

ANNUAL MEETING - MAY 1957PORTUGUESE RESEARCH REPORT 1956Observations on the Cod (Gadus callarias L.) in Newfoundland Waters (Subdivision 3K) 1955

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The present paper summarizes in preliminary form and as a basis for discussions, the observations carried out on cod in Subdivision 3K during the Portuguese fishing campaign of 1955.

1. Material and Methods

12 samples, around 3,000 specimens, were studied. The samples were caught by a trawler operating in Subdivision 3K (Belle Isle) in October-November 1955. The mesh size of the cod-end used was around 117 mm. The samples consisted for the main part of fish to be landed, i.e. catch after discarding.

The positions of the samples and the kinds of observations made on each sample are shown in Table 1 (Fig.1). In order to facilitate the study, the samples were arranged in regional and seasonal groups, also taking into account the characteristic age composition (Table 2).

The methods for the arrangement of the data were the same as those used in Document No.13 dealing with the W. Greenland cod.

2. Age Distribution

Around 700 otoliths from 7 samples were studied. One of the samples, No.2, was studied separately on account of its special characteristics. The rest were arranged in two groups (A' and B', Table 2, Fig.1).

The otoliths of cod caught in Subdivision 3K seem to be a little more difficult to interpret than those from Subareas 1 and 2. In general the otoliths studied belong to two types: "a" and "b".

The otoliths of type "a" show more or less well defined rings. They are relatively homogeneous, sometimes with a diffused structure and additional rings often occur. At times the first and the second rings are broad, composed of a number of less defined narrow rings. These otoliths are of a type very close to the otoliths of the Labrador cod.

The otoliths of type "b" are more difficult to interpret. The rings are less well defined in relation to the growth zones. The structure of the rings is diffused and a number of false rings appear. The otoliths are of much the same type as those of cod from Subdivision 3L (the Grand Bank). Otoliths of type "a" are the most abundant, approximately 70%; they are found especially in the 1947 and 1946 year-classes.

The results of the otolith readings from the 1955 samples are to be considered as a tentative interpretation, subjected to later corrections. The fact that no data are made available for comparison from other years makes the work more difficult.

In sample groups A' and B' (Tables 4 and 5), the following year-classes predominate: 1947 (22%), 1946 (16-22%) and 1945 (21-24%). The 1944 year-class yields around 10% and the 1948 year-class about the same (6-10%).

In sample 2' (Table 3) from a fishery more close to the coast, the 1947 year-class predominated with 26%, followed by the 1946 year-class (17%) and the 1944 and 1945 year-classes with around 14%. The 1948 year-class had only 6%.

Summary: The 1947, 1946 and 1945 year-classes predominate; less abundant are the 1948 and 1949 year-classes.

It should be noted that the sample from Labrador, 1955, also showed a predominance of the 1947, 1946 and 1945 year-classes. However, in this subarea the 1948 year-class was more abundant.

### 3. Size Distribution

Besides the samples from which otoliths were taken (2', A' and B', Tables 3-5) five additional samples (3', 7', 10', 12' and 13', Table 6) were studied, but only as to size.

In nearly all the samples the main peak is in the 62 cm. group. The length frequency curves are relatively symmetrical with a predominance of the 57 and 67 cm. groups. Only in two samples do peaks occur at a smaller size: in the 57 cm. group (sample 7', night fishery) and in the 52 cm. group (sample 3'). The size distribution thus reflects the age grouping, showing a predominance of the age groups VIII, IX and X, all three with nearly the same abundance. This explains the symmetry of the length frequency curves.

### 4. Growth

Tables 3-5 show the mean sizes by age groups.

The growth of the males is just a little smaller than that of the females. The crossing point of the growth curves is in the 7th year (Table 7, Fig.2). From the 8th year both curves show a remarkable decrease in growth. The small number of specimens of Group XI+ do not permit a consideration of the differences in growth of these older cod.

It should be noted that the mean sizes found for the age groups VIII, IX and X are about the same; this might be the result of a wrong interpretation of the otolith. Although this might well be the case, it should be noted that it will only hold good for a small number of specimens. The results obtained indicate existence of individuals of two growth types in the same age group: a slower-growing group, which resembles the Labrador cod, and a more rapid-growing group resembling the Grand Bank cod.

