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Portuguese Investigations in the ICNAF Area during the Campaign of 1956

Observations on the Cod (Gadus callarias L.) in Subarea 2 (Labrador)

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The present paper is a preliminary summary of observations carried out on the cod in the campaign of 1956 in the Labrador waters (Subarea 2).

1. Material and Methods

21 samples, to a total of about 2,300 individuals, were studied. The samples were collected on board a trawler operating in Subdivision 2J (Fig.1) in various periods between August and November 1956.

The mean size of the meshes in the codend used was around 117 mm. The samples contained hardly any fish destined for landing, after the discarding into the sea of those individuals which were of no commercial interest (below around 35-40 cm.).

In Table 1 (Fig.1) the position where the samples were taken is shown. To make the study easier some samples were grouped in accordance with place and date of capture, covering as far as possible periods of 15 days (Table 2).

The methods followed for the study of this material are the same as those indicated in the paper on observations carried out in Subarea 1 (vide Document No.14).

2. Age Composition

From the samples (Tables 3-7, Fig.1), with the exception of sample B (= L3), it is seen that the age groups IX (1947), X (1946) and XI (1945) are predominating in the proportions of 6-19%, 13-18% and 12-20% respectively. The age group VIII is a little higher than 10%, reaching around 17% in the sample group E. The age group XII represents 7-10%. The groups below VI and over XII are far more scarce or almost non-existent.

The sample L3, although including only a small number of individuals, merits a special reference on account of its geographical position as well as its characteristic features. The sample is the most northern of all those collected within the limit of Subdivisions 2H-2J. The age group most common in this sample is the age group V (24%), group VI (20%) follows and then group X (15%). The age groups VII, VIII and IX are just below 10%.

3. Size Composition

The peak (30-36%) of the sizes (Tables 3-8, Fig.1) is in the majority of the samples in the size group 57 cm., thereupon follows the 62 cm. group (28%) in the sample groups A and C. In the remaining samples, the size group most common is that of 52 cm., with 22-26%. These values correspond to the predominance of age groups IX, X and XI and in some cases age group VIII.

In sample L3 (Fig.1B), which was already singled out as of special interest by its composition of age groups, the peak is found in the size group 42 cm. (39%) corresponding to the age groups V and VI.

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4. Growth

In the Tables 3-7 the mean sizes are summarized by age groups. These figures are based on the calculation of the mean growth of males and females (Table 9) and the mean annual growth of the various age groups (Fig.2). The growth of the males is just a little less than that of the females, the divergence of the growth curves being particularly clear from the sixth year. This difference in growth is surely in relation with the displacing of the ages of first maturity, this being reached more early in the males than in the females as will be shown in item 7.

It should, however, be noted that the individuals of sample L3 show a smaller growth compared to those of the other samples, which could be in relation with the fact that this sample comes from one of the most northern regions (limit between Subdivision 2J and 2H).

5. Sex Ratio

From a consideration of the samples investigated (Tables 3-8), a more or less pronounced predominance of females (53-55%) appears, especially in sample groups F (66%) and H (59%).

Sample L3, contrary to all the remaining, shows a clear predominance of males (68%).

6. Stage of Maturity

It appears from the samples (Table 10, Fig.3, Age-groups VIII, X and XI) that in August the majority of the males (89%) are in the developing stage or in the resting stage (10%). Of the females, 62% are in the after-spawning stage, the remaining females being in the resting stage (38%).

In October-November, the percentage of males in the after-spawning stage is insignificant. Nearly all specimens were in the developing stage and a small number only in the resting stage. In the females, a decrease in the number in the after-spawning stage, which falls from 37% to 3%, is found. The numbers in the resting stage also decreases, from 42 to 23%. The developing stages are dominating towards the end of November.

7. Age at First Maturity

The age at first maturity was determined from the first spawning ring in the otoliths. The number and percentage of first spawners within the various age groups appear from Table 11 and Fig.4.

All the cases in which it was not possible to determine with accuracy the first spawning ring or to verify clearly its existence are included in the "doubtful" category.

Generally, first maturity is achieved between the 6th and the 10th year of age, rarely at the age group XI.

The majority of the males reach first maturity in the 7th year, the majority of the females in the 8th year.

The observations on age groups VII and VIII deserve to be discussed separately owing to the difficulty in the interpretation of the first spawning ring among the rings under formation. In effect, these rings which are formed in the proximity of the edge of the otolith never show the structure typical for the spawning rings. Further, the absence of other more external rings, which could serve for comparison, makes it difficult to interpret these rings clearly.

