

## ANNUAL MEETING - JUNE 1964

## Soviet Research Report, 1963

In 1963 Soviet fishing fleet took 491446 tons of fish in the ICNAF area.

The distribution of catches by main commercial species is given in Table I.

Table I. Specific composition of Soviet catches in the ICNAF area.

Species	1962		1963	
	tons	%	tons	%
C o d	100791	27.3	81658	16.6
Haddock	5315	1.4	6504	1.3
Redfish	32269	8.7	37535	7.6
Herring	160404	43.5	100036	20.4
Silver hake	50725	13.8	230380	46.9
Other ground fish	18233	///	18429	///
Other pelagic fish	2057	5.3	4567	7.2
Others	-	///	12337	///
Total	369794	100.0	491446	100.0

The main changes in the fishery were the growth of silver hake catches and some corresponding shifting of fishing operations to Subareas IV and V. The catches of cod and herring have shown some decline.

Tables 2 and 3 show the Soviet catches by Subareas and the subareal distribution of catches by main commercial species.

Table 2. Distribution of Soviet catches by ICNAF subareas

subareas	1962		1963	
	tons	%	tons	%
I	-	-	6302	1.3
II	68059	18.4	25116	5.1
III	61774	16.8	63756	13.0
IV	30591	8.4	165440	33.6
V	209370	56.4	230832	47.0
<b>Total</b>	<b>369794</b>	<b>100.0</b>	<b>491446</b>	<b>100.0</b>

Table 3. Catches of main commercial species in ICNAF subareas in  
1962-1963 (in tons)

Species	I		II		III		IV		V		Total	
	1962	1963	1962	1963	1962	1963	1962	1963	1962	1963	1962	1963
Cod	-	5053	60072	20833	32954	40201	2463	10221	5302	5350	100791	81658
Haddock	-	62	-	8	1614	372	2567	3701	1134	2361	5315	6504
Redfish	-	868	5896	3808	20808	19485	3975	12288	1590	1086	32269	37535
Herring	-	-	-	-	-	-	9260	2707	151144	97329	160404	100036
Silver hake	-	-	-	-	-	-	8825	123023	41900	107357	50725	230380
Others x/	-	319	2091	467	6398	3698	3501	13500	8300	17349	20290	35333
Total	-	6302	68059	25116	61774	63756	30591	165440	209370	230832	369794	491449

x/ Others include halibut, flatfish, argentine, ray, horse mackerel, mackerel, wolf fish,  
and unidentified ground and pelagic fishes.

Fishery conditions and Soviet fishery investigations in the ICNAF area are summarized below by subareas by

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## S U B A R E A I

### A. Status of the Fisheries

I. Cod. Several BMRT - type trawlers operated in the area of West Greenland during the first half of 1963. In the second part of the year the subarea was surveyed by one scouting vessel and by one fishing vessel. In February- March catches were good in the area of Banan Bank ( IC ) where dense concentrations of wintering cod were found at the depths 130 m to 150 m. Catches amounted 10-17 tons per one hour of trawling. The bulk of catches in February was composed of a very rich 1957 year- class ( dominant sizes 66-68 cm ). Cod of 1956, 1958 and 1959 year- classes ( Fig. I ) were much less represented in catches.

Commercially important concentrations of pre- spawning cod were also observed in February on Danas Bank ( I D ) . Specimens of the 1957 year-class dominated in catches.

In early June fishing was successful on the western slope of Frederikshob Bank ( I E ). Catches were dominated by post-spawning cod of the 1957 and 1956 year- classes with body lengths being correspondingly 66-68 cm and 75-77 cm.

In mid-June a stable concentration of cod was observed on Danas Bank.

Almost no fishing operations were conducted off Western Greenland in the second half of the year. Only in October-November cod was caught on the southern slope of Store-Hellifiske Bank. Both large-sized cod of the 1957 and 1956 year-classes and smaller-sized cod of the 1960 year-class were represented in catches.

II. Redfish. In April redfish was caught together with cod at the depths 275-300 m on the western slope of Banan Bank where it made 30 to 40 per cent of the catches. The prevailing

sizes were 35 to 40 cm. The sex ratio was 1 : 1. In June-July redfish occurred in catches in this area more frequently than in other areas. Catches did not exceed one or two tons per one hour of trawling. The prevailing sizes were 38 to 40 cm, the sex ratio 1 : 1. In November-December individual catches of redfish amounted to 3 to 6 tons per haul. In other areas redfish occurred in small numbers as by-catch in the catches of cod.

#### B. Special Research Studies

##### I. Environmental Studies

###### 1. Hydrography

In 1963 the temperature minima in layers 0-200; 100-200, and 200-500 were observed towards the end of February and equalled, correspondingly, to 0.95°C, 1.61°C and 2.70°C.

Spring warming of waters began in the end of April. Maximum temperatures in 0-200 m and 100-200 m layers were observed in September being, accordingly 5.07°C and 4.87°C. In the 200-500 m layer temperature maximum at 5.20°C was registered only in November, one and a half months later than in the surface layers.

In the beginning of July 1963 an intermediate cold water layer with temperature below 1°C was clearly defined on Frederikshob and Danas Banks. In comparison with 1961 this layer was of much greater size.

On Fiskenas, Fyllas and Banan Banks this layer was better warmed (up to 2°C) and was located more westwardly than in previous years.

Mean water temperature in September 1963 (as of 15th September) in layers 0-200 m, 200-500 m, and 100-200 m in Divisions I F and I E was 0.5 - 0.8° lower than in September 1961 and 1962.

On Fyllas and Fiskenes Banks as well as in the gut between Banan and Fyllas Banks the temperature of these layers was higher than in 1962 but somewhat lower in comparison with 1961.

On Lille and Store-Hellefiske Banks warming of 0-200 m and 100-200 m layers was also found to be 0.3 - 0.5° higher

than in 1961-62. The temperature of the Canadian cold current was approximately 1° below that of the previous years.

Thus, the heat supply in the area from Cape Farwell to Fiskenes Bank was lower than in 1961-1962.

Northward of Fiskenes Bank up to Store-Hellefiske Bank the sea water temperature in September 1963 was higher than in 1962 but lower than in 1961.

## 2. Plankton

In 1963 the workers of the Polar Research Institute (PINRO) took zooplankton and ichthyoplankton samples off Southwestern Greenland. In April there was but very little zooplankton; development of phytoplankton and the beginning of spawning of Copepoda were observed only occasionally in waters of Atlantic origin. Many cod eggs were found in April in shallow waters off the southwest coast of Greenland. In July Copepoda nauplii were observed almost on all the stations worked off Western Greenland, so the spawning of Copepoda was still going on. In July redfish larvae were found; they are apparently brought here with the Irminger current and are dispersed over the southwest coast of Greenland.

