



Serial No. 546
(D. Res.a./58)

Document No. 20

ANNUAL MEETING - JUNE 1958

Portuguese Research Report, 1957

by Mario Ruivo and Glicinia Quartin

A. Observations of Cod, *Gadus callarias* L., in Subarea 1 - Greenland

1. Material and methods

A total of 38 samples of cod were collected, of which 28 were from trawlers and 10 from dory vessels; they comprise in all 4,500 individuals. The samples from dory vessels (Nos. 29° - 38°) include only length measurements. For 21 of the 28 trawler samples (Nos. 1° - 28°) age determinations by means of otoliths were also carried out.

The average mesh size of the trawl codend used was around 117 mm. The hooks used by the dories were No. 14½.

The samples from trawls were taken just after capture, i.e. before the culling of the catch. The dory vessel samples were taken when the dories brought their catches on board the dory vessels.

Measurements, age determinations and other data from the samples will appear in tabular form in the 1957 Sampling Yearbook.

The 28 trawl samples were grouped as follows:

<u>Sample group</u>	<u>Sample Nos.</u>	<u>Subdivision</u>	<u>Date</u>
A°	27	1F	24 June, 1957
B°	2,3,5,11,13,14	1E	11-31 May, 1957
C°	1,8,9,10,12	1D	9-26 May, 1957
D°	16,17,26	1D	5-27 June, 1957
E°	28	1D	11 Oct., 1957
F°	15,18,20,22,24	1C	4-16 June, 1957

The map, Fig. 1, shows the positions of the samples. To the left in the figure is shown age distribution of the six sample groups, to the right length distribution of the sample groups and of some separate samples.

The methods for the working up of the material were the same as used in previous years (cf. Portuguese Research Report for 1956, ICNAF Ann. Proc. Vol. 7).

2. Age composition

a) Trawlers 1st campaign (May-June, Fig. 1). The only sample from Subdivision 1F (June, No. 27°) shows a predominance of age group VII (34%); the IV, VI and VIII groups are represented by around 15%; the V group with a little less (11%).

In 1E (May sample group B°) the age groups VII and X predominate with 37% and 21% respectively. The other age groups are lower with around 10%. The IV group (2%) and the V group (5%) are very scarce.

In 1D (May-June, sample groups C° and D°) age groups IV (25-27%), VII (20%) and X (18-20%) dominate. The V group is represented with 10-12%. The other age groups are around or below 5%.

In 1C (June, sample group F°) the IV group (33%) and the VII group (21%) are the most abundant. The V and the VI groups are around 13%, the X group only 6%.

...../2

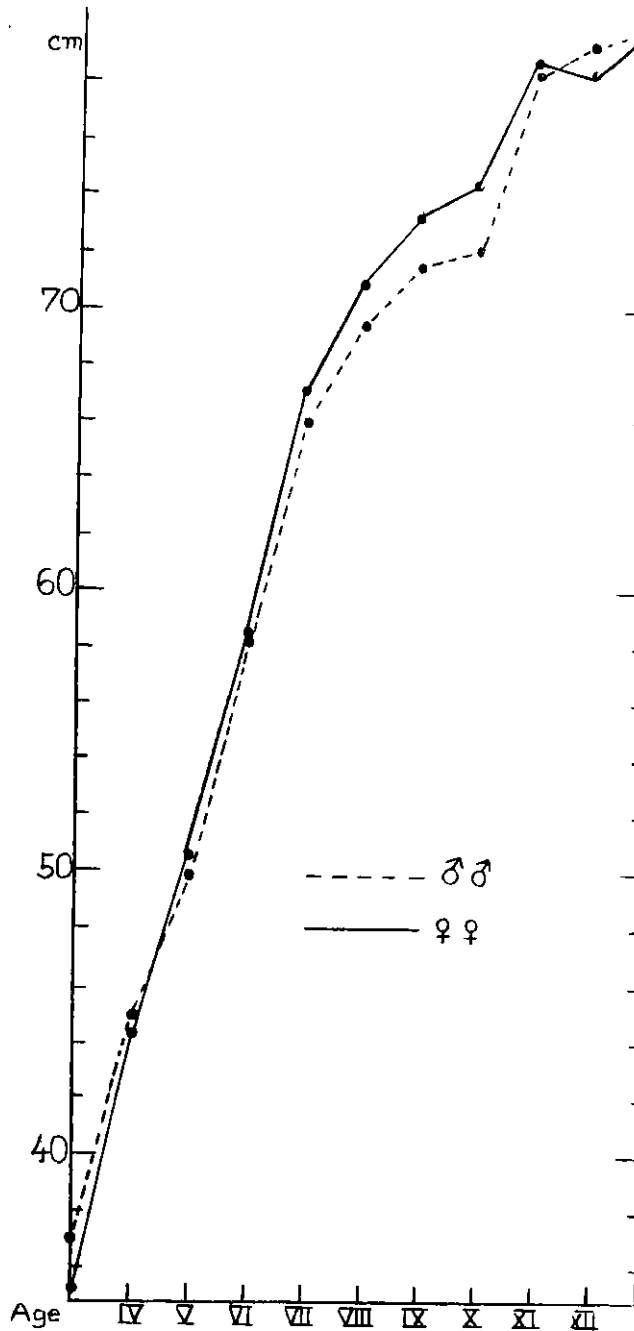


Fig. 3. Cod, W. Greenland, 1957. Growth curves for males and females from Subdivisions 1C-F.

