. of Aberdeen.	57° 11' N.; 1° 57' W.	30	"	Aberdeen.	About $\frac{2}{3}$ ripe.	Good.
6013	F.	42-5	43-8	3 / 5 / 14	26' S.S.-E. of Aberdeen.	56° 48' N.; 1° 32' 30" W.	43	"	Aberdeen.	Spent.	Good.
6016	F.	50-5	47-3	9 / 6 / 14	25' E.-S.-E. of Aberdeen.	57° 6' N.; 1° 17' 30" W.	31	"	Aberdeen.	Spent.	Good.
6019	F.	47.	41-3	5 / 3 / 14	4' E.-S.-E. of Ord Head.	58° 8' N.; 3° 2' 30" W.	27	Cod Nets	Buckle.	Spawning.	Good.
6024	F.	36-5	39.	18 / 3 / 14	34' S.-E. / E. of Aberdeen.	56° 59' N.; 1° 3' 30" W.	34	S.T.	Aberdeen.	Imm.	Good.
6025	M.	35-5	39-4	9 / 11 / 14	40' N.-E. / N. of Longstone Light.	56° 16' 30" N.; 0° 16' W.	38	"	N. Shields.	—	Sound.
6026	M.	36-5	41-1	15 / 11 / 15	25' E.-S.-E. of Aberdeen.	57° 5' N.; 1° 17' W.	33	"	Aberdeen.	About $\frac{2}{3}$ ripe.	Good.
6029	F.	41-5	49-3	17 / 9 / 15	26' S.-E. $\frac{1}{2}$ E. of Aberdeen.	56° 58' N.; 1° 19' W.	32	"	Aberdeen.	About $\frac{2}{3}$ ripe.	Good.
6034	F.	49.	51.	29 / 6 / 14	25' E.-S.-E. of Aberdeen.	57° 6' N.; 1° 17' 30" W.	35	"	Aberdeen.	Spent.	Good.
6036	M.	41-5	41-8	14 / 3 / 14	23' S.-E. of Ball Rock.	56° 15' N.; 1° 46' 30" W.	30	"	Dundee.	Spawning.	Good.
6040	M.	40-5	40-7	27 / 2 / 14	12' E.-S.-E. of Bell Rock.	56° 25' N.; 2° 1' W.	26	"	Dundee.	Ripe.	Good.
6043	F.	38.	41-5	23 / 5 / 14	32' S.-E. / E. $\frac{1}{2}$ E. of May Isle.	56° 5' N.; 1° 38' W.	30	"	Aberdeen.	Imm.	Good.
6047	M.	44-5	44-3	25 / 3 / 14	4' E. of Berrisdale Head.	58° 11' 30" N.; 3° 23' 30" W.	22	Cod Net.	Lossiemouth.	Ripe.	Good.
6048	F.	50.	50-9	11 / 6 / 14	25' S.-E. / E. of Aberdeen.	57° 1' N.; 1° 18' 30" W.	37	S.T.	Aberdeen.	Spent.	Good.
6052	M.	42-5	42-3	10 / 3 / 14	3' N.-E. of Burchhead Harbour.	57° 45' 30" N.; 3° 26' W.	18	Cod Nets	Lossiemouth.	Spawning.	Good.
6058	F.	42.	48-4	14 / 7 / 15	12' E.-N.-E. of Aberdeen.	57° 16' N.; 1° 45' W.	32	S.T.	Aberdeen.	Imm.	Good.
6063	F.	46-5	48-5	—	No particulars.	—	—	—	—	Imm.	Good.
Stud.No.											
1503	M.	33.	34-7	5 / 6 / 14	44' E. / S. of Bass Rock.	56° 8' 30" N.; 1° 20' 30" W.	34	S.T.	Granton.	Imm.	Good.
1504	M.	31-5	41.	19 / 2 / 15	30' S.-E. of Aberdeen.	56° 54' 30" N.; 1° 15' W.	35	"	Aberdeen.	Imm.	Good.
1510	F.	35-5	36-1	12 / 3 / 14	6'-7' S.-E. of Bell Rock.	56° 23' N.; 2° 12' 30" W.	26	"	Granton.	Imm.	Good.
1513	M.	31.	32-3	22 / 5 / 14	40' S. of Aberdeen.	56° 30' 30" N.; 1° 41' 30" W.	27	"	Aberdeen.	Imm.	Fair.
1514	F.	34.	42-2	19 / 4 / 15	40' E.-N.-E. of May Isle.	56° 36' N.; 1° 37' W.	32	"	Granton.	Imm.	Good.
1515	F.	26-5	32-7	13 / 10 / 14	9' S.-E. of Seurdy Ness.	56° 38' N.; 2° 12' W.	29	"	Aberdeen.	Imm.	Good.
1520	F.	36-5	46-5	14 / 9 / 15	34' S.-E. of Aberdeen.	56° 52' N.; 1° 8' W.	38	"	Aberdeen.	Imm.	Good.

Date, 3rd December 1913. Liberated, St. Andrew's Bay, Fairway Buoy, N.-E. / E. 3', 56° 23' N.; 2° 43' W. Depth, 11 Fms.

Sc. A. 10	M.	35.	34-8	17 / 3 / 14	6'-7' S.-E. of Ball Rock.	56° 23' N.; 2° 12' 30" W.	30	S.T.	Granton.	Spawning.	Good.
6171			Mark only.	12 / 4 / 15	5' S.-E. of Lybster.	58° 15' 30" N.; 3° 8' W.	31	Cod Net.	Lossiemouth.	—	—
6176	M.	32.									

TABLE II.—SUPPLEMENTARY LIST.

No. of Tab.	Sex.	Length.			PARTICULARS OF RECAPTURE.						
		Cm.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.	Depth, Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Date, 3rd December 1913. Liberated, St. Andrew's Bay— <i>continued</i> .											
6177	F.	34	34.5	2/3/14	6' E. of Carr.	56° 20' N.; 2° 22' W.	26	S.T.	Dundee.	Imm.	Good.
6180	F.	35.5	36.5	11/3/14	4' E. of Tod Head.	56° 54' N.; 2° 5' 30" W.	35	"	Aberdeen.	Imm.	Good.
6182	M.	34.5	34.6	10/3/14	18' E.-N.-E. of May Isle.	56° 23' N.; 2° 8' W.	30	"	Granton.	Spawning.	Good.
6185	F.	34	34.6	30/3/14	1' N.-E. of Pittenweem.	56° 13' N.; 2° 38' W. (about).	8	Line.	Cockenzie.	—	Fair.
6186	F.	38.5	38.5	12/3/14	4' E. of May Isle.	56° 13' N.; 2° 24' 25" W.	30	S.T.	Granton.	Imm.	Good.
6187	F.	38.5	41.7	28/6/14	29' E. $\frac{1}{2}$ S. of May Isle.	56° 17' N.; 1° 42' 30" W.	30	"	Leith.	Imm.	Good.
6189	M.	33	33.3	27/2/14	Near Bell Rock.	56° 26' N.; 2° 15' W. (about).	—	"	—	Imm.	Fair.
6190	M.	34	35.2	21/4/14	6' E. of Carr.	56° 19' 50" N.; 2° 23' W.	25	"	Granton.	Imm.	Good.
6194	M.	36.5	38.2	28/11/14	Off Bell Rock.	56° 26' N.; 2° 15' W. (about).	—	"	Dundee.	Nearly ripe.	Good.
6199	F.	35	48.9	15/12/16	30' E.-S.-E. of Aberdeen.	57° 5' N.; 1° 9' W.	33-35	"	Aberdeen.	Ripening.	Good.
6205	F.	32.5	38.3	25/7/15	14' S.-E. of May Isle.	56° 4' N.; 2° 11' W.	26	"	Granton.	Imm.	Good.
6207	M.	36	35.5	12/3/14	12' off Burghhead.	57° 50' N.; 3° 40' W. (about).	28	"	Grimby.	—	—
6208	M.	34	34.7	28/3/14	14' E.-N.-E. of May Isle.	56° 20' 30" N.; 2° 14' W.	28	"	Granton.	Imm.	Good.
6209	M.	32	32.8	5/3/14	$\frac{1}{2}$ off Ratray Point.	57° 37' N.; 1° 49' W.	8	Line.	Peterhead.	—	Fair.
6211	M.	37	39.7	11/9/14	7' E. from Bass Rock.	56° 7' N.; 2° 26' W.	26	S.T.	Granton.	Imm.	Good.
6212	M.	37	38.6	9/6/14	31' off Helmsdale Light.	58° 5' N.; 3° 25' W.	20	"	Grimby.	—	Sound.
6214	M.	33	33.3	7/3/14	Off Bell Rock.	56° 26' N.; 2° 15' W. (about).	20	"	Dundee.	Imm.	Good.
6223	M.	29.5	29.9	26/2/14	14' E. $\frac{1}{2}$ N. of May Isle.	56° 17' N.; 2° 10' W.	24	"	Granton.	Ripe.	Fair.
6227	M.	31.5	31.3	6/4/14	5' E.-S.-E. of Carr Light.	56° 17' N.; 2° 23' 30" W.	28	"	Dundee.	Imm.	Fair.



Date, 12th December 1913. Liberated, Burghhead, S.-E./E.  $\frac{1}{2}$  E.  $2\frac{1}{2}$  miles,  $57^{\circ} 42' 30''$  N.;  $3^{\circ} 34' W.$  Depth, 6 Fms.

6257	41-42-5	40-41-8	? / 5/14 7 / 3/14	Not known. 5' S.-E. of Dunrobin.	57° 57' N.; 3° 44' 30" W.	16	S.T. Line.	Grimsby. Golspie.	— Spawn- ing. Imm.	— Good.
6260	M.									
6269	M.	41-4	9 / 1/14	North Edge, Smith Bank.	58° 15' N.; 2° 50' W.	22-25	S.T.	Grimsby.	Imm.	Stale.
6270	F.	44-	11 / 3/14	5' S.-E. of Clyth Ness.	58° 16' N.; 3° 5' W.	35	"	Ymuiden.	—	Sound.
6272	M.	41-5	5 / 3/14	10' S.S.-W. of Ord Head.	57° 58' N.; 3° 37' W.	24	Cod Nets	Lossiemouth.	Spawn- ing.	Good.
6274	F.	47-5	21 / 3/14	7' E.-S.-E. of Dunrobin.	57° 58' 30" N.; 3° 40' W.	22	Line.	Golspie.	Spent.	Good.
6278	F.	42-5	3 / 8/16	$\frac{1}{2}$ off Burghhead.	About 57° 42' N.; 3° 30' W.	45	Net.	Lossiemouth.	Spent.	Good.
6281	M.	42-0	—	Farø Isles, ?	57° 41' N.; 3° 36' W.	6	S.T.	Grimsby.	—	Gutted.
6282	F.	39-5	3 / 6/15	1' N.-E. of Findhorn.			Small Line.	Lossiemouth.	Spent.	Good.
6283	M.	43-	14 / 1/15	Off Nairn	57° 37' N.; 3° 52' W.	7	Line.	Inverness.	—	—
6285	F.	44-5	? / 7/14	Not known	58° 5' N.; 3° 3' W.	24	S.T.	Grimsby.	Mature.	—
6287	M.	41-	27 / 2/14	25' N./E. of Buckie			Cod Nets	Buckie.	Spawn- ing.	Good.
6288	F.	48-	47-6	3' N. of Burghhead.	57° 45' N.; 3° 30' 30" W.	27	"	Lossiemouth.	Spent.	Good.
6295	M.	41-	42-9	7'-8' N.N.-E. of Whiten Head.	58° 42' 30" N.; 4° 35' W.	36	S.T.	Aberdeen.	Nearly ripe.	Good.
6296	M.	38-	25 / 2/14	3' E. of Nairn.	57° 38' N.; 3° 49' W.	9	Cod Nets	Lossiemouth.	Imm.	Good.
6297	M.	43-	27 / 3/14	10 $\frac{1}{2}$ ' E.-S.-E. $\frac{1}{2}$ E. of Berriedale Hd.	58° 10' N.; 3° 10' W.	35	S.T.	Ymuiden.	—	Sound.
6299	F.	41-	42-6	4' off Helmsdale.	58° 5' N.; 3° 25' W.	24	"	Grimsby.	Imm.	Sound.
6301	F.	45-5	21 / 4/15	1' N.-E. of Findhorn.	57° 40' 30" N.; 3° 35' W.	4	Cod Net.	Burghhead.	Spent.	Good.
6303	M.	46-5	46-	10 $\frac{1}{2}$ ' E.-S.-E. $\frac{1}{2}$ E. of Berriedale Hd.	58° 10' N.; 3° 10' W.	35	S.T.	Ymuiden.	—	Sound.
6304	F.	43-	48-9	18' N.-E. of Findhorn.	57° 40' N.; 3° 36' W.	3	Line.	Lossiemouth.	Spent.	Good.
6306	F.	47-	45-	4' off Helmsdale.	58° 5' N.; 3° 25' W.	24	"	Grimsby.	—	—
6308	F.	45-5	13 / 4/16	1 $\frac{1}{2}$ off Findhorn.	About 57° 41' N.; 3° 37' W.	6	Small Line.	Lossiemouth.	Spent.	Good.
6309	M.	42-	1 / 4/14	Smith Bank, Moray Firth.	58° 11' N.; 2° 55' W.	24	"	Ymuiden.	—	Sound.
6310	M.	43-	? / 2/14	8' S. of Lybster.	58° 10' N.; 3° 13' W.	26	"	Grimsby.	—	—
6311	F.	42-	8 / 5/15	2 $\frac{1}{2}$ ' N.-E. of Findhorn.	57° 22' N.; 3° 34' W.	7	Line.	Lossiemouth.	Spent.	Good.
6321	F.	39-	? / 3/14	Loch Ineard.	58° 25' N.; 5° 10' W.	34	S.T.	Grimsby.	—	—
6322	F.	48-	11 / 3/14	7' E./N. $\frac{1}{2}$ N. of Whiten Head.	58° 39' N.; 4° 34' 30" W.	59	"	Aberdeen.	Spawn- ing.	Good.
6324	F.	40-	7 / 5/15	4' N.-E. of Findhorn.	57° 40' N.; 3° 36' W.	3	Line.	Lossiemouth.	Spent.	Good.

TABLE II.—SUPPLEMENTARY LIST.

PARTICULARS OF RECAPTURE.											
No. of Tab.	Sex.	Length Cms.	Length Cm.	Date.	PLACE.	LATITUDE AND LONGITUDE.	Depth. Fms.	Vessel.	Port Landed.	R. Organs.	Condition.
Date, 12th December, 1913. Liberated, Burghed— <i>continued</i> .											
Sec. A. 10											
6331	F.	42.5	46.8	20/5/15	1' N.-N.-W. of Findhorn.	57° 40' N.; 3° 39' W.	—	Small Line.	Lossiemouth.	Spent.	Good.
6332	F.	50.	49.	1/4/14	16' E. N. of Sule Skerry.	59° 13' N.; 3° 57' W.	47	S.T.	Grimshy.	Mature.	—
6333	F.	48.5	52.2	11/6/15	1' N.-E. of Findhorn.	57° 41' N.; 3° 36' W.	—	Small Line.	Lossiemouth.	Spent.	Good.
6335	M.	44.	47.	26/2/15	4' S.-E. of Berriedale Head.	58° 8' 30" N.; 3° 22' W.	26	Cod Nets	Buckie.	Spawning.	Good.
6336	M.	43.5	43.	2/4/14	26' N.-E. of Buckie.	58° 35' N.; 2° 38' W.	37	"	Buckie.	Ripe.	Good.
6337	M.	46.	45.8	20/3/14	2½' N. of Burghed.	57° 45' 30" N.; 3° 37' W.	34	"	Lossiemouth.	Ripe.	Good.
6338	F.	47.5	47.8	25/2/14	5'-6' E.-S.-E. of Sule Skerry.	59° 4' 30" N.; 4° 13' 30" W.	32	S.T.	Aberdeen.	Ripe.	Good.
6341	M.	45.	45.1	10/3/14	24' N. of Burghed Harbour.	57° 45' 30" N.; 2° 37' W.	33	Cod Nets	Lossiemouth.	Ripe.	Good.
6342	F.	41.5	41.	15/2/14	1½' N.-E. ½ N. of Noss Head.	58° 30' N.; 3° 2' W.	30	S.T.	Vlaar(h)ngen.	—	Sound.
6343	M.	42.5	42.6	27/6/14	3½' from Trochday Island, Skye.	—	—	"	Aberdeen.	Imm.	Good.
6344	M.	42.	40.	27/1/14	Moray Firth.	—	—	"	Grimshy.	Ripe.	Good.
6351	M.	44.	45.3	27/10/15	4' S.W. of Burghed.	57° 41' N.; 3° 37' W.	—	Small Line.	Lossiemouth.	¾ ripe.	Good.
6355	M.	42.	41.3	28/2/14	3' off Tarbet Ness.	57° 53' N.; 3° 38' W. (about).	19	Cod Nets	Buckie.	Spent.	Good.

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SCIENTIFIC INVESTIGATIONS,

1919.

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THE EGGS AND LARVAE OF THE  
ANGLER (*LOPHIUS PISCATORIUS* L.)  
IN SCOTTISH WATERS.

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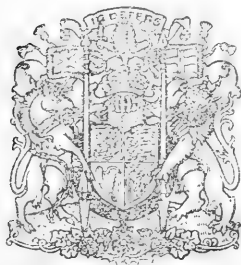
A REVIEW OF OUR PRESENT KNOWLEDGE OF  
THE LIFE HISTORY OF THE ANGLER.

(With 9 Coloured Figures and 2 Charts.)

BY

ALEXANDER BOWMAN, D.Sc., ABERDEEN.

Illustrations by Miss I. M. DUFF.



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# THE EGGS AND LARVAE OF THE ANGLER (*LOPHIUS PISCATORIUS* L.) IN SCOTTISH WATERS.

## INTRODUCTION.

THE ANGLER (*Lophius piscatorius*), with its bizarre form and strange adaptations to mode of life, has always attracted much attention. In recent years, it has become increasingly important commercially, and the species, regularly brought to market, now contributes its share to the food supply of the nation. The Angler often grows to a very large size, sometimes exceeding 5 feet in length. The very large, broad and depressed head of grotesque appearance is of no commercial value, and the practice has grown up of landing only the tails on the markets, and these find a ready sale.

Many contributions to our knowledge of the life-history of this strange species have been made. In spite of the wealth of fact, however, many details of the life-history still remain obscure, and, in particular, little is known definitely regarding the chief spawning-places and the distribution of the larval, post-larval, and small bottom-forms.

The first important contribution to a knowledge of the spawning and of the young forms was made by Agassiz in 1882. In that year, he described the eggs and larvæ from specimens obtained in the Atlantic off the American coast. In 1891, Prince gave somewhat similar descriptions of forms from Scottish waters. Although both these authors deal very fully with the appearance of the eggs and the larvæ until the absorption of the yolk, there is little reference to the later stages. (Agassiz describes one post-larval stage of about 30 mm. in length.) Indeed, there was almost an entire absence of definite information regarding the later post-larval stages until 1911, when Stiasny gave a very detailed description of forms found by him in the Gulf of Trieste. In this publication we have, until now, the only detailed reference to the capture of the later post-larval stages. On the other hand, there are no specific references to the spawning-places of the Angler. Further, information regarding the distribution of small bottom-forms is very scanty. Dr. Fulton (1902) has dealt most fully with this aspect of the problem, and he points out that small Anglers are very rarely met with in the North Sea under a size of 6 inches, although adults are by no means rare within the area.

In brief, our knowledge of the early life-history and the developmental changes through which the young Anglers pass is built up from information derived from very widely separated areas. Yet, when one thinks of the comparative frequency of adult Anglers over a very wide area, and the striking appearance of the floating masses of spawn, and the post-larval forms, one may well feel astonished that complete information regarding the life-history has not been obtained even from restricted areas where the spawn and adults are known to occur.

In the present communication a detailed description is given of the occurrence and developmental changes of the Angler in Scottish waters, and, in addition, an attempt is made, from a consideration of all the facts known about the distribution of the adults, and the younger stages, to bring the detached facts from the different areas into harmony.

The characteristic appearance of the ovaries and the ova just before and after maturation, as can be very easily verified by a microscopic examination of the parts in the adult, has been very minutely described by Dr. Fulton (1897, p. 125). The following is that author's description of some of the points which have a bearing on the problem under consideration:—"The ovaries are confluent, and form a single, long, flattened tube or band whose dimensions vary with the size of the fish and the season of the year. In a specimen with almost mature eggs, caught on 11th February, the ovaries measured a little over 29 feet in length, the greatest breadth was  $13\frac{1}{2}$  inches, and the thickness was only 4 millimetres. It formed a long, flat, semi-transparent band, soft and easily ruptured. The ovaries form a continuous tube, the oviduct, which is thick-walled and narrow—admitting a finger with difficulty—opens into it at its middle, at the junction of the ovigerous and non-ovigerous sides. The ovigerous tissue is limited to one side of the tube, the opposite wall of the ovary, a thin, delicate, translucent membrane, being closely

applied to it. . . . In the ovary, especially before the eggs are quite mature, it will be found that each large egg is contained in a pyriform pouch, which projects into the cavity of the ovary, and which, in such specimens, may be easily separated at its pedicle. In the early stages, gelatinous matter between the pouches is not apparent. When the large, mature eggs escape from their follicles, they pass into the gelatinous secretion, and the mass is extruded no doubt gradually. The process of expulsion through the narrow oviduct would appear to be a matter of difficulty, and the mode in which fertilisation takes place is also a little puzzling. The males are much more numerous than the females, in the proportion of 100 to 26, and it is probable several males attend the female during oviposition."