The data thus show that there are two types of growth causing intermediate figures for the mean size of the age groups considered.

### 5. Sex Ratio

Data concerning sex ratio were only collected for sample 2' (the sexes were equal in number; 50% males) and for sample groups A' and B' where there was a slight predominance of the females (52-55%).

The number of observations is too small to allow definite conclusions. They only indicate that the sex ratio is the opposite of what was observed for the Labrador cod (1955 campaign) where the males were found to dominate (58%).

### 6. Stage of Maturity (Table 8, Fig.3)

Males - In October and November the majority are in the after-spawning stage (62-65%), the remainder in the developing stage (21-26%) or in the resting stage (12-14%).

Females - Nearly all the females are in the developing stage (95%), the remainder being in the after-spawning or resting stages.

### 7. First Maturity

The age at first maturity was determined from the study of the otoliths (Table 9, Figure 9). Only the more abundant age-groups are considered.

Generally the identification of the first spawning ring was more difficult than in the material from Subareas 1 and 2.

The considerations referring to the interpretation of the peripheral rings are identical to those which were noted for the W.Greenland cod, Document No.13.

First maturity is found to appear between the 6th and the 19th year, most commonly in the 7th and 8th years. The females are found to become mature a little later than the males, having a tendency to attain first maturity only in the 8th year. However, this is not found for all the age groups studied.

8. Weight Data

Only observations of total weight were carried out and on a small number of individuals (269). No notable difference between the weight of males and females within the same size groups occurred (Table 10).

Table 1. List of Fish Samples Taken During 1955 - Subdivision 3K

Sample No.	Species	Month	Position	Loc.	Gear	No.of	Observations Made							
							Spec.	L	W	Sex	Mat.	Otol.	Age	Mat.
2'	Cod	X	51°10'N 55°20'W	Sea	Trawl	100	+	+	+	+	OT	+	+	+
3	"	X	51°10'N 55°20'W	"	"	250	+							
4'	"	X	51°19'N 53°50'W	"	"	150	+		+	+	OT (100)	+	+	+
5'	"	X	51°19'N 53°48'W	"	"	100	+	+	+	+	OT	+	+	+
6'	"	XI	51°25'N 53°55'W	"	"	150	+		+	+	OT (100)	+	+	+
7'	"	XI	51°20'N 54°30'W	"	"	450	+							
8'	"	XI	51°18'N 54°10'W	"	"	100	+	+	+	+	OT	+	+	+
9'	"	XI	51°16'N 54°14'W	"	"	100	+		+	+	OT	+	+	+
10'	"	XI	51°20'N 54°00'W	"	"	524	+							
11'	"	XI	51°18'N 54°00'W	"	"	150	+	+	+	+	OT (99)	+	+	+
12'	"	XI	50°51'N 53°30'W	"	"	150	+							
13'	"	XI	51°24'N 53°50'W	"	"	500	+							

Table 2. Cod. Newfoundland (3K) Grouping of Samples, Belle Isle, 1955.

Group	Samples	Subdivision	Date
A	4-5-6	3K	25 Oct.-4 Nov. 1955
B	8-9-11	3K	9-15 Nov. 1955

Table 3. Cod. Subdivision 3K, Sample No.2', 21 October 1955.

Year- Class	Age Gr.	M %	Mean Length cm.		M + F		Length Group	
			M	F	Mean Length cm.	%	(cm.)	%
1950	V	100.0	42.0	-	42.0	1.0	42	3.0
1949	VI	66.7	46.0	43.0	49.5	3.0	47	1.0
1948	VII	66.7	55.8	56.0	55.9	6.0	52	5.0
1947	VIII	38.5	56.9	61.6	59.8	26.0	57	31.0
1946	IX	58.8	60.8	60.9	60.9	17.0	62	36.0
1945	X	64.3	63.1	61.2	62.4	14.0	67	14.0
1944	XI	35.7	64.2	62.9	63.6	14.0	72	6.0
1943	XII	20.0	59.0	64.3	61.7	5.0	77	3.0
1942	XIII	40.0	60.0	72.3	66.2	5.0	82	-
1941	XIV	50.0	66.0	68.7	67.4	6.0	87	1.0
1940	XV	100.0	68.0	-	68.0	2.0		
1939	XVI	-	-	-	-	-		
1938	XVII	100.0	68.0	-	68.0	1.0		

