MEDDELELSER

FRA

KOMMISSIONEN FOR HAVUNDERSØGELSER

SERIE: FISKERI · BIND V

NR. 2. A. C. STRUBBERG: MARKING EXPERIMENTS WITH COD AT THE FÆROES

KØBENHAVN
I KOMMISSION HOS C. A. REITZEL
BIANCO LUNOS BOGTRYKKERI
1916

MEDDELELSER FRA KOMMISSIONEN FOR HAVUNDERSØGELSER
SERIE: FISKERI · BIND V · Nr. 2 · 1916

MARKING EXPERIMENTS WITH COD AT THE FÆROES

BY

A. C. STRUBBERG

KØBENHAVN
I KOMMISSION HOS C. A. REITZEL
BIANCO LUNOS BOGTRYKKERI
1916

A. Introduction.

1. General Remarks.

SINCE 1903, the Danish institution known as "Kommissionen for Havundersøgelser" has carried out extensive marking experiments with various food fish, not only in the strictly Danish waters[1], but also in those of Iceland[2] and the Færoes. The following pages deal with the experiments in the last-named waters.

During the years 1909—1913, large numbers of Cod, Plaice and Lemon Sole were marked at the Færoes, for the most part in the summer months, from May—August. The numbers in each case will be seen from the table below. The great majority of the markings were made in coastal waters, up to 5 miles from land, and inside the 100 m. isobath, at places where intense fishery is carried on. Only two experiments exclusively with cod were made on banks farther out, viz; the Sandø Bank to the east and the Færoe Bank to the south-west, which lie respectively within 35 and 50 miles from land, the respective depths ab. being 150—200 and 100—170 metres.

The following pages treat exclusively of the marking experiments with cod.

Table showing number of each species marked.

Year & month	Cod *Gadus callarias*	Plaice *Pleuronectes platessa*	Lemon Sole *Pleuronectes microcephalus*
1909 August	800	..	..
1910 March & June ..	1029	500	200
1911 August—Sept...	1031	40	178
1912 May—July.....	1023	668	..
1913 April & June ...	210	..	..
Total No. marked...	4093	1208	378

2. The mark, and how affixed.

During the years from 1909—1912, marks of a uniform pattern were exclusively employed; these being of the so-called "Danish Type 1908", which consists of two bone buttons connected with silver wire, a small bronze disc inscribed with distinctive lettering (Da), year, and serial number, being affixed to the bone plate on one side. In 1913, a new pattern was tried, consisting of two ebonite plates, marked with number, letter etc. and connected by silver wire; this being a copy of the mark employed by the Fishery Board for Scotland, obtained through the courtesy of Dr. FULTON. Both marks are affixed to the body of the fish at the same place, viz; in the center of the gill cover and in the same manner, viz; by thrusting the wire through the middle of the gill-cover between the opercular bones[3].

The bone mark has the advantage of being more conspicuous than the ebonite; its value is, however, considerably impaired by the inferior durability of the material. On comparing the total numbers of recaptures (cod and plaice together) month by month, a distinct diminution is noticeable after the expiration of the first twelve months[4]. This is doubtless largely due to loss or destruction of the marks, or to their being so affected as to be easily overlooked. The Scottish pattern of mark now in use will, it is hoped, prove more efficacious in this respect.

[1] Medd. fra Komm. for Havunders., Serie Fiskeri, Vol. II, No. 5.

[2] - - - - - - - - II, No. 6, IV, No. 6.

[3] For further particulars, *vide* JOHS. SCHMIDT: Marking Experiments on Plaice and Cod in Icelandic Waters. Medd. Komm. Havunders., Serie Fiskeri, Vol. II, No. 6. 1907.

[4] As will be shown later on, the marks appear to evince a far greater "durability" in the case of the plaice than in that of the cod.

3. Treatment of fish marked.

The fish are, in the great majority of cases, taken by hand line from an open boat or cutter at depths varying from 20—100 metres, the mark being affixed immediately, and the fish marked and liberated at the same place. Only such fish as had suffered but superficial injury from the hook were marked. If the fish, after marking, was seen to have difficulty in making its way down, it was at once taken up again and the mark removed. The actual operation occasions as a rule only momentary discomfort to the fish; it will be seen from the lists of recaptures that cases of serious inflammation of the affected or adjacent parts are of but infrequent occurrence, the wound healing up, as a rule, rapidly and completely.

The great majority of the markings were made by the captain of the Danish research steamer "Thor", Capt. G. HANSEN, working with hired boats and crew. Some were further made from the research vessels "Thor" and "Margrethe" and others again by the mate of the "Thor", H. C. CHRISTENSEN, from a cutter belonging to Mr. J. DAHL, a merchant in Vaag (Suderø), during the spring fishery in 1910 on the Færoe Bank.

The recaptured fish were delivered up, as far as possible unharmed, to merchants in different parts of the islands, who had kindly undertaken the work of noting, and if able to do so, checking the fishermen's statements as to locality of capture, and other particulars, and communicating same to us.

The total length of the fish is measured at time of marking, and, since 1910, the weight also has been noted[1]; since 1910 also, a scale sample has been taken from each specimen, the part selected being in the vicinity of the lateral line below the first dorsal fin. On recapture, the fish is again measured and weighed, sex noted, and a new scale sample taken; since 1912, the otoliths also have been preserved. Since 1912 also, endeavours have been made to ascertain in each case the number of hours which have elapsed between recapture and delivery or measurement. As will be seen from the table below, we have here to reckon with a not altogether inconsiderable shrinkage of the fish, even during the short time which elapses between capture and weighing. In the same table, which is compiled from estimates made by Capt. HANSEN, will be seen noted the loss in weight occasioned by gutting[2], the marked fish recaptured by English and Scottish fishermen in Færoe waters being invariably so treated.

4. Records of recaptures.

It should be borne in mind, however, that the method of proceeding above described has not been employed throughout in its entirety, but has been built up gradually since the commencement of the experiments, so that the records of recaptures from the 1909 experiments cannot be regarded as of equal value with those of later date (*vide infra*). The measurements in particular appear to have been not altogether satisfactory during that year, having been made in the first place in Danish "Tommer" — an approximate equivalent to inches[3] — and in the second place, apparently with a degree of accuracy inferior to that which experience has shown to have been observed in subsequent years. Even now, unfortunately, several of the records are found to be insufficiently precise, and evidently incorrect.

We have, however, in the course of the experiments, had the good fortune to find that besides the native fishermen various private persons not officially connected with the researches have kindly interested themselves in the work, and hasten therefore to avail ourselves of this opportunity to thank especially the following gentlemen for much courteous and painstaking assistance rendered during the past years.

[1] Fish being placed in a small net suspended from a balance.

[2] Only intestines removed, not head. Cf. for comparison between whole and gutted weight. J. HJORT in Rapp. Proc. Verb. vol. XX, p. 141.

[3] 6 "Tommer" = 6.18 inches = 15.7 cm.

Table showing loss of weight in cod after gutting, and shrinkage of whole fish after removal from the water. July 1912. Færoes.

Length in cm.	Whole weight in gr. ♀	Loss after gutting ♀	Whole weight in gr. ♂	Loss after gutting ♂	Shrinkage in gr after removal from the water in					
					2 hours	4 hours	6 hours	8 hours	16 hours	20 hours
100	8400	1000	..	..	..	..	..	..	..	300
97	8150	700	..	..	..	..	..	..	..	300
96	7700	1250	..	..	..	..	..	..	..	..
93	6950	650	7375	650	..	..	..	..	..	350
92	8000	600	..	..	..	..	..	..	..	..
	6750	683	6725	475	..	..	..	..	..	250
90	6650	650	..	..	..	..	..	..	..	300
	6000	312	5950	750	..	..	..	..	..	250
88	5967	567	..	..	..	..	..	..	..	..
	5975	613	5775	475	..	..	..	..	..	200
86	6000	958	5600	400	50	50	100	150	200	250
	6100	600	5675	500	50	100	150	200	200	200
84	5530	470	5245	457	50	100	150	150	150	150
	5500	600	5250	500	50	100	100	100	150	200
82	5000	425	5700	525	50	50	100	150	150	150
	5000	375	5100	550	50	100	100	150	175	175
80	5100	500	5100	500	50	100	150	150	200	175
	5500	900	4600	400	50	50	100	125	125	125
78	..	..	4300	300	25	50	50	50	75	150
	..	..	4300	475	50	75	100	100	125	..
76	4575	450	4400	445	50	50	75	75	100	125
	..	..	4150	450	50	50	75	100	100	..
74	3850	250	4025	375	25	50	50	75	100	175
	3875	375	..	..	25	50	50	75	100	175
72	3575	338	..	..	50	50	75	100	125	..
	3200	200	3500	330	25	25	50	50	75	150
70	3155	280	3170	395	50	50	75	75	100	125
	3200	300	3313	388	25	50	50	75	100	175
68	3275	300	2995	300	25	50	50	75	100	100
	2892	325	..	..	25	50	75	75	100	175
66	..	..	2950	300	25	50	50	75	75	125
	2500	242	2950	350	25	50	50	75	75	100
64	..	..	2400	250	25	50	75	75	75	100
	2525	325	2225	250	25	50	50	50	75	75
62	2269	247	2265	220	25	50	50	75	75	100
	1950	175	2325	150	25	50	50	50	75	75
60	2013	175	2138	200	25	50	50	50	75	50
	2017	174	2000	225	25	50	50	50	75	50
58	1975	283	1950	196	25	50	50	50	75	100
	1700	108	1807	225	25	25	50	75	75	100
56	1768	237	1738	244	25	25	50	50	50	75
	1571	200	1625	225	25	50	50	50	75	75
54	1637	229	1517	192	25	50	50	50	50	50
	1446	179	1475	220	25	25	25	50	50	75
52	1363	213	1413	200	25	25	50	50	50	50
	1320	255	1288	119	25	50	50	50	50	75
50	1190	210	1213	200	25	25	50	50	50	75
	1206	156	1218	172	25	25	50	50	50	50
48	1095	149	1205	185	25	25	50	50	75	75
	1054	136	1030	80	25	25	50	50	50	75
46	1014	139	987	106	25	50	50	50	75	50
	942	122	934	184	25	25	50	50	50	50
44	898	157	928	162	..	..	..	..	..	50
	823	141	873	129	..	..	..	..	..	25
42	814	200	768	118	..	..	..	..	..	50
	750	92	718	96	..	..	..	..	..	50
40	667	97	660	83	..	..	..	..	..	25
	608	89	600	75	..	..	..	..	..	25
38	563	107	607	94	..	..	..	..	..	25
	546	103	506	67	..	..	..	..	..	25
36	488	65	511	61	..	..	..	..	..	25
	450	87	444	131	..	..	..	..	..	25
34	392	50	433	116	..	..	..	..	..	25
	375	62	400	150	..	..	..	..	..	25
32	350	50	..	..	..	..	..	..	..	..
31	345	45	313	40	..	..	..	..	..	..
28	240	70	250	43	..	..	..	..	..	..

First of all, Hr. Fuldmægtig ØSTER, of Thorshavn, to whose unremitting zeal and care we owe the greater part of the information received as to the Færoe recaptures; also Hr. Sysselmand C. MARTENSEN, Trangisvaag (Suderø) and three merchants on the islands, Hr. POULSEN, of Skopen (Sandø) Hr. REJNERT, of Vestmanhavn (Strømø) and Hr. J. DAHL, of Vaag (Suderø).

Information as to the relatively few[1] marked fish recaptured by English and Scottish trawlers (and long-line steamers) has been forwarded to us from the Board of Agriculture and Fisheries in London, and through Dr. FULTON, from the Fishery Board for Scotland. We are also greatly indebted to these two institutions for reliable measurements, etc. which have been of great value to us in the work.

The work of dealing with the material obtained has been entrusted to me by my Chief, Dr. JOHS. SCHMIDT, who, as Head of the Danish Fishery Investigations at the Færoes and in Iceland, planned out the entire series of marking experiments here. I am glad to embrace this opportunity of thanking Dr. SCHMIDT for confiding the present task to my care, and also for the valuable knowledge gained during the course of our collaboration, as well as for the expert advice and interest with which he has on this, as on many other occasions, assisted my work.

Thanks are also due to Dr. A. C. JOHANSEN for valuable advice and assistance with the proofs.

Proceeding then to the separate experiments, we give below all the information procured with regard to the rate of growth, the intensity of fishery, and the migrations of the cod in Færoese waters.

Table showing locality and extent of the experiments with cod at the Færoes 1909—1913.

Experiment No.	Year and month	Position	Depth in m.	No. of cod marked pr. year	Marked in all
I	1909 August	Nolsø Fjord	60—65	306	
	1910 June	—	50	94	
	1911 August	—	35—60	138	
	1912 July	—	40—60	165	
	1913 April	—	66—40	101	804
II	1909 August	E. and S. of Nolsø	50—60	294	
	1910 May & June	—	10—110	163	
	1911 August	—	40—60	363	
	1912 July	—	65—110	166	986
III A	1911 August	W. of Strømø	40—100	300	
	1912 July	—	60—90	137	437
- a	1912 July	Myggenæsfjord	45	117	117
- b	1912 July	N. W. of Strømø	120	20	20
- c	1910 May	Vestmanhavn	ca. 10—20	7	7
IV	1911 September	E. and S. of Lille Dimon	50—85	230	230
V a	1909 August	E. of Suderø	60	43	43
V	1909 August	S. of Suderø at "Munken"	90	157	
	1910 May	—	90	173	330
VI	1912 July	E. of Sandø	50	168	168
VII	1912 July	W. of Sandø	90	150	
	1913 June	—	ca. 70—90	109	259
VIII	1912 July	Sandø Bank	150—190	100	100
IX	1910 March—April	Færoe Bank	ca. 100—170	585	585
				Total...	4086*

* To this should be added 7 specimens transplanted from the Færoe Bank to Vaag Fjord (Suderø) in March 1910. (Exp. X).

B. The various Experiments in 1909—13.

The table above[2] and Fig. 1 show the locality and extent of the different series of experiments, grouped according to the areas in which they were made.

The greatest number of markings (abt 2400), was made east and west of Strømø.

[1] ab. 11 % of total recaptured (see p. 82), otherwise the only foreign nationality which need to be considered here.

[2] The spelling of the færoese place-names follows in this work as a rule those customary in the Danish Governements publications „Fiskeriberetningen", „Færøske Lods" and in the Danish sea charts, which is unfortunately not always itself quite consistent; in some few cases, however the english spelling has been deemed preferable.

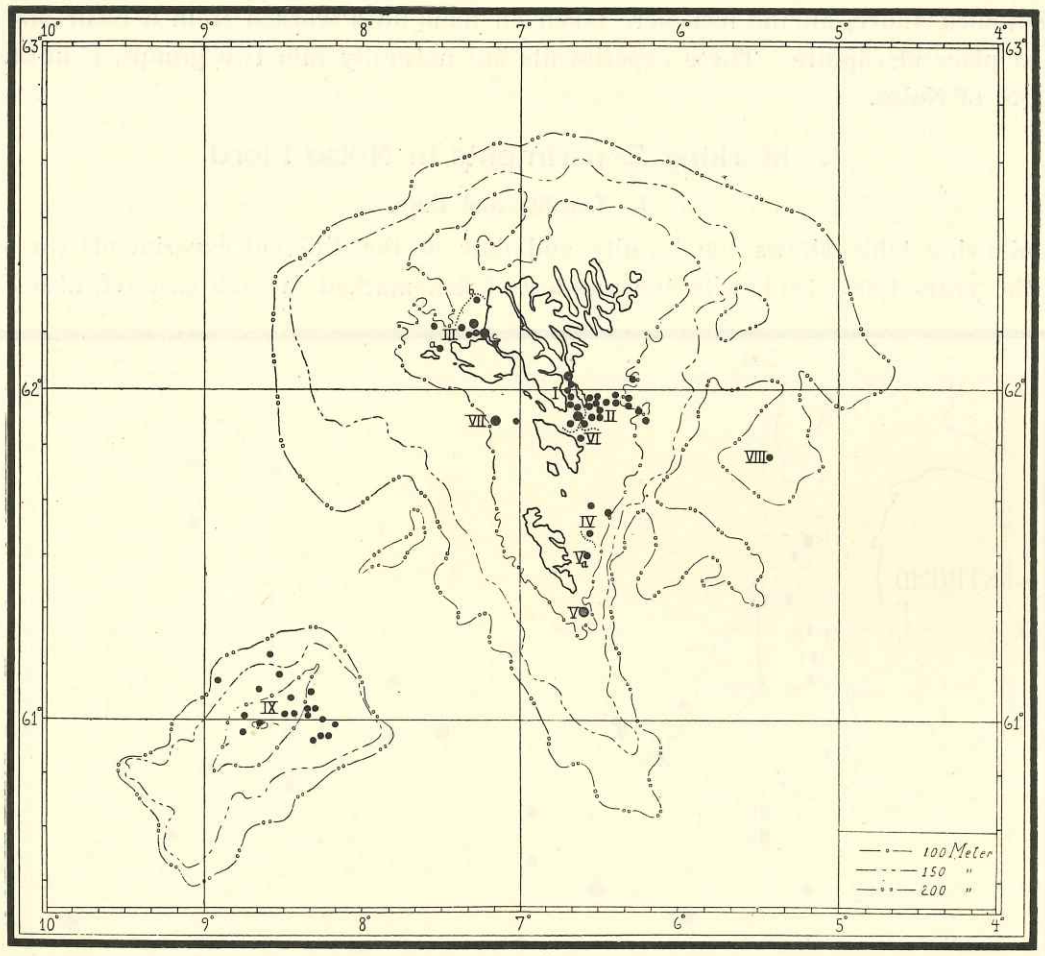

Fig. 1. Marking Experiments with cod at the Færoes 1909—1913.
The spots indicate places where marked cod were liberated; the larger ones denoting liberation of more than 100 fish.

We may now proceed to consider the experiments separately, commencing with those made east of Strømø in the waters around Nolsø.

These experiments comprise the greatest number of markings of all those made at the Færoes, almost half (abt. 1800) of the total number (abt. 4100) of marked cod having been taken and liberated

Marking experiments in the Nolsø Fjord 1909—1913.

No. of Experiments	Year and month	No. of cod liberated	No. of cod recaptured	Locality of liberation	Central position (approximately) N. Lat.	W. Long.	Depth in metres
A	1909 August 3	1	1	1 mile W. of Nolsø Bygd	62°00′	6°42′	ca. 45
B	— — 8, 10	195	130	2 miles S. E. by E. ½ E. of Kirkebønæs	61°56′	6°40′	60
B_0	— — 15	110	72	1 mile W. ½ N. of Nolsø Light	61°56·5′	6°40′	65
C	1910 June 2, 8	80	23	1·5 miles S. by E. of Kirkebønæs	61°55′	6°42′	ca. 60
C_0	— — 8	14	4	2·5 miles S. of Kirkebønæs	61°54′	6°42′	ca. 60
D	1911 August 12	59	44	0·5 mile E. S. E. of Glivursnæs	61°59′	6°42′	40—60
E	— — 16, 17	79	44	2 miles E. S. E. of Thorshavn Light	62°00·5′	6°41′	35
F	1912 July 4	15	11	1 mile S. E. of Glivursnæs	61°57·7′	6°42·5′	45
G	— — 6	41	28	1·5 mile E. of Kirkebønæs	61°57′	6°41′	60
H	— — 8, 9	109	80	0·5 mile N. of Northpoint of Nolsø	62° 1·7′	6°42′	40
I	1913 April 28	70	46	1·2 miles N. E. by E. of Glivursnæs	61°09·5′	6°42′	66
K	— — —	31	18	0·5 mile N. N. W. of Nolsø Bue	62°01·5′	6°41·5′	40
	Total...	804	437				

here. As mentioned above, all the fish were taken on hand-lines worked from a boat, and the marking was effected at place of capture. These experiments fall naturally into two groups, I. in the Nolsø Fjord, and II. E. or S. of Nolsø.

I. Marking Experiments in Nolsø Fjord.

1. Locality and Date.

The following table shows the locality and date of the different experiments carried out in the fjord during the years 1909—1913, with the number of fish marked in each case (cf. also Fig. 2).

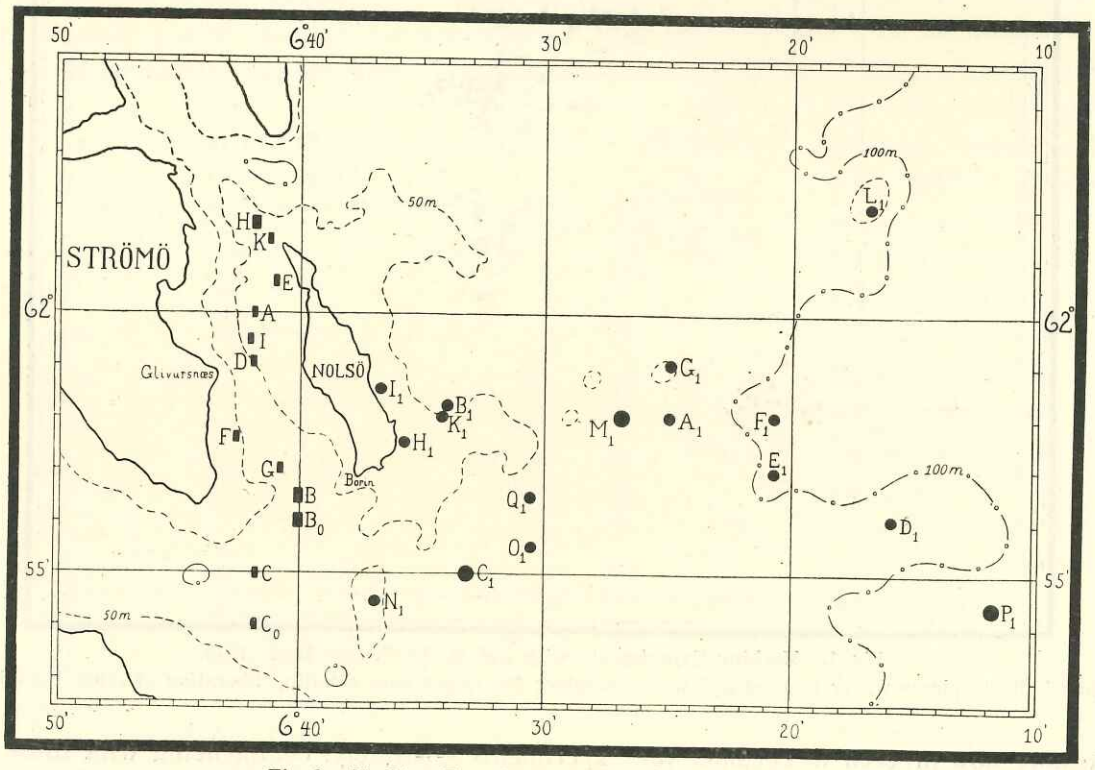

Fig 2. Marking Experiments with cod at the Færoes.
Places where marked cod were liberated in the waters around Nolsø 1909—1913.

The greater portion of the fjord comprises depths between 20—50 metres (*vide* Fig. 2) with a narrow channel of deeper water in the middle, with depth to 100 m.

2. Size of the fish marked.

Fishing is carried on to a great extent in Nolsø Fjord, the craft employed being small boats, mostly from Thorshavn (*vide infra*) and the catch consisting mainly of cod and coalfish.

Table showing number and size of cod liberated in Nolsø Fjord 1909—1913.

No. of cod marked in the different years	Initial sizes in cm.							Total
	30—39	40—49	50—59	60—69	70—79	80—81	90—118	
1909.....	88	182	32	..	3	..	1	306
1910.....	..	9	30	46	9	..	..	94
1911.....	42	89	6	..	1	..	..	138
1912.....	90	59	9	2	2	1	2	165
1913.....	54	29	14	3	1	..	..	101
Total...	274	368	91	51	16	1	3	804

A comparison of the lengths of the marked fish with similar measurements for those taken in the ordinary course by the fishermen shows that the yield in the northern and central parts of the fjord — the deeper portions — is predominantly composed of fish between 30—50 cm long, at any rate during that portion of the year for which we have been able to procure information, viz. April—September. In the more open waters immediately south of the fjord (*vide* Experim. C_1 and C_2) a distinctly different order of composition with regard to size is apparent, the large cod here making up a greater

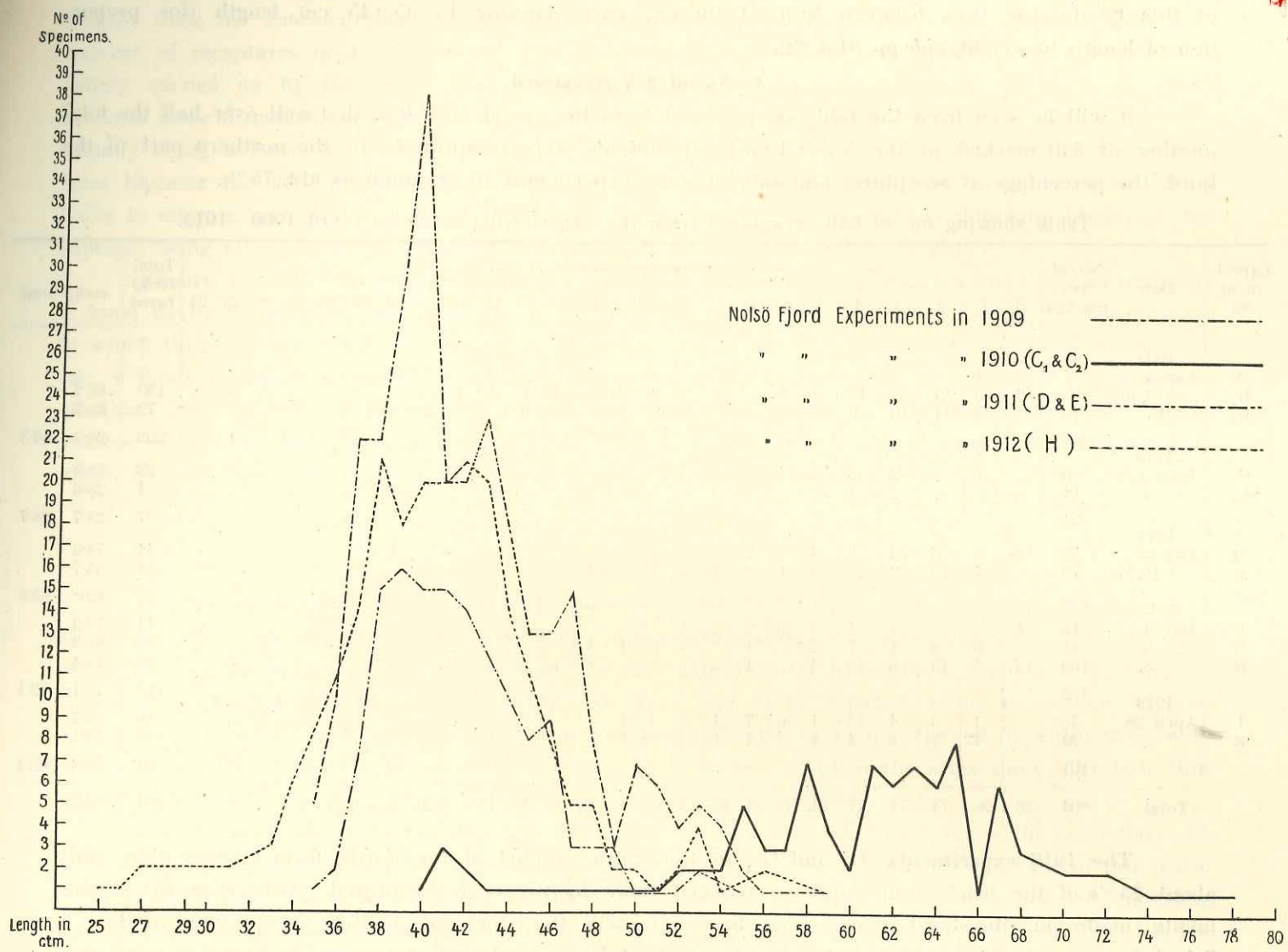

Fig. 3. Marking Experiments with cod at the Færoes. Size of the fish marked in Nolsø Fjord 1909—12.

proportion of the catch, though. The depth here does not differ from those of the other experiments.

It should, however, be borne in mind that all the measurements here given were, as already mentioned, made during the summer months. The experiments, which were commenced at the end of April 1913, show that the number of large fish found in the fjord at this early season of the year is greater than that noted later on in the summer. We are as yet still without sufficient data to furnish any adequate explanation of this fact, or even to trace the course of the change in average length of the younger fish throughout the summer; both the measurements and the curves (Fig. 3) however, clearly indicate the existence, during summer, of the well-defined size-group above mentioned. Determin-

ations of age based upon measurements of the scales and otoliths[1], show that this Nolsø Fjord Group is predominantly (almost exclusively) composed of 2—2½ year-old fish (Group II), which thus form the stock affected by our experiments.

The records of weight, which have since 1911 been made at time of marking, show that the weights for the 35—50 cm group in all our experiments lie between 500 and 1400 gr., a weight of 1000 gr. being reached at 45—46 cm length. The great majority of the fish marked in this fjord were thus between 500—1000 gr., corresponding to 35—45 cm length (for proportion of length to weight, *vide* pp. 81 & 82).

3. No. of fish recaptured.

It will be seen from the table on p. 7 and from the one given below, that well over half the total number of fish marked in the Nolsø Fjord experiments were recaptured. In the northern part of the fjord, the percentage of recaptures amounts in some experiments to as much as abt. 75 %.

Table showing no. of fish recaptured from the experiments in Nolsø Fjord 1909—1913.

Experiment No.	Date	No. of fish marked	No. of months between liberation and recapture																							Total recaptured	% recaptured	
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24			
	1909																													
A	Aug. 3	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	
B_1	— 8,10	195	7	19	17	32	18	1	9	..	10	2	2	2	3	4	1	1	1	..	..	..	..	..	..	1	..	130	66·7	
B_2	— 15	110	..	23	11	16	6	3	3	1	..	..	2	1	..	2	2	..	..	2	..	..	..	..	..	..	..	72	65·5	
		306																										203	66·3	66·3
	1910																													
C_1	June 2,8	80	..	7	..	2	6	1	4	2	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	23	28·8	
C_2	— 8	14	..	..	..	..	1	..	..	2	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	4	28·6	
		94																										27	28·7	28·7
	1911																													
D	Aug. 12	59	1	6	6	13	5	4	4	2	..	..	2	..	..	..	..	..	..	..	1	..	..	..	..	..	..	44	74·6	
E	— 16,17	79	.	7	18	2	1	3	1	2	1	6	2	..	1	..	..	..	..	..	..	..	..	..	..	..	..	44	55·7	
		138																										88	63·8	63·8
	1912																													
F	July 4	15	1	..	..	1	1	1	3	2	..	1	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	11	73·3	
G	— 6	41	..	6	8	1	7	2	..	1	..	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	28	68·3	
H	— 8, 8	109	17	25	13	3	13	4	..	1	..	..	..	..	1	1	..	2	..	..	..	..	..	..	..	..	..	80	73·4	
		165																										119	72·1	72·1
	1913																													
I	April 28	70	..	1	3	4	15	1	6	7	4	2	1	1	..	..	..	..	..	..	1	..	..	..	..	..	..	46	65·7	
K		31	..	1	1	3	4	1	2	1	1	2	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	18	58·1	
		101																										64	63·4	63·4
	Total...	804	26	96	77	77	77	21	32	21	16	13	10	6	7	7	3	4	2	2	2	..	1	..	..	1	..	501	62·3	

The 1910 experiments (C_1 and C_2, in the southern part of the fjord), form an exception, only about 25 % of the fish[2] — all large — marked there having been recaptured. Otherwise, the experiments made in the fjord itself show how intensely the stock of Codling (two-year-olds) is fished here, up to 75 % of the total number being taken. It should, moreover, be borne in mind that the percentages found are doubtless to be regarded as minimal values, as allowance must be made for an indefinite number of marked fish not reported, the mark having either been disregarded, lost before recapture, or overlooked by the fishermen, finally, the number may occasionally become illegible, rendering it impossible to include the fish in its proper place among the different experiments.

The rapid developement which has taken place of late years in the motor boat fishery from Thorshavn — and other places on the islands[3] — will in all probability have effected a considerable

[1] Cf. Rapports et Procès-Verbaux, vol. X & XX. Meddel. fra Komm. f. Havunders. Serie Fiskeri, vol. IV, Nr. 8.

