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Portuguese Research Report, 1958

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Continuation

Observations on the cod, Gadus callarias L., in Subarea 4 (Gulf of St. Lawrence) during the fishing campaigns 1956/58.

The evaluation of the benefits in Subarea 4 from the application of the enforced trawl mesh regulations (4 1/2") has been one of the main problems for consideration during the recent ICNAF meetings. Data at hand suggest an advantage by increasing the mesh-size to 5 1/2" which would permit a greater escapement of fish without serious reactions on the landings.

A detailed study of this problem, in respect of haddock as well as of cod, is, however, necessary.

For this purpose it was considered indispensable to establish a basis for the work by compiling data from the various countries fishing in the area on the samplings from recent years, and to publish such data as soon as possible. Therefore a preliminary Portuguese report on sampling for age- and size of the Subarea 4 cod in 1956/58 was presented to the meeting of the Groups of Advisers in Boston, Dec. 1958 (ICNAF Ser. No. 600, Meet.Doc.No.3, app VIII).

The present report, which also includes additional ~~data~~ (sex-ratio, stage of maturity), has, however, also a preliminar character; its aims are first of all to provide data for a comparative study and a critical consideration of the results, especially those from age-reading of otoliths. In effect, the otoliths of the St. Lawrence cod provide great difficulties, which may lead to errors in interpretation, owing to the existence of numerous rings of the polymorph type (e.g. double-rings and "false rings"). The distinction between the 1st ring and the nucleus often offers difficulties.

The errors in interpretation, mentioned above, will unavoidably react upon the evaluation of the age at first maturity. This evaluation is also made difficult by the fact that the spawning rings in many cases are less clear than for instance those in otoliths from Greenland and Labrador.

1. Material and Methods.

All samples studied arrive from fisheries with trawls with a cod-end mesh-size of approximately 117 mm. In 1956 the samples were taken from the fish to be landed i.e. after discard of undersized cod. In 1957 and 1958 the samples were taken from the catches before discarding.

The methods followed for the study of the material and the data are the same as those indicated in earlier reports (see Portuguese

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Research Report, 1956, ICNAF, Annual Proceedings, vol. 7)

During the fishing campaigns the following numbers of samples were collected:

1956 - 16 samples	(2,000 individuals)
1957 - 13 "	(1,600 ")
1958 - 19 "	(1,900 ")

The position of the samples are shown i Figures 1-3. To facilitate the study of the samples these were grouped according to subdivisions and months. 1)

Table showing grouping of samples

	Group	Sample-nos.	Subdivision	dates
Year 1956	A	1-3-4-5	4R	27-III/1-IV
"	B	6-7	4V	3/4-IV
"	C	8	4V	6-IV
"	D	11-12-14-15	4T	17/21-IV
Year 1957	A	3	4R	22-III
"	B	4	4T	25-III
"	C	5-6-8-9	4V	29-III/5-IV
"	D	11-12-13	4R	15-IV/17-IV
Year 1958	A	1-2	4V	25/26-III
"	B	3-5-6-7	4R	27/31-III
"	C	9-10-11-12-15-16	4R	2/14-IV
"	D	14-17-18	4T	11/20-IV
"	E	19	4V	22-IV

The age determination, by means of otoliths, comprised the following numbers: 1956 - 1,000 spec , 1957 - 1,600 spec. and 1958 - 1,900 spec.

2. Age - Composition.

a. 1956 - campaign (Fig. 1).

In Subdivision 4R (March-April, Group A) the age-group VIII predominated with 20%, followed by VI (17%), VII (17%) and IX (15%).

In Subdivision 4R (April, Group B) age-group VI predominated strongly with 49%; it was followed by VII (17%), V (13%) and IV (12%).

In Group C (also 4V, April) the age-distribution was different: Age-group X-26%, VIII-18%, XII-14% and IX-11%.

In Subdivision 4T (April, Group D) the age-groups VI and VII predominates with 26 and 23%, followed by VIII and IX with 17%.

b. 1957 - campaign (Fig. 2).

In Subdivision 4R (March, Group A) the most prominent age-

1/ The report includes a large number of tables giving detailed data on the samples. These tables are not included here, as they will be published in the ICNAF Sampling Yearbook. Exec. Secr.

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groups are VII -30%, IX - 22%, and VIII - 14%. Groups X and VI are represented with ca. 10%.

In April (Group D) the same subdivision shows a different age-composition with the V-Group predominating (27%), followed by VI-17% VIII-14% and IV-10%.

In Subdivision 4T (March, Group B) age-group V is the richest with 20%; it is followed by X-17%, VII-17%, VIII-13%, VI and IX-10%.

In Subdivision 4V (March-April, Group C) the age-groups VII (24%), VIII (20%) and V (12%) predominate.

c. 1958 - campaign (Fig. 3).

In Subdivision 4R (March, Group B) the age-group VI predominates with 19%; next comes VII-16%, VIII and X-12%, and V-10%. In April, however, (Group C) the age-group V is the most numerous (24%), followed by VI-23%, VII-14%, and VIII-10%.

In Subdivision 4T (April, Group D) age-group VI is represented with 20%, V and VIII each with 19%, and groups VII and IX each with hardly 10%.

In Subdivision 4V (March-April, Groups A and E) the age-groups V (15-22%) and VI (20-28%) predominate, followed by VII-12 and 14%, and VIII- 13 and 20%.

d. Summary.

In Fig. 4 the age-compositions of the various sample groups are summarized by subdivisions. The figure only includes age-groups represented by more than 10%.

3. Size-Composition.

The size-compositions for the sample groups are shown for each of the three years to the right in Figures 1-3.

4. Growth (Figures 5,6 and 7).

A number of tables (not reproduced here) show data relating to the growth of the Gulf of St. Lawrence cod (4R, 4T, and 4V) in 1956/58. As this material has only been studied provisionally, an analysis by subdivisions has not been made; such an analysis, however, aught to be done as the data at hand suggest that the stocks of Subdivisions 4V and 4T are different in growth from those of Subdivision 4R.

As the samples from 1956 only refer to fish for landing (after discard), the data for the younger age-groups, III and IV are misleading due to the exclusion of the slower growing fish (discard).

This fact also explains some anomalies found for the growth of the younger year-classes from the 1957 material.

