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The total Soviet catch in the Convention Area in 1972 was 1,053,190 tons (Table 1). This is 150,979 tons higher than in 1971. The overall USSR catch in the Northwest Atlantic Ocean in 1972 was 1,150,038 tons, 128,326 tons greater than in 1971.

SUBAREA 1

A. Status of Fisheries

In 1972 the Soviet catch in this Subarea was 3,523 tons (Table 1). Most of the ships operating there were research and scouting vessels.

B. Special Scientific Investigations

1. Environment

As was indicated by the results of hydrological observations made from the research vessel *Perseus III*, water temperature of the Atlantic component of the West Greenland current was lower than in the same period of 1962, 1963 and 1966 (Table 2). The temperature in the Arctic component of the West Greenland current was lower than in 1962 and 1964, roughly at the 1966 level, and higher than in 1963.

In November 1972, the water temperature in the northern Davis Strait was also lower than in the same period for a number of previous years (Table 3).

The years 1971 and 1972 can be considered to be analogous.

2. Biological investigations

a) Cod. Trawling and biological analysis of cod were carried out on scouting and research vessels. Fish of 40-65 cm were prevalent at 150-300-m depths on the western slopes of Fyllas and Banan Banks in January (Fig. 1). The results of age determination were correlated with the size row. It turned out that the fish of 4, 5 and 6 years were far more abundant, i.e., they pertained to the 1966, 1967 and 1968 year-classes.

In February on the same banks of Div. 1C and 1D, cod were somewhat larger and older. Individuals aged 7 years of the 1965 year-class became important in trawl catches.

Immature cod actively fed on sandlance, young redfish and various invertebrates. The feeding of immature prespawning cod was not intensive.

In March mature cod on Banan Bank contributed substantially to the catches, but after it left for spawning in April, immature fish aged 4 and 5 years became dominant.

Large postspawning cod appeared again on Banan and Fyllas Banks in May. In Div. 1E of the southern part of the Subarea, mainly immature individuals occurred. Year-classes of 1966 (316‰), 1967 (224 ‰), 1968 (186 ‰) and 1965 (143 ‰) were, on the whole, abundant in the trawl catches during the first six months in the Subarea.

Table 1. Species classification of Soviet catches (tons) in the Northwest Atlantic Ocean, 1972.

Species	1972 catches by ICNAF Subareas					Total in ICNAF Area		Statistical Area 6		Baffinland		Total for Northwest Atlantic	
	1	2	3	4	5	1971	1972	1971	1972	1971	1972	1971	1972
Total	3,523	133,096	309,604	199,614	407,353	902,211	1,053,190	113,960	81,641	835	15,207	1,017,006	1,150,038
Argentine	-	-	105	5,412	32,610	5,535	38,127	-	-	-	-	5,535	38,127
Capelin	-	17,814	48,362	-	-	750	66,176	-	-	-	-	750	66,176
Atlantic halibut	-	-	121	-	-	241	121	-	-	-	-	241	121
Greenland halibut	245	5,928	4,376	-	-	9,813	10,549	-	-	240	9,397	10,053	19,946
American plaice	-	4,863	16,946	3,610	439	28,490	25,858	-	-	-	-	28,490	25,858
Winter flounder	-	-	-	617	2,517	3,593	3,134	114	14	-	-	3,707	3,148
Summer flounder	-	-	-	-	393	843	393	61	-	-	-	904	393
Yellowtail flounder	-	-	11,931	445	4,815	14,755	17,191	829	61	-	-	15,584	17,252
Long flounder	-	569	12,204	5,207	2,533	30,477	20,513	124	35	-	-	30,601	20,548
Cod	1,021	89,580	80,917	4,676	1,837	111,996	178,031	-	52	-	-	111,996	178,083
Haddock	-	-	342	116	141	1,425	599	-	-	-	-	1,425	599
Pollock	-	-	60	2,452	1,043	2,322	3,555	-	-	-	-	2,322	3,555
White hake	-	-	1,749	-	-	4,588	1,749	-	-	-	-	4,588	1,749
Red hake	-	-	-	1,388	56,629	27,152	58,017	8,285	14,704	-	-	35,437	72,721
Silver hake	-	-	-	113,774	94,151	210,148	207,925	7,061	7,735	-	-	217,209	215,660
Grenadier	2,164	2,867	21,157	-	-	78,287	26,188	-	-	595	5,577	78,882	31,765
Redfish	24	7,500	104,841	11,858	4,639	100,763	129,862	-	2	-	119	100,763	129,983
Wolffish	-	1,943	1,761	1	-	2,596	3,705	-	-	-	-	2,596	3,705
Goby	-	-	-	-	4,217	1,095	4,217	443	2,337	-	-	1,538	6,554
Ocean pout	-	-	-	4	975	3,725	979	186	92	-	-	3,911	1,071
Scup	-	-	-	-	314	198	314	372	359	-	-	570	673
Sea robin	-	-	-	-	283	46	283	792	3,489	-	-	838	3,772
Goosefish	-	-	-	2,872	4,092	17,182	6,964	-	-	-	-	17,182	6,964
Butterfish	-	-	-	-	435	400	435	86	1,413	-	-	486	1,848
Bluefish	-	-	-	-	1	-	1	16	-	-	-	16	1
Atlantic saury	-	-	-	-	3,415	2,144	3,415	-	-	-	-	2,144	3,415
Herring	-	-	-	23,961	43,764	92,951	67,725	17,355	4,564	-	-	110,306	72,289
Alewife	-	-	-	160	4,645	9,014	4,805	2,275	2,048	-	-	11,289	6,853
Mackerel	-	-	-	5,769	103,686	68,566	109,455	68,754	30,371	-	-	137,320	139,826
Sharks	-	-	-	2,452	12,486	9,045	14,938	2,997	8,364	-	-	12,042	23,302
Skates	-	-	370	5,241	7,957	21,423	13,568	-	-	-	-	21,423	13,568
Other species	69	2,032	4,355	7,775	11,925	28,949	26,156	3,731	5,406	-	114	32,680	31,676
Squid	-	-	7	1,824	6,381	12,885	8,212	479	595	-	-	13,364	8,807
Other molluska	-	-	-	-	30	814	30	-	-	-	-	814	30