Fig. 1 and 2, opposite page, show samples from the Portuguese trawl (1) and line (2) fishery in Greenland waters.

b) Trawlers 2nd campaign (Oct., Fig. 1). One sample from 1D and from October (sample No. 28°) shows predominance of the IV group (34%) and the V group (22%), followed by the VII group (17%) and the VI group (12%). The other age groups are lower than 5% or negligible.

Summary. In the spring of 1957 the 1950 year-class predominated in the most southern region (1F); relatively rich were the 1949, 1951 and 1953 year-classes. The 1947 year-class had nearly disappeared completely.

In 1E the 1950 year-class predominates, and the 1947 year-class is rather well represented. In 1D these year-classes are also well represented, but the 1953 year-class is more abundant.

In 1C the 1953 year-class is the most abundant; it is followed by the 1950 year-class. The 1947 year-class is rather scarce.

In autumn a complete change in the composition of the catch appears for Subdivision 1D. The 1952 and 1953 year-classes are now about to predominate. The 1950 year-class has about the same percentage as in the spring; the 1951 year-class is a little more abundant.

3. Size composition

A bimodal distribution appears generally in the samples from trawlers (Fig. 1). The peaks of the curves are in the cm. groups 62-67 (less common in group 72, sample group D°), and in the cm. groups 42-47. This corresponds to the predominance of the age groups VII and X and IV and V, respectively.

...../4

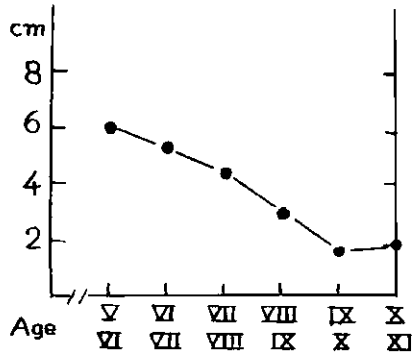
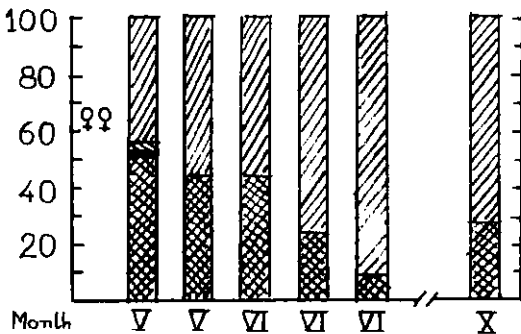
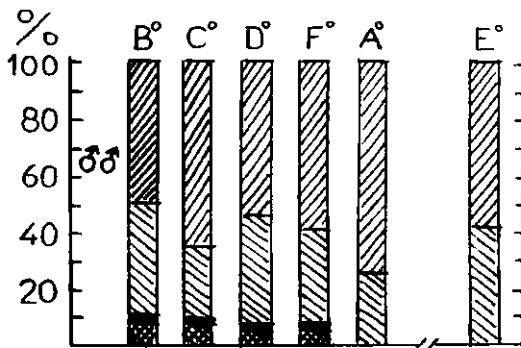


Fig. 4. Cod, W. Greenland, 1957. Annual growth of the richer age groups. Subdivisions 1C-F.



Resting
 Developing
 Spawning
 After spawning

Fig. 5. Cod, W. Greenland, 1957. Percentage number of males and females of different stages of maturity in different months, V (May) to X (Oct.). Sample groups indicated above (B°-E°)

Fig. 1 also shows a comparison of day and night samples from trawlings carried out in the same region.

Samples 4° and 7° (1E) and 21° (1C) differ from the bimodal trend, showing only one peak. This suggests that during the night generally smaller fish are caught. Sample 19° does not show any difference in size between day and night catches. However, the data are not sufficient to permit valid conclusions.

The size composition of the catches from the line fishery (Fig. 2) differs considerably from that from the trawl fishery. The length curves have one, two or more peaks, in the 62 and, more common, in the 72, 77 and 82 cm. groups.

4. Growth

Fig. 3 shows growth curves for males and females for the combined Subdivisions 1C, 1D, 1E, and 1F.

The growth of the males is slightly inferior to that of the females for the medium aged and older fish; the crossing point of the curves is at age group VII.

Fig. 4 gives the yearly growth for the more abundant age groups (V-XI). The growth is much the same as that observed in 1956.

