RESTRICTED

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Serial No.2224
(D.a.68)

ICNAF Res.Doc.69/17

ANNUAL MEETING - JUNE 1969

USSR RESEARCH REPORT, 1968

by K. G. Konstantinov and A. S. Noskov

The total Soviet catch in the ICNAF Convention Area in 1968 was 741,300 tons (Table 1), that is 165,299 tons more than in 1967.

The increase of the total catch was mainly due to growth in catches of cod from 167,987 tons in 1967 to 245,956 tons in 1968, of mackerel from 11,969 tons in 1967 to 43,522 tons in 1968, of grenadier from 15,902 tons in 1967 to 26,812 in 1968, of flounders from 61,117 tons in 1967 to 99,144 tons in 1968 and of some other species.

Catches of silver hake decreased considerably from 72,460 tons in 1967 up to 47,299 ton in 1969, and those of haddock - from 8,586 tons in 1967 to 5,159 tons in 1968.

S u b a r e a I

A. Status of the fisheries

One commercial BMRT in March - June and one fish finding trawler in January-February were working. Their total catch made 2309 tons, mainly of cod.

B. Special research studies

1. Environmental Studies

The fish finding trawler "Volgograd" worked partially the standard hydrographic secton 8-A lying between the points 59°24'N, 44°24'W and 58°09'N, 46°55'W. That part of the hydrographic section characterizes the Atlantic component of the West-Greenland Current. The water temperature in the layer 0-50 m was 4.28°C, in the layer 0-200 m - 4.29°C,

50-200 m - 4.30°C and in this one in the layer 200-500 m - 4.37°C. Comparing the data with those of 1964, it is possible to note that in January 1968, the water temperature in the layers 0-50 m, 50-200 m, 0-200 m was higher correspondingly 1°C, 0.40°C, 0.63°C, and in the layer 200-500 m it was practically the same, as in January 1964.

II. Biological studies

1. COD

a) Age composition

As is evident from Table 2, 1962 and 1963 year - classes prevailed in number in Div. 1C and 1D; 1961, 1962 and 1963 year - classes prevailed in number in Div. 1E, the 1960 year-class was particularly rich. The 1962 and 1963 year-classes are, apparently, average by their strength; rich year-classes, 1960 and 1961, decreased greatly in their abundance due to the intensive fishery and natural mortality.

Throughout the period from January to April, a relative number of the young specimens increased in Div. 1C and 1D, that was caused by the fact that mature cod left fishing grounds for spawning.

In April, a series of trawlings was made with mid-water trawl at the Holsteinborg Area, in June - at the Frederikshaab Area.

The age - size composition in cod catches was the same as in bottom trawl catches (immature - at the Holsteinborg Area, mature, post-spawned - at the Frederikshaab Bank).

In comparison with 1967, the total fish catch by the USSR trawl fleet became three times as high, mainly due to a successful cod fishery in Div. 2J in the first half of the year. The average catch per hour trawling increased considerably from 2.05 to 3 metric tons.

Table 1

Species composition of the USSR catches (in tons) in the Convention Area, 1967 and 1968

Species	1968						1967
	Subarea 1	Subarea 2	Subarea 3	Subarea 4	Subarea 5	Total catch	Total catch
1	2	3	4	5	6	7	8
Herring	-	-	-	2793	126965	129758	124153
Argentine	-	-	304	1589	1481	3374	7015
Cod	1950	104336	132285	5926	1459	245956	167987
Haddock	-	-	1173	589	1397	3159	8386
Pollock (saithe)	-	-	82	231	141	454	710
Silver hake	-	-	-	3441	43858	47299	72460
Red hake	-	-	-	531	11342	11873	39588
Grenadier (Macrurus Rupestris)	116	2553	24143	-	-	26812	15902
Flounders	43	2061	62186	29842	5012	99144	61117
Halibut	42	2621	6820	32	-	9515	5326

1	2	3	4	5	6	7	8
Redfish	90	3086	32002	186	-	35,364	38978
Wolffish	3	81	760	-	-	844	360
Ocean pout	-	-	-	-	4324	4,324	261
Scup	-	-	-	-	1782	1,782	347
Pomolobus	-	-	-	-	21235	21,235	5,531
Mackerel	-	-	142	9419	33961	43,522	11,969
Butterfish	-	-	-	-	1596	1,596	1,406
Sea robins	-	-	-	-	1130	1,130	127
Angler fish	-	-	-	2418	2221	4639	-
Dogfish and scates	-	-	-	6177	7405	13,582	3,979
Squids	-	-	9	49	2415	2,473	336
Others	65	3820	12470	2880	14230	33,465	10,066
Total	2309	118558	272376	66103	281954	741,300	576,001

