INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Restricted

Serial No. 2819
(C.c.72)

ICNAF Res.Doc. 72/42

ANNUAL MEETING - JUNE 1972

USSR Research Report, 1971

by

K.G. Konstantinov
PINRO, Murmansk, USSR

and
A.S. Noskov
AtlantNIRO, Kaliningrad, USSR

The total USSR catch in the Convention Area in 1971 was 902,211 tons (Table I) , i.e. 193,013 tons higher than in 1970. The total USSR catch in Northwest Atlantic in 1971 was 1.017.006 tons i.e. 204.701 tons higher than in 1970.

Subarea I.

A. Status of the Fisheries

In 1971 the total fish catch in this Subarea was 4.962 tons.

B. Special Research Studies

I. Environmental Studies

Hydrographic observations made from R/V's Perseus III and Procyon showed the water temperature on the West Greenland central banks to be lower than the average long-term normal. The water temperature remained low in the northern part of the Davis Straight, e.g. along standard hydrographic section 9-a (Fig.1).

II. Biological Studies

Grenadier. In August and October series of hawls were made with a bottom trawl at a depth of 600-800 m along the Greenland-Canada ridge, mainly in the western part of Div.1C. Roundnose grenadier (Macrurus rupestris) measuring 35-95 cm prevailed in the catches, with the highest number of fish within the length

Table 1. Species composition of the USSR catches in North-West Atlantic, 1971 (tons)

Species	1971					Total ICNAF area		Area 6		Baffin Island		Total North-west Atlantic	
	I.	II.	III.	IV.	V.	1970	1971	1970	1971	1970	1971	1970	1971
1	2	3	4	5	6	7	8	9	10	11	12	13	14
T O T A L	4962	136126	198310	270059	292754	709198	902211	102300	113960	799	835	812305	1017006
Argentine	-	-	87	3555	1893	2614	5535	-	-	-	-	2614	5535
Capelin	-	-	750	-	-	-	750	-	-	-	-	-	750
Halibut	-	-	199	42	-	-	241	-	-	-	-	-	241
Greenland Halibut	545	7420	1848	-	-	8136	9813	-	-	215	240	8351	10053
American plaice	192	1600	19570	6700	340	21763	28490	-	-	-	-	21763	28490
Winter flounder	-	-	-	1647	1946	504	3593	8	114	-	-	512	3707
Summer flounder	-	-	-	-	843	25	843	11	61	-	-	36	904
Yellowtail	-	-	13102	728	925	9039	14755	111	829	-	-	9150	15584
Witch	-	926	15574	10964	2713	17140	30477	2	124	-	-	17142	30601
Cod	99	61562	44262	4843	1270	113570	111996	-	-	29	-	113599	111996
Haddock	-	-	479	572	374	932	1425	-	-	-	-	932	1425
Pollock	-	-	106	1053	1163	550	2322	-	-	-	-	550	2322
White hake	-	-	4588	-	-	-	4588	-	-	-	-	-	4588
Red hake	-	-	-	1799	25353	7680	27152	834	8285	-	-	8514	35437
Silver hake	-	-	-	128633	61515	197913	210148	3044	7061	-	-	200957	217209
Grenadier	4118	55761	18408	-	-	28884	78267	-	-	545	595	29389	78882
Redfish	13	5519	71246	20591	3394	76023	100763	-	-	-	-	76023	100763
Wolffish	-	206	2390	-	-	798	2596	-	-	-	-	798	2596
Sculpins	-	-	-	-	1095	2333	1095	320	443	-	-	2653	1538
Ocean pout	-	-	-	172	3553	915	3725	-	186	-	-	915	3911
Cusk	-	-	-	5	193	93	198	72	372	-	-	165	570
Sea robin	-	-	-	-	46	-	46	258	792	-	-	258	838
Angler fish	-	-	31	13507	3644	3439	17182	-	-	-	-	3439	17182
Butter fish	-	-	-	-	400	399	400	8	86	-	-	407	486
Bluefish	-	-	-	-	-	-	-	-	16	-	-	-	16
Atlantic saury	-	-	-	-	2144	1054	2144	-	-	-	-	1054	2144
Herring	-	-	-	29048	63903	111186	92951	22406	17355	-	-	133592	110306
Alewife	-	-	-	-	9014	13145	9014	5954	2275	-	-	19099	11289
Mackerel	-	-	-	9492	59074	60449	68566	66026	68754	-	-	126475	137320
Menhaden	-	-	-	-	-	6	-	-	-	-	-	6	-
Sharks	-	-	-	-	9045	4336	9045	568	2997	-	-	4924	12042
Skates	-	-	35	17638	3750	7352	21423	-	-	-	-	7352	21423
Other fish	35	3052	5327	11844	8691	16653	28949	665	3731	10	-	17329	32660
Squids	-	-	-	7226	5659	1489	12885	-	479	-	-	1489	13364
Other molluscs	-	-	-	-	814	818	814	-	-	-	-	818	814

D 3

range of 55–65 cm. Males were somewhat smaller but more abundant than females comprising 59.5% of the total number of fish taken. All the fish taken were immature. The stomachs contained shrimps, Themisto, calanus, jellyfish, luminous anchovy, i.e. bathypelagic species. Commercial concentrations of grenadier usually occurred at a temperature of 3–4°. No grenadiers were recorded north of the Greenland - Canada ridge where the near bottom temperature was below I°C.

Greenland halibut. Greenland halibut (Reinhardtius hippoglossoides) occurred in commercial quantities in the bottom trawl catches of research and exploratory vessels both south and north of the Greenland-Canada ridge. At a depth of about 800 m in Div. IC in June males were much more abundant than females, with about 20% of the fish of either sex showing the evidence of comparatively recent spawning. The predominant length was 50–70 cm for males and 55–80 cm for females.

In August 424 Greenland halibuts measuring 35–85 cm were tagged west of Store Hellefiske Bank.