## II. Biological Studies.

### 1. Redfish.

In November-December 1963 and January 1964 distribution of young redfish (size 4 to 6 cm) was traced by the presence of the young in the stomachs of cod. Great numbers of young redfish were observed in November over the vast sea space from Division I F to I C (western slope of Banan Bank).

In December young redfish of similar size was found in cod stomachs on Store-Hellefiske Bank. Beginning from the middle of December and in January 1964 young redfish occurred very rarely.

Distribution of larger-sized young redfish up to 30 cm long was studied in summer and autumn. 184 trawlings were made. In July only a few scores of redfish of 15 to 30 cm long were caught on the western slopes of Banan and Helder

Banks at the depths from 200 to 430 m. A few small-sized redfish (13-25 cm) were taken on the southeast slope of Banan Bank at the depth 300 m.

## S U B A R E A II

### A. Status of the Fisheries

I. Cod. Catches off Labrador dropped three-fold in comparison with 1962 and amounted to slightly over 20,000 tons. Such decrease in catches is explained by bad ice conditions in the area during the first part of the year that compelled the fishing vessels to leave the fishing grounds. The productivity of fishery during the short periods of fishing operations in ice-free areas was indicative of the good condition of the stock of Labrador cod: February - 5.64 tons; March - 3.27 tons, April - 3.71 tons, and May - 3.66 tons per one hour of trawling.

The prevailing sizes of cod in Division 2 j in February-March were 45-56 cm. In April catches were mainly composed of cod of 6 to 8 years old and in May - 7 to 10 years old (Fig.2).

In March-April 1963 a scouting vessel met a dense concentration of cod in Division 2G. Several BMRT trawlers that were operating there in mid-April have taken 1185 tons of cod and reported good daily catches. The dominant sizes of cod were 53 to 62 cm.

II. Redfish. The catch has dropped by more than 2000 tons in comparison with 1962 and amounted to 3808 tons. The reason was the same - redislocation of the fishing fleet to other areas because of bad ice conditions. The main area of redfish fishing in April was off Southern Labrador where redfish was taken together with cod at the depths of 328 to 385 m and constituted up to 20% of the total catch.

B. Special Research StudiesI. Environmental Studies1. Hydrography

In 1963 transport of arctic cold waters into the areas of Labrador and Newfoundland was much more vigorous than in previous years. As a result the heat supply in the active layer of the sea (0-200 m) was reduced. Thus, in spring 1963 a mean temperature of the 0-200 m layer at the standard stations in the area off northeast slope of the Grand Newfoundland Banks was 1-2° lower than in 1962. On the Grand Bank itself warm waters in July and September were observed less frequently than in 1962. Ice conditions in the Labrador and Newfoundland areas in 1963 were much more severe than in 1962.

II. Biological Studies1. Cod

In March-April the area of Labrador was surveyed for the purpose of locating the spawning grounds of Labrador cod. In the middle of March concentrations of pre-spawning and spawning cod were observed in Subdivision 2G at the depths 280 to 350 m and near bottom at temperatures 2.0° to 3.5°C. This area apparently served as a place of mass spawning of cod that proceeded from mid-March to the end of April. The results of tagging and presence of great number of post-spawning cod specimens in Divisions 2 J and 3 K indicate that after spawning in Division 2 G the cod migrate southward to Divisions 2 J and 3 K. The main spawning grounds of Labrador cod may be supposed to be off North Labrador (2 G) from where the eggs are drifted southward.

During two expeditions especially organised for the purpose of estimation of the young in the areas of Labrador and Newfoundland in December-January 1961-62 and 1962-63 a great number of data was obtained on the age composition of young cod. The results of age determinations are summarized in Table 4 where size fluctuations and mean sizes of young cod are given by age categories and by Divisions. The size groups of the young cod are considerably extended for each age category. The

rate of growth of young cod in the northern Divisions is somewhat slower than in the southern ones. It must be observed that the mean sizes and the length fluctuations for the year-class 3+ are undoubtedly underestimated due to the intentional limitation of this size group of the young by 35 cm length.

Table 4. Size fluctuations and mean lengths of the young cod by age groups

Age	0 +			1 +			2 +			3 +		
	cm from- to	M	n									
2 G				17	17.0	1	20-29	25.4	12	26-35	31.7	71
2 H	8	8.0	1	-	-	-	20-30	26.1	58	26-35	32.0	315
2 J	7-15	10.0	30	12-22	17.7	96	17-32	25.3	826	24-35	31.3	3246
3 K	7-15	10.5	34	15-25	18.1	139	17-35	25.4	310	25-35	31.9	409
3 L	6-14	9.5	39	14-26	19.7	104	18-34	26.1	118	20-35	32.1	196
3 M	6-17	10.9	132	18-22	19.3	19	18-34	23.9	131	25-35	32.1	549
3 N	9-15	12.2	12	14-29	22.7	109	21-35	29.3	35	30-35	33.6	4
3 O	7-14	10.4	109	15-26	20.2	42	21-34	28.3	26	28-35	32.7	18
3 P	6-16	9.6	837	15-25	19.1	121	26-35	26.4	97	24-35	30.8	31

## 2. Redfish

Distribution of redfish was studied on scouting vessels; these studies covered the size and sex compositions of redfish in catches.

In June redfish was scattered over a wide area off Central Labrador (2H). No commercially important concentrations were observed. The area of Southern Labrador (2 J) was surveyed from March through May and in December. Liberation of larvae took place in April-May. Male specimens prevailed in catches made in May-June at the depths 500 to 600 m. Sex ratio was 2 : I, 3 : I and even 4 : I. In other seasons of the year the sex ratio was close to I : I.

In July small concentrations of S. marinus L. consisting of pre-spawning and spawning females (90%) were found at the depths 210 to 540 m.

### S U B A R E A III

#### A. Status of the Fisheries

I. Cod. The catch in this subarea in 1963 has somewhat increased (40201 tons against 32954 tons in 1962).

In Division 3 K fishing operations were conducted in February - April. Wind - influenced changes in ice conditions frequently compelled the fishing boats to leave the area despite the good concentrations of cod being available there. In February the daily catch per one BMRT - type trawler amounted to 34 to 45 tons. The size of cod was 45 to 56 cm.

In March a group of BMRT operated on Flemish Cap Bank (3M) where the average catch per one hour of trawling was 3.7 tons. The bulk of catches was composed of cod of a rich 1957 year-class.

In June-July trawlers of the SRT and SRT-R type conducted fishing operations in Division 3 M, and in June- in Division S L. There they took more than 7000 tons of cod whereas in Division 30 the boats of this type took in May about 10,000 tons of cod.

II. Redfish (S. mentella Tr.) The catch in 1963 has somewhat dropped in comparison with the previous year (19485 tons in 1963 against 20808 tons in 1962). The significance of certain areas as the redfish fishing grounds has undergone some changes. In Division 3 K the catch has decreased three-fold because of unfavourable ice conditions. In Division 3 L the catch has grown by 8 times in comparison with the previous years. There was no redfish fishing in Division 3 N and reduced catches were taken in Division 3 O.

