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U.S.S.R. Research Report, 1961. Soviet Investigations in the ICNAF Area in 1961.

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Investigations in the ICNAF Area in 1961 were conducted by the Polar Research Institute of Marine Fisheries and Oceanography (PINRO) and the Baltic Research Institute of Marine Fisheries and Oceanography (BALTNIRO) from scouting vessels and a vessel specialized for hydrological research, "Topseda", of the Murmansk and Kaliningrad exploratory fishing service.

The research cruises covered the regions of West Greenland, Labrador, Newfoundland, the Nova Scotia Shelf and Georges Bank. The various researches carried out included the sampling of data on catch composition, hydrological conditions, bottom relief, migrations and distribution of major commercial species and their food. The regions and periods of spawning were determined. Investigations on zooplankton and ichthyoplankton were also carried out. Studies on race composition and division of stocks of cod and redfish, previously started, were continued. Tagging experiments on cod and haddock with hydrostatic tags were carried out on a larger scale. The number of fish tagged in 1961 in the ICNAF Area amounts to 2,583 of which 583 were tagged in Subarea 1, 635 in Subarea 2 and 1,361 in Subarea 3.

The "Topseda" made two hydrological surveys (May-June and August-September) in the waters of West Greenland, Labrador, Newfoundland and Nova Scotia. In the future such surveys will be carried out along adopted routes and within the same period of time.

At the end of the year a specialized cruise initiated systematic work on determining the abundance of young and the strength of separate year-classes of cod and haddock in the Labrador-Newfoundland areas.

In 1961 the scouting vessels "Novorossiysk", "Odessa", "Kreml", "Rossiya", "Volgograd", "Boguchar", "Balaklava" and middle-sized fishing trawlers (SRT) 4170, 4177, 4234 made 21 cruises to different parts of the Convention Area with groups of scientists on board. About 315,000 fish, including 102,000 cod, 189,000 redfish and 24,000 haddock, were measured.

Data for age determination were collected from 6,500 cod, 10,100 redfish and 2,500 haddock.

724 plankton samples were taken and stomachs of 29,000 specimens of fish were examined.

SUBAREA 1

In 1961 the "Topseda" carried out two detailed hydrological surveys in Subarea 1. In addition, hydrological observations were made from the exploratory fishing vessels "Volgograd" /April-May / and "Novorossiysk" / September-October /; both vessels undertook one cruise to West Greenland.

The analysis of the material obtained shows that the hydrological conditions in 1961 compared with those in 1959 and 1960 are characterized by the following peculiarities:

1. Favourable ice conditions caused early warming (in March), whereas in 1959-1960 the process only started in April. By the end of May 1961 surface water temperature reached 2° - 3° C. In September due to increased contributions from the warm current surface temperatures along the coast were 5° C, and from the south-west of Cape Farewell and until Ivigtut they rose to 7°-8° C.

2. In spite of early warming the temperature of the warm waters of the Irminger component in April-May on the slope and top of the Lille Hellefiske Bank was 1°-1,5° below that in 1959-1960 for the same months, but towards September the temperature on the banks reached 3°-4° C.

3. The intermediate cold layer on the Lille Hellefiske Bank was less developed in 1961 than in 1959-1960, it being 50 m thick here, and 100 m thick on the Store Hellefiske Bank, while in 1959-1960 it was 100-150 m thick on both the banks. The cold water boundary had a more northward position than in 1959-1960.

The biological material[1] collected during the two cruises indicated that in 1961, due to the early warming of waters, the main bulk of cod completed spawning in April; in May spawning specimens were scarce.

In April the size compositions of cod in Divisions 1D and C were about the same with the peaks at 50-53 and 62-65 cm (the mean lengths being 58.5 cm and 57.9 cm respectively).

In May the quantities of large cod in Subarea 1C increased and the length curve was characterized by three peaks (the groups 53, 65 and 74 cm predominated).

Higher water temperatures than in the previous year contributed to a considerably earlier formation of cod concentrations on the Store Hellefiske Bank. In May cod of 44-53 cm long prevailed in Division 1B.

The feeding of cod during the first cruise (April-May) was not intensive; this did not, in any regions, contribute to the stability of concentrations. In early April 1960 cod were already intensively feeding on sand-eel, whereas in the stomachs of cod examined in 1961 sand-eel only occurred in late May. The main type of food for cod in April-May was Euphausiidae. During May the fishery conditions improved. In early May cod catches were taken on the Fylla and Banan Banks, in late May on the Lille and Store Hellefiske Banks. Through September and in early October cod occurred in scattered quantities in mid-water layers. Only in mid-October, with the appearance of sand-eel, comparatively stable cod concentrations were formed near the bottom on the Fylla Bank.