The number of eggs in such an ovary has been estimated by Fulton. He calculated that, in two nearly mature ovaries, there were 1,345,848 and 1,312,587 eggs respectively.

#### THE FLOATING SPAWN.

(Fig. 1).

The eggs of the Angler, after expulsion from the ovary, are found floating in the sea enveloped in a ribbon-shaped band of mucus. Agassiz (1882) described the appearance of this floating mass of spawn. Some of the bands were from 25 to 30 feet long, and from 2 to 3 feet broad. Thus probably the whole of the eggs from a single ovary are enveloped in this mucoid sheet. Fulton concludes that in such a case extrusion must take place with some rapidity, and that impregnation of the ova is assured by the great excess of males.

The published records of the occurrence of sheets of spawn are discussed later. Hitherto, however, descriptions of sheets of spawn have been confined to examples in which the embryos were already far advanced in development, and the following observations, the result of an examination of a mass in which the eggs exhibited no trace of embryos, are therefore given.

The eggs are arranged in a single irregular layer through the mass, and the gelatinous material forms a series of polygonal cells almost hexagonal in shape but with rounded corners, in which the eggs lie. When the investing jelly-like material is examined under the microscope, the walls of each cell in optical section appear as if made up of a series of very fine concentric lamellae.

Each cell contains an egg, and the eggs are therefore quite separate from each other. The egg is only about half the diameter of the cell, and, surrounded by fluid which fills the remainder of the cell and acts as a buffer, the egg is not deformed by contact with the sides of the cell or with other eggs. Thus each egg is free within its cell, and can be turned about with the point of a needle; it floats with its contained oil-globule uppermost, and if the gelatinous sheet be turned over, the eggs revolve within the cells so that the oil-globules are again on top.

If the eggs are freed from the gelatinous material, they float at the surface of sea-water and appear like normal large pelagic eggs.

The mucous band is of a light violet-gray colour, and when the embryos are well developed in the eggs the dark pigment spots of the young Anglers, still in the egg, give to the mass a somewhat blackish appearance.

Agassiz' figure of the spawn is somewhat misleading. Either the embryos have hatched out from the eggs and are now free within the cells, or if the embryos have not hatched out from the egg, the investing membrane is absent from the illustration. Cunningham's suggestion that the gelatinous substance arises by a modification of the outer surface of the *zona radiata* was apparently based on Agassiz' description. Fulton (1897) has already pointed out that this is not the case. "It (the gelatinous substance) is situated not only outside the follicle, but outside the ovigerous pouch; that is to say, it lies in the cavity of the ovary, and it is, in reality, formed as a secretion by the columnar epithelium."

#### ISOLATED EGGS OF LOPHIUS PISCATORIUS.

The extensive investigations made by the Scottish Fishery Research Vessel, *Goldseeker*, and other research vessels, have shown that the pelagic eggs, and the larval and post-larval stages of our common food-fishes, can be caught in large numbers with special apparatus. Notwithstanding the many extensive voyages of investigation which have been made in recent years by these specially equipped

vessels, hitherto no records have been published of the occurrence of the eggs or larvæ of *Lophius piscatorius*.

Amongst the many collections made by the *Goldseeker* of pelagic fish eggs of common species, an occasional egg, conspicuous by its large size, and possessing an oil-globule, has appeared from time to time. At first there was considerable uncertainty as to the identification of this species of egg, but on 5th May 1911 one was obtained at 59° 26' N.; 1° 20' W., which gave some clue to its identity. This large egg, separated from the rest of the collection, was kept alive and under observation until the embryo had assumed definite shape within the egg. Unfortunately, the embryo died before hatching out, but it was sufficiently advanced in development to enable me, from its characters, to decide that the egg belonged to *Lophius piscatorius*. The characteristic dendritic, dark, chromatophores had developed over the head of the embryo and over part of the yolk and oil-globule, and this particular specimen also showed the characteristic pigmentation on the gut. All doubts as to the specific identification of these large eggs were cleared away when, in April 1914, similar eggs were obtained, from which the embryos were successfully hatched out and reared until the yolk had been very considerably absorbed. The nature of the egg and the characteristic appearance of the larva are sufficient for the purpose of identification.

DESCRIPTION OF THE ISOLATED EGG.

(Fig. 2).

The isolated egg of *Lophius* is pelagic, large and transparent, with a homogeneous yolk. The egg, especially in the living condition, is therefore easily distinguished from that of *Argentina*, in which the yolk is segmented. The pelagic isolated egg of *Lophius* is enclosed in a very delicate membrane. The perivitelline space is extremely small, even when the embryo is well developed in the egg. It never becomes large. (In eggs which have been kept in preserving fluid for some time, the perivitelline space is sometimes larger, a condition due to the shrinkage of the yolk.) The yolk is usually of a very pale straw or yellow colour, and oil globules like burnished copper or amber are present on the surface of the yolk. The number of oil-globules varies; there may be only a single large one, but usually there are one or two larger ones with a variable number of very small ones. These smaller oil-globules may coalesce later, to form a single large oil-globule.

The eggs are not always perfectly spherical, but often appear more or less oval in shape, with a long and short axis at right angles to each other.

The following are the measurements of 500 eggs isolated from a mass of spawn caught on 3rd May 1916 at 57° 37' N.; 0° 53' E. The eggs were measured in the living state, and each egg was measured along its greatest and least diameter—

*Measurements of 500 Eggs caught 57° 37' N.; 0° 53' E.—3/5/16.*

50 scale divisions of eye micrometer = 2 mm.

Major Diameter.		Minor Diameter.		Both Diameters.	
Scale Divisions.	No. of Eggs.	Scale Divisions.	No. of Eggs.	Scale Divisions.	No. of Eggs.
51	1	51	8	51	9
52	2	52	21	52	23
53	14	53	42	53	56
54	19	54	84	54	103
55	52	55	105	55	157
56	81	56	130	56	211
57	117	57	64	57	181
58	99	58	33	58	132
59	71	59	10	59	81
60	33	60	3	60	36
61	8	61	—	61	8
62	3	62	—	62	3
<hr/>		<hr/>		<hr/>	
500		500		1000	

The mean of the major diameters ( $M_1$ ) is 57.146 (2.28584 mm.), and the Standard Deviation ( $\sigma_1$ ) = 1.7892. The mean of the minor diameters ( $M_2$ ) is 55.298 (2.21192 mm.), and the Standard Deviation ( $\sigma_2$ ) = 1.67387.

If  $\frac{M_1 - M_2}{\sigma_{M_1 - M_2}} = D$  is  $> 3$ , these distributions are significantly different where

$$\sigma_{M_1 - M_2}^2 = \left( \frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2} \right).$$

$$\text{Now, if } \sigma_{M_1 - M_2}^2 = \left( \frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2} \right), \frac{M_1 - M_2}{\sigma_{M_1 - M_2}} = \sqrt{\frac{1.848}{\frac{3.201351}{500} + \frac{2.801863}{500}}} = 16.86521.$$

Hence, although in a number of these eggs freed from the gelatinous material, the two diameters at right angles were equal, and the eggs were therefore almost spherical, the eggs of *Lophius* are typically oval, the long diameter being significantly different from the minor diameter.

The following table shows the variable number of oil-globules in the sample of 500 eggs.

Number of Oil Globules.	Frequency.
1	45
2	111
3	111
4	113
5	71
6	27
7	17
8	5
	<hr style="width: 10%; margin: 0 auto;"/>
	500

In addition, 38 isolated eggs caught at 58° N.; 2° 54' W. on 4th April 1914 were measured in the living condition. Two measurements at right angles to each other were made on each egg; the range was from 2.33 to 3.11 mm., and the mean was 2.72 mm. The number of oil-globules varied from one to nine, and the diameters of the largest oil-globule ranged between .51 and .71 mm.

These 38 eggs, when caught, showed no traces of developing embryos, and although the eggs were kept alive as long as possible in fresh sea-water, no traces of developing embryos appeared. Indeed, the eggs gradually died. In five days after capture three eggs were dead at the bottom of the vessel; in seven days the total had increased to nine, whilst eleven days after capture, only six eggs remained clear, floating at the surface of the water. Even in these, the germinal disc showed no signs of segmentation, so that one may conclude that this particular batch of eggs had escaped fertilisation.

The eggs, when preserved in formalin, usually retain their pale yellow tint. The following are the measurements of eggs so preserved. All the eggs, before measurement, had remained more than a year in preserving fluid (.2 per cent. formalin), so that practically they had reached their maximum shrinkage.

*Measurements of Isolated Eggs of Lophius piscatorius caught in the North Sea.*

Size in mm.	. . .	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
Frequency	. . .	5	33	48	41	62	56	38	12	3 = 298

The mean size is 2.4745 mm. The mean size of the oil-globule in those eggs which contained only a single large oil-globule was .6718 mm., with a range from .52 to .88 mm.

Agassiz and Whitman (1885), in their description of the eggs of *Lophius piscatorius* from the American side of the Atlantic, state that the eggs are large, measuring 1.75 mm. in diameter, and that the single oil-globule is .40-.42 mm. The eggs obtained in American waters would appear to be much smaller than those obtained in Scottish waters. The American authors do not say, however, whether the eggs were measured in the living condition or after long immersion in preserving fluid.



M'Intosh (1891) gives the diameter of the contained ova in spawn cast ashore in St. Andrews Bay as 2.2860 mm., and of the large oil-globule as .5334 mm. For an isolated pelagic egg captured about the same time in the Bay, he gives the following dimensions:—long diameter, 1.6764 mm.; short, 1.6383 mm.; oil-globule, .3048 mm.

Ehrenbaum (1905, 1911) records the diameters of the eggs of *Lophius* as varying between 2.13 and 2.36 mm., and of the oil-globules 0.53–0.57 mm. In his tables for the determination of the plankton eggs of fishes occurring in the North Sea, he gives the following criteria for the identification of the eggs of *Lophius piscatorius*:—“Yolk homogeneous, without segmentation. Eggs enveloped in a common mucous mass, from which, however, they often apparently become isolated. Eggs polygonal, flattened against one another, with large perivitelline space.” In view of the foregoing observations, the last sentence should read: Mucous cells polygonal, flattened one against the other, diameter of cell about twice egg diameter; egg free within the mucous cell, with small perivitelline space.

The newly-spawned egg is entirely free from pigment, but even before the embryo begins to assume definite form dark dendritic pigment appears on the embryo and on the yolk in the neighbourhood of the embryo. Isolated eggs at this stage of development are very easily recognised amongst the preserved material; the size of the egg and oil-globule, the thin membrane, and the pigmented yolk and embryo, are sure guides for the identification of such eggs.

As the embryo grows, the dark pigment rapidly spreads, but does not extend to the tail of the embryo itself. The pigment becomes more intensive on the head and anterior body portion, and appears as large, black, dendritic spots. The dark pigment spots also spread down the food canal and over the yolk especially in the neighbourhood of the oil-globule. Indeed, the pigmentation becomes so dense over the oil-globule that the limpid colour of the oil is hidden and the oil-globule seen through this veil of reticulated pigment appears as a cloudy-like ball.

Gradually the embryo assumes a more definite form. It always remains broad and short, never extending more than two-thirds round the yolk. In isolated eggs in the living state the black pigment appears very soft and delicate, and, in some of the embryos, there is a development of violet pigment along the gut. This violet pigmentation is not present in all specimens, and is often very transient, disappearing from the embryo before it hatches out from the egg. Fulton (1902) says that the newly-hatched larvæ possess much bright canary-yellow in addition to the black pigment. This canary-yellow pigment did not appear, however, in any of these isolated eggs.

The embryo almost fully grown and stretching two-thirds round the yolk causes the thin membrane to stretch greatly by its violent movements within the egg. Unlike most pelagic eggs, the embryo does not stretch round the whole circumference of the egg before it is ready to hatch out, and the hatching may, therefore, take place rather unexpectedly. Indeed, so pigment-free is the tail that careful observation has to be made to determine whether the embryos have hatched. There is a very considerable amount of unabsorbed yolk still remaining when hatching takes place. It is probably due to the fact that, by the embryo hatching out thus suddenly, and remaining in the mucous cell for some considerable time before being freed, differences in the description of the newly-hatched larva have arisen.

#### NEWLY-HATCHED LARVA.

(Fig. 3).

The newly-hatched larva floats in the water with the yolk uppermost; the head, being heaviest, is lowest, so that the larva in still water assumes an oblique position, the tip of the tail just touching the surface film. The newly-hatched larva is about 4.5 mm. long, and the yolk is still of enormous size in comparison, the diameter being more than half the length of the larva. The pigment-free tail is very short, being less than the diameter of the yolk. The larva is strongly pigmented with dense dark pigment, especially over the head. This pigment extends over the body almost half way to the anus. The gut is also pigmented, and often

on the posterior half mauve pigment remains for some time. There is also very considerable pigment on the yolk, the pigment spots being large, with dendritic branches, and occurring in dense masses. There is one mass on the yolk under the body, another mass over and encircling the oil-globule. The large dendritic spots which cover the oil-globule give it a peculiar reticulated appearance, so that the oil-drop, with its brilliance dimmed, assumes a weak coffee colour. Isolated dendritic pigment spots occur over the rest of the yolk. The eye is of a deep dark blue colour. The mouth is closed, and there is no appearance of dorsal filaments except that there is a slight depression in the embryonic fin above the head, the edge of which is slightly thickened.

The newly-hatched larva is, therefore, a striking object, and the large yolk, pigmented body and short fleshy pigment-free tail, gives it a peculiar stumpy appearance.

Four days after hatching, the larva has gained considerably in size at the expense of the yolk, which has therefore diminished in volume. The increase in size is most apparent in the yet pigment-free tail, which extends beyond the yolk to a distance exceeding two diameters of the yolk. In the living state, the larva measures about 5 mm., while the yolk-sac has a diameter of about 2.3 mm. The yolk has contracted considerably from the outer membrane. The head, as in the newly-hatched larva, lies over the yolk in close proximity to it, and the contour of the anterior portion of the head is continuous with that of the yolk membrane, there being a deep bay between the yolk and the head. The mouth is closed. In the living condition, the head usually lies on the surface of the yolk. The pigment is somewhat more intensively developed. The head, anterior portion of the body, and gut, are covered with intense black pigment, whilst the eye is of a deep black colour. The yolk, especially over the still large oil-globule, is also covered with branching black pigment. The distinctive colour of the oil-globule has now almost entirely disappeared, and is only seen below the dark-coloured pigment as a faint coffee colour. The gut is covered with black pigment, especially in the region of the pectoral fins, but this becomes less intensive towards the end of the food canal. A short loop of the gut lies above the yolk-sac, and here, as well as in the posterior portion of the intestine, violet pigment may yet persist. The pectoral fins, now somewhat large, are fleshy and scoop-shaped, and rounded or blunt at the tip. The pelvic fins are much smaller and arise directly on the surface of the yolk as conical prominences. Both the pectoral and pelvic fins are free from pigment, and are of a dull mottled gray colour.

The first dorsal fin-ray now appears beyond the margin of the embryonic fin. In the newly-hatched larva, the first hint of the development of this ray was given by the appearance of a thickening above the notochord just posterior to the pectoral fin. This thickening, although ending rather abruptly in front, tails off posteriorly in a wedge-shaped manner. Simultaneously, there appeared a depression in the margin of the embryonic fin, the edges of which also become thickened. To the naked eye, this bay in the embryonic fin looks like a constriction behind the head of the larva. Soon there arises in the indentation of the embryonic fin a small conical prominence, whilst the wedge-shaped thickening above the notochord grows up to meet the indentation. This wedge-shaped thickening now extends much further back on the top of the notochord, whilst there seems to be a shunting forward of the whole mass. This may be more apparent than real, since, at this period, the tail is growing at a relatively greater rate than the head region. The tail has lost its distinctive rounded form, and is now somewhat pointed and appears less fleshy.

#### LARVA—7 TO 8 DAYS OLD.

(Fig. 4).

Considerable yolk remains even after the larva has been hatched a week. Even now, the larva does not lose its unique position in the water, but floats yolk uppermost, the body lying obliquely to the surface film. Occasionally, the larva lies over to one side, but frequently there is vigorous movement from side to side of the now much elongated tail. When a slight movement is given to the water, the larva sinks a few inches, only to rise again slowly to the surface.

The dorsal fin-ray is now very distinct. The pectoral fins have also grown considerably, and are moved vigorously by the larva.

The larva at this stage measures, in the living condition, about 5.5 mm. The yolk is, however, much smaller in comparison to the total length of the larva, and the pigment-free tail is also much larger than the diameter of the yolk.

The larva has become much thicker and more opaque, although the body pigment does not extend much behind the dorsal fin prominence. The tail is still practically pigment-free, but in some larvæ there may appear a single dendritic pigment spot on the notochord near the middle of the tail, and there may also appear the beginning of pigment on the ventral surface near the tip of the tail. Usually, at this stage, the mauve pigment has disappeared from the gut. The dorsal fin filament has now grown considerably in length. The pelvic fins are, however, very striking objects. They arise from the surface of the yolk-sac as long conical prominences posterior to the fan-shaped pectorals. As the yolk gets absorbed, the pelvic fins grow rapidly in length, and gradually get shunted forward, until finally at the complete absorption of the yolk they are inserted on the ventral surface of the body anterior to the pectorals. Small pigment spots appear on the tips of the pelvic fins, but the pectoral fins, as yet, are pigment-free.

Soon after this stage, the larvæ begin to lose their characteristic position at the surface of the still water. They gradually sink towards the bottom of the vessel and, although they may remain suspended in the water for some little time, they finally come to rest on the bottom. No difficulty is encountered in rearing the larvæ in a hatchery until the absorption of the yolk. In the summer months, the absorption of the yolk is completed in about fifteen days.

#### LARVA AT THE COMPLETION OF THE ABSORPTION OF THE YOLK.

(*Fig. 5*).

A very fine specimen at this stage was caught in a bottom tow-net at Station 36 (58° 26' N.; 0° 8' W.) on the 15th July 1914. The larva, after preservation in 2 per cent. formalin for a few days, measured 8 mm. It still retains the characteristic form, and shows no signs of depression of the head or body. The head is two-sevenths of the total length, and the notochord extends as a supporting rod the whole length of the elongated tail. The embryonic fin is broad and still quite complete. The head and body regions are now completely covered with pigment, and this feature, together with the elongated, almost pigment-free tail, gives to the larva its superficial tadpole-like appearance. The pigment on the head and body is of a delicate dark brown colour, merging into black over the brain and behind the pectoral fin. The eye is still normal in position, slightly nearer to the tip of the snout than to the insertion of the pectoral fin. It is dark, with a bluish shimmer. The mouth, at this stage, is well-formed and open, whilst the gill-cover is also very distinct.

The pectoral fins are large, transparent, and fan-shaped, the posterior border extending almost to the anus. They are inserted on the body just half-way between the posterior border of the eye and the anus, and have lost the distinctive fleshy appearance of the early larval stages. They are only made out with difficulty against the darkly pigmented body.

The greatest changes have taken place in the dorsal fin-rays and in the pelvic fins. A second dorsal fin-ray element has arisen behind the first; it is shorter and not so robust, but both rays end in a fine filament. The length of the first ray is greater than the depth of the body.

The pelvic fins have now entirely lost their primary form. They are shunted very far forward, and are inserted on the ventral surface in front of the pectoral fins. They have increased enormously in length, and are long, simple, filamentous rays, pigmented at the tip. They extend to the mid-point of the total length of the larva.

In this specimen there is a single large chromatophore on the notochord in the middle of the tail. As yet, there are no signs of the development of the unpaired fins.

There are no indications, up to this stage of development, that the larva belongs

to such a depressed form as the adult *Lophius piscatorius*. The larva is deeper than broad, and the head, body, and tail are in the same line. The eyes are placed laterally on the head, and the broad embryonic fin which borders the tail is continued dorsally to the elements of the first dorsal fin.

Agassiz and Whitman (1885) have described very minutely the development of the larval forms until the completion of the absorption of the yolk, and Prince (1890), in his descriptions of Scottish specimens at the same stages of development, has pointed out that they differ in some respects from the American forms.

In the Scottish specimens hatched from isolated eggs, the first ray has not appeared when the larva is newly hatched, whereas the American workers describe the newly-hatched larva as possessing a single (first) dorsal appendage. As has been pointed out already, the newly-hatched larva may be held for some time in the gelatinous mass. There is the greatest difference, however, between the American and North Sea specimens in the degree of development of black pigment, especially on the tail. In the American specimens, there are three or four prominent patches of intense black pigment placed at equal intervals along the lower, upper, and terminal parts of the notochord. The tail pigment spots extend on both sides of the notochord, and form the largest of the three patches. This is the case from the earliest stages. On the other hand, in the Scottish specimens, the black pigment is confined entirely to the head and anterior body portion of the larva. Only very rarely is pigment found on the tail portion, and then only in the form of single chromatophores. One chromatophore may sometimes be found at the tail-tip on the notochord and another on the notochord in the middle of the tail.

Variation in the intensity of development of the larval pigmentation is not unusual in other species. Schmidt has shown that Gadoid larvæ of the North Sea are characterised by weak pigment development.

#### POST-LARVAL FORM WITH THREE WELL-DEVELOPED FIRST DORSAL RAYS AND BEGINNING OF SECOND DORSAL AND ANAL FINS.

(Fig. 6).

The next stage illustrated is that of a specimen caught 30 miles E. of Bard Head ( $60^{\circ} 15' N.$ ;  $0^{\circ} 7' W.$ ) on 13th July 1905, in a depth of 125 metres. The specimen had been some considerable time in formalin, and its length when examined was 10 mm. Its actual length, when alive, would probably have been slightly over 11 mm. Even in this preserved specimen the colour had not entirely disappeared. The eyes retain their dark colour, and pigment still covers the head and body, but it is not so dark as in the preceding stage.