S U B A R E A 2.

A. Status of the Fisheries

In I97I the total catch in Subarea 2 was I36.I26 tons (Table 2).

Table 2. Annual catch in Subarea 2 (metric tons)

Total catch by vessels of all types						TOTAL
Cod	Grenadier	Redfish	Flatfish	Halibuts	Other	
6I.562	55.76I	5.5I9	2.606	7.420	3.258	I36.I26

In 1971 the cod catch declined against 1970 mainly due to severe ice conditions which made the commercial fleet leave Subarea 2 as early as in the middle of February, 1971. In subsequent months the vessels operated in this Subarea only from time to time and did not obtain good catches.

The length composition of cod in the trawl catches is presented in Table 3.

Table 3. Length composition of cod in trawl catches in Div.2J (°/oo)

Length (cm):	January:	February :	March :	April :	May
18-20	-	-	-	-	1
21-23	-	1	2	-	2
24-26	4	6	15	-	11
27-29	18	29	67	3	30
30-32	66	86	180	10	57
33-35	101	121	202	39	88
36-38	107	96	105	64	119
39-41	102	80	60	70	88
42-44	129	86	53	100	81
45-47	142	106	57	150	130
48-50	125	107	58	127	84
51-53	66	66	48	138	101
54-56	39	58	35	97	73
57-59	42	56	39	82	52
60-62	25	42	31	53	34
63-65	15	26	21	28	18
66-68	11	16	11	21	15
69-71	5	9	7	6	8
72-74	2	5	4	5	4
75-77	1	2	3	2	3
78-80	-	2	1	4	1
81-83	-	-	1	1	-
Total (%o)	1.000	1.000	1.000	1.000	1.000
Number of fish	12.186	7.771	4.748	2.198	3.668
Mean length (cm)	44.11	44.86	40.56	49.45	45.10

In I97I the mean length of cod was found to be lower than in I970 (USSR Research Report, Redbook, I97I, Part II) and the peak of the size range shifted to the left. This change was caused by the recruitment to the commercial stock of the abundant I967, I966 and I965 yearclasses which were of minor importance in the catches of I970 but reached commercial sizes a year later while the abundance of the I96I, I962 and I963 yearclasses decreased due to natural mortality and fisheries, and these fish lost their dominating importance in trawl catches.

Variations in the length composition of cod in different months are caused by seasonal migrations. In January - February both immature and pre-spawning cod concentrate on the continental slope of South Labrador. In March mature cod move northward to the main spawning grounds while small immature cod remain in the South Labrador area. In April - May the big spent cod migrate back to South Labrador after spawning.

An indication of the age composition is provided by a sample taken on Sundahl Bank in April when both mature and immature cod remain near South Labrador (Table 4).

Table 4. Age composition of cod (‰) in Div.2J in April I97I

Year-class	: (Age)	: Numbers (‰)	: Mean length (cm)
I967	(4)	80	36.00
I966	(5)	I40	39.58
I965	(6)	37I	45.67
I964	(7)	220	50.I8
I963	(8)	83	57.28
I962	(9)	53	59.88
I96I	(I0)	30	65.67
I960	(II)	I3	64.75
I958	(I3)	7	70.00
I948	(23)	3	88.00

The sample consisted of 300 fish (I62 males and I38 females). Typically, males were numerically predominant in younger age groups from 4 to 8 years. (More males than females are hatched from the eggs of the northatlantic cod and the sex ratio does not level off until the fish attain maturity).

According to the cod fishery forecast (See USSR Research Report, Redbook, I97I. Part II) for I972 an increase in the effectiveness of fleet operations and an increase in the catch per hour trawling were expected. The actual fishery in the early months of I972 showed an increase in the density of cod concentrations in Div.2J and 3K as compared with the same period of several preceding years.

In I973 a further improvement in the trawl cod fishery is likely to occur in Subarea 2 mainly due to the recruitment to the Labrador stock of the strong I968 year-class (Table 7) and the expected decrease in the water temperature over the Labrador shelf.

Other objects of trawl fishery. During the last months of I97I the commercial fleet operated successfully on grenadier and Greenland halibut concentrations in Subarea 2. The length composition of these species in trawl catches is shown in Figs 2 and 3.

B. Special Research Studies

I. Environmental Studies.

In early November standard hydrographic section 3-A was made by R/V Perseus III. Along the AB portion of the section over the Labrador shelf (between 53°40'N, 55°44'W and 54°50'N, 53°32'W) water temperature was lower than the average long-term normal. (Table 5).

Table 5. Average water temperature (°C) along the AB portion of section 8-A across Hamilton Bank (November, I)

Depth,m.	I964	I965	I966	I967	I968	I969	I970	I97I
0- 50	0.98	I.30	2.4I	2.00	2.29	0.82	I.34	0.88
50-200	-0.I8	I.06	I.44	0.89	-0.I8	0.36	0.3I	0.43
0-200	0.I7	I.I3	I.72	I.I9	0.50	0.50	0.60	0.57
200-500	0.98	-	2.47	0.95	0.3I	I.64	-	I.58

II. Biological Studies

Recapture of tagged fish. Among the recaptured tagged fish of some interest is the cod marked with N 229196 tag. This fish was released from R/V Perseus III on February 8, 1970 at 53°24'N, 52°50'W with the overall length at the moment of release of 55cm. One year and five months later, on July 5, I97I this cod was recaptured at 46°27'N, 50°48'W by the Portuguese vessel "Neptuno", which suggests that cod belonging to the Labrador stock may migrate in summer up to the very boundary of Div.3 NO.

S U B A R E A 3

A. Status of the Fisheries

In I97I the total catch in Subarea 3 was I98.3I0 tons (Table 6).