[2] If all our experiments here are taken together the following likewise serves to express how far less intensively the larger cod are fished for. Of the size groups: 30—49, 50—69 & 70—110 cm, are recaptured resp. 67.6, 43.7 & 25.0 %.

[3] According to statements in the Danish "Fiskeri Beretning", the number of motor boats belonging to the islands was in 1911, 120, in 1912, 146, in 1913, 175, in 1914, 186; showing a constant and rapid increase.

alteration in the intensity of the fishing as regards the larger sizes, so that the low percentage (abt. 25 %) noted for C_1 and C_2 cannot be taken as generally applicable; as to this, however, subsequent experiments must decide.

Further as regards the length of time elapsing between liberation and recapture, we find that up to 75 % of the total number of recaptures are made within 4 months of liberation, after which time the percentage rapidly decreases. Only some very few have been retaken after a lapse of more than 14 months from the commencement of the experiments, and none after more than 23 months. The great number of recaptures made during the first 4—6 months of the period, is naturally due to the intense fishery carried on by the small boats from Thorshavn and adjacent localities. Later on, the stock becomes more dispersed, some of the fish migrating out of the fjord, while the number is of course continually being reduced by natural causes, so that the chances of recapture are thus greatly diminished. Here likewise the 1910 experiments form an exception, the fish then dealt with being larger and more liable to migrate, and thus less intensively fished during the period immediately following liberation, the captures being more evenly distributed throughout the whole of the following year.

Finally, it should be mentioned that the number of months elapsing between marking and recapture is here, as throughout the whole of the work, reckoned as follows: Recapture during the same month in which the experiment was commenced is taken as = 0, in the month immediately following as = 1, etc., without regard to whether the marking took place at the beginning or at the end of the month in question. Most of the markings were carried out about the middle of the month, thus reducing the number of "fishing days", and consequently the chances of recapture, in the 0 month of the experiment, which fact will serve to explain the low percentage of recaptures during this period (*vide* Fig. 24).

4. Growth.

Increase in length, and in weight.

For the purposes of studying growth, only such fish as had been measured in centimetres both on marking and on recapture have been taken into consideration. We have thus been obliged to disregard the greater portion of the records from the 1909 experiments. In addition, a considerable number of the recaptures among subsequently marked fish have had to be rejected, either on account of their having been measured in "Tommer" or because the lengths stated, though reckoned in centimetres, were evidently incorrect, when compared with the records as to weight noted at the same time. We have thus included only such measurements as appeared to be thoroughly accurate.

It was found that the great majority of the cod marked in Nolsø Fjord during the years 1909—13, April—September, consisted of fish between 35—50 cm in length, and further, that the age of this Nolsø Fjord group may be taken as 2½ years (at about midsummer). We may therefore be justified in dealing with this group separately. Similarly, in dealing with the experiments made at other parts of the islands, distinction has throughout been made between the growth of the younger fish, and that of the older individuals, these latter being also, in most cases, of far less frequent occurrence.

Finally, as regards the tables and graphs illustrative of growth, these are based exclusively on such recaptures as have been made later than the month of marking. Each of the first 4—5 months subsequent to commencement of the experiments is divided into three periods, 1—10, 11—20, and 21—30 (31), and it has in several cases proved possible to discern a gradually increasing increment of growth from one period to another within one and the same month. Later on, the recaptures become too few, and the deviations from the normal too great to permit of such calculations.

The 1909 Experiments (mid August).

It will be best to treat the experiments of each year seperately.

Rate of growth of 2 & 2—3 year old cod, liberated in Nolsø Fjord mid August 1909.

Recaptured in	Period of growth (months)	Increment in cm.			No. of specimens measured and their initial length in cm.		
		Average	Minimum	Maximum	35—42	43—50	51, 53
1910 February	6	5	..	..	..	1	..
— March	7	10	..	..	1	..	..
— April	8	6·3	5	7	3	..	..
— —	8	4·5	3	6	..	..	2
— June	10	9·5	7	12	2	..	..
— July	11	13·5	13	14	2	..	..
— August	12	17	..	..	1	..	..
— —	12	10	..	..	..	1	..
— September	13	11·3	9	14	4	..	..
— —	13	6	2	10	..	2	..
— October	14	25	..	..	1	..	..
— —	14	8	..	..	..	1	..
— November	15	13	..	..	..	1	..
1911 January	17	13·5	12	15	..	2	..

The available measurements of recaptured fish — unfortunately but few in number[1] — reveal an average increase in length of abt. 13.5 cm per whole growth period (of twelve months). As will be seen from table above, cod of under 42 cm initial size exhibit a little greater increment of growth than the somewhat larger fish (43—50 cm); no such difference is, however, apparent in the subsequent far greater experiments (*vide* tables) so that the fact may be regarded as unimportant. The maximal increment of growth is 25 cm in 14 months, in a specimen of 39 cm initial size. The extremely low increase of 2 cm in 13 months, in a 43 cm fish, must be presumed to be altogether abnormal. These experiments are, it should be noted, not suited for purposes of detailed study.

Taking the quickest-growing fish separately, we find for these a total increment during the period of 10—13 months corresponding to 1.1—1.4 cm average growth per month.

Recaptures of larger fish, i. e. having an initial size of over 50 cm, are only recorded twice, the initial sizes of 52 and 58 cm respectively showing, after a lapse of 7 months, an increase of 6 and 3 cm respectively, making an average monthly increment of less than 1 cm.

The 1910 Experiments (2—8 June).

Table showing growth in cm. of liberated cod. Experim. in Nolsø Fjord June 1910.

Initial Size in cm.	Recaptured in 1910—1911						
	September	October	November	December	January	February	June
40—49	..	..	..	11·6	..	..	..
50—59	..	4	..	..	8	..	..
60—69	..	3, 6, 6, 8, 9	6	6·6, 9	8·5	..	2·1
70—80	3·7	..	..	..	..	..	..

In this as in the following similar tables each figure means increment (in cm or in gr) per fish.

The few data here given are of interest solely as furnishing some information regarding growth during the period June—January (six months) in the case of cod older than the Nolsø Group. Without going into details, it will here suffice to state that the highly variable increment of growth for 60—70 cm cod during the summer half of the year amounts to about 7—8 cm average (see Fig. 19, p. 65). This gives an average monthly increment of a little over 1 cm; in the case of the best 1.3 cm, and far less for others; a single specimen of 65 cm initial size was found to have grown only 2.1 cm in a whole growth period.

[1] It ought to be mentioned that in several cases the growth of the cm-measured specimens is in excellent agreement with the "Tomme"-measured.

The 1911 Experiments (mid August).

Table showing growth in cm. in cod for the period between liberation and recapture. Experiments in Nolsø Fjord August 1911.

Initial Size	Recaptured in: 1911												1912															1913		
	September			October			November			December			January			February			March	April	May	June	July	August	Septbr.	October	Novbr.	Decbr.	January	February	March
cm.	1–10	11–20	21–30	1–10	11–20	21–31	1–10	11–20	21–30	1–10	11–20	21–31	1–10	11–20	21–31	1–10	11–20	21–29												
55	..	..	..	..	..	..	..	..	4	..	..	..	..		..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
53	..	..	..	..	0, 3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
52	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
51	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
49	..	..	..	..	2	..	..	1	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..
48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
47	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
46	1, 2	..	2	4	2	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..
45	..	..	1	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
44	..	..	..	..	1,1,2,2	..	6	..	4	..	..	..	4	..	..	..	..	..	10[1]	..	..	15	..	..	..	..	..	..	..	..	..
43	..	..	..	..	..	4	..	3	4	..	5	..	..	..	..	6	..	..	13	..	13	..	..	10	..	..	..	..	..	..	..
42	..	1	..	..	2, 1, 4	..	..	2	6	..	..	..	..	..	..	..	..	..	10	7[2]	..	9	..	..	..	..	..	..	..	..	..
41	0	..	3	1	..	..	..	..	..	..	1, 5	..	..	..	5	8	..	..	..	..	10[2], 8	6[2]	..	..	..	..	..	..	..	20	..
40	..	2	..	1,3,3,2	..	..	..	..	3, 6	..	..	9	4	..	..	..	6	..	..	..	..	17	..	..	..	..	..	..	..	..	..
39	1	..	1	..	2, 3, 0	..	..	4	..	..	3	..	4	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
38	2	..	..	2	..	..	..	..	3	..	..	..	..	..	8	..	..	..	..	..	14[2], 4[2]	..	..	..	..	..	..	..	..	..	..
37	..	..	..	..	3	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..
36	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

[1] Init. size: 43 cm.
[2] Age determinations from scales showed, that all these were abt. 2¼ years old at liberation.

The best material for the investigations as to growth of the younger cod is furnished by the experiments from this year and that following. It will be seen from the tables subjoined and the curves in Fig. 4 that the average increase in length for cod of less than 50 cm initial size during the period from middle of August to 1st January may be fixed at about 5 cm for the period as a whole. The average increments in the different months show, however, a distinct decrease from August (1.5 cm) to December (0.8 cm). From the latter date onwards, there is unfortunately a marked decline in the number of reliable measurements, which again impairs the accuracy of the given averages of

Rate of growth of 2-year-old cod, liberated in the Nolsø Fjord August 1911.

Recaptured in	Period of growth (months)	Increment in cm. Average	Minimum	Maximum	No. of specimens
1911 Septemb. 1-10	..	1·2	0	2	5
1911 Septemb. 11-20	..	1·5	1	2	2
1911 Septemb. 21-30	..	2·0	1	3	4
1-30...	1	1·5	0	3	11
— October 1-10	..	2·3	1	4	7
— October 11-20	..	1·9	0	4	14
— October 21-31	..	4	..	..	1
1-31...	2	2·1	0	4	22
— November	3	3·8	1	6	13
— December.....	4	4·6	1	9	5
1912 January	5	5·2	4	8	6
— February	6	7·3	6	9	4
— March	7	10·3	8	13	4
— April	8	7	..	..	1
— May	9	9·3	4	14	6
— June	10	11·8	6	17	4
1913 February	18	20·0	..	..	1

growth values. Such information as we possess, regarding specimens recaptured between 1st January and 1st April 1912, tends thus to show that these fish, given a similar increment of some 5 cm from August—January, have grown quite as much during the three months from January—April as during the previous 4½ months, or if anything, rather more. The monthly increment of growth during the period from mid-August to 1st January may thus be approximately reckoned as about 1.8 cm (maximum), and thereafter, until April, abt. 2.5 cm. Compared with the later recaptures, especially those from May and June, the growth values here again exhibit essentially lower averages (1.2—1.3). The extreme values are represented by two fish of 40 and 41 cm initial size, which in June 1912 exhibited a growth increment of 6 and 17 cm respectively. Both these fish were recaptured at about the same place.

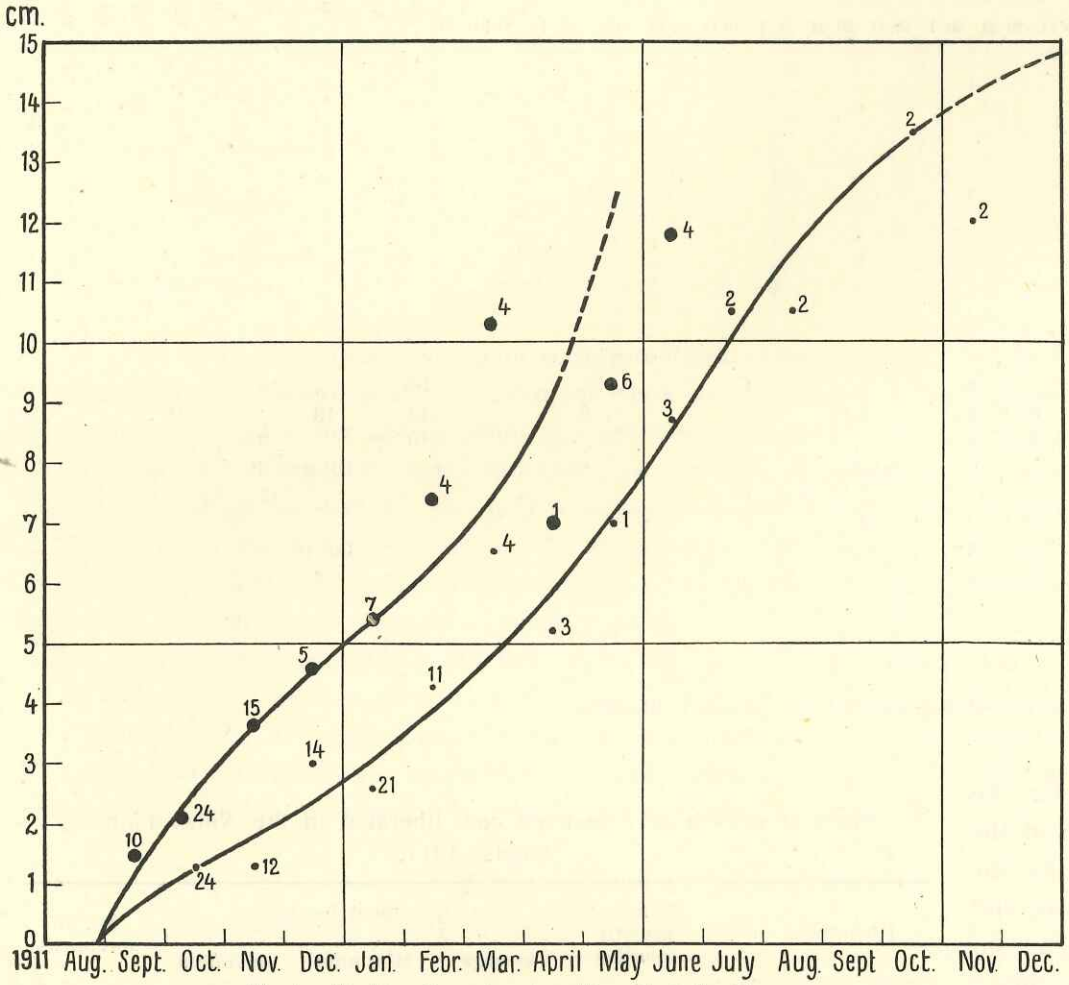

Fig. 4. Marking Experiments with cod at the Færoes.
Rate of growth of cod liberated in the Nolsø Fjord and in the waters E. of Nolsø (see p. 31) August 1911. The spots indicate averages of growth (large spots referring to the exp. in the Fjord), the figures no. of specimens measured.

One fish of 41 cm initial size had, when recaptured 30 months later, grown 20 cm. No further recaptures have since been made.

Taking only the best grown of the specimens recaptured over 6 months subsequent to marking, the average monthly increment for these works out at about 1.6—1.8 cm.

The probable rate of growth within 9 months of liberation, as far as it can be estimated from these observations, is given in a smoothed curve (Fig. 4); this figure however also indicates rate of growth as found in the experiments east of Nolsø in the same year, which will be treated later on. Characteristic of this, as of all our curves of growth in the following, is its steady rise from month to month through the whole year. A decrease in the rate of growth during autumn and winter is however, occasionally noticeable, the slope of the curve being then somewhat less steep. This will be clearly seen from Fig. 4.

The 1911 experiments were, as already mentioned, the first in which the marked fish were weighed both on marking and on recapture. A comparison of these weights, duly corrected for shrinkage after recapture, shows, as might be expected from the measurements of length, but slight increase

during the autumn months, the average increment up to November for specimens of less than 1 kg initial weight being only about 200 gr. Later recaptures show a far greater increase, up to twice the initial weight (January—March); the figures reveal, however, a wide range of variability. The only fish recaptured after the lapse of more than 12 months had then attained more than thrice its initial weight (800 to abt. 2800 gr.).

Table showing weight increment in gr. for all fish recaptured during the period between liberation and recapture. Experim. in Nolsø Fjord August 1911.

Initial weight gr.	Recaptured in 1911—1912																								
	Septbr.			Octbr.			Nov.			Dec.			Jan.	Febr.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Febr.
500—660 (I)	0	..	100	35	0	..	..	175	75	..	85	600	340	385	..	..	250	..	..	..	..	..	..	..	..	..
	0	..	.	60	25	..	..	..	110	..	..	..	375	..	..	..	825	..	..	..	..	..	..	..	..	..
	50	..	..	100	25	..	..	..	..	..	..	..	400	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	200	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
660—1000 (II)	25	0	0	50	0	125	150	140	100	..	25	..	215	525	550	300	575	300	..	>2400	..	..	..	..	..	2000
	..	25	0	100	0	..	200	75	200	..	180	..	225	..	675	..	700	675	..	..	..	..	..	..	..	..
	..	..	..	125	25	..	..	..	200	..	225	..	425	..	650	..	975	..	..	..	..	..	..	..	..	..
	..	..	..	275	100	..	..	..	225	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	120	..	..	..	355	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	150	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	150	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	150	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	175	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Average weight incrm. of (I and II)	11			95			167			223			330	455	625	..	665	..	..	..	..	..	..	..	..	..
Init. weight 1000—2000 gr.	0	..	..	..	75	..	..	150	150	..	..	..	550	655	450	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	175	..	..	..	200	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	..	..	..	275	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

The few larger fish (5 in all) of 50—55 cm initial size which were recaptured throughout the period October—January (1912) exhibit similar growth values to those of the smaller specimens (November abt. 3.5; January 7); the number recaptured is, however, too small to be of any particular interest.

The 1912 Experiments (July).

The results of this year's experiments are even more valuable than those from the previous year as regards the information furnished concerning the rate of growth during the transition period from summer to autumn of the Nolsø Fjord Group. They were carried out over a month earlier in the year than the 1911 experiments, and the large number of recaptures made during the first four months show (*vide* table on pag. 16 below, and Fig. 5) an average increment of growth for July—August—September distinctly superior to that from September to 1st January, (2.2 or 2.3 cm per month in the former as against 1.3 to 1.8 cm per month in the latter case). The average monthly increment in the case of the best grown specimens recaptured between 6 and 13 months after liberation is here greater than in 1911, viz; 1.9—2.3 cm as against 1.6—1.8 cm (p. 14).

The number of recaptures made after January 1913 is rather small to give any reliable average figures. One fish of 37 cm initial size had, after the expiration of one complete period of growth (12 months) increased its length by 18 cm. One of 36 cm had grown only 12 cm, while one of 45 cm had in the course of 20 months grown 30 cm. For further details *vide* tables on p. 16. Here also, with a single exception, the average monthly increment for the first year after marking is found to be between

Table showing length increment in cm. of all fish recaptured, for the period between liberation and recapture.
Experim. in Nolsø Fjord. July 1912.

Initial Size cm.	Recaptured in: 1912 August 1–10	11–20	21–31	September 1–10	11–20	21–30	October 1–10	11–20	21–31	November 1–10	11–20	21–30	December 1–10	11–20	21–31	1913 January 1–10	11–20	21–31	February	March	April	May	June	July	August	Septbr.	October	Novbr.	Decbr.	1914 January	February	March	April
94	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
72	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
63	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
61	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
59	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
58	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
57	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
55	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
53	2	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
52	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
51	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
49	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
48	0,1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
47	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
46	3	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
45	..	..	..	..	..	5	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30·5	..
44	..	2	..	..	..	4	..	..	..	2[1]	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..
43	..	..	2	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..	..	..	..
42	2	..	2, 4, 2, 4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..
41	1, 2	2	..	..	4	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
40	1	3	..	..	..	5	..	6	6	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..
39	2, 3	..	3	..	3, 5, 2	..	..	..	..	6, 6	9	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..
38	1	..	4	..	..	7	..	..	..	10	..	..	9, 8	7	..	..	..	13	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..
37	1	3	..	..	7, 4	7	..	..	..	6	9	..	..	..	10	12	..	..	11	..	..	..	..	17·5	..	..	..	..	..	..	..	..	..
36	4	3	..	..	..	4	..	..	..	8, 8	6	..	9	11	..	14	..	..	..	..	..	..	..	12[2]	..	..	..	..	..	..	..	..	..
35	2	..	..	..	5, 5, 5	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..
34	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
33	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
32	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

[1] III years old, if. omitted from the calculations below, the aver. inc. f. Nov. will be found to reach 7.7 cm. [2] II years old at liber ; age determ. by means of scales.

Rate of growth of cod of 2-year-old cod liberated in Nolsø Fjord July 1912.

Recaptured in	Period of growth (months)	Increment in cm. Average	Minimum	Maximum	No. of Specimens
1912 August 1—10	..	2	0	4	15
1912 August 11—20	..	2·4	1	3	7
1912 August 21—31	..	3	2	4	7
— September	1	2·3	0	4	29
— October	2	4·5	1	7	17
— November	3	5·8	5	6	4
— December	4	7·3	2	10	13
1913 January	5	9·1	7	11	7
— February	6	13	12	14	3
— April	7	9	7	11	2
— May	9	19	..	..	1
— July	10	14	..	..	1
— August	12	14·8	12	17·5	2
— October	13	23	..	..	1
1914 March	15	22	19	25	2
	20	30·5	..	..	1

about 1—1.7 cm. Fig. 5 gives the rate of growth for the first year after liberation in the waters west and east of Nolsø — only the first part is to be treated here. Compared with Fig. 4 it shows, despote the general resemblance, in its steeper course, a slightly better growth in 1912 than in 1911 during especially Autumn. We shall in the following repeatedly find this observation confirmed.

A comparison of the in-

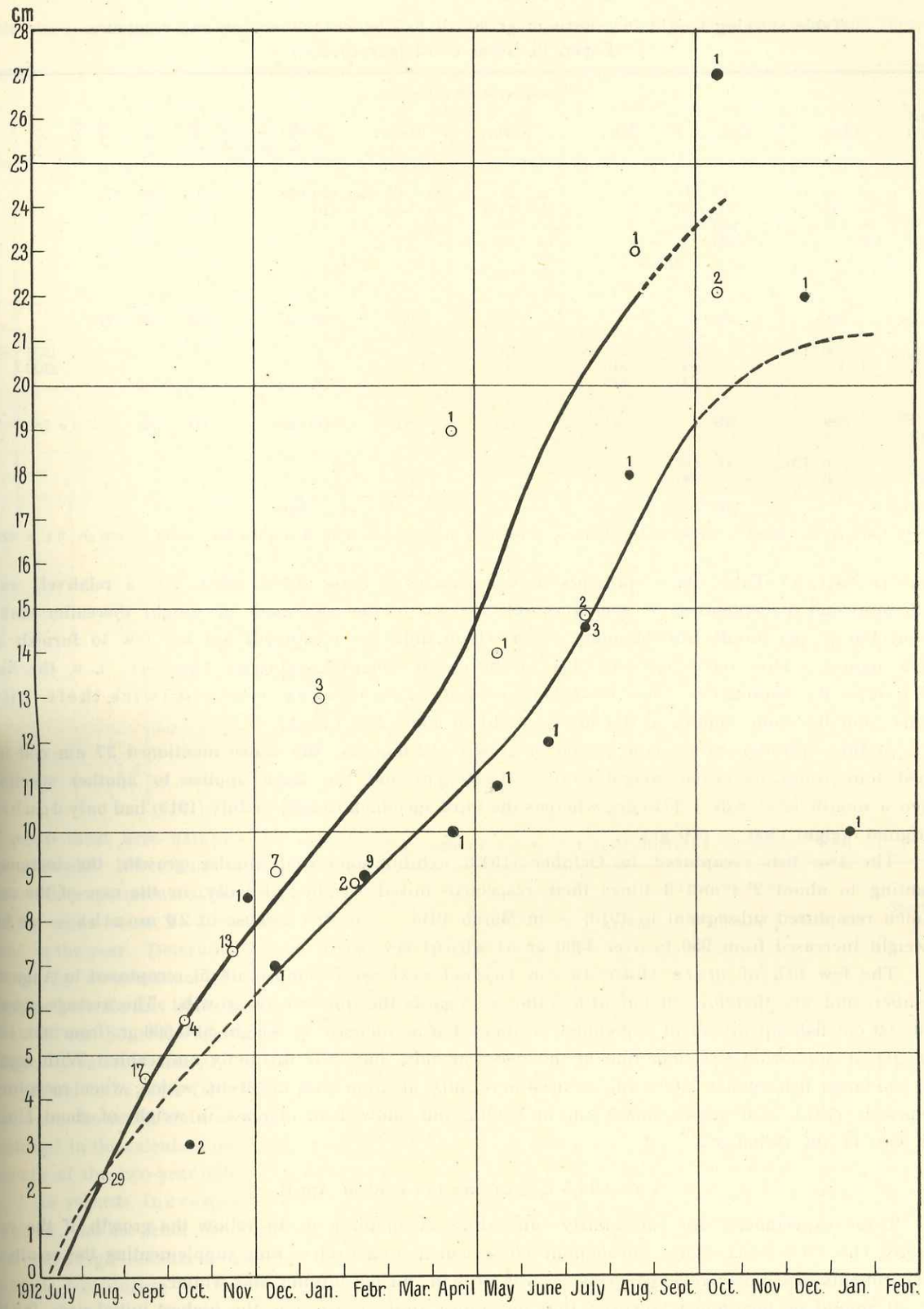

Fig. 5. Rate of growth of cod liberated in the Nolsø Fjord (the thicker line) and in the waters E. of Nolsø (see p. 35). The spots indicate averages of growth (○ the experiment in the Fjord), the figures number of specimens measured.

Table showing weight increment in gr. of all fish between liberation and recapture.
Exper. in Nolsø Fjord July 1912.

Initial weight gr.	Recaptured in 1912—1913: Aug.	Septbr.	Octbr.	Novbr.	Decbr.	Jan.	Febr.	March	April	May	June	July	Aug.	Septb.	Octbr.	March
375—650 (I)	0 .. .. / 10 50 110 / 80 75 .. / 90 110 .. / 100 .. .. / .. .. .. /	.. .. .. / .. 115 275 / .. 200 315 / .. 260 350 / .. 290 .. / .. .. .. /	.. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. /	.. .. .. / 325 250 .. / 350 300 .. / 375 470 .. / 400 520 .. / 500 .. .. / 550 .. .. / 625	.. .. .. / 350 365 650 / 370 680 .. / 450 .. .. / .. .. .. / .. .. .. / .. .. .. /	.. .. .. / 610 650 .. / 710 .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. /	.. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. /	.. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. /	.. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. /	.. .. .. / 600 .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. /	.. .. .. / 550 975 .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. /	.. .. .. / 1715 .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. /	.. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. /	.. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. .. / .. .. ..
Average	66·7	258	..	424	478	660	650	..	..	..	600	763	1715	..	..	..
660—1000 (II)	25 50 125 / 75 125 .. /	.. .. 255 / .. .. 400 / 230	.. 275 375 / .. 340 .. / .. 375 ..	175[1] 470 .. / .. .. .. /	.. .. .. / .. .. .. /	.. .. .. / .. .. .. /	.. .. .. / .. .. .. /	.. .. .. / .. .. .. /	.. .. .. / .. .. .. /	.. .. .. / .. .. .. /	.. .. .. / .. .. .. /	.. .. .. / .. .. .. /	.. .. .. / .. .. .. /	.. .. .. / .. .. .. /	.. .. 1535 / .. .. 2100 /	>3200 / .. / ..
Average (I+II)	72·9	269	341	428	478	660	650	..	..	..	600	763	1715	..	c. 1820	>3200
1000—2000	0 0 120 / 125 150 ..	.. 300 175 / 390	.. .. .. /	.. .. .. /	.. 575 .. /	.. .. .. /	.. .. .. /	.. .. .. /	.. .. .. /	.. .. .. /	.. .. .. /	.. .. .. /	.. .. .. /	.. .. .. /	.. .. .. /	.. .. .. / .. .. ..
2000-8600	..	250[2]	210[3]	..	..	..	1500	..	..	..	..	..	..	..	..	..

[1]) ? III years old, and therefore omitted from the figures, representing the increment of the II year old fish. [2]) init. w. 2025 gr. [3]) i. w. 3500 gr.

crease in weight (Table above) presents similar features to those above noted, viz; a relatively rapid growth until end of September, — averaging abt. 270 gr, — the increment of weight thereafter sinking to about 100 gr. per month until January, after which time the recaptures are too few to furnish any reliable figures. This refers only to fish of an initial weight less than 1000 gr; i. e. the Nolsø Fjord group. By November, the best grown fish have already attained twice their initial weight, and the same applies to the three caught in Jan.—Feb. (1913).

At the expiration of a whole period of growth (12 months) the above mentioned 37 cm cod had reached four times its initial weight (550 + 1550 gr) and the same applies to another specimen retaken a month later (625 + 1715 gr), whereas the third specimen caught in July (1913) had only doubled its original weight (560 + 600 gr).

The two fish recaptured in October (1913) exhibit somewhat similar growth, the increment amounting to about $2^1/_2$ and 3 times their respective initial weights. Finally, in the case of the only specimen recaptured subsequent to 1913, — in March 1914, — or after a lapse of 20 months — we find the weight increased from 950 to over 4300 gr or about fivefold.

The few fish of more than 50 cm initial size were almost all (5) recaptured in August—September, and are therefore of but little value as regards the question of growth. The average growth for 50—60 cm fish up to end of September is about 4 cm, increase in weight abt. 500 gr (from abt. 1500—2000 gr) or somewhat less than that of the two-year-olds, but still distinctly noticeable. With regard to the two larger fish retaken later still, we need here only mention that of 92 cm, which, when recaptured in February (1913) had grown but 2 cm in length, but showed an increase in weight of about $1^1/_2$ kg (from 8500 to abt. 10,100 gr).

The 1913 Experiments (end of April).

These experiments are particularly interesting as enabling us to follow the growth of the cod, especially the two-year-olds, throughout the summer months, thus supplementing the results of the experiments previously referred to as regards growth during autumn and winter.

It should be mentioned however, that the upper limit of size, i. e. the highest initial sizes, for the

Table showing length increment in cm of all fish recaptured, for the period between liberation and recapture. Experiments in Nolsø Fjord April 1913.

Initial Size cm.	Recaptured in 1913—1914																														
	May			June			July			August			September			October			November			December			January	February	March	April	May	June	July	October
	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-30	1-10	11-20	21-30	1-10	11-20	21-31								
61	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	..	..	..	..	..	..	..	..	..	..	6 ♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
59	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·6.5	..	..	..	..	..
58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9 ♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..
57	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
55	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3 ♂	..	..	..	..	..	10 ♀	..	..	..	..	..	..	..	..	..	..	..
54	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8 ♀	..	..	..	..	..	..	..	..	..	..	..	..
53	..	..	..	..	..	·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
52	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
51	..	..	0 ♀	..	..	..	..	..	..	7 ♀	..	..	..	..	..	..	..	..	..	..	..	..	..	7 ♂	..	..	..	..	..	..	..	..
50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
49	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
47	..	..	..	..	..	..	..	..	..	..	..	5.2	..	..	..	5 ♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
46	..	..	..	..	..	..	1 ♀	..	..	..	5 ♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
45	..	..	..	..	..	..	..	..	..	..	..	8 ♂	..	..	..	..	..	..	12 ♀, 13 ♀	..	..	..	..	..	..	..	..	..	..	..	..	..
44	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
43	..	..	..	..	..	..	..	..	..	..	7 ♀	7 ♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
42	..	..	..	..	..	..	..	..	5 ♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..	·11	12 ♀	..	..	..	..	..	..	..
41	..	..	..	..	..	2 ♂	..	..	.	..	10 ♀	..	..	..	..	..	..	..	..	..	..	..	..	13 ♀	..	..	..	..	..	..	..	..
40	..	..	..	..	..	3 ♀	..	..	..	..	5 ♂	..	..	..	9 ♀	..	..	..	..	..	..	..	14 ♂	.	..	..	..	..	..	..	..	..
39	..	..	..	..	..	..	..	..	..	..	..	8 ♀	..	..	..	..	..	..	12 ♀	..	..	..	..	..	·13	11 ♀	..	..	..	..	..	..
38	..	..	3 ♀	..	..	..	5 ♂	..	7 ♂	7 ♀	7 ♂	6 ♀	..	..	..	..	10 ♀	..	10 ♀	..	..	..	..	..	..	..	20 ♂	..	..	..	..	..
37	..	..	..	..	..	..	..	..	4 ♂	..	7 ♀	8 ♂	..	..	..	..	10 ♀	..	..	12 ♂	..	..	..	..	16 ♀	..	..	..	..	..	..	..
36	..	..	..	..	..	..	..	..	..	..	8 ♀	..	..	..	..	..	13 ♀	..	..	..	..	..	13 ♂	..	..	..	..	..	..	..	..	..
35	..	..	..	..	..	..	3 ♂	..	..	..	7 ♀	7 ♂	..	..	..	..	..	10 ♀	7 ♂	..	..	..	..	..	..	..	..	..	..	20 ♀	..	..
34	..	..	..	..	..	..	..	..	5 ♂	..	7 ♀	..	..	..	..	..	10 ♂	..	..	..	..	..	..	..	8 ♂	..	..	..	..	..	..	32
33	..	..	..	..	..	1 ♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

II group must here naturally be set somewhat lower than in the case of the experiments of previous years, made some 2—4 months later in the year. Determinations of age by examination of scale samples indicate this limit as here about 42 cm. Some few specimens of greatly inferior size are, it is true, found to be older (III group) these are, however, naturally not included in the calculations as to growth of the two-year-olds.