The pattern of length curves in the second part of the year remained nearly the same. In Division 1C sizes of 50-62 cm (mean length 60.64 cm) prevailed in September; in October the lengths varied from 50-62 to 74-80 cm (mean length 64.27). In 1D the curve was also rather irregular with lengths from 44 to 77 cm prevailing.

1) Graphs illustrating the results of the biological investigations are attached.
(See p. 10).

In Division 1B specimens from 44 to 58 cm predominated as was the case in May.

In September the mean length of cod in Division 1F was 59.90 cm.

Age determination indicated that cod from 4 to 8 years old of the 1953-1957 year-classes constituted the main bulk of the trawl catches.

The successful 1953 year-class was the most abundant in the 1958 fisheries accounting for 42.2% of the total trawl catch. This year-class prevailed also in the catches of 1959 (32.7%). In 1960 the new rich 1956 year-class entered the fishery, and accounted for over 28% of the catch. In 1960 the 1953 year-class took the second place (24.1%) and in 1961 the third place (18.2%). A new stronger year-class, that of 1957, was dominant in the catches. The 1955 year-class took the second place comprising 20.6% of the total catch. It should be noted that considerable numbers of 4-year-old cod were found in all divisions, the 1957 year-class was especially abundant in Division 1B. It is evident that this year-class is distributed over a wide are and must be regarded as the richest year-class of cod in the waters off West Greenland.

In spring "marinus" type redfish were taken mainly in Division 1C on the western slopes of the Lille Hellefiske Bank. In April-May 1961 the distribution limit of cod concentrations extended further north than in the same period of the previous years. Redfish catches ranged from 0.3 to 5.0 tons per hour trawling. As in previous years the mean lengths of redfish increased from Division 1 C to E, with a mean length of 38.7 cm in 1C, 41.1 cm in 1D and 42.6 cm in 1 E.

The average age of redfish in 1 C was 16.1 years. 16-18 years old fish were dominant in the catches.

As in previous years young redfish were scarce in catches from the bank slopes, whereas, according to Hansen, large quantities of young redfish are found in the fjords (Godthaab, Julianehaab and others); their prevailing length is 10-25 cm; the length composition remains constant for a number of years. There is every reason to suppose that the largest part of young redfish coming from the Danish Strait are transported into the fjords of West Greenland where they spend their first 10-15 years of life. At the same time the occurrence of great numbers of redfish below 41 cm in 1C (the length group 31-40 cm making up 62.6%) is accounted for by the fact that grown up redfish leave the fjords and inhabit the slopes of the adjoining banks.

In 1961, as in previous years, females with maturing larvae and developing embryo were not recorded; evidently Sebastes marinus have not been breeding in the waters off West Greenland for the past few years. In autumn redfish males in the stage of maturity close to copulation and in the period of copulation were found.

SUBAREA 2

The previous studies of the hydrological regime in the Labrador and Newfoundland areas (Subareas 2 and 3) and the comparison of the data available with those obtained in 1961, allow us to determine the hydrological conditions in the subareas. As regards the heat balance for the Labrador and Newfoundland Banks, 1959 was abnormally cold; the warming that began in 1960 is attributed to the weakening of the cold Labrador Current. In 1961, especially in the first half of the year, the warming of the waters proceeded. During June-July the mean temperature anomalies in the standard sections of Subarea 3 were above the normal.

In July the mean temperature anomaly in Subarea 2 of the whole Labrador Current approached the normal value. The core of the Labrador Current was cooler than usual. The temperature of the relatively warm waters transported by the current over the depths of 300-700 m was higher than usual (3°-4° C).

A slight increase in the transportation of cold waters by the Labrador Current was observed from the end of July in the area of the Newfoundland Banks.

The Labrador area (2J) was the main fishing ground in the first part of 1961. Cod occurring throughout the period in stable concentrations on the south-eastern slopes of the Hamilton Bank, were fished successfully at depths of 285-360 m and with temperatures of 3° -3.75° C in the daytime.

Division 2J accounted for 49% of the total catch of the trawl fleet operating in the ICNAF area in 1961. Scouting and research vessels operated in Subarea 2, mainly in Division 2J from February to December. Fishery operations in 2H, in May, July and September, were not regular. The material sampled from the scouting vessels was treated. The size range was between 32 and 135 cm with the 53 cm group predominating. Cod of 45 cm and over were mature. The fish were well nourished. Cod of 6-,7- and 8-years old comprised the bulk of the catches.

In the catches in Division 2H, where the fishing trawlers operated for a short time (April-May) in the areas adjoining 2J, 8-,9-and 10-year old cod with a length of 56 cm predominated.