III. Haddock. No sizable commercial concentrations of haddock were observed in the southern part of the Grand Newfoundland Bank during the spawning and summer feeding periods. This is accounted for by a poor abundance of the 1957-60 year classes of haddock. Distribution of fish was also considerably influenced by hydrological conditions.

#### B. Special Research Studies

##### I. Biological Studies

###### 1. Haddock

Distribution of young and mature haddock was the main subject of fishery investigations in Subarea III.

During the first half of January young haddock was caught in the south of Saint Pierre Bank (3 P) at the depths 100-180 m. The near bottom temperature at that time was from -0.6° to +1.4° C (Fig. 3 A). The best catch (433 specimens per one hour of trawling) was taken at the depth 160-165 m at temperature 1.3°C. Haddock of 24-27 cm long of the 1961 year-class dominated in catches.

In Division 3 O young haddock was caught at the depths 70 to 250 m with the temperature observed near bottom being 2-4°C. The richest catch (124 specimens per hour of trawling) was taken at the depth 155-170 m with water temperature near bottom being 6.9°C. Specimens of the 1962 year class were prevailing. No commercially important concentrations of haddock were observed during this period.

Small concentrations of pre-spawning haddock (Fig. 3 B ) were available in the southern Saint Pierre Bank in the first half of April. Maximum catches of 0.5 tons per one hour of 0.5 tons per one hour of trawling were obtained at the depths 175 to 200 m with water temperature observed near bottom being 3-4°C. The sizes of haddock were 42-47 cm. Catches were mainly composed of specimens of the 1958 year-class (51.6%) and 1956 year-class (8.2%).

In Division 3 0 haddock was caught in April at the depths 200-300 m with water temperature observed near bottom being at 0.5 - 0.6°C.

The best catches up to 1.3 tons per one hour of trawling were taken at the depth 250-300 m with 42-45 cm haddock of the year classes 1955 (37.5%) and 1956 (25%) prevailing in catches.

Fishery investigations were resumed in subarea III in July-September. Haddock catches brought up to 0.5 tons of fish per one hour of trawling (Fig. 3 C). The temperature of water near bottom was 3.9 - 4.2°C.

Catches were dominated by 22-25 cm haddock of the 1961 year-class and 30-33 cm haddock of the 1962 year-class. Mature specimens occurred in catches only as individuals. Young and mature haddock occurred as individuals throughout the slope in Division 3 0 at the depths from 70 to 300 m. The water temperature near bottom was 0.7° - 5.8°C.

In late August-September catches of haddock in shallow waters of the Grand Newfoundland Banks yielded up to 0.5 tons of fish per one hour of trawling (Fig. 3 D). By this time the shallows have been sufficiently warmed and haddock spread northward up to 45° N. The best catches (0.5 tons) were registered at the depths 42 to 54 m with water temperature observed near bottom being 4.1 - 4.7° C. The bulk of catches was again composed of haddock of the 1961 and 1962 year-classes.

In Division 3 0 up to 230 young haddock specimens of the 1962 year-class were taken per one hour of trawling at the depths 108 to 160 m with water temperature being 0.2°C.

Individual specimens occurred in catches in the south of Saint Pierre Bank at the depths 140 to 310 m.

The results of observations make it possible to consider the haddock year-classes of 1961 and 1962 as generations of average abundance. The haddock of these year-classes will most likely form the basis of fisheries in the summer-autumn period of 1964.

#### S U B A R E A IV

##### A. Status of the Fisheries

I. Silver hake. Soviet trawl fishery for silver hake commenced in the end of 1962 was successfully expanded in 1963. The greatest and densest concentrations of silver hake were observed off Sable Island in Division 4 W. It was in that area where the bulk of the silver hake catch was taken (109000 tons). In much smaller numbers hake was observed in Divisions 4 V and 4 X.

From November 1962 to February 1963 concentrations of silver hake were encountered northwest of Sable Island in the gut at the depths 100 to 150 m; this deep was penetrated by an inflow of warm water from between Emerald and Sambro Banks. The densest concentrations of silver hake were observed on the border of the warm tongue and cold Labrador waters within the near bottom temperatures ranging from 5.5° to 7.8°C. Specimens of 25-29 cm long constituted the bulk of catches.

Though the catches were composed of haddock of 2 to 10 years old, they were mainly represented by first time spawners (3-4 year-old specimens).

Catches of BMRT - type trawlers amounted to 1.5 - 3.0 tons per one hour of trawling.

Starting from the second half of February 1963 hake concentrations were noticed to begin moving gradually in the northwestward direction along the warm water tongue, and in April they appeared on the continental slope southwest of Sable Island. Here hake preferred the depths from 140 to 250 m below the layer of cold Labrador waters with near bottom temperatures keeping within the range of 7° to 10°C. Dense con-

concentrations of hake were successfully fished by trawlers from April till June. The catches by BMRT - type trawlers amounted to 2-5 tons per one hour of trawling. Hake in the area of continental slope southwest of Sable Island was bigger than that in the catches made in January and February northwest of Sable Island. In May catches on the slope southwest of Sable Island were mainly composed of specimens with prevailing sizes of 29-35 cm and mean length of 32.6 cm. The observed changes in the size composition of catches towards the end of spring are explained by the fact that only mature and pre-spawning specimens migrated to the slope area from the area of winter fishery, and also by the fact that this area was approached by large-sized mature specimens of older age groups. Age samples showed that catches in May did not contain two-year-old immature haddock, the share of three-year-olds declined to 26.9% and that of four-year-olds increased to 67.6%. Moreover, catches contained up to 16% of five-year-old specimens.

During summer there was only sporadic fishing in the area of Sable Island in June and July by the trawlers sailing through the area. The catches remained to be high and amounted to 5 tons per hour of trawling.

In the end of August and in September concentrations of hake were observed on the shallows near Sable Island. By this time the water mass has already been warmed throughout from surface to bottom and the near bottom temperature on the shallows (depth up to 50 m) amounted to 9-12°C.

By the end of August and in September the main mass of hake had mature gonads and was involved in the process of mass spawning. Mean size of hake at that time was somewhat lesser than in the end of spring which is possibly accounted for by the departure of larger-sized post-spawners. Catches of hake in August-September amounted to 3-4 tons per one hour of trawling. In the end of autumn and in the beginning of winter

1963 catches of hake per hour of trawling showed a decline in comparison to the previous year. Dense concentrations of hake were observed only in the end of February 1964 in the area northwest of Sable Island.

Comparison of the age composition of spawning hake from autumn catches made in 1962 with the age composition of hake in the corresponding period of 1963 shows that the bulk of spawning population of hake in both years was composed of specimens at the age of 3-4, while older specimens of hake occurred in small numbers. It is quite possible that spawning populations of hake are mainly composed of first time spawners and that silver hake die in mass after spawning. Similar thing is observed on Georges Bank.