This stage may be indicated by the appearance of the elements of the second dorsal and anal fins in the tail region. The rudiments of these fins are seen to arise on the dorsal and ventral sides of the notochord in the still complete embryonic fin which borders the whole tail region. As yet, however, there are no indications of the first elements of the caudal fin, for the notochord is straight and the tail pointed.

Most of the specimens in the present collection are at this stage of development.

The head and body region shows the first signs of that progressive change which gradually leads up to the typical form of the adult. The head and body region is now slightly more than two-sevenths of the total length, and placed at a somewhat obtuse angle to the straight tail. There is no sign of flattening of the larva, however, although now the eye has a relatively higher position on the head. It lies immediately over the angle of the mouth. The bones of the mouth are well-developed. The under jaw is very prominent, projecting beyond the upper, and is toothless. The operculum is distinct behind the eye. The fin-rays of the first dorsal fin, the pectoral and pelvic fins, show considerable advances in development from the preceding stage. There are three well-developed fin-ray elements of the first dorsal, and a fourth has made its appearance posteriorly. The three anterior rays end in fine filaments and are very long, exceeding the depth of the body. The first ray is still the longest. It arises directly over the cerebrum, and its jointed nature is easily made out. Its real attachment is much further back.

The pectoral fins have increased in size and are large, fan-shaped organs inserted

on the body at the upper corner of the gill-opening. The borders of the fins have a crenated appearance, but there are no signs of thread-like appendages. The pelvic fins have grown greatly, and now extend beyond the mid-point of the larva, but, in addition, they have increased their surface enormously by the development of subsidiary lobes. Scattered groups of delicate pigment appear on the pelvic fins, but there are distinct pigment groups at the tips of the long rays.

A specimen from Scottish waters of somewhat similar size is described by Fulton (1902). The head is about one-quarter the length of the body, and it is more than a third deeper than long; in a front view, the breadth of the head is about seven-tenths of the height. Fulton also describes the movements in the water of the pelagic form at this stage. "The little post-larval Angler, about 10 mm. long, has a very odd appearance as it swims through the water by the rapid vibration of the pectorals and tail, the long black verticals projecting downwards and upwards and quiescent below, and the almost equally long, black-tipped rays of the first dorsal standing erect on the top of the head. The eyes are large, deep ultramarine in colour, and look upwards and forwards, and the mouth is usually gaping, each jaw being provided with a row of ten or twelve minute-pointed teeth. They were observed to dart and snap at particles in the water."

#### FIVE DISTINCT RAYS IN THE FIRST DORSAL FIN, THE ELEMENTS OF THE SECOND DORSAL AND ANAL FINS COMPLETE.

(Fig. 7).

As the post-larval form grows, there is a progressive development of all the different parts. The head and body become longer and more massive in comparison to the total length of the larva. The fins are also progressively developed, and, at the stage illustrated in Figure 7, there are now five distinct rays in the first dorsal fin, whilst the elements of the second dorsal and anal fins are complete, and the caudal fin has also appeared. The total length of a post-larval form at this stage is about 15 mm. when preserved in formalin, and the distance from the tip of the lower jaw to the anus 5.2 mm. In the specimen figured, the mouth is widely open with the lower jaw the more prominent, and minute conical teeth and papillæ denoting the positions of future teeth can be seen in both jaws. The eyes are now somewhat higher in the head, gradually tending to look upwards as well as outwards. The horizontal diameter of the eye is one fourth of the length of the body from the tip of the snout to the anus. The anterior margin of the eye is slightly more than half its horizontal diameter from the anterior margin of the head. The gill openings are large and distinct, and the bases of the pectoral fins are inserted on the body almost in a line with the eye at the upper angles of the gill-openings. Both pectoral and pelvic fins are extremely well-developed. The base of the pectoral fin is kidney-shaped. The membranous fan-shaped portion, with fin-ray supports quite distinct, is very large. When fully expanded, the pectoral fin covers the bases of the two posterior rays of the first dorsal fin, and also the anterior rays of the second dorsal and anal fins. There are no traces of filamentous prolongations of the rays. The pelvic fins, inserted on the ventral surface of the head, anterior to the pectoral fins, have an extensive surface. The longest ray extends behind the second dorsal and anal fins, but the surface is increased by the development of secondary lobes. These fins are delicately pigmented along the rays, and the pigment is most intense at the tips of the rays. There are five distinct rays in the first dorsal fin, the tips of which end in long filamentous processes. The bases of the rays are enveloped in the same membranous sheath which extends some distance up the posterior four rays. In front of the first ray, the rudiment of a sixth ray has been formed, the tip of which has just made its appearance in a depression above the contour of the head. The interspinous elements of the second dorsal and anal fins are now well-formed, and eleven dorsal and nine anal rays can be counted extending to the edge of the embryonic fin. The embryonic fin, however, is still complete, and extends beyond the tip of the still straight notochord. The rays of the caudal fin are much better developed on the ventral side of the notochord some distance from the tip, but the basal elements of the caudal fin are not yet distinct from each other.

SIX RAYS IN THE FIRST DORSAL FIN, THE FIRST RAY STILL SMALL BUT APPEARING ABOVE THE CONTOUR OF THE HEAD; SECOND DORSAL AND ANAL FINS COMPLETE.

(Fig. 8).

In this post-larval form, there is not a great increase in size, but the development of the fins has progressed sufficiently to give some idea of the complete pelagic form. The pectoral and pelvic fins are large; still, there are no signs of filamentous prolongations of the rays of the pectorals. Neither are there filaments to the pelvic fins, although this may be due to the difficulty in obtaining perfect specimens. The pelvic fins are extraordinary, however, for the principal rays extend as far back as the caudal fin, and there is an enormous surface when the fins are expanded.

Another characteristic of these older post-larval forms is the persistence of the embryonic fin which still remains broad. The completed second dorsal and anal fins add three diameters to the depth of the tail. Even the first dorsal fin helps to give depth to the fish, for the membranous sheath enveloping the bases of the four posterior rays is over three-fourths of the depth of the body. The first two rays of the first dorsal are not included in this membranous sheath. The first ray is very small, immediately anterior to the second ray, and the tip appears quite distinctly above the contour of the head. The second ray is inserted on the head in front of the middle of the eye. It is relatively further forward than at the previous stage. It is still very long, and ends in a filamentous tip. The third ray, which is about the same length as the second, arises from the head just posterior to the eye. The bases of the three posterior rays are very close to each other, and arise far back on the head above the insertion of the pectoral fin. There is, therefore, a greater distance between the third and fourth rays than between the second and third.

The rays of the caudal fin are now distinctly formed, and extend from the ventral surface of the notochord to the margin of the embryonic fin. The notochord is still straight at the tip, and is distinct from the rays of the caudal fin.

The body has not gained much in breadth; it has not changed greatly in form. The pectorals are, therefore, still inserted high up on the side of the body, and the gill-cover with the branchiostegal membrane is also distinct, when the fish is viewed in profile. The mouth is large and well-developed, and the lower jaw very prominent. The eyes are large, tending to look forwards, as well as outwards. The distance from the anterior head contour to the anterior edge of the eye is slightly less than the horizontal diameter of the eye.

Stiasny (1911) has given most complete descriptions of the post-larval forms after the absorption of the yolk. There is a number of points of difference between the North Sea specimens and those of the same size from the Adriatic series.

The smallest specimen described by Stiasny is one of 10 mm. in length, but, as it had remained a long time in formalin, its original length may probably have been about 11 mm. The stage of development is indicated by the degree of development of the rays of the first dorsal fin. The first ray of the first dorsal fin, which later carries the two-lobed appendage, is small, almost rudimentary, and sunk in a small groove above the eyes. Directly behind this, there project the strongly-developed second and third rays of the first dorsal, which, with the three posterior rays, are still connected by a border which is confined to the base. The continuous embryonic fin connects these latter with the easily distinguished second dorsal fin, in which nine rays may be counted.

Scottish specimens of a similar length are not so far advanced in development as Mediterranean specimens. At this size, the post-larval forms show only three well-developed first dorsal rays, and the beginnings within the embryonic fin-fold of the elements of the second dorsal and anal fins in which, however, the separate elements cannot be distinguished.

Similarly, at the later stages, the Scottish specimens are larger than Mediterranean ones at the same stage of development. The same feature has been observed in other species, for Petersen points out that specimens of *Drepanopsetta* from Iceland are much larger than specimens from the North Sea at a similar stage of

development. It is possible that this difference, and the fact that the smallest specimen from the Mediterranean had already the complete number of rays in the first dorsal fin, led Stiasny into error regarding the sequence in development of the rays of the first dorsal fin. The 10-mm. long specimen, described by Fulton, from the North Sea, had not yet developed the true first ray. In reality the first ray is the last to make its appearance in the development of the first dorsal fin, and the Scottish specimens do not reach this stage of development until they are about 15 mm. long. On the other hand, the Mediterranean forms, at a length of 15 mm., show the separation of the first ray of the first dorsal fin into a long thin stalk and a flap-like termination.

Stiasny states that the first small teeth in the upper and lower jaw are visible in individuals of 17 mm. long. According to Fulton, the 10-mm. long form, described by him, showed 10 to 12 small pointed teeth. In the present series, the first indications of teeth on the jaws were made out in specimens with five dorsal fin-rays.

A post-larval form of about 30 mm. in length has been described by Agassiz (1882), but here again Mediterranean specimens of a similar size are further advanced in development than the American one. Agassiz' post-larval specimen, although very much larger than the largest North Sea specimens, resembles these much more closely than it resembles the Mediterranean ones. The description given by Agassiz may, therefore, be used to bridge the gap between the oldest post-larval form here described and the smallest bottom stage.

"Although the body is still laterally compressed, the head, which has greatly increased in size, as well as the body anterior to the anal opening, have become somewhat flattened ventrally, the first trace of the great flattening so characteristic of the genus. The anterior part of the head projects proportionally far in advance of the orbits, the head sloping less from the base of the anterior dorsal ray than in preceding stages. The pectorals have now become enormous; they extend across the whole width of the body of the young *Lophius*; they are lobed at the edge, the rays articulated, well-marked, and edged with rows of elongated dark pigment spots. The tail is well-formed, though it still retains its ganoid shape, and the posterior dorsal and anal, though well-formed, are still connected by a distinct remnant of the dorsal and ventral embryonic fin-fold with the caudal fin. The anterior dorsal now has five rays, with a rudimentary one anterior to the first formed ray. These rays are connected at the base by a fin-fold at a much higher point than in younger stages; they extend far beyond the fold; the extremities curve down about a quarter of the length of the ray. The increase in length of the ventral rays has been still more remarkable. The original ventral ray is now nearly twice as long as the body of the fish, and the second ray extends fully as far as the extremity of the caudal fin. There are two shorter exterior rays and one interior ray; they are joined by a membrane extending nearly to the base of the caudal, so that when expanded and seen from above the ventrals appear like regular wings."

It is to be noted that, in the American specimen, the first ray of the first dorsal fin is still small. Again, the membrane, which connects the posterior rays extends high up the rays, whereas in Stiasny's forms this membrane does not extend beyond the base of the rays. Further, although the second dorsal, anal, and caudal fins are well formed, the embryonic fin-fold still persists. In Stiasny's series, the embryonic fin-fold has dwindled considerably before this size is reached.

If the above differences are kept in mind, the later stages described by Stiasny may be considered briefly. In the young fish of 22 mm. length, the fan-shaped pelvic fins have increased to almost twice the length of the body; at a length of 27 mm. the membrane connecting the rays has grown still broader so that they give to the fins, especially in movement, the appearance of wings; whilst, at 30 mm., the thread-like prolongations of the rays are still very long, often twice as long as the body, or more. In the Mediterranean specimens at a length of 17 mm., there is the first sign of the little leaf-like appendages at the border of the under jaw. These rugged tags increase in number on the whole body as the fish gets longer. There is a general and gradual flattening of the head, and at the length of 50 mm. the head has increased still further in size and has grown flatter, the breadth now exceeding the height by 2 mm. Stiasny states that at this stage, apart from the still thread-like appendages, the wing-like pelvic fins and the broad pectorals

have already the appearance characteristic of the fully developed post-larval form.

The largest post-larva described by Stiasny measured 55 mm., but he thinks that, when about 80 mm. long, they seek the ground, the natural habitat of the adult.

#### SMALL BOTTOM STAGE OF 64 MM.

(*Fig. 9*).

Unfortunately, there is a considerable gap in the series between the largest post-larval form and the smallest bottom stage caught in Scottish waters. There is no difficulty, however, in recognising the specimen of 64 mm. in length as a young Angler, on account of its close approach to the typical adult form. Although many of the changes leading up to this form have been radical, they have not yet been completed, and it is therefore of interest to compare this stage with the preceding one, as well as with the larger forms.

A small bottom form of 124 mm. (preserved in formalin) has already been described by Fulton (1902). It was caught in the month of July in the Dornoch Firth in a depth of 8 to 11 fathoms. As it has many characters in common with the smaller specimen, Fulton's description has been incorporated in the present one. The relation of the 124-mm. specimen to a series of small bottom forms, which have been examined, is considered later.

The transference from a pelagic to a bottom habit has involved many changes both in form and in the relation of the paired and unpaired fins.

The small specimen of 64 mm. in length is still soft and gelatinous, with an abundance of mucoid tissue in the head region.

The change in form has been brought about mainly by the enormous lateral expansion of the bones of the head behind the eyes. The greatest breadth of the head behind the eyes is now almost one-and-a-half times the distance from the tip of the upper jaw to the occiput, and almost twice the greatest depth of the head. The actual measurements are: breadth behind the eyes, 23 mm.; distance from tip of upper jaw to occipital region, 16 mm.; depth at occipital region, 13 mm. The body narrows suddenly behind the head; its breadth, just behind the gill-openings, is 8 mm. The body and tail form an elongated truncated cone slightly flattened on the ventral surface. The distance from the occiput to the end of the tail peduncle is 32 mm., and the breadth at the tail peduncle, 4 mm. The breadth of the body at the head is masked by the disposition and size of the pectoral fins. The angles of the large mouth are in a line with the anterior margins of the eyes; the gape with the mouth closed is 19 mm. The eyes are 5 mm. in diameter, and the concave interorbital space is only slightly greater than the diameter of the eyes. The eyes have, therefore, lost their original lateral position on the head.

The pectoral fins are large, the fan-like portion being equal to the length of the head. They are pigmented at the tips, but there are no filamentous prolongations of the rays. The membrane between the rays is still delicate and the fin is capable of considerable expansion. The lateral growth of the bones of the head behind the eyes has been accompanied by the rotation of the pectoral fins through a right angle, so that the surfaces of the fins, when expanded, are now in a horizontal plane, and, therefore, more adapted to a bottom habitat. The lateral expansion of the head and the adhesion of the edges of the branchiostegal membranes across the isthmus have made the gill-openings appear below the axils of the pectoral fins. The pelvic fins are inserted on the ventral surface very far forward. They are also pigmented at the tips, and are still membranous and capable of expansion. They are much reduced in size, however, but the tips of the rays extend back almost to the anus, which opens immediately in front of the anal fin.

The first dorsal fin has altered considerably, the six rays being now well developed. The first two rays are very far forward, and arise close to the tip of the snout. The second ray is the larger, and, when stretched along the head, reaches to the base of the third ray. The first ray is only about half the length of the second. It is very delicate and destitute of lateral appendages or fringes, but bears on the tip a small membranous horizontal appendage about 4 mm. long, attached by the middle. This membranous appendage is usually curled on itself in preserved specimens.



Examination shows that it is provided at the free border with small hair-like filaments. As Fulton remarks, it presents an extraordinary superficial resemblance to an Amphipod.

The third ray of the first dorsal fin is quite separate from the others, and arises from the head just in front of the two occipital spines. It is only slightly smaller than the second ray. The three posterior rays are united by their bases to the skin membrane, and arise on the dorsal surface of the body. They decrease in size posteriorly. All the rays of the first dorsal fin, except the first, are feathered laterally with membranous fragments.

The spines on the head are well developed, and appear very prominent in these small preserved specimens. The most prominent spine lies posterior to the eye. Other prominent spines are two on the inner margin of the orbit, and the two occipital spines.

The upper surface of the body is covered with tag-like processes of skin which simulate seaweed. These skin-fragments are especially numerous as a fringe along the middle line of the body and along the margin of the lower jaw. The skin-tags are even present on the upper surface of the pectoral fins.

Little can be said with regard to the exact colouring of small preserved specimens. The general colour of the smaller specimens may be described as grayish-brown, but a gradual transition to the typical adult coloration can be followed with the increase in size of the specimens.

#### DEVELOPMENTAL CHANGES IN SMALL BOTTOM FORMS.

Although the small specimen of 64 mm. had assumed the bottom habitat, the transition from the pelagic to the bottom form had not been completed. Further changes take place before the typical miniature adult form is assumed.

A series of small specimens, ranging in size from 64 to 344 mm., has been examined and careful measurements made.

TABLE I.  
*LOPHIUS PISCATORIUS*—DEVELOPMENTAL CHANGES IN SMALL BOTTOM FORMS.

No. of Specimen.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A. Total Length in mm. . . . .	64	67	69	72	83	94	116	145	184	199	203	203	205	220	244	265	344
B. Length without Caudal Fin . . . . .	48	51	52	55	65	74	91	119	150	163	165	166	167	179	200	216	281
Length of Caudal Fin . . . . .	16	16	17	17	18	20	25	26	34	36	38	37	38	41	44	49	63
Percentage of B. . . . .	33.3	31.4	32.7	31.0	27.7	27.0	27.5	21.9	22.7	22.1	23.0	22.3	22.8	22.9	22.0	22.7	22.4
Distance from Lower Jaw to Occiput . . . . .	20	19	21	22	26	28	34	44	51	63.5	58	58	60	65	74	74	97
Percentage of B. . . . .	41.7	37.3	40.4	40.0	40.0	37.8	37.4	37.0	34.0	38.9	35.1	34.9	35.9	36.3	37.0	34.3	34.5
Distance from Upper Jaw to Occiput . . . . .	16	16	16.5	18	20.5	21	28	35	42	46.5	48	45	45	51	56	60	79
Percentage of B. . . . .	33.3	31.4	31.7	32.7	31.5	32.4	30.8	29.4	28.0	28.5	29.1	27.1	27.0	28.5	28.0	27.8	28.1
Greatest Breadth of Head behind Eyes . . . . .	23	25	27	27	33	36	44	56	71	77	80	79	82	87	97	105	134
Percentage of B. . . . .	47.9	49.0	51.9	49.1	50.8	48.6	48.4	47.1	47.3	47.2	49.1	47.6	49.1	48.6	48.5	48.6	47.7
Depth of Head at Occiput . . . . .	13	12	14	12	15.5	18.5	21	22	23	25	26	25	27	31	32	36	51
Percentage of B. . . . .	27.1	23.5	27.0	21.8	23.8	25.0	23.1	18.5	15.3	15.3	15.7	15.1	16.2	17.3	16.0	16.7	18.2
Length of Pectoral Fin . . . . .	26.5	24.5	26	27	30	35	39	42	47	54	52	52	53	62	65	72	92
Percentage of B. . . . .	55.2	48.0	50.0	49.1	46.2	47.3	42.9	35.3	31.3	33.1	31.5	31.3	31.7	34.6	32.5	33.3	32.7
Length of Pelvic Fin . . . . .	19	20	19.5	19.5	18	20	23	24	25	29	29	26	28	29	30	34	42
Percentage of B. . . . .	39.6	39.2	37.5	35.4	27.7	27.0	25.3	20.2	16.7	17.8	17.6	15.7	16.8	16.2	15.0	15.7	14.9
Distance from Lower Jaw to Anus . . . . .	29	32	32.5	34	40	46	58	77	104	112	109	110	113	122	138	144	192
Percentage of B. . . . .	60.4	62.7	62.5	61.8	61.5	62.2	63.7	64.7	69.3	68.7	66.1	66.3	67.7	68.2	69.0	66.7	68.3
Length of 1st Ray of 1st D. . . . .	5	5	5	5	7.5	7.5	10	12	23	21	25	24	22	22	30	34	52
Percentage of B. . . . .	10.4	9.8	9.6	9.1	11.5	10.1	11.0	10.1	15.3	12.9	15.1	14.5	13.1	12.3	15.0	15.8	18.5
Length of 2nd Ray of 1st D. . . . .	13	12	12	12	14	14	19.5	22	33	31	34	37	36	34	38	43	58
Percentage of B. . . . .	27.1	23.5	23.1	21.8	21.5	18.9	21.4	18.5	22.0	19.0	20.6	22.3	21.6	19.0	19.0	19.9	20.6
Long. Diameter of Eye . . . . .	5	5	5.5	5.5	6	6	7.5	9	13	13	13	14	14	14	16	16	20
Interorbital Space . . . . .	5	5	5.5	6	6.5	7	8.5	9	12	13	13	14.5	14	15	17	18	25

All the specimens were measured after preservation in formalin. The Angler is a form on which measurements are not easily taken, but, as far as possible, only those have been selected which can be made between definite and comparable points in the several specimens. For the present purpose, the specimens have been arranged in series according to their lengths from the tip of the lower jaw to the end of the tail peduncle (*i.e.*, length without caudal fin). For each specimen, this measurement has been used as the standard, and all other measurements have been calculated as percentages of this standard length. The total length has been given in brackets for the purpose of ready reference.

The head length of *Lophius* is difficult to define, and measurements have therefore been made from both the lower jaw and upper jaw to a point in the occipital region between the two strong occipital spines. Breadth of head has been measured behind the eyes, the fringe of tag-like processes acting as a guide to the limits. Depth of head is perhaps the most unsatisfactory measurement, as it depends greatly on the degree of distension or depression of the head at the time of death. The vertical distance of the occiput above the flat surface on which the specimen lay has been taken as a measure. In order to secure uniformity for the paired fins, these have been measured from their insertions to the tip of the longest ray.