5. Sex composition

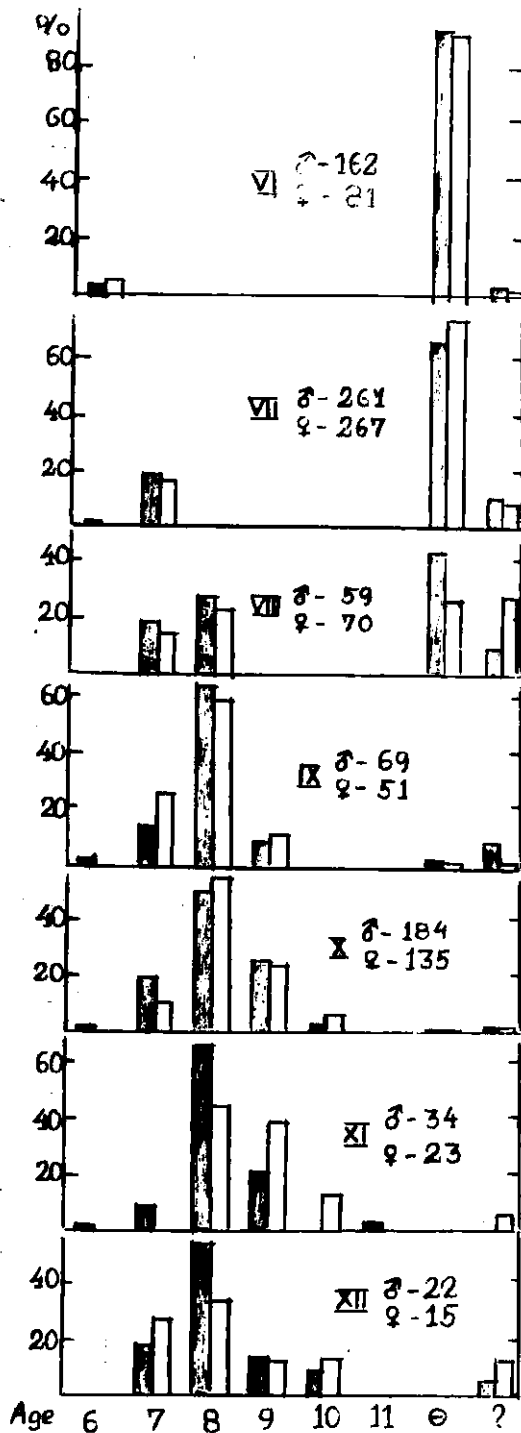
The samples on the whole show a slight predominance of the males; only groups A° and F° are exceptions with 52-55% females.

A comparison of day and night catches from the same place indicates a slight predominance of the males in night catches; only sample No. 19° is an exception. In the day samples there is more equality in numbers of the two sexes.

6. Stage of Maturity (Fig. 5)

Males. In May-June the majority are in the resting stage (48-60%) and the developing stage (25-40%). 5-8% are after spawners and 1-2% are in full spawning. In sample 27° (1F), June, only males in the resting stage (74%) or in the developing stage (26%) are observed. In October all males are

...../5



either in the resting stage (59%) or in the developing stage (41%).

Females. In May practically all females are in the resting stage (45-55%) or in the after spawning stage (44-54%). Only in one sample group (B^o) very few cases of the developing or spawning stage are found (less than 1%).

In June all females are either resting (54-92%) or in the after spawning stage (8-45%).

In October the situation is about the same: resting - 73%, after spawning - 26%.

7. First Maturity. (Fig. 6)

Based on the observation of spawning rings, the first maturity is observed to occur between the 6th and 10th year, most commonly in the 8th year; however, quite important numbers reach first maturity in the 7th and 9th years.

The material at hand does not show any significant difference between males and females as to age at first maturity, which is contrary to what was observed in previous years (males maturing earlier than females).

8. Weight

Data on weight (total, liver, gonads, intestines) were collected from 200 individuals; these data will be published in the 1957 Sampling Yearbook.

Fig. 6. Cod, W. Greenland, 1957. Percentage number of males (shaded columns) and females (white columns) of the various ages (6-11) spawning for the first time. ⊙ indicates no spawning mark.

...../6

B. Observations of Cod in Subarea 2 - Labrador

1. Material and methods

<u>Sample group</u>	<u>Sample Nos.</u>	<u>Subdivision</u>	<u>Dates</u>
A°	1,3,4,7,8,9	2J	5-31 Oct., 1957
B°	11	2H	2 Nov., 1957
C°	12,14,16,19,20	2J	6-22 Nov., 1957
D°	22,23,25	2J	24-30 Nov., 1957

The above 25 samples from trawlers, including around 4,100 individuals, were studied. Age determinations were made for 15 of these samples (1,500 individuals).