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Thus in the age group VII the majority of individuals were considered as immature on the basis of the reading and interpretation of the rings in the otoliths. In a number of cases, however, this does not agree with the microscopical observations on the gonads nor in a more general way with the scheme of the maturity observed in age groups more advanced (first maturity in the majority of cases found in the 7th and the 8th year).

However, as these marginal rings did not suggest doubts as to the observation (the doubts are as to interpretation), they were not included in the category of the doubtful.

The same considerations are valid for the interpretation of the results concerning age group VIII in which the determination of the first maturity in the 7th year must be correct, the more so as the small number of individuals with a spawning ring in the 8th year (marginal ring) could be the result, first of all, of difficulties in interpretation.

8. Study of Weights

Observations on weights were carried out on a number of specimens; the results obtained are summarized in Table 12.

As in the observations of the previous year, no significant difference in the weights of males and females by sizes was observed.

The weights by sizes are just a little superior to those found in 1955.

The figures found for the weights of the testes and ovaries are rather low, which confirms the observations on the stages of maturity: after-spawning stages rare, predominance of resting stages or developing stages.

The weights of the livers and the intestines for various sizes of fish are also shown.

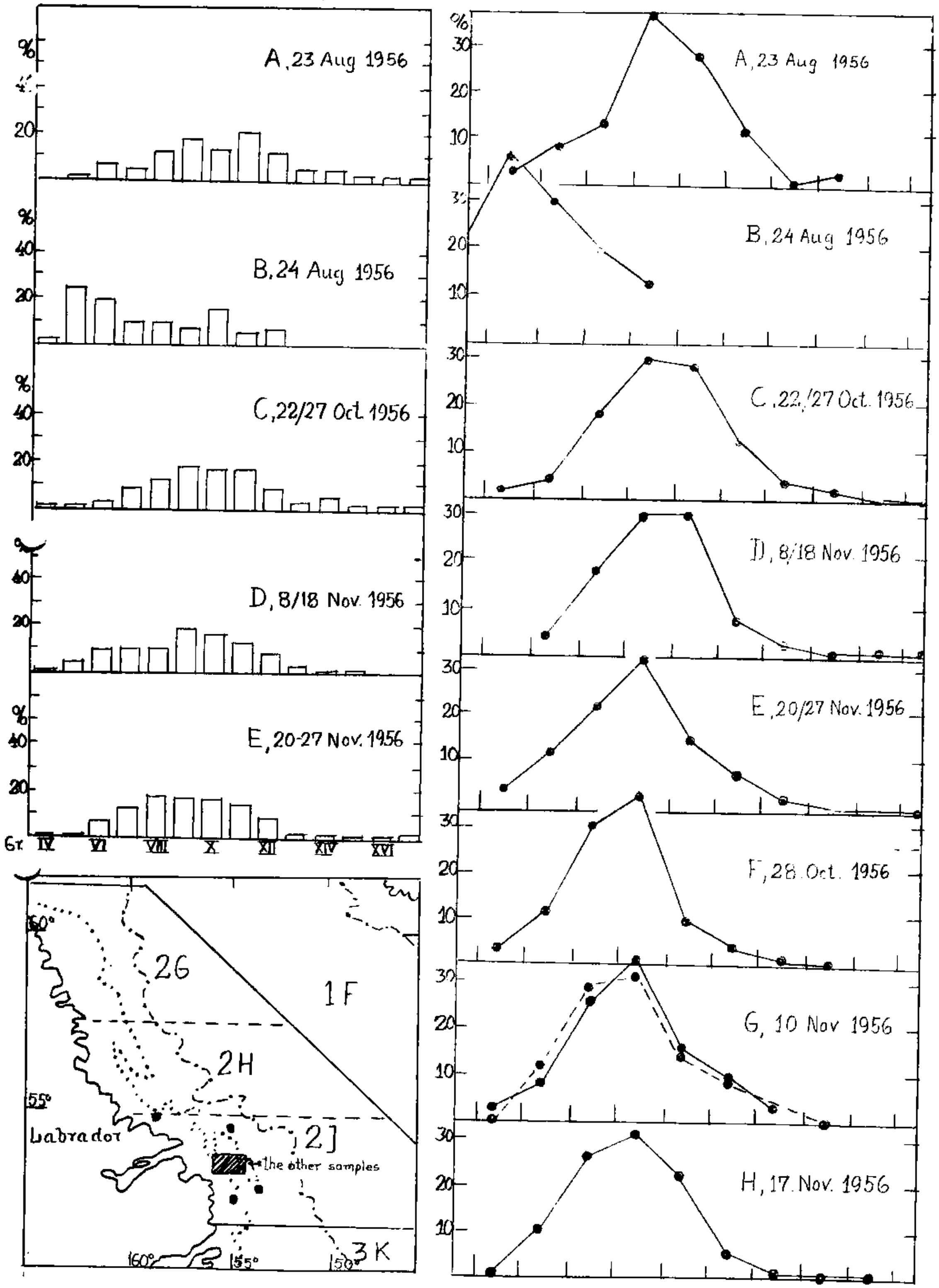

Fig. 1. Map showing localities sampled. Above age-distribution, to the right size-distribution by sample-groups.

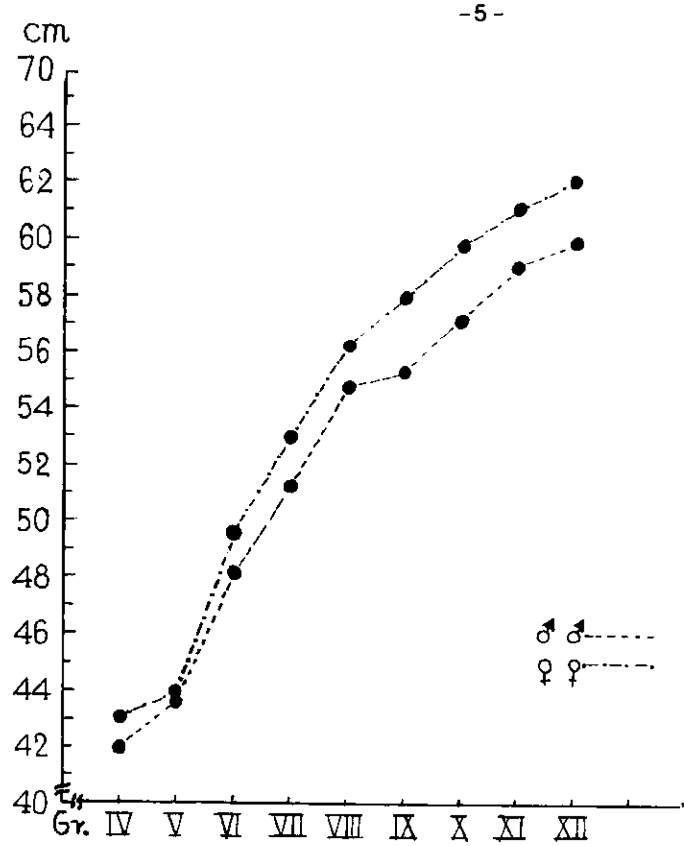

Fig. 2. Cod. Subarea 2. 1956. Growth of males and females

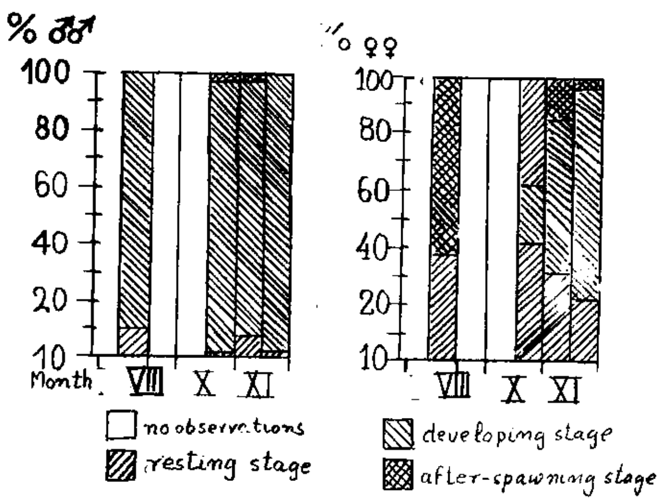

Fig. 3. Stage of maturity of males and females in half month periods, August (VIII) to November (XI).