The number of specimens examined is certainly small, and discrepancies may arise through individual variations, but, when these points are taken into consideration, the general trend of the developmental changes is sufficiently obvious to allow certain conclusions to be drawn from the data obtained. The results have been plotted out in a diagram, the standard lengths being represented as abscissae, the percentage-lengths of the various measurements as ordinates. Any change in the relative growth of the different parts with increasing size of specimen will thus be indicated by the slope of the lines. Curves have been drawn as uniformly as possible among the points for each series of observations. After a length of about 150 mm. (185 mm.), these curves in general run parallel to the abscissal axis. The interpretation is that the young Angler at a length, without caudal fin, of 150 mm. (or about 185 mm. total length), has completed its metamorphosis, and acquired its true bottom form, and that thereafter the growth of the different parts is uniform.

The changes from the typical pelagic form to the bottom form of 150 mm. length (185 mm.) are orderly and progressive. The length, breadth, and depth of the head decrease regularly, although slightly, in proportion to the length of the fish. The relation, head length to head breadth, is established before the Angler reaches a length of 48 mm. (or 64 mm. total length). On the other hand, the distance from the tip of the lower jaw to the anus, relative to the total length, increases slightly as the fish grows, until the length of 150 mm. (185 mm.) is reached. In other words, until this length is reached, the body portion between the head and anus grows relatively most quickly.

There are also orderly changes in the relations of the fins to the total body length. Here again, however, the paired fins and the caudal fin have assumed their definite proportional size when the fish has reached a length of about 150 mm. (185 mm.), and after this length, these fins grow uniformly with the fish. The transition is most rapid in the relative length of the pelvic fins, and least rapid in the caudal fin, as was to be expected. The proportional length of the pectoral fins to the total length falls from over 50 per cent. at a length of 48 mm. (64 mm.) to an average of 33 per cent. at 160 mm. (195 mm.), whilst the pelvics fall from 40 per cent. to between 16 and 17 per cent. within the same limiting sizes.

The changes in growth of the rays of the first dorsal fin are also of considerable interest. It has already been seen that the first dorsal fin, on account of the extension of the rays and the development of the membranous sheath is of considerable importance during pelagic life. The first two rays, however, are not included in this common membranous sheath, but are gradually shunted further and further forward on the top of the head by the rapid growth of the interspinous elements, until their free portions arise only a very short distance behind the tip of the snout. The first ray is the last to develop, and is at first very much smaller than the second ray. In the smallest bottom form examined, it is less than half the length of the second ray. The diagram shows that the second ray loses its relative importance, and only after the small bottom form has attained a length of 65 mm. (83 mm.),

does the second ray grow regularly with the increasing length of the fish. The first ray, however, although starting late, grows uniformly but more rapidly in proportion to the increasing length of the fish, so that in the largest specimen examined the first ray is almost as long as the second.

The measurements of the small specimen described by Fulton (1902) may now be compared with those given for the present series in Table I. The following are the comparable measurements :—

		In percentages of Length without caudal.
Total length . . . . .	124 mm.	—
Length without caudal fin . . . . .	99 "	—
Length of caudal fin . . . . .	25 "	25·3
Tip of snout to base of third ray (length of head) . . . . .	28 "	28·3
Greatest breadth of head . . . . .	48 "	48·5
Greatest height (depth) . . . . .	20 "	20·2
Length of pectoral fin . . . . .	30 "	30·3
Length of pelvic fin . . . . .	23 "	23·2
Distance from lower jaw to anus . . . . .	67 "	67·7
Length of first ray of first dorsal . . . . .	6 "	6·1
Length of second ray of first dorsal . . . . .	17 "	17·2
Diameter of eye . . . . .	6 "	—
Distance between the eyes . . . . .	12 "	—

If due allowance is made for differences which may arise through the selection of different points from which the measurements were made, it is seen that Fulton's specimen can be placed in its position in the series, and these independent measurements give ample justification for the correctness of the deductions regarding the developmental changes.

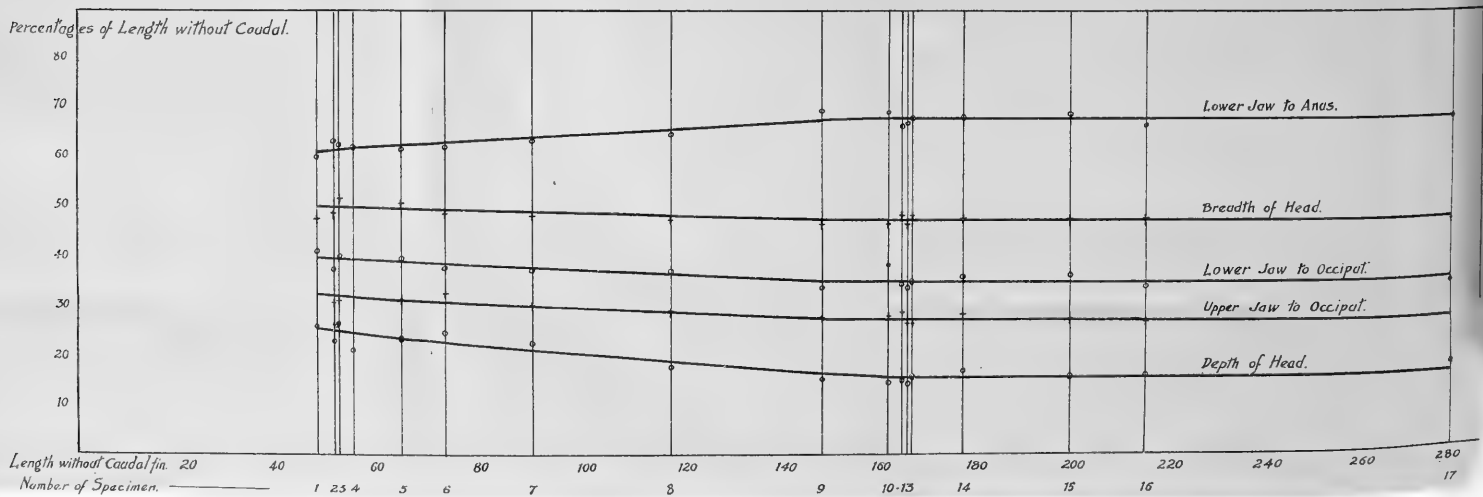
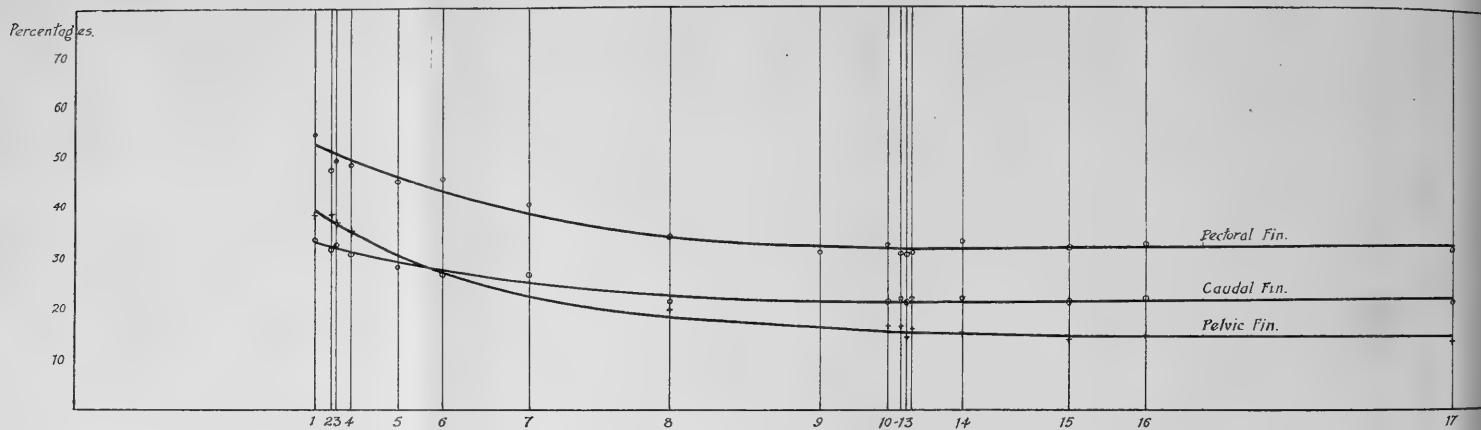
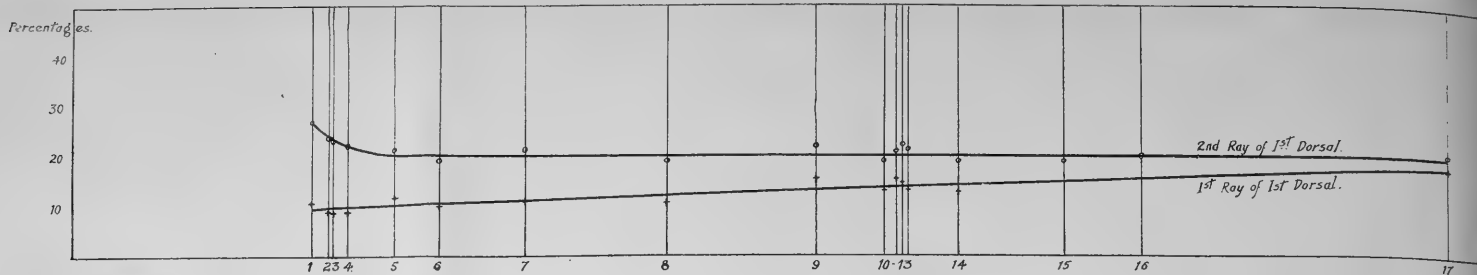
#### OTHER SMALL BOTTOM FORMS.

Two small specimens, 94 mm. and 78 mm. long respectively, from the West Coast of Norway, have already been described by Düben and Koren (1844) as *Lophius eurypterus*. Günther (1861) compares these two specimens with small forms from the Mediterranean, and although there are many points of difference, he concludes that they do not belong to a separate species, but are *Lophius piscatorius*. Considerable difficulty arises when one tries to compare either Günther's specimens or the Norwegian specimens with the present series, especially regarding the relative proportions of the different parts. Günther does not state definitely the sizes of the Mediterranean specimens, although one may infer from those figured and described that they are younger than the Scottish or Norwegian ones, the post-larval characters being still well marked. The short description given of the Norwegian specimens is also applicable to the Scottish specimens. "The head is broader than long—its length (from the extremity of the snout to the margin of the gill-cover) being one half of that of the remainder of the body, the caudal fin not included. The dorsal spines are comparatively short, the length of the first being only one half of that of the second, or one-fifteenth of the total length of the fish; the first terminates in a transverse cylindrical knob, which is provided with minute cilia; the two others have alternate fringes on both sides. The spines which form the continuous dorsal are similarly fringed, and the rays of the soft dorsal project very slightly beyond the membrane. The pectoral is exceedingly broad, and extends beyond the margin of the anal. The ventral also is broad and can be expanded like a fan."

In the Norwegian specimens, as figured, the length of the pectoral fin appears to be in fairly close agreement with the Scottish specimens of similar size. It has already been pointed out, however, that all measurements of the paired fins are open to objection unless the points from which the measurements have been made are given, and that the length of the young form is also taken into consideration.

The Scottish specimens show that the first ray is late in developing, but that, as the fish grows, the first ray increases at a greater rate than the others. The





variation in length of the first ray in young specimens and its greater development in adult specimens cannot be held to prove, as is suggested by Günther, that this ray is exposed to injury and is reproduced when lost. He neither knew the course of development of this ray, nor does he give the absolute lengths of the young specimens examined.

#### THE ADAPTATIONS OF *LOPHIUS PISCATORIUS* TO A PROLONGED PERIOD OF PELAGIC EXISTENCE.

Hitherto, the absence of complete information of the different developmental forms has led to the view that the pelagic stages of existence were passed through very quickly. For the North Sea, where sheets of spawn had occasionally been recorded, there was no definite information as to the post-larval stages, the youngest stages known being bottom forms which had reached a length of 12 cm. Fulton, therefore, reasonably assumed that the absence of records of the small forms was due to the fact that the pelagic life was very short, and that these forms soon reached a habitat, such as the sea-weed zone, where they were inaccessible to the ordinary fishing apparatus. On the other hand, the spawn and very early stages were unknown to Stiasny from the Gulf of Trieste, where numerous older post-larval stages were caught during three months of the year. He, therefore, also concluded that the pelagic stage of *Lophius* was of very short duration.

It has already been stated that individual eggs, freed from a sheet of spawn recently extruded, floated at the surface of sea-water and appeared like normal large pelagic fish eggs. Pieces of the spawn with the contained eggs also floated at the surface, but the gelatinous material itself when freed from the eggs sank slowly.

The evidence which may be deduced from previous observations on the sheets of spawn—whether they float for a time at the surface or are found normally in the lower water layers—is not convincing.

The remarks made by Milroy (1897) on the egg masses of *Lophius* in his researches on the physical and chemical changes taking place in the ova of marine teleosts during maturation are of interest. "The ova of *Lophius piscatorius* may be perhaps regarded as a class distinct from the ordinary demersal ova. When immature they have a volume of about .268 cubic mm., when mature 4.18 to 5 cubic mm. These eggs are of especial importance, as they are examples of ova which are dependent for their floating capabilities, not on their specific gravity, but on that of the gelatinous sheet in which they are embedded. Again, the specific gravity of the interstitial mucoid-like tissue, with the eggs embedded in it, was 1.005, while the ripe ova alone had a specific gravity of 1.030 to 1.035. In the ripe *Lophius* roe 20.22 per cent. of the total weight is due to the ova, and the rest to the mucoid-like tissue." It is to be observed, however, that these experiments were made on ova which had not been spawned, and the specific gravity given for the eggs is probably higher than it would be for eggs which had been extruded.

If the table of records of isolated eggs caught in the North Sea be examined, it will be found that most of these were caught in the tow-nets in the surface layers.

Observations made on larvæ newly hatched from isolated eggs captured in the North Sea showed that a considerable quantity of unused yolk still remained, and that these larvæ were able to float at the surface. It was not until the yolk had been considerably reduced that they sank to the bottom of the vessel.

According to Mr. Dunn, Mevagissey, Cornwall, who sent a sheet of spawn to Cunningham, he saw the spawn from the cliffs as a dark-coloured patch in the water, and next day took a boat, found it, and brought it ashore.

Meek (1903) states that a sheet of spawn, obtained off the coast of Northumberland, was caught five fathoms under the surface, and Lo Bianco (1908-9) also records the fact that a portion of spawn from the Mediterranean was found floating three metres under the surface. Williamson (1911) has suggested that the sheet of spawn may float some distance below the surface water, but gives no reason for this view. In these three cases it is known that the embryos were well developed. A large mucoid band obtained by Fulton (1902) in a trawl haul made in Aberdeen

Bay on 1st August 1901, in 6 to 12 fathoms, contained eggs with embryos far advanced in development, and indeed some of the embryos had already hatched out.

While positive evidence as to the buoyancy of the sheets of spawn is as yet perhaps too meagre, a study of the remarkable adaptations of the larval and post-larval forms to a pelagic life will convince one that the method of oviposition is admirably adapted to a long period of flotation for the eggs, if not at the surface for the whole period, at least in the upper and middle water layers.

The eggs are spread out in a single layer and bound loosely together, in a gelatinous matrix, which is often over 30 feet long, 2 feet broad, and less than 3 mm. thick. This thin sheet of spawn may, therefore, cover an area of over 60 to 70 feet square. It is well known that such a body in which the surface is not only large compared with its volume, but whose surface presents a large area at right angles to the direction of sinking, will sink much more slowly than a body of a similar volume but with a much smaller surface. High specific gravity and viscosity of the water are also factors which will aid the flotation of the spawn over an extended period.

There is no very definite information regarding the length of time which the eggs of the Angler take to hatch. The statements made by Fulton (1902) may be conveniently quoted here: "The nature of the yolk, and the advanced condition of the larva on issuing, argue a more prolonged period for the embryonic development than in the case of pelagic eggs. On the other hand, the temperature of the surface water in May, and still more in June and July, is high, and, judging from the period in the case of a large pelagic egg like that of the plaice, it is probable that the eggs of the Angler require over three weeks in May and more than a fortnight in July before hatching occurs."

As already stated, the larvæ hatched from isolated eggs retained considerable yolk even after they had been hatched a week. They also floated at the surface of the water. In the sheets of spawn, however, the newly-hatched larva does not immediately escape from the investing gelatinous sheet. Agassiz' illustration supports this conclusion. Fulton, describing the sheet of spawn obtained by him in Aberdeen Bay, states that the embryos were well advanced, and that some had already hatched out.

Thus, the specific gravity of the eggs themselves and the loose binding together in a gelatinous matrix of extended surface, tend to ensure for such large eggs flotation in the upper water layers and for the larva, with yolk much reduced and pectoral fins well developed, liberation from the investing jelly as far as possible from the bottom.

A consideration of the remarkable developmental changes which take place during pelagic life will at once convince one that the transitions are gradual, and that the typical bottom form is attained only after an extended period.

Large surfaces, at right angles to the direction of sinking, are developed by the extraordinary increase in length and in spread of the membranous pelvic fins. These long and greatly expanded fins, inserted very far forward on the ventral surface of the body, add greatly to the surface without a corresponding increase in weight, and hence by the lively up-and-down motion of these membranous planes, the small forms will not only keep suspended in the water, but will tend to rise to the upper water layers.

Stiasny's statements regarding the mode of life of the older post-larval forms are instructive. These were caught in the Bay of Trieste, in the day-time, but not in the open sea. He caught them with a simple hand-net, or with a small net on a long rod. "They are lively swimmers, while the adults are ground dwellers. We usually found them swimming in the upper water layers or in small depths in which they were easily seen by their thread-like appendages, and the lively up-and-down motion of their pelvic fins in striking contrast to the strongly vibrating pectoral fins. Sometimes we found them suspended without motion in the water or on the rocky wall of the harbour, lying peacefully upon the rich and luxuriant sea-weed."

There are other modifications for a pelagic existence in these small forms. The embryonic fin, at the escape of the larva from the egg is very broad, and it persists for a remarkably long period. It even persists after the true fins have



been formed. Further, during the development of the first dorsal fin, the membrane connecting the elongated rays rises very high between them, so that the depth of the larva is considerably increased, also without much additional weight. Thus, the great development of these structures along the median line of the body gives the young fish much greater stability whilst living in the upper water layers. This stability is still further increased by the enormous development of the paired pectoral fins which are expanded fan-like and attached high up on either side of the body.

In short, the morphological changes through which the Angler passes during its early life-history must be regarded rather as adaptations to a pelagic mode of life than as structures reminiscent only of pelagic ancestors, and that only after an extended period and when the young fish has reached a considerable size do retrogressive changes bring about a form suited to life at the bottom.

#### THE OCCURRENCE OF THE SHEETS OF SPAWN.

Notwithstanding innumerable investigations carried on, especially in recent years, over the extensive area in which adult Anglers are caught, the number of published records of the occurrence of the spawn of the Angler, and of its larval and post-larval forms, is strikingly small. The few isolated records are from areas very widely separated; the east coast of America, the North Sea, the English Channel, and the Mediterranean in the neighbourhood of Naples. No satisfactory explanation has been offered why the records of such a conspicuous object as the spawn of the Angler are so few. Agassiz (1882), who was the first to describe the appearance of the spawn, gives no information as to the frequency of its occurrence on the American side of the Atlantic. Gill (1905), however, in his story of the life of the Angler, makes the following statements:—"About the end of summer, the fishes seek shallower water, and the inhabitants of the depths advance upwards; the sexes must then consort together, but in what manner and what rites of marriage are performed is unknown; the result, however, is that about the time indicated, the fishermen on the New England coast often notice a substance floating on the water, which they term a 'purple veil.'" It would appear from this statement that the spawn is not infrequently met with, since the fishermen have coined a popular name for it, and it is, therefore, of interest to have a more recent and definite record from this area, by Murray and Hjort (1912). During the voyage of the *Michael Sars* across the Atlantic, a large cluster of Angler eggs was found at Station 69 (41° 39' N.; 51° 4' W.), from which the embryos were hatched. "Angler-fish only inhabit the coast-banks, so that our find of slightly developed eggs that could not have been drifting many days indicated that we were now in the neighbourhood of the American coast."

#### SCOTTISH RECORDS OF OCCURRENCE OF SPAWN.

Definite records of the occurrence of the gelatinous bands have been made mainly by Scottish workers, but when all the records are collected, they do not form a very imposing list. Prince (1891) says that egg-masses have occasionally been seen, and Mr. (Now Dr.) Thomas Scott, F.L.S., found a mass of spawn stranded on the beach east of the flagstaff on Elie Ness, in July (presumably July 1890). It was between twelve and thirteen yards in length. Later, two additional specimens were obtained by the Fishery Board for Scotland. One was secured off Kinnaird Head on 18th February 1891, and Fulton got a second mass of eggs of *Lophius* in the Firth of Forth in July 1891. Another large mucoid band was obtained by Fulton (1902) in a trawl haul made in Aberdeen Bay on the 1st August 1901, in 8 to 12 fathoms. The embryos were far advanced, and some indeed had already hatched out.

M'Intosh and Masterman (1897) state that the masses are sometimes caught by the ropes and nets of the salmon stake nets off the east rocks at St. Andrews. On 10th July 1891, a considerable portion of the gelatinous mass containing the ova of the Angler was found in the stake nets off the East Rock, having apparently been swept in by the currents and entangled in the meshes.