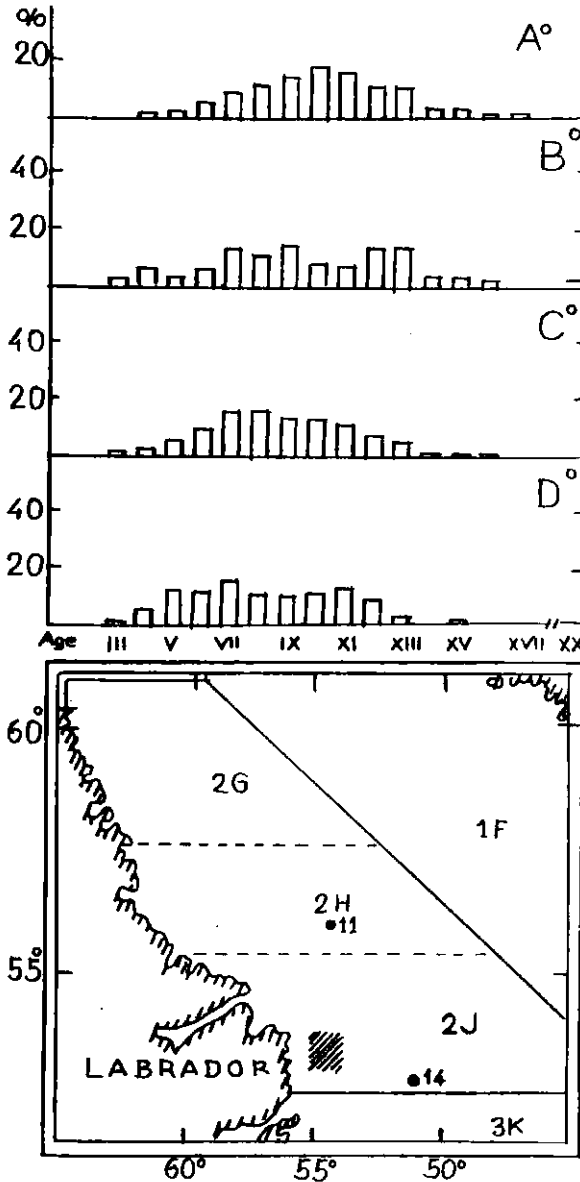


Fig. 7a. Cod, Labrador, 1957. Age distribution by sample groups (above). Positions of samples (below).

The mean mesh size of the codend used by the trawlers was 117 mm. The sampling included the cod as caught, i.e. before culling.

Fig. 7a and b show the position of the samples, the age composition and the size distribution of sample groups or separate samples.

The methods used for the investigations are the same as those described in earlier reports (Portuguese Research Report, 1956; ICNAF Ann. Proc. Vol. 7). All data will appear in tabular form in the 1957 Sampling Yearbook.

2. Age composition (Fig. 7a)

In Subdivision 2J, October (sample group A°) the X group predominates (17%); it is followed by the IX and XI groups (14%); the VIII, XII and XIII groups are represented with around 11%. The remaining age groups are poor or nearly non-existent.

In the beginning of November (sample group C°) the VII and VIII groups predominate (15%), followed by the IX, X and XI groups (12-13%).

By the end of November (sample group D°) the VII group is the richest (around 16%), followed by the V, VI and IX groups (around 12%). The VIII and X groups are represented with 10%.

In the more northern Subdivision 2H, beginning of November (sample group B°), the predominating age groups are: IX - 14%, VII, XII and XIII - 13%. The VIII group accounts for 10%.