As regards increment of length, we see from the Table above and Fig. 6 that this is distinctly at its best during the summer

Rate of growth of 2-year-old cod, liberated in Nolsø Fjord April 1913.

Recaptured in	Period of growth	Increment in cm.			No. of Specimens
		Average	Minimum	Maximum	
1913 May	1	3	..	..	1
— June	2	2·0	1	3	3
— July 1—10	..	4·0	3	5	2
— July 21—31	..	5·3	4	7	4
	3	4·8	3	7	6
— August	4	7·3	5	10	12
— September	5	9	..	..	1
— October	6	10·6	10	13	5
— November	7	10·3	7	12	4
— December	8	12·8	11	14	4
1914 January	9	12·3	8	16	4
— February	10	11·0	..	..	1
— March	11	20·0	..	..	1
— July	15	20	..	..	1
— October	18	32	..	..	1

months. For the four months from 1st May to 1st September, we have an average increment of length amounting to 7.3 cm, whereas the corresponding increment for the subsequent four months, 1st September—1st January, amounts to only abt. 5.5 cm. This fluctuation in the rate of growth during the first eight months of the experiments is rendered still more distinct if we calculate, from the average figures given above, the growth from month to month.

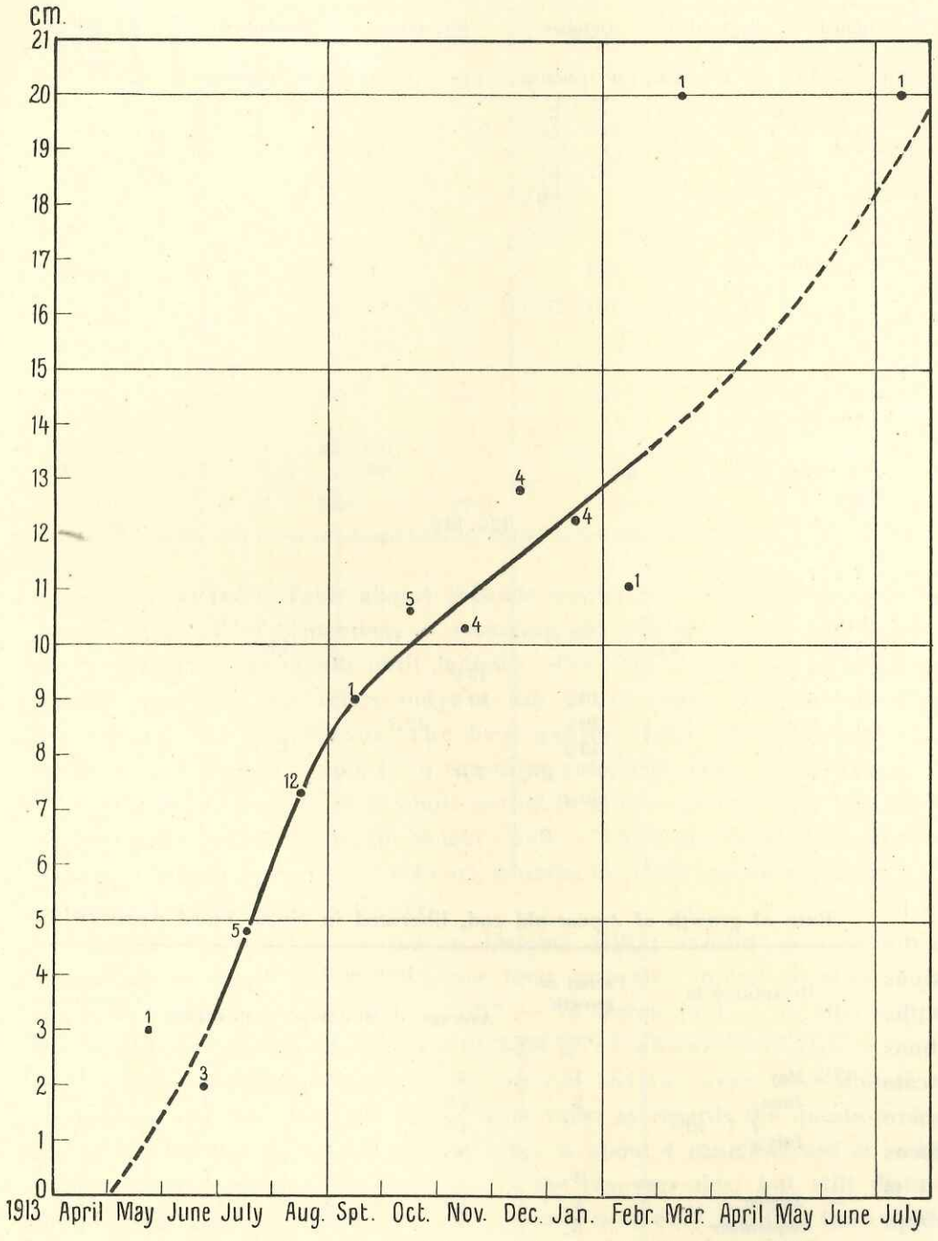

Fig. 6. Rate of growth of cod liberated in the Nolsø Fjord April 1913.
The spots indicate averages of growth: the figures number of specimens measured.

We thus find, for July—August, an increment of up to 2.5 cm per month, whereas in October and November, the corresponding value is only half of this figure, or even less, the increment for November, for instance, being only 0.7 cm.

On comparing Fig. 6 with the results of the 1911—12 experiments, we find a summer growth which is, if anything, greater than that of 1912. It will further be seen that in all the 3 years, but especially in 1913, a very distinct decrease of the rate of growth makes itself apparent as the autumn sets in.

True, it may be objected that the observations are in many cases too few to furnish any thoroughly accurate view of the growth; nevertheless, the resemblance between the results of the three years' experiments points very strongly to the conclusion that we have here to deal with a phenomenon of regular annual occurrence. An explanation of this retardation of the growth with the commencement of autumn may possibly be found in the marked fall of temperature which takes place at the same time. The following Fig. 7 showing the amplitude af the monthly average surface temperatures at Thorshavn, calculated from figures[1]) furnished by the Danish Meteorologisk Aarbog 1902—1912 compared with the average growth

[1]) The averages are for May 8·1, June 8·7, July 9·7, Aug. 10·1, Sept. 9·9, Oct. 8·8, Nov. 7·3, Dec. 6·6, January 5·7, Febr. 5·3° C.

(in cm.) from month to month of the II-year-old cod in the 1913 experiments. It distinctly shows that the warmest months of the year are those showing fastest growth (July and August). In September, the water begins to cool, (abt. 0°.5); not until after 1st October, however, does the abrupt fall in temperature as in growth occur, after which the temperature steadily decreases (by abt. 1°—1°.2 per month) until the end of January.

We have, however, of course to reckon with a certain fluctuation of the point of time at which rise and fall take place, as well as with a variability as regards the extent of same even less it is trues at than as at the surface at those depths where the two-year-old cod have their habitat.

According to measurements made both from the "Thor" and the "Margrethe" at various places on the coastal banks and in the fjords, the difference between the temperature at 0 and at 50 m depth is always less than 1° (and frequently less than ½°) C. so that the difference between summer and autumn temperature at any rate would appear to be hardly less marked at the mentioned depth — and even deeper — than at the surface. For the present, however, nothing further can be stated as to this.

We have nevertheless thought it as well to draw attention to the simultaneous occurrence of these two phenomena, the fall of temperature and the retardation of growth, as possibly a case of cause and effect.

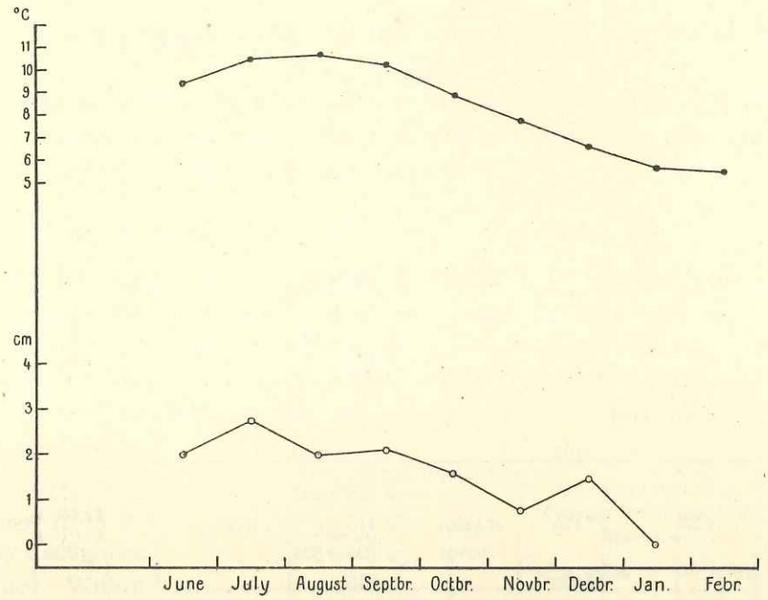

Fig. 7. Marking experiments with cod at the Færoes. Comparison between monthly average surface temperatures at Thorshavn and average growth from month to month of II-year old cod in the Nolsø Fjord. Experim. April 1913.

The separate records of growth throughout the whole of the following year exhibit also here a certain fluctuation, but the best grown fish show, as in previous experiments, an increment of over 20 cm amounting *in casu* to over half the initial size, (38 cm). After a lapse of 18 months (i. e. including two periods of summer growth) a fish of 34 cm initial size was found to have grown to 66 cm, the increment of weight here being 3 kg (350 gr + 2500 gr) i. e. a ninefold increase.

The few three-year-old fish do not call for any especial comment. The growth increment fluctuates as usual about an average of abt. 1 cm per month.

With regard to increment of weight (in two-year-old fish) it will suffice to state that the initial weight (½ to 1 kg) is doubled in the course of the summer, up to abt. 1st November, the weight also naturally exhibiting a great increase in July and August, (up to twice the initial size) the increment being distinctly less in October and November. No thoroughly accurate average figures can however, be given (*vide* p. 22).

If we now sum up the results of the earlier experiments, especially those of 1911 and 1912, and compare them with those of the experiments in the northern part of the fjord at the end of April 1913 above described, it will be seen that the experiments in all three years[1], more especially those of 1913,

[1] The 1909-experiments indicate in reality the same feature.

Table showing increment in gr. of all fish recaptured for the period between liberation and recapture. Experiments in Nolsø Fjord April 1913.

Initial weight gr.	Recaptured in 1913—1914																												
	May			June			July			August			September			October			November			December			January	February	March	July	October
	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31					
2100											♂ 400							♀ 910											
2000																											825		
1800																													
1700																													
1600																				♀ 570	♀ 1000								
			♀ 0												♂ 280														
1500										♀ 170																			
1400																													
1300																								♂ 870					
1200																													
1100							♀ 50																						
1000											♂ 320	♂ 520				♀ 490			{♀ 800, ♀ >800}										
900																													
												♀ 400																	
800									♀ 300		♀ 400, ♀ 550														♀ 860				
					♂ 50	{♂ 0, ♀ 175}									♀ 550														
700																							♂ 900	♀ 910					
							♂ 195				♂ 320	♀ 420							♀ 585										
600			♀ 135																										
									♂ 325	♀ 275	♂ 250	♂ 43													800	♀ 665			
											♀ 325	♀ 235							♀ 620	♂ 625							♂ 1450		
500					♂ 25		♂ 125		♂ 125		♀ 415						♀ 475								♀ 995			♀ 925	
																	{♀ 450, ♀ 675}	♀ 455											
											♀ 325	♂ 325					♂ 520												
400							♂ 225				♀ 275												♂ 625						
																									♂ 400				{♀ 2500 ab.}

reveal a growth continued through the whole year, with a marked decrease during the autumn months, from September to January. That this should be so markedly evident in 1911 as in 1913 is very likely due to peculiar conditions during these years. We find again this difference between the years 1911 & 1912 in the experiments at other parts of the Færoes. The average value found for monthly increase in length, viz, a little under 2 cm, should give an annual growth of abt. 20 cm for these two-year-olds, which are the only ones considered here. Most of the recaptures made more than a year after liberation however, indicate a lower figure for the total increase of growth, though, to be sure, in some few cases the reverse had been noted. We are still without sufficient data to determine where precisely the figure for mean annual growth should lie.

Table showing average length increments in cm from month to month for the Nolsø Fjord Experiments.

Year of Experiment	Average increment of length in:				
	August	Septbr.	Octbr.	Novbr.	Decbr.
1911	..	1·5	0·8	1·3	1·0
1912	2·4	2·1	1·3	1·8	1·4
1913	2·5	1·7	1·6	0·7	1·5

Briefly, the increase in weight may be stated as amounting to a doubling of the initial size during the course of the period July/August—January/February, while at the end of one completed period

Table showing length increment in cm. for cod of 35—50 cm. initial size recaptured over one year after liberation. Exper. in Nolsø Fjord 1909—13.

No. of months between liberation and recapture .	12	13	14	15	16	17	18	19	20
Experim. in 1913	..	..	..	20	..	..	32	..	..
— - 1912	12	23	..	25	..	..	..	..	30.5
— - —	17.5	..	..	19	..	..	..	..	..
— - 1911	10	..	..	..	..	..	20	..	..
— - 1909	9	..	8	13	..	12	..	..	..
— - -	9	..	25	..	..	15	..	..	..
— - -	10	..	..	..	..	..	..	..	..
— - -	13	..	..	..	..	..	..	..	..
— - -	14	..	..	..	..	..	..	..	..

of growth, the initial weight increased approximately fourfold. All this refers to the fish of less than 1 kg initial weight.

As regards the larger fish, the recaptures of these do not furnish any accurate information beyond the fact that their increase in weight appears to be somewhat inferior to that of the two-year-olds. In the subsequent experiments, we were somewhat more fortunate in this respect.

5. Migrations.

The experiments of 1909, and 1911 to 1913, both those noted in Fig. 8, 9, 10, and the others from the same years — i. e. all those dealing with the Nolsø Fjord group — agree both as regards the high percentage of recaptures (abt. 63—72 %) and as regards the extraordinarily stationary habits of the stock as far as the experiments have been able to follow them. The 1910 experiments, where the marked fish were of much larger size, for the most part 50–70 cm, differ from these both as regards the far lower percentage of recaptures (abt. 28 %), and the far greater mobility of the stock. The following table gives a good idea of these features.

Year	No. liberated	% recaptured	No. recaptured at a distance from place of liberation	
			< 6 miles	6—50 miles
1910	94	28·7	19	8
1909	306	66·3	198	5
1911	138	63·8	86	2
1912	165	72·1	117	2
1913	101	63·4	57	7

Further information is furnished by the figures. A few remarks may however, here be added. Within an area of very few (1—2) miles from the locality of the experiments lie about 70 % of all recaptures made, these fish having been retaken during the first four months. Not until after the expiration of that time are some few found to have moved any great distance farther up into the fjord or out of same, towards north or west. As late as 12, 15, 18 or even 23 months after marking, the great majority were found to have remained practically on the same spot.

An exception to this is formed, as mentioned, by the larger fish from the 1910 experiments. In the case of these, we find some fish still in the fjord after the lapse of six months, while others had, within a month of marking, moved out as far as the north-west of Vaagø, a distance of 50—60 miles, at least. Neither here nor in the other experiments is there any regularity apparent as regards the direction of these migrations or the size of the migrating fish. In many cases it is the smaller fish which are found to migrate, the larger remaining behind. Thus the fish from the 1910 experiments just referred to as having moved round to the western side of the islands after the lapse of only a month, were among the smallest included in the experiments (abt. 55 and 65 cm).

Most of the recaptures group themselves about 1) Kirkebønæs, 2) Glivursnæs, and 3) north end of Nolsø (Buen), close to and partly outside the 50 metre line.

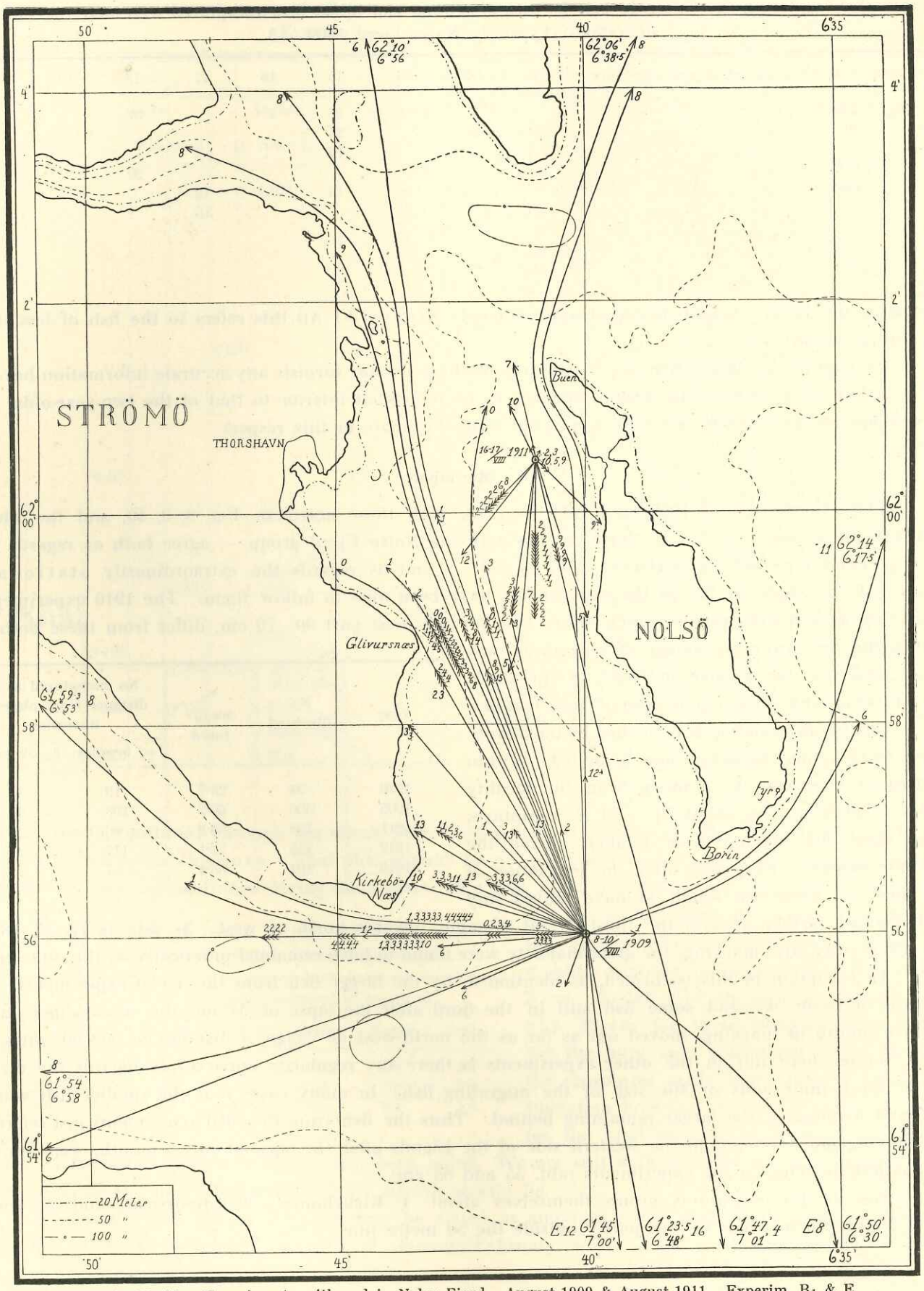

Fig. 8. Marking Experiments with cod in Nolsø Fjord. August 1909 & August 1911. Experim. B_1 & E.

Hen and in the following similar Figures, the ⊙ denoting places where liberated cod are set free, the arrows places of recapture, the connecting lines the supposed direction of migration, the figures No. of months since liberation. The recaptures are, when not otherwise stated, effected by Færoese fishermen. E = English. Sc = Scottish.

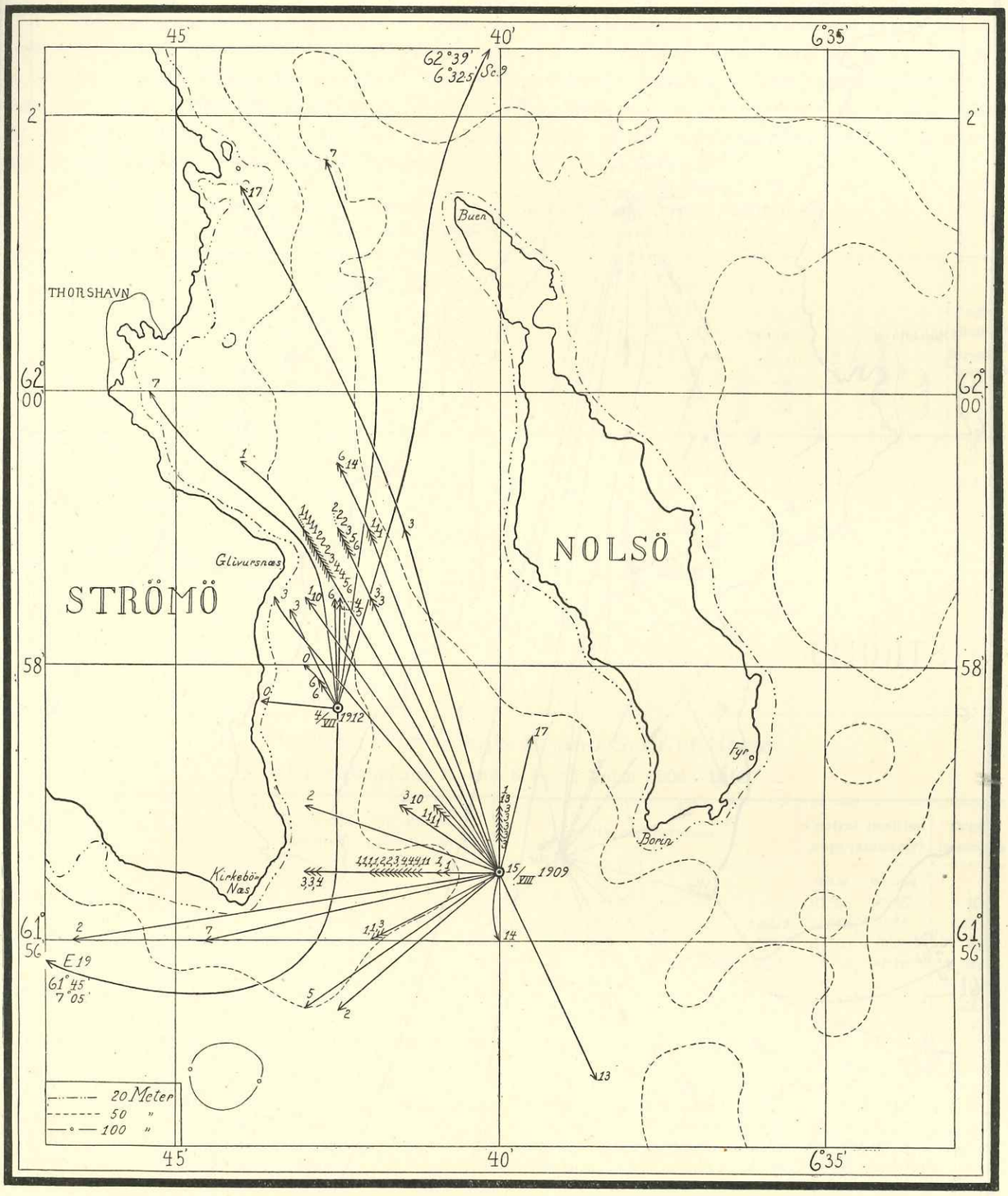

Fig. 9. Marking Experiments with cod in Nolsø Fjord. August 1909 & July 1912. Experim. B_2 & F.

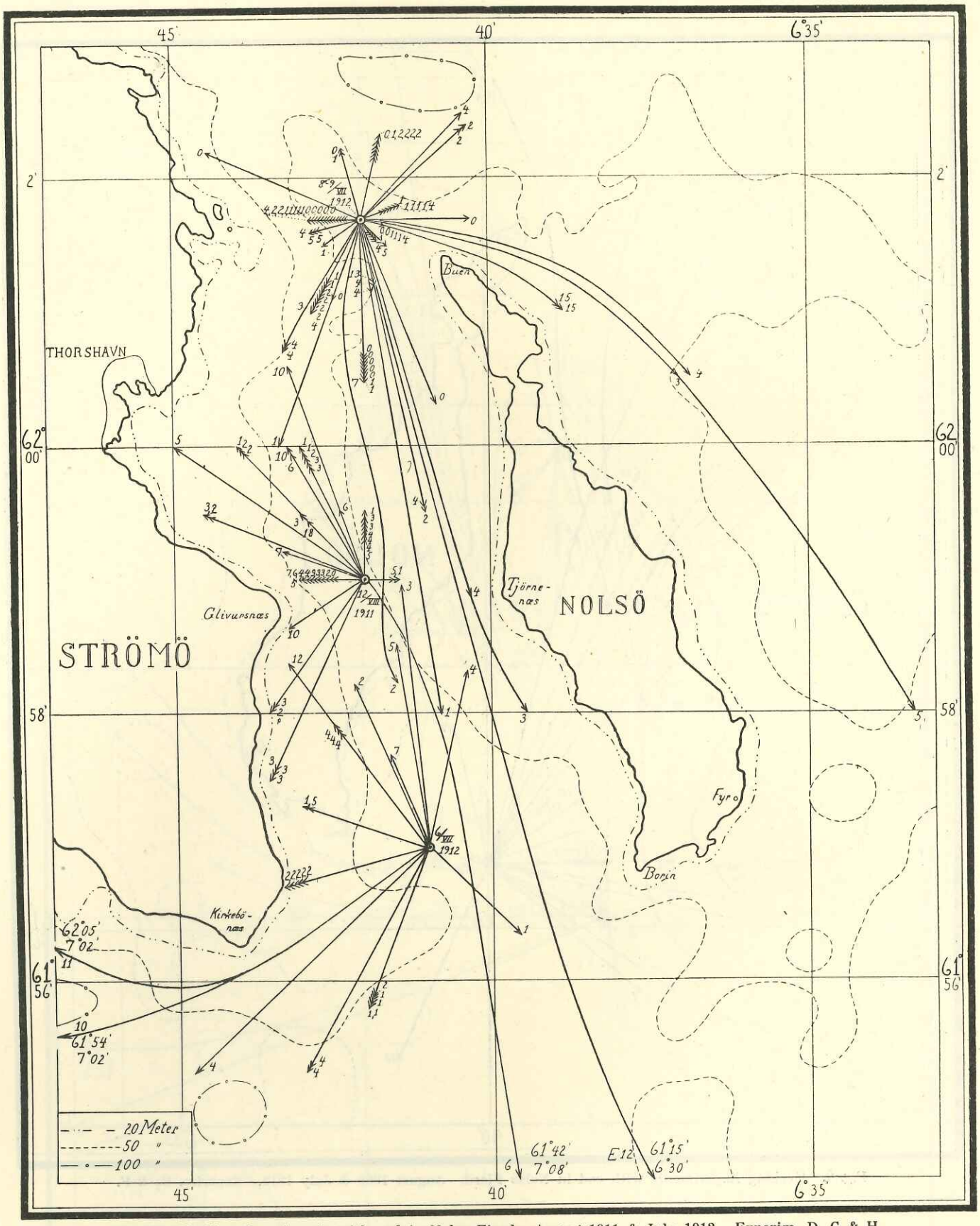

Fig. 10. Marking Experiments with cod in Nolsø Fjord. August 1911 & July 1912. Experim. D, G & H.

6. Nationality of the fishermen.

The following table, giving place of origin of the vessels concerned, shows in the first place, how slight a portion of the stock in the fjord falls to the catch of fishermen from distant parts, and also how far slighter a proportion of the recaptures were made by foreign fishermen. The highest figures in this respect are those of the 1910 experiments, with the larger and more migratory fish then marked outside the southern end of the fjord. In these experiments, 48 % of the recaptures were made by foreign — English and Scottish — fishermen, as against abt. 4 % in the other years.

Table showing No. of recaptures made by Færoe and foreign fishing vessels.
Marking experiments with cod. Nolsø Fjord 1909—1913.

	Færoe fishing boat, registered in																				English Steam Trawler	Scottish S.T.
	Nolsøfjord					Kalbak	Kollefjord	Skaalefjord					Nordre-Øerne			Sandø		Hestø	Myggenæs	Suderø		
	Nolsø	Thorshavn	Arge	Højvig	Hvidenæs			Næs	Tofte	Strænder	Saltnæs	Skaale	Nordtofte	Hattervig	Klaksvig	Skopen	Sand			Sumbø		
1909....	..	169	18	..	..	2	2	..	1	..	..	1	1	..	..	2	..	3	..	1	3	..
1910....	..	12	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	..	13	..
1911....	2	73	6	..	..	1	2	..	..	2	..	..	..	..	..	..	2	..	..	..	..	..
1912....	5	60	6	1	2	12	3	3	8	10	3	..	..	..	..	..	..	1+1*)	..	..	3	1
1913....	1	49	4	..	2	1	1	..	..	..	..	..	..	..	1	1	..	..	1	..	3	..
Total	8	363	34	1	4	16	8	3	9	12	3	1	1	1	1	3	2	6	1	1	22	1

*) Kvivig-boat.

	Færoes	English	Scottish
Total...	478	22	1

II. Marking experiments E. and S. E. of Nolsø.

Marking experiments E. and S. E. of Nolsø 1909—1912.

Experiments	Year and month	No. of cod liberated	No. of cod recaptured	Locality of liberation	Central position (approximately) N. Lat.	W. Long.	Depth in meters
Exp. A_1	1909 August 7	11	5	5·5 miles E. $^3/_4$ S. of Nolsø Light	61°58′	6°25′	49
— B_1	— — 12	93	62	1 — E. — - — —	61°58′	6°34′	50
— C_1	— — 16, 17	190	122	3 — S. E. by S. - — —	61°55′	6°33′	60
— D_1	1910 May 13	35	5	10 — S. E. by E. $^1/_2$ E. of Nolsø Light	61°56′	6°16′	c. 90
— E_1	— — 13	9	2	7 — E. S. E. - — —	61°57′	6°21′	c. 110
— F_1	— — 13	6	1	7 — E. by S. $^1/_4$ S. - — —	61°58′	6°21′	100
— G_1	— — 13	10	4	5.5 — E. $^1/_4$ S. - — —	61°59′	6°25′	50
— H_1	— June 6, 8	37	16	E.-coast of Nolsø, near shore, E. of Nolsø L.	61°57′.5	6°35′.8	20
— I_1	— — 6, 8	62	25	— — —	61°58′.5	6°36′.5	20—50
— K_1	— — 6	4	1	— — —	61°58′	6°34′	60—70
— L_1	1911 August 13	71	25	10 miles E. $^1/_2$ N. of Nolsø Light	62°02′	6°17′	40
— M_1	— — 14, 15	133	80	4 — E. by S. $^1/_2$ S of Nolsø Light	61°58′	6°27′	60
— N_1	— — 17	79	46	$2^1/_2$ — S. S. W. of Borin, S.-point of Nolsø	61°54′.5	6°37′	45
— O_1	— — 18	80	57	3·5 — S. E. — — —	61°55′.5	6°30′.5	60
— P_1	1912 July 1, 2	99	29	12 — S. E. $^3/_4$ E. of Nolsø Light	61°54′.5	6°12′	110
— Q_1	— — 2, 3	67	22	3 — S. E. $^1/_4$ E. —	61°56′.5	6°30′.5	65
	Total number...	986	502				

1. Locality and date of the experiments.

The experiments were, as will be seen from Fig. 2, distributed throughout a zone some 6 miles broad, extending from Nolsø out beyond the 100 metre line, a distance of 12 miles. The largest experiments were made during the years 1909 and 1911, most being grouped about the 50 metre line.