M'Intosh and Prince (1890) in a footnote refer to the rarity of the floating ova

on the east coast of Scotland. Further, they say that, so far as is known, the spawn is also uncommon on the west coast, though there, and off the south coast, it had once or twice occurred recently. No definite records are given.

A mass of spawn was sent to Williamson (1911) from Sandhaven, on July 15th 1907, from which embryos hatched out two days later. Again, on 25th June 1908, a sample of eggs was sent him, which had been obtained 5 miles east of Loch Bracadale.

On 4th May 1916, a sample of spawn was brought into Aberdeen Fish market. It had been taken by the steam trawler *Cygnets* at 57° 37' N. ; 0° 53' E. The jelly-like mass was taken off the net after a trawl haul. The mass of spawn was not in the bag of the net, and there is no evidence as to the depth at which it may have been floating. The spawn had been kept in a very limited supply of fresh sea-water for three days on board the trawler. A number of living eggs was separated from the gelatinous material and kept in a large volume of fresh sea-water in the laboratory for some days longer, until the outline of the embryo could be distinguished in the egg, thus proving that the eggs had been fertilised. As there were no traces of developing embryos in the eggs when captured, it may be concluded that the mass had been recently extruded.

Meek (1903) records the capture of a sheet of spawn in herring-nets 15 miles off Beadnell, Northumberland, at a depth of 5 fathoms, on 23rd July 1902. Professor Meek kindly informs me that the embryos were far advanced in the eggs.

A sheet of spawn has also been got from the neighbourhood of the English Channel. Cunningham states that he received a sheet of spawn from Mr. Dunn, Mevagissey (Cornwall), on 24th June, the eggs of which contained embryos well advanced in development. He also remarks (1912) that the sheet of spawn of the Angler has been frequently obtained off the south coast of England.

Ehrenbaum (1905) says he has caught spawn in the Skagerrak in the beginning of July.

Schmidt (1906) states that, although *Lophius* lives in the northern part of the Kattegat, it does not propagate there.

The above are the positive records of occurrence of the mucoid bands, and, as Prince remarks, their paucity is all the more remarkable, because the eggs float in large masses in the sea, and, unlike most pelagic ova, would appear to be especially subject to observation.

The remaining records of spawn are from the Mediterranean, and these are given by Lo Bianco (1908-9). A broad cluster of pelagic eggs with embryos in different stages of development was obtained on 21st January, and again a floating gelatinous cluster (in which the eggs were all in the same stage of development with embryos apparent) six-and-a-half metres long and thirty centimetres broad was fished at a depth of three metres. He calculated that there were about 150,000 eggs in the mass, so that he had probably only obtained a portion of the mass. The various records are shown on the accompanying table.

TABLE II.  
RECORDS OF SPAWN.

Locality.	Date.	How obtained.	Embryos.	Authority.
57° 37' N. ; 0° 53' E.	3rd May 1916	Sticking to trawl net	Eggs recently spawned	Present report.
E. of Flagstaff on Elie Ness, Fife	July 1890	Cast ashore	...	Dr. Thos. Scott. Prince (1890).
Off Kinnaird Head	February 1891	...	...	Dr. T. W. Ful- ton. Prince (1890).
Firth of Forth	July 1891	...	Embryos well developed	Dr. T. W. Ful- ton. Prince (1890).
Aberdeen Bay	1st August 1901	Ordinary trawl	Embryos well developed and some hatched	Fulton (1902).
East Rock at St Andrews	10th July 1891	Cast ashore	Embryos far advanced	M'Intosh and Prince.
Sandhaven	15th July 1907	...	Embryos well advanced	Dr. H. C. Wil- liamson (1911).
5 miles E. of Loch Braca- dale	25th June 1907	Floating under the surface	Embryos far advanced in development	Dr. H. C. Wil- liamson (1911).
15 miles off Beadnell (Northum- berland)	22nd-23rd July 1902	Floating 5 fms. under surface	Eggs with embryos	Prof. A. Meek (1903).
Skagerrak	July	...	...	Ehrenbaum (1905).
Mevagissey (Cornwall)	24th June	Seen from shore float- ing at surface	Eggs with embryos well developed	J. T. Cunning- ham (1896).
Naples	21st January	Floating under the surface	Embryos well developed	Lo Bianco (1908-1909).
41° 39' N. ; 51° 4' W.	27th February 29th June 1910	Floating	Eggs with em- bryos slightly developed	Murray and Hjort (1912).
Coastal waters, western At- lantic	Early in June and late in August	Floating	Eggs with em- bryos de- veloped	Agassiz (1882).

The records of the occurrence of isolated pelagic *Lophius* eggs are all from Scottish waters. Other references have been made to the occasional occurrence of such isolated eggs, but no precise statements are given of the numbers, date, or locality. For example, Ehrenbaum in "Nordisches Plankton" merely mentions the fact that isolated pelagic eggs of *Lophius* also occur.

The single record of the capture of an isolated egg in Scottish waters was made by M'Intosh in 1891. He refers to the occurrence of an exceptionally large egg caught in a tow-net in St. Andrews Bay by the *Garland* on 3rd July 1891. "A week later, a considerable portion of the gelatinous mass containing the ova of the Angler was found in the stake nets, off the East Rock, having apparently been

swept in by the currents and entangled in the meshes. The isolated egg had the same characters as the eggs in the mass." He concludes that there are few eggs, if indeed any, with which it can be confounded.

Altogether, 156 isolated eggs have been taken in the collections made by the *Goldseeker* in the eleven years 1904-1914. These records are, therefore, very numerous when compared with previous records of isolated eggs. The occurrence of **these** is given in the accompanying table and chart.

TABLE III.  
RECORDS OF ISOLATED EGGS OF *LOPHIUS PISCATORIUS* IN SCOTTISH WATERS.

Locality.	Date.	Net Used.	Depth.	Developmental Stages.				Remarks.
				Newly Spawmed.	Embryos Distinct.	Embryo ready to Hatch.	Total.	
58° 57' N. 1° 22' E.	21-4-04	1 m. ch. cl.	0 m. $\frac{1}{4}$ hour	1	...	...	1	Two Oil-globules.
57° 57' N. 3° 20' W.	31-3-05	Do.	Do.	1	...	...	1	Most of embryos ready to hatch. Very dark pigment on yolk and larva.
Do.	1 <sup>o</sup> .	Do.	Do.	1	3	53	57	Black pigment appearing.
58° N. 2° 54' W.	Do.	Do.	Do.	...	1	...	1	Head of larva intensely black; scattered pigment on yolk.
Do.	1 <sup>o</sup> .	Petersen Young fish trawl	0 m. $\frac{3}{4}$ hour	...	...	...	1	
Do.	Do.	Do.	Do.	1	...	...	1	
58° 13' N. 1° 32' W.	Do.	Do.	Do.	2	...	...	2	
58° 34' N. 0° 47' E.	1-4-05	1 m. ch. cl.	Do.	1	...	...	1	
57° 34' N. 0° 17' W.	3-1-05	1 m. ch. cl. Vertical haul	103 m.	1	...	...	1	
61° 02' N. 1° 10' W.	14-4-06	1 m. ch. cl.	0 m. $\frac{1}{4}$ hour	2	...	...	2	
57° 55' N. 2° 48' W.	24-4-06	Do.	0 m. $\frac{3}{4}$ hour	1	...	...	1	
57° 30' N. 1° 19' W.	24-2-09	Do.	0 m. $\frac{1}{4}$ hour	1	...	...	1	
50° 36' N. 0° 41' W.	25-3-10	Do.	Do.	...	1	...	1	
57° 57' N. 2° 40' W.	28-4-10	Do.	Do.	...	1	...	1	
59° 26' N. 1° 20' W.	5-5-11	Petersen Young fish trawl	0 m. $\frac{1}{4}$ hour	...	...	...	1	Embryo ready to hatch; very black pigment.
60° 5' N. 0° 48' W.	Do.	1 m. ch. cl.	0 m. $\frac{1}{4}$ hour	...	...	...	1	
56° 16' N. 2° 17' W.	25-7-12	Do.	25 m. $\frac{1}{4}$ hour	...	1	...	1	
58° 36' N. 1° 46' W.	22-6-13	Do.	0 m. $\frac{1}{4}$ hour	4	...	...	4	
58° 3' N. 2° 50' W.	28-4-13	Do.	Do.	...	1	...	1	
58° 4' N. 2° 28' W.	30-4-13	Do.	Do.	...	2	...	2	
58° 36' N. 1° 46' W.	5-7-13	Do.	Do.	...	...	...	1	
Do.	Do.	Do.	Do.	1	...	...	1	
57° 57' N. 3° 10' W.	18-3-14	Do.	113 m. $\frac{1}{4}$ hour	1	...	...	1	Five oil-globules.
Do.	Do.	Do.	0 m. $\frac{1}{4}$ hour	3	...	...	3	Three oil-globules in one.
58° N. 2° 54' W.	4-4-14	Do.	26 m. $\frac{1}{4}$ hour	2	...	...	2	Two oil-globules in each.
Do.	Do.	Do.	0 m. $\frac{1}{4}$ hour	24	...	...	24	
56° 26' N. 0° 8' W.	Do.	Do.	Do.	53	...	...	53	
59° 28' N. 1° 30' E.	12-4-14	Do.	Do.	1	...	...	1	
59° 36' N. 0° 41' W.	16-4-14	Do.	Do.	1	...	...	1	
Balta Lt. N.W., 2 miles	Do.	Do.	Do.	...	...	...	1	Two oil-globules; embryos ready to hatch.
57° 26' N. 0° 15' W.	11-6-14	Do.	Do.	...	...	...	1	Embryo deeply pigmented.
St. Andrews Bay	23-6-14	Do.	Do.	...	...	...	1	Record by McIntosh.
Do.	3-7-01	Do.	Do.	...	...	...	1	

It has already been noted that most of the eggs were taken in the surface tow-nets. All were captured, however, in the northern North Sea, north of  $57^{\circ}$  Latitude. It has been impossible to express within the limits of a single chart the number of times the various localities have been visited within the eleven years under observation. Even from Chart II., however, it can be seen that the stations south of  $57^{\circ}$  North Latitude have been visited very frequently at all periods of the year. The negative records from these stations are, therefore, of considerable importance in dealing with the distribution of these isolated eggs, which, if present, could have been so readily caught in the tow-nets.

#### THE SPAWNING PERIOD.

Fulton (1902) discusses the spawning time of the Angler from the evidence of the occurrence of the ripe adult. On the east coast of Scotland, the males are apparently earlier than the females. A ripe male was got off Lossiemouth on the 3rd November, and on the 20th and 24th December two ripe males were obtained at Burghead in shallow water. He also quotes Holt as having found a ripe male 25 inches long in 115 fathoms, in March. Females apparently almost ripe, with very large ovaries were taken in February, on the east coast of Scotland, and Holt found spent females of 30 inches in length in June, and one of 40 inches in March.

The times of occurrence of the sheets of spawn and of the isolated eggs give much more definite information regarding the duration of the spawning period. This period appears to be an extended one. On the Scottish coast, one sheet of spawn was obtained off Kinnaird Head on 18th February, and another, in which the embryos were far advanced, was obtained in Aberdeen Bay as late as 1st August. The record from  $57^{\circ} 37' N.$ ;  $0^{\circ} 53' E.$ , made on 4th May 1916, is the only one in which the eggs were in the initial stages of development. Isolated eggs were captured as early as 18th March 1914. On that date, five eggs, in which there were no signs of developing embryos, were obtained at  $57^{\circ} 57' N.$ ;  $3^{\circ} 10' W.$  Again, on the 31st March 1905, at  $58^{\circ} N.$ ;  $2^{\circ} 54' W.$ , there were taken fifty-three isolated eggs of *Lophius*, in which the embryos were very far advanced in development; in fifty of these, the embryos stretched two-thirds round the yolk, and were thus almost ready to hatch out. One must conclude, from the appearance of these eggs so far advanced in development at that time of the year, that they must have been spawned very much earlier. On the other hand, isolated eggs, captured on the 5th July 1913, showed no traces of developing embryos.

These records, therefore, show conclusively that the spawning period in Scottish waters begins as early as February, and extends at least to the first weeks in July.

Ehrenbaum (1905) does not add any original information to our knowledge of the spawning period, except that eggs were obtained by him in the Skagerrak in the beginning of July. In his tables of the plankton eggs of fishes occurring in the North Sea, he restricts the spawning period to the months June, July, and August.

Agassiz and Whitman (1885), from the American side of the Atlantic, state that the floating eggs of *Lophius* have been obtained early in June and late in August, and Murray and Hjort's record for 29th June is in agreement.

The two samples of spawn, got by Lo Bianco in the Mediterranean on 21st January and 27th February, show that spawning in that area is very early. In both cases, embryos were well developed in the eggs.

The statements by Stiasny and Graeffe, regarding the spawning season for the Mediterranean fish, must be taken with great reserve. Neither of these authors gives actual records of the occurrence of the eggs, but they deduce the time of spawning from the capture of the post-larval forms. Graeffe (1888) gives the spawning period as December and January, because young forms are found swimming pelagically in the sea in the months of February, March, April. His remark that he believes the eggs may be pelagic, suggests that he did not know the eggs of the Angler.

Stiasny (1911) mentions that the eggs of *Lophius* have not been observed in the Gulf of Trieste, but suggests that the frequently-occurring adult probably spawns in the winter months. This conclusion is based on the time of occurrence of the post-larval forms, and its validity will be considered later.

The time of spawning given for the Mediterranean fish does not conflict in any

way with that for those of the North Sea. It is well known that, for a species with such a wide distribution, spawning occurs earliest in the south, and gradually gets later and later towards the north. (For example, the Hake, which has a distribution very similar to that of the Angler, spawns much earlier in the Mediterranean than west of the British Isles.) The only definite record of the spawn between the widely-separated areas, the Mediterranean and North Sea, is the one given by Cunningham for Plymouth. The spawn was got in June with the embryos far advanced in development. Hence, one may say, with some degree of confidence, that the spawning of the Angler in European waters begins at least as early as January in the Mediterranean, and gets later and later further north. In the Scottish area, spawning begins at least as early as March, and extends to the last weeks in July.

#### THE OCCURRENCE OF THE POST-LARVAL FORMS.

There is only a single record of the capture of a larval form in the North Sea. This specimen was taken by the *Goldseeker* at  $58^{\circ} 26' N.$ ;  $0^{\circ} 8' W.$  on the 15th July 1914. The absorption of the yolk was almost complete.

The time and place of occurrence of the post-larval stages in Scottish waters agree with what has already been stated concerning the spawning. The records are most numerous for the months of July and August, so that the height of the spawning season in Scottish waters probably occurs in the month of June. Further, most of the post-larval forms were got north of  $58^{\circ}$  North Latitude, but the greater number of these specimens was caught in the lower water layers, in contrast to the isolated eggs which were taken mainly at the surface.

The oldest post-larval form from the North Sea, which measured 16 mm., was captured at  $57^{\circ} 17' N.$ ;  $1^{\circ} 3' W.$  in a Petersen Young Fish Trawl fishing in a depth of 103 metres on 11th September 1909. This post-larval form had the six rays in the first dorsal fin, and the second dorsal and anal fins were completely formed, the rays extending to the margin of the embryonic fins. The pectoral and pelvic fins had also attained their extraordinary development. The other specimens, which had reached a similar degree of development, were captured in the month of August in the Atlantic, north-west of Scotland.

There are one or two previous records of post-larval Anglers from Scottish waters which may be referred to here. There is the post-larval specimen described by M'Intosh and Prince (1890), which was caught in 25 fathoms, 15 miles off May Island, on 30th August 1886. It is a mutilated specimen, which, from its size and description, is probably a young post-larval form in which the second dorsal and anal fins have not yet appeared.

Another specimen from Scottish waters was caught by Williamson (1909) in Loch Fyne, near Otter, in a tow-net worked horizontally about five fathoms below the surface, on 28th July 1899. The specimen preserved in spirit measured about 7 mm., and it had two dorsal filaments developed on the head. It is, therefore, a very young post-larval form.

The detailed list of larval and post-larval stages captured in Scottish waters is given in the following table:—

TABLE IV.  
LARVAL AND POST-LARVAL STAGES OF *LOPHIUS PISCATORIUS* IN SCOTTISH WATERS.

Locality.	Date of Capture.	Apparatus.	Depth.	Duration of Haul.	Length of Larva.	Remarks.
60° 15' N. 0° 7' W.	13-7-05	1 m. ch. cl.	125 m.	¼ hour.	10 mm.	Three rays in first dorsal fin. Pectorals and pelvics large.
Do.	Do.	Do.	40 m.	Do.	10 mm.	Pelvics well developed.
59° 53' N. 0° 8' E.	14-7-05	Do.	133 m.	Do.	8.6 mm.	Three rays in first dorsal fin.
Kinnaird Deep (57° 44' N. 2° 12' W.)	15-7-05	Do.	96 m.	Do.	11.5 mm.	Four rays in first dorsal fin.
58° N. 2° 54' W.	19-7-05	Do.	40 m.	½ hour	8.1 mm.	Larva well pigmented. Three rays in first dorsal fin. Pelvics extending behind mid-point of body.
59° 31' N. 0° 37' E.	Do.	Petersen Young fish trawl	45 m.	Do.	11.5 mm.	Four rays in first dorsal fin.
58° 13' N. 1° 32' W.	Do.	Do.	45 m.	Do.	10.9 mm.	Four rays in first dorsal filamentous.
58° 34' N. 0° 47' E.	20-7-05	Do.	0 m.	Do.	9 mm.	Poor specimen. Three rays in first dorsal fin.
57° 34' N. 0° 1' W.	Do.	1 m. ch. cl.	10 m.	Do.	7.6 mm.	Three rays in first dorsal. Pelvics well developed.
58° 48' N. 0° 7' W.	11-7-06	Do.	108 m.	Do.	10 mm.	...
60° 34' N. 3° 53' W.	11-8-07	Petersen Young fish trawl	505 m.	Do.	11.5 mm.	Elements of second dorsal and anal fins established. Sharp conical teeth present.
Do.	Do.	Do.	Do.	Do.	10 mm.	Five rays in first dorsal fin.
59° 54' N. 7° 6' W.	12-8-07	1 m. ch. cl.	100 m.	¼ hour	17 mm.	Six rays in first dorsal fin.
Do.	Do.	Do.	Do.	Do.	17 mm.	Second dorsal and anal complete.
59° 36' N. 7° W.	17-8-07	Do.	50 m.	Do.	10.8 mm.	Four rays in first dorsal. Beginning of second dorsal and anal fins.
59° 36' N. 7° W.	Do.	Do.	100 m.	Do.	15 mm.	Six rays in first dorsal. Interspinous elements of second dorsal well formed.
Do.	Do.	Fry net	400 m.	½ hour	11 mm.	Do.
57° 30' N. 1° 19' W.	23-7-08	Petersen Young fish trawl	60 m.	½ hour	11 mm.	Four rays in first dorsal fin.
58° 17' N. 1° 3' W.	11-9-09	Do.	103 m.	Do.	16 mm.	Six rays in first dorsal. Second dorsal and anal fins complete. Pectorals and pelvics large.
58° 8' N. 2° W.	12-7-10	1 m. ch. cl.	99 m.	¼ hour	10 mm.	Specimen damaged. Three rays in first dorsal fin.
59° 40' N. 1° 14' W.	8-8-10	Do.	95 m.	Do.	9.5 mm.	Three rays in first dorsal fin.
57° 22' N. 1° 6' W.	7-8-11	Do.	83 m.	Do.	10 mm.	Three rays in first dorsal, fourth just appearing.
57° 43' N. 0° 38' E.	8-8-11	Do.	86 m.	Do.	14.5 mm.	Five rays in first dorsal.
58° 55' N. 2° 14' W.	16-8-11	Fry net	80 m.	½ hour	9 mm.	Two specimens; each four rays in dorsal fin.
60° 17' N. 2° 20' W.	17-8-11	1 m. ch. cl.	118 m.	¼ hour	9 mm.	Three rays in first dorsal; fourth just appearing.
60° 2' N. 1° 46' W.	17-8-11	Do.	0 m.	Do.	10.5 mm.	Four rays in first dorsal.
59° 31' N. 0° 37' E.	16-4-14	Do.	0 m.	Do.	5 mm.	Three specimens. Large yolk.
58° 42' N. 2° 45' W.	4-7-14	Do.	74 m.	Do.	11 mm.	Four rays in first dorsal.
60° 37' N. 0° 30' E.	8-7-14	Do.	60 m.	Do.	11 mm.	Do.
Do.	Do.	Do.	120 m.	Do.	11 mm.	Three rays in first dorsal.
59° 28' N. 1° 30' E.	10-7-14	Do.	108 m.	Do.	10.5 mm.	Four rays in first dorsal.
58° 55' N. 0° 4' E.	14-7-14	Do.	120 m.	Do.	10.5 mm.	Three rays in first dorsal.
58° 26' N. 0° 8' W.	15-7-14	Do.	60 m.	Do.	9 mm.	Two rays in first dorsal; completion of yolk-absorption.
60° 37' N. 0° 30' E.	Do.	Do.	120 m.	Do.	10.5 mm.	Three rays in first dorsal.
58° 11' N. 0° 32' W.	16-7-14	Do.	115 m.	Do.	10.5 mm.	Two specimens. Three rays in first dorsal fin.
57° 47' N. 3° 15' W.	29-7-19	Do.	52 m.	Do.	10 mm.	Do.
15 miles off May Island	13-8-86	Tow-net	25 fms.	...	7 mm.	Damaged specimen. Recorded by M'Intosh & Prince.
Loch Fyne, near Otter	28-7-89	Do.	5 fms.	...	7 mm.	In spirit. Two head filaments present. Recorded by Dr. Williamson (1909).