Table 2. Mean water temperature (°C) in the Greenland end of the hydrographic section 8-A in October.

Depth (m)	1962	1963	1964	1966	1972
Region E between 58°10'N, 47°00'W and 59°25'N, 44°25'W (Atlantic component of the West Greenland current)					
0- 50	6.26	4.71	6.60	6.34	5.16
0-200	5.99	5.20	6.43	6.14	5.24
200-500	4.86	5.15	5.27	5.86	4.38
Region D between 59°30'N, 44°10'W and 59°35'N, 44°05'W (Arctic component of the West Greenland current)					
0- 50	3.44	0.11	4.56	2.60	2.12
0-200	4.10	0.15	4.93	3.08	4.16

Table 3. Mean water temperature (°C) in section 11-A (between 64°02'N, 52°45'W and 63°10'N, 58°56'W) in November.

Depth (m)	1963	1964	1966	1971	1972
0- 50	1.89	3.07	3.62	1.60	1.81
0-200	3.05	4.52	4.80	3.50	3.11
200-500	5.01	5.99	6.13	4.65	4.94

b) Grenadier. Mass measurements of roundnose grenadier, *Macrurus rupestris*, were made on board scouting and research vessels between July and September. Hauls were made at 600-800-m depths mainly on the southern slope of the Greenland Canadian sill (Div. 1C). As in previous years, males were more abundant than females, and somewhat smaller in size (Table 4).

Table 4. Size composition (‰) of grenadier in trawl catches in Subarea 1 in 1972.

Length (cm)	July		August		September	
	Males	Females	Males	Females	Males	Females
Less than 24	-	-	-	-	1	4
24-26	-	-	-	-	2	-
27-29	-	-	-	-	1	1
30-32	-	-	2	2	2	2
33-35	6	2	15	10	5	5
36-38	15	11	24	22	13	18
39-41	20	26	40	45	22	15
42-44	29	20	50	55	34	25
45-47	46	44	62	56	29	25
48-50	61	57	81	66	36	36
51-53	79	54	87	76	68	59
54-56	97	87	104	93	84	66
57-59	151	151	139	129	138	115
60-62	120	118	114	112	153	126
63-65	114	110	93	104	168	162
66-68	87	81	63	82	115	121
69-71	69	72	48	53	52	73
72-74	40	47	34	36	38	56
75-77	34	51	22	27	23	36
78-80	19	26	17	20	11	30
81-83	9	26	4	7	3	10
84-86	3	14	1	4	2	8
87-89	1	3	-	1	-	5
90-92	-	-	-	-	-	1
93-95	-	-	-	-	-	1
Number of fish	4,040	1,989	5,704	3,841	2,760	1,707
Mean length (cm)	59.48	61.21	56.93	57.66	59.70	61.54

c) Tagging and return of commercial species. As many as 400 cod were tagged in Div. 1D, and 344 Greenland halibut in Div. 1C. Among the tagged fish caught in 1972, a cod with tag number 208189 is most remarkable. It was released from a Soviet scouting vessel on 12 May 1970 at 61°34'N and 50°30'W, and was

caught by Danish fishermen on 6 September 1972 at 65°25'N and 52°48'W. When released, its overall length was 56 cm, when returned, 85 cm, weighing 4.9 kg. During the 28 months, the cod grew 29 cm. This period covers three seasons of intensive feeding and growth (May to September).

SUBAREA 2

A. Status of Fisheries

In 1972 the Soviet catch in Subarea 2 was 133,096 tons (Table 1), including 89,580 tons of cod, 17,814 tons of capelin, 5,928 tons of Greenland halibut, 7,500 tons of redfish, 2,867 tons of grenadier, 5,432 tons of flatfish, and a small amount of wolffish and other bottom species.

In the period from February through April, the cod fishery off Labrador was greatly hampered by the severe ice conditions.

As forecast in 1972 (Report on Soviet Investigations, Redbook 1972, Part II), further improvement of the trawl fishery for cod off Labrador was observed in the spring of 1973. This was the result of recruitment of the strong 1968 year-class into the commercial stock, and of the rise in water temperature on the Labrador Shelf.

In 1974, the total biomass of the Labrador cod stock will remain on a pretty high level. Fish of the strong 1968 and 1967 year-classes will be prevalent. The mean length, mean weight and average age of cod will increase to some extent. The future environmental conditions are more difficult to forecast. However, considering the 3-4 year fluctuations in hydrological conditions, it is probable that some rise in water temperature will occur off Labrador in winter of 1973-1974, as compared to the winter of 1972-1973.