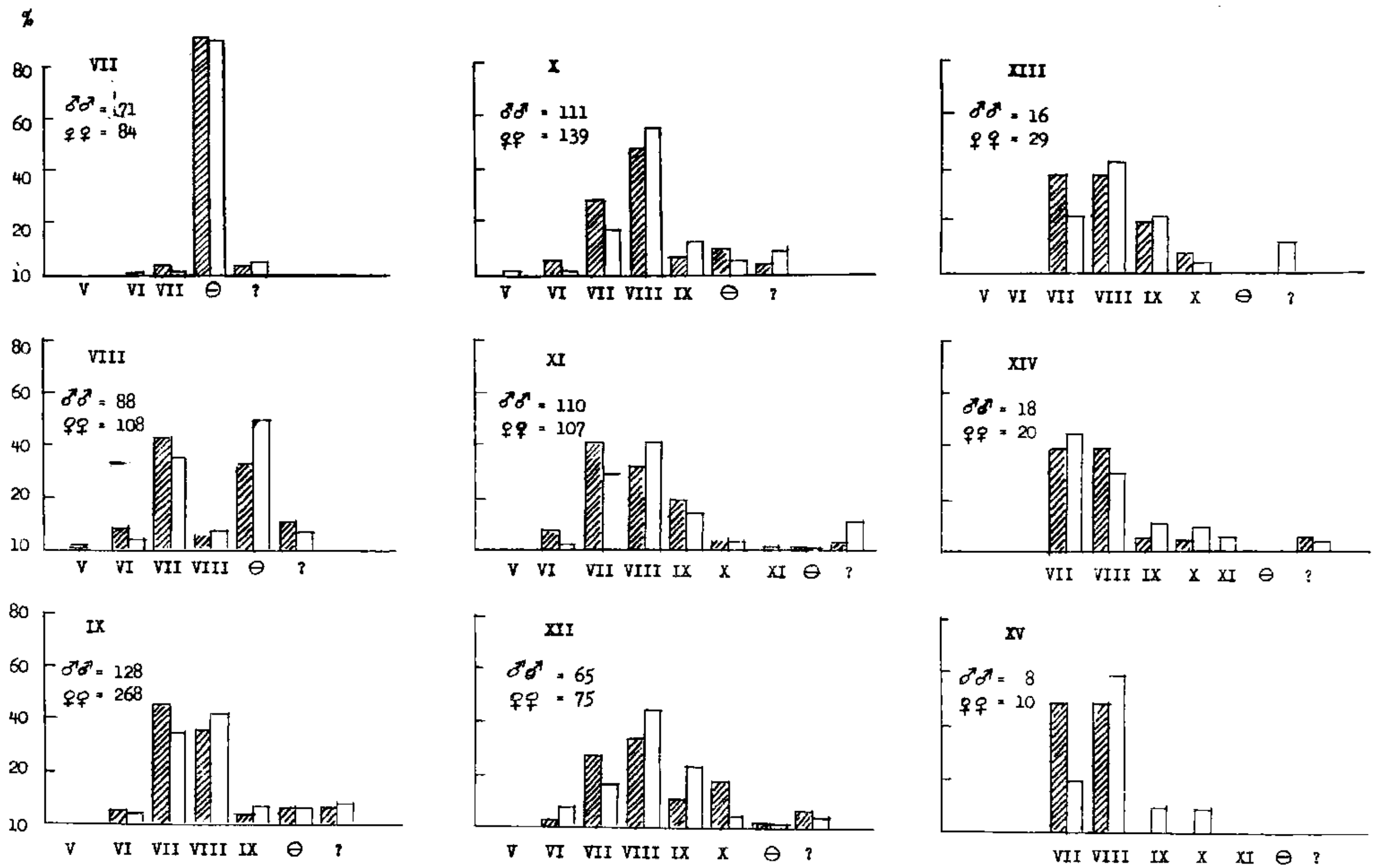

Fig. 4. Cod, Subarea 2, age at first maturity. Percentage number of individuals (males - striated columns, females-white columns) spawning for the first time at various age-groups (V-XI). ⊖ indicates no spawning mark.