Table 2

Age composition of cod (%), caught by trawl off West Greenland, 1968

Age group	Year-class	Division IC					Division ID				Division IE		
		January	February	April	May	June	January	February	March	April	January	March	April
III	1965	0.2	1.1	22.7	10.7	7.6	0.1	0.3	1.9	1.0	-	0.4	1.8
IV	1964	1.9	5.5	14.7	9.4	8.5	1.1	4.3	14.6	7.7	1.7	2.3	6.6
V	1963	33.9	42.8	37.6	40.6	39.3	35.5	36.6	56.4	48.9	13.3	23.9	23.4
VI	1962	37.8	30.7	17.9	26.0	27.1	38.3	31.7	19.4	27.6	30.9	36.8	25.3
VII	1961	18.4	13.9	5.4	9.6	12.1	17.6	18.1	5.8	10.3	31 9	24.7	25.1
VIII	1960	6.1	4.8	1.4	3.0	4.3	5.9	7.0	1.5	3.4	16.8	9.2	12.2
IX	1959	1.1	0.8	0.2	0.5	0.8	1.1	1.2	0.3	0.7	2.7	2.3	2.5
X	1958	0.3	0.2	0.1	0.1	0.2	0.2	0.4	0.05	0.3	1.8	0.4	1.3
XI	1957	0.2	0.2	-	0.1	0.1	0.2	0.2	0.05	0.1	0.9	-	1.2
XII	1956	0.1	-	-	-	-	-	0.2	-	-	-	-	0.6

Subarea 2

Table 3

A. Status of the Fisheries

The annual catch is given in Table 3.

Annual catch and catch per hour trawling (in tons)

Division	Total catch by trawler (all types)							Average catch hour of BMRT trawling
	Cod	Grenadier	Redfish	Flounders	Halibut	Others	Total	
2G	7557	1439	175	20	657	340	10.188	2.67
2H	13501	682	457	189	471	452	15.552	3.39
2J	83478	432	2454	1852	1493	3109	92.818	3.54
Subarea 2	104536	2553	3086	2061	2621	3901	118.558	3.48

B. Special Research Studies

I. Environmental Studies

In November-December, the fish finding vessel "Neptun" made a hydrological section 8-A along Hamilton Inlet Bank (between stations 53°40' N, 55°44'W and 54°50'N, 53°32'W). Data on water temperature for different years by November 1 are shown in Table 4.

Table 4

Average water temperature (°C) along the section 8-A (Hamilton Inlet Bank) by November 1

Depth	1958	1962	1964	1965	1966	1967	1968	Average long-term mean	Anomaly 1968
0-50	1.28	1.58	0.98	1.30	2.41	2.00	2.29	1.69	0.60
50-200	0.59	1.54	-0.18	1.06	1.44	0.89	-0.18	0.71	-0.89
0-200	0.79	1.49	0.17	1.13	1.72	1.19	0.50	1.00	-0.50
200-500	-	1.70	0.98	-	2.47	0.95	0.31	1.28	-0.97

Those data show that the water temperature timed to November 1, was in 1968 much lower than the long - term mean for all the layers (except for the surface one). It was caused by a higher intensity of the cold component of the Labrador Current.

To the end of December 1968 and in January 1969, near-bottom waters with temperature below 2°C spreaded easterner than those in the same months, 1963-1964 and 1966-1967. The water temperature in winter 1968-1969 was almost the same as in 1964-1967. Apparently, the water temperature in 1969 will be much below the norm, as it was in 1965.

More detailed description of hydrographycal conditions in Subarea 2 are given in a special report by Burmakin.

II. Biological Studies

1. Cod

a. Age composition

Table 5 shows the age composition of cod in Soviet trawl catches for a series of years in April-May, South Labrador. In April-May, cod of all the commercial ages are keeping in the South Labrador area: mature, migrating to the south after the spawning period and immature spent winter on the continental slope. As seen from the Table, the individuals of 1961, 1962 and 1963 year-classes prevailed in number in the commercial stock of the Labrador cod of 1968. The strength of the mentioned year-classes is somewhat higher than the average level, that is also confirmed by the data on the counting of the young cod (Table 7). The youngs of the Labrador cod at the age 2+, 3+ are keeping in Div. 3K, they were earlier brought there with the current from the northern spawning areas. Table 7 shows that cod of 1961, 1962 and 1963 year-classes were abundaut enough. The recruitment of commercial size cod stock with the grown fish of the mentioned year-classes increased the density of cod concentrations exploited by trawl fleet in the first half, 1968. Besides that, the decrease in temperature of water column favoured mass cod distribution to the south, that also helped the operations of trawl fleet.

A gradual change of the age composition of the Labrador cod in the first years of the intensive trawl fishery is shown in Table 5 - a relative number of 10-year-olds and of the elder ones became scarcer. Then, to the middle of the current ten year period a mobile equilibrium between the stock recruitment and its commercial mortality was established; the mean age of cod in trawl catches fluctuated, but the trend to further decrease was not observed there. The commercial catches are usually based on the cod at the age of 5, 6, 7 and 8 years old.