B. Special Scientific Investigations

1. Environmental studies

The standard hydrographic section 8-A was made in late October 1972. At the AB part of this section which traverses the Labrador Shelf between 53°40'N, 55°44'W and 54°50'N, 53°32'W, the water temperature was lower than the average for many years (Table 5).

Table 5. Mean water temperature (°C) at the AB part of the hydrographic section 8-A over Hamilton Bank (on 1 November).

Depth (m)	1964	1965	1966	1967	1968	1969	1970	1971	1972
0- 50	0.98	1.30	2.41	2.00	2.29	0.82	1.34	0.88	0.35
50-200	-0.18	1.06	1.44	0.89	-0.18	0.36	0.31	0.43	-0.39
0-200	0.17	1.13	1.72	1.19	0.50	0.50	0.60	0.57	-0.17
200-500	0.98	-	2.47	0.95	0.31	1.64	-	1.58	1.19

Estimates obtained by the dynamic method indicated that, in 1972, the intensity of the Labrador current in the Hamilton Bank area exceeded that in any previous years. It may have been the increased water flow which caused the negative anomalies in water temperature, and the more expanded drift of floating ice around Labrador (see also ICNAF Res.Doc. 73/43 and 73/44).

2. Biological investigations

a) Cod. The length measurements (26,000) obtained during January through June were combined in order to obtain the characteristics of the size composition of cod in Div. 2J. Figure 2 shows that fish of 40-60 cm prevailed in trawl catches. The catches taken in April are most representative as far as the age composition of cod is concerned. Both immature and mature cod concentrate in Div. 2J at this month. The mature cod return from the main spawning grounds located to the north (see Report on Soviet Investigations, Redbook 1972, Part II). The results of age determination were correlated with the size row (Table 6). Fish aged 5, 6, 7 and 8 years of the 1967, 1966, 1965 and 1964 year-classes were predominant. The age of 699 individuals was determined, including 377 males and 322 females.

In 1974 the commercial stock of cod around Labrador will remain abundant because of the strong 1967 and, particularly, 1968 year-classes. Some increase in the mean length, mean weight and mean age of cod

Table 6. Age composition and mean length of cod in Div. 2J, April 1972.

Year-class	Age	Number (‰)	Mean length (cm)
1968	4	54	34.99
1967	5	193	40.12
1966	6	194	45.88
1965	7	205	51.88
1964	8	139	57.82
1963	9	88	62.11
1962	10	61	65.53
1961	11	34	67.12
1960	12	19	70.39
1959	13	5	71.02
1958	14	3	77.83
1957	15	1	73.00
1956	16	1	70.00
1955	17	1	76.00
1954	18	2	80.00

can be expected since the newly recruited young fish of the 1969 year-class are not very abundant. It is difficult to anticipate the future changes in hydrological conditions. Probably, the period of extreme cooling will come to an end and another warming period will start. This may somewhat diminish the density of cod concentrations on the continental slope of Labrador during the first months of 1974.

b) Tagging and return of commercial species. In 1972, off Labrador, the tagging program involved 2,001 samples of cod and 309 samples of Greenland halibut. The tags applied were hydrostatic transparent tagging tubes with a note inside. The tag was fixed on the fish with a flexible synthetic thread run through its back muscles.

Cod tagging was conducted in Div. 2J, mainly in December, from the SRV *Perseus III*. Return of the tagged fish, as of January 1973, indicated the cod's fast southward migration along the continental slope since the cod tagged on 23 December 1972 at 54°36'N, 53°38'W was caught on 3 January 1973 at 53°25'N, 53°03'W, and the cod tagged on 23 December 1972 at 54°26'N, 53°28'W, was caught on 26 January 1973 at 51°54'N, 50°47'W. Indeed, the singularity of the winter of 1972/73 in general was an early retreat of the basic concentrations of Labrador cod southward farther than usual, to Div. 3K (because of extreme cooling of water masses in the Labrador area).

SUBAREA 3

A. Status of Fisheries

The 1972 total Soviet catch in Subarea 3 amounted to 309,604 tons, including 104,841 tons of redfish, 80,917 tons of cod, 48,362 tons of capelin (for investigations, see ICNAF Res.Doc. 73/26), 41,081 tons of flounder, 21,157 tons of roundnose grenadier, 4,376 tons of Greenland halibut, 1,749 tons of white hake, together with modest catches of haddock, pollock, wolffish and other demersal species.

The outlook for the 1973 fishery in Subarea 3, as presented earlier (Report on Soviet Investigations, Redbook 1972, Part II), does not require any change. In 1974, the 1968 year-class will still be of primary importance in the trawl catches of cod in Div. 3N, 3O and 3P. On Grand Bank and Saint Pierre Bank, haddock will be very scarce, except as a minor by-catch in cod and flounder fisheries.

B. Special Scientific Investigations

1. Environment

Hydrographic surveys were carried out from SRV *Procion* (January-February and April-June) and SRV *Perseus III* (April-June). Water temperatures were taken at standard depths of sections 2-A, 3-A, 4-A, 6-A, 7-A and 44-A.