TABLE 1 - LIST OF FISH SAMPLES TAKEN BY PORTUGAL, 1956, IN SUBAREA 2

SAMPLE NUMBER	SPECIES	MONTH	SUBDIV-ISION	IN PORT OR AT SEA	GEAR	NO. OF SPECIMENS	INDICATE BELOW OBSERVATIONS MADE: LENGTHS	WEIGHTS	SEXES	MATURITIES	OTOLITHS OR SCALES COLLECTED	AGES DE-TERMINED	FIRST MATURATION	PARASITISM		
1	Cod	23.8	2J(53°00'N (54°50'W	At Sea	Trawl	95	x		x	x	OT	x	x	x		
2	"	23.8	2J(53°55'N (55°30'W	"	"	24	x		x	x	"	x	x	x		
3	"	24.8	2J(55°17'N (57°48'W	"	"	41	x		x	x	"	x	x	x		
4	"	22.10	2J(53°45'N (54°30'W	"	"	100	x		x	x	"	x	x	x		
5	"	23.10	2J(53°30'N (54°30'W	"	"	100	x	x	x	x	"	x	x	x		
6	"	26.10	2J(53°28'N (54°39'W	"	"	100	x		x	x	"	x	x	x		
7	"	27.10	2J(53°21'N (53°39'W	"	"	100	x		x	x	"	x	x	x		
8	"	28.10	2J(53°42'N (55°00'W	"	"	200	x		x							
9	"	8.11	2J(55°05'N (54°29'W	"	"	50	x		x	x	"	x	x	x		
10	"	9.11	2J(53°45'N (54°55'W	"	"	75	x		x	x	"	x	x	x		
11	"	10.11	2J(53°50'N (55°03'W	"	"	300	x		x							
12	"	12.11	2J(53°46'N (54°15'W	"	"	75	x		x	x	"	x	x	x		
13	"	14.11	2J(53°45'N (54°29'W	"	"	75	x		x	x	"	x	x	x		
14	"	15.11	2J(53°36'N (54°40'W	"	"	100	x		x	x	"	x	x	x		
15	"	17.11	2J(53°38'N (54°40'W	"	"	300	x		x	x						
16	"	18.11	2J(53°43'N (54°40'W	"	"	100	x		x		"	x	x	x		
17	"	20.11	2J(53°40'N (54°50'W	"	"	74	x		x	x	"	x	x	x		
18	"	21.11	2J(53°53'N (54°20'W	"	"	100	x		x	x	"	x	x	x		
19	"	24.11	2J(53°35'N (54°30'W	"	"	100	x		x	x	"	x	x	x		
20	"	26.11	2J(53°44'N (54°55'W	"	"	100	x		x	x	"	x	x	x		
21	"	27.11	2J(53°47'N (54°45'W	"	"	100	x		x	x	"	x	x	x		

TABLE 2 - PLAN OF THE GROUPING OF THE SAMPLES, LABRADOR 1956

Group of Samples	Samples	Sub-Div.	Date
A	L 1-2	2J	23.8.56
B	L 3	"	24.8.56
C	L 4-5-6-7	"	22-27.10.56
D	L 9-10-13-14-16	"	8-18.11.56
E	L 17-18-19-20-21	"	20-27.11.56
F	L 8	"	28.10.56
G	L 11	"	10.11.56
H	L 15	"	17.11.56

TABLE 3 - **AGE AND LENGTH DISTRIBUTION (MEANS) OF TWO SAMPLES FROM THE HAMILTON BANK (TRAWLER):**
A = L1, 23.8.1956, 53°00'N, 54°50'W; L2, 23.8.1956, 53°55'N, 55°30'W.

Year-Class	Age	♂♂ %	♂♂ cm.	♀♀ %	♀♀ cm.	Total	♂♂ + ♀♀ %	♂♂ + ♀♀ cm.
1952	-	-	-	-	-	-	-	-
51	V	100.0	44.0	-	-	2	1.7	44.0
1950	VI	62.5	47.6	37.5	50.3	8	6.7	49.0
49	VII	71.4	49.4	28.6	55.0	7	5.9	52.2
48	VIII	35.7	56.8	64.3	56.8	14	11.8	56.8
47	IX	40.0	54.3	60.0	58.4	20	17.0	56.4
46	X	31.3	56.6	68.7	59.2	16	13.4	57.9
1945	XI	54.2	58.4	45.8	62.1	24	20.2	60.3
44	XII	50.0	59.5	50.0	60.8	12	10.1	60.2
43	XIII	40.0	67.0	60.0	65.6	5	4.2	66.3
42	XIV	60.0	65.3	40.0	65.0	5	4.2	65.2
41	XV	66.6	64.5	33.4	59.0	3	2.5	61.8
1940	XVI	-	-	100.0	62.0	1	0.9	62.0
39	XVII	-	-	100.0	71.0	2	1.7	71.0
Mean in sample		47.1%		52.9%		obs.119		

TABLE 4 - **AGE AND LENGTH DISTRIBUTION (MEANS) OF ONE SAMPLE, NW OF HAMILTON INLET BANK (TRAWLER):**
B = L3, 24.8.1956, 55°17'N, 57°48'W.