Table 6. Annual catch in Subarea 3 (metric tons)

Total catch by vessels of all types						TOTAL
Cod	Grena-dier	Red - fish	Flat-fish	Halibut	Other	
44.262	I8.408	7I.246	48.554	2.047	I3.793	I98.3I0

In 1973 an improvement in the cod fishery in the southern part of Subarea 3 (Div.3N, 3O and 3P) may be expected due to the high abundance of the 1968 year-class (Table 7). This year-class is likely to be strong also in Div.3M so therefore in 1973 the productivity of cod trawl fisheries on Flemish Cap Bank may increase provided that the total fishing effort is restricted. (See USSR Research Report, Redbook 1971, Part II).

In 1973 the abundance of the Newfaundland haddock will remain at a very low level due to the absence of good year-classes for a number of preceding years (Table 8).

B. Special Research Studies

I. Environmental Studies.

In March - July standard hydrographic Sections I-A, 2-A, 3-A, 4-A, 6-A, 7-A, 44-A were made by R/V's "Perseus III" and "Procyon". Water temperature and salinity data are presented in a special report (V.Burmakin & B.Kudlo).

Over the shelf in Div.3K, 3L and 3N the temperature was almost everywhere lower than the average long-term normal, which might have been due to the intensification of the Labrador Current. On the other hand positive anomaly was observed in the Cabot straight and over the shelf in Div.3O and 3P in March - June. In July, however, negative anomalies were recorded in the above mentioned divisions, partly under the effect of the inflow of cold water brought by the coastal branch of the Labrador Current. The intensification of the Labrador Current also resulted in lower salinities in all the areas influenced by this current.

II. Biological Studies

I. Ichthyoplankton sampling

From April 28 to May 28 a series of ichthyoplankton samples were taken from R/V Perseus III and Procyon covering the area of Div. 3K, 3L, 3M and 3N. The samples were mainly taken along stan-

dard sections, with hydrographic observations made at the same time. The gear used was an egg sampler with the opening of 80 cm in diameter. Usually three hauls (vertical, surface and oblique) were made at each of the 234 stations worked. In 1971 the mean number of cod eggs in Div.3K and 3L was somewhat lower than in 1970, possibly due to more severe hydrographic conditions. The later hatching of larvae in 1971 is another indication of the effect of this factor.

The analysis of all data collected confirms that the main cod spawning grounds are located near North Labrador from where the eggs and larvae are brought to Div.2H, 2J, 3K and 3L by the current. There is some spawning in the above mentioned divisions as well but to a much lesser extent than in Div.2G.

2. Young cod and haddock survey.

In May - August 1971 a young fish survey was conducted covering all divisions of Subarea 3. Altogether 240 one-hour hauls were made at standard points with a survey trawl. The young fish taken were counted and measured, and five thousand young cod and one thousand haddock were read for age. The results of the surveys made in 1971 and in earlier years are given in Tables 7 and 8.

Table 7. Average catch (numbers) of young cod at the age of 1 to 4 years per hour trawling with a survey trawl

Year-class / Div.	1 Year				2 Years				3 Years				4 Years			
	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	27	4	1	1
1962	1	1	7	42	2	8	2	7	15	18	2	12	24	1	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	22	60	9	9
1966	1	2	15	7	3	27	17	32	27	37	34	28	40	10	4	4
1967	1	1	2	1	8	3	4	20	34	32	14	10	12	2	2	6
1968	1	6	18	40	7	109	28	66	40	91	23	64	-	-	-	-
1969	1	2	4	15	4	11	6	50	-	-	-	-	-	-	-	-
1970	1	6	1	6	-	-	-	-	-	-	-	-	-	-	-	-

The I97I survey confirmed the high abundance of the I968 year -class cod in the Labrador (as shown by the number of three - year - olds in Div.3K), the South Newfoundland and the St.Pierre Bank stocks.

Table 8. Average catch (numbers) of young haddock at the age of I to 3 years per hour trawling with a survey trawl

Year-class	I Year		2 Years		3 Years	
	3 NO	3P	3 NO	3P	3 NO	3P
I963	-	-	-	-	2	I7
I964	-	-	4	55	6	I53
I965	I	I3	I	4I	I	4
I966	3	II0	8	I9I	I	20
I967	I	I83	I	I6	I	2
I968	4	25	8	I0	2	4
I969	4	35	4	38	-	-
I970	I	32	-	-	-	-

In the last three years the abundance of young haddock in Div. 3P (from where they migrate to Div.3 NO) remained at a rather low level. There was no appreciable recruitment to the commercial stock on the southern Grand Bank.

3. Trawl survey

In May-August a trawl survey was made by R/V Perseus III in Subarea 3 aimed at the quantitative assessment of both young and mature cod and haddock. The results of this survey are presented in a special report (A.Postolaky).

Deep water redfish (Sebastes mentella) was found to be predominant both in numbers and in biomass in almost all the areas except Div.3L where American plaice (Hippoglossoides platessoides) came first.

4. Recapture of tagged fish

As may be inferred from Table 9 American plaice (Hippoglossoides platessoides) is capable of performing quite lengthy migrations from the open sea shoreward.

Table 9. Tagged American plaice release and recapture data

Date	Released			Tag No	Country	Date	Recaptured	
	Lat. (N)	Long (W)	Length (cm)				Lat.(N).	Long. (W)
26.5.70	46°21'	47°37'	44	248014	Canada	20.5.71	46°52'	55°48'
26.5.70	46°21'	47°37'	42	248036	Canada	23.11.70	47°23'	52°25'
26.5.70	46°21'	47°37'	50	248062	USSR	29.12.71	46°30'	47°30'
26.5.70	46°21'	47°21'	50	248063	Canada	5.3.71	47°10'	55°50'
26.5.70	46°21'	47°37'	46	248078	Canada	10.4.71	47°10'	55°50'
26.5.70	45°51'	48°06'	48	248257	Canada	10.9.71	46°30'	48°40'
26.7.70	48°31'	50°09'	49	248876	Canada	19.2.71	47°48'	48°52'

SUBAREA 4.