2. Size of the fish marked.

In the Nolsø Fjord, the stock consists for the most part of fish under 50 cm. (i. e. the II group) so that fish of 50—60 cm were very few in number, and those over 60 extremely rare among the large

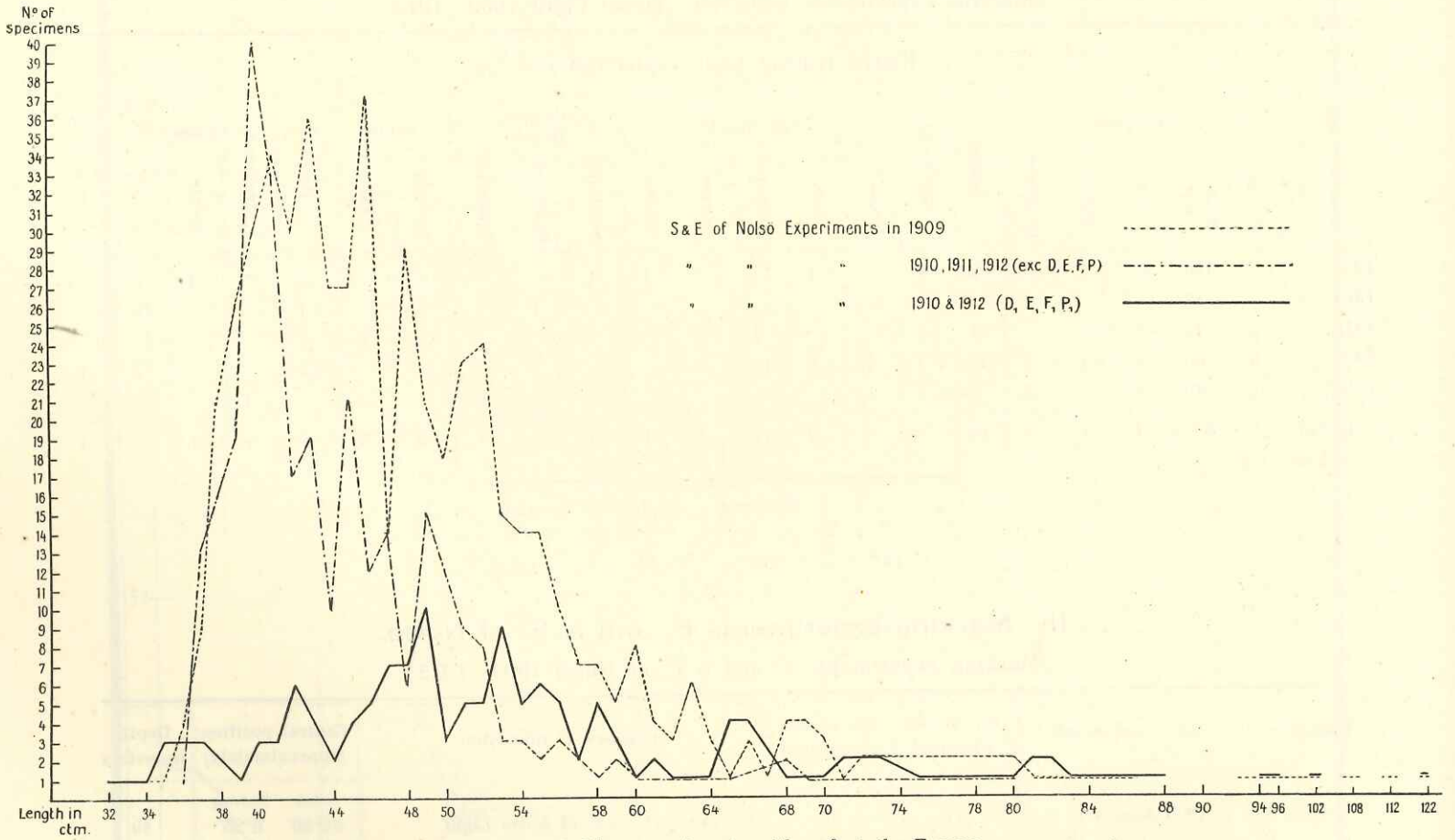

Fig. 11. Marking experiments with cod at the Færoes.
Size and number of the cod marked in the waters E. and S. of Nolsø 1909—12.

numbers marked in the fjord itself (spring & summer). It is somewhat otherwise, however, with the experiments made east and south-east of Nolsø. Fish of 35—50 cm (< 1.2 kg) are still in the majority as regards the experiments made inside the 100 metre line, the 50—60 cm group (1.2—2.1 kg) however, here forms a not inconsiderable portion of the whole, amounting, in some of the 1911 experiments, to about one half of all fish marked, in 1909 fewer, the last named markings being also (*vide* Fig. 11) made closer in to land. All these experiments, with others of the same year, and some of 1910 and 1912, included numerous fish of up to 100 cm or more. In the experiments outside or close to the 100 m line, D_1, E_1 and F_1 in 1910 and P_1 in 1912, large fish play an even more important part, up to one-third of the catch here being composed of fish over 60 cm long. The table below shows the distribution of the different sizes in the experiments of the various years.

Table showing number and size of cod liberated in the waters about Nolsø 1909—1913.

Experiment in	No. of marked fish of initial lengths					Total number
	—49 cm	50—59	60—69	70—79	80—110	
Nolsø Fjord 1909, 1911—1913	633	61	5	7	4	710
E. of Nolsø, 1909, exp. A_1, B_1 and C_1	237	44	6	2	5	294
— 1911, — N_1 and O_1	119	24	8	3	5	159
— 1911, — L_1 and M_1	122	61	13	6	2	204
— 1910 and 12, exp. D_1, E_1, F_1 and P_1	60	44	17	14	14	149
— 1909—1912; total liberated	643	227	60	26	30	986

3. No. of recaptures.

Out of a total of 986 fish marked, 502, or 50.9 % are known to have been recaptured, showing a somewhat slighter intensity of fishing than in the case of the Nolsø Fjord experiments (62.3 %). A glance at the numbers of recaptures from the different experiments clearly shows that here likewise over half of the younger fish here two and three-year olds — are annually taken by the fishery, the great majority of these being, as in the Nolsø Fjord, recaptured during the first six months. The stock of older fish, those over 60 cm, is not affected to such a great degree. As already noticed (see "the 1910 experiments") in the Nolsø Fjord, we find here that the experiments made in deeper water (D_1 E_1 F_1 and P_1) though small, agree well one with another in results. They all exhibit, for instance, a lower percentage of recaptures (16 %, 22 %) and the recaptures of the larger fish here marked are more evenly distributed throughout the period of the experiments than was the case with those made in shallower water, due east of Nolsø (B_1 H_1 I_1) or south-east of same (C_1 O_1 N_1). This will be clearly seen from the following table. None of the fish recaptured had been 2 years in the water since liberation. Finally it should be remarked that the percentage of recaptures among the larger fish in all the experiments here taken together also is only very little inferior to that of the younger ones.

Table showing no. of recaptures from the experiments E. and S. of Nolsø. 1909—1912.

Experiment No.	Date	No. of fish marked	No. of months between liberation and recapture																						Total no. recaptured	% recaptured
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
	1909																										
A_1, B_1	Aug. 7, 12	104	..	11	..	27	8	..	1	3	2	..	3	3	..	1	3	1	1	..	1	2	..	..	..	67	64.4
C_1	— 16, 17	190	1	19	9	47	4	1	6	3	3	4	1	5	4	7	2	..	1	..	4	1	..	..	..	122	64.2
		294																								189	
	1910																										
D_1, E_1, F_1	May 13	50	..	1	..	..	..	..	..	..	..	..	5	1	..	1	..	..	..	..	..	..	..	..	..	8	16.0
G_1	— 13	10	..	..	1	1	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	40.0
H_1, I_1, K_1	June 6, 8	103	5	7	1	2	9	..	4	3	5	1	..	..	2	2	..	..	..	1	..	..	..	..	..	42	40.4
		163																								54	
	1911																										
L_1	Aug. 13	71	..	..	..	13	4	3	1	..	1	..	1	..	..	..	..	..	2	..	..	..	..	..	..	25	35.2
M_1	— 14, 15	133	..	21	14	14	3	13	7	..	2	..	1	..	..	1	1	..	..	..	1	..	..	1	1	80	60.2
N_1	— 17	79	..	4	13	..	4	9	1	4	2	2	2	2	1	..	1	1	1	..	..	..	..	..	..	46	58.2
O_1	— 18	80	1	19	12	1	3	6	7	1	..	..	2	..	2	..	..	1	..	.	..	..	1	1	..	57	70.4
		363																								208	
	1912																										
P_1	July 1, 2	99	..	.	2	1	..	1	..	11	2	4	..	1	2	2	1	..	..	1	1	..	..	..	..	29	22.2
Q_1	— 2, 3	67	..	1	..	2	1	1	..	6	1	2	1	1	2	1	..	1	1	..	1	..	..	..	..	22	31.3
		166																								51	
	Total...	986	7	83	52	108	36	35	27	32	18	13	16	13	13	15	8	4	6	2	8	3	1	2	1	502	50.9

4. Growth.

Increments of length and of weight.

As already mentioned above, the greater portion of the 1909 material has had to be rejected on account of insufficient accuracy in the measurements. The 1911 experiments furnish the best basis for a

study of the growth during a great part of the year; even here, however, the relative paucity of recaptures after the first six months renders all calculations of average annual growth uncertain.

The 1909 Experiments.

The few reliable measurements do at least serve to furnish some valuable information as to growth of the II group, but tell us nothing of that of the slightly larger fish. The annual growth is here again about 20 cm, in the case of the best-grown fish, the average monthly increment of same being 1.5—2 cm, or values similar to those noted in the Nolsø Fjord experiments previously described.

Table showing rate of growth of 2- and 2-3-year-old cod, liberated E. of Nolsø mid August 1909.

Recaptured in	Period of growth	Increment in cm			No. of specimens and their initial sizes in cm		
		Average	Minimum	Maximum	35—42	43—50	51, 53
1909 October	2	3·5	2·4	4·5	..	2	..
1910 January	5	10	..	..	..	1	..
— March	7	8	..	..	1	..	..
— —	7	9	..	..	..	..	1
— April	8	9	..	..	..	1	..
— June	10	11	..	..	1	..	..
— July	11	13	..	..	1	..	..
— —	11	12	7·5	16	..	2	..
— — & August	11 & 12	8 & 15	..	..	..	..	1,1
— September	13	19·7	18	22	3	..	..
— —	13	13	..	..	..	1	..
— October	14	14	11	17	..	2	..
— December	16	14	..	..	..	1	..
1911 February	18	21	..	..	1	..	..
— —	18	29	..	..	..	1	..

Not a few exihibit far inferior growth, down to about 1 cm average per month; the reliable records are, however, too few. One point should nevertheless be noted; as will be seen from the table, there does not, in these experiments, appear to be that difference in the rate of growth between larger and smaller individuals within the range of sizes dealt with, which was noted in the 1909 experiments, nor is, as has been stated, any such difference observed elsewhere.

Table showing growth in cm of liberated cod. Experiments E. of Nolsø. May & June 1910.

Initial sizes in cm	Recaptured in 1910—1911						
	Sept.	October	December	January	March	June	Novbr.
40—50	3	..	10	..	..	13·7	11*)
50—59	..	3	..	..	..	11*)	..
60—69	..	..	..	5*)	6, 12, 14	..	..
70—79	..	..	..	..	5	..	..

*) lib. init. June.

The 1910 Experiments.

The table below shows the length increments since the commencement of the experiments, with all such information as is furnished by this material.

The only figures of particular interest are those referring to the four large cod recaptured 10 months after liberation, and having then increased their length by 5 and 6 & 12 and 14 cm, respectively, their initial sizes being 73 and 65 and 63 and 61 cm. These fish should probably have been placed in pairs, each pair in its own year-class; this cannot however, now be done.

The average monthly increment found here both for the younger, and the best-grown of the older fish, is abt. 1.3 cm, barely half that figure, however, for the largest fish (0.5—0.6). This result is confirmed by various similar instances which will be noted in the following.

The 1911 Experiments.

These furnish the greatest amount of material for determination of growth as regards the younger fish in this area. The table below shows all reliable growth measurements taken.

1. Cod of less than 50 cm initial size. The recaptures are both more numerous and more evenly distributed throughout the first six months of the experiments than in the case of the 1911 markings in Nolsø Fjord; the number of reliable measurements is in any case greater, so that the material may be regarded as even more representative.

The figures for average growth increment between liberation and recapture reveal, as in the case of the Nolsø Fjord experiments, a distinct retardation of the growth during the autumn months, until some way on in February, which latter feature was not so clearly evident from the scantier material furnished by the markings in Nolsø Fjord. The average growth increment from mid August to mid February — i. e. for six months — is 4.3 cm or considerably less than the corresponding value for the 1911 experiments in the fjord (7.3 cm, see p. 13); there is however, after all, this and our other experiments taken together, clear indication that the growth is somewhat slower outside than in the fjord itself (*vide* Fig. 4). Our graphs, constructed upon the reliable measurements of growth, show this difference with all certainty.

If we, for further details compare for instance the maximal values for growth from time of marking, until November, December, January etc. respectively for the 1911 experiments on both sides of Nolsø, we find a distinct and almost constant difference; as follows:

Maximal growth increment in cm until	mid. Novbr.	mid. Decbr.	mid. Jan.	mid. Febr.	mid. March
In Nolsø Fjord 1911 Exp....	6	9	8	10	13
S. and E. of Nolsø Fjord 1911 — ...	3	6	7	10	8

Rate of growth of 2-year old cod., liberated E. of Nolsø. August 1911.

Recaptured in	Period of growth (months)	Increment in cm.			No. of specimens
		Average	Minimum	Maximum	
1911 September.....	1	0·5	0	1	13
— October	2	1·3	0	3	22
— November	3	1·3	0	3	12
— December	4	3·0	0	6	13
1912 January	5	2·6	1	6	21
— February	6	4·3	0	10	11
— March.....	7	6·5	4	8	4
— April.....	8	5·3	4	8	3
— May	9	7	7	7	1
— June.....	10	8·7	6	10	3
— July	11	10·5	10	11	2
— August.....	12	10·5	8	13	2
— October	14	13·5	11	16	2
— November	15	12	11	13	2
— December	16	18	—	—	1

Table showing length increment in cm of cod for the period between liberation and recapture.
Exp. E. and S. for Nolsø Aug. 1911.

Initial Size cm.	Recaptured in:																								
	1911								1912													1913		
	September			October			November	December	January	Febr.	March	April	May	June	July	August	Septbr.	October	November	December	February	May	June
	1-10	11-20	21-30	1-10	11-20	21-31																		
79	..	..	..	..	..	..	..	..	2♂	..	..	..	..	..	..	..	..	..	..	.	..	..	..
76	1♀	..	..	2♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
75	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..
72	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..
70	..	..	..	..	..	..	1♀	..	..	..	..	..	..	..	..	..	..	..	..	15♀	..	..	..
69	0♂	..	..	1♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
68	..	..	..	1♀	..	..	1♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
66	2♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
64	1♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
62	..	..	..	..	..	..	4♂	..	1♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..
61	..	..	0♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
60	1,0♂,♂	..	1♂	2♂	..	..	1♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
59	0♂	..	..	..	..	..	..	..	4♂, 12	..	..	..	..	..	..	..	..	.	..	..	..	..	..
58	..	..	1♀	..	..	..	1♀	..	..	..	..	4♀	..	..	..	..	..	..	..	..	..	..	..
57	..	1♀	..	3♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
56	0♂	..	..	..	..	..	1♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
55	..	..	..	..	..	..	1♀ 1	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..
54	0♂	..	..	..	..	..	0♀ 1♂	..	..	..	4	..	..	..	..	..	12♂	..	..	..	..	..	..
53	..	..	..	1♂	2♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	(12·3)	..	..
52	0♂,1♂	2♀	..	..	1♀	..	0♀, 0♀, 1♂	..	5♀	..	..	..	..	..	..	..	..	..	..	17♂	..	..	..
51	0♀	..	1♂	0♀	0♂	..	1♀	..	..	..	..	5♂	..	7♀	..	..	..	..	..	..	..	..	..
50	..	..	0♀	..	1♀, ♀0	..	1♂	..	7♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..
49	0♂	..	0♀	..	..	..	0♀	4♂	3♂	10♀	..	..	..	(ca.9)	..	..	..	..	..	..	..	(7)	..
48	1♂	0♀	..	..	..	..	0♀	1♀	3♂	..	..	..	..	..	10♂	..	..	..	11♀	..	..	..	..
47	0♀	0♂	1♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
46	..	..	..	..	0♀, 2♀	..	0♀, 2♀	6	2♂ 2♂	..	..	4	..	6	11♂	8♂	..	..	..	..	..	..	..
45	1♂	..	..	2♀	1♀	..	..	..	2♂	0♀	..	..	..	..	..	..	..	..	..	..	..	..	..
44	0♂	1♀	0♀	1♂	1♂, 1♀, 2♀, 2	2♀	..	..	..	1♀, 2, 8·3	..	..	..	10♀	..	..	..	..	13♂	..	..	..	..
43	..	..	..	1·5♀, 1, 2, 2	3♀	..	2♀	4♂, 5♂	2, 4♂, 5♂, 3♀	5, 4♂	4·2	..	..	10	..	..	..	16♀	..	..	..	..	..
42	1♂	..	..	2, 0·5♀	2♀	..	1♂, 1♀, 2♀, 3	5♀, 3♂	1♂, 2♂, 3♂, 5♂, 3♀	..	..	4♂	..	..	..	..	..	..	..	..	..	..	..
41	..	1	..	..	0♂, 1♂, 3♂, 1♀	..	1♂, ♀1	0♀, 2♀	1♂, 4·1	..	..	..	..	..	..	13♀	..	..	..	..	..	..	..
40	..	..	..	..	0♂	..	..	3♀	1♂, 6	..	..	8♂	..	..	..	..	..	11♀	..	18♂	..	..	..
39	..	..	..	..	..	..	3♂	3♂	1♂	3♂, 5	7·7 ♂, 6♀	..	..	..	..	..	..	..	..	..	..	..	(23·7)
38	..	..	..	..	..	..	..	..	2♀	5	..	..	7♂	..	..	..	..	..	..	..	..	..	..
37	..	..	..	..	..	..	..	1♀, 1♀	..	4	8♂	..	..	..	..	..	..	..	..	..	..	..	..

Table showing weight increment in gr. of marked cod between liberation and recapture. E. and S. of Nolsø. Exp. Aug. 1911.

Initial weight in gr.	Recaptured in 1912—13																				
	September			October			November	December	January	February	March	April	May	June	July	August	Septbr.	October	Novbr.	Decbr.
	1-10	11-20	21-30	1-10	11-20	21-31														
4900	..	..	..	..	..	..	..	..	♂0	..	..	..	..	..	..	..	..	..	..	..
4100	..	..	..	♀160	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4000	·0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3300	..	..	..	..	..	..	♀0	..	..	..	..	..	..	..	..	..	..	..	..	♀3300
3200	·0	..	..	♀0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3000	..	..	..	♀50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2900	..	..	♀225	..	..	..	♂0	..	..	..	..	..	..	..	..	..	..	..	..	..
2300	♂0	..	..	..	..	..	♂450	..	..	..	..	..	..	..	..	..	..	..	..	..
2000—2200	..	..	♀0, 0	♂0, ♂25	..	..	♀0, ♂0	..	♂0, ♂325	..	..	♀25	..	..	..	..	..	..	..	..
1800	♂0	♀0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	♂0	..	♂25	..	..	..	..	..	..	..	..	..	..	..	..	..
1600	♂0	..	..	..	..	..	♂40	..	..	..	..	..	..	..	..	..	..	..	..	..
..	♂0	..	..	..	♀0	..	♀0, ♀0	..	♀375	..	..	..	..	..	..	..	♂1700	..	..	..
1500	..	♀125	..	..	..	..	♀0,	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	♂0	..	..	..	..	♂275	..	..	..	..	..	..	..	..
1450	·50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	♂1720
1400	..	..	..	♂185	..	..	♀0	..	..	..	..	..	..	♀525	..	..	..	..	..	..
..	..	..	..	..	♀75	..	♀150	..	..	..	..	..	..	..	..	..	..	..	..	..
1350	..	..	♂0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1300	..	..	..	♀0	..	..	♂100	..	..	♀500	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	♀25	..	♀0	..	..	..	..	..	..	..	..	..	..	..	..	..
1250	..	..	..	..	♂30	..	..	..	♂ ca. 150	..	..	..	..	..	..	..	..	..	..	..
..	♂0	..	..	..	..	..	..	..	♂100, ♀675	..	..	..	..	..	..	..	..	..	..	..
1200	..	♀0	..	..	..	..	..	♂50	..	..	..	..	..	..	..	..	..	..	♀715	..
..	♂0	♂0	♀0, ♀0	..	..	..	♀0	..	..	..	..	..	..	..	♂850	..	..	..	..	..
1150	..	..	♀0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1100	..	..	..	..	..	..	..	♂200	..	..	..	..	..	..	..	♂485	..	..	..	..
1050	♀0	..	..	..	♀0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	♀25	..	..	..	♂225	..	..	..	..	..	..	..	..	..	..	..
1000	..	..	..	..	♀80	..	..	..	♂60	..	..	..	..	..	♂825	..	..	..	..	..
..	..	♀25	..	..	♀125	..	..	..	♂0	♀50	..	..	..	..	..	..	..	..	♂850	..
950	..	..	..	..	..	..	♀170	..	♀65	..	..	..	..	..	..	..	..	..	..	..
..	♂0♂0	..	..	♀0	..	..	♀0	♂265	..	..	..	..	..	♀525	..	..	..	..	..	..
900	..	..	..	♀100	♂50, ♀50	♀75	..	♂290	♂290, ♂300, ♂0	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	♀0	..	..	..	♂285	·125, ♂125, ♀160, ♂250	..	..	..	..	..	..	..	..	..	..	..
850	..	..	..	♂55,♀0,♀50	..	..	♀150, ♀200	♀335	♂120	♂250	..	..	..	..	..	..	..	..	..	..
..	..	..	♂0	·50, ♀40	♀25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
800	♂0	..	..	..	♂100,♂0,♀350	..	♀50	..	♂375	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	♀150	..	♀40, ♂140	♀0, ♀40	..	..	..	♂300	..	..	..	♀740	..	..	..	..
750	..	·0	..	..	♂25	..	♀0	♂200	♂0	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	♂70	..	..	♀275	..	..	..	..	..	..	..	..	..	♀1175	..	..
700	..	..	..	..	..	..	..	..	♂385	..	..	♂435	..	..	..	..	..	..	..	♂1425
650	..	..	..	..	..	..	♂10, ♂120	..	♂0	..	♀225	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	♂160	♂90, ♀75	♂200	..	..	♂275	..	..	..	..	♀600	..	..
600	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
550	..	..	..	..	..	..	..	♀50	..	..	♂375	..	..	..	..	..	..	..	..	..
500	..	..	..	..	..	..	..	♀0	..	..	..	..	..	..	..	..	..	..	..	..
Average increment (in gr.) for cod with initial weight: 1) 1000—1500 gr. 2) 700—1000 - 3) 500— 700 -		1)			45·0		41·7	125·0	201·7	(500)		(368)		(525)	838	485		(1175)	715	1720
		2)			69·2		93·8	211·2	153	(150)	..	..	..	(525)	..	(740)	..	..	..	(1425)
		3)			0		(65·0)	(70·0)	(83)	(200)	(300)	..	(275)	..	..	..	..	(600)	..	..

A similar difference is noticeable on comparing the graphs illustrative of growth during a whole period of 12 months or thereabout. The measurements for June and July (1912) outside Nolsø — which are, it must be admitted, but few in number —, lie below the mean value for the experiments in the fjord itself[1]; actual figures for the averages cannot, however, be given with any degree ofaccuracy. As in all the experiments E. and W. of Nolsø in 1911 however, we find the growth during 1911 to be inferior to that during the following year — as will be mentioned below.

The increase in weight is, as might be expected from the figures for length increment, also poor. The increment for initial weights of 700—1000 gr. after the lapse of 5—6 months never amounts to more than about 400 gr., i. e. only about half the initial weight, and frequently hardly one-fourth. Two fish recaptured after the lapse of 12 months had even then scarcely doubled their initial weight.

The larger fish, i. e. those between 50—60 cm, appear to have grown more or less similarly to the two-year-olds, — at least as far as can be judged from the few data available — in most cases, however, somewhat less; i. e. less than an average monthly increment of 0.9 cm. The still larger fish, of which but very few were recaptured, exhibit for the most part an even slower rate of growth (less than 0.5 cm average monthly increment).

Table showing growth in cm of all fish recaptured for the period between liberation and recapture.
Experiments E. of Nolsø. July 1912.

Initial sizes in cm.	Recaptured in														
	1912					1913									1914
	Aug.	Septb.	Octbr.	Novbr.	Decbr.	February	March	April	May	June	July	Aug.	Nov.	Decbr.	Jan.
91, 94	..	..	..	..	..	..	11·5	2·2♀[1])	..	..	..	..	..	..	..
84	..	..	..	..	..	..	..	3 ♀	..	..	..	..	..	..	..
65—68	..	..	..	..	..	10♂, 12♀	7	..	..	5	..	..	..	..	..
60—64	..	..	..	..	..	10 ♀	..	..	..	..	..	..	..	..	..
56—59	..	4,6	..	..	..	9♀, 10♀	..	10 ♀	..	..	..	..	..	..	..
50—55	..	..	6·5♂	..	3♂	7♂, 10♀	14[2])	..	..	..	17♂	14	..	..	26 ♀
45—49	..	..	..	..	7♂	2♂[3]), 7, 10♂, 10♂, 12, 12♀	..	10 ♀	11	..	11♂, 14♀, 19♀	..	..	22	10 ♂
40—44	..	..	3 ♀	..	..	10 ♀	..	..	..	..	..	18	15 ♂	..	..
37—39	2♂	..	3 ♂	8·5	..	7♂, 12♀	..	..	..	12 ♀	..	..	..	..	..

[1]) init. size 94 cm. [2]) init. size 51 cm. [3]) init. size 48 cm ♂.

Rate of growth of 2-year-old cod (< 50 cm l.) liberated E. of Nolsø. July 1912.

Recaptured in	Period of growth	Increment in cm			No. of specimens
		Average	Minimum	Maximum	
1912 August	1	2	—	—	1
— October	3	3	3	3	2
— November	4	8·5	—	—	1
— December	5	7·0	—	—	1
1913 February	7	9·1	2	12	9
— April	9	10·0	—	—	1
— May	10	11·0	—	—	1
— June	11	12	—	—	1
— July	12	14·7	11	19	3
— August	13	18·0	—	—	1
— November	16	15·0	—	—	1
— December	—17	22·0	—	—	1
1914 January	—18	10·0	—	—	1

[1] For June for instance 6, 10, 10—11 cm. against 11.8 (mean value June, Nolsø Fjord).

The increase of weight among the larger fish is also, like that of the length, less than that noted during the experiments made during the same year inside the fjord. Exactly as in the case of the smaller fish, we find, for fish of initial size between 1000—2000 gr. an increment of but half the initial weight at the outside after the lapse of 6 months. The one recaptured specimen of even larger size (70 cm) had doubled its initial weight of 3200 gr. (length increment — 15 cm) during the period from August 1911 to December 1912, i. e. 16 months.

The 1912 experiments afford, owing to the relatively small number of fish marked (and recaptured) but little information as to growth. Only for the period from July (1912) to end of February (1913) can we obtain here a reliable view of the growth of 35—50 cm cod. This amounts, for the nine fish recaptured in February, to 2, 7, 7, 10, 10, 10, 12, 12, and 12 cm respectively, giving an average of 9.1 cm.

In other words, the growth increment is 5 cm. greater than in the 1911 experiments at this place for the period from August to end of February. Otherwise we find about the same course of graphs with a distinct rise early in summer 1912 as in 1913 (Fig. 4 & 5).

A difference between rate of growth 1911—12 and 1912—13 is distinctly evident from the table given below, showing the measurements of growth for the 1911 experiments as compared with those for 1912, both those made E. of Nolsø and those in the fjord itself. The table further shows the not inconsiderable difference already referred to between the growth at the two localities in the same year.

Table showing growth of 2-year-old cod in the waters about Nolsø 1911—12—13.

Period of growth	Average increase in cm		Maximal increase in cm	
	Nolsø Fjord	E. of Nolsø	Nolsø Fjord	E. of Nolsø
mid August 1911—end Febr. 1912	9·3	4·3	>10	10
mid July 1912—end Jan. 1913	12·5	9·1	14	12

After the lapse of 12 months, the difference is less marked; even then, however, it may still be traced.

The weights are found, according to the very few observations available, to have doubled by about the middle of February, (the increment in the corresponding period in the 1911 experiments was only half as great), trebled after a whole growth period 1912—1913, and hardly doubled form 1911—1912.

Table showing increment in gr of all fish between liberation and recapture.
E. and S. of Nolsø Exp. July 1912.

Initial weight gr.	Recaptured in:													
	1912					1913								1914
	Aug.	Sept.	Octbr.	Novbr.	Decbr.	February	March	April	May	June & July	Aug.	Novbr.	Decbr.	Jan.
5400	..	..	..	..	..	..	..	♀1250	..	..	..	..	..	..
2700	..	..	..	..	..	..	1000	..	..	..	..	..	..	..
2500—2550	..	..	..	..	..	♂ 2070, ♀ 2100	..	..	.	..	..	..	..	..
2000—2100	..	180, 250	..	..	..	♀ 1225, ♀ 1450	..	♀1060	..	..	..	..	..	..
1500—1700	..	..	..	..	..	♀ 1115, ♀ 1325	..	..	..	♂ 1625	..	..	..	♀ 3100
1000—1450	..	..	..	..	♂170, ♂625	♂ 325, ♂ 770, ♂ 950, ♂ 1030, ♀ 1050, ♀ 1100	c. 1000	♀675	375	♂870, ♀1120	1375	..	1880	♂ 920
750— 950	..	..	♀75	..	..	♀ 670, ♀ 680	..	..	..	♀ 1220	..	♂ 940	..	..
450— 700	♂85	..	♂150	525	..	♂ 325, ♀ 825	..	..	..	♀ 850	1450	..	..	..

The growth of the few large specimens is as follows:

Table showing increment in cm of older fish. E. of Nolsø 1912.

Initial size in cm	No. of months between liberation and recovery												
	2	3	4	5	6	7—7	8	9	10	11	12	13	18
50—59	4 6	6·5	..	3	..	7, 9, 10, 10	14	10	..	..	17	14	26
60—69	..	..	..	..	..	10, 10, 12	7	..	..	5	..	..	..
70—79	..	..	..	..	..	..	..	..	..	..	..	..	..
80—89	..	..	..	..	..	..	..	3	..	..	..	..	..
91	..	..	..	..	..	..	11·5	..	..	..	..	..	..
94	..	..	..	..	..	..	..	2·2	..	..	..	..	..

The size groups 50—59 & 60—69 cm, comprising for the most part the 3-year-old fish, thus show, for the period from mid July to the end of February (1913) an average increment of 9·0 and 9·5 cm respectively, or about the same as that of the 2-year-old during the same period. The weights are likewise doubled. For most of these, as for the same sized fish recaptured still later in the year, the average monthly increment is more than 1 cm — up to 1·6 cm; the corresponding value for the still larger fish recaptured, however, is about the same (abt. 1·5 cm) for the one, which had an initial length of 91 cm; far lower, viz. 0·3 cm per month for the two others (init. size 84 and 94 cm).

Neither the 1911 experiments E. of Nolsø Fjord nor the 1911 & 1912 experiments in the fjord itself furnish any information as to the growth of any considerable number of the larger fish during longer periods.

This in itself renders it impossible to make comparison between the experiments of different years in these waters as regards the growth of older fish. It should be mentioned, however, that the 1910 experiments both east and south of Nolsø with 60—70 cm (? three-year-old) fish give values for growth increment corresponding to those found in the 1912 experiments for 4, 6 and 10 months respectively, viz. abt. 1·1 to 1·6 cm average per mouth. The accompanying table, based on all our available data for this feature, will serve to give an idea of the conditions, as also for purposes of comparison with the figures for growth of the larger fish S. of Nolsø as shown on p. 65.

Table showing increment in cm of larger cod. Experiments in the waters around Nolsø. Summer 1909—1912.