Male % - 50.0 No. of Spec. 100

Table 4. Cod. Subdivision 3K, Samples A', 4', 5', 6', 25 Oct.-4 Nov. 1955

Year- Class	Age Gr.	M %	Mean Length cm.		M + F		Length Group	
			M	F	Mean Length cm.	%	(cm.)	%
1952	III	-	-	29.0	29.0	0.3	27	0.3
1951	IV	-	-	38.0	38.0	0.3	32	-
1950	V	100.0	35.0	-	35.0	0.3	37	1.0
1949	VI	30.0	46.0	46.4	46.2	3.3	42	0.7
1948	VII	44.8	54.2	55.3	54.8	9.7	47	2.0
1947	VIII	60.6	59.9	58.0	59.0	22.0	52	9.3
1946	IX	47.9	60.4	62.8	61.6	16.0	57	26.7
1945	X	44.4	60.9	62.5	61.7	21.0	62	29.3
1944	XI	43.3	64.2	62.7	63.5	10.0	67	21.7
1943	XII	33.3	64.1	70.4	67.3	8.0	72	6.0
1942	XIII	25.0	69.7	69.2	68.5	4.0	77	1.3
1941	XIV	-	-	73.7	73.7	2.0	82	1.3
1940	XV	20.0	64.0	72.3	68.2	1.7	87	0.3
1939	XVI	100.0	68.0	-	68.0	0.7		
1938	XVII	-	-	-	-	-		
1937	XVIII	-	-	71.5	71.5	0.7		

Male % - 45.0 No. of Spec. 300

Table 5. Cod. Subdivision 3K, Samples B', 8', 9', 11', 9-15 Nov. 1955

Year- Class	Age Gr.	M %	Mean Length cm.		M + F		Length Group	
			M	F	Mean Length cm.	%	(cm.)	%
1949	VI	50.0	53.3	50.7	52.0	2.0	47	1.3
1948	VII	57.9	55.0	53.3	54.2	6.4	52	6.4
1947	VIII	45.3	60.0	61.9	61.0	21.4	57	24.1
1946	IX	57.6	59.6	62.5	61.1	22.1	62	33.1
1945	X	46.5	61.7	64.9	63.8	23.7	67	24.7
1944	XI	37.9	62.8	64.9	63.9	9.7	72	8.0
1943	XII	37.5	64.2	68.6	66.9	5.4	77	2.0
1942	XIII	46.7	67.3	77.4	72.4	5.0	82	0.3
1941	XIV	50.0	63.3	66.7	67.5	2.0		
1940	XV	40.0	76.0	70.3	73.2	1.7		
1939	XVI	100.0	68.0	-	68.0	0.3		
1938	XVII	-	-	75.0	75.0	0.3		

Male % - 48.2 No. of Spec. 299

Table 6. Cod. Subdivision 3K. Size Distribution of the Following Samples from Trawlers: 3', 22-X-55; 7', 8-XI-55; 10', 12-XI-55; 12', 18-XI-55; 13', 22-XI-55

Length Group cm.	3'		7'		10'		12'		13'	
	Day %	Night %	Day %	Night %	Day %	Night %	Day %	Night %	Day %	Night %
32	0.4	-	-	-	-	-	-	-	-	-
37	0.8	-	-	-	0.6	0.7	-	-	-	-
42	3.6	-	-	-	1.9	-	-	-	-	0.4
47	10.4	1.2	2.5	-	6.5	-	0.8	-	0.4	-
52	37.1	4.8	5.0	-	10.7	6.0	4.8	-	3.2	-
57	29.9	26.0	29.0	-	17.6	12.7	21.6	-	20.0	-
62	13.5	29.6	24.0	-	21.2	36.7	37.6	-	36.4	-
67	3.6	24.8	27.5	-	18.7	18.6	23.6	-	20.8	-
72	0.4	10.8	8.5	-	11.2	14.0	8.0	-	12.8	-
77	0.4	2.8	3.5	-	4.9	8.7	2.4	-	3.6	-
82	-	-	-	-	2.8	1.4	2.0	-	2.4	-
87	-	-	-	-	1.5	0.7	-	-	-	-
92	-	-	-	-	1.1	-	-	-	-	-
Total	251	250	200	-	532	150	250	-	250	-