II. Cod and haddock were not subjects of specific fishery, however they were always present in silver hake catches as by-catch.

Cod was caught during the first part of the year and haddock - in September and October. Rather great concentrations of haddock appeared in the shallow waters of Sable Island by the end of summer and in autumn; in some cases its catches amounted to 10-20% of the total catch.

Rather dense concentrations of haddock were observed in late October in the Nova Scotian gut at the depth of 50 to 90 m. At that time the catches of BMRT amounted up to 5 tons per one hour of trawling. Haddock was usually observed in the places where the near bottom temperature kept within the range of 4° to 8°C.

III. Redfish (Sebastes mentella) was taken, like cod and haddock, as by-catch during silver hake fishing. Small numbers of redfish occurred in catches in winter, and in the area of Nova Scotian gut off Esmerald Bank - in spring.

IV. Argentina. Argentina fishery was conducted mainly in spring in the area of Emerald Bank where mass spawning of this species was observed in March. At that time it was caught

together with hake. Individual catches were wholly composed of argentine alone. Catches of argentine by BMRT-type trawlers in March amounted to 5 tons per one hour of trawling.

## B. Special Research Studies

### I. Environmental Studies

#### 1. Hydrography

During 1963 seven hydrological surveys were made in Subarea IV in the waters from Saint Pierre Bank to Browns Bank (in January, May, June, July, September, October and November) that provide sufficiently good coverage of hydrological conditions in all seasons.

In winter the whole shelf was covered by cold Labrador waters with temperatures 2-3°C. These waters were observed in the layer from 30 to 100 m. In areas with depths less than 100 m cold waters reached the bottom. In deeper parts of the shelf penetration of warm Atlantic waters was registered, their temperature being 5.5° - 7.5°C. The areas with warmer waters were located between Georges and Browns Banks in Nova Scotia gulf and in the channel between Bankero and Saint Pierre Banks.

Cold waters with temperatures 1.0° - 2.0°C were observed in the northeast of Bankero Bank. Southern slopes of the shelf (south and southwest of Sable Island) were covered by waters with temperature not exceeding 4°C.

In spring southern slopes of the shelf, were, as in winter, covered by cold waters with temperature 2°-4°C. The front dividing the borders of Labrador and Atlantic waters was beyond the shelf slope.

In summer period more intensive penetration of Atlantic waters into the shelf area was registered. In the areas of convergency of warm and cold waters substantial gradients were observed: from 3° to 7° within 10 miles.

Especially marked temperature gradients were registered in the northern and northeastern parts of Nova Scotian gulf. Southern slopes of the shelf were covered by warm Atlantic waters.

In autumn the area covered by cold Labrador waters was gradually expanding. Warm waters near bottom were observed in Nova Scotian gulf and on Middle and Sable Island Banks. On the southern slope of the shelf layers near bottom were filled with warm Atlantic waters.

## S U B A R E A V

### A. Status of the Fisheries

In 1963 the Soviet catches in Subarea V have grown to 231000 tons (as against 209400 tons in 1962). As in previous years the overwhelming part of catches was taken in Division 5 Z (Georges Bank). A special feature of 1963 fishery was an increase in catches of silver hake and a decline in catches of herring.

I. Silver hake. As in 1962, the main area of silver hake fishery was the southeast part of Georges Bank.

Concentrations of hake appeared in the southeast part of the bank in the second half of May. Catches were almost entirely represented by mature specimens; mass spawning took place in the end of June - in the beginning of July. After the termination of spawning no dense concentrations were observed and the catches declined. In June catches of hake per one hour of trawling by BMRT averaged 4.44 tons and towards the end of July - 1.0 ton per one hour of trawling. Beginning from the second part of July till October hake was caught together with herring in the northwest part of Georges Bank.

In November dense concentrations of silver hake were observed north of Georges Bank at the depths 240-280 m. Successful fishing for hake continued here till the end of the year. Catches per one hour of trawling amounted to 1.5 - 2.0 tons.

Size and age compositions of hake catches in the southeast part of Georges Bank in 1963 were essentially the same as in 1962. The mean length of hake in the southeast part of the bank in 1962 was 31.3 cm and in 1963 - 30.2 cm. In the northwestern part of the bank the mean length of hake in catches was 28 cm both in 1962 and in 1963.

In the area north of Georges Bank the catches in November and December were dominated by small-sized hake of 24-28 cm long. The bulk of catches in 1962 and 1963 was composed of 3-4 year old hake specimens. In 1962 three-year-old hake made 37.4% of the catch, four-year-old 50.8%, and five-year-old and older - 7.5%.

In 1963 fish at the age of 3 composed 32.3% of the catch, at the age of 4 - 47.2%, and at the age of 5 - 17.2%. The number of specimens of 6 year old and older did not exceed 3% of the catch.

Males of silver hake of Georges Bank attain the stage of sexual maturity at the length from 24 to 31 cm, in mass - at the length of 26-29 cm; females - at the lengths from 26 to 31 cm, in mass - from 29 to 31 cm. 60% of males become mature at the age of 3 and 100% - at the age of 4. 10% of females attain maturity at the age of 3, 70% - at the age of 4, and 100% - at the age of 5.

The bulk of catches is composed of first-time spawning hake. After spawning the number of hake is greatly reduced due to high mortality, so only a small part survive to the age of 5. The total relative mortality of hake over 5-year-old was more than 80% in 1962-63; instant mortality  $Z (F+M) = 1.46$ .

In the report of the working group on regulation of fishery presented to the 11th annual meeting of ICNAF in 1961 the value of  $(F+M)$  was cited to be 0.45 as determined according to Ricker's method on the basis of weight composition of catches intended for consumption as food. In our opinion the value of  $Z$  in this case is under-estimated. The

error made in estimating this value was probably caused by the fact that the data on weight composition of the catch were collected on those vessels where the fishermen picked out only big specimens for food purposes and discarded the smaller ones into the sea which made the correct estimation of instant mortality impossible. Composition of these catches evidently greatly differs from that of the Soviet catches where all fish is used for consumption.

II. Herring. Conditions of herring fishery on Georges Bank in 1963 were less favourable than in 1961 or in 1962. Catches of herring declined from 151,000 tons in 1962 to 97,000 tons in 1963. Most pronounced decrease was observed in the drift-net fishery.

The trawl catches remained at the level achieved in the previous years.

Unlike the previous years spawning concentrations in 1963 were observed on a narrower space and the spawning itself has been completed within shorter time.

Considerable changes in the size composition of herring catches were observed in 1963 in the period from February to November (Fig.4). If in the first part of the year the bulk of catches was composed of herring of 25 to 29 cm long (80%), then beginning from August small-sized herring (20-24 cm) became prevalent as a result of recruitment of a new generation of 1960 which is likely to be an abundant one. Herring of the 1960 year-class composed the bulk of autumn catches.