Initial size in cm	Experiments in	No. of months since liberation									
		7	8	9	10	11	12	13	16	18	19
50—59	1909, 10	8, 9	2	..	..	8	15	11	.	..	..
	—11	..	4, 5	..	7	..	..	12	17	..	..
	—12	7, 9, 10, 10	14	10	..	..	17	14	..	26	..
60—69	1910	5, 8·5	..	..	6, 12, 14	..	2·1	..	..	..	..
	—11	..	..	..	..	5	..	..	..	..	..
	—12	10, 10, 12	7	..	..	..	..	..	..	..	..
70—79	—10	..	..	10	5	..	..	..	..	..	..
	—11	..	..	10	3	..	..	..	15	..	..
80—89	—12	..	..	3	..	..	..	..	..	..	11·5
> 90	—12	2	11·5	2·2	..	..	..	..	..	..	..

The material does not permit of going into details; it may be pointed out, however, that the average monthly growth during the first year after liberation for most of the fish up to abt. 70 cm amounts to something like 1—1·6 cm, that of the larger fish in most cases being far below this figure.

The increment of weight naturally gives a more reliable idea of the actual growth than do the measurements of length, where an error of a single centimetre or so in measuring the slight increase which can have taken place may in many cases upset the calculations altogether. The figures for weight increment will be found in the table below.

Table showing increment in gr. of larger cod in the waters around Nolsø 1911 & 12.

Initial weight in gr	Experiments in	No. of months since liberation				
		7	8	9	13	16
1500—2000...	1911	..	25	..	1700	1720
	1912	1450	..	1060	..	..
		1225	..	..	..	..
2000—2500...	1912	2100 (♀)	..	..	..	..
		2077 (♂)	..	..	..	..
2500—2700...	1912	..	1000	..	..	..
3300.....	1911	..	..	..	..	3300
5400.....	1912	..	..	1250	..	..

It will be noticed that the initial weight is in several cases doubled in the course of 12 months; with fish over 3 kg within 16 months.

The results of the experiments E. of Nolsø as regards growth may be briefly summed up as follows:

The 2-year-old fish, (35—50 cm) grow during the first year after liberation abt. 15 cm average, reaching during that period three times their initial weight.

Finally, the growth of the fish out here appears to be somewhat slower than in the Nolsø Fjord, though differing in the four different years. Slowest growth was found during the period from August 1911 to August 1912, being for the most part less than 1 cm average per month as against 1—2 cm in the 1909, 1910 and 1912 experiments.

The best grown of the 3-year-old correspond more or less in point of growth to the fast-growing 2-year-old fish; i. e. they more than double their weight, and exhibit an average monthly length increment of abt. 1 cm in the first year, while the length increment of the remainder, as in the case of most of the older fish, rarely if ever attains half this value.

5. Migration.

As in Nolsø Fjord, the stock of 2-year-old fish here is extremely stationary during the first year after liberation. Even after the lapse of 18 months, most of the recaptures were made at a distance of less than 5 miles from the spot. The older fish, especially the sizes from 50—70 cm, which in several of our experiments here amounted to one-third or one-half of the total number marked, (*vide* p. 29) likewise exhibit, in most cases, but little migratory tendency. There is, however, even within the first 12 months, a somewhat greater dispersal of the stock here than in the case of the Nolsø group; this will be evident from the following table, where the figures in brackets indicate number of fish taken more than 10 miles from the place of liberation. This peculiarity is most distinctly revealed in Exp. P_1 — a small experiment, it is true, as regards numbers — which was made in deepest water, and with the largest fish. We here find, that in the course of 11 months, only 2 of the 8 recaptured fish of 60—90 cm initial size were taken within five miles of place of liberation, the remainder being found considerably farther off, three of them having even moved round to the western side of the islands. On the other hand, many fish of this size are quite as stationary as the younger ones; this is shown by the 1910 experiments made at similar depths to P_1,

Table showing total number of marked fish recaptured during the experiments 1909—12 E. of Nolsø (below 70 cm initial size).

Initial size in cm	Number of months since liberation							
	0—4	5—6	7	8	9	10	11	12
30—49	189 (5)	48 (4)	20 (2)	9 (2)	6 (1)	9 (3)	9 (1)	8 (1)
50—69	87 (4)	13 (2)	12 (1)	6 (2)	5 (2)	5 (0)	2 (2)	2 (0)

viz. D_1, E_1 and F_1, where, after the lapse of ten months, five specimens of 57—70 cm initial size were recaptured less than 3 miles from place of liberation.

In the course of the second year after liberation, the dispersal of the stock progresses slowly, being most distinctly evident in the case of the 3-year-old and older fish, as far as can be judged from the very few recaptures made. The table below shows the figures for total number of recaptures made close to (within 5 miles of) and farther from the place of liberation in the course of the second year after marking.

Table showing numbers of recaptured, stationary and migrating cod in the experiments. E. of Nolsø 1909—12.

Distance between place of liberation and recovery	Initial sizes in cm	No. of months since liberation													
		9	10	11	12	13	14	15	16	17	18	19	20	21	22
< 8 Miles	35—49	4 ..	6 ..	8	8 ..	8 ..	7 ..	3 ..	4 ..	2 ..	5 ..	. ..	. ..	1 ..	. ..
	50—59	3 ..	2 ..	..	2 ..	1 ..	.. ..	.. ..	.. ..	.. ..	2 ..	.. ..	.. ..	.. ..	.. ..
> 8 Miles	35—49	.. 1	.. 3	.. 1	.. 1	.. 2	.. ..	.. 1	.. ..	.. ..	.. ..	.. 2	.. ..	.. ..	.. 1
	50—59	.. 1	.. ..	.. 1	.. 1	.. 2	.. 1	.. ..	.. 1	.. ..	.. 1	.. ..	.. ..	.. ..	.. ..
< 8 Miles	60—69	.. ..	3 ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	70—79	.. ..	1 ..	1 ..	.. ..	.. ..	.. ..	.. .	1 ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	80—89	1 ..	.. ..	1 ..	.. ..	.. ..	.. ..	. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
> 8 Miles	60—69	.. 1	.. ..	.. 1	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. 1	.. ..	.. ..
	70—79	.. 1	.. 1	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
	80—89	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. 1	.. ..	.. ..	.. ..
	> 90 >	.. 1	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
< 8 Miles	Total recap.	8 ..	12 ..	10 ..	10 ..	9 ..	7 ..	3 ..	5 ..	2 ..	7 ..	.. ..	.. ..	1 ..	.. ..
> 8 Miles		.. 5	.. 4	.. 3	.. 2	.. 4	.. 1	.. 1	.. 1	.. ..	.. 1	.. 3	.. 1	.. ..	.. 1

The more extended migrations are made for the most part in a northerly direction, round to the northern and north-western side of the islands, where the Færoe, English and Scottish fishermen found the 32 cod which were all that had reached here out of the total of 502 recaptured. A single specimen was taken W. of Myggenæs; only two were found as far south as the north and south points of Suderø, after a lapse of 3 and 19 months respectively, the respective distances being 25 and 40 miles, measured by shortest roule on the chart.

Fig. 14 shows the results of Exp. L_1 and M_1. The figure speaks for itself; we may, however point out that it exhibits this difference in the two experiments; the stock of two- and three-year-olds in Exp. M_1, about 4 miles E. of Nolsø, had, after only two months from date of marking, already commenced to spread over some few (less than 8) miles in a northerly and north-easterly direction, whereas in Exp. L_1, made about 6 miles farther to the eastward, close to the 100 m line, the fish had, after 3—5 months, hardly moved at all. During the autumn of 1911 moreover, some 20 of the M_1-fish were taken within two miles of L_1, the individuals in question having thus wandered off towards the deeper waters to the north-east (and east). The composition of the stock was about the same in both experiments. Thus in Exp. L_1, 41 specimens < 50 cm, 28: 50—70 cm in Exp. M_1, 81 spec. < 50, 46: 50—70 cm.

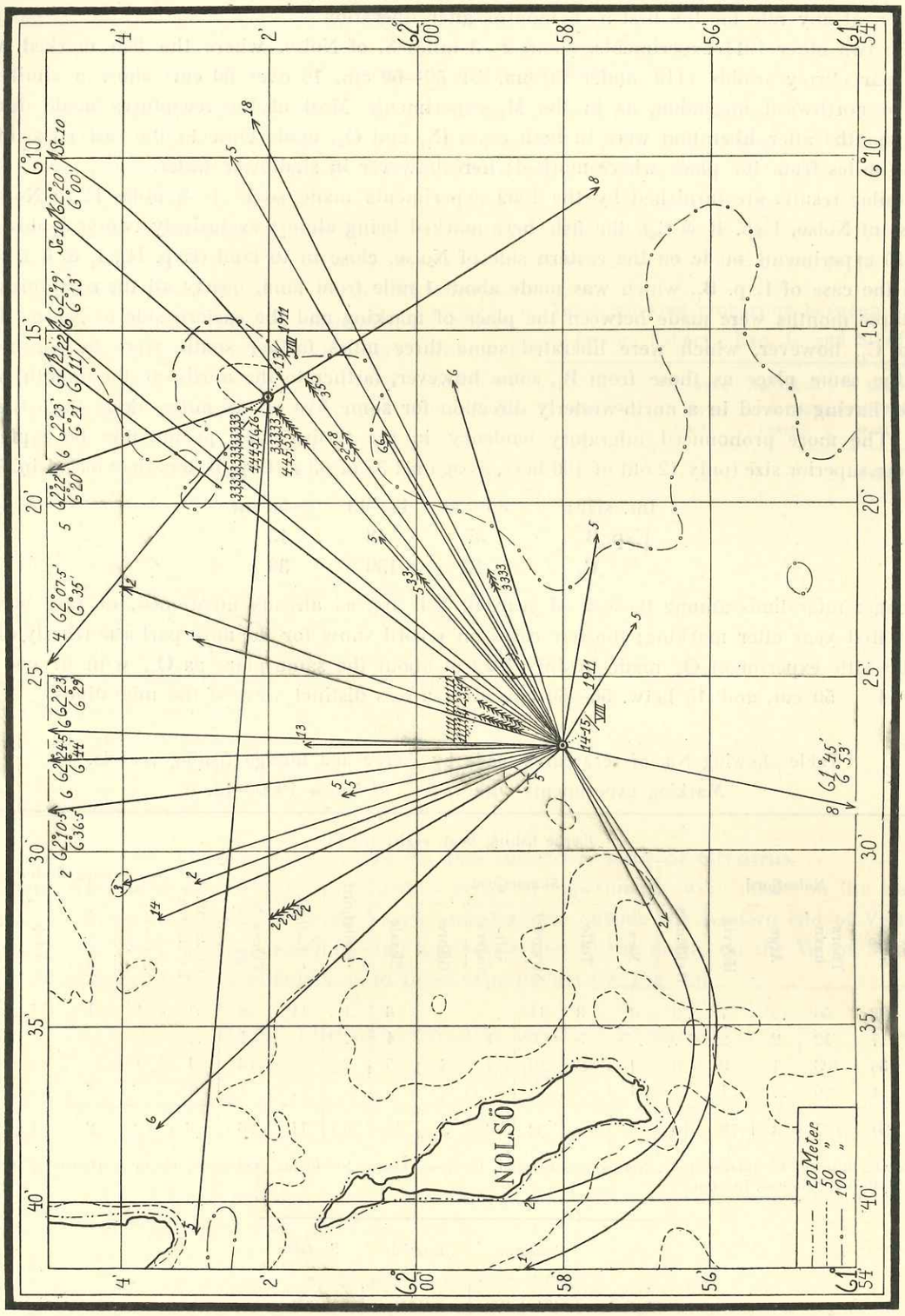

Fig. 14. Marking Experiments with cod at the Færoes. Exp. L1 and M1, 13 & 14—15 August 1911.
In Exp. L1 19 recaptures were made within 3—16 months at actual place of liberation.

The lists show, that fish of the same initial size migrate in the one case and remain stationary in the other, at any rate for the first 5—6 months after liberation.

The two other 1911 experiments, about 2—3 miles S. of Nolsø, where the fish marked were for the most part two-year-olds (119 under 50 cm, 24 50—60 cm, 16 over 60 cm) show a similar slight tendency to northward migration, as in the M_1 experiment. Most of the recaptures made during the first 2—5 months after liberation were in both cases (N_1 and O_1) made close to the east coast of Nolsø, about 3—4 miles from the place where marked; here however in shallower water.

Similar results are furnished by the 1909 experiments made some 1—3 miles E. of Nolsø Light (East coast of Nolsø, Exp. B_1 & C_1), the fish here marked being almost exclusively two-year-olds, as also by the 1910 experiments made on the eastern side of Nolsø, close in to land (Exp. H_1, I_1 & K_1).

In the case of Exp. B_1, which was made about 1 mile from land, nearly all the recaptures during the first three months were made between the place of marking and the eastern side of Nolsø. The fish from Exp. C_1, however, which were liberated some three miles farther south, were for the most part taken at the same place as those from B_1, some however, farther to the north, at the mouth of Nolsø Fjord; i. e. having moved in a north-westerly direction for some five or six miles along the eastern side of Nolsø. The more pronounced migratory tendency in the C_1-fish may presumably be explained as due to their superior size (only 12 out of 190 here, as against 37 of 93 in Exp. B_1 less than 39 cm initial size).

Int. size:	30—39	40—49	> 50 cm
Exp. B_1	37	43	13
— C_1	12	139	39

Longer migrations among these 2—3 year-old fish are, as already mentioned, of rare occurrence during the first year after marking; the few cases on record show for the most part a northerly direction.

The little experiment Q_1 made in July 1912 at about the same place as O_1, with 67 cod in all, of which 44 < 50 cm, and 15 betw. 50—60 cm, gives a less distinct view of the migrations.

Table showing No. of recaptures made by Færoe and foreign fishing vessels.
Marking experiments with cod E. of Nolsø 1909—12.

	Færoe fishing boat, registered in																		
	Nolsøfjord					Skaalefjord												English Steam Trawlers	Scottish Steam Trawlers
	Nolsø	Thorshavn	Arge	Hoyvig	Hvidenæs	Næs	Tofte	Strænder	Saltangeraa	Glibre	Skaale	Kollefjord	Kalbæk	Places N. of 62° 10' *)	Places W. of Kirkebønæs **)	Sand-Ø Skopen & Sand	Vaag-Ø Sandvaag	Suder-Ø Vaag	
1909.....	73	56	..	7	3	1	3	11	..	..	6	1	11	8	1	1	1	1	5	..
1910.....	17	12	2	2	..	..	5	5	1	..	4	..	..	1	..	..	..	..	3	1
1911.....	36	103	1	9	6	1	2	16	2	1	5	2	..	16	1	1	..	..	1	4
1912.....	4	26	..	1	1	1	..	..	..	..	..	..	..	1	1	..	1	..	11	4
Total...	130	197	3	19	10	3	10	32	3	1	15	3	11	26	3	2	2	1	20	9

*) Thorsvig, Rituvig, Lamhauge, Gøte, Nordregøte, Lervig, Andefjord, Skard, Norddeble, Viderejde, Fuglø (& Hattervig), Svinø, Ejde, Tjørnevig. **) Hestø, Velbestad, Leinum.

	Færoe	English	Scottish
Total..	471 + 2*)	20**)	9**)

*) Precise locality not known. **) Including two line-caught.

This is partly due to the fact that 17 of the 22 fish recaptured were not taken until from 7 to 18 months after liberation, so that the general dispersal is not so easily seen.

6. Nationality of the fishermen.

It will be seen from the table above that of the mainly 2—3 year-old fish marked east of Nolsø, about 420 or 84·3 % of the 502 recaptures were made by boats from Nolsø and Skaalefjord. The remainder are fairly evenly distributed among fishers from the northern or southern villages, and vessels of foreign (English or Scottish) origin. On looking through the experiments separately with a view to ascertaining what annual percentage of recaptures was made by foreign vessels, we find that this percentage only in five of the sixteen experiments amounted to four or upwards in two out of these four, moreover, from about 17 to 25. This feature is shown in the 1912 experiments, especially P_1, where, as also might be expected from the larger size and greater migratory tendency of the fish, and consequent the relatively small number of recaptures (29 of 99 liber.) we find that close on fourth the fish retaken were brought in by English and Scottish vessels (cf. C_1 and C_0 in Nolsø Fjord) in the course of the first year after marking.

Table showing proportion between Færoe and foreign fishery. Exp. E. and S. of Nolsø.

Exp. No.	No. taken by Færoe boats	No. taken by foreign vessels	% taken by Færoe boats	% taken by foreign vessels
A_1	4	0	100·0	0
B_1	54	0	100·0	0
C_1	103	4	96·3	3·7
D_1 E_1 F_1	7	0	100·0	0
G_1 H_1 I_1 K_1	41	2	95·3	4·7
L_1	22	1	95·7	4·3
M_1	74	1	98·7	1·3
N_1	40	3	93·0	7·0
O_1	54	0	100·0	0
P_1	18	6	75·0	25·0
Q_1	15	3	83·3	16·7

The fishing done by foreign vessels is therefore, both as regards the eastern and western sides of Nolsø, of negligible import in as much as concerns its effect upon the stocks. It is at any rate extremely slight when compared with the extremely intensive fishing carried on by the Færoe fishermen themselves in Nolsø Fjord, where the stock consists mainly of growing two-year-old fish and off the east coast, among the two- and three-year-olds. The annual toll taken by the native industry thus amounts to about three-quarters and about one-half respectively of the actual stock.

III. The experiments on the western side of Strømø.

During July and August 1911 and 1912, a series of experiments were made on the western side of the islands, the great majority between Vaagø and Strømø, outside the western end of Vestmansund; one farther to the west, in Myggenæsfjord, and another farther to the north, on the W. of Strømø. The following table gives further particulars as to these experiments (cf. Fig. 13).

III A. The experiments west of Strømø.

1. Locality and Date.

Markings were made here at various localities, for the most part between the 50 and 100 m. isobaths, outside the mouth of Vestmansund, comprising 300 and 137 fish in 1911 and 1912 respectively. The 1911 experiments were made fairly close together (Exp. A_2, B_2 and C_2) with a distance of only 1—2 miles between. The 1912 experiments were carried out partly close by, (E_2 and G_2) and partly some distance away (abt 6—8 miles) from these (D_2 and F_2).

2. Size of the fish marked.

The great majority of the fish marked here were, as in the Nolsø experiments, under 50 cm., while a not inconsiderable portion of the total catch is made up of 50—60 cm fish, as was also the case with

Table showing marking experiments W. of Strømø 1911 & 1912.

No. of Experiments	Year and month	No. of cod liberated	No. of cod recaptured	Locality of liberation	Central Position (Approximately) N.Lat.	W. Long.	Depth in metres
III A A_2	1911 August 24	61	34	3 miles W.N.W. of Slettenæs	62°09·5′	7°20′	40
III A B_2	— — 28	139	70	1·5 miles N.W. 1/4 W. of Mulen	62°11′	7°18′	100
III A C_2	— — 30	100	51	1 mile N.W. by N. of Slettenæs	62°10′	7°15′	60
III A D_2	1912 July 13	9	3	2 miles N.W. of Saksen Vestmanhavns Flegue	62°15·5′	7°17′	80
III A E_2	— — 16, 25	68	16	1·5 miles N.W. of Slettenæs	62°10′	7°17′	60
III A F_2	— — 20	27	5	4 miles N.N.W. of Baret	62°11·5′	7°33′	90
III A G_2	— — 20	33	4	2 miles N. of Ritunøv	62°10·5′	7°21·5′	75
		437	183				
				Myggenæsfjord			
III a A_3	1912 July 19	67	19	1·5 miles N.N.E. of Myggenæs	62°07′	7°31′	45
	— — 22	50					
III b	1912 June 13	20	3	15 miles N. by W. of Myling Head	62°30′	7°32′	120
III c C_3	1910 May 19, 20	7	4	Vestmanhavn	62°08·5′	7°09′	ab.10—20

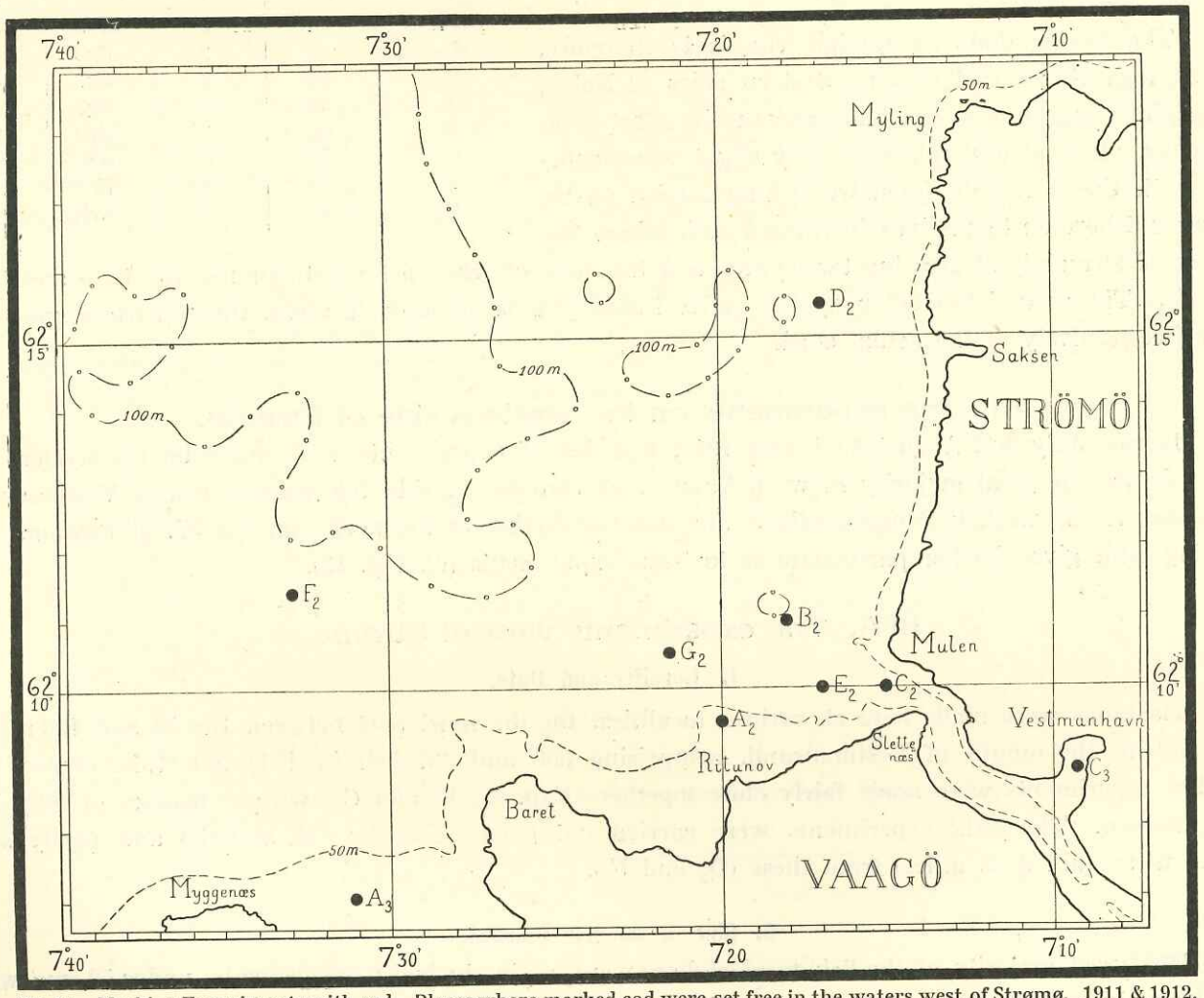

Fig. 13. Marking Experiments with cod. Places where marked cod were set free in the waters west of Strømø. 1911 & 1912.

the experiments E. of Nolsø. Of larger fish, up to 65 cm, only a very few were found in the 1911 experiments, which, as was to be expected from their close proximity to each other, furnished the most homogeneous and greatest amount of material. In the 1912 experiments, the same younger size groups were found to predominate; fish of considerable size (70—80 cm) were, however, also found nearer the deep water, this being particularly the case with Exp. D_2 and F_2.

Table showing number and size of cod liberated west of Strømø 1911 & 12.

No. of cod liberated in the different years	Initial sizes in cm					
	32—39	40—49	50—59	60—69	70—79	80—81
1911	17	218	59	6	..	..
1912	23	68	28	12	5	1
Total...	40	286	87	18	5	1

3. No. of recaptures.

Of the 300 cod marked in 1911, over half were recaptured, viz; 155 fish, or abt. 52 %. All the three experiments made in this year give similar results, also in this respect viz; from 50.4 to 55.7 % recaptured. The stock of two-year-olds is thus here also subjected to intense fishery, as also that of the somewhat older fish, (50—60 cm initial size); in both groups, about half the total number marked were recaptured within the first year. Close upon half of the total number of recaptures were made during the first four months after liberation, as is generally the case in our experiments with these two and three-year-old fish; about 3/4 of the remainder were taken between the 7th and 12th months of the experiment. Some few were also taken after the lapse of nearly two years.

Table showing no. of fish recaptured from the experiment W. of Strømø 1911 & 12.

Experiment No.	Date	No. of fish marked	No. of month between liberation and recapture																			Total recaptured	% recaptured
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	17	21	22	25	
	1911																						
A_2	Aug. 24	61	..	4	11	3	..	1	..	2	2	5	..	2	2	1	..	..	..	..	1	..	34	55·7
B_2	— 28	139	..	6	25	10	..	..	1	3	2	7	2	7	3	2	..	1	..	..	..	1	70	50·4
C_2	— 30	100	..	3	25	1	..	..	..	..	1	4	2	4	4	..	3	..	..	2	2	..	51	51·0
		300																					155	51·7
	1912																						
D_2	July 13	9	..	..	..	..	1	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	3	33·3
E_2	— 16, 25	68	..	4	3	..	1	..	1	..	..	..	..	2	2	..	3	..	..	..	..	..	16	23·5
F_2	— 20	27	..	..	..	..	..	2	..	1	..	..	..	..	..	..	..	1	1	..	..	..	5	18·5
G_2	— 20	33	..	1	2	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	4	12·1
		137																					28	20·4
	Total...	437	..	18	66	14	2	3	2	6	5	16	5	17	11	3	6	2	1	2	3	1	183	41·9

The 1912 experiments, with their smaller number of markings and wider distribution of localities, give, taken together, a far smaller percentage of recaptures; only 28 of 137 marked, or 20.4 %. This may be partially explained as due to the greater distance of the localities from land, and to the greater size of the cod liberated this year in places where the fishery is not so intense; the number of marked fish here is, however, so small as to render comparison between the separate experiments in 1911 and those of 1912 impossible.

4. Growth.

Increase in length, and in weight.

The comparatively large number of accurately measured fish from the 1911 experiments (*vide* Tables of Growth), fall, for the most part, as already mentioned, to the first three, and ninth to twelfth months after libration. The growth, i. e. the increment of length, for the group comprising fish of less

Table showing growth increment in cm of marked cod between liberation and recapture.
Experiments W. of Strømø Aug. 1911.

Initial Size cm	Recaptured in 1911						1912											1913		
	Septbr.		October			Novbr.	Jan.	Febr.	March	April	May	June	July	August	Septbr.	Octbr.	Novbr.	May	June	Septbr.
	1-10	20-30	1-10	11-20	21-31															
65	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3♂	..	..
60	..	..	..	0♀	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
59	..	..	..	1♀	..	..	..	..	..	..	..	..	4♀	..	..	..	..	..	..	..
58	..	..	..	1♀, 0♀	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..
57	..	2♂	..	..	..	..	..	..	..	..	..	..	4♀	..	..	..	..	..	..	..
55	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3♀	..	..	..
54	..	..	..	2♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
53	..	..	..	2♀	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..
52	..	..	..	1♂	3♀	2♂	..	..	6	..	6, 10♂	.	8♂	..	..	..	..	..	..	..
51	0	.	0♂	2♂	..	..	..	..	..	..	7♀	..	4♂	..	..	..	..	..	..	..
50	..	..	1♀	1♀, 2♀	1♀	..	..	..	..	..	6♀, 1♂	3♂	..	4♀, 9♀	..	..	..	..	..	..
49	1	1♀, 2♀	..	1♀, 2♀	..	..	..	.	..	..	..	..	..	8♀	..	8♀	..	..	..	..
48	..	2♀	2♀	1♀, 1♂, 2♀	0♂	2♂, 2	7	..	0	6♀	..	..	6♀	6♂	..	..	..	..	..	..
47	..	1♀, 1♀	1♂	1♀, 2♀, 3♂	0♀	1♀	..	..	..	1	..	..	..	..	..	..	..	..	..	..
46	..	3♀, 1♂	0♀, 0♀, 2♀, 2♀	1♂, 2♂, 3♂, 1♀, 2♀, 2, 3♀	2♂, 3♂	4♀, 2♀, 4♀	..	..	..	..	3, 8♀, 11♀	12	12♂, 7	9♂	..	..	..	..	..	..
45	..	2♀	1♂, 3♂	1♂, 3♂, 2♀, 2♀	..	0♂	..	..	..	6♀	4, 12♂, 13	6♀	7♀	..	..	7♀	..	..	..	..
44	..	2♂, 1♀	2♀	1♂, 2♂, 2♂, 2♂, 3♂	..	2♂, 2	..	..	..	6	8, 8, 14♀	..	7♂, 9♀	7♀	..	..	..	..	22, 16♀	..
43	..	..	1♂	1♀	1♀, 4♀	0, 4♂	..	..	..	..	..	..	5♀	4♀	7♂	..	..	..	..	23♀
42	..	..	..	2♂, 0♀, 3♀	..	2♂	..	..	..	..	4♂, 4♂	..	..	..	..	..	..	..	..	..
41	..	..	0♂	2♂	..	..	..	3·7	..	..	..	9	..	..	..	..	..	..	..	..
40	..	..	..	2♀	..	..	..	..	5♀	..	..	..	..	7♀	10♂	..	..	..	..	..
39	..	..	..	..	..	..	..	..	..	..	..	..	9♂	..	..	12♂	..	..	..	..
38	..	..	..	..	..	1♂	..	..	..	..	..	..	..	..	..	..	..	..	..	..
37	..	..	..	..	..	..	..	..	..	..	..	..	20♀	..	..	..	..	..	..	..
36	..	..	..	3♂	..	..	..	..	..	8♀	..	..	..	..	..	..	..	..	..	..

Rate of growth of 2-year-old cod (36—49 cm), liberated W. of Strømø.
August 1911.

Recaptured in	Period of growth (months)	Increment in cm			No. of specimens
		Average	Minimum	Maximum	
1911. mid September...	1/2	1·6	1	3	10
— — October ...	1 1/2	1·9	0	3	30
— November.....	2 1/2	2·0	0	4	13
1912. January	4	7	—	—	1
— February	5	3·7	—	—	1
— March	6	2·5	0	5	2
— April	7	5·4	1	8	5
— May	8	8·1	3	14	11
— June..... ...	9	9·0	6	12	3
— July.....	10	9·1	5	20	9
— August	11	6·8	4	9	6
— September	12	8·5	7	10	2
— October.....	13	9·0	7	12	3
1913. June	21	19·0	16	22	2
— September	24	23	—	—	1

than 50 cm initial size, is in the majority of cases extremely poor during the first three months, averaging only 2.0 cm from mid. August to mid. November, which is far less than that noted for instance in the experiments made the same year near Nolsø. Fig. 14 indicate, compared with Fig. 4—6; a very marked decrease in the rate of growth during autumn and winter. It will be clearly seen that only in the experiments E. of Nolsø 1911 was the rate of growth found to be so slow as here (Fig. 14). Some few specimens were found, as there, to have grown

abt. 4 cm, but the great majority showed an increase of only about 2 cm by the end of November. For the months immediately following, the material for growth determinations is somewhat scanty; not until April (1912) can we resume the study of their further progress. The great majority continued to grow but poorly, the average growth for the whole year (August to August) being less than 10 cm; a number of individuals now commence, however, as in the autumn months, to grow more rapidly, one fish showing an increment of 20 cm in 10 months. Three recaptures made after 22 and 25 months, however show that these fish had, in the course of about two years, grown no more than the specimen just mentioned had in one.