Generally speaking, and in accordance with what have already been noted, the growth-curves for 1956 and 1957 coincide fairly well

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but they differ from those of 1958, which show a more rapid growth. On the other hand, whilst the point of inflexion of the curves for 1956-57 is at age 8 and 9, this point is in 1958 already at age 5.

5. Stage of Maturity (Figures 8, 9 and 10)

The data for the years 1956, 57 and 58 coincide so well that they can be combined and analyzed together.

Males. In March 20-34% were in the resting stage, and 65-75% in the developing stage. Only very few (1%) were spawning; in the samples from 1957, only, 14% spawning

In April still many individuals (36-45%) were in the resting stage and the developing stage (46-54%). The spawning stages are now more frequent (2, 8, and 19%; very few were after-spawners (0.4%).

Females. In March the majority were in the developing stage (44-54%) or the resting stage (36-47%); very few (1%) were in the spawning stage, some (1, 8, and 11%) were after-spawners, the higher values corresponding to the samples from 1957 and 1953.

In April the resting stage predominated with 49-61%, and the developing stage with 34-49%; spawners were only rarely observed (2-3%), post-spawners accounted for ca 4%.

6. Age at First Maturity (Figures 11, 12 and 13).

First maturity was determined by means of the spawning rings in the otoliths. In the samples from 1956/58 first maturity was found to be reached most commonly between age 6 and 9, more exceptionally between ages 5 and 10. The majority reached 1st maturity at age 7 or 8, principally at age 7. No difference between males and females was observed.

The comparative analysis of ages at first maturity within the same year-classes for the years of observation (1956-58) reveals considerable differences. Such differences could result from errors of interpretation of the spawning rings (including the age-determination proper), or from the fact that the material used was a combination of all samples from the Gulf of St. Lawrence where the different subdivisions are irregularly represented over the three years.

A further discussion of this problem is postponed until further data are collected.

7. Weight data.

Data on total weight, weight of gonads, livers, and intestines were collected from 425 individuals (1956-275, 1958-150).

Rather high values were observed for the gonads, which confirms that the developing stages are fairly advanced, indicating spawning in the near future.

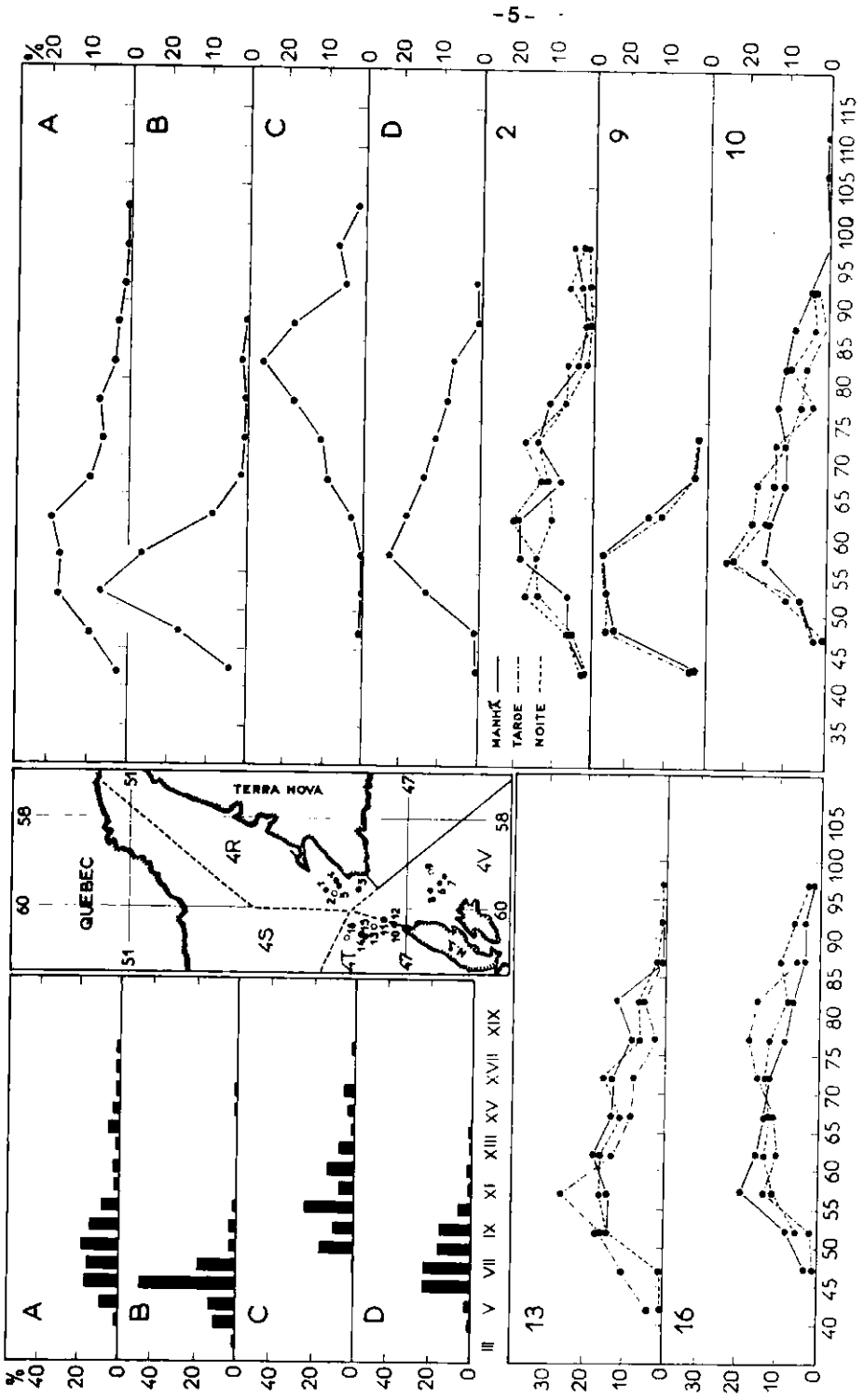

Fig. 1. Age and length of samples of cod caught by Portuguese trawlers in the Gulf of St. Lawrence in 1956, arranged by sample groups (A–D) and sample numbers (2, 9, 10, 13, and 16). To the left and above age-distribution; to the right and below, length distribution. On the map are shown the positions of the samples.