Table 7. Cod. Subdivision 3K. Mean Lengths of Males and Females of the Various Year-Classes. Sample Groups 2'-A' and B'

Year-Class	Age Gr. 1955	Mean Length (cm.)	
		M	F
1952	III	-	29.0
1951	IV	-	38.0
1950	V	38.5	-
1949	VI	48.5	46.7
1948	VII	53.0	54.9
1947	VIII	58.9	60.5
1946	IX	60.3	62.1
1945	X	61.9	62.9
1944	XI	63.7	63.5
1943	XII	62.4	67.8
1942	XIII	65.7	73.0
1941	XIV	67.2	69.7
1940	XV	69.4	71.3
1939	XVI	68.0	-
1938	XVII	68.0	75.0
1937	XVIII	-	71.5

Table 8. Cod. Subdivision 3K. Oct.-Nov. 1955. Stage of Maturity from Macroscopic Observation of Gonads

Sample Date	2'-4'-5'		6'-8'-9'-11'	
	M %	F %	M %	F %
21/25-X-55	11.5	3.0	13.5	3.1
4/15-XI-55	25.7	95.2	21.4	96.2
Resting	-	-	-	-
Developing	62.3	1.8	65.2	0.8
Spawning	0.5	-	-	-
After-Spawning	100.0	100.0	100.1	100.1
Doubtful	183	167	290	260

Table 9. Cod, Subdivision 3K, Age at First Maturity of the More Abundant Age Groups (VII-XV), Oct-Nov, 1955. 0 = Doubtful

Age Gr.		Age at First Spawning - Males							Total	
		V	VI	VII	VIII	IX	X	0		?
VII	No.	-	2	6	2	-	-	15	14	39
	%	-	5.1	15.4	5.1	-	-	38.5	35.9	100.0
VIII	No.	-	3	39	11	-	-	8	21	82
	%	-	3.7	47.6	13.4	-	-	9.8	25.6	100.1
IX	No.	-	3	28	22	2	-	1	11	67
	%	-	4.5	41.8	32.8	3.0	-	1.5	16.4	100.0
X	No.	1	5	23	28	8	-	-	5	70
	%	1.4	7.1	32.9	40.0	11.4	-	-	7.1	99.9
XI	No.	-	4	12	8	2	-	-	3	29
	%	-	13.8	41.4	27.6	6.9	-	-	10.3	100.0
XII	No.	-	-	7	8	-	1	-	-	16
	%	-	-	43.8	50.0	-	6.3	-	-	100.1
XIII	No.	-	1	4	3	1	-	-	-	9
	%	-	11.1	44.4	33.3	11.1	-	-	-	99.9
XIV	No.	-	1	-	5	-	-	-	-	6
	%	-	16.7	-	83.3	-	-	-	-	100.0
XV	No.	-	-	1	2	3	-	-	1	7
	%	-	-	14.3	28.6	42.9	-	-	14.3	100.1

Age Gr.		Age at First Spawning - Females							Total	
		V	VI	VII	VIII	IX	X	0		?
VII	No.	-	2	4	3	-	-	13	4	26
	%	-	7.7	15.4	11.5	-	-	50.0	15.4	100.0
VIII	No.	-	1	38	15	-	-	6	18	78
	%	-	1.3	48.7	19.2	-	-	7.7	23.1	100.0
IX	No.	-	-	16	29	3	-	3	9	60
	%	-	-	26.7	48.3	5.0	-	5.0	15.0	100.0
X	No.	-	-	17	39	15	-	-	5	76
	%	-	-	22.4	51.3	19.7	-	-	6.6	100.0
XI	No.	-	1	8	21	9	2	1	1	43
	%	-	2.3	18.6	48.8	20.9	4.7	2.3	2.3	99.9
XII	No.	-	-	7	14	5	1	-	4	31
	%	-	-	22.6	45.2	16.1	3.2	-	12.9	100.0
XIII	No.	-	-	10	7	5	-	-	1	23
	%	-	-	43.5	30.4	21.7	-	-	4.3	99.9
XIV	No.	-	1	3	6	1	1	-	-	12
	%	-	8.3	25.0	50.0	8.3	8.3	-	-	99.9
XV	No.	-	2	2	3	-	-	-	-	7
	%	-	28.6	28.6	42.9	-	-	-	-	100.1

Table 10. Cod, Newfoundland, Total Weights by Size Cm. Groups of Whole Fresh Fish. Samples: 2', 21-X-55; 5', 26-X-55; 8', 9-XI-55; 12', 18-XI-55.