...../7

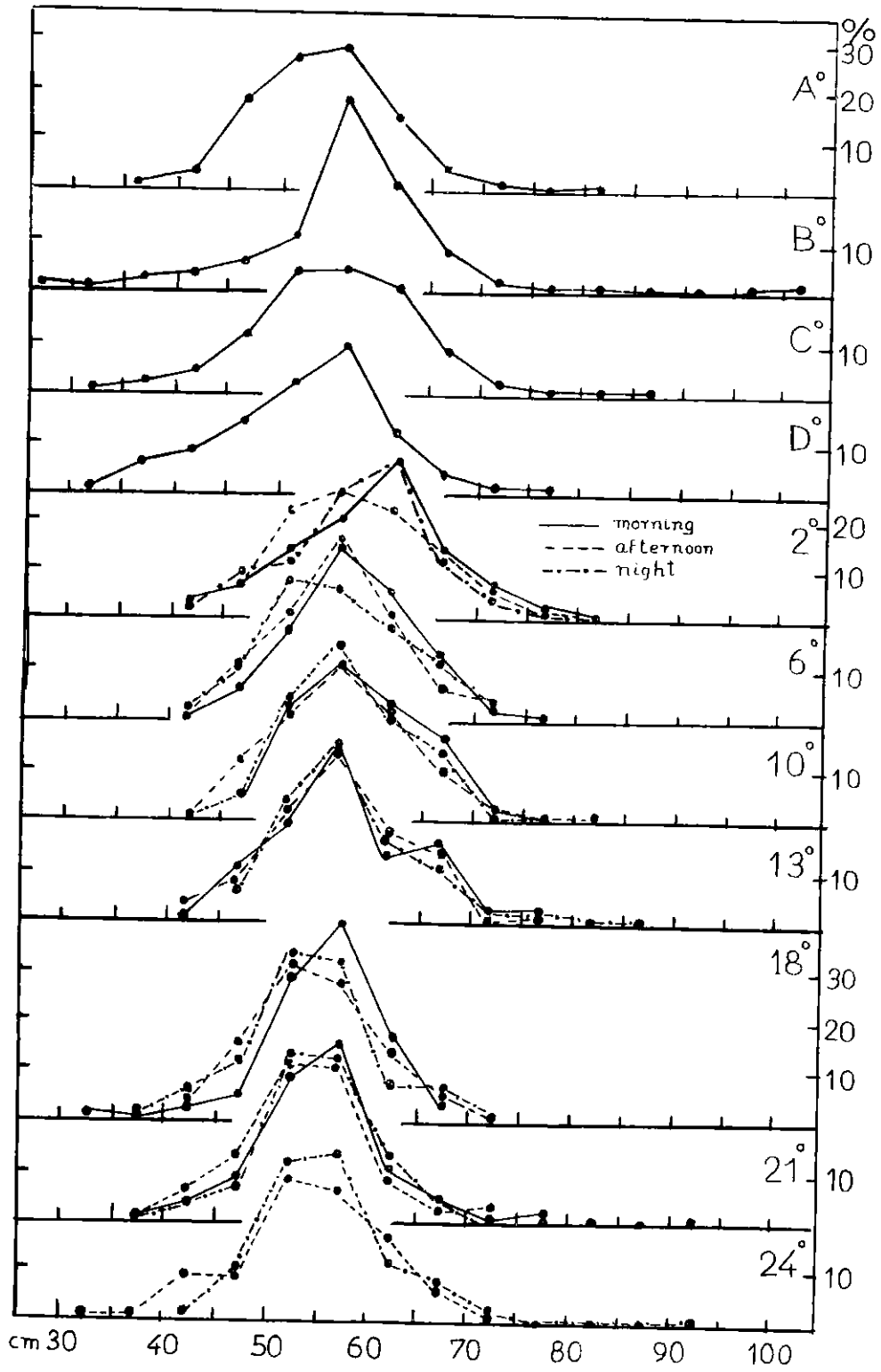


Fig. 7b. Cod, Labrador, 1957. Length distribution of sample groups or samples.

...../8

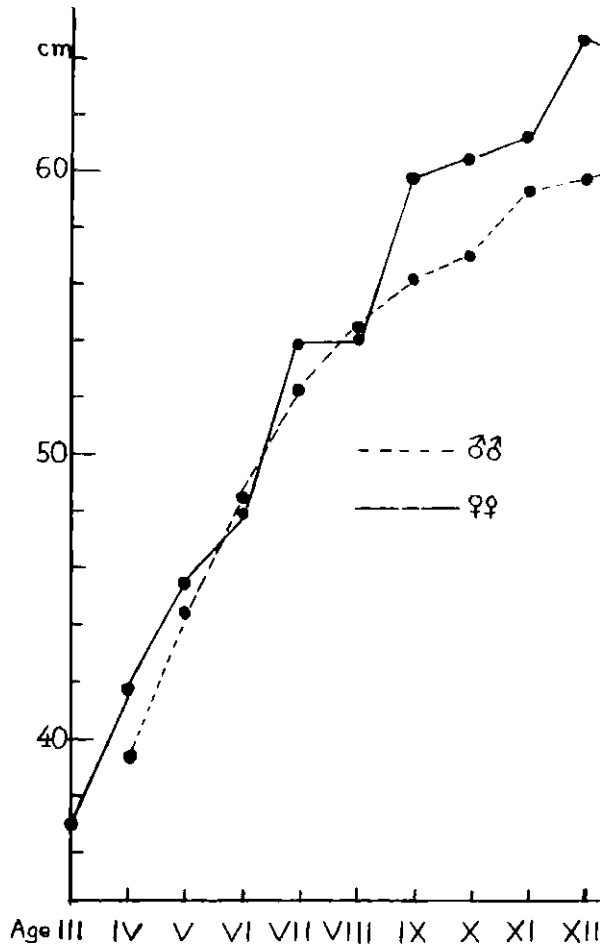


Fig. 8. Cod, Labrador, 1957. Growth curves for males and females.

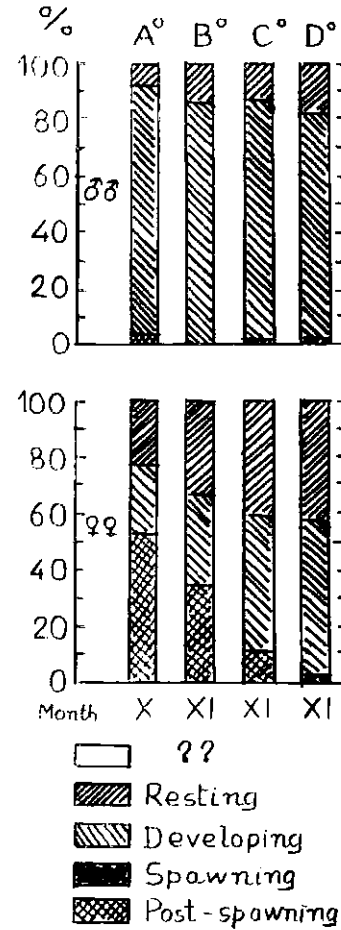


Fig. 9. Cod, Labrador, 1957. Percentage number of males and females of different stages of maturity in the months October (X) and November (XI). Sample groups indicated above (A°-D°).

Summary. In the Labrador region no strongly predominating year-classes appear; the 1946-1950 year-classes are those best represented.

3. Size distribution (Fig. 7b)

The sample groups A°-D° present a relatively uniform size distribution with a peak in the 57 cm. class. There is one exception, with the peak falling in the 62 cm. class; in this sample age group X predominates.

In Fig. 7b are also shown size distribution curves for samples taken by day, in the afternoon and by night. The results are too irregular to permit any conclusions as to variations in size distribution over the 24 hours.