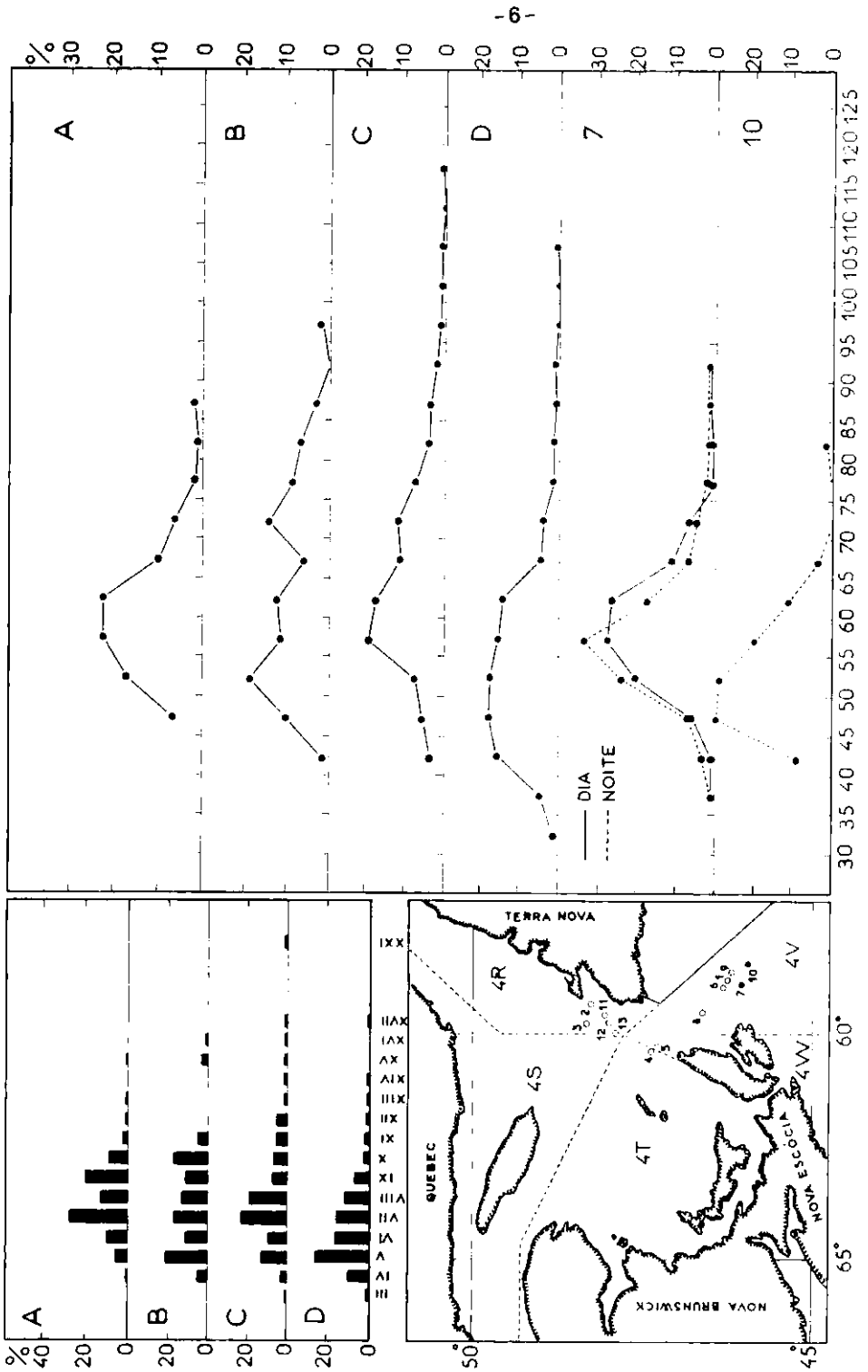

Fig. 2. Age and length of samples of cod caught by Portuguese trawlers in the Gulf of St. Lawrence in 1957, arranged by sample groups (A-D) and sample numbers (7 and 10). Left: age-distribution. right: length distribution. On the map are shown the positions of the samples.