The other European records are from the Atlantic and the Mediterranean. Dr. Johs. Schmidt, in *Fiskeriundersøgelser ved Island og Faerøerne i Sommersen*, 1903, states at p. 46 that single young specimens of *Lophius piscatorius* were taken at Stations 90 and 165 at the surface over great depths. His accompanying charts show that Station 90 (61° 30' N.; 14° 40' W.) lies outside the contour line of 1000 fathoms deep, and was examined in the months of May to June, whilst Station 165 (62° 35' N.; 19° 45' W.) lies between the 500 and 1000-fathom contour lines, and was examined in July to August. No descriptions are given of these post-larval forms.

Again, Schmidt (1906), in discussing the biology of the fresh-water eels refers to the occurrence of post-larval forms of the Angler at places where the Leptocephali of the eel were got in the Atlantic over great depths west of the British Islands.

Stiasny's (1911) material from the Adriatic consists of no fewer than eighty-five specimens of different sizes, ranging from 10 mm. to 55 mm. These specimens were caught in the years 1908, 1909, and they appeared in the Gulf of Trieste normally from the end of November to the month of February. In 1908, however, larvæ appeared in the Gulf in the month of September, and Stiasny describes this occurrence as transitory and striking. He also quotes Steuer as having obtained post-larval forms for the years 1902-1904. The young fish were recorded by Steuer for the whole of December, in the year 1902; in the years 1903 and 1904, in the second half of January. Stiasny, therefore, summarises the appearance of the post-larval *Lophius* in the Gulf of Trieste in the following table:—

APPEARANCE OF POST-LARVAL *LOPHIUS* IN THE GULF OF TRIESTE. (Stiasny).

Month.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
1908. . .												
1909 . . .												

Graeffe (1888) states that the young forms of *Lophius* are found in the Adriatic swimming pelagically in the open sea in the months of February, March, April. The youngest specimen captured by him is a post-larval stage. The forms found by him in these months were still semi-transparent. The first ray of the first dorsal fin was not yet developed. He also knew the older forms, as he mentions that the leaf-like skin continuations are first indicated in specimens of 5 to 6 cm. Graeffe apparently did not know the eggs or newly-hatched larval forms.

Günther gives no locality or date for the older post-larval forms described by him from the Mediterranean.

Lo Bianco, who was the only one to observe the sheets of spawn, records the capture of eggs, with embryos well developed, in the months of January and February. These records were, however, made in the Mediterranean.

The combined observations of Lo Bianco, Graeffe, and Stiasny on the Mediterranean specimens thus give definite information regarding the spawning time and the appearance of the older post-larval forms for the Mediterranean and Adriatic.

The time of appearance of the small transparent post-larval forms in the Adriatic in the open sea, in February, March, and April, as recorded by Graeffe, is in natural sequence to the occurrence of the spawn. The statements made by Stiasny regarding the period of spawning of the Angler must be carefully considered, as the sheets of spawn do not occur in the Gulf of Trieste, and he dealt only with the post-larval forms. The eighty-five specimens he examined are summarised by him in the following table:—

SUMMARY OF MATERIAL (Stiasny).

	10-15 mm.	16-20 mm.	21-25 mm.	26-30 mm.	Other stages to 55 mm.
Length . . .	10-15 mm.	16-20 mm.	21-25 mm.	26-30 mm.	to 55 mm.
Number . . .	7	5	18	20	35
Percentage of total . . .	8·2	5·9	21·2	23·5	41·2

Thus, of the total specimens, only twelve (*i.e.*, 14 per cent.) were under 20 mm. The smallest specimen was already 10 mm. in length, and, as we have seen, was

further advanced in development than Scottish specimens of the same length. The older stages were mainly caught, and the largest was 55 mm. long. Any attempt, therefore, at estimating the spawning period of the species, exclusively from such material, must depend on a knowledge of the rate of growth of the larval and post-larval forms. No attempt is made by Stiasny to estimate the rate of growth, but it is legitimate to assume that the spawning period is some time anterior to the appearance of the post-larval forms. The statement made by Stiasny for the Gulf of Trieste, that the very frequently-occurring adult *Lophius* probably spawns in the early winter months, is therefore not intelligible, unless he means that the post-larval forms caught by him in the Gulf of Trieste between the months of September and February had been spawned in the previous winter months.

The only older post-larval form recorded from the American side of the Atlantic is the one of 30 mm. length described and figured by Agassiz in 1882.

The following table is a summary of the records of post-larval forms from areas outside Scottish waters.

TABLE V.  
RECORDS OF POST-LARVAL STAGES OF *LOPHIUS PISCATORIUS*  
OUTSIDE SCOTTISH WATERS.

Locality	Latitude and Longitude.	Date.	Measurement of post-larval forms.	Authority.
ICELAND	61° 30' N.; 14° 40' W.	May-June 1903	Single specimen	Dr. Johs. Schmidt (1904).
	62° 35' N.; 19° 45' W.	July- August 1903	Single specimen	
ATLANTIC	West of Great Britain over deep water	...	...	Dr. Johs. Schmidt (1906).
ATLANTIC	Coast of America	July, August, Sept.	Single specimen, about 30 mm. long	A. Agassiz (1882).
MEDITER- RANEAN	Naples ?	No date	Old post-larval stages	Günther (1861).
	Adriatic. Gulf of Trieste ?	February, March, April	Transparent forms without much pigment	Graeffe (1888).
	Adriatic	December January	Older post- larval forms	Steuer (1909).
	Gulf of Trieste	Sept. to February	10-55 mm. long	Stiasny (1911).

#### THE OCCURRENCE OF YOUNG BOTTOM FORMS.

If the records of capture of the later post-larval stages of *Lophius* are few, especially when one considers the magnitude of the scientific investigations carried out in the last decade, the paucity of records of small bottom forms is still more striking, since the chances of capture of these by the ordinary commercial trawl would appear to be great, owing to the changes of form and habitat.

The present investigations add only seven new records of young bottom forms less than 120 mm. long to the existing extremely short list. Two small specimens, 64 and 67 mm. long respectively, were captured on 11th July 1906, in a small trawl of fine mesh at 58° 44' N. ; 7° W., in a depth of 108 metres. Other two specimens, 72 mm. and 83 mm. long, were captured in the same apparatus on 12th July 1906, at 59° N. ; 7° 4' W. in a depth of 182 metres. Again, a specimen of 69 mm. in length was taken in the small trawl on 4th September 1906, at 60° 45' N. ; 2° 30' E., in 129 metres depth, and another of 116 mm., in Broad Bay (Minch) in 11 metres depth on 20th September 1906. The only specimen under 120 mm. in length, captured in the ordinary commercial trawl, was one of 94 mm. taken off Berriedale (Moray Firth) in 22-24 fathoms on 14th October 1911.

Reference has already been made to the small Angler of 127 mm. in length obtained by Fulton (1902) in November, in a trawl haul made in the Dornoch Firth in a depth of 8-11 fathoms. He also gives an account of the capture of a very large number of small Anglers in a single trawl haul off Lybster, on the Caithness coast, in a depth of 23-34 fathoms in the month of November. No less than twenty-seven of the thirty-six Anglers taken in this haul were under 200 mm. (7½ inches). The smallest individual was 128 mm. long, and the largest 198 mm. Fulton, in reference to the distribution of the Angler, also states that the proportion of young Anglers on the deep-water grounds of the North Sea appears to be higher than on the inshore trawling grounds.

M'Intosh and Masterman (1897) record an example 5½ inches long (140 mm.), which was cast ashore in St. Andrews Bay in March.

There are the two specimens 94 mm. and 78 mm. long, recorded by Düben and Koren, from the west coast of Norway.

Saemundsson (1909) reports that a small bottom form of the young Angler, now in the museum at Reykjavik, was found cast ashore at the Westmann Isles (Iceland). No date is given.

Finally, Lo Bianco (1908-9) gives the most complete information as to the occurrence of young bottom forms in the Mediterranean. He says that in the months March to May there were fished with the seine-net on shallow ground young ones of lengths 6 to 15 cms.

The tabulated list of small bottom forms under 200 mm. in length is as follows:—

TABLE VI.  
RECORDS OF SMALL BOTTOM FORMS.

Locality.	Date.	Means of Capture.	Depth.	Specimens.	Authority.
58° 44' N. 7° W. .	11-7-06	Small trawl	108 m.	64 mm. 67 mm.	"Goldseeker."
59° 4' N. 7° 4' W.	12-7-06	Do.	182 m.	72 mm. 83 mm.	Do.
60° 45' N. 2° 30' E.	4-9-06	Do.	129 m.	69 mm.	Do.
Broad Bay (Minch)	20-9-06	Do.	11 m.	116 mm.	Do.
Off Berriedale . . . (Moray Firth)	14-10-11	Ordinary trawl	23-24 fms.	94 mm.	Do.
Off Lybster . . . (Caithness coast)	November	Do.	Do.	27 specimens under 200 mm.	Dr. T. W. Fulton (1902).
Dornoch Firth . . .	Do.	Do.	8-11 fms.	127 mm.	Do.
St. Andrews Bay . .	March	Cast ashore	...	5½ inches (140 mm.?)	M'Intosh and Masterman, "British Food Fishes," (1897).
West Coast of Norway	No date	...	...	94 mm. 78 mm.	Düben and Koren (1844.)
Westmann Isles . . (Iceland)	Do.	Cast ashore	...	91 mm.	Can. Mag. B. Saemundsson (1909).
Naples . . . . .	March to May	Seine net	Shallow ground	60-150 mm.	Lo Bianco (1908-1909).
Bank of Newfoundland	1856	..	..	About 4 inches long	Goode and Bean (1895), "The Most Northern Recorded Occurrence in Western Atlantic."
—?	—?	...	...	About 2 inches long	Described by Valenciennes.

## THE AGE OF THE SMALL BOTTOM FORMS.

A study of the developmental changes in small bottom forms has shown that, when they first take to a bottom habitat, the change from the pelagic form is not yet complete. The transition is gradual, and the typical or perfect ground-form is not attained until the fish has grown to a length of almost 180 mm.

Fulton (1902) is the only investigator who has endeavoured to estimate the age of the bottom forms. The task was a very difficult one, owing to the absence of complete information regarding the earliest bottom stages.

It is perhaps best to deal, first of all, with the series from the Mediterranean, where the sequence of appearance of the different stages seems quite intelligible. The Angler spawns in the Mediterranean in the winter months—eggs with advanced embryos were obtained by Lo Bianco in January and February. The young pelagic forms were caught by Graeffe in the open sea of the Adriatic in the months February, March, April. Post-larval stages (15–55 mm. in length) appear in the Gulf of Trieste from September to February. Lo Bianco caught small bottom forms 6–15 cms. long on shallow ground in the Mediterranean in the months March to May. The small bottom forms caught in the months March to May, therefore, belong to the brood of the previous year.

The smallest bottom forms, caught in Scottish waters, are therefore comparable with the smaller Mediterranean bottom forms just mentioned. They are 64, 67, 69, 72, 83, 94, and 116 mm. long respectively, and were caught in the months July, September, and October. It has been shown that they have not yet completed their metamorphosis, although they have assumed a bottom habitat. These small bottom forms, therefore, belong obviously to an earlier brood than the post-larval forms which appear in the same areas at the same time, and, as the general spawning period occurs in the locality in the months May, June, July, the small bottom forms must be at least a year old. The results are, in fact, in close agreement with those from the Mediterranean.

Comparison may now be made with the series obtained by Fulton. His material was very much restricted at its lower limits, as the smallest specimen obtained by him was already 127 mm. long. The smallest series was, however, obtained off Lybster, on the Caithness coast, in the month of November. The individuals ranged from 127 mm. in length to 214 mm., and the mean size of the thirty-six specimens was 161.5 mm. Owing to the absence of information concerning the later post-larval and very young bottom forms, Fulton underestimated the age of this series; they are undoubtedly at least one year and six months old. The members of the other series are, therefore, correspondingly at least one year older than is stated. It would probably be correct to say that the Angler is very rarely caught in the North Sea by the commercial trawl before it has reached an age of at least two years.

## DISTRIBUTION OF THE ADULT.

The known distribution of the young stages of *Lophius piscatorius* has now been very exhaustively treated, but so far no reference has been made to the distribution of adult forms. The adult has, however, a very wide distribution; it is found on both sides of the Atlantic. On the European side, it occurs as far north as Iceland and the Faroes, and beyond 69° N. on the Norwegian coast, whilst, according to Goode and Bean (1895), it extends as far south as the Cape of Good Hope. It is met with frequently in the Baltic. All round the Scottish coast, it is caught in considerable numbers. Fulton (1902) records the Angler as common both in the inshore waters and in the greatest depths at which trawlers work, and states that it seems to be most abundant in waters of moderate depth.

It also occurs in the Mediterranean. Lo Bianco (1908–1909), in describing the fauna of the Gulf of Naples, says that the adult is not rare, and attains sometimes the weight of 20 kilos.; it is caught in numbers, principally during winter and spring. According to Goode and Bean (1895), however, there is another species of *Lophius* confined to the Mediterranean. This is *Lophius budegassa* Spinola, and it is distinguished from the other Lophiidae by its shorter second dorsal and its simple lanceolate humeral spine.

Along the American side of the Atlantic, *Lophius piscatorius* is most common in the comparatively shallow water of the New England coast, and in the deeper water in the vicinity of Nova Scotia and Newfoundland. It also occurs as far south as the Caribbean Sea. Gill (1905) seems to think that south of Cape Cod the Angler retreats to deep water in summer, but that, although quite common along many coasts in shallow water, it appears to be at home in deep water. He states that its range of distribution in the Atlantic lies between 32° and 60° F., perhaps even higher.

Tate Regan (1914) records the capture of *Lophius piscatorius* off Cape Frie (Brazil) at 22° 56' S.; 41° 34' W., in a depth of 40 fathoms.

The most general survey of its distribution on the European side of the Atlantic, from a commercial point of view, is given by Murray and Hjort (1912), who have compiled tables from the statistics published by Dr. Kyle, of the International Bureau for the Study of the Sea, up to the year 1906. These tables show the relative and absolute importance of different marketable species within the different European fishing areas. The data relative to *Lophius piscatorius* have been extracted from these tables.

#### LOPHIUS PISCATORIUS.

Relative and Absolute Importance from each area (Murray & Hjort).

	White Sea and Barents Sea.	Norway, N. of Stett.	Iceland.	Færoe.	North Sea.	N.-W. of British Isles.	S.-W. of British Isles.	Bay of Biscay.	Portugal and Morocco.	
Percentage of species landed from all areas	...	...	1.8	2.4	70.8	5.1	18.1	1.5	0.3	100
Percentage of aggregate landed from each area	...	...	...	0.2	0.5	0.4	0.9	1.0	0.5	All areas in tons, 2.506

These figures do not give an exact representation of the numbers taken on the various fishing grounds, but represent rather the quantities landed at the markets. The proportion of Anglers taken to market, at least up to the date of compilation of the tables, varies for the different areas, and is largely influenced by local conditions.

There can be little doubt from the general distribution that the headquarters of the species is in the Atlantic, and that it extends its range into the Mediterranean and North Sea.

There is considerable conflict of opinion as to whether the Angler is to be considered a very shallow water form, or whether it is an inhabitant of the deeper water.

Holt and Calderwood (1891) caught a specimen at 115 fathoms, and Bryne (1889) records one from a depth of 200 fathoms off the Irish coast. The *Talisman* obtained examples at 400 to 700 metres, about the Azores and Cape Verde. Brown-Goode, from the American side of the Atlantic, gives depths of 84, 142, and 365 fathoms in which the species was caught.

The previous table shows clearly that the North Sea area is of greatest importance in so far as the quantities brought to market are concerned, and the following table shows the relative contributions from the different zones of depth.

Percentage of Anglers taken at different depths in the North Sea (after Murray and Hjort):—

Metres	0-20	20-40	40-60	60-80	80-100	100-200	Over 200
	0.5	17.3	20.7	28.6	15.2	17.5	0.3

In the North Sea over 80 per cent. of the total weight brought to market is caught in depths between 20 and 100 fathoms, and less than one per cent. is caught in depths of less than 10 fathoms.

It appears, therefore, that *Lophius piscatorius* has not only a very wide territorial range, but its bathymetric range is also very great.

The sub-order Pediculati, to which *Lophius* belongs, form a group, the members of which are quite easily distinguished from all other forms. Although this group is a very characteristic one, it includes members which are peculiarly adapted for life in very divergent habitats. Some of the members of the order belong exclusively to the deep sea; others, such as *Antennarius*, are at home at the surface amongst the sea-weed of the open sea.

The members of the family Lophiidae are, however, all true bottom forms, which range from moderate to great depths.

Smith (1892) considers that the fishes of the genus *Lophius* should really be regarded as shore-fishes, for, at least during youth, they live in shallow water, but, when older, they withdraw to greater depth. Gill (1905) says that, although the Angler is quite common in shallow water, it appears to be at home in deep water, and Günther, on the strength of its capture in deep waters, has admitted it to his list of deep-water forms.

The specialised form and the characteristic adaptations of *Lophius piscatorius*, which have given to the species the name of fishing frog, have been regarded by most observers as mainly modifications suited for life in the shallow water, the tag-like processes of the skin, and the fishing apparatus having generally been regarded as modifications especially adapted for life in the sea-weed zone. Indeed, this view is the predominant one, and is perhaps largely owing to the graphic description which Saville Kent gave in 1874 of a large Angler which was living in one of the tanks of the Brighton Aquarium.

Fritsch (1884), however, in his work on the angling apparatus of *Lophius*, has shown that the Angler is peculiar in possessing a superficial layer of closely-packed ganglion cells on the posterior portion of the medulla, which are in intimate relation with the angling apparatus and the sensory skin system. The observations made by Mr. Lane, which Cunningham (1896) gives, are therefore of peculiar interest. "But another, and perhaps more important use of the tentacle is indicated by some experiments made during the Irish Survey by Mr. Lane, and mentioned in Mr. Holt's Report (Scientific Proc. Royal Dublin Society, vol. III., part IV., p. 459). Mr. Lane found that, when he touched the tip of the erected tentacle with a stick, the fish at once snapped with its jaws, so as to catch exactly that part of the stick which had touched his tentacle. This was repeated until the fish was exhausted. It is evident that this automatic and precise mechanism of sensitive nerve and jaw muscles must be most effective in the capture of the Angler's prey. It is a spring-trap of the most certain action, always set, and never betraying its nature. Any fishes swimming near the ground, are liable to touch the tentacle of the Angler, which cannot be distinguished from the most innocent and insignificant frond of weed or stem of zoophyte, and to touch it is certain and immediate death."

Such a mechanism, which does not depend on sight, should be as effective for the capture of prey in the deeper waters as on the shallow grounds.

The Angler has, however, many characters highly suggestive of a deep-water habitat; the bluish-black colouring of the upper surface, the loose skin with its numerous serous spaces, and the weak development of lime in the skeleton are especially noteworthy. So, too, in the young bottom forms, the abundance of mucoid tissue and serous spaces, are characteristics which must not be overlooked.

In short, then, *Lophius piscatorius* as a species is very closely related to forms which are true inhabitants of the deep waters, but the Angler itself is an inhabitant of more moderate depths, and has extended its range into the shallow waters.

#### THE PAUCITY OF RECORDS OF THE YOUNG STAGES.

*Lophius piscatorius* is, therefore, a species which is very frequently met with in the adult form in waters of moderate depths, both on the European and American sides of the Atlantic. Yet, as previously referred to, the spawn and young stages have only been recorded from isolated localities over this very wide area. No satisfactory explanation has been given for the paucity of records of young forms of such a frequently occurring adult. One must remember, however, that the spawning area of a species is, as a rule, much more restricted than the actual dis-

tribution of the species. The frequency of the records of young stages will, therefore, in a large measure, depend on the frequency with which the areas, where the young forms occur, have been explored with apparatus suitable for their capture. The chances of capture of these forms also depend on the time of year in which the different areas have been investigated.

The whole area throughout which the adult Angler is captured has not been equally exhaustively investigated. The North Sea area, which supplies 70 per cent. of the total weight of marketable Anglers to European markets, has been very thoroughly explored, especially since the inception of the International Investigation. Yet, the records of capture of the young forms belong almost exclusively to the Scottish section, and to the northern portion of it. The southern area of the North Sea has been explored again and again by research vessels belonging to the bordering countries with negative results. The results are also negative for the southern section of the area which has been most exhaustively investigated by the Scottish research steamer. It is difficult to indicate on a single chart, or even on a series of charts, the many observations which have been made at all times of the year from 1904 to 1914, with different apparatus operating not only at the bottom, but in mid-water layers and at the surface. There is a line of stations, however, which runs east from the Firth of Forth, which has an important bearing on this question. This line of stations, for the eleven years under review, has been visited every year, and in practically every month of each year, with negative results in so far as *Lophius piscatorius* is concerned. But similar observations made in the northern Scottish area have yielded positive results, thus showing that these young stages can be captured with the apparatus employed. The records of occurrence of the spawn, isolated eggs, post-larvæ, and young bottom forms are represented in Chart I. Chart II. shows the stations investigated by the Scottish Investigation steamer *Goldseeker* during the period 1904 to 1914, and the quarters of the year in which each station was visited. The number of times each station was visited is not represented. Although the number of captured specimens is small, the occurrence of newly-spawned isolated eggs of *Lophius* within this northern area is proof that the Angler does spawn within the area. This statement is confirmed by the capture on 4th May 1916 at 57° 37' N.; 0° 53' E. of a sheet of spawn which had been very recently spawned.

The evidence at present available, therefore, leads one to conclude that the Angler is a species which spawns in the North Sea only in northern or deeper areas, north of 57° North Latitude.