Impressive negative anomalies in the water temperatures from -0.1° to -2.2°C were observed in almost the whole of Subarea 3. The extreme cooling was caused, mainly, by an intense surge of Labrador Current water.

Figure 3 shows distinctly the main stream of the Current running along the eastern slope of the Grand Bank. Negative temperatures extended to a depth of 400 m.

By contrast, water temperature anomalies on the southern and southwestern slopes of Grand Bank and Cabot Strait were found to be markedly positive, apparently on account of an increased inflow of warm Gulf Stream waters (see also ICNAF Res.Doc. 73/43 and 73/44).

2. Biological investigations

a) Collection of ichthyoplankton. From 21 April through 31 May, eggs and larvae were collected from the SRV *Procion* throughout Div. 3K, 3L, 3M and 3N. Samples were taken chiefly from the standard hydrological sections with concurrent water temperature measurements at standard depths. With a net of 80 cm diameter opening as the primary catching tool, three hauls (vertical, surface and oblique) were taken at each of 196 stations.

Because similar programs to collect eggs and larvae were also undertaken in previous years, comparable data were available. Thus, the number of American plaice eggs in 1972 was found to be twice their number in the two previous years (likely due to the anomalous cooling of water masses conducive to the breeding of cold-water species).

b) Numbers of young cod and haddock. In April-July 1972, a count of young stock was made from SRV *Perseus III* in all Divisions of Subarea 3. It involved 241 check-up trawlings of one-hour duration each, made at standard stations. A total of 24,937 young cod were caught and measured for length; of these, age determinations were made of 3,967 individuals; the figures for young haddock were 1,795 and 882, respectively. The counts for 1972 and some previous years are found in Tables 7 and 8. They reveal a high concentration of the 1968 year-class of cod, both off Labrador (from the numbers of young cod caught in Div. 3K) and in the southern portion of the Grand Bank and Saint Pierre Bank. All the more recent cod year-classes were found to be much poorer (for distribution and abundance, see ICNAF Res.Doc. 73/22).

Young haddock one year of age appeared to be more numerous over southern Grand Bank in 1972 than in any of the previous years. This may be viewed as a sign of progressive recovery of the Newfoundland haddock stock. This assumption looks more probable because the cod and haddock stocks on the Grand Bank fluctuate in reverse, namely, years of abundant year-classes of cod saw, as a rule, poorer year-classes of haddock, and vice-versa.

Table 7. Mean catch (number of species) of young cod (age 1-4 years by zones) per one-hour haul by control trawl.

Year-class	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	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	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	26	28	5	13
1969	1	2	4	15	4	11	6	50	13	26	12	25	-	-	-	-
1970	1	6	1	6	1	24	3	9	-	-	-	-	-	-	-	-
1971	0	4	2	5	-	-	-	-	-	-	-	-	-	-	-	-

The past decade witnessed an increase in numbers of Newfoundland cod with a contiguous decline in the quantities of haddock. In all likelihood, a change in the opposite direction is about to occur in the area; the reason: periodicity of variations in the oceanological environment.

c) Trawl survey. Along with the commitment to survey the young stock in Subarea 3 (ICNAF Res.Doc. 73/40), SRV *Perseus III* completed a total enumeration of all demersal fishes. Deep-water redfish (*Sebastes mentella*) were found to exceed in both biomass and numbers of all other species in Div. 3K, 3N, 3O and 3P. Also, cod and American plaice outnumbered other species in Div. 3L. Of the non-commercial fish, thorny skate (*Raja radiata*) was quite numerous, an example being in Div. 3P where it ranked third in biomass after deep-water redfish and cod.

d) Tagging of commercial species. There were 1,510 individuals of cod tagged in Div. 3K and 3L, and 513 individuals of Greenland halibut in Div. 3K.

Table 8. Mean catch (number of fish) of young haddock (age 1-3 years) per one-hour haul by control trawl.

Year-class	1 year		2 years		3 years	
	3NO	3P	3NO	3P	3NO	3P
1963	-	-	-	-	2	17
1964	-	-	4	55	6	153
1965	1	13	1	41	1	4
1966	3	110	8	191	1	20
1967	1	183	1	16	1	2
1968	4	25	8	10	2	4
1969	4	35	4	38	1	5
1970	1	32	1	8	-	-
1971	9	2	-	-	-	-

e) Redfish. On the southern slopes of Grand Bank, similar to previous years, fish aged 7-10, i.e., those in the mature age bracket, made up the largest single group in the trawl catches of deep-water redfish (*Sebastes mentella*) (Table 9). As will be noted, the deep-water redfish has a markedly short life which explains why the Newfoundland population is relatively fast in replacing the losses to the commercial fishery and is less susceptible to the effects of intense fishing than the northern populations of deep-water redfish which have a shorter life span. Despite the continued increase in redfish catches in Div. 3N, 30 and 3P from year to year, no depletion of the stocks has been observed to date.

Recently, Soviet ichthyologists (V. Barsukov and G.P. Zakharov) have shown that one other species, *S. fasciatus* together with *S. mentella* and very similar to it, is found in the southern portion of Subarea 3. This redfish features a still shorter life. As a result, the Grand Bank fisheries rely on a mixture of the two species, both of which are fast maturing, and can quickly replenish their stocks.

f) White hake. In Div. 30 and 3P, white hake are found in commercial concentrations chiefly at depths of 100-250 m and in water temperatures 3°-8°C. Spawning in May-June, it normally feeds on fish and less often on crustacea. Commercial trawl catches consisted in 1972 of 3-7-year-old individuals (see also ICNAF Res.Doc. 73/39).