Age composition changed in a similar manner. Until August catches were dominated by herring of the 1957 and 1958 year-classes (60%) and since August the 1960 year-class took the leadership (47%).

In comparison with 1961-62 the composition of herring catch in 1963 has markedly changed.

In 1961-62 the bulk of catches was composed of the 1956 year-class. Younger herring, especially under 4-year-old was poorly represented in catches. In 1963 young herring of the 1960 year-class has taken the lead by the number of specimens in catches (Fig.5). This may be explained by the fact that by

1963 an abundant generation of 1956 and an average (by numerical strength) year-class of 1957 had already been withdrawn from fishery due to natural and fishing mortality. The numerical strength of poor 1959 and 1958 year-classes has been reduced. Consequently, fishery then had to place emphasis on the young herring of the 1960 year-class which, unlike the previous generations, has attained mass maturity already in 1963.

Observation on the composition of catches during the period from 1961 to 1963 showed that the life cycle of herring on Georges Bank is comparatively limited. The relative mortality according to the age composition data as estimated per fishing effort (per one net and one hour of trawling), amounts to 80% at the age of 5 and older (the age of herring in this case is estimated on the basis of calendar time, i.e. the spring fry on the 31st December is referred to yearlings, and on the 31st Dec. of the following year it is classified as two-year-old etc.)

According to the age composition data instant mortality value in drift catches during 1961-63 amounted to 1.17, and according to data collected on BMRT-type trawlers - 1.25 (Figs. 6,7).

In 1964 the catches will be based on the 1960 year-class, so the commercial stocks in 1964 will evidently not exceed the level of 1963.

## B. Special Research Studies

### I. Environmental Studies

#### 1. Hydrography

In 1963 research-scouting vessels made regular hydrological surveys from February to November on Georges Bank and in adjacent areas with temperature-salinity determinations.

These observations enabled to define the following seasonal peculiarities of temperature regime:

In winter the water mass throughout the surveyed area was characterized by homogeneous temperature in the whole

water thickness. Cold Labrador waters were observed on the slopes with the temperature being 4°-5°C.

In April spring heating was observed to begin on the slopes of Georges Bank. In May the temperature gradients on the slopes have risen from 4.5° to 7.5° at a 5 to 10 miles distance.

In summer, due to heating, the near bottom temperature on Georges Bank has increased to 9-14°C and on the northern slopes to 5-6°C. In August the influence of Labrador waters was not very great on the southeast part of the bank. On the northern slopes the temperature gradients remained to be relatively high: 5-12°C per 10 miles.

In Autumn the shallow part of Georges Bank (up to 100 m isobath) was covered in September by warmed waters with temperatures 9-15°C. Cooling began in October. Maximum temperatures at that time did not exceed 10-11°C. Waters of Labrador origin were located in the same areas as in summer.

## 2. Plankton

In 1963 observations on seasonal development of zooplankton were continued. Three surveys were performed one in late April-early May, the second one in the beginning of June, and the third one in the beginning of August. Altogether 334 samples were taken on 123 stations.

Results of observations have enabled us to draw the following conclusions:

In 1963 the composition of phytoplankton was dominated by peridinaceous and in 1962 - by diatomaceous.

Phytoplankton in May-June 1963 was more abundant than in the corresponding period of 1962.

Seston biomass in 1963 was somewhat greater than in 1962.

Spawning of Calanus finmarchicus and Euphausiacea sp. began in 1963 10-15 days earlier than in 1962.

## II. Biological Studies

In 1963 tagging of herring and hake was carried out on Georges Bank by means of hydrostatic and flat tags. Both type tags were fastened by kapron thread ahead of the dorsal fin. Altogether 1760 specimens of herring and 220 specimens of silver hake were tagged during the summer.

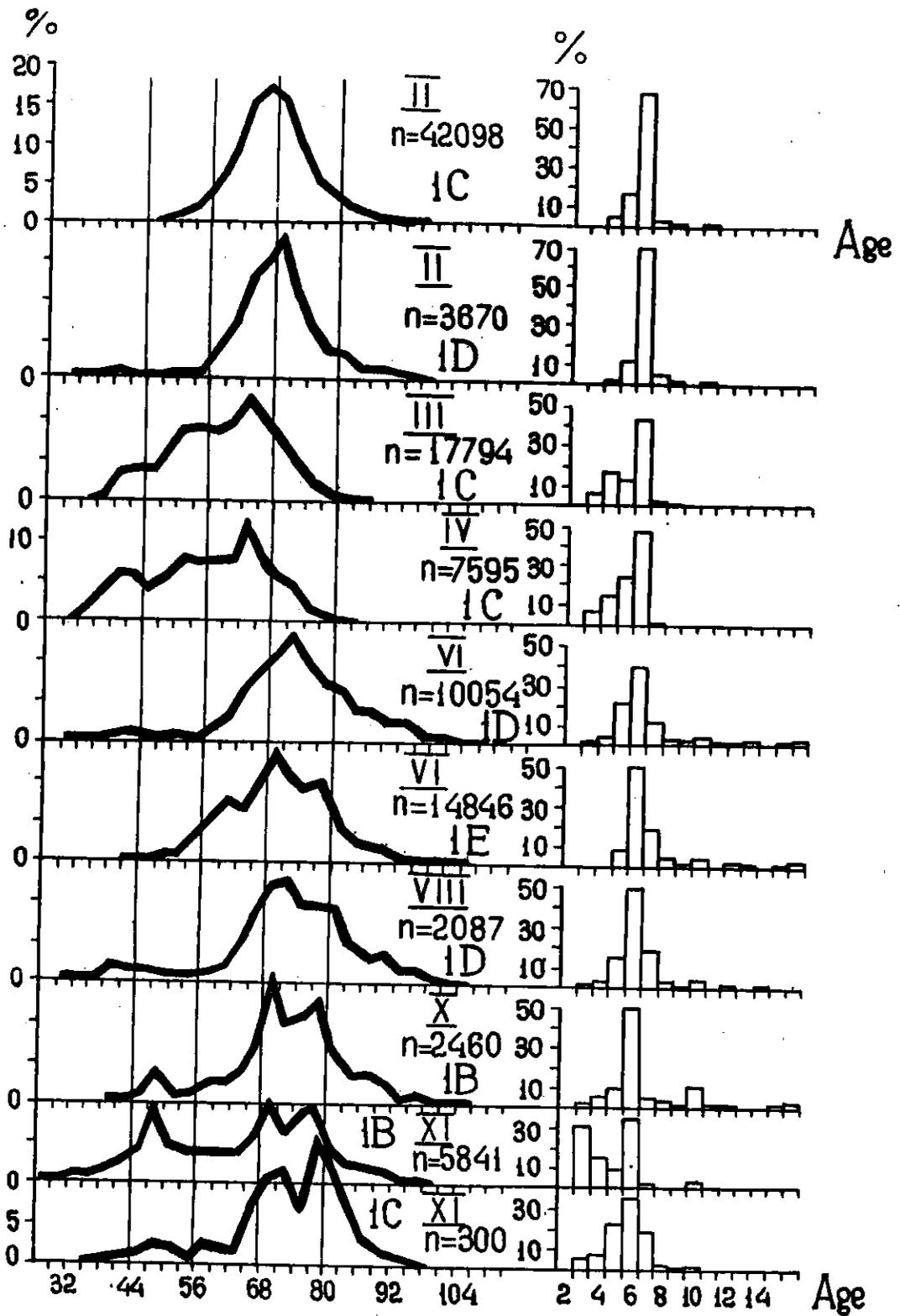


Fig.I Size-age composition of cod in Subarea I (by Divisions)