If this northern area, which has been so diligently searched, is the general spawning area of the Angler, the paucity of records of such a conspicuous object as the spawn is altogether inexplicable.

The information regarding these sheets of spawn has mainly been got from samples which have drifted into shallow water, or have been stranded on the beaches. The observations already made on the sheets of spawn have shown that they are floating objects. They may not always float at the surface, even when newly-spawned, and may thus escape observation. It may also be urged that the sheets of spawn, on account of their size and nature, are peculiarly elusive, and that apparatus, such as tow-nets and young fish trawls, are not adapted to their capture.

Such an argument cannot be used to explain the infrequency of records of larval and post-larval forms in the northern North Sea, if it is a general spawning area for *Lophius*. Larval and post-larval forms of such common species as haddock, cod, and whiting, which are as active in their movements as young Anglers, have been caught by the same apparatus, in great numbers. The Scottish area has been extremely well searched at that period when the young post-larval Anglers are most likely to be present.

The absence of information concerning the distribution of the very small bottom forms is also especially noteworthy. In the present Report, only seven new records can be given for the Scottish area of specimens under 120 mm. in length. All these, however, are smaller than the smallest previously recorded, but only two of them were from the North Sea. One, 94 mm. in length, was got off Berriedale, in the Moray Firth, in the ordinary commercial trawl. The other was got at 60° 45' N.; 2° 30' E., in a small trawl of very fine mesh, the head line of which

measured only thirty feet. This apparatus has been very frequently used in the North Sea, much more so than in areas beyond the North Sea, yet the other five records of small forms were made by means of this apparatus in the areas outside the North Sea. It may also be noted here that, whilst these bottom forms were caught at  $58^{\circ} 44' N.$ ;  $7^{\circ} W.$ , and  $59^{\circ} 4' N.$ ;  $7^{\circ} 4' W.$ , post-larval stages, 15 to 17 mm. long, were obtained at  $59^{\circ} 54' N.$ ;  $7^{\circ} 6' W.$ , and  $59^{\circ} 36' N.$ ;  $7^{\circ} W.$  In addition, our knowledge of the distribution of bottom forms of under 200 mm. in length is extremely scanty, although the Angler, on account of its peculiar shape, is specially liable to capture in the ordinary trawl long before it reaches this size. Fulton, who gives most information concerning these sizes, says that they are obviously uncommon on bottoms suitable for trawling, otherwise they would be taken in much greater numbers. This statement is undoubtedly true for the North Sea, but his suggestion, viz., that in the case of the Angler, a prolonged pelagic habit is out of the question much after the post-larval stage, was made before the elaborate developmental changes, through which the post-larval stages pass, were known. He therefore adds that the reason for the comparative scarcity of records of young Anglers may be that they frequent rocky algæ-covered ground, where they can have shelter and suitable food. According to this view, the young Angler, up to a size of about 200 mm., might be considered as a shore-fish. But small forms of *Lophius piscatorius* are conspicuous by their absence from all lists of shore-fishes. Fulton (1902), however, in the same Report, states that the proportion of small Anglers (that is, of over 200 mm. in length) on the deep-water grounds appears to be higher than on the inshore trawling grounds, and that the higher proportion in the deep water may indicate the comparative absence of shelter, and it shows in all probability that spawning and the developmental changes may take place far from land. But shelter in these deeper water grounds from the operations of the commercial trawl is no more possible for the somewhat smaller bottom forms than for the larger ones.

All the facts concerning the occurrence of the floating sheets of spawn and the larval and post-larval stages may now be taken together. The absence, or comparative scarcity, of these forms from the records for the northern North Sea may be very simply described by the hypothesis that they do not occur there, or are there in very small numbers. In other words, although Anglers may spawn in small numbers in the northern North Sea, this area is not the main spawning area, and the Angler does not appear there in numbers, until it has reached some considerable size.

The records of the sheets of floating spawn are of especial interest in this relation. If the records of the capture of these sheets of spawn are examined with care, it will be found that in all cases, except the one already described, the embryos in the eggs were already very far advanced in development. These sheets of spawn float passively during the whole period of development of the embryos in the eggs, and perhaps for some time longer, and are drifted with the prevailing currents from the areas in which they were originally spawned. They are objects analogous to the floating drift-bottles which Fulton experimented with to test the direction and rate of flow of the surface waters in the North Sea. He has shown very conclusively that there is, at all seasons of the year, 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 sheets of spawn found along the east coast were spawned, if not without the North Sea, at least in an area in the North Sea further north than the locality in which they were found. Ehrenbaum's record of a sheet of spawn in the Skagerrak in July does not conflict with this statement, for, if one may judge from his description of the spawn of the Angler, it is evident he had never seen it when recently spawned.

It must be borne in mind that, if the spawning area of a species is to be deduced from the occurrence of the eggs, larvæ and post-larvæ of a species, the proximity of the true spawning area will depend on the time it takes for the species to pass through these stages of development, and the strength of the prevailing currents.



If the records of the isolated eggs and larvæ of *Lophius* are considered, the spawning area must be looked for to the north and west, in a direction contrary to that of the prevailing current.

There is abundant proof from recent investigations that, on the European side of the Atlantic, there occurs annually a northerly extension of true Atlantic passive organisms. The magnitude of this phenomenon varies greatly from year to year, but in some years it may be so great that the drift carries great numbers of these passive forms over the Faeroe-Shetland Channel into the Norwegian Sea and to the coast of Norway, and, in addition, large numbers may be brought into the North Sea through the Scotland-Shetland entrance. For example, *Lepas fascicularis*, the floating barnacle, which is not a true North Sea form, may often be picked up from the surface in the northern North Sea in the summer months. The following few records show that these forms may penetrate well into the North Sea, and that the phenomenon is a recurring one:—60° 7' N.; 0° 32' E., 10/8/11; 57° N.; 0° E., 1/8/12; 58° 13' N.; 0° 49' E., 25/8/04; 57° 50' N.; 0° 30' E., 25/8/04; 58° 34' N.; 0° 47' E., 20/7/05; 57° N.; 0° 5' W., 15/8/12.

The year 1905 seems to have been particularly favourable for the immigration of passive Atlantic forms into the North Sea. In that year, there was an immigration of considerable magnitude of the true Atlantic form, *Salpa fusiformis*, which is extremely well represented in the *Goldseeker* collections for that year. The limits of distribution of the Salps in the different summer months are graphically described by Schmidt, who had exceptional opportunities for studying the phenomenon that year. At the end of the month of May, the northern boundary of the Salps in the Atlantic had not extended beyond the latitude of the Hebrides, but by the month of August this boundary had been gradually pushed northwards and eastwards until it included a part of the North Sea and the Orkney and Shetland Islands.

Perhaps of more interest and importance in the present instance is the appearance in this northern section of the North Sea of fish larvæ which are admitted to belong to the Atlantic, or to areas to the west and south. *Fierasfer*, a form which does not belong to the North Sea but to the warmer water-masses of the Atlantic and Mediterranean, and which has often been compared with *Lophius piscatorius*, on account of its mode of spawning and the similarity of the post-larval stages in the development of filamentous rays on the head, has been captured a large number of times in the North Sea in the autumn and winter months, at stages both with and without the filamentous ray on the head.

Mention may be made here of the occurrence in the North Sea of pelagic stages of *Arnoglossus imperialis*. This is a species, the adult stages of which have never been recorded from the North Sea, although it is hardly likely that its occurrence would have been overlooked in an area so intensively fished. According to Kyle (1913), the adults are common in 60–70 metres at the western mouth of the English Channel, and are not rare south and south-west of Ireland. The post-larval stages were found in these areas and southwards, as well as in the Mediterranean. There is one record from the north of Scotland. It was taken in September 1905. Dr. Kyle, in reviewing the captures of these pelagic stages, says, "The small specimens occur in practically every month in which investigations were made, whilst the large are most abundant in September; one large specimen occurs in January. According to Holt, the spawning period should be in Spring, and with this agrees the large number of the large specimens (eleven altogether, including the earlier) taken in September. But the occurrence of small specimens in February, as well as of a large specimen in January, would indicate that here, just as in the case of *A. Thori* and *A. Laterna*, we have to deal with an indefinitely prolonged spawning period, with the main spawning in Spring. The presence of both small and large specimens over very deep water points to both a prolonged post-larval life and also to a deep-water habitat." The two captures of *Arnoglossus imperialis* in the North Sea are in complete accord with these statements. One specimen, 16.5 mm. in length in the preserved condition, was taken in the Petersen Young Fish Trawl at 58° 34' N.; 0° 47' E., at a depth of 66 metres below the surface, on 26th November 1904; the other specimen 18 mm. long, was captured by the same apparatus at 58° N.; 2° 54' W., at a depth of 27 metres, on 21st November 1904. Both these specimens, even of such a large size, were symmetrical; the position of the eyes

showed that metamorphosis had not yet begun. There is no reasonable doubt but that these forms had been carried by the currents from the Atlantic into the North Sea, as the prolonged nature of the post-larval life keeps them under the influence of the prevailing currents for an extended period.

If we next turn to the records of the post-larval stages of *Lophius piscatorius* from the North Sea, we find that, whilst the total number of specimens recorded is undoubtedly small, the years 1905 and 1914 are particularly well represented. There is no reason to believe that these records are due merely to chance, as similar investigations were carried out within the area in the intervening years with equal vigour. The year 1905 is of particular interest; it was the year in which the immigration of *Salpa fusiformis* of Atlantic origin into the North Sea was especially well marked; it was the year in which the post-larval form of the southern species *Arnoglossus imperialis* was captured by the Danish research steamer *Thor*, between the north of Scotland and Orkney.

These facts are sufficient justification for suggesting that the main spawning area lies beyond the limits of the North Sea, and that the Atlantic itself may be the main spawning area. It is already well known that the Atlantic is a spawning area, for Agassiz in 1882 was the first to describe the sheets of spawn and the young post-larval stages. The Scottish records made in areas beyond the North Sea also support this view. It must not be forgotten, however, in considering the Scottish captures, that areas outside the limits of the North Sea have been investigated much less frequently than the areas within the North Sea. Yet, the largest post-larval forms and the smallest bottom forms have been obtained from these Atlantic areas. These large post-larval forms were captured over considerable depths, at 60° 34' N.; 3° 53' W.; 59° 54' N.; 7° 6' W.; and 59° 36' N.; 7° W.; and the smallest bottom forms yet recorded from Scottish waters were caught at 58° 44' N.; 7° W.; and 59° 4' N.; 7° 4' W. There are also the two specimens of post-larval stages which were taken by Schmidt to the south of Iceland over waters of great depth. The fact that these pelagic stages were obtained over areas of very great depths, and that they—already considerably advanced in development—had therefore been carried by the currents for some considerable time, suggests that they had their origin in areas of some considerable depth.

The capture, by Schmidt, of post-larval forms of *Lophius piscatorius* in the Atlantic over great depths, west of the British Islands, may now be mentioned. His statements are of very considerable importance in the present instance, and are, therefore, quoted at length. "Of fish young that occurred with the eel larvæ, there should first of all be mentioned the Leptocephalus of the conger (*Leptocephalus morrisii*) and four other Leptocephali, the young of *Fierasfer*, *Lophius*, *Molva birkelange*, *Gadus poutassou*, *Galiculus argenteus*, *Zeugopterus megastoma* and spp., a characteristic, plump, pelagic gadoid (*Gargilius* sp., Ad. Jensen nov. gen. et spec.) *Macrurus* species, many different *Scopelini*, etc., as well as adult specimens, some with eggs, of the needle fish *Nerophis pelagica* and its young. *All these forms are true warm-water species of the Atlantic, most of which were not found during our investigations further north in the Atlantic.* They clearly belong mainly to the more southerly, warm water-masses than those we had previously investigated with the *Thor*, even though single specimens of some of them were found by us further north (west of the Faeroes and south of Iceland)."—Dr. Johs. Schmidt, "Contributions to the life-history of the Eel (*Anguilla vulgaris*, Flem.)" (*Rapports et Procès* vol. v., Oct. 1906, page 177).

Similarly, the tables quoted from Hjort regarding the distribution of Anglers brought to market may again be referred to. Over 18 per cent. of all the Anglers landed in European markets are caught in the region to the south-west of the British Islands, and indeed in relative proportion to other commercial fishes the Angler is most numerous in that area and in the Bay of Biscay, comprising about one per cent. of the total catch of fish.

The capture of the post-larval forms of *Lophius piscatorius* by Schmidt over deep water in the Atlantic points to the view that spawning takes place in water of considerable depths, or at least that spawning may occur on the continental slope. On the other hand, there is the negative evidence that the Angler does not spawn in the shallow water of the Atlantic. The sheet of spawn which was obtained by Cunningham from the western portion of the English Channel had

already the embryos in the eggs very far advanced in development, an indication that it had probably been carried a considerable distance from its place of origin. Similarly, the eggs in the sheet of spawn procured by Williamson outside Loch Bracadale, Skye, contained well-developed embryos.

On the American side of the Atlantic, the shallow water area is of limited extent, and the deeper waters of the continental shelf are in close proximity to the coast, and it is not strange, therefore, that American workers should have been the first to describe the floating sheets of spawn of the Angler. It is so common on the western side that the fishermen have given it the popular name of the "purple veil." In the descriptions of the floating spawn given by Agassiz and Whitman, there is no evidence, however, that they ever found eggs which had been recently spawned. Indeed, as has already been pointed out, it is probable that the eggs captured by them were all far advanced in development, if the larvæ had not already hatched out. The sheet of spawn found by Hjort and Murray on the western side of the Atlantic was taken over water of considerable depths. It is stated by these authors, however, that, since the Angler-fish only inhabit the coast banks, the finding of slightly developed eggs that could not have been drifting many days indicated that they were in the neighbourhood of the American coast bank. But our knowledge of the distribution of the Angler on the American coast, and the fact that these eggs were only slightly developed, may be held to prove that they were shed in waters of considerable depths. The Angler on the western side of the Atlantic belongs to the warmer waters. According to Goode and Bean, a specimen about four inches long caught on the Banks of Newfoundland is the most northern recorded occurrence in the western Atlantic.

The evidence from the Mediterranean is also all in favour of a deeper water spawning habitat. There are no records of the occurrence of sheets of floating spawn, or even of very early stages of *Lophius* in the inner region of the Adriatic. The only records of spawn in the Mediterranean are got from Naples, which is near to deeper areas. Even the spawn got at Naples contained embryos well advanced in development. Again, in the Gulf of Trieste, which is very remote from the deep water, only the older post-larval stages of the Angler were found, whilst in the open sea of the Adriatic, less distant from the deep water, the earlier post-larval stages were also captured.

So far, the northern North Sea is the only area in which recently spawned eggs of *Lophius piscatorius* have been captured. The known distribution of the adults, the occurrence of sheets of spawn with embryos well advanced in development, and of larval, post-larval, and bottom forms, together with the knowledge of the adaptations of the young forms to a prolonged pelagic life, are facts which show that the Northern North Sea is only a very subsidiary area for the spawning of the species. The limits of the spawning area of *Lophius piscatorius*, however, cannot be defined exactly from the present evidence, but a hypothesis may be advanced which describes the isolated facts—a hypothesis which must be tested by future experiment.

*Lophius piscatorius* is a species which has its headquarters in the Atlantic. On the European side, the species extends its range into the Mediterranean, North Sea, Skagerrak, Cattegat, and Baltic. The Angler is very closely allied to Atlantic species which belong exclusively to the deep-water, but *Lophius* itself is most abundant in waters of moderate depths. Its extreme bathymetric range is, however, somewhat extensive; it has been taken in depths of over 300 fathoms, and it is also found in large numbers in the shallow coastal waters. Its extreme limits of distribution are, therefore, much wider than its spawning distribution, for it is found very frequently in areas where it never spawns. Modifications in the adult form are usually said to be adaptations for a life in the sea-weed or shallow water areas, but such structures may be equally effective for life in deeper waters. The Angler does not spawn in the shallow coastal zone, but in moderate to deep water. It is a species which spawns in the warmer waters, and suitable conditions are found in the warm salt water of the Atlantic and Mediterranean, probably in the neighbourhood of the continental slope, on the edge of the deep water. It spawns on both sides of the Atlantic. On the European side, to the west of the British Isles, these conditions are found only at a considerable distance from the coast, whilst on the American side of the Atlantic, suitable spawning areas are much nearer

the coast. On the European side of the Atlantic, the known spawning range extends from the Mediterranean to the northern North Sea. The extension of the limits of spawning towards the north depends on the physical conditions in the Atlantic at the time of spawning. The frequency of spawning in the northern portion of the North Sea, which is under influences from the Atlantic, is dependent on these conditions. Spawning begins earliest in the Mediterranean, probably in the winter months, but at least as early as January; the spawning is later further north in the Atlantic; in the northern North Sea, spawning may begin as early as March, and it extends to the end of July.

The method of deposition of the eggs in long extended bands of mucus, and the characteristic development of post-larval adaptations secure for the species a very prolonged pelagic life, and during this early period the young forms may be carried very considerable distances from the original spawning grounds by the prevailing currents. Even when the larvæ are hatched from the eggs, they may be detained for some time in the gelatinous matrix which tends to keep the larvæ in the upper water layers until post-larval structures are developed. The appearance of the larvæ and post-larvæ is very unlike that of the typical bottom form. In the pelagic stages, the body and head are laterally compressed, and the eyes are situated on each side of the head. The young forms swim upright in the water. From the earliest stages, the embryonic fin is especially broad, and it is very persistent, traces remaining even in the older post-larval stages. As the post-larvæ grow, the embryonic fin is replaced by the development of the unpaired fins, and the enormous development of the membrane between the rays of these fins adds greatly to the depth of the fish, thus giving stability to the pelagic form. The paired fins are extremely well adapted for pelagic life. The pectoral fins, as perfect balancing organs, are large and fan-shaped, attached high up on the body just behind the gill-openings, whose surface is in a plane parallel to the plane of symmetry. The pelvic fins—enormously developed—extend far beyond the body, and the filamentous tips of the rays grow to an extraordinary length. When expanded, these fins have an enormous surface in comparison to the size of the small fish, and attached far forward on the ventral surface of the fish their rapid up-and-down motion keeps the young fish in the upper water layers. The pelagic life may last many months, and the young form appears to be more than nine months old before it takes to a bottom habitat. During the pelagic period, the young forms may be drifted far from the spawning area. In the North Sea, sheets of spawn may be drifted south from the deeper northern area and may be ultimately stranded on the east coast of Britain. In the Atlantic, the prevailing current carries the young pelagic forms northwards and eastwards; some may be carried towards Iceland, for isolated specimens have been taken over waters of great depths to the south of Iceland; others may be carried up over the Faeroe-Shetland Channel, whilst a number may enter the North Sea by the channels between Scotland and Shetland. The magnitude of the northerly immigration at this stage will depend largely on the prevailing conditions in the Atlantic. In the Mediterranean, spawning does not occur in the coastal water, but the sheets of spawn may be drifted into shallow areas, such as the Gulf of Naples, from the near deep water areas. Spawning does not occur in the shallow inner region of the Adriatic, and the post-larval forms are late in arriving there, as the area is far removed from the deep water of the Mediterranean. On the American side of the Atlantic, the deep water is adjacent to the coast, and therefore the sheets of spawn and the larval forms have been frequently met with in the coastal area at such places as Newport and in Massachusetts Bay.

The prolonged pelagic life therefore secures a wide distribution for the growing forms. The extension of the distribution area does not stop at the completion of the pelagic life. The change from the typical pelagic form to the bottom form is progressive but slow, and the young fish may take to a bottom habitat long before these changes are complete. In the North Sea area, although the larger forms are common, the very small bottom forms are extremely rare; few are found less than 200 mm. in length. The Angler does not appear in the North Sea in numbers until it is at least one year and a half old, and even then the smaller ones are relatively in greater proportion in the northern and deeper parts of the North Sea. Although the North Sea thus depends on its supply of Anglers from areas beyond its own

boundary, it is nevertheless the most important area for the Angler, from the fishery point of view, since 70 per cent. of the total weight of Anglers landed at European ports are captured within the area.

The illustrations, which have been so ably drawn from very difficult material, are due to the exceptional artistic skill and patience of Miss I. M. Duff. This paper would have been far less complete without the aid of Dr. Fulton, who has not only supplied me with material, but has helped me with the literature of the subject. I am also greatly indebted to Dr. Williamson for part of the literature.

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## DESCRIPTION OF PLATES.

## Plate I.—

- Fig. 1. Portion of Egg Mass of *Lophius piscatorius*. Caught 57° 37' N.; 0° 53' E. 3/5/16.  
 Figs. 2a and 2b. Isolated Egg of *Lophius piscatorius*, with pigmented embryo. Caught 59° 36' N.; 0° 41' W. 16/4/14.  
 Fig. 3. Newly-hatched Larva of *Lophius piscatorius*. Length, ca. 4.5 mm. Diameter of Yolk, ca. 2.5 mm. Caught as isolated egg at surface, 59° 31' N.; 0° 37' E. 16/4/14. Hatched 19/4/14.

## Plate II.—

- Fig. 4. Larva of *Lophius piscatorius*, 7-8 days hatched. Length ca. 5.5 mm. Caught as isolated egg at 59° 31' N.; 0° 37' E. 16/4/14.  
 Fig. 5. Larva of *Lophius piscatorius*. Yolk-sac almost absorbed. Length ca. 8 mm. Caught 58° 26' N.; 0° 8' W. 15/7/14.

## Plate III.—

- Fig. 6. Post-larval *Lophius piscatorius*. Length, ca. 10 mm. Caught 60° 15' N.; 0° 7' W. 13/7/05.

## Plate IV.—

- Fig. 7. Post-larval *Lophius piscatorius*. Length ca. 15 mm. Caught 59° 36' N.; 0° 42' E. 17/8/07.