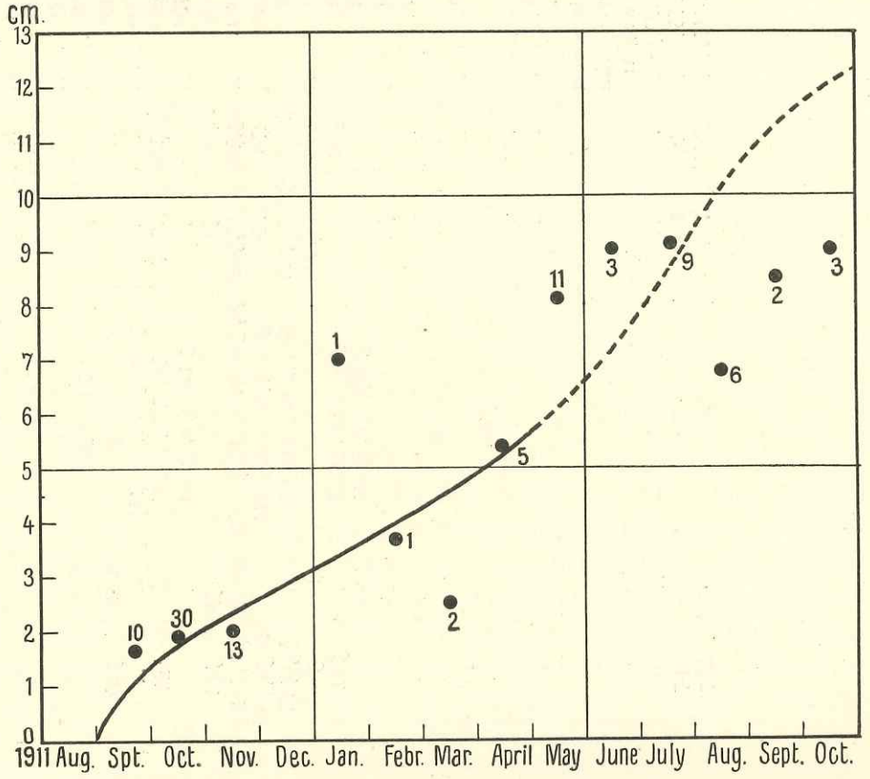

Fig. 14. Rate of Growth of 35—50 cm lange cod liberated West of Strømø August 1911. The spot indicate averages of growth the figures number of specimens measured.

The records of weight — they are remarkably few — of recaptured fish from these experiments further illustrate the poor growth noted above, especially during the first three months. The highest increment recorded is in most cases of 750—950 gr fish thus < 150 gr during October and November. Not until after the lapse of 9 months, — in May 1912, — had some few especially well-grown fish attained twice their initial weight (900 + 830), while in July, we find a single specimen which has trebled its original figure (650 + 1225 flr.) Even as late as September—October (1912) however, the weight in most of the recaptured fish is only about doubled.

Table showing rate of growth of larger cod (50—60 cm), liberated W. of Strømø. August 1911.

Recaptured in	Period of growth (months)	Increment in cm			No. of specimens
		Average	Minimum	Maximum	
1911. mid October	ca. $1^1/_2$	1·1	0	2	10
— — November	ca. $2^1/_2$	2·0	—	—	1
1912. March	6	5·7	5	6	3
— May	8	6·0	1	10	5
— June	9	3·0	—	—	1
— July	10	5·0	4	8	4
— August	11	6·5	4	9	2
— November	14	3·0	—	—	1
1913. May	20	3·0 *)	—	—	1

*) Initial size: 65 cm.

The fish of 51—60 cm initial size exhibit also here (*vide* Table) an even slower rate of growth than the Nolsø Fjord group. The measurements from May 1912 and those for July of the same year show an increment of about 3—4 cm less in the case of the recaptured fish of the first size-group, than in that of the younger

Table showing weight increment in gr of marked fish between liberation and recovery. West of Strømø. Experim. August 1911.

Initial weight in gr	Recaptured in 1911					Recaptured in 1912										Recaptured in 1913		
	Septb.	October			Novbr.	January	March	April	May	June	July	August	Septbr.	October	Novbr.	May	June	Septbr.
	21-30	1-10	11-20	21-30	11-20													
2800	..	..	..	..	..	..	..	..	..	..	♀ 290	..	..	..	..	♂ 0	..	..
2250	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2000—2200	♂ 0	..	♀ 0, ♀ 0, ♀ 0	..	..	..	..	..	..	..	♀ 25	..	..	..	♀ 360	..	..	..
1700—1900	..	..	♀ 0	..	..	..	350	..	♂ 400	..	..	..	..	..	..	..	..	..
1500—1690	..	♂ 0	♀ 0, ♂ 250	..	..	..	..	..	♀ 440	..	♂ 430	..	..	..	..	..	..	..
1400—1490	..	..	♂ 200	♀0,♀215	♂ 50	..	..	..	♀ 410	..	♂ 165	♀280, ♀320	..	♀ 615	..	..	..	..
1300—1390	♀ 0	..	♂ 100, ♂ 0, ♀ 10, ♀ 15	..	..	..	..	..	..	..	..	♂425, ♀650	..	..	..	..	..	..
1200—1290	♀0♀,50	♀ 0, ♀ 170	♀ 0, ♀ 75, ♀ 135	..	25	..	..	..	..	..	♀ 410	..	..	..	..	..	..	..
1150—1190	..	..	♂ 110, ♀ 0, ♀ 110	..	..	c.450	..	♀ 350	..	..	300	♂ 550	..	..	..	..	..	..
1100—1140	♀ 40	♂ 0	♀ 0	♂0, ♂40	♂ 65	..	..	..	..	635	..	..	..	..	..	..	..	..
1050—1090	0♂,♀85	♀0,♀15,♂150	♂0, ♂15, ♂115, ♀15, ♀75, ♀90	♂160,♀0	♀50,♀160	..	..	..	50	..	..	..	..	..	..	..	c. 1550	..
1000—1040	♀ 0	♀ 165	♂ 0, ♂ 25, ♀ 55, ♀ 145	..	♀0,♂0,♀80	..	..	..	♀ 385	..	♂ 1200,♀ 390	..	..	♀ 475	..	..	..	..
950—990	♀0,♀15	♀ 195, ♂ 55	♂ 0, ♂ 50, ♂ 100, ♂ 150	..	50, ♂ 75	..	..	..	..	♀ 250	♂ 450, ♀ 400	♀ 375	..	..	..	..	..	..
900—940	..	♂ 5, ♀ 40	..	♀ 0	♂ 0	..	..	♀ 225	♂ 650, ♀ 840	..	♀ 30	♀ 160	..	..	..	..	..	..
850—890	♂ 50	..	♂ 0, ♂ 110, ♀ 135	..	♂ 110	..	..	..	♂ 100	..	..	..	♂ 675	..	..	..	♀ 1375	♀ 2550
800—840	..	..	♂ 165, ♀ 0, ♀ 100	♀ 100	..	..	..	c. 425	..	..	..	..	♂ 350	..	..	..	..	..
750—790	..	♂ 0	..	..	..	..	..	..	..	..	..	♀ 365	..	..	..	..	..	..
700—740	..	..	..	..	..	..	..	..	..	..	..	..	..	♂ 630	..	..	..	..
	..	..	♀ 125	..	..	..	♀ 225	..	..	..	..	..	..	..	..	..	..	..
600—690	..	..	..	..	♂ 0	..	..	..	..	..	♂ 340	..	..	..	..	..	..	..
	..	..	♂ 50	..	..	..	..	..	..	..	♀ 1225	..	..	..	..	..	..	..
500—540	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
450—490	..	..	..	..	..	..	..	♀ 300	..	..	..	..	..	..	..	..	..	..
Average increment (in gr) for cod with initial weight:																		
1) 450—690 gr	..	..	7·5	..	0	..	..	300	..	..	(·783)	..	..	(630)	..	..	..	..
2) 700—975	(21·7)	59·0	79·5	50·0	61·7	..	..	325	530	250	293·3	300	(513)	..	..	..	(1375)	(2550)
3) 1000—1475	25·0	71·4	58·6	68·8	53·7	..	..	..	321·3	..	482·5	445	..	545	..	..	(1550)	..

fish. A single specimen of still larger size had, by May 1913, only increased its initial size of 65 cm by 3 cm. The values for weight increment are, as the few records shows, similarly low, being even in May—July often less than half the initial weight of 1000—2000 gr.

Table showing growth in cm of liberated cod. Experiments West of Strømø. July 1912.

Initial size in cm	Recaptured in 1912—13													
	August		September		November		Decbr.	January	May	June	July	Septbr.	October	December
	1-10	11-31	11-20	21-30	1-10	11-20	21-31							
34—40	1 ♂, 1 ♀	..	..	..	..	..	..	9	..	20 ♀	..	13 ♀	..	..
41—50	..	2 ♂	2♀, 2♀, 3♂	..	5 ♂	9·6	7 ♀, 7 ♀	..	7 ♂	..	11	5 ♀*)	20 ♂	19
51—59	0 ♀	..	..	4 ♀	..	..	..	..	..	13	.	8 ♂	..	..
68	0 ♀	..	..	..	..	..	..	..	..	..	..	..	..	..

*) init. size 50 cm.

The 1912 Experiments.

The tables below and above show the few data furnished by the 1912 experiments with regard to growth, among the fish of less than 50 cm initial size. Despite the paucity of the records, they still suffice to suggest a somewhat better growth by November—December that that noted in the 1911 experiments, a length increment of 9.6 cm (November) being here attained after the lapse of only 4 months from time of liberation, in the middle of July. It must of course be remembered, that the experiment in 1912 commenced in the middle of July; that of 1911 not until the end of August. But even if this is considered, there remains a difference in the rate of growth corresponding to that found in the Nolsø experiments. This is here, it is true, a maximal value, but in the experiments of the previous year, this figure is not reached until very considerably later, by some of the best grown specimens. The length increment of the remainder chiefly corresponds to that of the best grown fish in the 1911 experiments and is thus above the average for these. The only two accurately measured larger fish (50—60 cm) recaptured after any considerable length of time (resp. 11 and 14 months) were found to have grown 13 and 8 cm during that period, which is also far more than the majority in the 1911 experiments. This is all that can be said from the material available.

The increment of weight is naturally also in the majority of cases greater than in 1911.

Table showing increment in weight of liberated cod. Experiments West of Strømø. July 1912.

Initial weight in gr	Recaptured in 1912—1913											
	August		September		Novbr.	December	January	May	June	Septbr.	October	December
	1-10	21-31	11-20	21-30	1-10	21-30						
370—700	♀ 25, ♂ 50	..	..	♀ 425	..	..	ca. 730	♂ 300	♀ 1575	♀ ca. 800	..	..
725—1000	..	♂ 160	♀ 220, ♂ 155	..	♂ 520	♀ 375, ♀ 450	..	..	..	..	..	ca. 1800
1100—1750	♀ 40	..	♂ 160	..	..	..	..	..	ca. 1400	♀ 750, ♂ 600	♂ 1900	..

The smallest sizes among the recaptured fish had in one case doubled the initial weight in the first six months, and in another, quadrupled the same in the course of 11 months only. (550 + 1575 gr.) We find nothing corresponding to this among the fish marked in 1911; similar cases may however, be found among the material from Nolsø Fjord and elsewhere for 1912. Among the larger fish

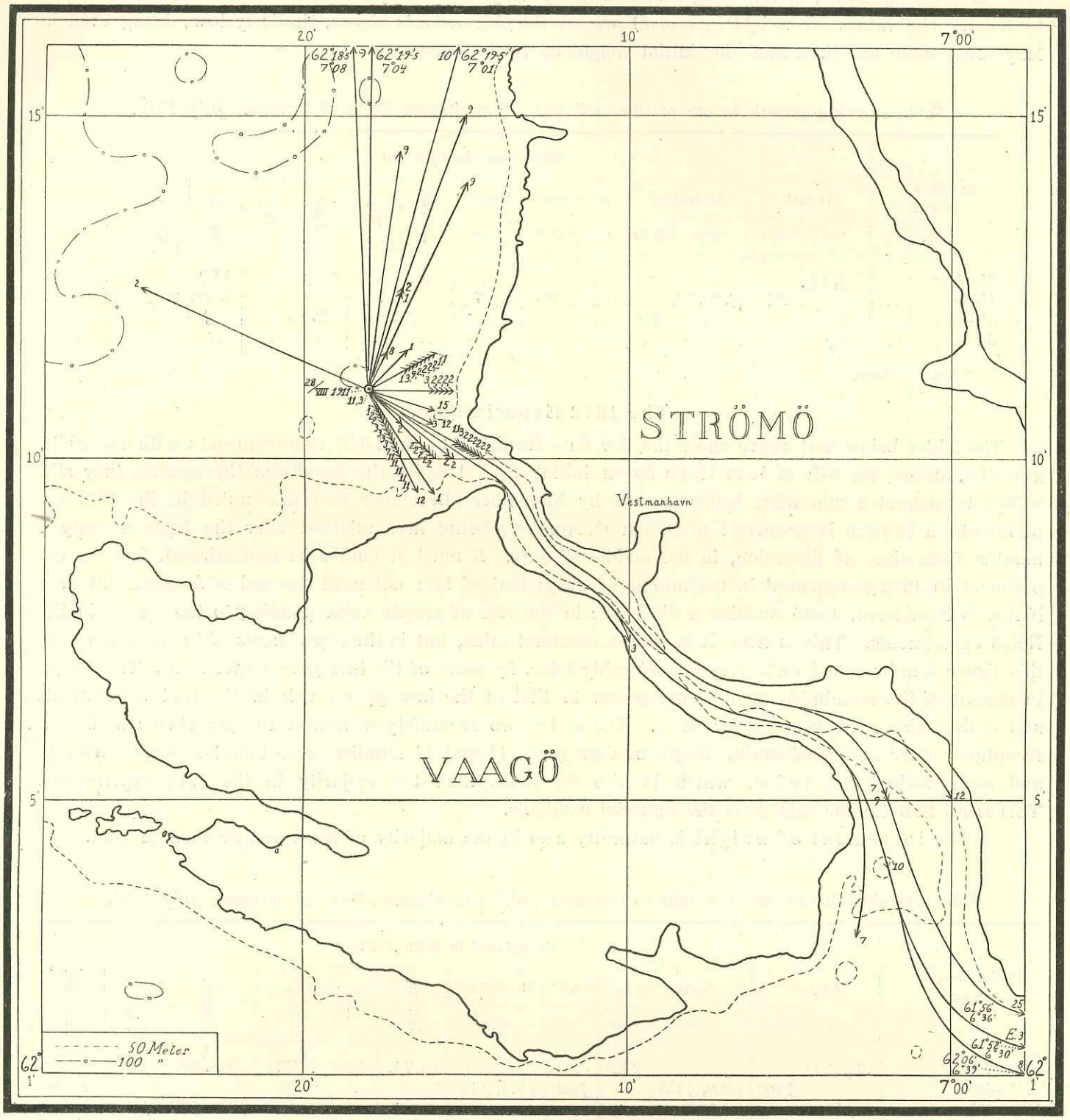

Fig. 15. Marking Experiment with cod. West of Strømø. August 1911. Experiment B_2.

the one mentioned above as from June 1913 had approximately doubled their initial weight in 11 months while in another specimen recaptured in October it was nearly trebled (1100 + 2000 gr) in 15 months.

Others again correspond well as to the values found in 1911—12.

5. Migrations.

Fig. 15 shows the movements of the fish marked and recaptured in Exp. B_2. Of the 70 specimens recaptured, 57 were retaken within 5 miles from the place of liberation. Only 3 had moved about 9 miles farther to the north, where they were taken 9—10 months later, six were taken 3—12 months after marking, in Vestmansund, some even in the eastern part of same, and finally, three were recorded as taken E. of Nolsø after a lapse of 3, 8 and 25 months respectively. The distance covered by the last-named amounts to at least 40 miles, (reckoned as *via* Vestmansund-Skopen Fjord); it is however, insignificant when compared with the length of time which had elapsed since liberation.

The remaining experiments in this group, (not illustrated) exhibit even more stationary conditions, only 4 of the 85 fish recaptured in the Exp. A_2 & C_2 having moved outside the area N. of Vaagø and W. of Strømø. One of these was taken at Svinø, two W. of Sandø and in Skopen Fjord respectively, and the fourth in the northern entrance to the Nolsø Fjord, but S. of Østerø, after the lapse of 8, 7, 22 and 9 months respectively. The 1912 experiments give similar stationary conditions, only one cod has in 6 months moved as far as West of Sandø, and one in 11 months to the north side of the islands; both were 2-year old cod at liberation. The remaining 24 recorded were retaken only 1—2 miles from the place of liberation.

No recaptures are reported S. of Sandø; the relatively few which move at all keep to the northern group of islands. As usual, we find younger and older fish migrating irrespective of size.

Taking only those fish recaptured 12 months or more after liberation, these are found for the most part to have remained equally stationary; thus of five recaptures made after the lapse of over 20 months, only one was taken as far away as Nolsø, the remainder still keeping to the west of Strømø; two of them, moreover, not 2 miles from the spot where they were marked. One of these two last mentioned was 65 cm the four others 43—44 cm at time of liberation. Later on the dispersal of the stock, combined with other features affecting the number of recaptures, has put an end to the experiment.

Table showing number of stationary and migrating cod recaptured in the experiments West of Strømø. 1911 & 12.

Distance between place of liberation and recovery	Initial sizes in cm	No. of months since liberation	
		12—18	19—25
< 5 miles	35—49	11	1
	50—59	4	..
	60—69	..	1
≦ 10 miles	50—59	1	..
	60—69	1	..
> 10 miles	35—49	2	3

Table showing no. of recaptures made by Færoe and foreign fishing vessels. Marking Experiments with cod. W. of Strømø 1911—12.

	Færoe fishing boat, registered in												English	Scottish
	Slettenæs	Vestmanhavn	Kvivig	Ejde	Haldorsvig	Tjørnevig	Gjov	Hestø	Kalbak	Tofte	Thorshavn	loc. unknown	Steam Trawlers	Steam Trawlers
1911	5	124	8	2	..	..	1	2	1	1	1	2	8	..
1912	..	17	..	1	1	1	..	..	..	..	..	..	7	1
Total no. recaptured..	5	141	8	3	1	1	1	2	1	1	1	2	15	1

	Færoe	English	Scottish
Total...	167	15	1

6. Nationality of the fishermen.

The table above shows, like the chart on which the recaptures are located, the very slight degree of movement made by the stock during the period of experiment. Almost all the fish retaken were brought in by boats from the nearest fishing villages. The percentage taken by British vessels is somewhat higher (8 %) than in the case of the Nolsø group. This must be partly due to the position of more places of liberation close to the western grounds, so frequented by the foreign trawlers.

III a. The Markings in Myggenæsfjord.

On the 19th and 22nd July 1912, 117 cod were marked and liberated N. of Myggenæsholm (*vide* Table p. 42) these being for the most part fish of 40—60 m, The lengths of the marked fish are stated below:

Initial size in cm	30—39	40—49	50—59	60—69	70—72	83
No. of cod liberated	10	47	44	12	3	1

The records of weight show an average per fish of between abt. 550 and abt. 2100 gr., corresponding to 40 and 60 cm length respectively.

In the course of the following 18 months, 19 cod in all were recaptured, or about 16.2 % of the total number marked. This agrees with the results of two of the 1912 experiments made some 10 miles farther to the north and east, (*vide* Exp. F_2 and G_2 (Fig. 13 & p. 43)).

Of the recaptures made during these 18 months, over half fall to the first 5. All the fish recaptured were of less than 60 cm initial size, exc. one of 60 cm int. size.

Table showing no. of fish recaptured from the experiments in the Myggenæsfjord. July 1912.

Experiment No.	Date	No. of fish marked	No. of months between liberation and recapture											Total recaptured	% recaptured
			2	4	5	6	7	9	11	12	13	16	18		
III a	1912 July 19 & 22	117	6	2	2	1	1	1	2	1	1	1	1	19	16·2

The very few recaptures made more than 6 months after liberation give, despite their insignificant number, growth values closely corresponding to those already mentioned. The following table shows the growth increments for all such fish as appeared to have been accurately measured.

Table showing growth in cm of liberated cod. Experiments in Myggenæsfjord. July 1912.

Initial size in cm	Recaptured in 1912—1913—1914								
	September	November	December	February	June	July	August	November	January
30—39	..	..	4 ♀	..	..	..	..	..	..
40—49	1·2 ♀, 2·1 ♂	..	..	..	..	..	17 ♀	..	30
50—58	2·1 ♂	9·5	9·5	9	18·4 *)	..	..	..	..
59—60	1·2 ♀	..	..	..	..	11	..	15 ♀	..

*) Initial size 50 cm.

The best grown fish, here likewise of less than 50 cm initial size, add some 17—19 cm to tha figure during the twelvemonth, and 30 cm in the course of one and a half periods (18 months) the weights being trebled in the first case and quadrupled in the second. Of older fish (3—4 years) we have but two certain records, viz. one of 59 and one of 60 cm initial size, captured after the lapse of 12 and 16 months respectively. Here likewise these appear to have had an annual growth equal to about half that of the two-years-olds. The marked decrease in the number of fish recaptured after January (1913) combined with the fact that the stock here consists of two- and three-year-olds in equal numbers, is evidently due to dispersal of the fish among localities even less intensely fished than the fjord. On the 19 fish recaptured, 15 were taken on the western or north-western side of Myggenæs, one on the eastern side of Vaagø after the lapse of 18 months, while the two found farthest away had in eleven and twelve months only travelled about 25 miles to N. of Østerø and off Fuglø.

Table showing magnitude of weight increment in gr of liberated cod. Experiments in Myggenæsfjord. July 1912.

Initial weight in gr	Recaptured in 1912—1913—1914						
	September	November	December	February	August	November	January
500—700	..	..	ca. 100	..	..	..	..
725—1000	..	..	..	..	ca. 1000	..	ca. 3000
1050—1500	150, 200	600	ca. 800	..	..	..	..
1550—2050	300	..	..	ca. 1000	..	ca. 2150	..

Table showing no. of recaptures made by Færoe and foreign fishing vessels. Experiments in Myggenæsfjord. July 1912.

Færoe fishing boat, registered in				English Steam-Trawlers	Scottish Steam-Trawlers
Sørvaag	Vestmanhavn	Kvivig	Eide		
10	1	1	1	5	1

	Færoe	English	Scottish
Total no. recaptured ..	13	5	1

From the places of origin of the vessels concerned, we see how great a portion of the fishery in the fjord falls to the boats from Sørvaag. The comparatively large number of recaptures made by foreign vessels (abt. 32 %) is explained by the proximity of the place of liberation to the highly frequented fishing grounds W. and NW. of Myggenæs (depth abt. 100—150 m).

III b. Markings NW of Myling.

Despite the small number of fish marked here, the experiment is nevertheless of some value, and may therefore be briefly referred to (for position etc. *vide* p. 42).

On the 13th June 1912, 20 cod of 50—82 cm were marked and liberated some 20 miles NW of the northern end of Strømø, in 125 m of water.

Initial size in cm	50—58	60—64	65—69	70—79	80	82
No. of cod liberated	3	6	4	5	1	1

The weights corresponded to the lengths, ranging from 1500 to 5550 gr.

This is thus one of the very few experiments where sizes less than 50 cm do not occur at all.

The nearest approach to it in this respect is found in the markings from the Sandø and Færoe banks (*q. v.*) where these younger fish are found, it is true, though but in small numbers.

Only three specimens were recaptured, after a lapse of 3, 10 and 13 months respectively. This corresponds to but 15 % of the total number, a figure similar to that found for the recaptures made on the Færoe Bank and in some of the 1912 experiments W. of Strømø and in Myggenæsfjord above referred to, albeit the stock in both these places was of a different composition.

The growth of the three recaptured fish was found to be:

Initial size 65 cm grown in 3 months 4.9 cm.
— 63 - — 10 — 10.2 -
— 61 - — 13 — 10.0 -

i. e. an increment of abt. 10 cm in the course of a whole growth period for fish presumably 3 (?4) years old at time of liberation. This is confirmed by the results of the Myggenæsfjord and other experiments.

For the sake of completeness it may be added that all three were retaken east of the place of liberation, and within 20 miles of same, one being brought in by a Færoe fisherman, the other two by Scottish steam trawlers.

III c. Experiment in Vestmanhavn.

This small experiment should be mentioned here. On the 19th and 20th of May 1910 seven cod, 43—52 cm long, were caught and liberated from the "Thor", anchored in Vestmanhavn. Four of these were retaken 3, 5, 6 and 12 months later respectively; the first two in the fjord itself, the two later just outside it, at the entrance to Vestmansund.

The growth apparently amounts to abt. 1 cm average pr. month as far as can be judged from the few, uncertain measurements. All the catches were made by fishermen from Vestmanhavn.

IV. Markings S. and E. of Lille Dimon.

1. Locality and Date.

Early in September 1911, 230 cod were marked at three different localities near Lille Dimon.

Table showing marking experiments S. & E. of Lille Dimon 1911.

No. of Experiments	Year and month	No. of cod liberated	No. of cod recaptured	Locality of liberation	Central position (approximately)		Depth in metres
					N. Lat.	W. Long	
A_3	1911. Septbr. 7	70	16	3·5 miles E by S of Lille Dimon	61° 39′	6° 34′	50
B_3	— — 8	78	15	5 miles S by E ¾ E of - -	61° 34′	6° 35′	50
C_3	— — 9	82	14	6·5 miles ESE of - -	61° 38′	6° 27′	50
	Total...	230	45				

These three localities are so closely adjacent one to the other, and the stock of cod is of so uniform composition, that the three experiments may in the following be taken together as one.

2. Size of the marked fish.

Initial size in cm	38—49	50	51—59	60—69	70—79	82
No. of cod liberated	97	3	72	46	11	1

The measurements show (*vide* Table) that the catch here differs essentially in point of composition from that of most of the experiments previously described. The sizes under 50 cm are no longer found to predominate; on the contrary, over half the total number of fish marked were between 50—70 cm long; one-fourth, moreover, being over 60 cm. In this respect the present markings resemble those made in Myggenæsfjord (Exp. III a) and W. of Sandø (Exp. VII) (see p. 77).

3. No. of recaptures.

The number of recaptures is here, as in the case of the experiments just referred to, comparatively low, amounting to but 45 out of 230, or only 19.6 %. Of these, 38 were taken during the first seven months

Table showing no. of fish recaptured from the experiments S. and E. of Lille Dimon. Septbr. 1911.

Experiment No.	Date	No. of fish marked	No. of months between liberation and recapture													Total recaptured	% recaptured
			1	2	3	4	5	6	7	8	9	10	11	12	ca. 20		
A_3	1911. Sept. 7	70	7	1	1	1	..	3	1	..	1	..	..	..	1	16	22·9
B_3	- - 8	78	6	1	1	1	2	..	2	1	..	..	..	1	..	15	19·2
C_3	- - 9	82	4	3	..	..	..	2	2	..	..	1	1	..	1	14	17·1
	Total...	230	17	5	2	2	2	5	5	1	1	1	1	1	2	45	19·6

after liberation, and 5 from 1 to 12 months later. Comparatively more of the larger fish are retaken, thus abt. 24—28 % of the cod 50—82 cm long as against only 10 % of smaller ones (< 50 cm). — These experiments, like those in the Myggenæsfjord, thus show that the young cod in the said places are fished for less intensively than for instance in Nolsø waters.

4. Growth.

The measurements of recaptured fish from these experiments are unfortunately very far from reliable, especially those from the first months. The following table includes such information as is furnished by the reliable measurements only.

Table showing growth in cm of liberated cod. Experiments S. and E. of Lille Dimon. Sept. 1911.

Initial sizes in cm	Recaptured in 1911—12								
	November	December	January	March	April	May	July	August	September
46—50	1 ♂	3 ♀	..	3 ♂, 3 ♀	..	..	..	..	9·5
51—59	1 ♂, 1 ♂, 0 ♂	..	..	0 ♂, 3	1 ♀, 4, 5 ♀	1	4	..	..
60—66	2 ♀	4 ♀	1	4	2	..	..	8·5	..

The growth of the youngest fish from September—February is very poor, as is also that of the only fish recaptured after the expiration of a whole growth period (9.5). The larger fish have at any rate during the first 10 months grown but poorly on an average; abt. 3.3 cm from September to end of March (1912). In other words, we find here the same slow rate of growth as in the fish marked near Nolsø in 1911. Further experiments must show whether this here is to be regarded as a constant phenomenon, or if, as in the experiments referred to, it is dependent upon varying external conditions.

The few accurate records of weight available present the same appearance as the measurements; we find fish having an initial weight of 1000 and 1300 gr. which had added but 100 and 300 gr. respect-

ively by April 1912, while one of 1000 initial weight exhibited an increment of only abt. 700 gr. in the course of a whole growth period; this likewise agrees with the results of the other experiments in the same year.

5. Migrations.

During the first six months after marking, 33 specimens were retaken, 30 quite near the place of liberation (within 7 miles) whereas of the 10 recaptures subsequently reported 7 were made at some considerable distance out. Thus 4 were taken N. of Norderøerne, 1 W. of Sandø, and 1 E. of Fuglø (*vide* lists); of the 13 immigrated specimens 12 were on liberation 50—70 cm long. In other words, the records here serve to confirm the results arrived at in several of the Nolsø experiments as to the extensive migrations made by the 3 (4) year-old cod. The fish do not appear to follow any regular course, though dispersal of the stock in a northerly direction will be seen to have taken place in several cases.

6. Nationality of the fishermen.

A remarkable feature is the fact that only one foreign boat made a recapture despite the relatively considerable degree of migration. This may be explained by the suggestion that the fish, migrating for

Table showing no. of recaptures made by Færoe and foreign fishing vessels.
Experiments S. and E. of Lille Dimon. Sept. 1911.

Færoe fishing boat registered in																Scottish Steam Trawler
Suderø					Sandø		Strømø		Østerø		The northern Færoes					
Trangisvaag	Tveraa	Frodebø	Vaag	port-unknown	Sand	Skarvenæs	Syderdal	Kollefjord	Risen	Giov	Mulen	Skard	Fuglø	Hattervig	Svinø	
7	19	1	3	2	1	1	1	2	1	1	1	1	1	1	1	1

	Færoes	Scottish
Total No. recaptured	44	1

the most part during the spring and summer following liberation would, in their wanderings north and west, for the most part hardly be able to escape beyond the territorial waters during that period within which recaptures might reasonably be expected to be made.

It will be seen, from the distribution of the recaptures given above, that the majority were made by fishermen from places close to the grounds about Store and Lille Dimon.

V a. & V. Markings E. and S. of Suderø.

1. Locality and Date.

The only marking experiments made from Suderø were carried out partly at Munken and partly east of Porkere Næs during 1909 and 1910, with 330 and 43 fish respectively.

The particulars will be seen from the following table:

Table showing cod marking experiments E. and S. of Suderø. 1909 & 10.

No. of Experiments	Year and Date	No. of cod liberated	No. of cod recaptured	Locality	Central position (approximately) N. Lat.	Central position (approximately) W. Long	Depth in metres
A_4	1909. August 21	43	19	2 miles E. of Porkere Næs	61° 30′	6° 37′	65
B_4	— — 23	157	63	S. of Munken	61° 20′	6° 39′	90
C_4	1010. May 10	173	62	Near Munken	61° 20′	6° 39·5′	c. 50—90
	Total...	373	144				

2. Size of the fish marked.

Of the fish marked, over half were under 50 cm; i. e. presumably two-year-olds. The upper limit for the II group cannot be fixed from the material available from these experiments; it will however

Table showing number and size of cod liberated E. and S. of Suderø. 1909—10.

No. of Experiments	Initial sizes in cm 36—39	40—49	50—54	55—59	60—64	65—69	70—79	80—89	90—115	Total
A_4	5	26	5	6	1	..	..	..	..	43
B_4	1	84	28	15	9	2	4	6	8	157
C_4	17	90	44	11	5	1	2	2	1	173
Total...	23	200	77	32	15	3	6	8	9	373

naturally differ for the two years, being higher in 1909 (Septr.) and lower in 1910 (May). A not inconsiderable number were however, especially in 1910, between 50—54—59 cm; i. e. three years old and upwards. Larger sizes were also represented, though but sparsely (*vide* table).

3. No. of recaptures.

The percentage of recaptures was about the same in all three experiments, viz; from abt. 36 to to abt. 44 %. As regards distribution of the recaptures throughout the months following liberation, it

Table showing no. of fish recaptured from the Experiments E. and S. of Suderø. 1909 & 1910.