Table 5

Age composition of cod (%), caught by trawl near South Labrador, April-May 1960-1968

Year	Age of cod (by years)																		
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1960	1.2	3.8	4.4	8.0	14.6	13.5	13.3	11.4	10.0	6.2	3.6	4.6	3.4	1.4	0.5	0.1	-	-	-
1961	-	5.7	7.0	18.8	22.5	12.4	12.4	8.2	3.4	3.5	2.5	2.7	-	0.9	-	-	-	-	-
1962	0.7	2.0	16.0	23.5	14.8	10.0	6.8	6.9	4.3	3.5	3.3	1.9	1.5	1.4	1.7	1.0	0.1	0.1	0.1
1963	0.2	3.5	4.8	11.7	32.4	16.9	8.7	7.1	3.3	3.5	1.8	1.3	1.1	1.4	0.8	0.4	0.7	0.2	0.2
1964	-	1.9	7.3	9.8	23.0	28.2	8.6	4.0	4.3	1,9	2.4	0.6	1.3	0.2	0.2	0.3	-	-	-
1965	0.4	5.8	6.4	16.2	16.6	24.0	17.0	7.8	1.5	1.1	1.0	0.3	0.4	0.4	-	0.1	-	-	-
1966	-	21.4	31.9	16.7	15.8	5.4	4.8	2.3	0.4	1.3	-	-	-	-	-	-	-	-	-
1967	0.9	6.4	19.5	21.1	19.0	14.7	6.7	5.0	3.9	0.5	1.0	0.5	0.6	0.2	-	-	-	-	-
1968	0.2	2.1	21.0	20.5	19.6	16.4	8.9	4.2	3.1	2.9	0.4	0.4	0.3	-	-	-	-	-	-

2. Grenadier (Macrurus rupestris)

To the end of August some fishing vessels BMRT type exploited grenadier stocks in the waters of the continental slope of the Central and North Labrador, depths 550-800 m. The average catch per day made 38.5 tons. Individuals from 22 cm to 97 cm in length with peak 69-71 cm were observed in catches. In October and November, the fishery of grenadier was conducted in the same areas, males were more abundant than females at all the depths (of 5218 cutted fish males were 58.7%). No one grenadier was caught at the stage close to spawning.

At the continental slope of the North Labrador fat content of grenadier (relation of the liver weight to weight of the whole fish, in %) sharply decreased from October to November. Undoubtedly, one grenadier concentration was replaced by another one due to the process of its mass migrations.

S u b a r e a 3

A. Stutus of the Fisheries

The annual catch is given in Table 6.

Table 6

Annual catch and catch per hour trawling, Subarea 3 (in tons)

Div.	Total catch by trawl of all types							Average catch per hour trawling
	Cod	Grenadier	Redfish	Flounders	Halibut	Others	Total	
3K	33317	23537	2218	8765	6091	2697	76625	2.13
3L	764	54	109	483	27	53	1490	1.74
3M	3872	14	4686	337	1	187	9097	1.32
3N	46588	469	14686	25638	352	5201	92984	1.28
3O	32232	-	6364	15932	209	4576	59313	-
3P	15512	69	3939	10931	140	2226	32867	0.97
Subarea 3	132285	24143	32002	62136	6820	14940	272376	1.90

Table 7

Average catch (number of specimens) of the young cod per hour trawling

Year-class	0+				1+				2+				3+			
	3K	3N	3O	3P	3K	3N	3O	3P	3K	3N	3O	3P	3K	3N	3O	3P
1958													10	1	0	2
1959									21	8	1	4	15	1	1	1
1960					5	3	0	3	11	1	2	5	11	1	0	1
1961	1	1	1	6	3	4	3	6	20	5	1	6	24	4	1	1
1962	1	1	7	42	2	8	2	7	15	18	2	12	24	6	1	2
1963	1	1	1	3	1	5	1	13	36	30	1	17	17	7	3	4
1964	1	41	24	31	3	137	13	22	8	73	42	58	28	16	7	10
1965	1	1	1	5	1	14	12	21	15	23	20	25				
1966	1	2	15	7	3	27	17	32								
1967	1	1	2	3												

In comparison with I967, the total catch from Subarea 3 increased slightly. The catches of grenadier became greater in Div. 3K.

B. Special Research Studies

I. Environmental Studies

In April-June, R/V Rossia accomplished hydrological observations on Grand Bank, North Newfoundland Bank, as well as on the Flemish Cap Bank.

There was observed the warming influence of Gulf Stream on the southern slopes of Grand Bank, where the near-bottom temperature reached 8-I0°C, whereas in the years with normal thermal conditions it did not exceed 6-7°C.