## Plate V.—

- Fig. 8. Post-larval *Lophius piscatorius*. Length ca. 16 mm. Caught 58° 17' N.; 1° 3' W. 11/9/09.

## Plate VI.—

- Fig. 9. Small Bottom Form of *Lophius piscatorius*. Length ca. 64 mm. Caught 58° 44' N.; 0° 7' W. 11/7/06.



FIG. 1.

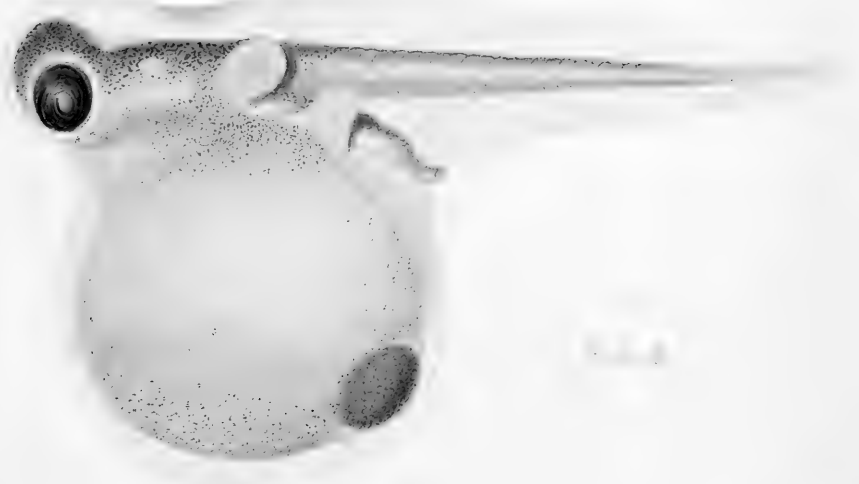
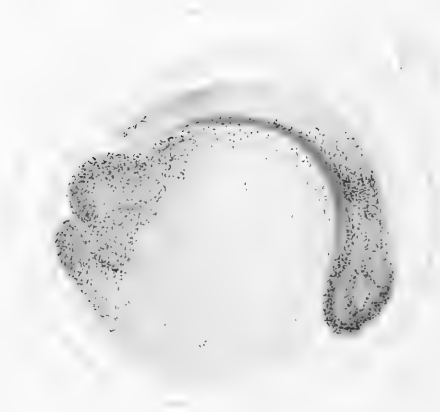






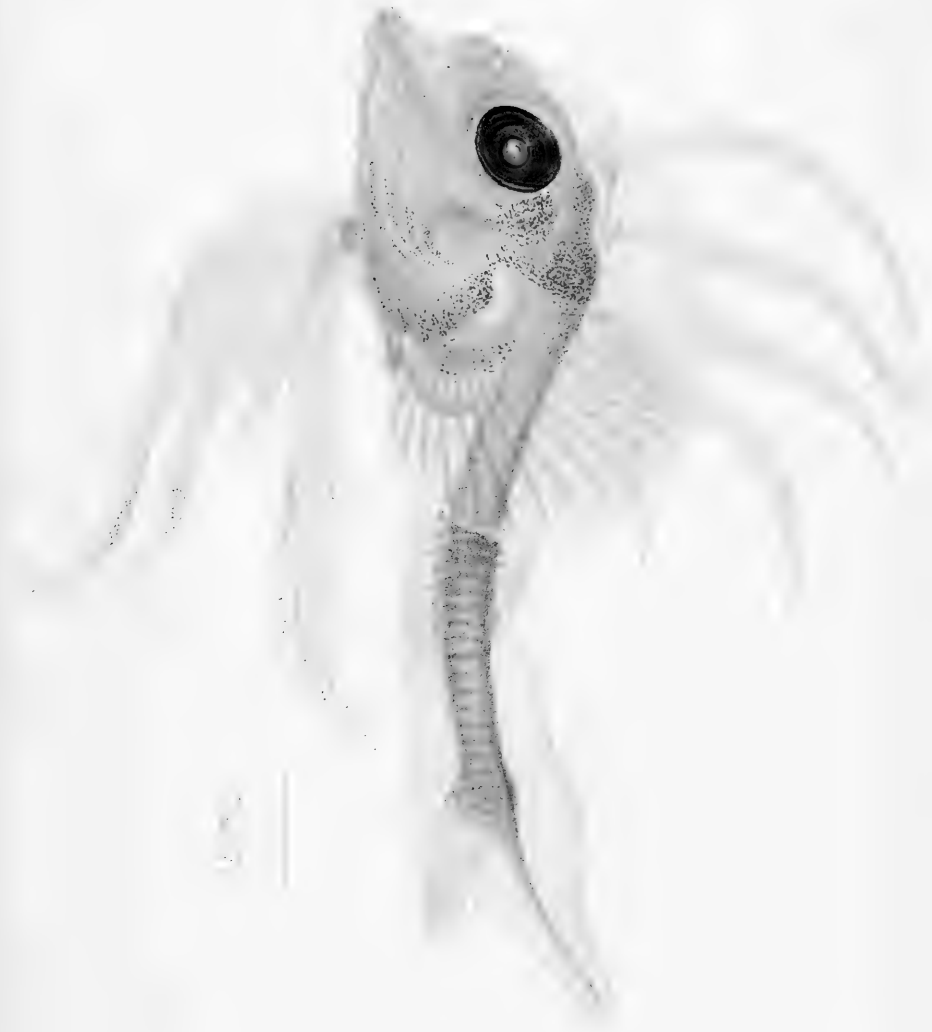






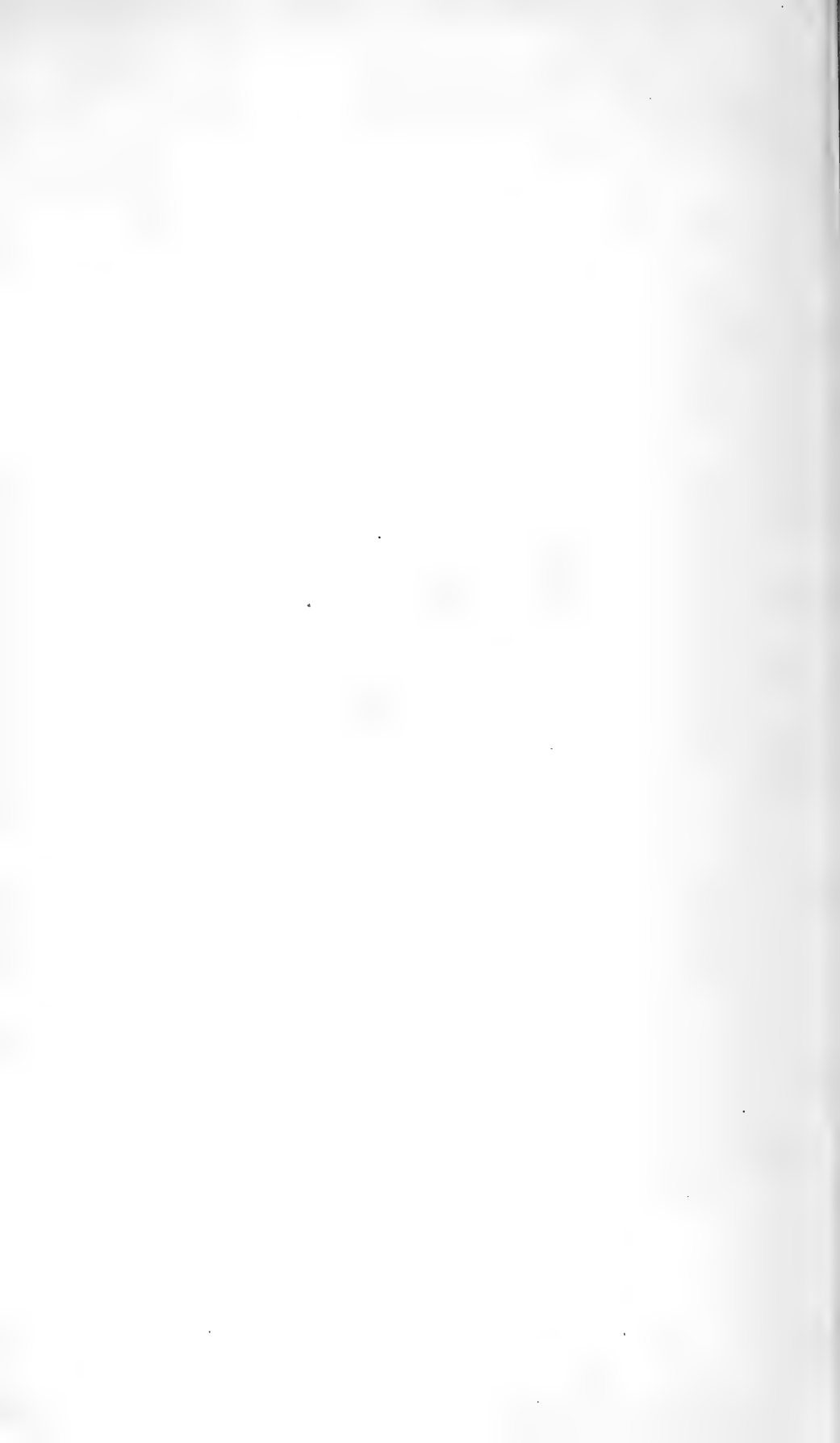
FIG. 8







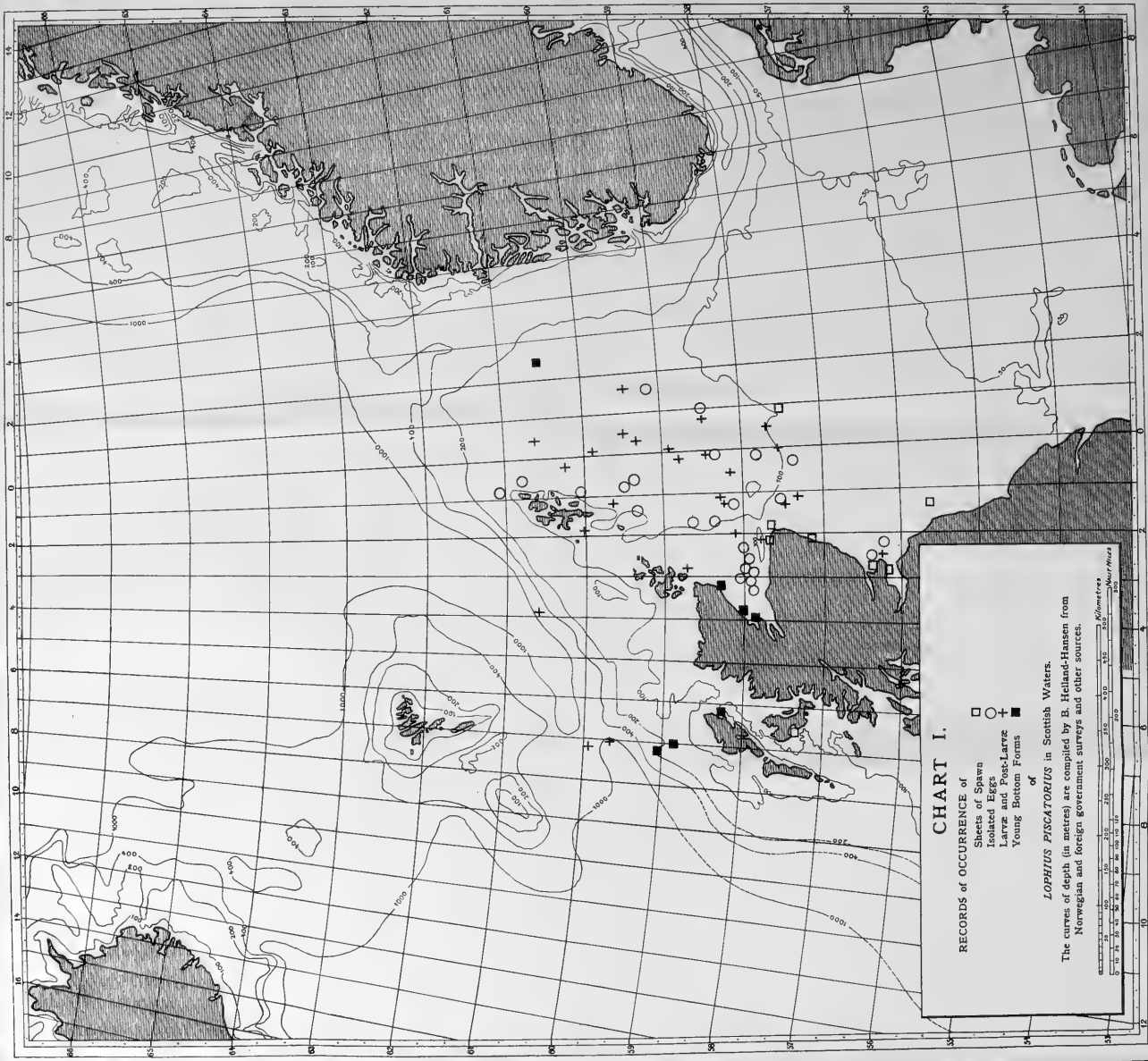








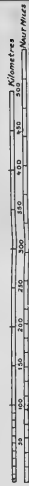




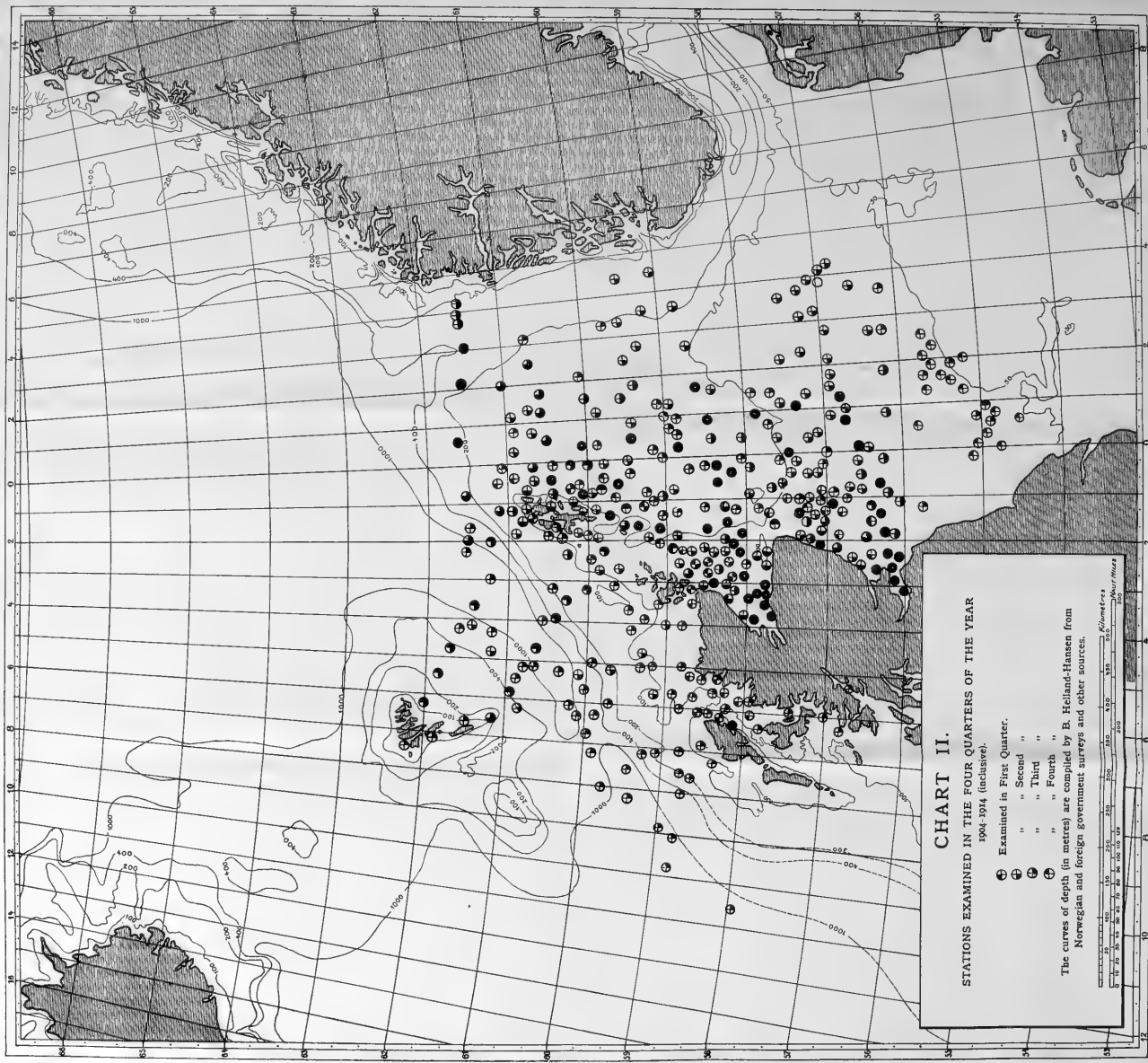
### CHART I.

RECORDS of OCCURRENCE of  
 Sheets of Spawn      □  
 Isolated Eggs      ○  
 Larvae and Post-Larvae      +  
 of  
 Young Bottom Forms      ■

*LOPHIUS PISCATORIUS* in Scottish Waters.  
 The curves of depth (in metres) are compiled by B. Holland-Hansen from Norwegian and foreign government surveys and other sources.







## CHART II.

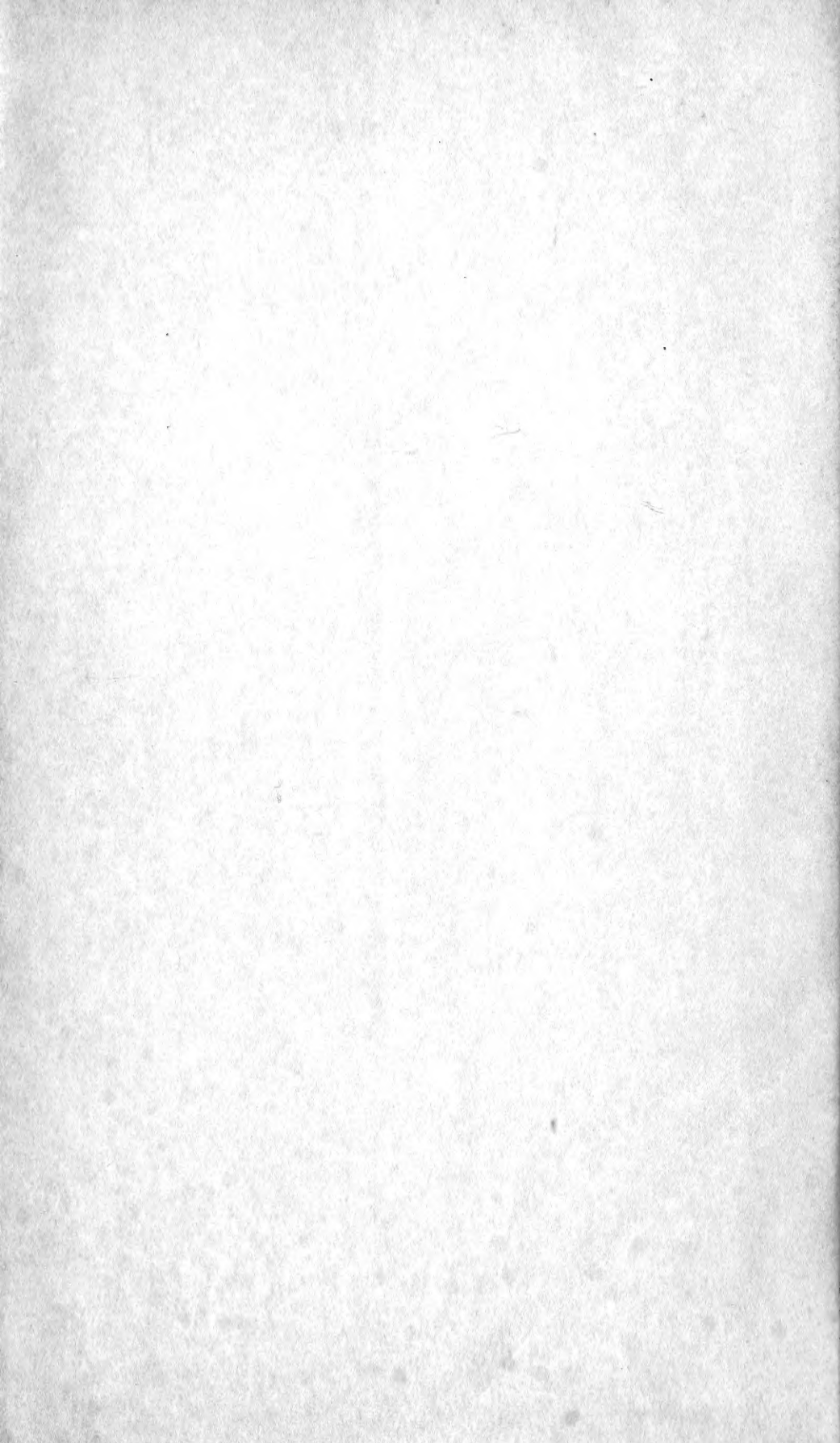
STATIONS EXAMINED IN THE FOUR QUARTERS OF THE YEAR  
1904-1904 (inclusive).

- ⊕ Examined in First Quarter.
- ⊙ " " " " Second " "
- ⊕ " " " " Third " "
- ⊙ " " " " Fourth " "

The curves of depth (in metres) are compiled by B. Heland-Hansen from Norwegian and foreign government surveys and other sources.

0 10 20 30 40 50 60 70 80 90 100 Kilometers  
0 10 20 30 40 50 60 70 80 90 100 Nautical Miles









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