Experiment No.	Date	Total number of cod marked	No. of months between liberation and recapture 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	?	Total number recapt.	Percentage of recapt.
A_4	1909. Aug 21.	43	..	..	3	5	2	..	..	..	..	..	1	1	..	..	4	1	1	..	..	..	..	..	1	..	..	19	44·2
B_4	— — 23.	157	..	2	..	11	..	..	5	8	12	4	2	7	..	..	2	1	..	..	1	5	..	..	..	3	..	63	40·1
C_4	1910. May 10.	173	1	2	13	1	3	18	1	..	1	..	9	3	..	..	4	4	..	..	..	..	..	..	..	1	1	62	35·8
	Total...	373	1	4	16	17	5	18	6	8	13	4	12	11	..	..	10	6	1	..	1	5	..	..	1	4	1	144	38·6

will suffice to mention that over half were made in 1910 within 6 months of marking; in 1909, the same proportion was recaptured during the second half year after marking, none, however, during the first

six months. This is presumably due to the fact that the grounds in question are situated in a difficult water, which in winter does not — or at any rate did not during the winter in question — offer may "fishing days". It was otherwise with the 1910 experiment, which was commenced at the beginning of May. Some few were taken during the following 12 months, none, however, more than 23 months after liberation. As in the Nolsø and Strømø experiments, different size groups are tolerably equally represented in the recaptures.

4. Growth.

Unfortunately, most of the measurements of recaptured fish from these experiments are quite useless. Only those noted in cm have been included here, the remainder being rejected. Some of these were evidently unreliable, others appeared reliable enough, but we have nevertheless preferred to disregard them as a whole. The few thus remaining give the following results:

Table showing growth in cm of cod liberated S. of Suderø
August 1909.

Initial sizes	Recaptured in 1909—1910—1911				
	November	February	July	November	July
41—46	3	..	..	19	23, 27·5
50, 57.....	..	2.1	9	..	..

May 1910.

Initial sizes in cm	Recaptured in						
	1910			1911			1912
	July	October	November	March	July	August	April
36, 37	..	..	11·5	..	22·5	..	..
41—46.....	3·5, 4	7	..	9	..	18	32
50, 51	..	..	..	..	12, 16	..	..

These few data thus show, in the case of the 1909 experiment, a comparatively slow growth for the two-year-old fish, averaging about 1—1.3 cm per month for more than a whole growth period, whereas the corresponding values for the 1910 experiment frequently amount to about 2 cm (2.0—1.8—1.6). This agrees fairly well with the rate of growth as found in several of the preceding experiments. The best grown fish exhibit an increment of 27 and 32 cm in about two years (23 months); nothing can be said however, as to the rate of growth within the separate portions of this period. The few specimens of about 50 cm initial size (?three-year-olds) show increments of about 1 cm or less average per month. The growth of the specimen recaptured in February 1910 (Exp. B_4) is seen to be particularly poor; this fish had, however, only been in the water during the autumn and winter months since liberation.

As regards increment of weight, nothing definite can be said.

5. Migrations.

In the experiments made at Munken, the stock was found to remain stationary for the first 12 months after liberation, as was also the case E. of Porkere. During the following year over half the recaptured fish were still found within about 2—3 miles of the spot.

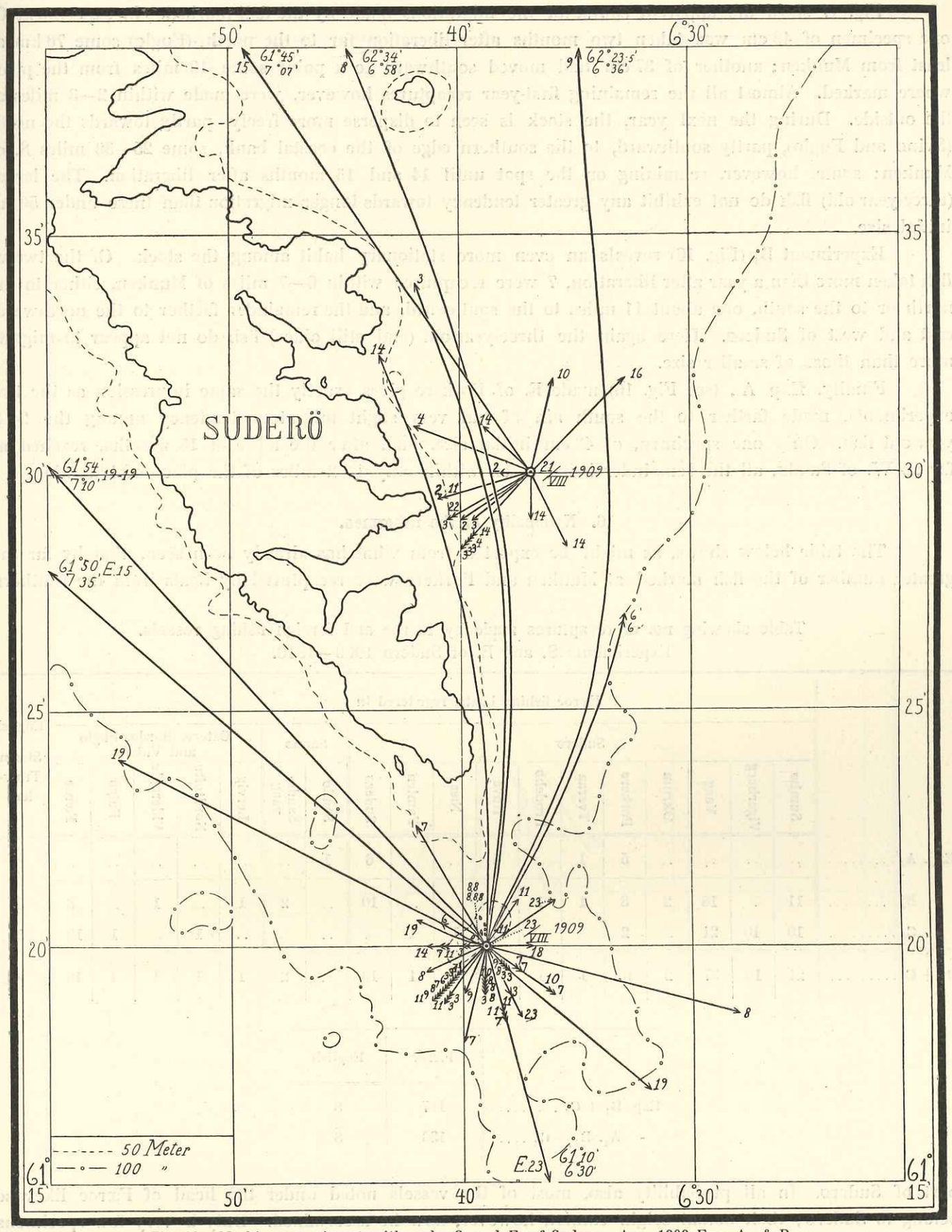

Fig. 16. Marking experiment with cod. S. and E. of Suderø. Aug. 1909 Exp. A_4 & B_4.

Fig. 17 show the apparent course of the migrations made by the fish marked. In experiment C_4 one specimen of 43 cm was taken two months after liberation far to the north, (Fuglø) some 70 km at least from Munken; another of 37 cm had moved southward to a point some 10 miles from the place where marked. Almost all the remaining first-year recaptures however, were made within 2—3 miles at the outside. During the next year, the stock is seen to disperse more freely, partly towards the north (Svinø and Fuglø), partly southward, to the southern edge of the coastal bank, some 25—30 miles S. of Munken; some, however, remaining on the spot until 14 and 15 months after liberation. The larger (three-year-old) fish do not exhibit any greater tendency towards longer migration than these under 50 cm initial size.

Experiment B_4 (Fig. 16) reveals an even more stationary habit among the stock. Of the twelve fish taken more than a year after liberation, 7 were recaptured within 6—7 miles of Munken, either to the north or to the south, one about 11 miles to the southward, and the remainder farther to the northward, east and west of Suderø. Here again the three-year-old (and still older) fish do not appear to migrate more than those of smaller size.

Finally, Exp. A_4, (see Fig. 16) made E. of Porkere gives exactly the same impression as the two experiments, made farther to the south *viz.* of but very slight migratory tendency among the 2—3 year-old fish. Only one specimen, of 42 cm initial size, had, after the lapse of 15 months, reached as far as W. of Sandø, all the remainder being taken within only 1—2 miles of the place of liberation.

6. Nationality of the fishermen.

The table below shows, as might be expected from what has already been seen, that by far the greater number of the fish marked at Munken and Porkere were recaptured by boats from the southern

Table showing no. of recaptures made by Færoe and foreign fishing vessels.
Experiments S. and E. of Suderø 1909—1910.

	Færoe fishing boats, registered in																		English Steam Trawlers
	Suderø											Sandø		Østerø, Bordø, Fuglø and Viderø					
	Sumbø	Vigerberg	Vaag	Økrum	Porkere	Tveraa	Frodebø	Hove	Næs	Famien	Suderø	Sandø	Sande-vaag	Lervig	Nordtofte	Viderejde	Fulgø	Færoe	
Exp. A_4	..	..	..	..	5	1	..	6	..	..	6	1	..	..	..	..	..	..	
- B_4	11	..	16	2	8	1	1	..	..	..	10	..	2	1	..	1	..	8	3
- C_4	10	10	21	..	2	..	.	..	1	1	..	..	..	..	1	..	1	10	5
$B_4 + C_4$	21	10	37	2	10	1	1	..	1	1	10	..	2	1	1	1	1	18	8

	Færoe	English
Exp. $B_4 + C_4$	117	8
- A_4, $B_4 + C_4$	136	8

part of Suderø. In all probability also, most of the vessels noted under the head of Færoe likewise belong to Suderø; their actual origin cannot, however, now be ascertained. Only a very few specimens

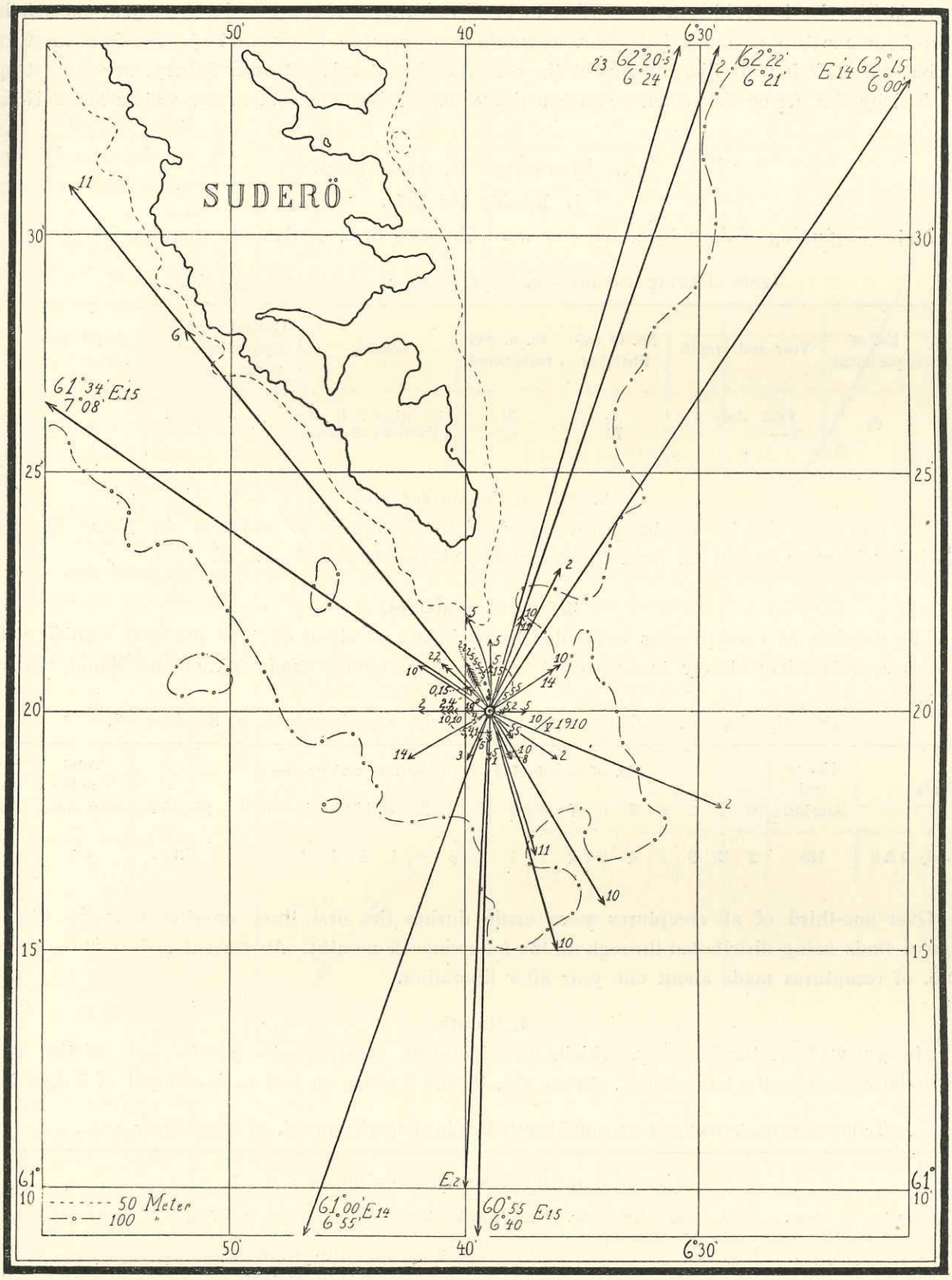

Fig. 17. Marking experiment with cod. S. of Suderø. May 1910, Exp. C_4.

were brought in by boats from Sandø and the northern islands. The part played by the foreign (English) craft here is likewise insignificant, amounting to barely abt. 2 % of the growing 2—3 year-old fish in the course of from one to one and a half year. It would thus seem, as far as can be judged from these experiments, that the stock here is likewise out of the reach of the intensive steamer fishery, nor does it appear to be fished by the Færoe fishermen to such a degree as for instance that of the waters about Nolsø.

VI. Markings E. of Sandø.

1. Locality and Date.

At the beginning of July 1912, 168 cod were liberated S. E. of Kvalnæs (Sandø).

Table showing cod marking experiment E. of Sandø July 1912.

No. of Experiment	Year and month	No. of cod liberated	No. of cod recaptured	Locality	Central Position (approximately) N. Lat. W. Long.	Depth in metres
VI	1912 July 5 — - 6	98 70	34 32	1.5 miles S. E. of Kvalnæs (Sandø)	61° 51′ 6° 38′	50

2. Size of the marked fish.

The fish were for by far the greater part of the same size as those of the Nolsø Fjord-group only 24 being between 50—61 cm long, the remainder (144) between 31—49 cm.

3. No. of recaptures.

The number of recaptures amounted to 66 in all, or about 40 % of the total number marked, which corresponds fairly closely to the results of the experiments made W. of the island (abt. 30 % *vide infra*).

Table showing no. of fish recaptured from the experiments E. of Sandø 1912.

Date	No. of cod marked	No. of months between liberation and recovery																		Total number recaptured	% recaptured
		0	1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	25—27?	
1912 July 5 & 6	168	2	13	9	2	4	2	4	1	1	2	6	8	1	4	1	1	1	1	3	66	39.3

Over one-third of all recaptures were made during the first three months after liberation, the subsequent finds being distributed throughout the following 16 months. An unsual feature is the relatively large no. of recaptures made about one year after liberation.

4. Growth.

The growth of the II group, which, as mentioned, composed the greater part of the material here, will be seen from the table below. From Fig. 18 and Tables we find an increment of length for the

Table showing growth in cm. of liberated cod. Experiments E. of Sandø July 1912.

Initial size in cm	Recaptured in 1912—1913															
	August	Sept.	Nov.	Dec.	Jan.	Febr.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
31—39	1.5, 2, 2,	3, 3, 4, 4,	5	5, 5, 9	..	..	..	..	12♂	12.8♀	12♀, 16, 18♂ [1]) 8♂ [1]), 15, 13.3	..	12♂, 16.5♂, 18♂	..	25.5	..
40—49	1, 1, 1, 1, 2, 2, 2	1, 2, 2, 2, 3,	6,	..	5, 10	8.5	6	8	13	11	6	10 [1])	15♀	10♀ [1])	..	25♀
51—59	1, 2,	..	..	..	..	..	..	..	..	3, 13 [2]),	5	..	..	..	..	..

[1]) The otolith of these showed on examination, that all these fish were two years old at time of marking

[2]) init. size 50 cm.

following year which corresponds to the value found in the cod E. of Nolsø in the same year. This gives an average for the whole growth period (12 months) of abt. 13 cm, ranging from 6 to 16 cm. The rate of growth in the Nolsø Fjord itself in the same year is distinctly greater. (Fig. 5)[1]. The fact that the majority of recaptures made more than 6 months after liberation fall in waters west and north of Sandø makes, however, any conclusion as to the growth in the waters near place of liberation, E. of Sandø, unreliable. After the lapse of a further 5—6 months, we find, in the case of the only two fish accurately measured, an increase of 25 cm in all, the initial sizes being 34, 34 and 45 cm respectively. The experiments made to the west of the island (Sandø) which are dealt with in the following, exhibit far more similar results to those of the Nolsø Fjord experiments. This difference may be due to the paucity of the material; it is however, perhaps more likely that local conditions are responsible. Another explanation might be, that the 30—50 cm group here includes comparatively more of the slow-growing III-year-old fish than has been found to be the case elsewhere. Until further experiments have been made, however, we can do no more than merely state the facts.

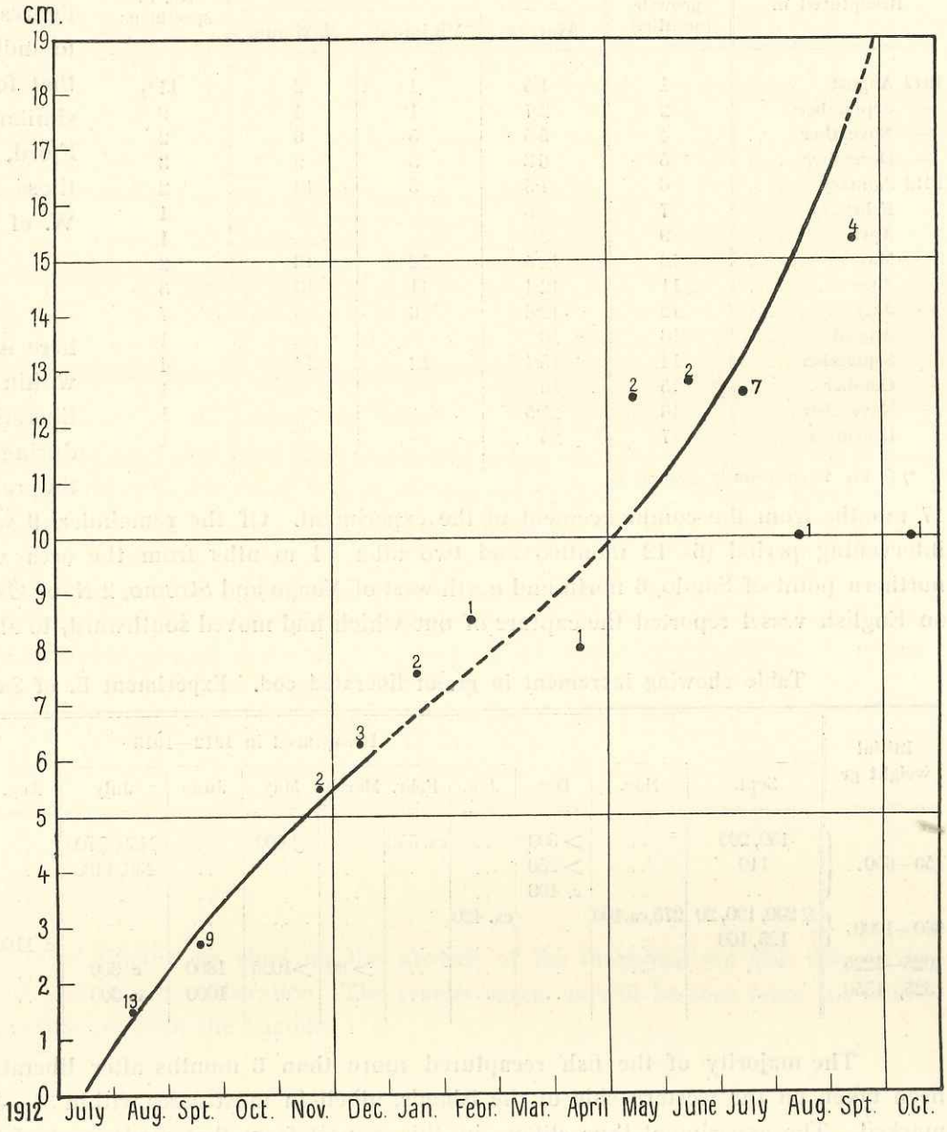

Fig. 18. Rate of growth of 30—50 m. cod, liberated E. of Sandø. July 1912.

As regards the increment of weight, we have as usual a poorer quantity of material. Some of youngest fish (initial weight less than 700 gr.) were found to have doubled their weight after the lapse of only 7 months (February) while some few specimens of the same initial weight had grown but little more than this in 12 months, during which time others, again, had reached three times their original figure. Finally we may mention, that of the latest recaptures, one fish of 400 gr. was found in 15 months to have reached five times that weight, while another of 1000 had about tripled this figure; these values correspond to an increment of 25 cm for lengths of 34 and 45 cm in 16 & 17 months respectively.

[1]) Average for June should more correctly be 12·2, this calculation based on 3 spec. measured.

As regards fish of over 50 cm initial size, we have but four recaptures within this group, made after the lapse of 8, 11, and 12 months respectively from time of marking (initial lengths 51—53 cm). The length increment amounts to 6, 3, and 5 cm; the max. increment of weight abt. 350 gr. These figures, few as they are, yet tend to indicate a poorer growth than that found in the case of fish of similar size (and age?) from Nolsø Fjord, and are also lower than those noted in the experiments W. of Sandø (*vide infra*).

Rate of growth of 2-year-old cod, liberated E. of Sandø July 1912.

Recaptured in	Period of growth (months)	Increment in cm.			No. of specimens
		Average	Minimum	Maximum	
1912 August	1	1·5	1	2	11*)
— September	2	2·7	1	4	9
— November	4	5·5	5	6	2
— December	5	6·3	5	9	3
1913 January	6	7·5	5	10	2
— February	7	8·5	—	—	1
— April	9	8	—	—	1
— May	10	12·5	12	13	2
— June	11	12·4	11	13	3
— July	12	12·6	6	16	7
— August	13	10	—	—	1
— September	14	15·4	12	18	4
— October	15	10	—	—	1
— November	16	25·5	—	—	1
— December	17	25	—	—	1

*) in Fig. 18 erraneously given as 13.

5. Migrations.

Of the total of 66 fish here marked, 40 were recaptured within 6 miles of the place of liberation, 26 of these being taken during the first five months, and the remaining within from 16—17 months from the commencement of the experiment. Of the remainder, 9 were brought in during the intervening period (6—12 months) and two after 14 months from the area west and north-west of the northern point of Sandø, 6 north and north-west of Vaagø and Strømø, 2 N. of Østerø and Fuglø and finally, an English vessel reported the capture of one which had moved southward, to abt. 61° N. 6° W. (5 months).

Table showing increment in gr. of liberated cod. Experiment E. of Sandø July 1912.

Initial weight gr	Recaptured in 1912—1913												
	Sept.	Nov.	Dec.	Jan.	Febr.	March	May	June	July	Aug.	Sept. & Oct.	Nov.	Dec.
450—650	150, 200	..	> 300	..	ca. 550	..	♂ 600	..	♀450, ♀700	..	♂ c. 1100, > 1000	> 1600	..
	110	..	> 250	..	..	..	..	..	430, 1400	..	♂ c. 900	..	..
	..	..	c. 400	..	..	..	..	..	..	..	..	..	..
660—1000	♀ 200, 190, 20	275, ca. 400	..	ca. 420	..	..	..	..	..	..	..	..	..
	125, 160	..	..	..	..	..	..	..	..	c. 1160	ca. 1050, ca. 800	..	..
1025—1225	..	..	..	..	..	> 80	> 1025	1800	c. 300	..	..	..	2400
1325, 1550	..	..	..	..	..	..	..	1000	c. 300	..	..	..	..

The majority of the fish recaptured more than 6 months after liberation are thus seen to have been taken on the western side of the islands, albeit in most cases within 35—40 miles of the place where marked. The experiment thus differs in this respect from that made west of the island (*vide infra*) and others, where the youngest year-classes have been found to be the most stationary.

6. Nationality of the fishermen.

As might be expected from the extensive migration towards west and north-west, a considerable number of the recaptures were here made by foreign fishermen, 13 out of the total of 66 being taken by English or Scottish vessels, which do most of the fishery here. Among the Færoe boats, those from Skaalevig and Skopen brought in the greatest number, viz; 30 out of the 53 recaptured by native fishermen.

Table showing no. of recaptures made by Færoe and foreign fishing vessels: marking experiments E. of Sandø 1912.

Færoe fishing boat, registered in																	English Steam Trawler	Scottish S. T.
Sandø			Hestø	Hestøfjord & Vestmansund					Vaagø		Strømø				Fuglø	Place unknown		
Skaalevig	Skopen	Sand	Hestø	Bø	Indredal	Kvivig	Leinum	Vestmanhavn	Midvaag	Sørvaag	Arge	Thorshavn	Strænder	Thorsvig	Kirke			
17	13	1	1	4	2	3	1	1	1	2	1	1	1	1	1	2	12	1

	Færoe	English	Scottish
Total No. of recaptures..	53	12	1

VII. Markings W. of Sandø (Guttagrynna).

1. Locality and Date.

During the months of July 1912 and June 1913, about 250 larger cod were marked on the western side of Sandø close in to land (1912) and farther out at Guttagrynna (1913), the Færoese name of the coastal bank here. The locality etc. will be seen from the table below.

Table showing marking experiments W. of Sandø 1912 and 1913.

No. of Experiments	Year and month	No. of cod liberated	No. of cod recaptured	Locality	Central position (approximately) N. Lat.	Central position (approximately) W. Long.	Depth in metres
A_5	1912. July 7	150	45	7 miles W. by N. of Troldhoved, Sandø	61° 54′	7° 10′·5	90
B_5	1913. June 26—28	109	32	Between West coast of Sandø and Guttagryna, 2—6 miles from shore	61° 50′	6° 56′	70
					61° 57′	7° 04′	90
	Total...	259	77				

These experiments are of interest as showing the growth of the three-year-old fish (50—60 cm) especially during the first six months after liberation. The results agree, as will be seen from the following, with those of other experiments from the islands.

2. Size of the marked fish.

It will be seen that more than 5/6ths of the total number marked were over 50 cm long initial size, 1/3rd, moreover, being over 70 cm. The average size is thus greater than for instance in the Nolsø experiments; the three-year-olds (and older fish) predominating. In the line-fishery on board the "Margrethe" in 1913, a number of smaller (two-year-old) fish were also taken; only sizes over 50 cm however, were included in the experiments for this year. The weighings made at time of marking showed the weight of fish less than 60 cm; i. e. the two- and three-year-olds, as from 1000—2000 gr, increasing thereafter by about 1000 gr at the following intervals of length 67, 75, 81, 87 and 92 cm. Half the catch comprising the III group and somewhat older, 50—70 cm, fish, thus includes weights of from 1500—3200 gr per fish.

Table showing number and size of cod liberated West of Sandø 1912 & 1913.

No. of Experiments	Initial sizes in cm									Total
	—39	40—49	50—59	60—69	70—79	80—89	90—99	100—109	120	
A_5	9	30	50	11	16	18	13	2	1	150
B_5	..	..	38	33	20	15	2	1	..	109
Total...	9	30	88	44	36	33	15	3	1	259

3. No. of recaptures.

About one-third — to be precise, 29.7 % — of the total number marked were recaptured, during the 20 months after liberation, within which period the recaptures are distributed as follows:

Table showing no. of fish recaptured from the experiments W. of Sandø. 1912 & 1913.

No. of Experiment	Date	No. of cod marked	No. of months between liberation and recapture														Total No. recaptured	% recaptured
			0	1	2	3	4	5	6	7	8	9	12	14	16	19	20	
A_5	1912 July 7	150	4	4	4	1	7	8	1	5	3	3	1	2	2	..	..	45	30·0
B_5	1913 June 26—28	109	0	4	7	2	1	2	6	3	..	5	..	..	..	1	2	32	29·4

The table gives a good idea of the even distribution of the recaptures throughout the first 9 months, a feature which, as we have seen in the experiments already dealt with, makes itself apparent in the case of a stock not very intensely fished. All the size-groups are represented among the recaptures, and this in approximately the same proportion as in the markings.

4. Growth.

1. The 1912 Experiment.

The growth of the two-year-old fish — i. e. initial size < 50 cm — averaged, for the period from mid July to mid December about 9.3 cm, or about the same as in the 1912 experiments in Nolsø

Table showing growth in cm of liberated cod. Experiments W. of Sandø July 1912.

Initial Size in cm.	Recaptured in 1912—1913										
	Aug.	Septb. 20—30	Octbr.	November	December	Jan.	February	March	April	Septb.	November
40—49	0, 3	0, 3, 3	..	..	9, 9 ♂, 9 ♂, 10 ♀	..	11 ♂, 12	..	15[1])	13 ♂	..
50—59	..	1	4	4 ♂, 4 ♀, 5 ♀, 7 ♂, 7 ♀, 8	6 ♀, 6 ♂, 7 ♂, 9 ♂	8 ♀	6 ♀, 9 ♀	..	..	14	10 ♂, 12 ♀
60—69	..	..	..	..	..	..	..	6	..	..	..
70—79	..	..	..	4 ♀	..	..	..	..	..	..	..
80—89	..	..	..	..	..	..	..	3·5 ♂, 5 ♀	..	..	..

[1]) Initial size 34 cm.

Fjord. The few recaptures subsequently made exhibit values similarly corresponding to the results already noted from the Nolsø Fjord experiments; owing to the great variation in growth of the individuals however, no actual average figure can be given. The next group in order of size, the 50—60 cm fish, had

end November grown but 5.8 cm, and after the lapse of one more month about 7.0 cm average. The estimated rate of growth of this size group is given in Fig. 21, curve No. II. As it will be seen it agrees fairly well with the results of the 1910 — experiments S. of Nolsø (curve I). As far as can be judged we find a growth during the summer and autumn only very slightly inferior, to that of the 2-years-old cod (cf. Fig. 5). In the following winter and spring the inferiority among these older fish is more and more distinctly marked. Two fish retaken after the lapse of 16 months — i. e. about $1^1/_2$ growth periods — had increased their initial size of 51 cm by 10 and 12 cm respectively.

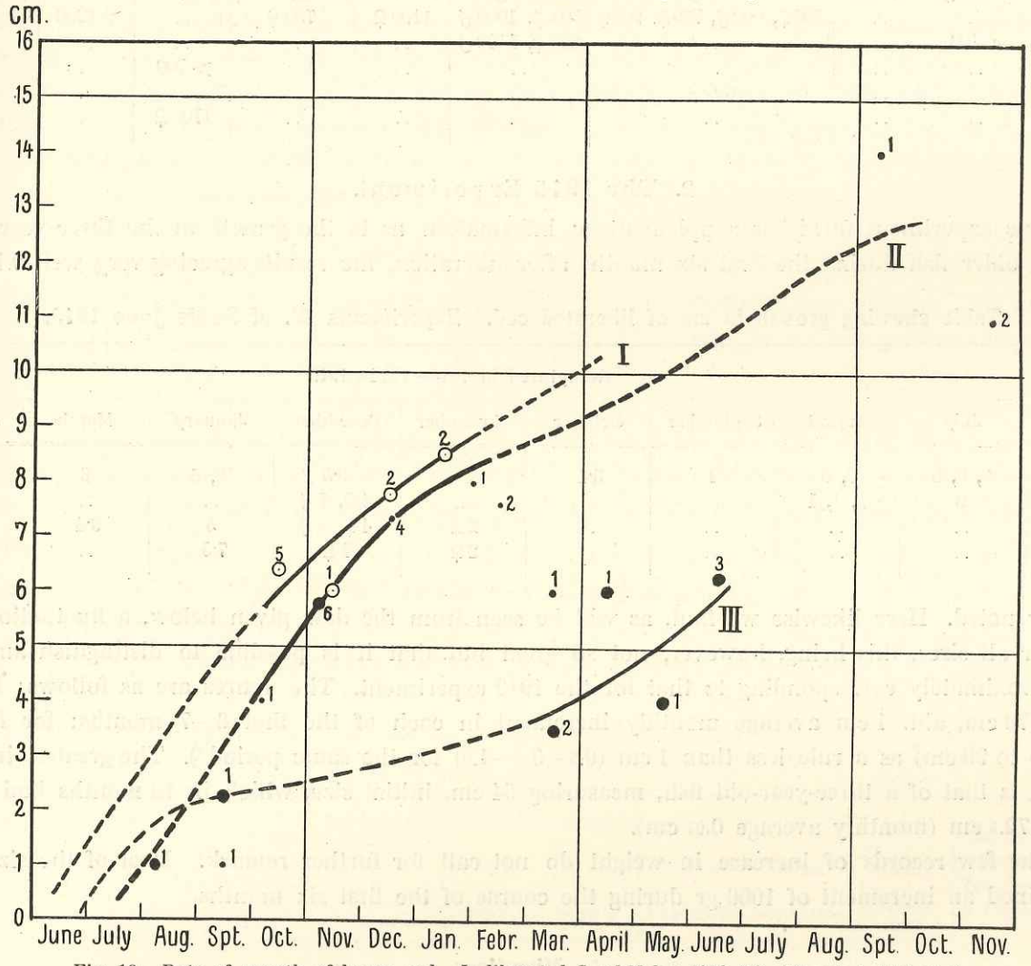

Fig. 19. Rate of growth of larger cod. I. liberated S. of Nolsø 1910 (50—70 cm's initial size).
II. — W. of Sandø 1912 (— —).
III. — on Sandø Bk. 1912 (65—90 cm's —).