Water temperature on Flemish Cap Bank was higher than in I96I, I962, I966 and I967, but on the NorthNewfoundland Bank it became 0.6°-I.0°C below rate (influenced by the intesification of the Labrador Current).

Hydrological conditions in Subarea 3 are described in details in a special report by Burmakin.

II. Biological studies

I. Cod

As previously, in I968 the counting of the yound cod was made in Subarea 3 (Table 7). It was determined that the abundance of the youngs of I965 at the age 2+ and I966 (at the age I+) was high enough in the areas 3N, 30 and 3P.

Cod of I963 and I964 year-classes prevailed in commercial catches from southern waters of Grand and Saint Pierre Banks.

In I968, 2439 individuals of cod were tagged at Grand Bank.

The return of the tagged specimens including those released earlier than in I968 in Subareas 2 and 3 confirmed that the limit of distribution of the Labrador and the South Newfoundland cod stock is lying between 46° and 47°N.

2. Haddock

The counting of the young haddock and the analysis of commercial catches showed that the recruitment of haddock of stock Grand Bank comes exclusively from the spawning grounds of St. Pierre Bank, from where the young haddock displace easterner to the Div. 3O and 3.N. The 1966 and 1967 year-classes are almost equal in the abundance and even higher than the previous ones appearing after 1955 and 1956.

3. Grenadier

In the Div. 3K grenadier was fished from June to December. In June, the main concentrations of grenadier were keeping at depths 950-1250 m, in August the mass migration of this species began to less depths and to the end of September they concentrated mainly at depths about 800 m.

Fish from 37 cm to 91 cm in length was observed in catches, the peak for males was 63-65 cm, for females - 60-62 cm. The males always prevailed in number at all depths, composing about 2/3 of the total catch. Fish at the prespawning stage were not observed there.

The fat content of grenadier (the relation of the weight of liver to this one of the whole fish) made 5.1% in June.

In October, grenadier fed only on pelagic Crustacea. To December, the intensity of feeding increased slightly, fish and shripms were found in stomachs at the same time with pelagic Crustacea.

Subarea 4

A. Status of Fisheries

1. Silver hake

In 1968, catches of silver hake remained at a low level due to their low abundance, though in comparison with 1967 they increased slightly (Table 8).

Table 8. USSR silver hake catches in Subarea 4, I962-I968

(tons)

Years	I962	I963	I964	I965	I966	I967	I968
Catches	8825	I23023	8II47	49987	I0323	2476	344I

Silver hake was caught as byfish, and only in certain periods the BMRT catches consisted mainly of silver hake.

Thus, in May silver hake at an average made 60% in BMRT catches taken on the slopes of the shelf in the area of the Emerald Bank at depths 75-250 m. The catch of all the species per hour trawling was at this period 2.2 tons. In October, November and December, when the greatest half of the Soviet annual catch was taken, silver hake was always observed on the slope off the Emerald Bank and on the Sable Island making from I0% to 30% of the catch.

The analysis of the size composition of silver hake catches in September and October showed that the body length of fish caught ranged between I8 cm - 65 cm; the bulk of catches were individuals from 24 cm to 3I cm in length (80%), the mean length was 27.9 cm.

II. Haddock

In I968, the total catch of haddock made 589 tons (Table 9). Haddock was taken as bycatch. A sharp decrease in haddock catches beginning from I967 may be explained by the fact that the vessels could not find their dense concentrations, serving the base for good catches. The results of control trawlings allow to suppose that the abundance of haddock year-classes became low after I963. Therefore, the increase in commercial stocks and hence in catches is not expected in the nearest future.

Table 9

USSR catches of haddock in Subarea 4, 1962-1968

(tons)

Years	1962	1963	1964	1965	1966	1967	1968
Catches	2567	3701	5439	45458	20566	753	589

Due to the fact that only single individuals of haddock were observed in catches, the collection of samples on the size and age composition was not made from the commercial catches.

III. Argentine

In 1968, argentine catches continued to drop (Table 10), and made only 1589 tons. The decrease in catches can be explained by the fact that this species was not almost speciallyfished by trawlers, as their concentrations were not stable and usually they are keeping on a slope areas with snaggy ground.

Table 10

USSR catches of argentine in Subarea 4, 1963-1968

(tons)

Years	1963	1964	1965	1966	1967	1968
Catches	8127	4923	5611	14983	4191	1589

Catch of argentine was mainly conducted in May, October and December. In May they were caught simultaneously with other species on south-eastern slopes of the Browns Bank at depths 120-300 m, off Sable Island at depths 120-200 m and Emerald Bank, depths 100-250 m. In October and December, argentine were caught by BMRT on south-western slopes of Browns Bank, depths 160-240 m, and the catch per hour trawling made at an average 3.7 tons without bycatch of other fish species. The length of argentine body in samples from commercial catches fluctuated within the range 20 cm - 43 cm. The mean length of argentine

from catches taken in the area of Browns Bank was 27.3 cm in May, 30.0 cm - in September, 30.3 cm - in October, 30.8 cm - in November. The mean length of argentine body from catches off Sable Island was 25.0-23.3 cm. In future, in case of the intensification of argentine fishery their catches may be increased, as their stocks are sligthly exploited.