A. Status of the Fisheries

The 1971 USSR catch in this Subarea was 270.059 tons (Table I).

1. Silver hake

The catches of silver hake were rather high though somewhat lower than in 1970. The total silver hake catch in 1971 was 128.6 thousand tons against 169.9 thousand tons in 1970 and 46.3 thousand tons in 1969 (Table I).

Since the silver hake fishery started in 1962 there was an increase in the catches to 123.0 thousand tons in 1963 followed by a significant decline in 1964 and 1965, a drop to 2.5 and 3.4 thousand tons in 1967 and 1968 and another sharp increase since 1969. The variations in the annual catch are chiefly explained by sharp fluctuations in the abundance of the stock caused by the

recruitment to the commercial stock of variable year-classes.

The fishing effort has not been constant during these years increasing in the years when the abundance is high and decreasing in those when it is low.

Silver hake are fished in the Nova-Scotian trough and on the slopes of Emerald, Middle and Sable Island Banks mainly from March through September by over I.800 ton trawlers with bottom and pelagic trawls.

As in previous years, the major part of the catch consisted of fish at age 3+ and 4+ (Table IO), which can be attributed to the fact that at the age of four-five years the majority of the fish are removed from the commercial stook by natural mortality.

The results of the trawl survey in the autumn of I97I indicated that the abundance of silver hake remained at the same level as in 1970. The 1968, 1969 and 1970 year-classes are estimated to be relatively strong, which suggests that in 1972 and 1973 the silver hake stock is likely to remain at a rather high level of abundance.

2. Herring

The 197I herring catch was 29.0 thousand tons against 70.2 thousand tons in I970. The decline is explained by smaller concentrations on Banquereau Bank and by lower fishing effort. Herring were mainly fished with purse seines on Banquereau Bank in February and March and on Emerald and Middle Banks in March, April and May.

The majority of herring in the Banquereau Bank (4v) catches were fish at age 6+ to I2+, those of age IO (the I96I year-class) being predominant (Table II). On Emerald and Middle Banks the major portion of the catch consisted of age 3+ to 9+ fish, with the predominance of three - and seven - year - olds of the I968 and I964 year-classes.

Table IO. Percentage age composition of silver hake catches in Subarea 4, I969 - I97I

YEAR	Age									Total (%%)	Mean age
	I	2	3	4	5	6	7	8	9		
I969	6.I	6.I	34.0	35.7	I2.7	3.6	I.2	0.6	-	I00.0	3.6
I970	7.0	II.6	35.9	33.I	I0.I	I.4	0.5	0.3	0.I	I00.0	3.4
I97I	-	8.8	43.2	36.8	8.8	I.2	0.5	0.5	0.2	I00.0	3.5

Table II. Percentage age composition of herring catches in Div.4Vand 4W in I969-I97I

Div.	Year	Age															Total (%)	Mean age
		I	2	3	4	5	6	7	8	9	I0	II	I2	I3	I4	I5		
4V	I969	-	0.7	2.4	6.7	II.5	I9.9	9.6	I0.2	I4.6	II.4	8.0	4.8	0.2	-	-	I00.0	7.36
	I970	-	-	-	-	0.2	I.I	6.8	9.7	I7.8	I7.5	I7.2	I4.4	9.8	5.5	-	I00.0	9.6I
	I97I	-	-	0.I	I.4	5.0	6.8	I6.5	I3.9	I9.3	I9.3	I4.2	6.6	I.8	0.3	0.2	I00.0	9.4
4W	I969	-	-	0.2	2.I	I8.8	36.3	I8.0	I2.7	8.I	2.6	I.6	0.I	-	-	-	I00.0	6.5
	I970	0.I	0.2	2.8	I6.0	27.7	I3.6	26.5	6.2	4.9	I.4	0.9	-	-	-	-	I00.0	6.I
	I97I	-	-	20.7	6.3	I2.6	I2.7	29.5	II.2	6.7	3.7	I.3	0.3	-	-	-	I00.0	5.3

B. Special Research Studies

I. Biological Studies

I. Argentine

a) Race analysis. Argentine from the southwestern slopes of Browns Bank (4x), eastern slopes of Sambro Bank (4w) and southeastern slopes of Banquereau Bank were analysed for growth rate, vertebrae number, weight of otolith in relation to body length and length-width otolith ratio in relation to body length. Div.4V argentine was found to have the highest growth rate, with lower growth rate observed in the fish from Div.4W and still lower in those from Div.4x.

As regards otolith weight with body length being equal the fish can be arranged in reverse order. The highest otolith weight was recorded in Div.4X argentine, with lower weight shown by Div.4W fish and still lower by those from Div.4V, i.e.argentine with lower growth rate appear to have higher otolith weight. These data suggest the existence of local argentine populations on Browns Bank (4X), Sambro Bank (4W) and Banquereau Bank (4V).

b) Observations on gonad condition suggest that argentine spawn from late February to May on the slopes of Browns Bank, in March - April on Sambro Bank and in April - May on Banquereau Bank.

S U B A R E A 5.

A. Status of the Fisheries

The USSR catch in this Subarea was 292,754 tons (Table I).

I. Silver hake.

In I97I the silver hake catch more than doubled as compared to I970 and was 8I.5 thousand tons against 29.0 thousand in I970. The higher catch in I97I is attributed to increased commercial concentrations and a higher fishing effort. The results of the autumn trawl surveys suggested that the silver hake stock was somewhat more abundant in I97I than in I970. The greater

portion of the catch was taken by over 1500 ton trawlers on the slopes of the bank between Black and Corsair Canyons and on the Nantucket shoal. Smaller quantities of silver hake were taken on the northwestern slopes of Georges Bank.

The catches were mainly composed of 28 to 35 cm fish (3 to 6 years), with three - and four-year-olds predominating as in previous years (Table I2).