Year-Class	Age	♂♂ %	♂♂ cm.	♀♀ %	♀♀ cm.	Total	♂♂ + ♀♀ %	♂♂ + ♀♀ cm.
1952	IV	100.0	42.0	-	-	1	2.4	42.0
51	V	40.6	41.5	60.0	41.6	10	24.4	41.6
1950	VI	50.0	44.8	50.0	44.0	8	19.5	44.4
49	VII	75.0	44.6	25.0	49.0	4	9.8	46.8
48	VIII	75.0	48.6	25.0	56.0	4	9.8	52.3
47	IX	66.6	51.5	33.4	51.0	3	7.3	51.3
46	X	100.0	52.6	-	-	6	14.6	52.6
1945	XI	100.0	51.5	-	-	2	4.8	51.5
44	XII	100.0	51.3	-	-	3	7.3	51.3
Mean in sample		68.3%		31.7%		obs.41		

TABLE 5 - **AGE AND LENGTH DISTRIBUTION (MEANS) OF FOUR SAMPLES FROM THE HAMILTON BANK (TRAWLER):**
C = L4, 22.10.1956, 53°45'N, 54°30'W; L5, 23.10.1956, 53°30'N, 54°30'W;
L6, 26.10.1956, 53°28'N, 54°30'W; L7, 27.10.1956, 53°21'N, 53°39'W.

Year-Class	Age	♂♂ %	♂♂ cm.	♀♀ %	♀♀ cm.	Total	♂♂ + ♀♀ %	♂♂ + ♀♀ cm.
1952	IV	100.0	44.0	-	-	1	0.3	44.0
51	V	33.3	43.0	66.7	44.8	6	1.5	43.9
1950	VI	64.3	51.4	35.7	50.4	14	3.5	50.9
49	VII	41.7	52.7	58.3	53.2	36	9.1	53.0
48	VIII	45.0	55.7	55.0	57.2	49	12.3	56.5
47	IX	39.2	55.6	60.8	59.3	74	18.6	57.5
46	X	47.1	58.3	52.9	61.1	68	17.1	59.7
1945	XI	52.2	59.4	47.8	61.9	67	16.8	60.7
44	XII	43.2	61.0	56.8	63.5	37	9.2	62.3
43	XIII	28.6	61.5	71.4	66.3	14	3.5	63.9
42	XIV	49.4	62.7	50.6	66.8	19	4.8	64.8
41	XV	20.0	66.0	80.0	68.8	5	1.3	67.4
1940	XVI	47.4	65.0	52.6	75.5	3	0.8	70.3
39	XVII	66.7	66.5	33.3	79.0	3	0.8	72.8
38	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-
36	XX	-	-	100.0	81.0	2	0.6	81.0
Mean in sample		44.7%		55.3%		obs.398		

TABLE 6 – AGE AND LENGTH DISTRIBUTION (MEANS) OF SIX SAMPLES FROM THE HAMILTON BANK (TRAWLER):
D = L9, 8.11.1956, 55°05'N, 54°29'W; L10, 9.11.1956, 53°45'N, 54°55'W; L12, 12.11.1956, 53°46'N, 54°15'W; L13, 14.11.1956, 53°45'N, 54°29'W; L14, 15.11.1956, 53°36'N, 54° 40'W; L16, 18.11.1956, 53°43'N, 54°40'W.

Year-Class	Age	♂♂ %	♂♂ cm.	♀♀ %	♀♀ cm.	Total	♂♂ + ♀♀ %	♂♂ + ♀♀ cm.
1952	IV	50.0	41.0	50.0	43.0	2	0.4	42.0
51	V	52.2	44.2	47.8	44.0	23	4.9	44.2
1950	VI	61.2	47.0	38.8	49.8	49	10.4	48.4
49	VII	54.0	51.0	46.0	51.6	50	10.6	51.3
48	VIII	44.9	53.4	55.1	55.7	49	10.4	54.6
47	IX	46.7	55.5	53.3	55.6	92	19.5	55.6
46	X	40.5	56.9	59.5	59.2	84	17.8	58.1
1945	XI	52.6	60.6	47.4	60.5	57	12.1	60.5
44	XII	36.1	60.0	63.9	63.9	36	7.6	62.2
43	XIII	25.0	60.5	75.0	69.8	16	3.4	65.2
42	XIV	37.5	62.3	62.5	70.2	8	1.7	66.3
41	XV	50.0	77.6	50.0	66.0	6	1.3	72.1
Mean in sample		47.0%		53.0%		obs. 472		