IV. Flounders

Up to I965, the share of flounders was very insignificant in total catches of the USSR. In I965 their catches increased up to 8324 tons, in I966 they increased up to I38I7 tons, and in I967 they dropped up to 324 tons. In I968 they again gave a sharp increase up to 29842 tons and it was the peak for all the fishery period by the USSR (Table II).

Table II

USSR catches of flounders in Subarea 4,
I962-I968 (tons)

Years	I962	I963	I964	I965	I966	I967	I968
Catches	67I	586	II3	8324	I38I7	324	29842

The fluctuations of the flounder catches in the above mentioned years depended mainly on the intensity of their catch, which in its turn was in a direct connection with fishery conditions in different areas of the north-west Atlantic. Thus, when conditions for silver hake fishery got worse, the vessels began fishing for other species and, particularly, for flounders. Random analyses showed that American plaice (Hippoglossoides platessoides) and yellowtail flounder (Limanda ferruginea) prevailed in catches.

V. Mackerel

Up to I968, the number of mackerel was very scarce in the USSR catches, they did not exceed I200 tons and only in I968

their catch reached 9.412 tons. The increase of mackerel catches can be explained by that of their commercial concentrations, that is possibly connected with the increased stocks. The same picture was observed in Subarea 5 and ICNAF Statistical Area 6. Mackerel was maily fished as bycatch in Div. 4W from April to December. In October-December their catch was great enough. It should be noted that mackerel was not observed in catches taken in the late autumn and in winter of the last years.

B. Special investigations

I. Environmental studies

In 1968, four hydrographic surveys were completed as previously (scheme of standard sections was given in the USSR Research Report, 1967, ICNAF Res Doc. 68/15). In winter, observations at standard sections were made from 13 to 23 January, in spring-from 2 to 9 May, in summer - from 2 to 8 August, in autumn - from 9 to 14 October. The water temperature was measured with deep water thermometers and the salinity was determined at each station along the standard depths. The results of surveys showed that the heat content in water masses appeared to be higher in 1968 than in 1967 in all the seasons. Such rise of the temperature may be connected with an intensive inflow of the Gulf Stream waters. This is represented in a special report in a more detailed form.

II. Biological Studies

Silver hake

Studies on the age composition of silver hake catches taken in Div. 4 W showed that three - four - and - five year old specimens prevailed there in May and June, but two-and-three year olds in September-October (Table 12).

Table I2

Age composition of silver hake catches in 4 W, I968 (%)

Months	Age									Total
	I	2	3	4	5	6	7	8	9	
May	-	-	I4.9	56.3	20.3	7.7	0.8	-		I00.0
June	-	0.9	28.4	38.5	24.5	7.5	0.2	-		I00.0
September – October	0.9	32.4	52.4	9.9	2.4	0.8	1.0	0.2		I00.0

A great dominance of two-and-three yearings in autumn 1968 testifies, apparently, on the entrance into fishery of I965 and I966 year-classes, whose abundance was somewhat higher in comparison with this one of I964 recruitment. But, there is no data confirming the augmentation of silver hake stocks up to the level of I963-I965.

Haddock

To study the age composition in July and August, six samples including 586 individuals were taken from the catches of herring trawls of fish finding trawler. Haddock was represented in these samples by the individuals from one to ten years old. One-year olds, two-year olds, five-and-six year olds prevailed there. Thus, the first age group made I2.5%, the second one -I9.I%, the third - 8.2%, the fourth - 7.2%, the fifth - I9.9%, the sixth - 2I.8, the seventh - 5.6%, the eighth - 3.5%, the ninth - I.8% and the tenth age group - 0.4%.

Studying of stocks and distribution of bottom fish

In July and August, SRTM-8I5 "Bleak" conducted a trawl survey for studying the distribution and stocks of the main commercial and mass fish species in the area of Nova Scotia

Shelf. Hauls were made by herring trawl, 27.I m with speed 3.5 knots during a half an hour. Thus, an attempt was made for determining the absolute stock of the American plaice, yellowtail flounder, scups and silver hake. A great number of the youngs of silver hake I967 generation was found there.

S u b a r e a 5

A. Status of fisheries

I. Silver hake

In I968, catches of silver hake began to reduce (Table I3). Decrease in catches can be firstly explained by that of their commercial concentrations on Georges Bank, especially in summer. Practically, in I963 a special silver hake fishery was not more conducted on southern slopes of Georges Bank in summer period, while it was successful up to I966. Smaller silver hake concentrations were caused by the decrease in their stocks.