The analysis of the material available indicates that the size and age-distribution of the Labrador cod stock has not changed considerably during 1957-1961.

Cod of older age groups are more strongly represented in the Labrador divisions than in the southern Newfoundland areas.

Young cod occur more frequently in the southern area of Labrador (south of the Hamilton Bank) along the deep-slope water.

The growth rates for cod in 2H and 2J (as well as in the adjacent 3 K) are the same, and lower than in the southern region of the Grand Bank.

The main bulk of cod in the Labrador area spawn in April; in May the majority of cod are post-spawners.

The results from tagging experiments in the Labrador area confirmed the fact that cod from the northern regions do not migrate southward or vice versa. The tags were returned from the place of tagging within 3-7 months.

In early June, due to the warming of water masses at the Labrador coast, cod started to move from the slopes of the shelf into the coastal zone.

An extensive survey of the Hamilton Bank area by a scouting vessel proved the absence of cod here at this period, only single specimens occurring in the catches.

Concentrations of Sebastes mentalla were,in the beginning of the year, scattered, constituting in the main a by-catch of the cod fishery.

In Subdivision 2H the peak of the length curve is at 35 cm. The length curve for females has two peaks at 35 and 40 cm. In May males accounted for 79% of the catches. In July the sex ratio became 1:1 owing to the fact that larger-sized females (38-40 cm) entered this region. Males were 14-16 years old, females 20-21.

The number of males and females in Division 2J remained about the same throughout the year. On the average the length peak during the period of investigations was at 34-35 cm, for females at 35-38 cm. The dominant age of the males is 13-14 years, single males reaching the age of 23;; the most common age of the females was 15-19 years, with few 28-year-old specimens occurring in the catches.

SUBAREA 3

The fishing operations in northern Newfoundland and in the divisions of the Grand Bank were conducted throughout the year but not continuously. In the second half of the year, (excluding August, September) the fishery was in the main for haddock (Divisions 3N and 3O).

Cod began to concentrate in the northern part of the Newfoundland Bank (3K) in April. Large post-spawners (fairly similar in size) with an admixture of immature cod comprised the bulk of the concentrations. The fish were intensively feeding on capelin and lantern anchovy.

The predominant length of cod in 3K was 60 cm, and in 3L - 57 and 80-85 cm.

The analysis of samples for age-determination indicated that 6-,8- and 9-year-olds prevailed in 3K, and 4-,6- and 9-year-olds in 3L. Older cod were more abundant in 3K and 3L (as well as in Labrador) than in the southern divisions.

In 3M, beginning from September, feeding concentrations of cod were observed with the prevailing lengths of 42-44 and 51-53 cm and with an age of 4 and 7 years. Young cod were distributed over the whole shallow water layer of the division. Insignificant concentrations of cod were observed in August on the south-western slopes of the Grand Bank (Green Bank) in depths of 110-130 m ; these cod were 59-62 cm long, 6-7 years old and in the II-III stages of maturity. Cod on the Flemish Cap Bank (3M) are the first to spawn (February, March); on the north-eastern slope (3K) the spawning of cod takes place in May,June; and the majority of cod in the southern regions of the Grand Bank spawn in June.

The results of tagging experiments in 3P and 3O indicate the absence of long migrations of cod from these areas.

The studies carried out in 1961 proved that great quantities of young cod occur on the south-western slope and on the southern and eastern slopes of the Grand Bank in the deep slope water.

At the beginning of the year (January - February), due to the scattered character of the concentrations, redfish in Subarea 3 were taken only as by-catch of the cod fishery. Owing to the approaching spawning season in March, April and May the density of the redfish concentrations in 3K, 3M and 3N increased.

In April single frozen-fish trawlers operated periodically in the deep slope waters off the Labrador Shelf and the northern part of Newfoundland where good catches of redfish alone were obtained. Expeditions of middle-sized trawlers of the Baltic fishery organizations took significant catches of redfish in April-May in 3K and in March, June and July - in 3M.

The length distributions of Sebastes mentella in 3K and 3L are the same with the mean length of the females between 38.8 - 39.3 cm, and of the males between 34.1 - 34.8 . In both the divisions the majority of females were mature, ready for the shedding of larvae. The predominant ages for males were 14-15 years, for females - 20-22 years. The sex ratio during the year was 1 : 1 ; except in 3K, where males in November constituted 36%, and females - 64%, and in 3L where the sex ratio in February was 3: 1 (males 77.5%, females 22.5%).