Table 9. Age composition and mean length of deep-water redfish in Div. 30 on 27 May 1972.

Year-class	Age	Males		Females		Males and Females	
		Number of fish (‰)	Mean length (cm)	Number of fish (‰)	Mean length (cm)	Number of fish (‰)	Mean length (cm)
1966	6	31	25.5	58	21.3	45	21.4
1965	7	156	23.3	117	23.3	136	23.3
1964	8	240	24.7	203	24.0	222	24.4
1963	9	302	26.3	203	25.9	251	26.1
1962	10	198	27.5	175	27.9	186	27.7
1961	11	31	28.3	117	28.3	75	28.3
1960	12	42	29.8	107	29.8	75	29.8
1959	13	-	-	10	34.0	5	34.0
1958	14	-	-	10	33.0	5	33.0

SUBAREA 4

A. Status of Fisheries

Silver hake. The 1972 silver hake fishery was an all-out success, with an annual catch of 113,800 tons, as against 128,600 tons in 1971, and greatly in excess of the 1967-1969 catches. The high concentration of silver hake in 1972 came about through a recruitment of the comparatively abundant 1968, 1969 and 1970 year-classes. These year-classes provided the bulk of the silver hake catches off Sable Island (Div. 4W). Thus, the contribution of 3-year-old fish of the 1969 year-class averaged 39.4% and of 4-year fish of the 1968 year-class and 2-year fish of the 1970 year-class, 23.9% and 22.2%, respectively (Table 10).

Table 10. Age composition of silver hake catches in 1970-72 (%).

Year	Age									Total	Mean age
	1	2	3	4	5	6	7	8	9		
1970	7.0	11.6	35.9	33.1	10.1	1.4	0.5	0.3	0.1	100.0	3.6
1971	-	8.8	43.2	36.8	8.8	1.2	0.5	0.5	0.2	100.0	3.4
1972	0.6	22.2	39.4	23.9	11.1	2.0	0.8	-	-	100.0	3.3

From the trawl survey data collected in the fall of 1972, the hake stocks in Subarea 4 toward the end of 1972 showed an increase over 1971. Thus, the catch per thirty minutes' enumeration trawling was 13.9 kg in 1968, 8.9 kg in 1970, 13.3 kg in 1971, and 30.3 kg in 1972. The abundant 1969 and 1970 year-classes are expected to provide the basis for stock size and catches in 1973.

Haddock. No special haddock fishery was undertaken in 1972, or in the past few years. Haddock was caught incidentally, while fishing for other species. The overall catch in Subarea 4 was 116 tons in 1972. While somewhat larger in 1972, the stocks of haddock will remain at a fairly low level in 1973, too, because of the numerical scarcity of all haddock year-classes before 1971.

Argentine. Argentine were caught on the slopes as a by-catch in the silver hake fisheries in Div. 4W and 4X mainly in April on their spawning grounds. The total catch was 5,400 tons, compared to 3,600 tons in 1971 and 1,600 tons in 1970. The argentine catch was made up, largely, of specimens 29-35 cm long and 8-12 years of age. The argentine stocks are barely usable, due especially to the ban placed on demersal fisheries in March-May to protect haddock stocks. To expand argentine catches, it will be necessary to authorize its fishery during the pre-spawning concentrations on the slopes of Browns Bank and the eastern slopes of Georges Bank.

Herring. Following a decline in fishing effort, catches of herring decreased somewhat in 1972 to 23,961 tons, as against 29,000 tons and 70,200 tons, respectively, in 1971 and 1970, but were still much ahead of the 1963-1968 catch figures. Herring fisheries being carried out, for the most part, on the slopes of Emerald and Middle Banks, made use of purse seines and occurred in April and May, and on a more limited scale, in July and June. Individuals 7-12 years old made up the bulk of the herring catches from Banquereau Bank, as did 4-9-year-olds from Emerald and Middle Banks (Table 11).

Observations from scouting vessels revealed an increase of the young herring of the 1970 year-class off Nova Scotia in 1972 which shows this year-class as apparently very abundant and very likely to replenish the stocks of adult herring in 1974.

Table 11. Age composition (%) of herring in catches from Banquereau Bank (Div. 4V) and off Nova Scotia (Div. 4WX) in 1970-72.

Stock	Year	Age															Total	Mean age
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
4V	1970	-	-	-	-	0.2	1.1	6.8	9.7	17.8	17.5	17.2	14.4	9.8	5.5	-	100	10.3
	1971	-	-	0.1	1.4	5.0	6.8	16.5	13.9	13.9	19.3	14.2	6.6	1.8	0.3	0.2	100	8.8
	1972	-	-	-	2.1	5.5	7.3	13.0	15.8	20.0	12.2	9.9	9.1	4.8	0.3	-	100	8.8
4WX	1970	0.1	0.2	1.8	10.1	26.3	19.1	23.6	10.7	5.0	1.9	1.2	-	-	-	-	100	6.2
	1971	-	-	41.4	12.0	20.4	9.2	8.2	4.8	2.4	0.8	0.2	0.6	-	-	-	100	4.6
	1972	-	-	2.5	17.9	24.9	15.3	15.9	11.8	7.7	1.8	2.0	0.2	-	-	-	100	6.1