On the basis of data obtained during the trawl survey in the autumn of I97I the I97I year-class was estimated to be abundant, which suggests that in I974 when these fish attain commercial age the stock and the catches are likely to increase.

2. Haddock.

The trawl survey data show the I97I haddock year-class to be of moderate abundance. When these fish are recruited to the commercial stock in I974 an increase in the stock abundance and in catches may be expected.

3. Red hake.

The red hake catch was 25.3 thousand tons which is I9 thousand tons more than in I970. The increase in catches is attributed to increasing fishing effort. As in previous years red hake were fished on the slopes of Georges Bank and on the Nantucket shoal, mainly from May through October. The major portion of the catch was composed of two -, three - and four-year-olds (Table I3).

4. Herring

The herring catch on Georges Bank increased as a result of the intensification of fishing and amounted to 63.9 thousand tons, which is almost 25 thousand more than in I970.

Herring were mainly fished by trawls from May through October. A small group of vessels fished with purse seines in May and June.

Herring were represented in catches mainly by ages 3+ to 7+, with the I966 (age 3+) and the I967 (age 4+) year-classes predominating (Table I4). In I97I, as in the preceding year,

Table I2. Percentage age composition of silver hake catches in Subarea 5 in I969-I97I

Year	Age										TOTAL	Mean age
	I	2	3	4	5	6	7	8	9	I0		
I969	I.3	I4.6	33.2	25.5	I4.5	5.2	4.0	I.2	0.5	-	I00.0	3.78
I970	I6.4	I3.4	I6.2	27.5	I6.3	4.0	4.0	I.7	0.3	0.2	I00.0	3.54
I97I	I.0	6.9	3I.6	32.6	I6.3	5.9	2.8	I.7	0.9	0.3	I00.0	4.0I

Table I3. Percentage age composition of red hake in Subarea 5, I969-I97I.

Year	Age							Total (%)	Mean age
	I	2	3	4	5	6	7		
I969	3.4	I7.5	35.5	35.4	7.6	0.3	-	I00.0	3.27
I970	-	2.5	63.8	29.2	4.5	0.3	-	I00.0	3.36
I97I	0.4	47.7	29.0	I4.4	6.9	I.5	0.I	I00.0	2.85

Table I4. Percentage age composition of herring catches in Subarea 5 in I969-I97I

Year	Age											Total (%)	Mean age
	2	3	4	5	6	7	8	9	I0	II	I2		
I969	+	5.I	I4.3	33.6	2I.I	I5.I	9.3	I.4	0.I	+	+	I00.0	6.22
I970	2.8	7.3	28.3	32.I	I2.0	9.2	5.0	3.0	0.3	-	-	I00.0	5.99
I97I	I.5	28.7	3I.5	I7.9	I0.2	7.0	2.6	0.5	0.I	-	-	I00.0	4,4I

all the herring year-classes available to the fishery were poor. In I972 no strong year-classes are likely to be recruited therefo re the stock is expected to remain at the I970 and I97I level.

5. Mackerel

The I97I mackerel catch was 59 thousand tons, i.e. 2.5 thousand higher than in I970.

Mackerel were represented in catches by twelve age groups (I+ to I2+), with the bulk of the catch composed of the strong I966 and I967 year-classes. These two year-classes together accounted for three-fourths of the catch (Table I5). In I972 the abundance of these year-classes is expected to remain at a high level therefore the stock is likely to be in good condition.

B. Special Research Studies

I. Environmental Studies

I. Hydrography

As in previous years a series of standard hydrographic sections were made in Subareas 5 and 6 in January, April, August and October. Water temperature measurements along these sections showed that the thermal level was higher in I97I than in I970.

An indication of the warmer water temperatures is provided by the minimum temperature of the cold intermediate layer which in the East Channel area (Section III) was I.7° higher in spring, the same as in I970 in summer and 0.5 higher in autumn (Table I6).

In the southern Georges Bank area the temperature of the intermediate layer in August was on the average I.0° higher than in I970. The calculations of the mean water temperature in August for the southern parts of Sections XXI, XXII, XXIII and for Section IV covering the southern part of the Bank as well as for

Table I5. Percentage age composition of mackerel catches in Div.5Z in I969-I97I

Year	Age												Total (%)	Mean age
	I	2	3	4	5	6	7	8	9	I0	II	I2		
I969	-	83,8	I2,7	3,2	0.2	0.I	-	-	-	-	-	-	I00.0	2.2
I970	I6.I	7.5	50.2	I5.8	4.0	I.4	I.5	I.5	I.3	0.7	+	-	I00.0	3.I
I97I	0.4	8.8	8.I	5I.2	24.2	4.4	0.8	0.3	0.6	0.7	0.4	0.I	I00.0	4.2

Table I6. Minimum water temperature along Section III.

Year \ Month	January	April	August	October
I970	2.3	I.7	5.2	4.2
I97I	3.2	3.4	5.2	4.7

Section V, XXIV and XXV west of 69°W also show a considerable increase in the mean water temperature in I97I (Table I7).

Table I7. Mean water temperature along sections covering Georges Bank and the Shelf.

Year	Southern Georges Bank			U S shelf, 70-74°W			
	IV	XXI	XXII	XXIII	V	XXIV	XXV
I970	II.6	I2.6	I2.0	I3.7	I5.4	I5.0	I4.5
I97I	I2.7	I3.4	I4.4	I5.7	I4.9	I7.3	I4.9

In the northern Georges Bank area no appreciable changes in the temperatures of the surface and intermediate layers were observed but higher temperatures were recorded in the near-bottom layer. An example is a higher temperature in the deepest part of the Gulf of Maine as a result of the strong advection of transformed slope waters through the East Channel.

It is seen from Table I7 that an increase occurred at each of the sections mentioned except Section V. The lower mean temperature along this Section might have resulted from the intensification of the inflow of relatively cold waters in the intermediate layer.