In Division 3M redfish were smaller in size than usual, the peak of the length curve for males was found to be at 32-33 cm, that for females at 35-36 cm; the prevailing age of the males was 11-12 years, and of the females 12-13 years. Over 40% of the females were mature, ready for the extrusion of larvae. In April males in 3O were in the III-IV maturity stages, females in the V-VI maturity stages; males accounted for 82.5%, females - for 17.5%. 3N males comprised 29.4%, and females 70.6%.

Dense concentrations of small Sebastes mentella, with a mean length of 28.6 cm and a mean age of 9-11 years, were found in April over the whole south-eastern slope of the Grand Bank between 130-160 m. These redfish were feeding intensively on capelin and kril.

In Subarea 3 the majority of the females completed extrusion of larvae in April.

No dense concentrations of redfish were observed during July - December.

Haddock investigations in Subarea 3 during 1961 (3N and 3O) were carried out during May and proceeded throughout summer and autumn. Haddock with the peak of the length curve at 36-43 cm were present in the catches of the scouting vessels. In 3P the length curve in February had 3 peaks: 32-37 cm, 40-47 cm and 52-53 cm, with 42-47 cm predominating.

The length distribution of haddock by divisions and months did not change greatly; in 3N the mean length was 39.2 cm, in 3O 40.2 and in 3P 41.0.

3-8 year-old haddock with a considerable dominance of 4 and particularly 5-year-old specimens[1] were found in the catches.

In Division 3O spawning haddock were observed in late May, mass spawning took place in June. A few spawning haddock were found in 3N in July. The fishery was particularly successful from the beginning of July in shallow water, where haddock were feeding intensively on spawning capelin. During August-September the trawlers switched over to fishing for herring in 5Z. The fishery for haddock was resumed in 3N and 3O in October, when haddock were feeding on sand-eel.

SUBAREA 4

In February a scouting vessel in Subarea 4 took some age samples; 2,569 specimens of Sebastes mentella were measured. The mean length of males was 28.5 cm, that of females 30 cm. The average age of males was 11.5 years, that of females 12.5 years. The commercial trawlers did not fish in this region.

SUBAREA 5

In 1961 exploratory fishing in Division 5Z (Georges Bank) was carried out by the "Balaklava" and "Boguchar".

In April commercial concentrations of western Atlantic herring were observed, and three oceanographic surveys were made.

As a result of the analysis of the hydrological data it was established that:

1. The Georges Bank area is an area of complex inter-action of three water masses: Atlantic waters, the Gulf of Maine waters and slope waters.

2. The central part of the bank is covered by the bank waters proper, which are a product of the above-mentioned water masses. The anticyclonic eddy in the centre of the bank is evidently the mechanism that facilitates the formation of these water masses.

3. The dynamics of the waters in the Georges Bank area is mostly affected by north-eastern, north-western and south-western winds. North-eastern winds increase the flow of the slope waters along the continental slope and may lead to a complete destruction of .....

1) In the data published by Templeman haddock are a year older, which may be attributed to different methods in age determination; this should be checked in the future.

the anticyclonic eddy over the bank. South-western winds intensify the penetration of Atlantic water masses of high salinity into the bank area.

4. During the year surface water temperatures on the bank vary from 3° to 19° C with maximum warming in August-September. In the first part of summer dense fogs retard the warming of waters.

5. In late summer dilution of surface water was at its height (32.18 o/oo).

As the analysis of the biological data indicates,herring of Georges Bank belong to the sub-species Clupea harengus harengus typical of the whole of the North Atlantic. Judging by their morphological and biological characteristics (the position of the dorsal and anal fins, the number of rays, the vertabrae number, the age composition of the population, the growth rate, etc.) they may be regarded as bank herring that do not perform long migrations and are evidently an isolated stock.

The lengths of Georges Bank herring in the 1961 catches range from 17 to 34 cm with specimens of 25-26 cm prevailing. The age is 4-5 years. Spawning was observed from early September through October.

Herring concentrations were successfully fished with mid-water trawls and with drift-nets.

The trawl catch amounted to 426.6 thousand centners, the drift-net fishery resulted in 259 thousand centners making up a total of 685.6 thousand centners.

STUDIES ON LOCAL STOCKS OF COD AND SEBASTES MENTELLA TR.

On the basis of studies on race composition of cod, parasitological investigations and the analysis of size variations in otoliths one can conclude that the Labrador and Newfoundland areas are inhabited by isolated cod populations which owing to their isolation differ in a number of characteristics.