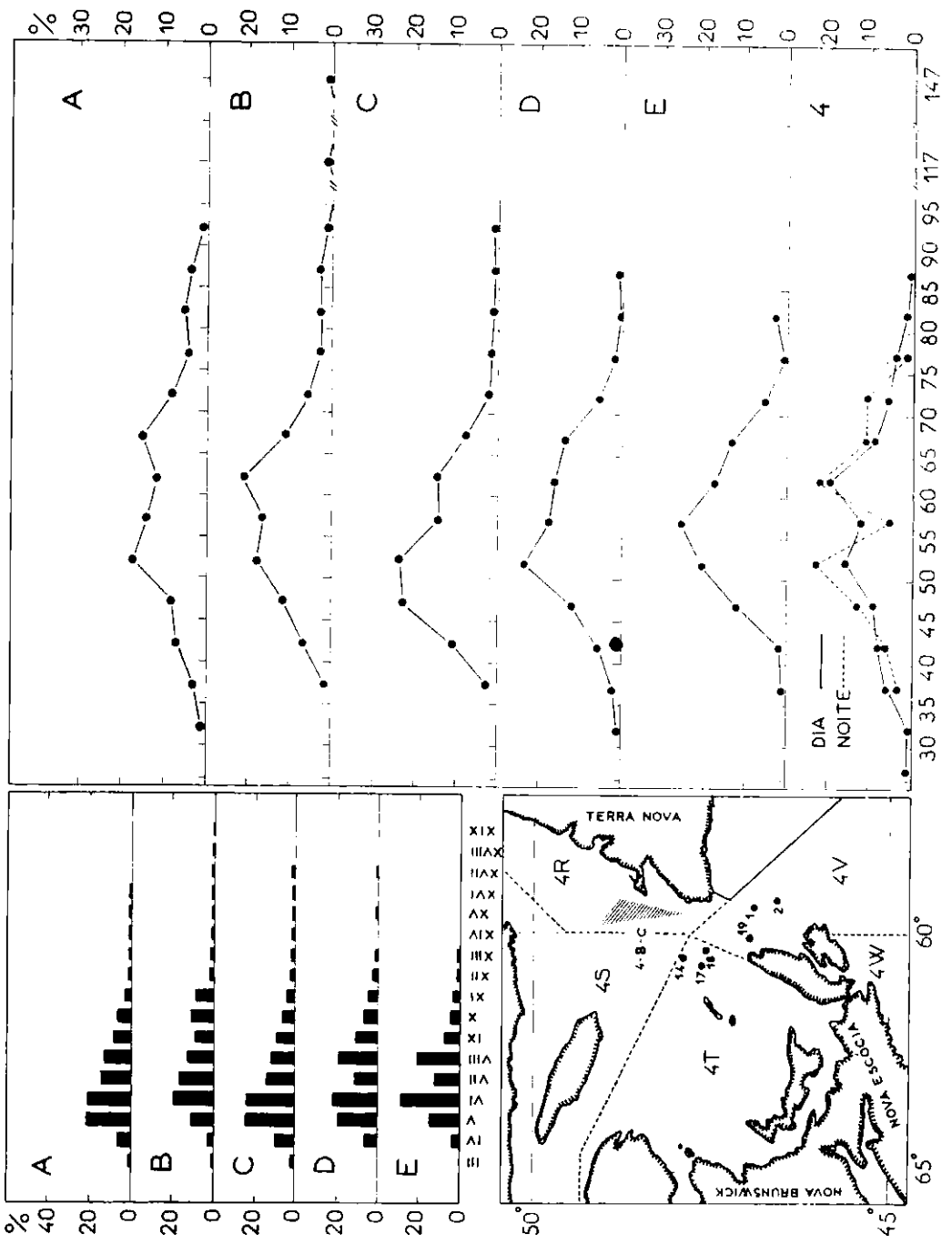

Fig. 3. Age and length of samples of cod caught by Portuguese trawlers in the Gulf of St. Lawrence in 1956, arranged by sample groups (A-E) and sample numbers (4). Left: age distribution. right: length-distribution. On the map are shown the positions of the samples.

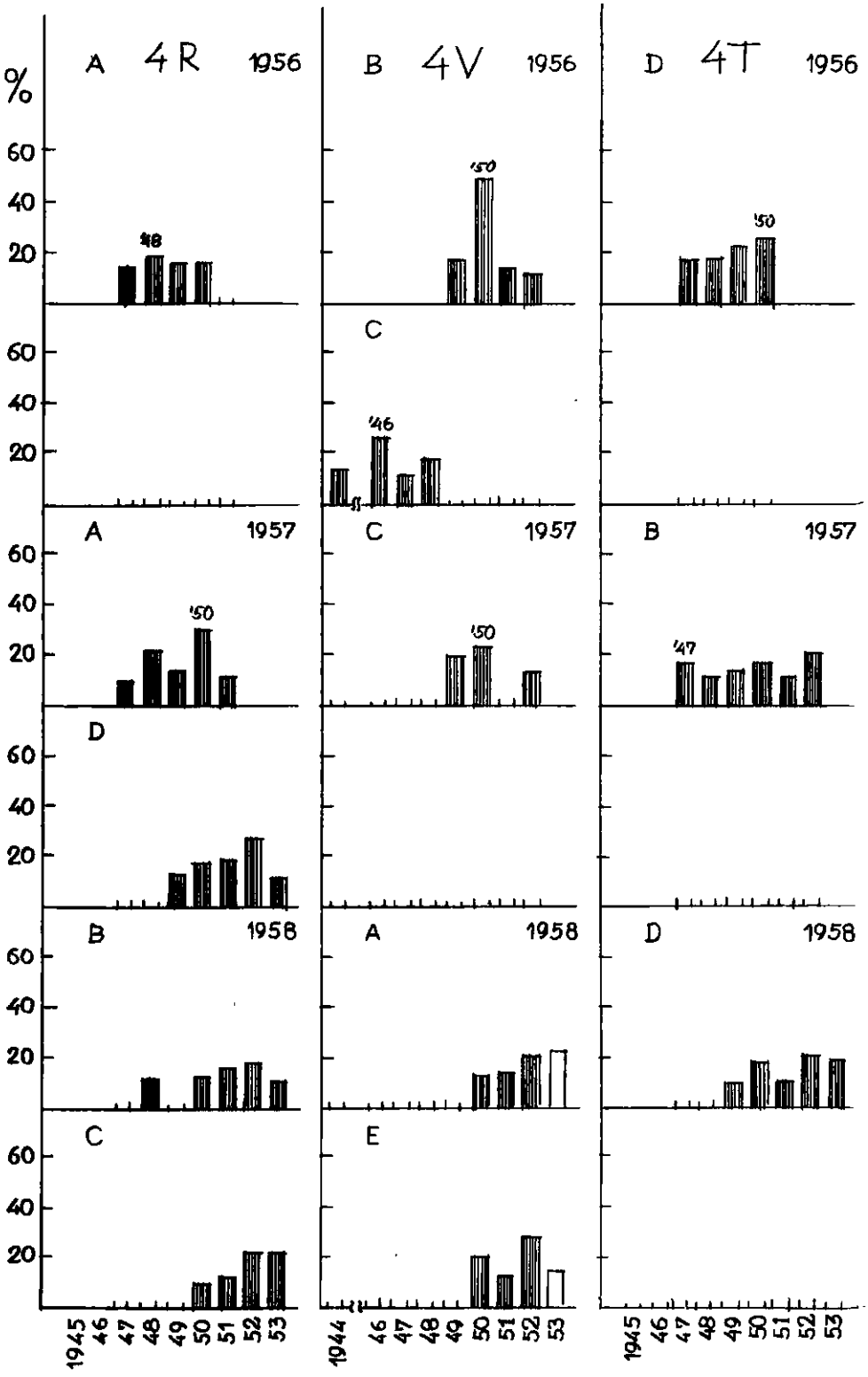

Fig. 4. Age-composition of the various sample-groups of cod from the Portuguese trawl fishery in the Gulf of St. Lawrence, 1956/58.