B. Special Investigations

1. Environment

Oceanography. Close observation of the thermal regime in 1972 shows clearly that the anomalous conditions which set in last winter on the Nova Scotian Shelf were caused by an enormous outflow of cold waters from Cabot Strait and their subsequent expansion over the entire eastern part of the Shelf. Indeed, in January, the water temperature in the 0-100-m layer never exceeded 0.5°-2.5°C and, in March, it was plainly negative in the same layer in the area of Canso, Misaine and Banquereau Banks. The 0° isotherm extended along Cabot Strait to the Gali depression. At the same time, floating ice was observed in great quantities on the northern slopes of Canso, Misaine and Artiman Banks. In the winter of 1972, in Cabot Strait, the water temperature in the 0-100-m layer was the lowest since 1967.

2. Biological investigations

Argentine. In 1972, the study to locate argentine stocks was completed. As a result, individual populations have been found to exist on Browns (Div. 4X) and Sambro (Div. 4W) Banks. Using the Bertalanffy equation, the parameters of the latter's growth rate have been determined, together with their total instantaneous mortality rate which appeared to be 0.23 (see ICNAF Res.Doc. 73/24 and 73/25).

3. Trawl surveys

In August, a trawl survey was completed under the ICNAF program from MRT *Blesk*. The survey covered the entire shelf from Banquereau to Browns Banks. From 120 trawlings of 30-minute duration each, using a 27.1-m trawl, preliminary results indicating an increase in the biomass of silver hake toward the end of 1972, as against the end of 1971. SRV *Argus* performed 20 follow-up trawlings in the Emerald hollow in late October. Young silver hake aged 1-2 years were found in great quantities, thus indicating that the 1970-1971 year-classes were strong.

SUBAREA 5 AND STATISTICAL AREA 6

A. Status of Fisheries

Silver hake. In 1972, silver hake catches, because of increased stock sizes and a more intense fishery, also showed an increase in catch to 94,100 tons, as against the 1971 figure of 63,400 tons and the 1970 figure of 29,000 tons. The most productive fishing was in Subdiv. 5Ze, on the slope of Georges Bank and Nantucket Shoals, and took place from June through September. Catches consisted for the most part of 3- and 4-year-olds of the 1968 and 1969 year-classes on Georges Bank, and of 2-, 3- and 4-year-olds of the 1968, 1969 and 1970 year-classes on the Nantucket Shoals. While these year-classes can be rated comparatively good, the 1971 year-class may be expected to be still better and more abundant, and one can, therefore, expect further increase of the commercial stock in 1973 and 1974.

Haddock. Haddock were seldom found in catches. The total catch was 141 tons in 1972, killing the hope for further expansion of its catches until 1974 since all year-classes before 1970 are numerically scarce, except for the 1972 year-class which rates well above average.

Red hake. The considerable increase in hake catches in 1972 can be ascribed to an increase in stock size and a more intense fishery. The 71,300 tons of hake caught in 1972 exceeds by a wide margin the catches in 1970 and 1971. In 1972 the hake fisheries were prosecuted mainly by the BMRT-type vessels along the slopes of Georges Bank and the Nantucket Shoals from June through December. The bulk of the hake catches was provided by 3-5-year-olds on Georges Bank and 2-4-year-olds on the Nantucket Shoals. The average age composition for each year from 1969 to 1972 in Subarea 5 is given in Table 12. The Georges Bank stock, as of the early part of 1973, was assessed at 24,000 tons, and for the stock habitating the area west of 69°W, 132,000 tons. Assuming the fishery rate to be optimal, i.e., close to 50%, it could be recommended that the 1973 catches be maintained at 12,000 and 65,000 tons, respectively. Because the 1971 year-class was assessed as fecund and certain to replenish the stocks by 1974, the quota of 75,000-80,000 tons for both stocks makes a sound recommendation for 1974.

Table 12. Age composition (%) of red hake catches in Subarea 5 in 1969-1972.

Year	Age									Total	Mean age
	1	2	3	4	5	6	7	8	9		
1969	3.4	17.5	35.8	35.4	7.6	0.3	-	-	-	100	3.27
1970	-	2.5	63.8	29.2	4.2	0.3	-	-	-	100	3.36
1971	0.4	47.7	29.0	14.4	6.9	1.5	0.1	-	-	100	2.85
1972	-	13.4	40.6	23.0	11.8	6.5	3.9	0.6	0.2	100	3.72

Argentine. Argentine catches were limited in Subarea 5 until, in April 1972, dense pre-spawning accumulations of argentina were spotted down in the Georges Basin, immediately adjacent to Div. 4X. These accumulations were caught effectively by vessels of the BMRT class. The total catch to date has amounted to 32,600 tons. Because the Georges Basin stock belongs properly to the Browns Bank stock, it is not surprising to see the composition of catches in both areas essentially the same. The large number of age-groups, which make up the commercial portion of the stock, validate the view that fluctuations in abundance of this species are fairly small and will not imbalance the relatively stable condition of the argentine stock in the area for some years to come.