In the Labrador - Newfoundland areas four cod populations may be distinguished:

1. Cod of southern Labrador, the northern Newfoundland Bank and the northern xtremity of the Grand Bank.

2. Cod of the Flemish Cap Bank.

3. Cod of the north-eastern and south-eastern Grand Bank.

4. Cod of the south-western Grand Bank.

Investigations, initiated in 1959-1960, were continued in 1961, and the material on the studies of redfish populations (Sebastes mentella Tr.) in the Labrador-Newfoundland areas was summarized. Plastic and meristic characteristics (the height of the body, the length of the head, the diameter of the eye, the number of fin rays etc.) were compared so as to define the difference between the fish of the isolated populations. Parasitofauna of redfish ("natural tags") was studied as well as external red and black spots and internal black spots in muscles ("biological tags").

Morphoanatomic differences and the use of "parasitic" and "biological" tags suggest the existence of three Sebastes mentella stocks in the areas under investigation: the first comprises populations of Divisions 2Y, 3K and 3L. The second stock inhabits the Flemish Cap Bank, the third occurs off southern Newfoundland and on the banks of Nova Scotia and New England.

In Division 3N an aboriginal population is found and considerable mixing between this population and specimens of the southern stock is observed.

PLANKTON INVESTIGATIONS

The plankton material sampled in the Newfoundland waters and in the Flemish Cap area in 1960 and treated in 1961 made it possible to establish that the spring plankton development in the warm waters off Flemish Cap and east of the Newfoundland Bank starts two months earlier than in the cold Labrador waters. The propagation of Calanus finmarchicus in Atlantic waters occurs in March, whereas in Labrador waters mass spawning of Calanus was recorded only in June.

These two water masses differ also as to the phyto-plankton composition - the cold Labrador waters of the Newfoundland Bank are characterized by a prolonged and intensive spring development of diatoms while this was not observed in the Atlantic waters. Peredineae were dominant in the phytoplankton.

During the summer a study of the distribution of Euphausiacea (one of food items for fish) in the Newfoundland Bank area was carried out. The greatest numbers of Euphausiacea occurred on the central eastern slope of the Newfoundland Bank (about 800 individuals per hour trawling). On the northern Newfoundland Bank slope Euphausiacea were present in smaller quantity (20-50 specimens per hour trawling). Very high numbers of Euphausiacea of the species Thysanoessa longicaudata were taken on Flemish Cap (10,000 - 11,000 individuals per hour trawling). Thysanoessa longicaudata was predominant on the northern slopes of the Newfoundland Bank in early spring (March), whereas an increase in the number of Thysanoessa inermis was observed in late summer. These changes result apparently from the seasonal fluctuations in the intensity of the Labrador waters.

No seasonal changes in the quantitative proportions of various species Euphausiacea were found.

The study of the ichthyoplanktonic material sampled during 1959-1961 permitted a preliminary establishment of the location of spawning grounds of such commercial fishes as cod, redfish, American plaice, (Hippoglossoides platessoides) and of the non-commercial sand-eel.

Cod spawning grounds must be located in south Labrador (2J), in the area of north-eastern slope of the Newfoundland Bank, in the south-western area of Flemish Cap (3M), in the shallow waters of 3N and on the south-western Grand Bank slope (3O).

Cod in these areas spawn during March to August. The maximum spawning is observed in April-May.

Redfish spawn on the north-eastern slope of the Grand Bank (3L), on the south-eastern part of Flemish Cap (3M), and in slope waters of the north of 3L. Redfish pre-larvae occur in the catches from April to August. The maximum spawning apparently takes place during April-May. In the Nova Scotia area no spawning of redfish was observed.

The spawning of American plaice (Hippoglossoides platessoides) is believed to take place in south Labrador (2J) and on the southern Newfoundland Banks (3M, 3N, 3O) during April, May and June.

A few haddock eggs were found in the Nova Scotia area (4V, 4W) in April, and on the Grand Bank in May (3L, 3N, 3O).

Sand-eel spawning grounds are situated on the south-eastern and south-western slopes and in the shallow waters of the Grand Bank (3O, 3N).

Graphs Attached

Fig. 1. Cod; off West Greenland - 1961. Age composition.

Fig. 2. Cod; off Labrador -1961. Age composition.

Fig. 3. Cod; Flemish Cap - 1961. Length-and age-composition.

Fig. 4. Cod; Divisions 3K and 3L - 1961. Age composition.

Fig. 5. Cod; Divisions 3O and 3P - 1961. Age composition.

Fig. 6. Haddock; Subarea 3 - 1961. Size composition.

Fig. 7. Cod; off West Greenland - 1961. Length composition.

Fig. 8. Redfish, Sebastes marinus; off West Greenland - 1961. Length composition.