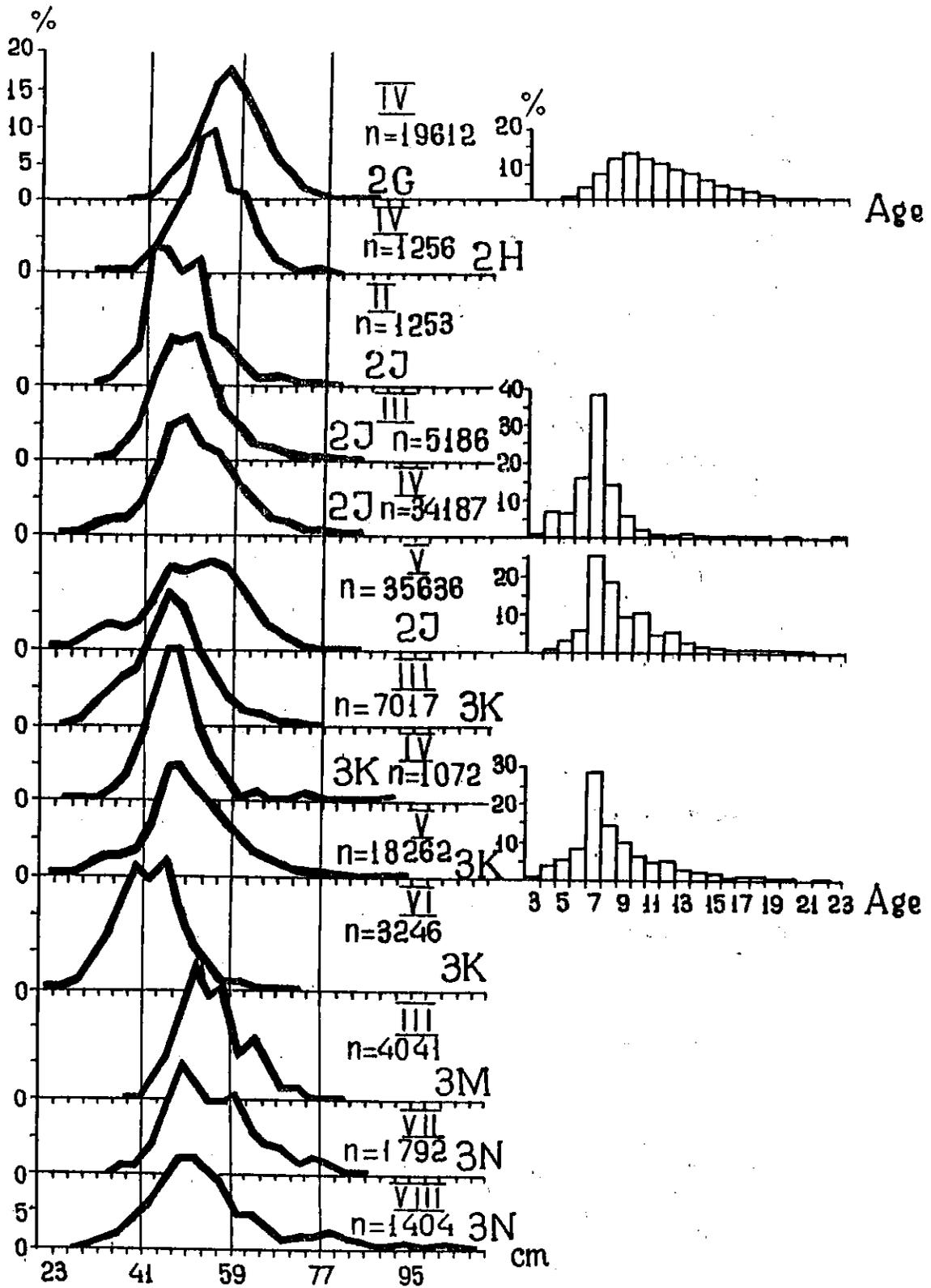


Fig.2. Size-age composition of cod in Subareas II and III (by Divisions)