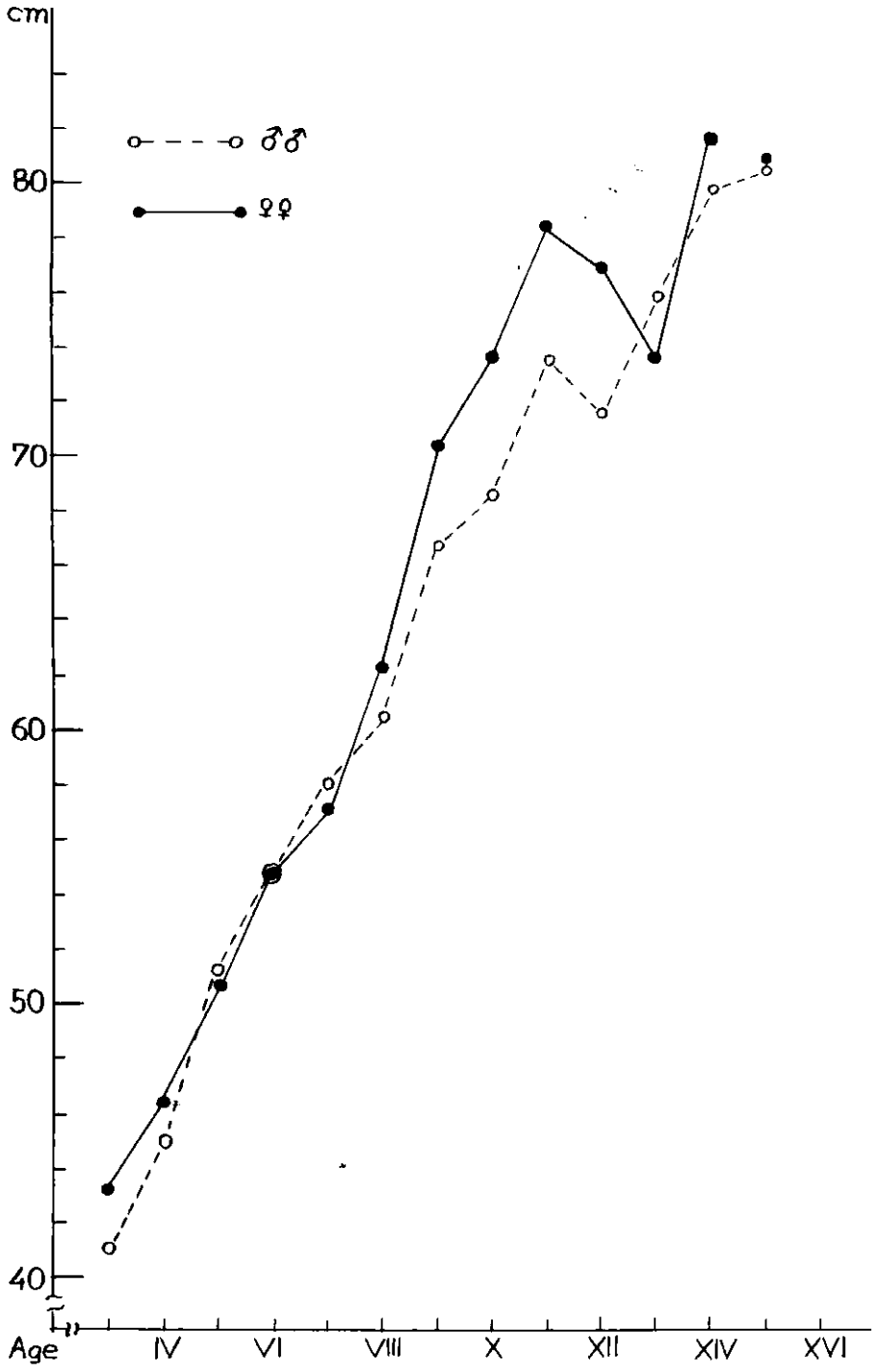

Fig. 5. Growth curves for cod; Portuguese trawl samples, Gulf of St. Lawrence, 1956.