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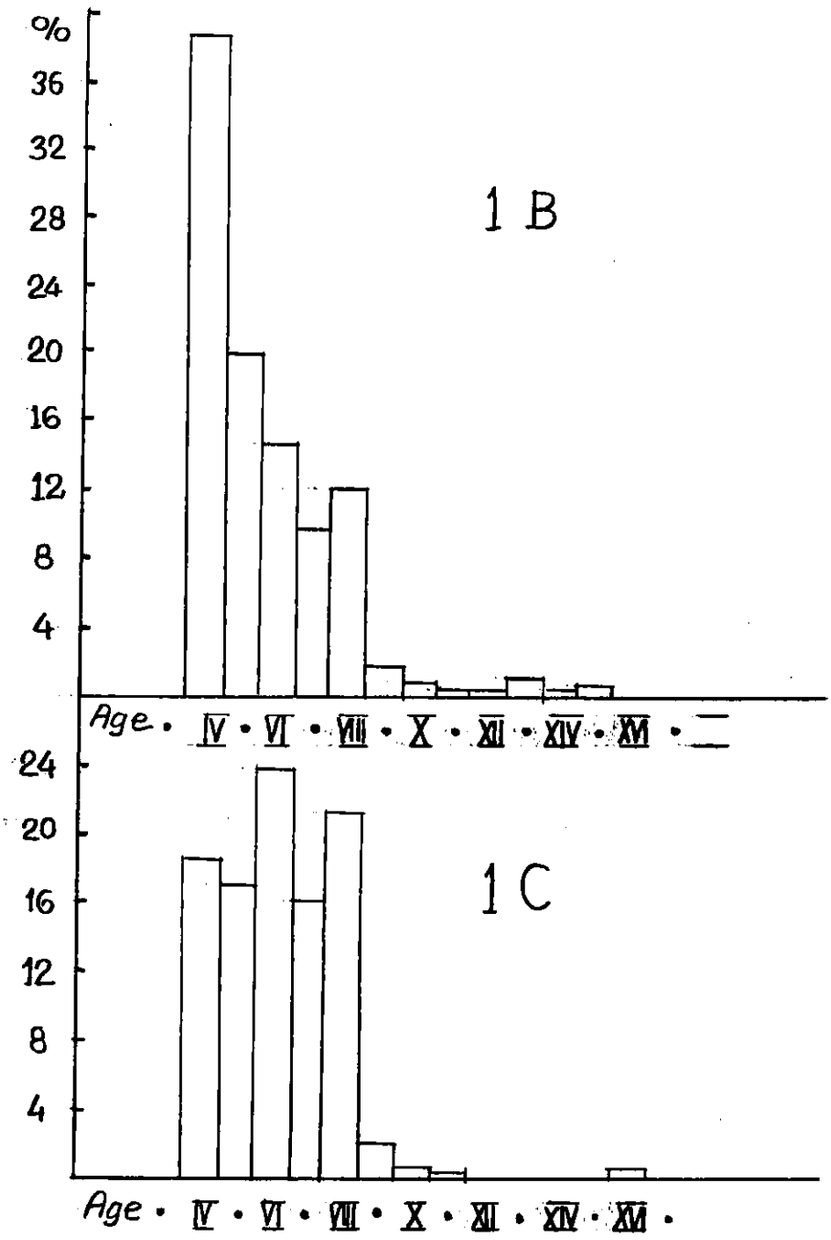

Fig. 1. Cod; off West Greenland-1961. Age composition.

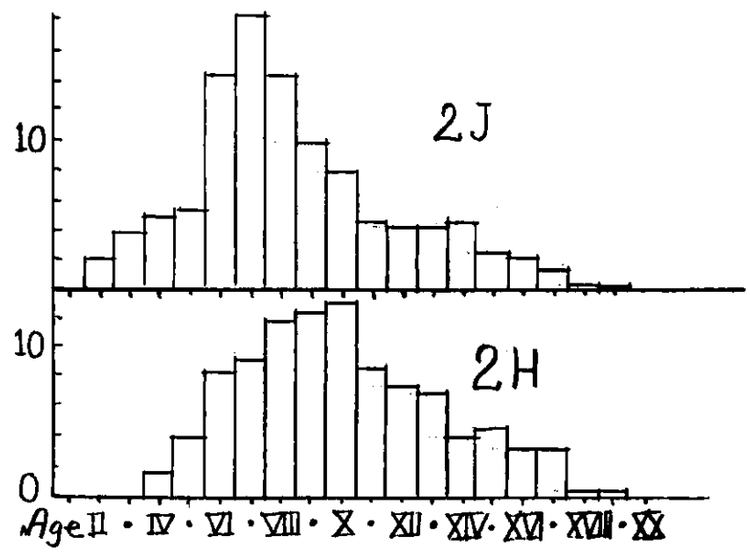

Fig. 2. Cod; off Labrador - 1961. Age composition.