TABLE 7 – AGE AND LENGTH DISTRIBUTION (MEANS) OF FIVE SAMPLES FROM THE HAMILTON BANK (TRAWLER):
E = L17, 20.11.1956, 53°40'N, 54°50'W; L18, 21.11.1956, 53°53'N, 54°20'W; L19, 24.11.1956, 53°35'N, 54°30'W; L20, 26.11.1956, 53°44'N, 54°55'W; L21, 27.11.1956, 53°47'N, 54°45'W.

Year-Class	Age	♂♂ %	♂♂ cm.	♀♀ %	♀♀ cm.	Total	♂♂ + ♀♀ %	♂♂ + ♀♀ cm.
1952	IV	100.0	41.0	–	–	1	0.2	41.0
51	V	66.6	43.0	33.4	43.0	3	0.6	43.0
1950	VI	60.6	46.8	39.4	47.8	33	7.0	47.3
49	VII	39.3	51.9	60.7	52.0	61	13.0	52.0
48	VIII	22.4	53.4	77.6	55.4	83	17.6	54.4
47	IX	53.2	56.2	46.8	58.6	79	16.8	57.4
46	X	44.7	56.8	55.3	59.8	76	16.1	58.3
1945	XI	44.1	57.9	55.9	59.9	68	14.4	58.9
44	XII	41.9	58.9	58.1	61.8	43	9.1	60.4
43	XIII	60.0	61.5	40.0	65.0	10	2.1	63.3
42	XIV	57.0	60.3	43.0	67.7	7	1.5	64.0
41	XV	33.4	71.0	66.6	67.0	3	0.6	69.0
1940	XVI	100.0	66.0	–	–	1	0.2	66.0
39	XVII	100.0	70.0	–	–	1	0.2	70.0
38	XVIII	–	–	100.0	79.5	2	0.4	79.5
Mean in sample		46.9%		53.1%		obs. 471		

TABLE 8 – COD. LABRADOR (2J). SIZE DISTRIBUTION AND SEX DISTRIBUTION OF THREE SAMPLES FROM THE HAMILTON BANK
F = L8, 28.10.1956, 53°42'N, 55°00'W;
G = L11, 10.11.1956, 53°50'N, 55°03'W;
H = L15, 17.11.1956, 53°38'N, 54°40'W.

cm.	L8 Obs. (day)	L11 Obs. (day)	L15 Obs. (day)	L15 Obs. (night)
42	–	4.0	2.5	1.0
47	4.5	12.0	8.5	12.0
52	18.0	30.5	26.0	28.5
57	29.5	37.0	34.0	31.0
62	30.0	9.5	16.0	14.5
67	13.5	4.5	9.5	9.0
72	3.0	2.0	3.5	3.5
77	–	0.5	–	0.5
82	0.5	–	–	–
87	0.5	–	–	–
92	0.5	–	–	–
T %	100.0	100.0	100.0	100.0
Obs.	200	200	200	200
%	34.0	47.0	48.0	41.0

Year-Class	Age	♂♂ cm.	♀♀ cm.	♂♂ cm. (1955)	♀♀ cm. (1956)	Yearly Growth
1952	IV	42.0	43.0	32.5	42.5	9.8
51	V	43.6	43.9	38.9	43.8	4.9
1950	VI	48.2	49.6	44.0	48.9	4.9
49	VII	51.3	53.0	47.1	52.1	5.0
48	VIII	54.8	56.3	51.0	55.6	4.6
47	IX	55.4	58.0	52.8	56.7	3.9
46	X	57.2	59.8	54.7	58.5	3.8
1945	XI	59.1	61.1	55.3	60.1	4.8
44	XII	59.9	62.5	57.0	61.3	4.3

TABLE 10 - COD. LABRADOR (2J). AUG. AND NOV. 1956. STAGES OF MATURITY DETERMINED BY MICROSCOPIC OBSERVATION OF THE GONADS (♂ AND ♀)