Among the still larger fish of known growth, two may be specially mentioned here. From an initial size of 82 and 84 cm they had by the middle of March grown but 3.5 and 5 cm respectively, thus showing, as might be expected, an even poorer growth than that noted in the case of the 50—60 cm fish (the III—IV group).

With regard to weight increment, the results are given below. Fish of less than 1000 gr had doubled their initial weight by the end of November, those of 1000—1500 gr by February. The still larger specimens exhibit a somewhat poorer growth, one specimen of 84 cm having increased its original weight of 4800 gr by about 2000 gr. in the course of 8 months (length increment 5 cm). The weight increment however, like that of the length, varies considerably for the different groups.

Table showing increment in gr. of liberated cod. Experiment W. of Sandø July 1912.

Initial weight in gr	Recaptured in 1912—1913								
	Septbr.	October	November	December	January	February	March	Septbr.	November
625	..	..	..	..	..	..	..	950 ♂	..
750—1000	..	..	..	750 ♂, 800 ♀	..	> 800	..	..	..
1000—1500	> 150 ♂	c. 450	800 ♂	750 ♂	..	1000♂, 1000♀	..	..	1050 ♂, 1100 ♀
1500—2000	..	..	500 ♀, 600 ♂, 760 ♀, 900 ♀	500 ♂, 1000 ♂	1100 ♀	750 ♀	..	> 1200	..
2000—2500	c. 400	..	..	600 ♀, 1100 ♂	..	..	..	..	..
3000—3500	..	..	..	..	..	..	> 700	..	..
4000—4500	..	..	600 ♀	..	..	..	..	..	..
4600—5000	..	..	..	..	..	..	1700 ♀	..	..

2. The 1913 Experiment.

This experiment furnishes supplementary information as to the growth of the three-year-old and somewhat older fish during the first six months after liberation, the results agreeing very well with those

Table showing growth in cm of liberated cod. Experiments W. of Sandø June 1913.

Initial Size in cm	Recaptured in 1913—1914—1915								
	July	August	September	October	November	December	January	March	January
50—59	0, 0, 0	0, 0	1	3·4	..	9·5	10, 6	6	18·5
60—69	0	1, 1, 1	..	..	..	4 ♀, 7 ♂	..	..	..
70—79	..	..	..	..	2 ♀	4 ♀, 5 ♂	5	9·4	..
80—89	..	..	..	..	2 ♀	1 ♀	7·5	..	..

previously noted. Here likewise we find, as will be seen from the data given below, a fluctuation in the growth for all sizes, this being, however, not so great but that it is possible to distinguish an average value approximately corresponding to that for the 1912 experiment. The figures are as follows: For sizes from 50—70 cm, abt. 1 cm average monthly increment in each of the first 6—7 months; for fish over 70 cm (up to 90 cm) as a rule less than 1 cm (0.2—0.4—1.0) for the same period [1]). The greatest increment of growth is that of a three-year-old fish, measuring 54 cm, initial size, which in 19 months had attained a size of 72.5 cm (monthly average 0.97 cm).

The few records of increase in weight do not call for further remark. Most of the size-groups have attained an increment of 1000 gr during the course of the first six months.

5. Migrations.

The results here show that both two- and three-year-old cod are in many cases found to live the whole year round in about the same place; fish of the last-named class are, however, considerably more disposed to move about than the two-year-olds, which, as in most of our other experiments were found to be very stationary (cf. E. of Sandø).

Close on half the total number of recaptures from the 1913 experiment (13 of 29) and over half those from 1912 (33 of 45) were made less than 10 miles from the place of liberation, and within twelve months of marking. The higher proportion of stationary fish in the 1912 experiment is mainly due to

[1]) Still more marked is this difference in 3 specimens recorded as recaptured after the foregoing was written and therefore omitted from the calculations above. With init. sizes of 56, 62 & 76 cm they have in 8, 9 & 8 months grown 10, 10 and (only) 1 cm, respect. the corresponding weight increments being c. 1600 + c. 1000, c. 2500 + c. 1400 & c. 3800 + (only) 100 gr. All were retaken within 1—2 miles from the place of liberation by fishermen from Skopen.

the fact that in that year as against 1913, a number of fish < 50 cm (of the II group) were marked and recaptured.

With regard to details in the results of these two experiments, the following remarks may be added:

In the 1912 experiment, according to the statements of the fishermen regarding recaptures, the stock spreads mainly towards south and south-east, by way of Guttagrynna to about 15 miles from the place of liberation. The recaptures made here within 16 months consisted for the most part of two- and three-year-old fish, $32 + 5$ spec., of $<$ and $>$ 70 cm's initial size. Only five had moved as far as to the north west and west of Myggenæs one farther north ward still, beyond Kunø after a lapse of 1, 7, 8, 8, 9 and 12 months respectively. Four of these were cod over 80 cm initial size.

In the 1913 experiment we find among the stock, which is during the first 6—7 months essentially stationary some migrating specimens esp. of the 50—70 cm's group, these having been recaptured partly about Myggenæs and partly still farther west and north of there. In the following 2—3 months and still later recaptures are only recorded from these and even more distant grounds. Two of the fish marked during this experiment were recaptured, by English fishermen, at Munken, i. e. at a distance of 60 miles or more from Guttagrynna —, after a lapse of only two months. These records appear hardly reliable, the more so as the fish in question were of 54 and 63 cm length respectively. We have, however, no means of checking these statements, and are similarly situated as regards another record, according to which a 60 cm fish, is said to have been taken, after a lapse of only 2 months, far away from the islands, out to the southward, between Shetland and Orkney. There is of course the possibility that this may be correct; if so, however, it is the only known instance of such a thing having happened. Otherwise, most of the records as to place of capture furnished by the foreign fishermen agree well enough with those of the Færoe men, the accuracy of which latter statements we of the are able to check.

6. Nationality of the fishermen.

As will be seen from the table below, a fairly high percentage — one-third to one-half — of the total recaptures were made by foreign vessels, which is explained by the fact that these experiments were

Table showing no. of recaptures made by Færoe and foreing fishing vessels; marking experiments with cod. W. of Sandø 1912 and 1913.

	Færoe fishing boats, registered in									English Steam Trawlers & Liners	Scottish Steams Trawlers & Liners
	Sandø		Vaagø	Strømø			Østerø	Bordø	Suderø		
	Skopen	Sand	Sørvaag	Vestmanhavn	Thorshavn	Hoyvig	Fuglefjord	Norddeble	Trangisvaag		
1912.....	20	2	..	1	5	..	..	1	1	13	2
1913.....	5	1	1	..	1	1	1	..	..	19	3

	Færoe	English	Scottish
Total No. recaptured ..	40	32*)	5*)

*) 1 + 2 line-caught.

made outside the territorial limit, on the western side of the islands, close to one of the grounds most extensively worked by the foreign (English and Scottish) trawlers. The higher percentage taken by foreign fishermen in 1913 is again due to the fact already noted above, that the stock in this case consisted exclusively of older fish (three years and upwards) of more migratory habit.

VIII. Markings on the Sandø Bank.

These experiments are most interesting on account of the considerable size of the fish marked, and the data furnished as to growth of the older specimens.

1. Locality and Date.

In the June 1912, 100 cod in all were marked, sizes given below. The markings were made some 35 miles east of Sandø, in 150–190 metres of water.

Table showing cod marking experiment on Sandø Bank. June 1912.

No. of Experiment	Year & Date	No. of cod liberated	No. of cod recaptured	Locality	Central position (approximately)		Depth in metres
					N. Lat.	W. Long.	
VIII	1912 June 18, 19 & 25	100	27	Sandø Bank	61° 48′	5° 27′	150–190

2. Size of the marked fish.

More than half the total number marked were thus over 70 cm, only a very few being below 50 cm. Such a proportion occur only in two of our other experiments, viz; NW of Strømø (Exp. III b) and on the Færoe Bank (Exp. IX).

Initial size in cm	40—49	50—59	60—69	70—79	80—89	90—108
No. of cod liberated	8	11	18	31	27	5

The weights will be seen from the following table, and are, as might be expected, considerable, over half the fish weighing more than 5000 gr.

Initial weight in gr	500—1000	1—2000	2—3000	3—4000	4—5000	5—6000	6—7000	7—8000	8—9000	< 15000
No. of cod liberated	4	16	13	16	23	14	11	1	1	1

Examination of the otoliths of cod taken at the same time, but not marked, gave the following result:

Size in cm	< 50	50—70	71—79	80—90
Age mainly	2 years old	3 and 4 years old	4 and 5 years old	5 and 6 years old

3. No. of recaptures.

The total number of fish recaptured was 27, or 27 %; in other words, about twice as many as in the markings made NW of Myling and on the Færoe Bank, which otherwise, as regards size of the fish marked, and distance of the locality from land, mostly resemble the present experiment.

It should also be noted that about two-thirds of the recaptures were made 7—13 months after liberation, as in the markings E. of Sandø. In all the other experiments, the majority of recaptures were either made during the first 6 months, or, more rarely, evenly distributed throughout the first 12—14 months of the experiment. Sizes < & > 70 cm are equally well represented in the recaptures.

Table showing no. of cod recaptured from experiment on Sandø Bank. June 1912.

Date	Total No. liberated	No. of months between liberation and recapture														Total No. recaptured	% recaptured
		0	1	2	3	4	5	6	7	8	9	10	11	12	13		
1912 June	100	1	2	1	1	2	1	..	1	3	2	1	5	6	1	27	27

4. Growth.

Increment of length, and of weight.

The tables below give all the reliable measurements of the recaptured fish:

Table showing growth in cm of cod liberated on Sandø Bank. June 1912.

Initial Sizes in cm	Recaptured in 1912—1913								
	September	October	November	January	February	March	April	May	June
45—49	..	6·5, 10 ♂	9 ♂	10 ♂	12 ♀	..	..	..	..
52—59	..	..	..	..	12 ♀	..	..	..	16 ♀
62—64	..	..	..	..	12 ♂	..	..	..	..
65—69	..	..	..	..	..	5	..	..	..
70—80	..	..	..	..	..	2	6	..	5, 6
81—88	2·3	..	..	..	..	..	..	4	8 (4·2)

The figures for increment of weight, as furnished by the very few weighings made on recapture, follow below.

As early as February (1913) we find in three of the recaptured fish an increment of length amounting to 12 cm, the weight being by then almost doubled. The initial sizes of these fish were 47, 53 and 64 cm respectively. One specimen of the same size group had, after the lapse of 12 months, increased its original length of 58 cm by 16 cm. The length increment of the still older fish (75, 75 and 88 cm initial size) (4 or 5 years old), was for the same period 5, 6, and 8 cm respectively, or somewhat less than half that of the 3 and 4 years olds. In Fig. 19, curve III we have given the estimated rate of growth of these large cod.

Table showing increment in gr of cod liberated on Sandø Bank. June 1912.

Initial weight in gr	Recaptured in 1913			
	January	February	March	June
1025—1050	660	950	..	..
1300—1900	..	1400	..	1700
2550—3050	..	♂ 2000	ca. 650	..

If we compare these figures with the results of other experiments, in 1910 and 1912, June and July, they will be found to be so far in agreement as to furnish, when taken together, a fairly accurate idea as to the growth of the older fish (over 50 cm). The following table (p. 70) shows the increment of growth during the whole period from marking to recapture for larger fish from the experiments W. of Strømø, W. of Sandø, the Færoe Bank (*vide infra*) and the Sandø Bank (underlined), all reliable measurements of fish more than 12 months out being here included.

The length of 70 cm appears in our experiment to mark the limit between the younger, smaller fish (init. s. 50—70 cm) with an average monthly increment of about 1—1.4 cm according to the foregoing, and the older specimens, having a monthly increment throughout the whole period (12 months) of only abt. 0.5—1 cm, or sometimes even less. The actual figures vary of course a good deal to

either side of the calculated average, one of the reasons for this being the mixture of younger, rapidly-growing fish, and older specimens, of slower growth, within one and the same size-group, this feature being the more marked as the age (size) of the group advances.

With regard to increment of weight, nothing can be stated in detail; the few weighings made in

Synoptic Table showing growth in cm of larger cod, liberated W. of Strømø, W. of Sandø, on Færoe Bank and on Sandø Bk. 1910 & 1912.

Initial size in cm	No. of months between liberation and recapture				
	12	13	14	16	17
59—60	>10, >10, >12, >13, 14, 17, >12 ♀, 16 ♀	8, 11, 4	14	10, 12, 19	26
60	11	..	..	15	..
61—69	>10, >10, >12, >12, >14, >12 ♂	10	..	..	..
70—80	5, 6, >5	..	..	..	..
81—88	8,	6.5	3	..	..
91	>11	..	..	..	..

the case of older recaptures show that these fish have almost doubled their initial weight of 1500—2000 gr in the course of the twelvemonth, making an average of 100—150 gr per month. The best grown of the still larger fish, (abt. 4000—5000 gr) had increased their weight by about the same amount in twelve mouths. For cod of between 60—80 cm, (see the curve on p. 81) an increment in weight of abt. 600—700 gr corresponds to a length increment of 5 cm; in fish over 80 cm, the weight increases still more considerably, with increasing length, an increment for the year of 5 cm here corresponding to an average weight increment of 1500—2000 gr. In other words, the values for increment of weight among the best-grown of the 4—5 youngest age-groups are about the same, viz; 1000—2000 gr, whereas the increment of length gradually diminishes.

5. Migrations.

A single specimen is stated as having been taken 7 days after liberation, off Fuglø, — a distance of about 40 miles from the place where marked —; 5 were taken 2, 4, 9, 9 and 10 months later off and N. of Svinø, and Viderø, and finally, one was recaptured about one month later west of Sandø. The remaining 22 were all recaptured on the Bank, or midway between it and the islands. The latter were taken during the winter months, November—February, those taken on the bank itself being brought in after the lapse of 11—12 months. A point particularly worthy of note is the fact that 5 cod were taken on three successive days in May, 1913, i. e. abt. 11 months after liberation at the same place, only a few (abt. 5) miles from the place of liberation [1]).

It would thus seen that the stock from the bank keeps closer to the islands i. e. in the shallower water during the winter months, moving out again to the banks in the spring. An alternative explanation however, might be the rough winter weather and its effect upon the fishery.

This is the only one of all our experiments which furnishes any suggestion as to the migrations of older fish; it is to be hoped, however, that we may in the future be able to pursue the question further.

6. Nationality of the fishermen.

All that need here be mentioned is the relatively high percentage of recaptures here made by foreign (English and Scottish) fishermen, who brought in 6 of the 27 taken in all. This is easily explained

[1]) These fish had then, according to the measurements (given in Danish "Tommer") grown from 63, 66, 69, 71 and 81 cm initial sizes the year before 10·2, 13·7, 8·2, 8·7 & 4 cm respectively.

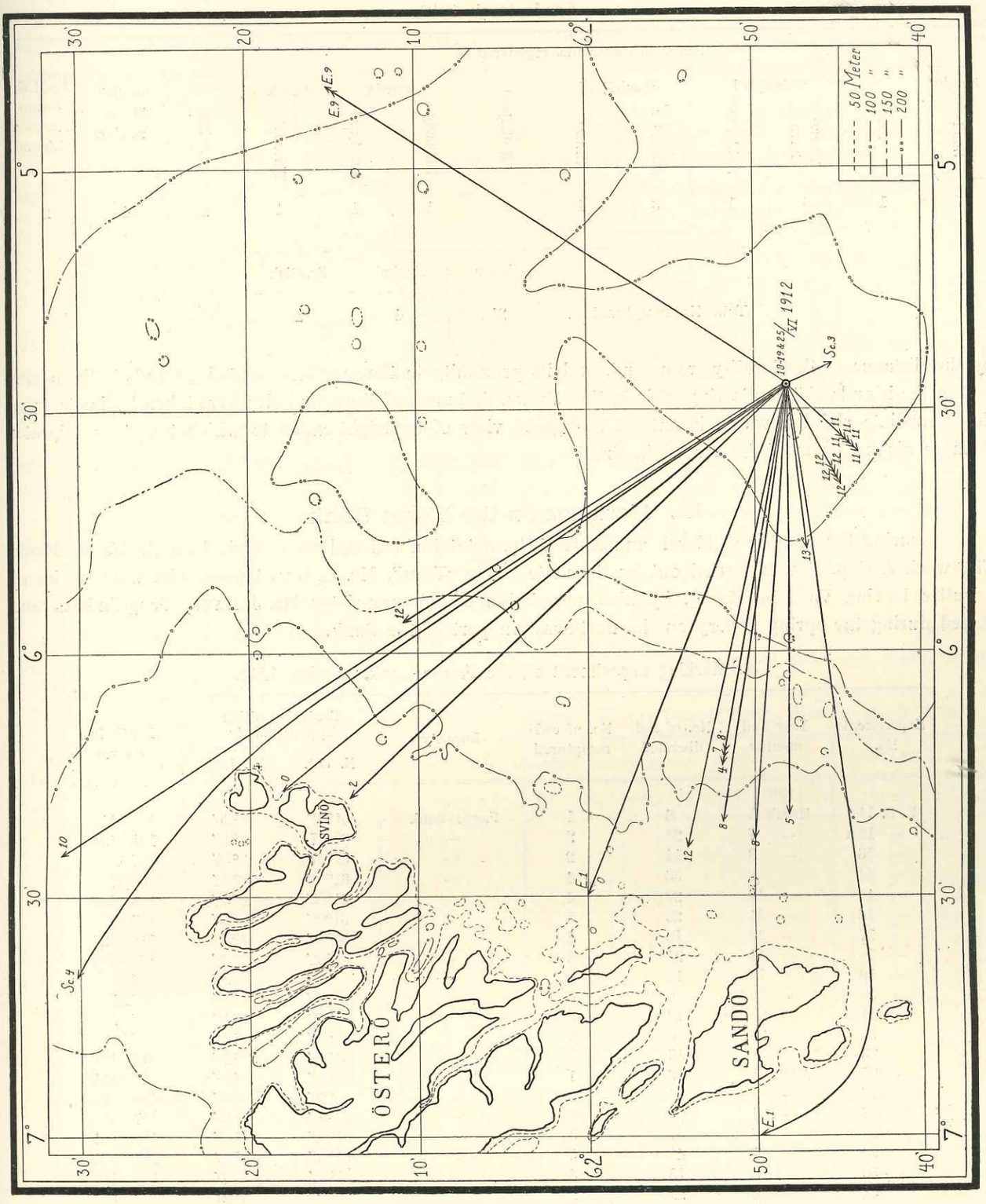

Fig. 20. Marking Experiments with cod. Sandø Bank. June 1912.

Table showing no. of recaptures made by Færoe and foreign fishing vessels. Marking experim. with cod. Sandø Bank 1912.

Færoe fishing boats, registered in											English Steam Trawlers	Scottish Steam Trawlers Liners
Sandø	Hestø	Nolsøfjord		Skaalefjord		Kollefjord	Bordø		Sundene	Svinø		
Sand		Thors-havn	Hvidenæs	Strænder	Glibre		Klaksvig	Arnefjord	Tjørnevig			
1	1	8	1	3	1	1	1	1	1	2	4	2

	Færoe	English	Scottish
Total No. recaptured . . .	21	4	2

by the distance of the locality from land, and its proximity to the much-frequented grounds to the north-east of the islands. The following table further shows, that most of the remainder were taken by boats from the immediate vicinity, which is natural enough in view of the slight extent to which the stock migrates to more distant parts of the coastal banks.

IX. Markings on the Færoe Bank.

During the months of March and April 1910, a total of 585 cod were marked on the Færoe Bank. The work & Exp. X was carried out by the mate of the "Thor", Mr. E. Christensen, who went on board a cutter leaving Vaag in March, by kind permission of the proprietor Mr. J. Dahl, Vaag-Suderø, and stayed during the spring fishery on the north-eastern part of the Bank.

Cod-Marking experiment on the Færoe Bank. Spring 1910.

Experiment No.	Year and months	No. of cod liberated	No. of cod recaptured	Locality	Central position (approximately)		Depth in metres
					N. Lat.	W. Long.	
	1910						
F. B. 11	March 5	6	1	Færoe-Bank	61°01′	8°20′	108—116
— 12 a	— 7	28	2	—	60°57′	8°13′	104—120
— 13	— 8	14	2	—	61°07′	8°55′	162
— 14	— 9	33	4	—	61°08′	8°32′	122
— 15	— 10	29	4	—	61°05′	8°38′	103—118
— 16	— 11	20	3	—	61°00′	8°13′	113—122
— 17	— 12	18	1	—	60°58′	8°10′	118—124
— 18	— 14	91	18	—	61°02′	8°30′	108—106
— 19	— 15	10	0	—	61°06′	8°28′	108
— 20	— 19	6	0	—	60°59′	8°05′	124
— 21	— 22	43	3	—	61°01′	8°45′	107
— 22	— 23	4	0	—	61°04′	8°28′	112
— 23	— 31	15	5	—	61°05′	8°20′	110—114
— 25	April 1	19	1	—	61°12′	8°36′	111—114
— 26	— 2	64	15	—	60°56′	8°18′	120—110
— 27	— 4	31	6	—	60°57′	8°15′	117—120
— 28	— 6	37	5	—	61°02′	8°26′	110—104
— 20	— 7	41	5	—	61°02′	8°20′	101—104
— 30	— 8	15	3	—	61°01′	8°20′	118—110
— 31	— 9	22	2	—	60°59′	8°40′	103
— 32	— 11	39	7	—	60°58′	8°45′	117
	Total . . .	585	87				

1. Locality and Date.

The fishing was done during the time from 5 March to 11 April, with some few days' interruption; all the fish were taken on hand lines, close to the bottom, at about 100—160 m depth. Of the total number caught, about 2000, some 25 % were marked, the remainder being unsuitable for experimental purposes.

2. The size of the marked fish.

The length was on an average considerably above that of those marked in any of the experiments already dealt with in the foregoing; it will be seen from the measurements, however, that in addition to

Initial Size in cm	43, 44	52—59	60—69	70—79	80—89	90—99	100—109	110—120	Total
No. of cod liberated	2	12	54	88	232	140	50	7	585

the great majority of full-grown, spawning fish, some of the younger individuals were also marked, including sizes down to 43 cm.

Most of the specimens examined over 80 cm were either preparing to spawn (March) or in a more advanced stage of spawning (April) while some few fish, both ♂ and ♀, were already spent by about the middle of April.

The bottom (and surface) temperature varied between 7.20° and 7.50° throughout the period of observation; Mr. CHRISTENSEN is responsible for this and the above stated observations.

3. No. of recaptures.

Of the total number of fish marked, 87 in all were recaptured, or 14.9 %; of these, 67, or more than 3/4 were taken within five months i. e. April—August. During the autumn of 1910 and winter 1910—

Table showing no. of fish recaptured from the experiments on the Færoe Bank. March—April 1910.

Experiment No.	No. of cod liberated	No. of months between liberation and recapture														Total No. recaptured	% recaptured
		0	1	2	3	4	5	6	12	13	14	16	18	39	?		
F. B. 11	6	1	..	..	..	..	..	..	..	..	..	..	..	..	..	1	16·7
— 12 a	28	..	..	1	1	..	..	..	..	..	..	..	..	..	..	2	7·1
— 13	14	..	..	..	1	1	..	..	..	..	..	..	..	..	..	2	14·3
— 14	33	..	..	2	..	..	..	..	1	..	..	..	..	..	1	4	12·1
— 15	29	..	2	1	..	1	..	..	..	..	..	..	..	..	..	4	13·8
— 16	20	..	1	1	1	..	..	..	..	..	..	..	..	..	..	3	15·0
— 17	18	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1	5·6
— 18	91	..	..	5	7	5	..	..	..	..	..	1	..	..	..	18	19·8
— 21	43	..	1	..	1	..	..	..	..	..	..	..	1	..	..	3	7·0
— 23	15	..	..	1	2	1	1	..	..	..	..	..	..	..	..	5	33·3
— 25	19	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1	5·3
— 26	64	..	3	6	2	1	1	..	..	..	1	..	..	1	..	15	23·4
— 27	31	..	..	4	1	1	..	..	..	..	..	..	..	..	..	6	19·3
— 28	37	..	1	..	3	..	..	1	..	..	..	..	..	..	..	5	13·5
— 29	41	..	1	1	2	..	..	..	..	1	..	..	..	..	..	5	12·2
— 30	15	..	2	1	..	..	..	..	..	..	..	..	..	..	..	3	20·0
— 31	22	..	1	..	1	..	..	..	..	..	..	..	..	..	..	2	9·1
— 32	39	1	2	3	1	..	..	..	..	..	..	..	..	..	..	7	18·0
Total...	585	2	16	26	23	10	2	1	1	1	1	1	1	1	1	87	14·9

11, no recaptures were recorded; not until about a year after marking was a single specimen again brought in, and some few others were recaptured during the subsequent 5—6 months. We have no certain knowledge of any recaptures made more than 18 months after marking; exc. one made 39 months after liberation. The class of fish most affected by the industry would seem to be that of the largest sizes, as will be seen from the following table:

Table showing percentage of recaptures of the different size-groups liberated.
Experiment on Færoe Bank 1910.

	Initial Size in cm						Total
	40—59	60—69	70—79	80—89	90—99	100—120	
Total No. liberated	14	54	88	232	140	57	585
— - recaptured	1	4	7	33	29	13	87
% recaptured	7·1	7·4	8·0	14·2	20·7	22·8	14·9

Of fish over 80 cm; i. e. the grown, mature fish, about one-fifth (17.5 %) were recaptured, the percentage of recaptures among the younger specimens amounting to scarsely half this figure (7.7 %).

4. Growth.

The material furnishes but little reliable information as to the growth of the bank cod. Many of the measurements given are evidently incorrect; the few which can in my opinion be taken as reliable are shown in the following table. The longer growth periods will naturally furnish a sounder basis for consideration of the length increment in the sizes here concerned, where errors in mensuration naturally affect the results to a greater degree than is the case with the younger fish of more rapid growth: the error will of course be the greater as the length of the experimental period decreases. It seems however,

Table showing growth in cm of cod liberated on the Færoe Bank. March—April 1910.

Initial Size in cm	Recaptured in 1910—1911							1913
	May	June	July	August	May	June	July	July
59	..	..	..	..	..	..	19	..
60—69	..	..	..	..	..	..	..	..
70—79	..	..	5, 1	0·5 ♀	..	..	..	23
80—89	0 ♂	0, 0 ♀, 2 ♂, 2 ♂, 0, 10 ♂ *)	0 ♂, 2 ♂, 2	4	6·5 ♂	3 ♂	..	..
90—99	..	0 ♀, 2, 0 ♂	9**), 1 ♂, 3, 1 ♂	..	..	..	..	..
>100	..	0, 0	0, 0	..	..	..	..	..

*) Weight at recovery 6300 gr. **) Weight at recovery "19½ lbs".

certain that the summer growth of the larger cod (> 70—80 cm) here also is very slow, in most cases on an average < 0.5 cm monthly. We find, moreover, also in this area — always provided that the above measurements are correct — some few specimens over 80 cm which have grown more rapidly than those just mentioned. Still, our observations here agree with those on Sandø Bank (p. 69) so that we may fix the limit in spring and summer between the quicker and slower growing cod at 70 cm.

The well-grown fish (59 cm's init.-size) retaken after 19 months is reported as having been caught close in to the islands, having moved away from the Bank, and can therefore not be taken without some reserve as representative of the conditions of growth obtaining on the Bank itself.

No weighing was done at time of liberation, and nothing can therefore be said as to increment in weight.

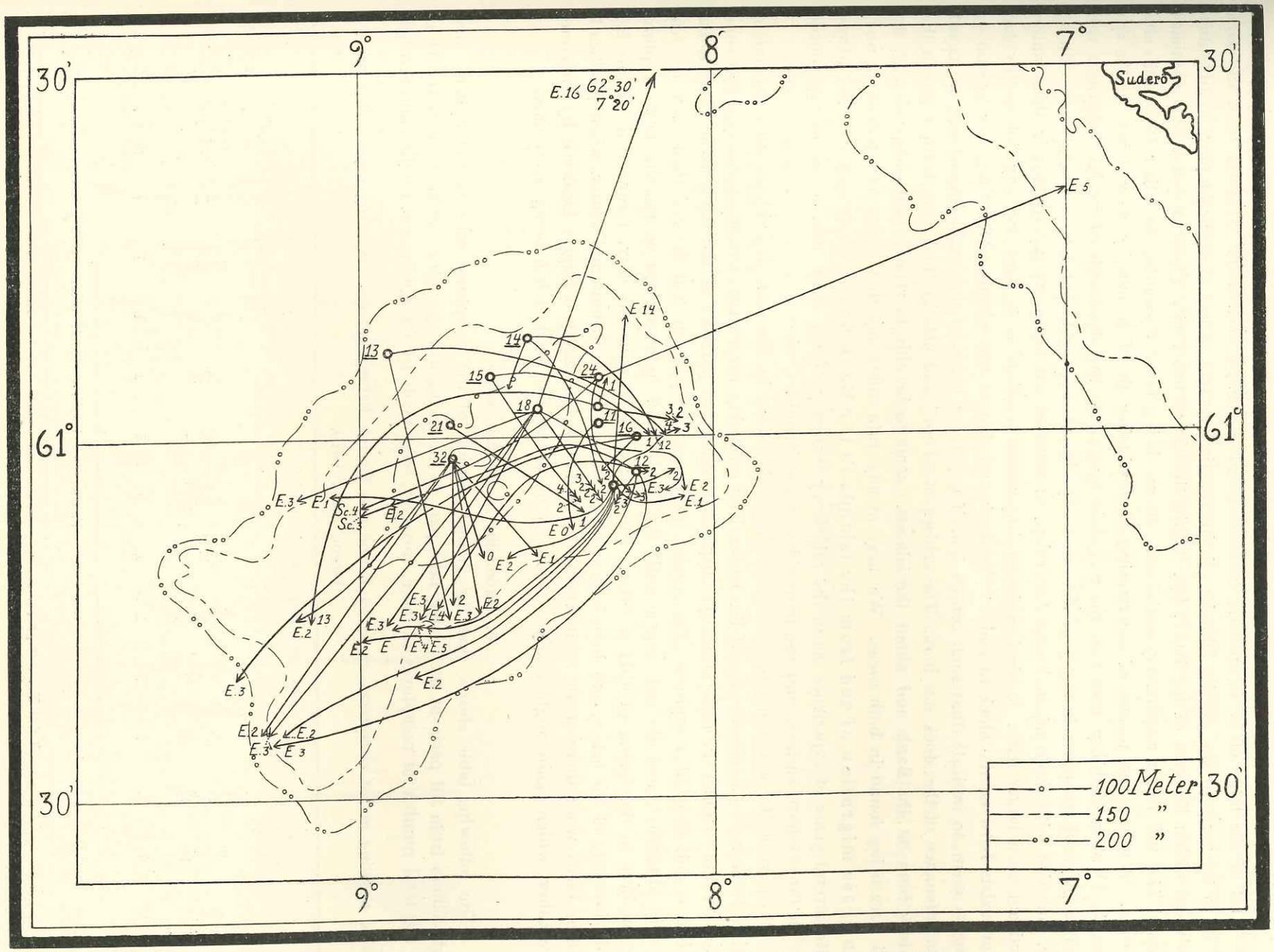

Fig. 21. Marking Experiment with cod on the Færoe Bank. March—April 1910.
The underlined No. means No. of Experiment (se p. 72). Owing to want of space Exp. No. 26 is not marked here.