Table I3

USSR catches of silver hake, Subarea 5,
I962-I968 (tons)

Years	I962	I963	I964	I965	I966	I967	I968
Catches	4I,900	I07,357	I67,308	28I,43I	I2I,373	69,984	47,299

The decrease in stocks may be explained by the entering into fishery of comparatively scarce concentrations.

From January to April, BMRT conducted silver hake catch together with red hake on slopes of shelf in Div. 5 Zw near Black and Veatch Canyons at depths I20-350 m. The silver hake catches made 60% at an average, and the remainder was for red hake (30%) and others (I0%). In May, silver hake went to the shallow waters. Then it was caught together with other species at the Nantucket Bank, north-western and south-western slopes of Georges Bank. In August, silver hake catch was the greatest. In the nearest future silver hake catches will remain at a low

level due to the continuous tendency of the decrease in their stocks.

II. Haddock

In I968, haddock catches made only 3I59 tons, which was much less than peak catches in I965 and I966 (Table I4).

Table I4

USSR catches of haddock in Subarea 5, I962-I968

(tons)

Years	I962	I963	I964	I965	I966	I967	I968
Catches	I,I34	2,36I	5,483	8I,882	48,409	2,3I6	3,I59

The decrease in haddock catches may be explained by that in their concentrations, which is caused by the diminishing of the abundance of previously rich I962 and I963 year - classes and by the entering into the fishery of poor I964 and I965 year-classes. In I969 and I970, haddock catches will apparently remain at a low level.

III. Red hake

In I968, red hake catches increased slightly. In January, March and August red hake were extremely successfully fished together with silver hake on shelf slopes in 5 Zw and in October in the Nantucket shallow waters. In winter, red hake catches were represented by the specimens from 22 cm to 56 cm in length (5 Zw), and these ones from 28 cm to 37 cm (mean length - 33.3 cm) prevailed there.

The results of counting the abundance of red hake in fall I968 with help of control trawlings were the same as in I967. Therefore, it may be supposed that in I969, the catches will remain at a low level as in I968 ones.

IV. Herring

In I968, herring catches from Subarea 5 increased up to I26965 tons in comparison with I2357[illegible] tons caught in I967 (Table I5).

Table I5

USSR catches of herring in Subarea 5,
I962-I968 (in tons)

Years	I962	I963	I964	I965	I966	I967	I968
Catches	I5I,I44	97,329	I30,723	36,349	II7,346	I23,572	I26,965

A slight increase in total catches of herring was accompanied by the decrease of catches per effort. Thus, the average catches per day by SRT and SRT-R dropped for the year period from 8.2 tons in I967 to 6.5 tons in I968. The total hering catch for the vessels of this type was 749 thousand tons in I968. Herring catch was conducted from March to December. The greatest catches were in May, July, August and September.

In spring, herring was caught in the western part of Subarea 5, in summer - on south-western, eastern and north--western parts of Georges Bank, in September and October - in northern and north-western areas of the Bank, in December - in the areas of the Nantucket Bank. In mass, herring taken from catches was from 28 cm to 33 cm in length. The mean body length was changing from 27 cm to 32 cm by months and by areas.

In the nearest two years, the decrease in herring stocks is not expected, therefore, their catches will remain at the I968 level and, possibly, below it, if the effort is equal.

V. Mackerel

Up to I967, mackerel was caught in small numbers (Table I6). In I967, their catches reached II.907 tons, and in I968 they grew up to 33.36I tons.

First of all, the growth in mackerel catches may be explained by a considerable increase in their commercial concentrations as well as by a greater commercial effort, as due to the decrease inconcentration of other fish species vessels had to fish mackerel.

Table I6

USSR catches of mackerel in Subarea 5,
I963-I968 (tons)

Years	I962	I963	I964	I965	I966	I967	I968
Catches	-	869	533	2,460	5,446	II,407	33,96I

Mackerel taken from catches was in their mass from 27 to 35 cm long. The mean length by months and by areas changed from 26.5 cm to 33.7 cm. The haddock stocks are at a relatively high level, and, apparently, in I959 their catches can be higher than I968 level.

B. Special investigations

I. Environmental studies

Oceanography

Throughout I968, four standard seasonal hydrological surveys were made in Subarea 5: I3-23 January, 2-9 May, 2-I8 August, 9-I9 October. At each station at standard layers 0,I0, 20, 30, 50, 75, I00, I50, 200, 300, 400, 500 m temperature was measured with help of deep-water thermometers and the salinity was determined. Besides that, from I to 6 July and from I9 to 24 July bathythermograph surveys were completed in southern Georges Bank, but from 8 to I0 September and from 6 to 9 October - in the northern part of the Bank and they were timed to the collection of plankton and ichthyoplankton samples. Data on surveys show to the intensification of the inflow of the Gulf Stream waters in I968 to the southern and south-eastern slopes of Georges Bank. In winter I968, in the East Channel temperature of the layer from I00 m to bottom was 0.5°C-I.0°C higher than in I967. In May and July, the advection of warm waters from south to the Bank was observed up to 60-70 m depth.