2. Hydrochemistry

Hydrochemical observations were made by R/V "Argus" in July at the time of the ecological survey in the Browns Bank - Hudson Canyon area. At 28 stations covering the entire ecological survey area determinations were made of oxygen, phosphate, nitrite and silicon contents, pH, oxidizability and primary production (oxygen method). July was found to be a typical transitional month from the hydrological spring to summer. The concentration of dissolved oxygen in the photic layer was never observed to be below 5.5 ml/l, with a maximum of 8.8 ml/l in the photosynthetic layer.

In the photic layer the concentration of phosphates was found to be below the value (I7 mg/l) limiting the development of phytoplankton. The values for nitrites in the 30 to 50 m layer were 0.o2 to 0.05 mg/l. The silicon concentration of I00 to 200 mg/l on the surface increased with depth and amounted to 450-550 mg/l in the near-bottom layer. The oxidizability usually varied from 0.3 to 0.6 mg/l O_2 and was as high as I.6 to 5.7 mg/l O_2 only in areas rich in phytoplankton.

3. Zooplankton

In summer and autumn zooplankton samples were taken with Juday net on the silver hake, red hake and herring spawning grounds in the Georges Bank area. Altogether 526 samples were collected which are being processed at present. The processed data collected in I970 show an appreciable decline in both the numbers and the biomass of zooplankton averaged over Georges Bank as a whole (Table I8).

Table I8. Numbers (thousands per sq.m) and biomass (mg/m^3) of zooplankton on Georges Bank in August and November, I965-I970

Month		Year					
		I965	I966	I967	I968	I969	I970
August	number	I73	I22	260	4I0	-	II4
	biomass	373	353	2I0	472	-	279
November	number	II4	82	I28	50	93	79
	biomass	483	5I0	280	2II	34I	22I

Over the southern slopes of Georges Bank the abundance of zooplankton was found to be slightly higher than in I968 but lower than in I965 (Table I9).

Table I9. Abundance (thousands per sq.m) of zooplankton on the southern Georges Bank in August, I965-I970

Year	I965	I966	I967	I968	I969	I970
Abundance	283	I49	I39	83	-	II6

Generally, over Georges Bank as a whole the numbers and the biomass of zooplankton have recently followed a downward trend, which may affect the condition of the young and adult fish feeding on zooplankton. This may also have an adverse effect on the strength of year-classes in herring, haddock and other species.

II. Biological Studies.

I. Silver hake

Eggs and larvae. In summer I97I studies were continued on the effectiveness of spawning on Georges Bank. Ichthyoplankton, zooplankton and hydrographic surveys of the area were conducted. The amount of eggs and larvae on the main spawning grounds on the southern slopes of Georges Bank was found to be much higher than in previous years. The study of the food of the silver hake larvae collected in I968 was completed and showed that as in I965-I967 the major part of the food consisted of nauplii, copepodites and adult Copepoda. Small larvae (3.0 to 7.9 mm long) caught on the northern slopes in August were feeding more intensively than those caught in the same area in October or those on the southern and southwestern slopes in July - August.

Young fish survey. I97I autumn trawl survey data show the I97I year-class to be strong.

Race analysis. In I97I material on race differences was summarized and the data on population dynamics, growth rate, weight of otoliths, biochemical variations and spawning characteristics made it possible to distinguish the following local silver hake stocks:

I. Sable Island Bank stock

2. Browns Bank stock

3. Georges Bank stock

4. Southern New England stock

2. Herring

Eggs and larvae. The distribution and abundance of eggs and larvae were studied on Georges Bank in September-October. The amount of eggs on the main spawning grounds in the northern part of the Bank was found to be as low as in I970. In October the greater part of larvae are to be found on Georges Bank (data of survey according to ICNAF program). The study of the feeding of larvae collected in I968-I969 shows that in October the larvae feed mainly on nauplii and copepodites as well as on bivalve larvae. The stomach contents of the I968 larvae showed no nauplii but they occurred in the stomachs of the I969 larvae. In I969 larvae were found to feed more intensively than in I968. In the plankton the abundance of nauplii was in I969 seven times and that of copepodites twice as high as in I968.

Spawning stocks. The abundance of the spawning stock estimated from the quantities of eggs laid in I97I appeared to be at the same low level as in I970. The spawning stock was estimated to be 60.000 tons in I969, I2.000 tons in I970 and II.000 tons inI97I.

Since in October the main mass of herring larvae occur on Georges Bank it can be said that the abundance of the Georges Bank spawning stock is much higher than in the Gulf of Maine and in southern Nova Scotia and that this spawning stock plays a decisivl role in the reproduction of the New England herring.

3. Groundfish trawl surveys

In I97I two trawl surveys were made. The first was conducted on R/V "Argus" in July and the second on R/V "Blesk" in August and October according to the joint USSR, US and Canada program. The abundance indices for the main species were determined and the silver hake and red hake year-classes in Subareas 5 and 6 were

found to be strong. The 1971 Georges Bank haddock year-class appeared to be of moderate abundance.

The minimum abundance of the stock of spiny dogfish in the Browns Bank - Hudson Canyon shelf area was estimated to be 300.000 tons and the stock of short-finned squid in the same area was estimated at 110.000 tons. As the hauls were made with a bottom trawl, only a small part of squid concentrations was available, which suggests that the actual squid stock may be about three times higher, i.e. about 300.000 tons. Squid appears to be a promising species for a fishery in this area.

STATISTICAL AREA 6

A. Status of the Fisheries

In 1971 the catch in Statistical Area 6 was 11.6 thousand tons higher than in 1970, which can be explained by increases in the silver hake catch from 3.000 tons in 1970 to 7.000 tons in 1971, in the red hake catch from 800 tons to 8.200 tons and in the catch of other species.