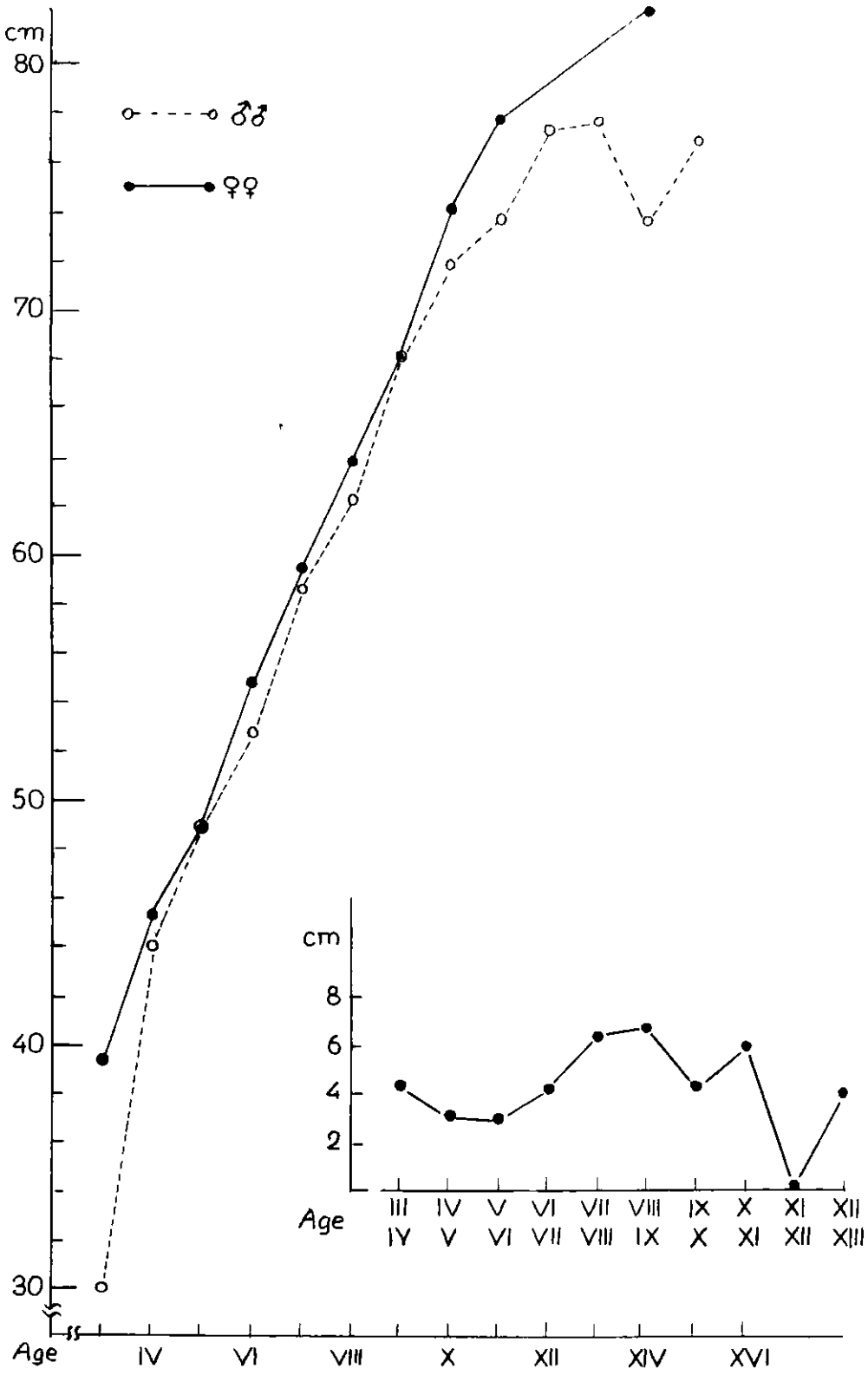

Fig. 6. Growth curves for cod. Annual growth curve inserted. Portuguese trawl samples, Gulf of St. Lawrence, 1957.

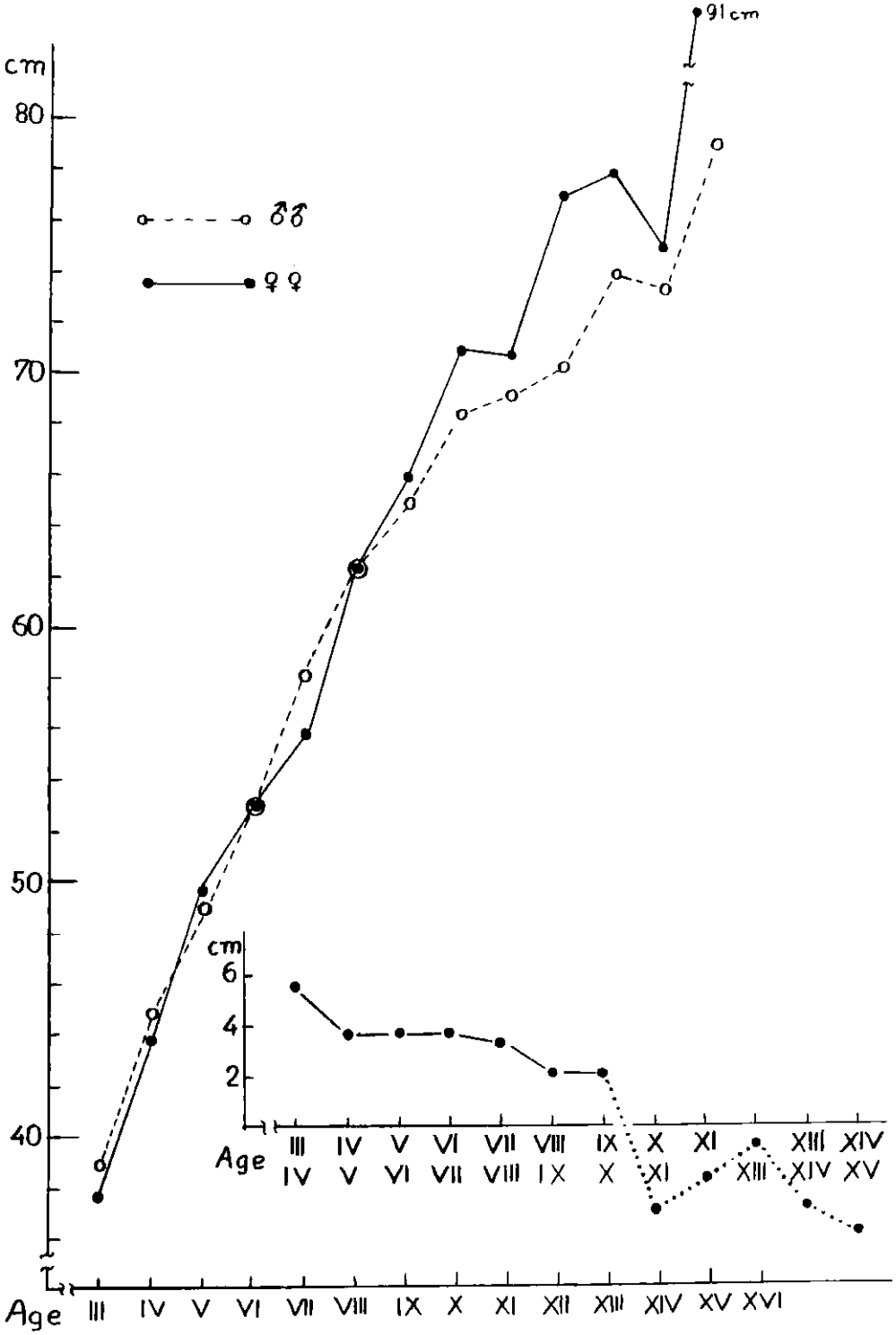

Fig. 7. Growth curves for cod. Annual growth inserted. Portuguese trawl samples, Gulf of St. Lawrence, 1958.