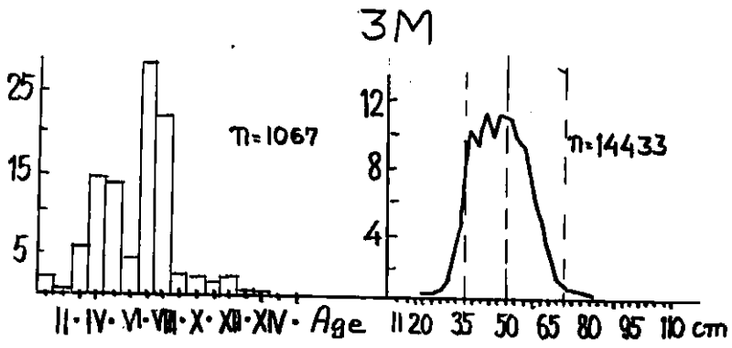

Fig. 3: Cod; Flemish Cap-1961. Length-and age-composition.

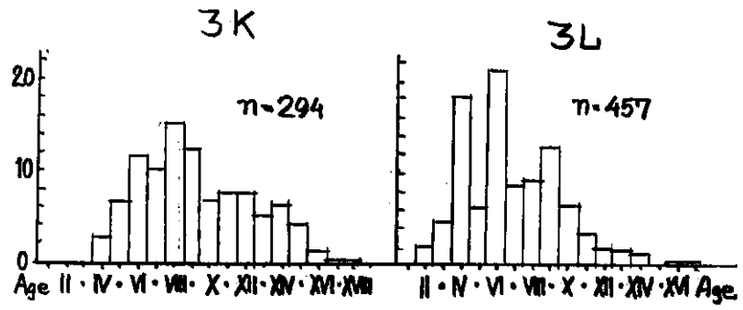

Fig. 4. Cod; Divisions 3K and 3L -1961. Age composition.

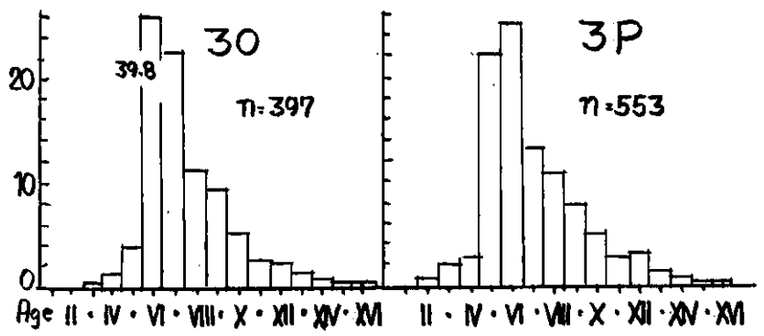

Fig. 5. Cod; Divisions 3O and 3P - 1961. Age composition.

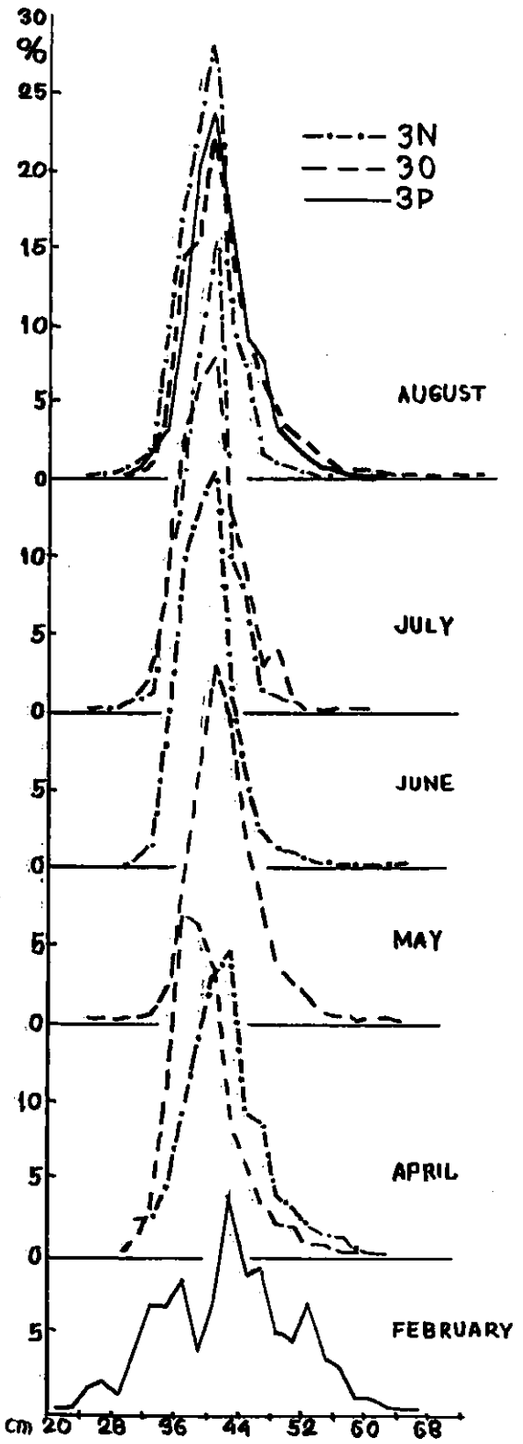

Fig. 6. Haddock; Subarea 3-1961. Size composition.