Fisheries were mainly conducted by big and medium trawlers in shallow waters in winter and in spring. The objectives were mackerel and herring. Silver and red hakes were taken on the shelf slopes in late April - early May and in November. The mackerel and herring taken in Area 6 belong to the stocks fished on Georges Bank. The results of trawl surveys suggest that no appreciable changes are likely to occur in the stocks of silver and red hake but a considerable increase is expected in 1974 due to the recruitment of the strong 1971 year-classes.

The age composition of herring catches in Area 6 differed from that on Georges Bank (Table 20), with older herring (ages 5+ to 7+) predominant in Area 6 and ages 3+ and 4+ dominating on Georges Bank. A possible explanation is that in winter older herring at age 5+ and above migrate from Georges Bank to Area 6 while younger fish remain on Georges Bank or in the Gulf of Maine.

The silver hake in the 1971 catches were represented by fish at age 1+ to 10+, with the 1969, 1968 and 1967 year-classes predominating (Table 21). The 1969 silver hake year-class appears to be more abundant than the 1967 and 1968 year-classes.

Table 20. Percentage age composition of herring catches in Area 6 in I969-I97I

Year	Age														Total (%)	Mean age
	I	2	3	4	5	6	7	8	9.	I0	II	I2	I3	I4		
I969	-	-	4.4	I2.5	30.I	I8.6	I6.6	I6.2	I.5	0.I	-	-	-	-	I00.0	5.88
I970	-	-	2.9	7.8	29.7	I5.3	I4,9	I4.5	I4.9	-	-	-	-	-	I00.0	6.I
I97I	-	-	0.8	5.9	38.I	23.9	24.0	4.9	2.4	-	-	-	-	-	I00.0	5.57

Table 2I. Percentage age composition of silver hake catches in Area 6 in I969 and I97I

Year	Age										Total (%)	Mean age
	I	2	3	4	5	6	7	8	9	I0		
I969	-	8.2	40.7	30.I	I0.4	3.8	4.4	I.4	0.8	0.2	I00.0	3.85
I97I	3.5	3I.I	37.5	I7.3	4.2	2.3	2.2	I.3	0.4	0.2	I00.0	3.I4

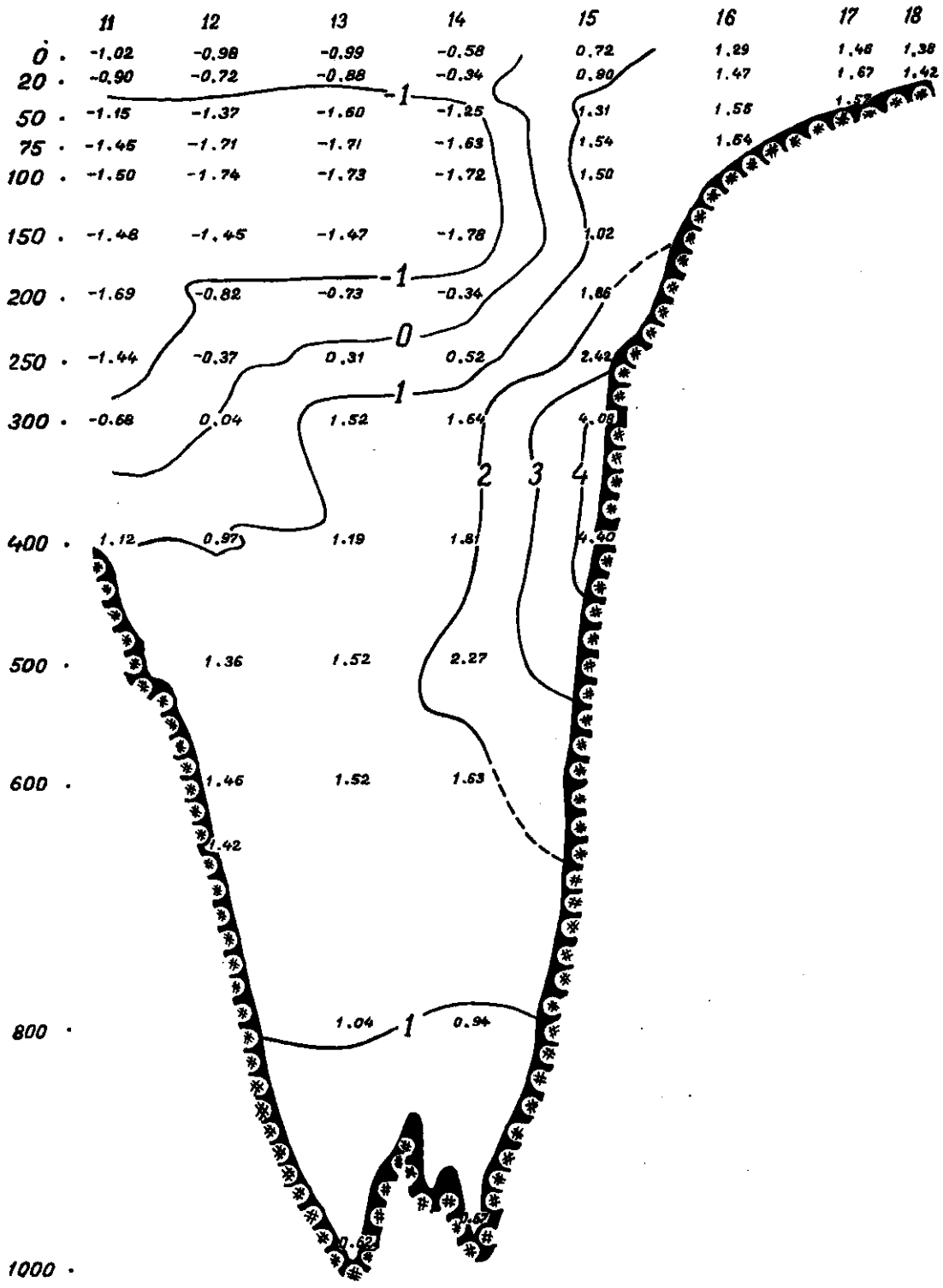

Fig. 1. Water temperature along Section 9A, October 25-26, 1971.