Herring. In the Subarea 5 and Statistical Area 6 fisheries, there is a single herring stock to deal with - the Georges Bank stock. In these areas herring catches were 48,300 tons in 1972, compared with

81,000 tons in 1971. The decline in Soviet catches in 1972 is due to the established quota of 48,200 tons. The winter and spring fisheries were conducted in shallow waters of Statistical Area 6, and the summer and autumn fisheries on Georges Bank. Essentially, the Georges Bank catches were made up of individuals 5-7 years old (Table 13), and the Statistical Area 6 catches of individuals 5-8 years old (Table 14).

Table 13. Age composition (%) of herring catches in Subarea 5 in 1970-72.

Year	Age											Total	Mean age
	2	3	4	5	6	7	8	9	10	11	12		
1970	2.8	7.3	28.3	32.1	12.0	9.2	5.0	3.0	0.3	-	-	100	5.99
1971	1.5	28.7	31.5	17.9	10.2	7.0	2.6	0.5	0.1	-	-	100	4.41
1972	1.2	1.8	5.5	42.2	25.9	15.9	5.7	1.4	0.4	-	-	100	5.70

Table 14. Age composition (%) of herring catches in Statistical Area 6 in 1970-72.

Year	Age													Total	Mean age
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1970	-	-	2.9	7.8	29.7	15.3	14.9	14.5	14.9	-	-	-	-	-	100	6.1
1971	-	-	0.8	5.9	38.1	23.9	24.0	4.9	2.4	-	-	-	-	-	100	5.57
1972	-	-	-	1.3	27.3	25.2	25.2	16.0	3.9	0.9	0.2	-	-	-	100	6.44

The catch per purse seine haul was 9.0 tons in 1972; 11.9 tons in 1971; 9.6 tons in 1970; 6.0 tons in 1969 and 13.6 tons in 1968. There was no marked downward trend in recent years. Catch per hour by SRT and SRTR trawlers remained at 16.7 tons in both 1971 and 1972 (16.7 tons). The 1970 year-class is held to be numerically above average and is to provide a broad replenishment for the herring stocks by as early as 1973.

Mackerel. Mackerel catches in Subarea 5 and Statistical Area 6, the one stock inhabitating the areas, reached 134,100 tons in 1972, as against 116,700 tons in 1971 and 124,500 tons in 1970. In most of the catches, individuals 3-6 years of age of the abundant 1966, 1967 and 1968 year-classes appeared in great numbers. The 1968 year-class, too, is far more numerous than any other year-class which appeared in 1960-1965. This indicates that the mackerel stock has been under-utilized and that it is advisable to increase catches in 1973 and 1974 over the 1972 level.

Atlantic saury. Atlantic saury is proposed now as an object for future fisheries. Its aggregations occur mainly in summer and autumn over a large area along the shelf slopes off New England and Nova Scotia. Atlantic saury fisheries have been maintained on a limited scale in October-December since 1970, using side-trap nets with attracting electric light, on the slopes of Georges Bank. The catches were, respectively, 1,100 tons, 2,100 tons and 3,400 tons in 1970, 1971 and 1972. The length of the fish in these catches varied from 20 to 39 cm but were mainly 26-32 cm and weighed 30-70 grams.

B. Special Investigations

1. Environment

Oceanography. Temperature observations on Georges Bank and juxtoposed areas, during the summer and autumn from the SRV *Argus*, show the temperature of the 0-50-m surface layer to be substantially lower than in 1971. For the intermediate (50-100 m) and bottom (100 m - bottom) layers, temperatures were either the same as, or above, those for 1971.

In June-October, SRV *Argus* completed hydrochemical surveys to determine the diluted oxygen, oxidability (permanganate), phosphates, silicon nitrites and biochemical consumption of oxygen, as well as the primary production using the oxygen method. The oxygen content of the water was found to decrease with depth; indeed, oxygen oversaturation to 105-115% was observed in the 0-30-m layer. In October, the proportion of oxygen rose somewhat, following a drop in water temperatures and more frequent gales leading to intense agitation of the water.

The biogenous elements found in the water dovetailed with the seasonal development of phytoplankton. The phosphate concentrations were observed to have reached 2.5-5.0 mkg/ℓ in August south of Cape Cod, and a maximum of 70-90 mkg/ℓ at depths of 300-500 m, with an average phosphate concentration rate of 10-20 mgk/ℓ. In June, the concentrations throughout the entire water layer stood at 35-45 mgk/ℓ to the east of the 68° meridian. The concentration of nitrites was 2-4 mgk/ℓ at bloom, and in some spots ran up to 7-8 mgk/ℓ.

The silicon concentration was 90-130 mgk/ℓ at the surface, and 120-250 mgk/ℓ in the bottom layer, but reached its maximum values of 400-500 mgk/ℓ in June east of the 68° meridian and at the offshore stations at a depth of 400-500 m.

Analysis of the biogenous element content leads one to remark on the extended time of phytoplankton blooming; indeed, the spring bloom in the south continued well into the month of June, and in the north was not over until July; the autumn bloom began in the south in July-August and ended in the north in late October. One of the foremost factors affecting the development of primary production in 1972 was a dramatic shortage of light on account of frequent fogs.

Zooplankton. In June-October 1972, collection of zooplankton was undertaken in the spawning areas for silver hake and red hake, in the 0-50-m layer, using the Bongo plankton collector (small-size model, gauze No. 38). The subsequent data processing and analysis are scheduled for 1973.