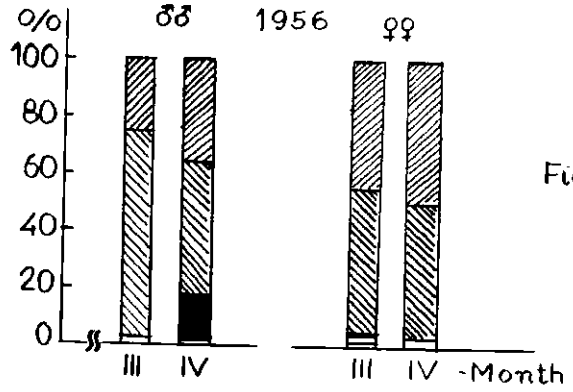

Fig. 8

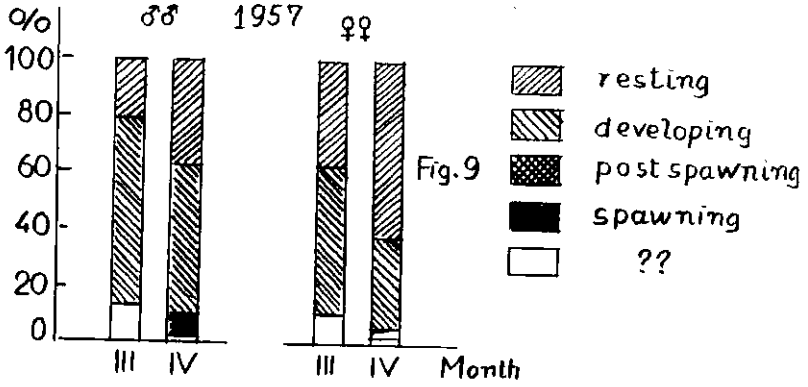

Fig. 9

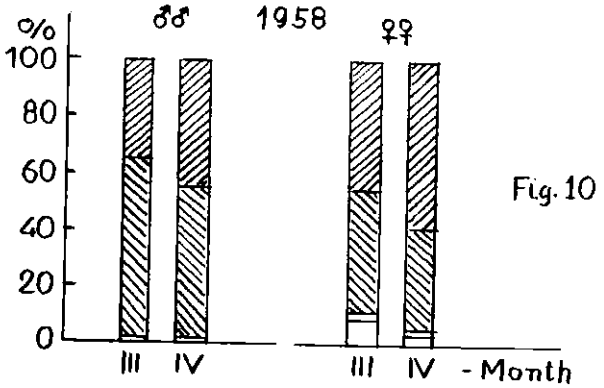

Fig. 10

Fig. 8,9, and 10. Portuguese trawl samples of cod, Gulf of St. Lawrence, 1956, 1957 and 1958. Percentage numbers of males and females of different stages of maturity, March-April.

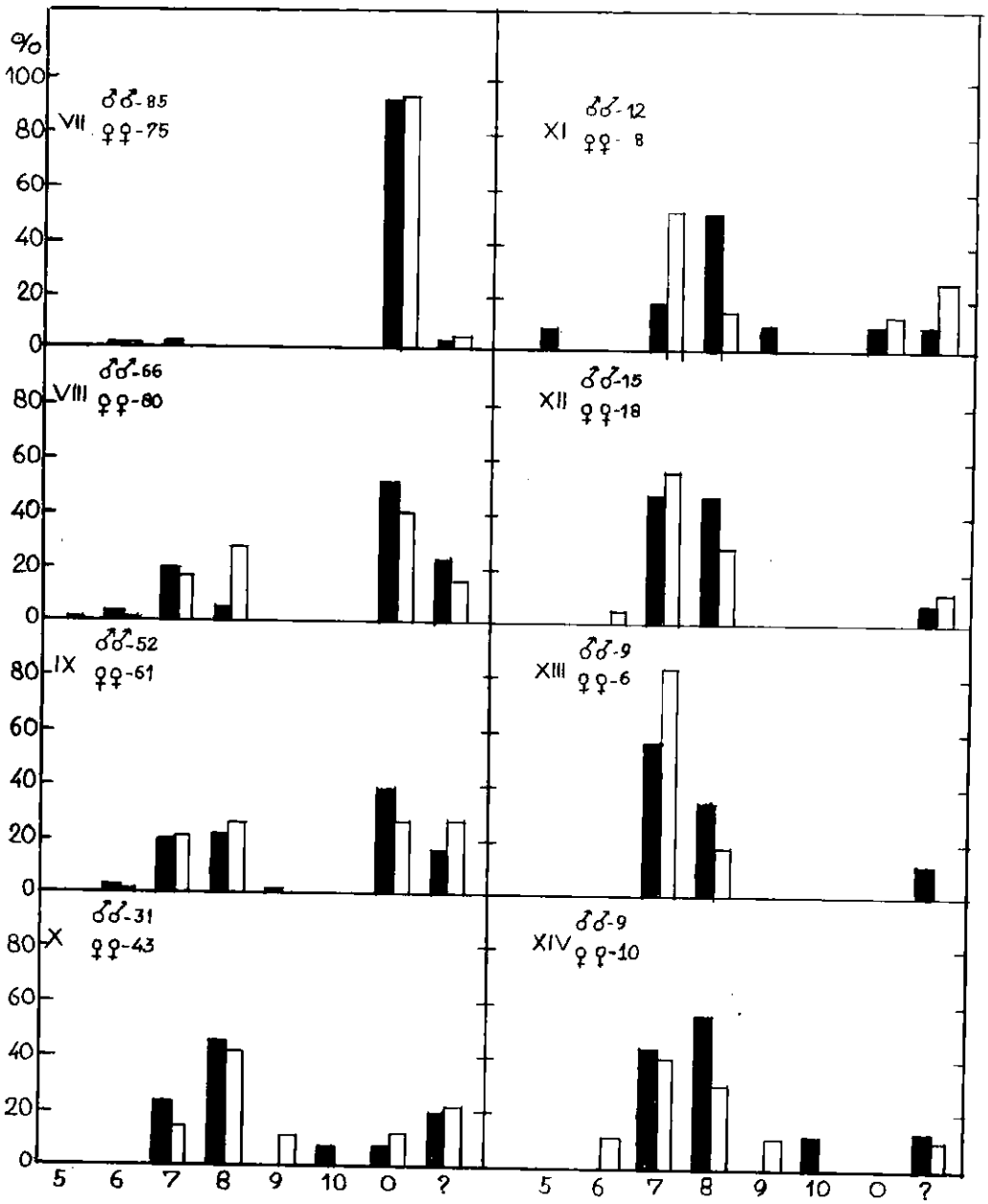

Fig. 11. Portuguese trawl samples of cod, Gulf of St. Lawrence, 1956. Percentage number of males (dark columns) and females (light columns) of the various ages (5-10) spawning for the first time. o-indicates no spawning mark.