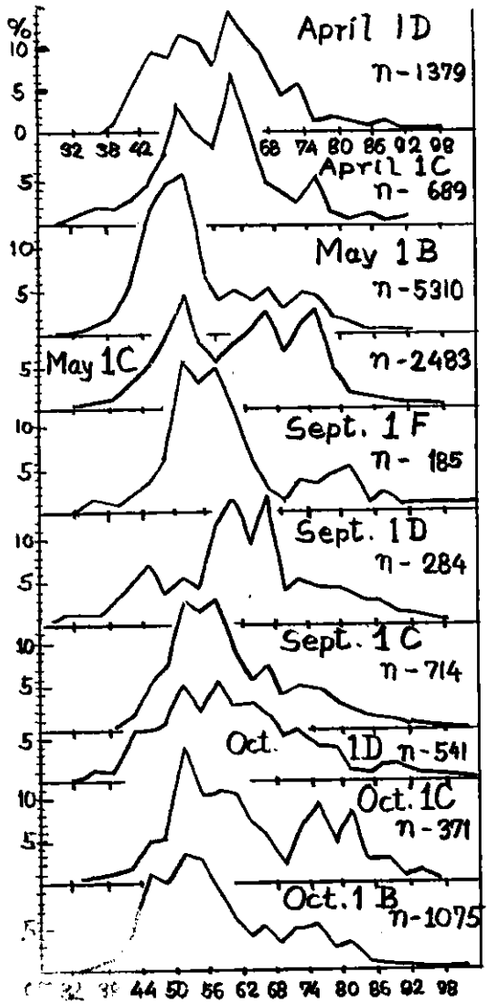

Fig. 7. Cod; off West Greenland -1961. Length composition.

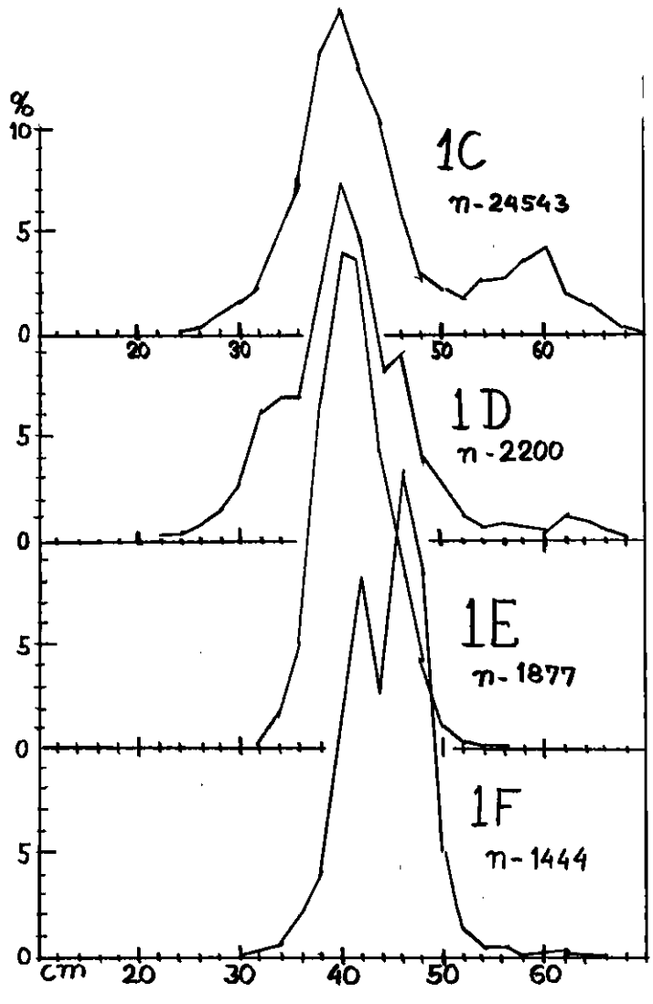

Fig. 8. Redfish, Sebastes marinus; off West Greenland -1961. Length composition.