...../9

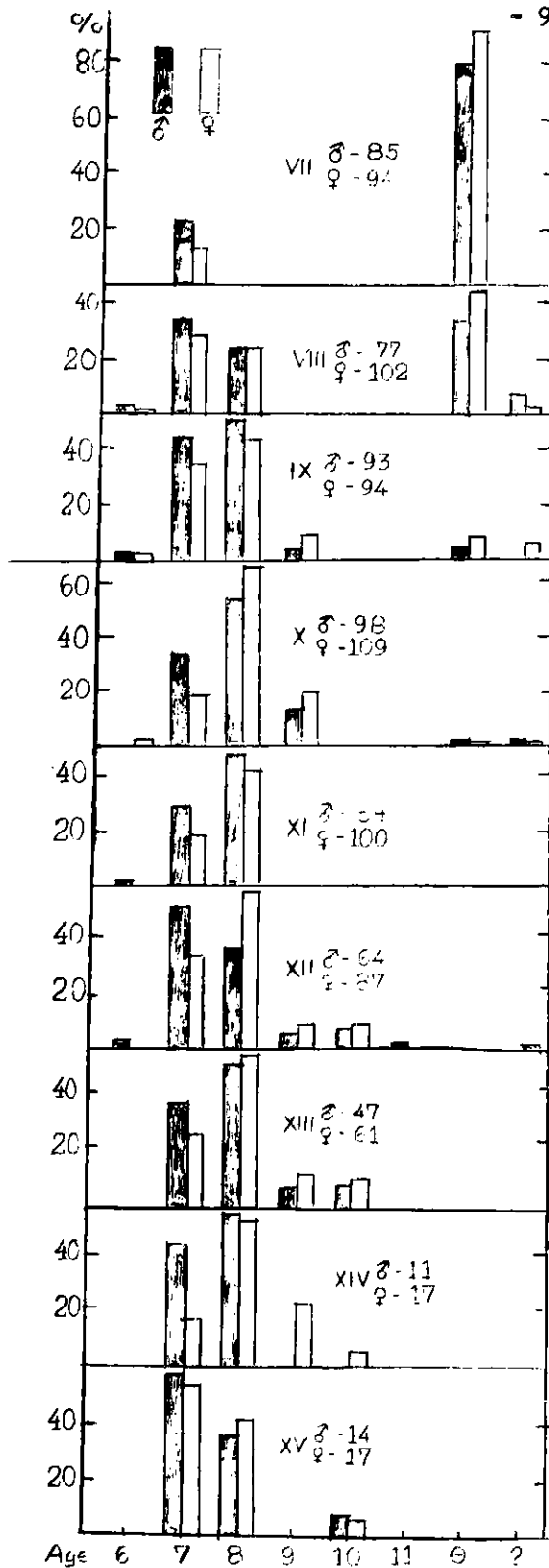


Fig. 10. Cod, Labrador, 1957. Percentage number of males (shaded columns) and females (white columns) of the various ages (6-11) spawning for the first time. 0 indicates no spawning mark.

4. Growth

Based on the samples growth curves for males and females from Subdivisions 2H and 2J are presented in Fig. 8. The growth curves are rather similar to those derived from the material collected in the previous year (1956).

The growth of the males is slightly inferior to that of the females from about the eighth year.

5. Sex Ratio

A considerable irregularity is found as to the sex ratio. In the sample groups C° and D° the percentage of males and females is nearly the same. In sample group A° the females predominate with 58%, and in B° the males with 56%.

Samples of cod caught at different hours of the day and night do not present any significant variation in the proportion of males and females. In their total these samples show a rather marked predominance of the females (55-65%).

6. Stage of maturity (Fig. 9)

Males. In October-November the large majority are in the developing stage (83-89%); a small percentage (7-16%) are in the resting stage. Post-spawners are exceedingly rare (2-3%).

Females. In October the majority are in the post-spawning stage (52%), the remainder in the developing stage (25%) or the resting stage (23%). During November the percentage of post-spawners gradually decreases. By the end of November 56% are in the developing stage (retarded stages) and 42% in the resting stage.

7. Age at first maturity (Fig. 10)

The spawning rings in the otoliths indicate that first maturity is reached from the 6th to the 11th year, especially in the 7th and 8th years (most frequently in the 8th year).

The samples did not show any difference between males and females regarding age at first maturity.

...../10

8. Weight

Observations on total weight, weight of liver, gonads and intestines were collected from around 150 cod.

C. Observations on the Cod (*Gadus callarias* L.) in Subdivision 3K (Belle Isle)

1. Material and methods

Four samples including 525 specimens were taken from trawlers. Age readings by means of otoliths were carried out for three of these samples.

The mean size of the meshes in the codend used was 117 mm. The samples comprise the cod as caught, without culling.

The samples are as follows:

No. 32°	26 - X - 57	3K	Trawl	100 specimens	age determination
No. 33°	27 - X - 57	3K	Trawl	100 specimens	age determination
No. 34°	28 - X - 57	3K	Trawl	225 specimens	
No. 35°	7 - XII - 57	3K	Trawl	100 specimens	age determination

For the study the four samples were combined in one sample group. The same methods as used earlier were applied.

2. Age composition (Fig. 11)

In the samples 32°, 33° and 35° (October-December) the age group X predominates with 23%, followed by XI (17%), IX and XII (around 12%). The VIII group includes 10%.