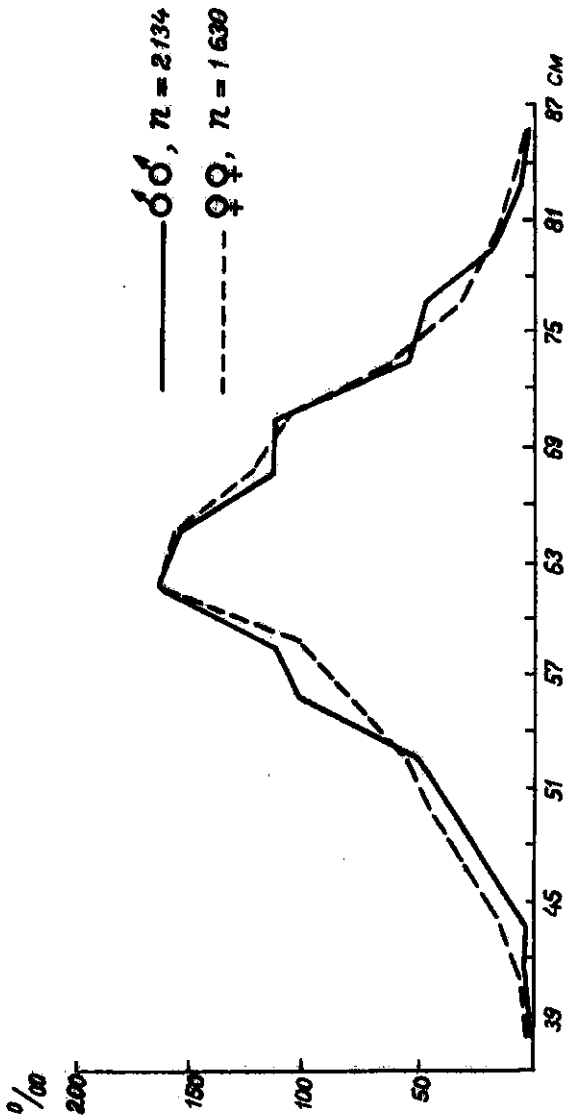

Fig. 2. Length composition of roundnose grenadier (*Macrurus rupestris*) in Div. 2G, December 1971.

F 1

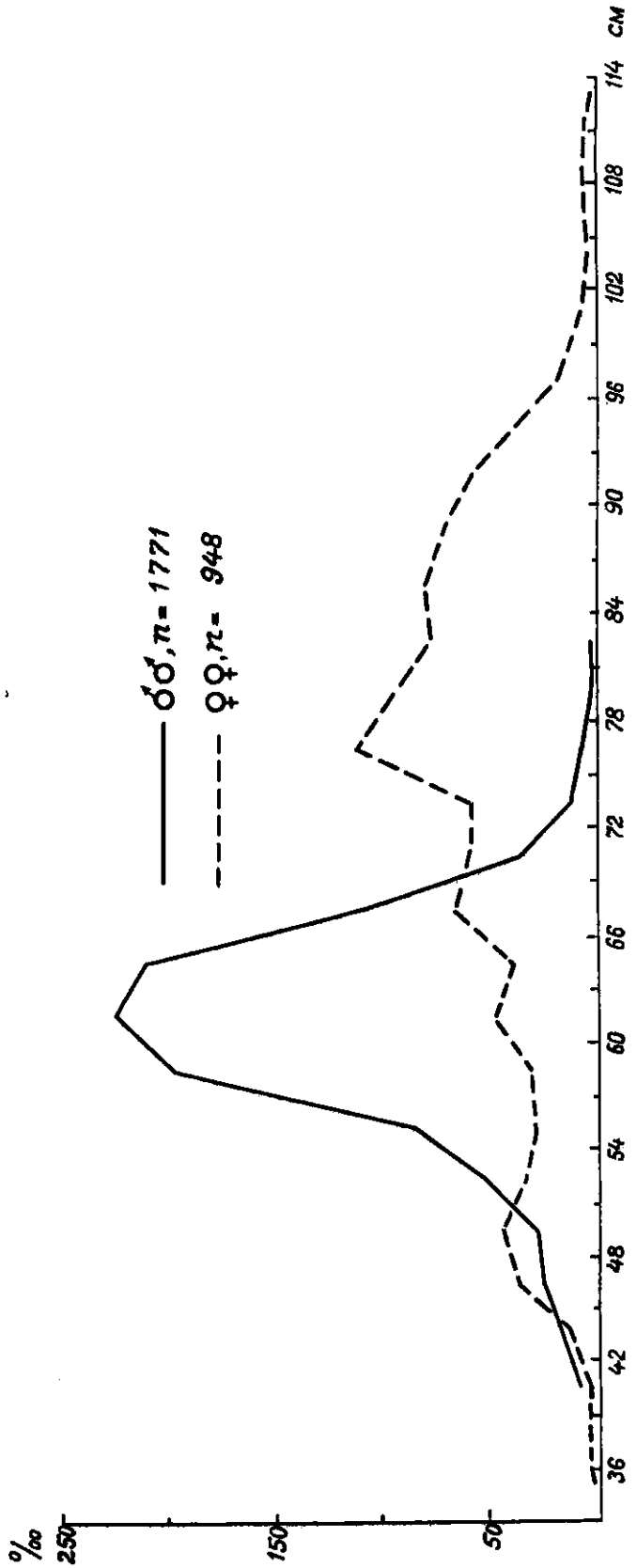

Fig. 3. Length composition of Greenland halibut (*Reinhardtius hippoglossoides*) in Div. 2G, December 1971.

F 2