Group (cm)	Males		Females	
	No. Spec.	Weight(kg.)	No. Spec.	Weight(kg.)
42	-	-	-	-
47	-	-	-	-
52	12	1,369	-	-
57	50	1,785	38	1,741
62	54	2,245	42	2,230
67	26	2,851	33	2,846
72	-	-	14	3,478

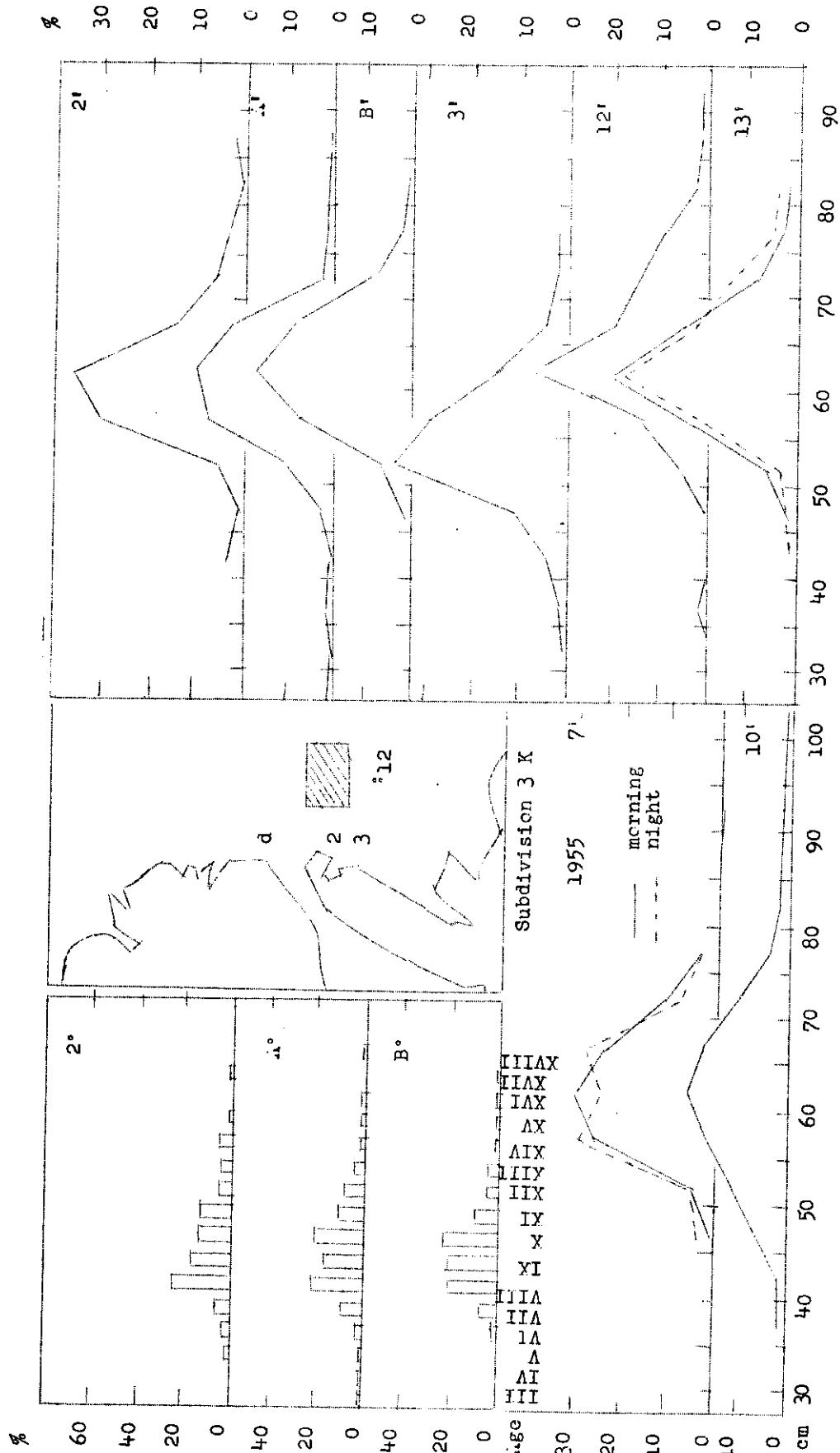