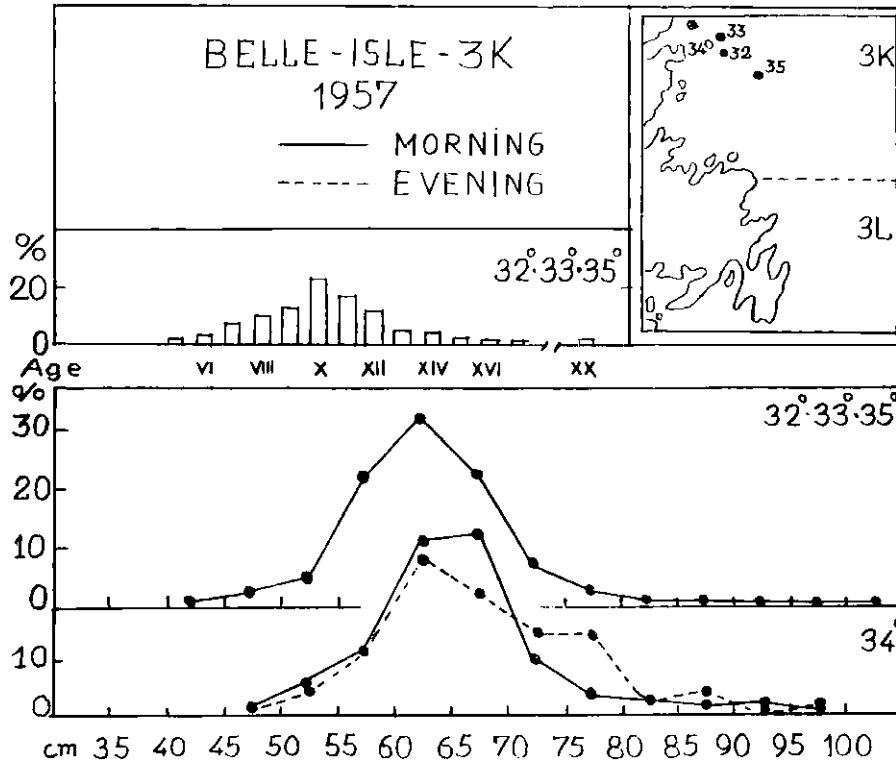


Fig. 11. Cod, Belle Isle area (3K), 1957. Age and length distribution; position of samples.

...../11

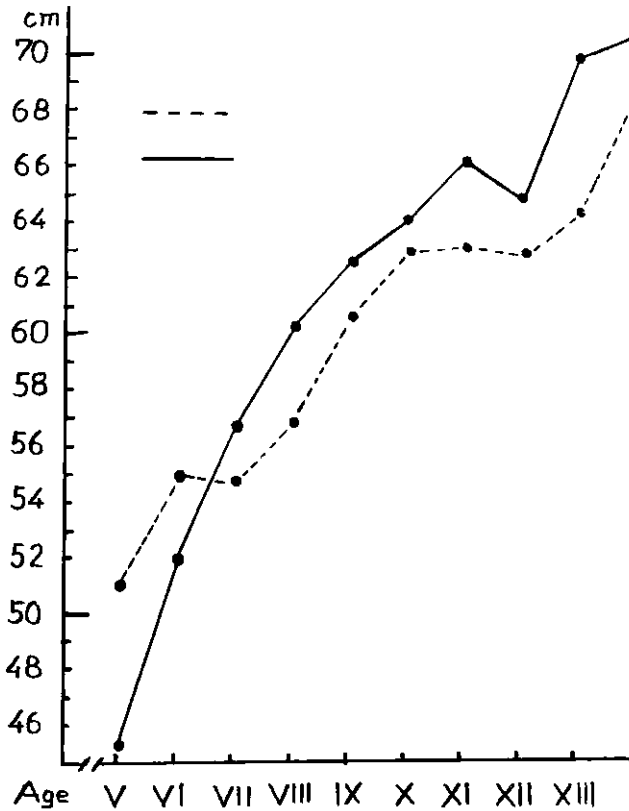


Fig. 12. Cod, Belle Isle area (3K), 1957. Growth curves for males and females.

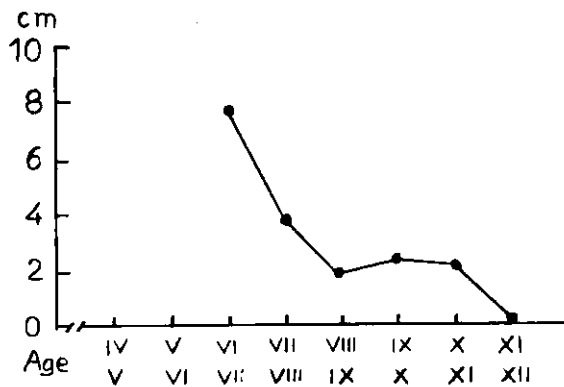


Fig. 13. Cod, Belle Isle area (3K), 1957. Annual growth of the age groups V-XII.

Thus the year-classes 1947, 1946, 1948 and 1945 are predominating; this is in agreement with the results of the 1956 researches.

3. Size distribution (Fig. 11)

The size distribution is rather regular. The curves show only one peak, in the 62-67 cm. groups, which corresponds to the rich 1947 and the relatively rich 1946 and 1948 year-classes.