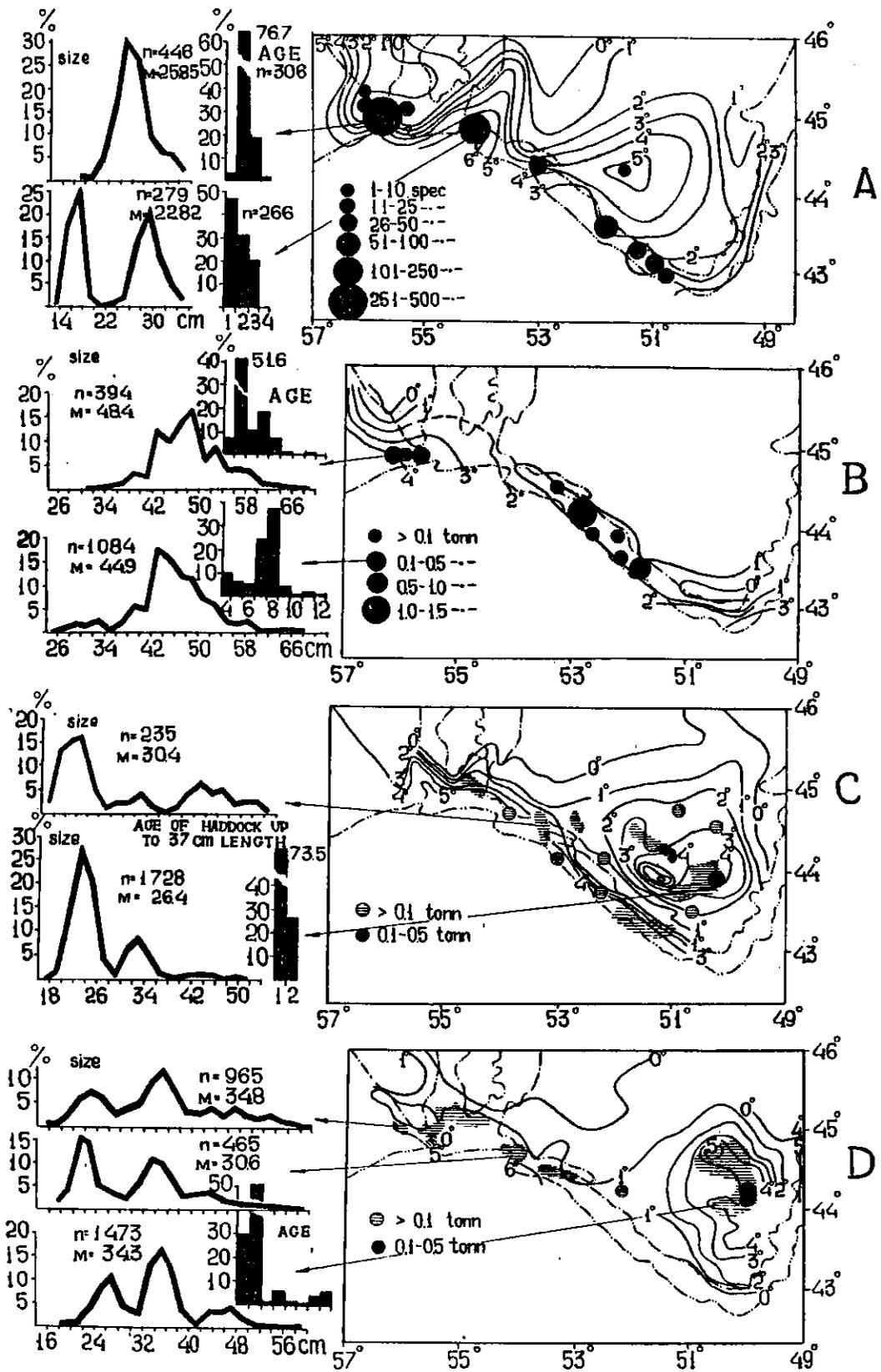


Fig. 3. Size-age composition and distribution (catch/one hour of trawling) of haddock in Subarea III in 1963.  
 A. Young haddock (up to 35cm), 1 - 15 January.  
 B. Mature haddock, April.  
 C. Mature haddock, end of July.  
 D. Mature haddock, 25 August to 17 September.

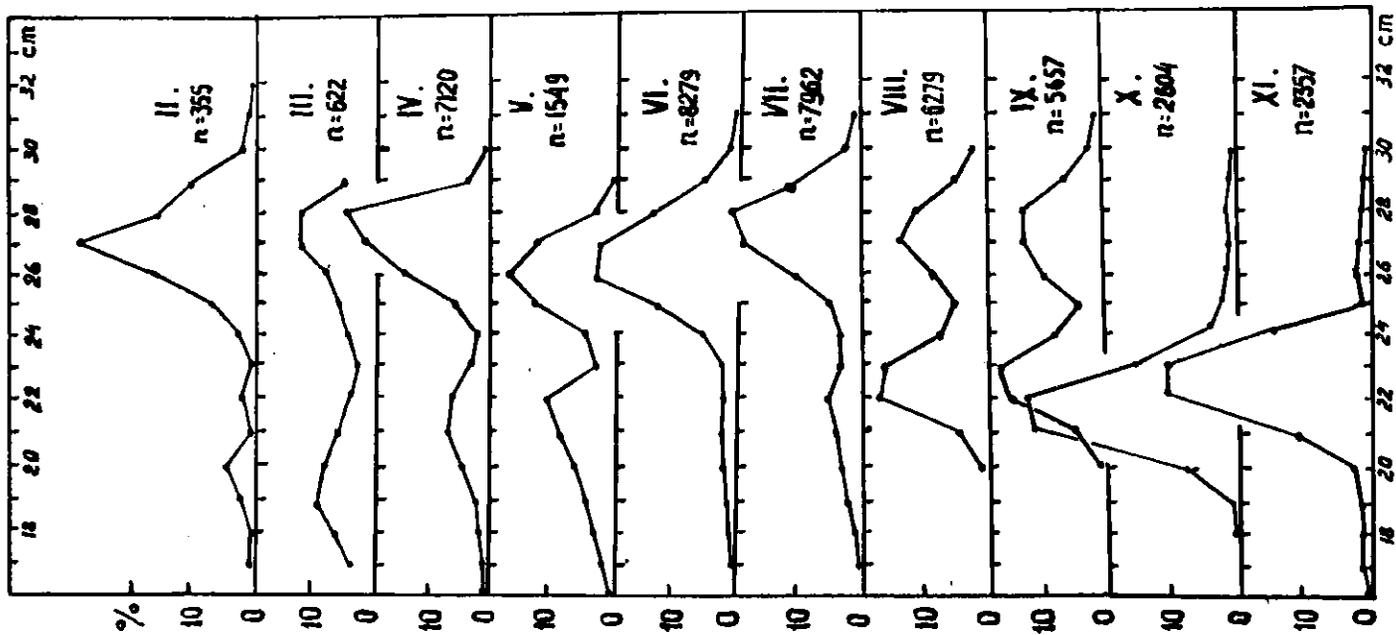


Fig. 4 Length of herring in trawl catches in Division 5 Z in 1963.