Fig. 1. Cod Subdivision 3 K. Age- and length distribution

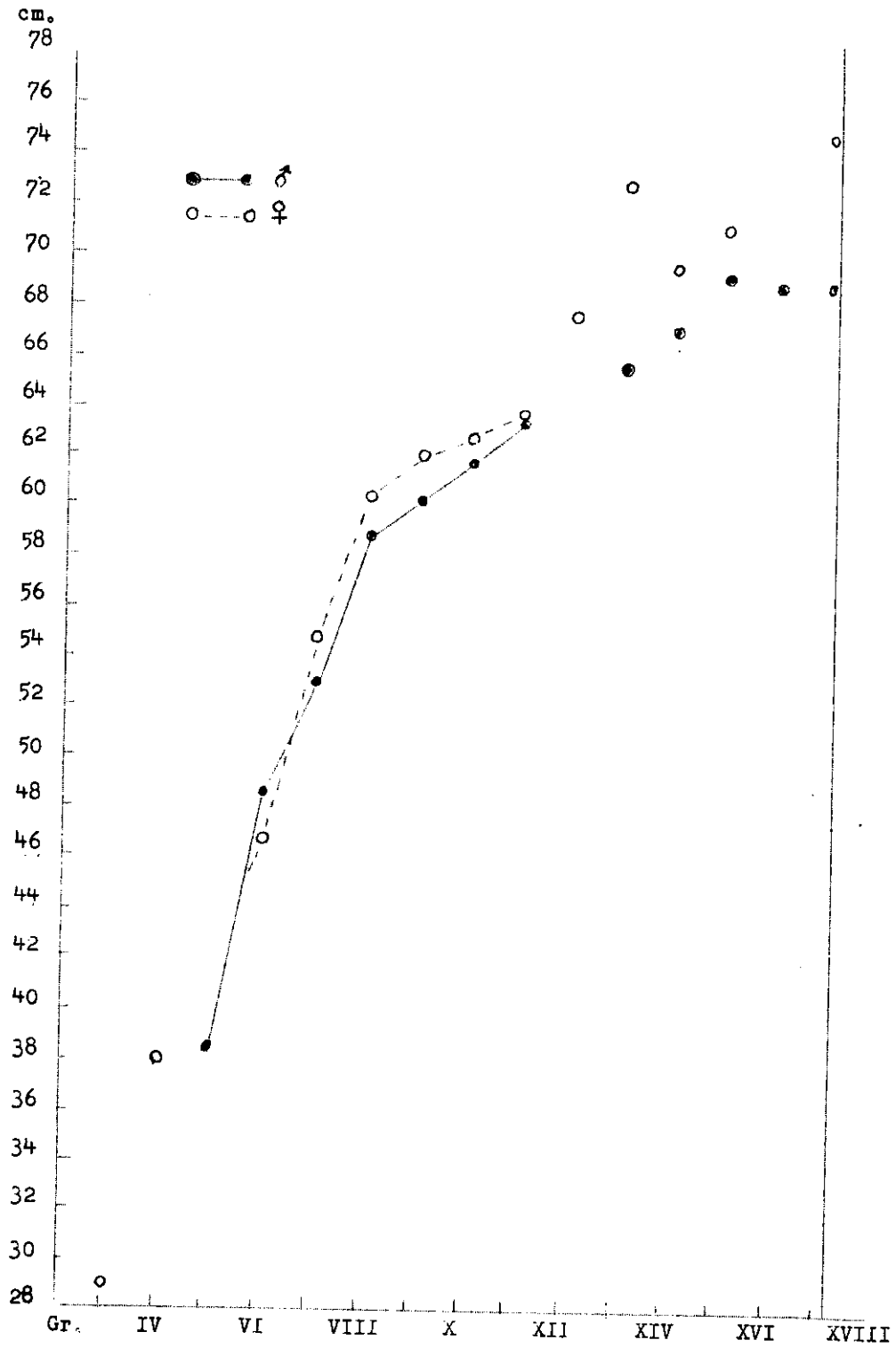


Fig.2. Cod subdivision 3 K. Mean length of females of the various age groups



Fig. 3. № of individuals (%) of various stages of maturity  
Cod, subdivision 3 K.