	A 23.8.1956 (119)		B 24.8.1956 (41)		C 22-27.10.1956 (400)		D 8-18.11.1956 (475)		E 20-27.11.1956 (475)	
Stage of Maturity	♂♂ %	♀♀ %	♂♂ %	♀♀ %	♂♂ %	♀♀ %	♂♂ %	♀♀ %	♂♂ %	♀♀ %
Resting	10.7	38.1	17.9	100.0	2.3	42.7	8.8	32.2	3.6	23.2
Maturing	89.3	-	82.1	-	95.6	20.0	90.8	54.9	96.4	73.3
Spawning	-	-	-	-	-	-	-	-	-	-
After Spawning	-	61.9	-	-	2.2	37.3	0.4	12.9	-	3.5
%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No.	56	63	28	13	180	220	227	248	220	255

TABLE 11 - COD. LABRADOR (2J) AGE AT FIRST MATURITY OF MALES AND FEMALES OF MOST ABUNDANT AGE GROUPS (VII-XV) IN SAMPLES FROM AUG. TO NOV. 1956. ⊖ = IMMATURE; ? = DOUBTFUL

Year-Class		Age at First Spawning ♂♂ V	VI	VII	VIII	IX	X	XI	⊖	?	T	Age at First Spawning ♀♀ V	VI	VII	VIII	IX	X	XI	⊖	?	T
VII	No.	-	-	3	-	-	-	-	68	3	71	-	1	3	-	-	-	-	76	4	84
	%	-	-	4.1	-	-	-	-	91.9	4.1		-	1.2	3.6	-	-	-	-	90.5	4.8	
VIII	No.	1	7	38	5	-	-	-	28	9	88	-	2	37	8	-	-	-	54	7	108
	%	1.1	8.0	43.2	5.7	-	-	-	31.8	10.2		-	1.9	34.3	7.4	-	-	-	49.9	6.5	
IX	No.	-	6	57	45	4	-	-	7	9	128	-	4	48	59	11	-	-	7	11	268
	%	-	4.7	44.5	35.1	3.7	-	-	5.5	7.0		-	2.9	34.3	42.7	7.9	-	-	5.0	7.9	
X	No.	1	6	32	51	7	-	-	9	5	111	-	1	24	77	16	-	-	8	13	139
	%	0.9	5.4	28.8	45.9	6.3	-	-	8.1	4.5		-	0.7	17.3	55.4	11.5	-	-	5.8	9.4	
XI	No.	-	8	4.4	28	20	5	-	2	3	110	-	2	31	43	14	4	1	1	11	107
	%	-	7.3	40.0	25.5	18.2	4.5	-	1.8	2.7		-	1.8	29.0	40.2	13.1	3.7	0.9	0.9	10.3	
XII	No.	-	2	18	22	7	11	-	1	4	65	-	5	12	34	17	3	-	1	3	75
	%	-	3.1	27.7	33.8	10.8	16.9	-	1.5	6.2		-	6.7	16.0	45.3	22.7	4.0	-	1.3	4.0	
XIII	No.	-	-	6	6	3	1	-	-	-	16	-	-	6	12	6	1	1	-	3	29
	%	-	-	37.5	37.5	18.8	6.3	-	-	-		-	-	20.7	41.4	20.7	3.4	3.4	-	10.3	
XIV	No.	-	7	7	1	1	1	-	-	1	18	-	-	9	6	2	2	-	-	1	20
	%	-	38.8	38.8	5.6	5.6	5.6	-	-	5.6		-	-	45.0	30.0	10.0	10.0	-	-	5.0	
XV	No.	-	-	4	4	-	-	-	-	-	8	-	-	2	6	1	1	-	-	-	10
	%	-	-	50.0	50.0	-	-	-	-	-		-	-	20.0	60.0	10.0	10.0	-	-	-	

TABLE 12 - COD. LABRADOR. DATA ON VARIOUS WEIGHTS BY SIZE CLASSES. SAMPLE L5, 23.10.1956

Cm.	♂♂ No.Obs.	Total Weight	Liver	Gonads	Guts	♀♀ No.Obs.	Total Weight	Liver	Gonads	Guts
47	3	1050	30	37	143	1	1140	70	30	120
52	3	1375	100	44	192	9	1483	116	54	167
57	13	1826	158	73	247	26	1782	165	67	223
62	18	2335	174	112	449	15	2308	218	90	281
67	1	2500	210	80	290	6	2802	242	97	303