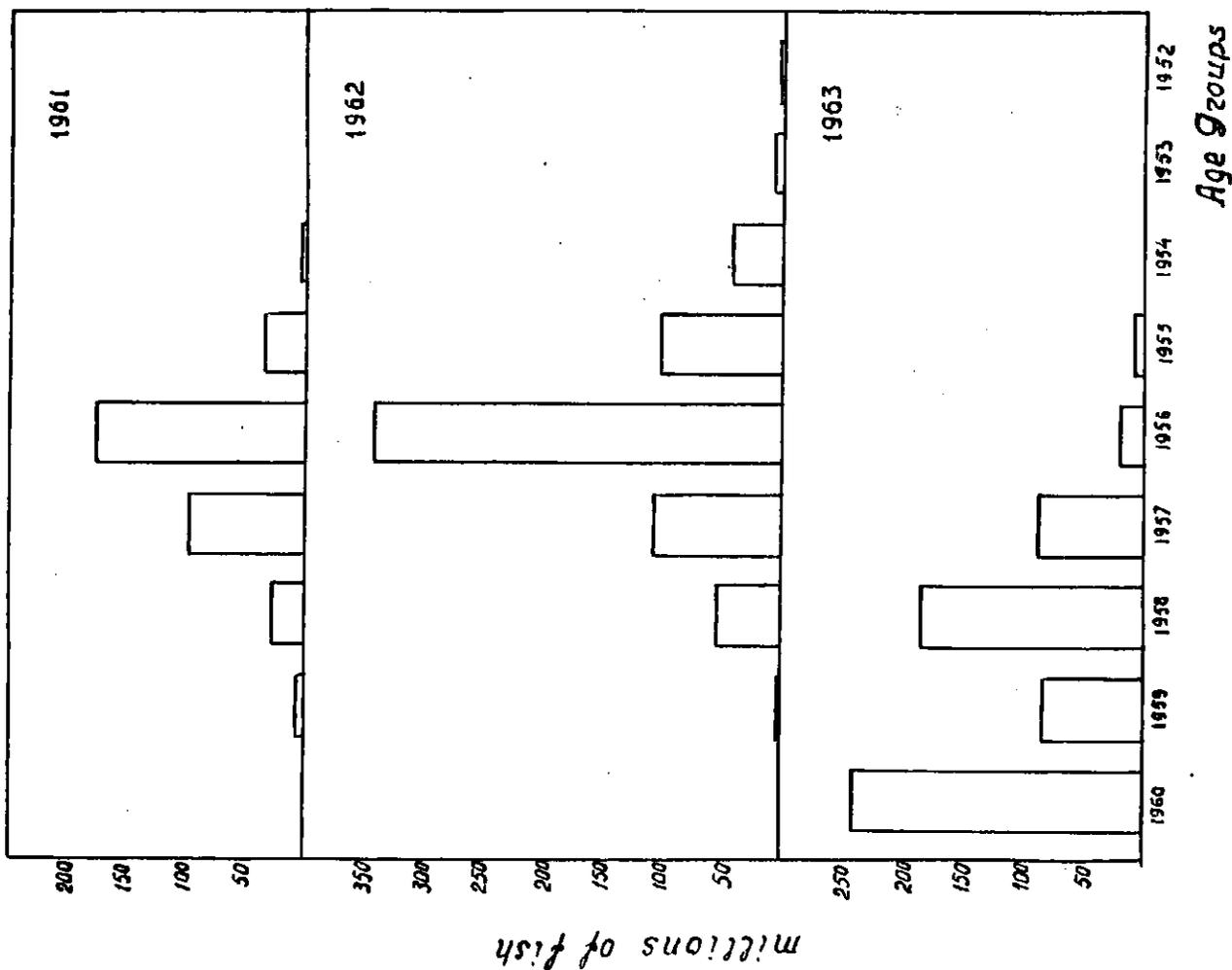


Fig. 5 Age composition of herring catches in Subarea I 961-03.

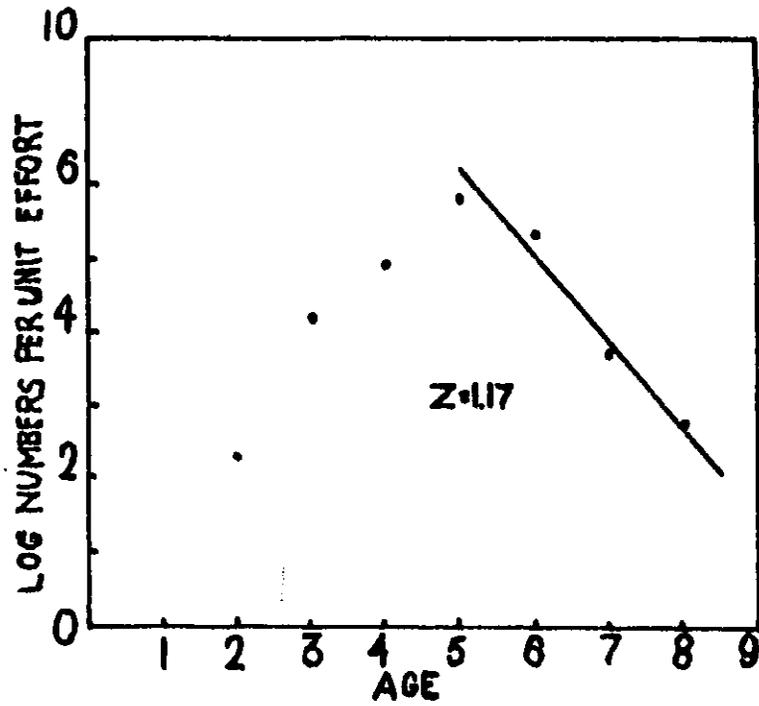


Fig.6 Age and log of the number of fish in catches per one <sup>hour</sup> net in 1961-63.

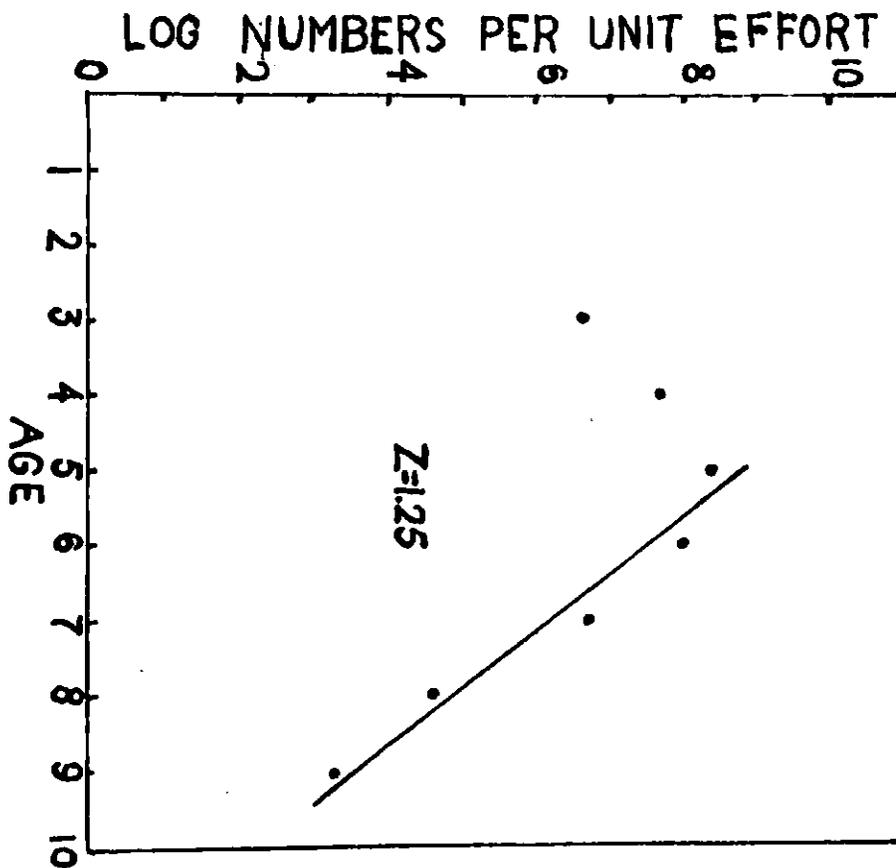


Fig.7 Age and log of the number of fish in catches per one hour of trawling by BMRT-type trawlers in 1961-63.