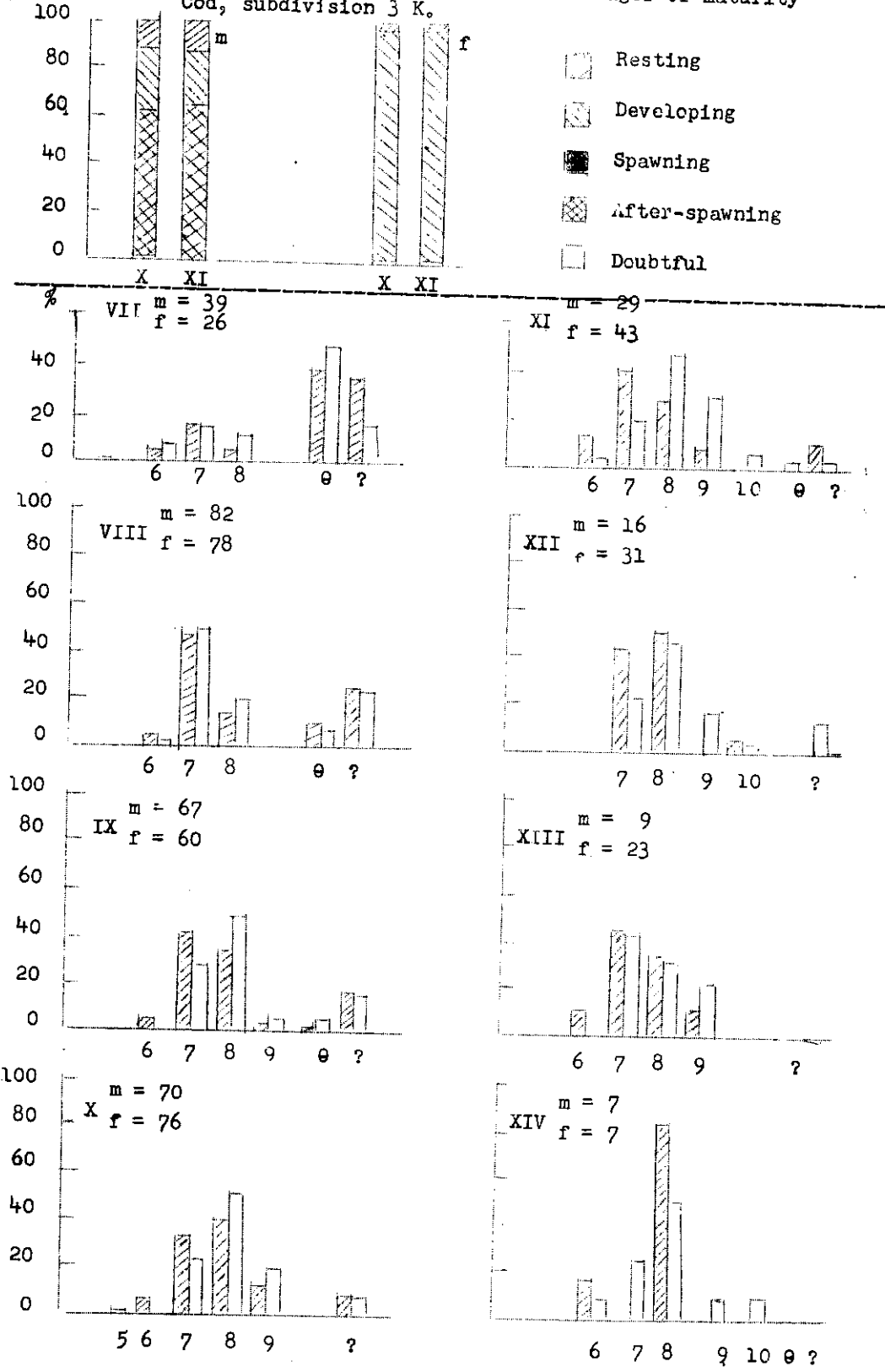


Fig. 4. Cod Subdivision 3 K. age at 1st maturity for males and females, observations on age groups VII - XIV θ = doubtful determination.