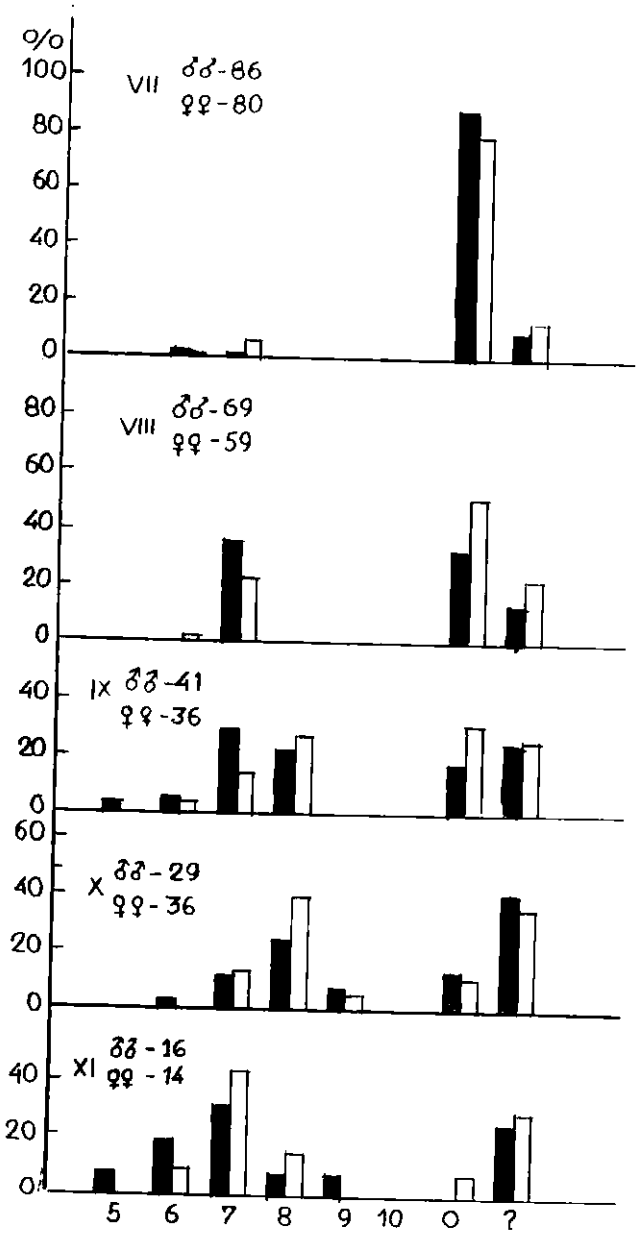

Fig. 12. Portuguese trawl samples of cod, Gulf of St. Lawrence, 1957. Percentage number of males (dark columns) and females (light columns) of the various ages (5-10) spawning for the first time. 0-indicates no spawning mark.

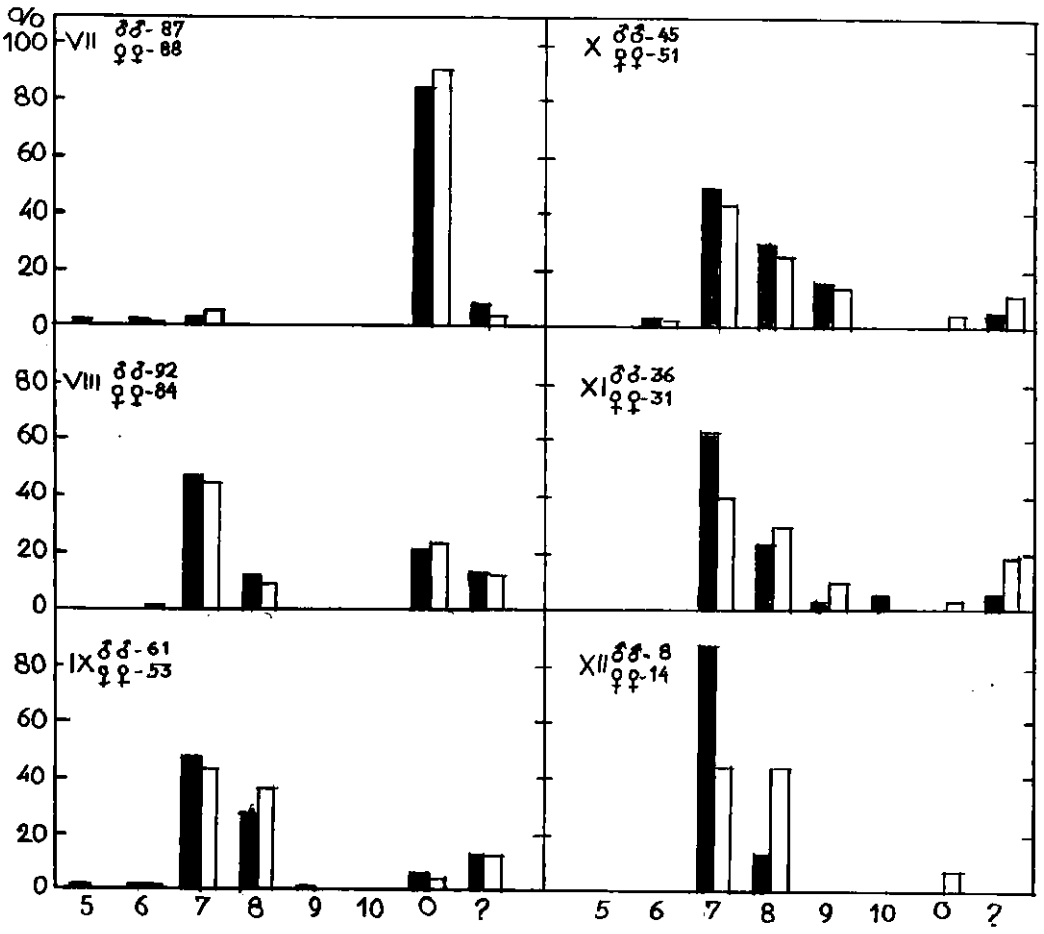

Fig. 13. Portuguese trawl samples of cod, Gulf of St. Lawrence, 1958. Percentage number of males (dark columns) and females (light columns) of the various ages (5-10) spawning for the first time. o-indicates no spawning mark.