4. Growth (Fig. 12-13)

Owing to the scarce material the data for the V and VI group cannot be regarded as representative.

The growth of the males is slightly smaller than the growth of the females from about the 7th year and onwards.

It is to be noted that within the same age groups two types of growth occur. The slow (Labrador) growth, and the faster (Grand Bank) growth.

5. Sex ratio

A small predominance (53-57%) was observed for the females in three of the samples. In the fourth sample the two sexes were equally represented.

6. Stage of maturity

(Fig. 14)

In October-December the majority of the males are in the developing stage (94%); the remainder are in the resting stage. Of the females 45% were in the developing stage, 29% in the resting stage and 25% were post-spawners. The figures are given in the table overleaf.

7. First maturity (Fig. 15)

From the reading of the spawning zones in the otoliths it appears that

...../12

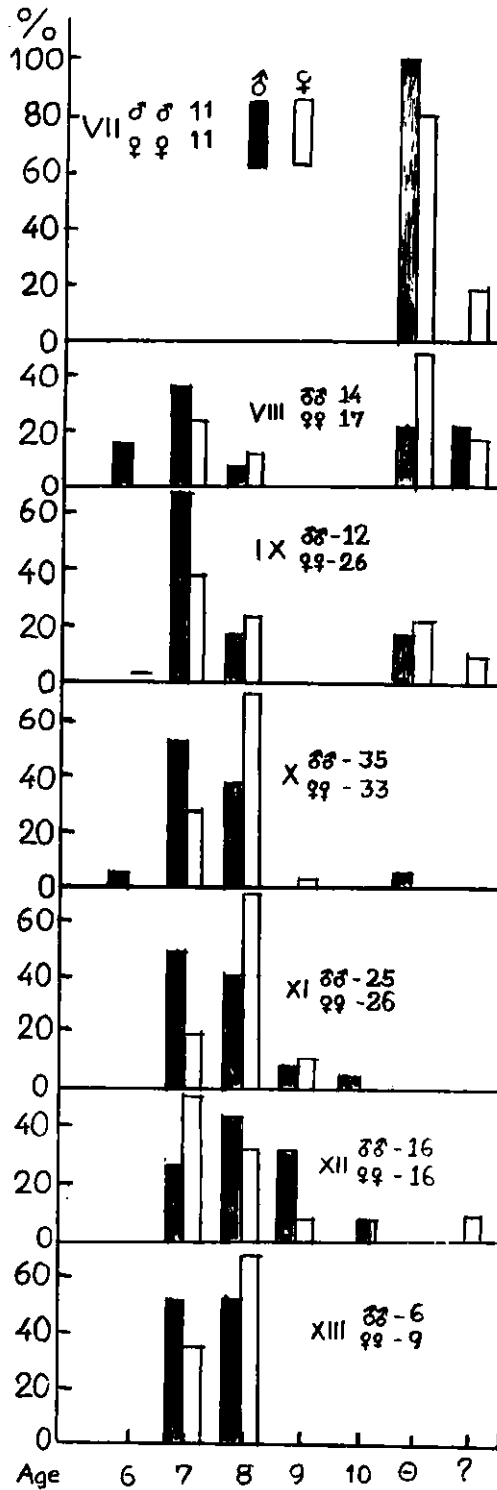


Fig. 15. Cod, Belle Isle area (3K), 1957. Percentage numbers of males (shaded columns) and females (white columns) of the various ages (7-10) spawning for the first time. θ indicates no spawning mark.

the first maturity occurs between ages 6 and 10, most commonly in the 7th and 8th years.

The females mature a little later than the males, in general only in the 8th year.

Stage of Maturity
Sample Nos. 32, 33, 35

	132 ♂	168 ♀
Resting	5.3%	29.2%
Developing	94.0%	45.2%
Spawning	-	-
Post-spawning	0.8%	25.6%

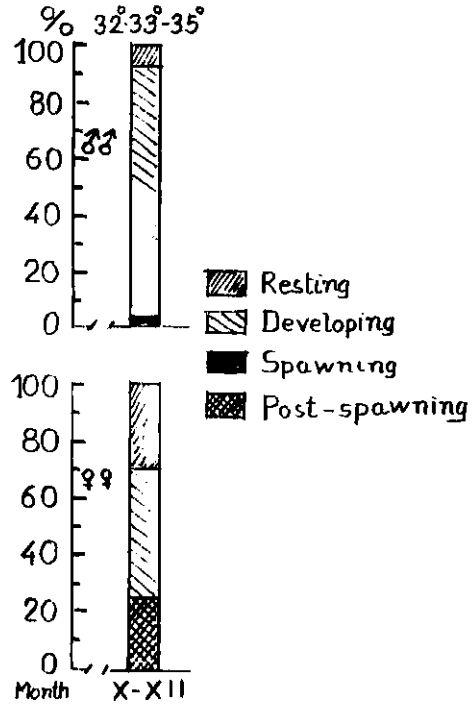


Fig. 14. Cod, Belle Isle area (3K), 1957. Percentage number of males and females of different stages of maturity in Oct.-Nov. Sample Nos. indicated above.