In May, an intensive inflow of warm waters to the East Channel was observed, from August to October advection of

warm waters was continued. In October, their inflow through the Eastern Channel intensified and the waters filled not only deeps lying to the north of the Bank, but also the areas outside of them. In August, bottom temperature in the East Channel was in the ranges from 8°C to 9.3°C and in October - from 8°C to 10°C; Thus, in 1968 heat content of water masses off Georges Bank was close to the same in 1962-1963 and higher than in 1967;

Zooplankton

In 1968, during the seasonal hydrologic surveys the collection of zooplankton samples was made with Dzeddy net in Subarea 5. Zooplankton samples were collected during microsurveys in the areas of silver hake and herring spawning. In September, the plankton was collected with planktonsamplers for studying the catchability of these gears at different conditions of collection by the R/V "Blesk" together with the USA R/V "Albatross IV" and the Canadian "Theta".

Ichthyoplankton

In 1968, the collection of ichthyoplankton samples was continued in the area of silver hake and red hake spawning and the treatment of samples collected in 1965 was terminated. The analysis of the data collected in 1965 showed that in the second half of June, in the beginning both of July and August the greatest number of silver hake eggs was found on the southern slopes of Georges Bank (from 115 to 1450 specimens/m^2). In July, the eggs number was less than in June and in August. The maximum number of silver hake larvae was sampled in the south - western Georges Bank. It should be taken into account that larvae were larger there than on the southern slopes, this fact testifies that the eggs and larvae were drifting in the south - western direction along southern slopes of Georges Bank.

The abundance of eggs and larvae of red hake in samples from the catches increased on the southern slopes of Georges

Bank from July up to early in August. That shows that the peak of red hake spawning was in the beginning of August. Red hake and silver hake larvae are drifting in the south-western direction. The analysis of the intestine content of silver hake larvae showed that they fed on nauplius and on different Copepoda stages.

II. Biological studies

Silver hake

a) Age determination

From March to September 1968, 28 samples of silver hake were taken from the catches for determination the age composition, this method helped to determine the age of 2262 specimens by otoliths. As seen from Table 17, the three-, four - and five year olds prevailed in the catches, and the share of three - year old specimens decreased from 56.4% in March up to 28.7% in September, but this one of five year olds increased from 3.2% in March up to 15.5% in September.

Table 17

Age composition of silver hake catches in Div. 5Z, March-September 1968 (%)

Months	Age									Total
	1	2	3	4	5	6	7	8	9	
March	-	8.9	56.4	30.7	3.2	0.4	0.3	0.1	+	100.0
June	-	0.3	37.6	45.0	14.2	2.2	0.4	0.2	0.1	100.0
August	2.6	1.6	27.6	37.3	20.5	4.9	2.4	2.2	0.9	100.0
September	4.7	2.9	28.7	25.2	23.9	10.0	2.6	1.3	0.7	100.0
Average	1.6	3.4	37.6	34.6	15.5	4.4	1.4	0.9	0.4	100.0

The size composition changed correspondingly to the age composition. Thus, in March the mean length of silver hake was 27.3 cm, in June - 30.4 cm, in August - 33.7 cm and in September - 33.9 cm.

b) Race studies

Studies of serum and erythrocyte antigens of blood of silver hake from the areas of the Sable Island, Georges Bank and the Middle Atlantic states were continued for determining both the intraspecific biological groups of hake and the rate of their mixture at the autumn-winter period, and a complex of the immunoserological methods (electrophoresis in agar gel, immunoelectrophoresis, reaction of precipitation in gel and hemoagglutination were used).

A comparative analysis of the silver hake specific blood antigens found, helped to distinguish three hake populations: the first one of the Sable Island, the second - of the Georges Bank and the third population - from the Middle Atlantic states, and those ones of the two last areas can be observed in the mixed stocks during autumn and winter. Moreover, it was found that the antigen components of silver hake blood serum fluctuated slightly by sex, size and age during the autumn-winter period.

Besides, during this period basing on the data obtained, a preliminary determination of the quantity percentage of two above silver hake populations in mixed concentrations was made.

It appeared that the silver hake population of the Middle Atlantic states observed in the area of Georges Bank made about 14%, and silver hake population of Georges Bank inhabiting the area of Middle Atlantic states-about 35%.

c) Studies on the feeding of silver hake

In 1968, the data on silver hake feeding were treated (they were collected in Div. 4W, 4X, 5Z and 6A in 1965-1967).

The analysis of intestine content was made for 42515 specimens. Food was found in 16597 intestines (39.1%). The species composition of organisms serving the base for silver hake feeding was determined. 57 species of invertebrates and fishes were included into the list of the organisms, 73.7% of

them were represented by the typical planktonic and bathypelagic species. Some peculiarities in feeding of silver hake of different size groups were discovered. Thus, the immature specimens (less than 30 cm in length) fed mainly on Euphasiidae. But, with their growth the share of fish increases in feeding. The specimens from 35 cm to 40 cm long fed mostly on fish (frequency from 42% to 96%). Females more than 40 cm long fed exclusively on fish. Some differences were found in the intensity of feeding by areas and seasons.

While studying the daily regime of food consumption two peaks were observed for feeding of silver hake inhabiting the southern slopes of Georges Bank, the shelf slopes of the Nantucket area in March and April (10-12 h and 2-4 h). But early in May, three peaks were found in feeding of silver hake inhabiting the slopes of the Nova Scotia Shelf (7-8 h, 14-15 h, 4-5 h).

Haddock

In June, July and August 1968, the otoliths were taken correspondingly for 298, 100 and 200 haddock specimens. The results of age determination showed that the bulk of the research vessels catches made haddock at the age of 4,5 and 6 years old. It is possible to assume, that in most of cases haddock commercial catches were also represented by the individuals of 4,5 and 6 years old at that period, because the fish finding vessels made control haulings in the fishery areas and used the analogous trawls.

Table 18

Age composition of haddock in the catches of fish finding trawlers on Georges Bank, 1968 (%)

Months	Age							Total
	3	4	5	6	7	8	9	
June	5.6	24.2	16.7	29.5	12.3	10.7	1.0	100.0
July	5.0	26.0	55.0	13.0	1.0	-	-	100.0
August	-	25.5	35.0	37.5	2.0	-	-	100.0

Red hake

In I968, the studying of stock locality, age-size composition and growth rate was continued.

Statistically reliable differences in the otoliths weight of fish of the same length and sex were observed for the red hake of the south-eastern and southern slopes of Georges Bank. Such differences were not observed for the red hake inhabiting the area from Cape Cod to Hudson Canyon as well as the area lying to south-west of Hudson Canyon. But, it is necessary to continue such investigations in further for obtaining final conclusions.

The base of the red hake age composition inhabiting the south-eastern slopes of Georges Bank made the specimens from four to five years old (27.4% and 22.5% correspondingly).

The individuals from three to five years old prevailed on southern slopes of Georges Bank and in the area from Cape Cod to Hudson Canyon. These age groups made about 70% in catches.

In comparison with previous years (I965-I966), the "aging" of red hake was observed in the main areas of fishery, so the mean age became I year more. The "aging" may be apparently explained by the fact that the commercial stock was recruited by poor year-classes during the last years.

There were not observed great changes in the size composition of this species in comparison with the previous years, that cannot be said about the age composition.

The analysis of the growth rate showed that in I968 the growth rate of red hake was slightly slowed in comparison with the previous years.

Herring

a) Studies of age composition

Since March to September I968, the herring samples were systematically taken from commercial catches for studying the age composition. The age determination was made by otoliths in

38 samples for 3504 herring specimens. Thus, it was established that in March-September I968, the age composition was at an average the following: the first age group - 0.I%, the second one - 0.5%, the third - 5.3%, the fourth - 8.0%, the fifth - 20.I%, the sixth - 22.5%, the seventh - 37.3, the eighth - 6.I% and the ninth - 0.I%.

Thus, in I968 the bulk of catches made herring at the age of 5,6, 7 years old, i. e. the I96I, I962 and I963 year-classes.

The I96I year-class was average in abundance, and in I968 it considerably reduced due to the natural and fishing mortality. The I962 and I963 year-classes and the next ones may be related to relatively poor year-classes. The I960 year-class, previously making rich, has dropped out of fishery, only 6.I% at the age of eight years old. Thus, in I969 the herring stocks in their mass will include poor year-classes, that undoubtedly will influence the effectivity of fishery in I969 and I970.

b) Estimation of the spawning population by number of deposited eggs

Eggs counting on the spawning grounds in the northern part of Georges Bank showed that eggs were deposited on the area of 5.7 km^2, the stock of the spawning population was 0.I3 thousand tons. However, some spawning grounds were not taken into account. By preliminary assesement, they made not more than I km^2.

Thus, in I968 the spawning stock of herring made near 0.15 thousand tons in the northern part of Georges Bank, that was considerably below the 1964-1965 level.

c) Race studies

In August-September I968, the immunoserological blood studies for 1200 specimens were conducted on spawning concentrations of herring in the northern part of Georges Bank.

Three phenotypes (three blood groups, i.e. A_1, A_2 and A_o) were found by the erythrocyte antigens, these phenotypes made the three - allelic system of blood groups named A - system,

It is supposed that the antigens "A" and "C" (described by Sinderman) are identical.

Surveys conducted on the spauning grounds show the availability of two groups of herring, one of them is characterized by the absence of phenotype A_o.