In 1972 analyses were conducted to discover the regularities governing the development of zooplankton during the vegetation period from 1964 through 1970, on the strength of collections made with a small-size model of the Judey net.

It was found that with a high rate of eutrophicity in the plankton community, there were four distinctly predominant copepod types of mesozooplankton, to wit: *Calanus finmarchicus*, *Pseudocalanus elongatus*, *Oithona similis* and *Centropagus typicus*. These species provide the basic edible organisms for planktophages (herring, young mackerel, hake, etc.).

The nature of seasonal change in the total number and biomass of plankton remains identical in different years. The peak values of both plankton number and biomass are observed to occur in June-July.

The seasonal development pattern of the indicated mass copepod species follows a certain regularity, not dissimilar to the one observed in the Gulf of Maine. Figure 4 shows plots of the biomass (mg/m^3) in August and October each year from 1964 to 1970. These show a gradual fall-off of the biomass of net sestone. The data cited above have been found to show a good fit with the changes (growth) of the thermal background index and with an enlarged number of trophycal species in the zone of exploration.

It is interesting to note that the decline in the plankton biomass is synchronous with the decline in herring stocks.

Ichthyoplankton. From June-October in 1972, SRV *Argus* carried out a series of successive surveys on Georges Bank, using the Bongo plankton collector to enumerate eggs and larvae of silver hake, red hake and herring. Preliminary analysis of the survey data on herring larvae showed that in the survey period from 22 September to 30 September 1972, 1,342 herring larvae were caught, all from the northeast portion of Georges Bank, with only one larva, 22-mm long, caught off southwestern Nova Scotia. In the survey period larvae were caught in great numbers on the spawning grounds. Their average length was 9.4 mm. As the survey proceeded to the east and northeast, there was an abrupt decline in the number of larvae, together with an increase in their average length to 10.3 mm. All the evidence at hand indicates, therefore, that spawning occurred on the northern side of Georges Bank and that the larval drift had barely begun.

From 12 through 28 October, larvae were observed over a more extensive area. This indicated that the larvae had dispersed from the Georges Bank spawning area, as well as from another spawning area off Nantucket, which had smaller larvae (average length, 8.6 mm) in impressive numbers. In all, 10,393 herring larvae were caught during the survey period in October.

2. Biological investigations

Nutrition studies of silver hake and herring larvae. For the purpose of elucidating the relation between the food supply and survival rates of silver hake and herring larvae, the samples collected on Georges Bank in 1965 and 1971 were analyzed. As in previous years, the larvae were feeding on the nauplia *Calanoida*, *Pseudocalanus* sp., *Centropages* sp., *Oithona* sp. and other organisms. Data on the frequency rates of individuals without food in their intestines give convincing evidence of more intense feeding of larvae in 1971 than in 1970 (Table 15).

Table 15. Number of larvae (%) with empty intestines.

Species	1965	1966	1967	1968	1969	1970	1971
Herring	84.5	99.9	-	92.0	80.5	95.8	87.1
Silver hake	30.0	32.8	45.2	33.3	-	13.7	12.2

In 1971 the spawning stock of silver hake was found to be less abundant than in the previous few years, while the number of larvae and fecundity of the year-class was higher, and they fed more intensely, by comparison. This leads one to believe that the availability of food at the earlier development stages is a determinant of the fecundity of silver hake in the area studied.

Surveillance of daily feeding cycles and rations of demersal fish. In July 1972 samples were obtained on the Nantucket Shoals to establish the feeding patterns of demersal fish (silver hake, red hake, yellowtail flounder, longhorn sculpin, small skate, ocean pout and goosefish) at various intervals during a 24-hour period. It appears that *Cancer borealis* and *Microdentopus dammonensis* form a major part of the ration of demersal species in that period, while the predators feed mostly on young silver hake, squid, mackerel and longhorn sculpin. The 24-hour cycles were found to have two distinct peaks of feeding intensity: the morning peak from 0600 hours to 1300 hours, and the nocturnal peak from 1900 hours to 0300 hours. The daily rations were at a fairly modest level in that period due to inter alia, low bottom water temperatures (6°C).

Yellowtail flounder. New estimates have been made to assess the natural mortality rates of yellowtail flounder (ICNAF Res.Doc. 73/31). It has been shown to be 0.6, i.e., essentially higher than the natural mortality previously accepted in calculating the stocks of the fish stock in southern New England. Also, the optimal intensity (F) for yellowtail flounder has been established at 0.7 and the total mortality (Z) always under 1.3.

Mackerel. From the age composition data, the linear and weight growth parameters have been determined for mackerel, using the Bertalanffy equation, together with the total instantaneous mortality ratio of 0.6 (ICNAF Res.Doc. 73/23).

Alewife. In 1972 age determinations were made from the otoliths of *Alosa pseudoharengus*. The findings showed that the alewife is represented in the catches by 2- to 8-year-old individuals, with 4- and 5-year-olds of the 1965 and 1966 year-classes, being by far the most numerous in 1970. The average length of the fish was estimated to be 22.6 cm and its weight, 162 g, at an age of 3; 25.3 cm and 230 g at an age of 5, and 28.0 cm and 300 g at an age of 8.

Shortfin squid. Studies of the size composition of Georges Bank squid have shown that this species tends to be represented normally by one generation in each particular year as its average length of 14 cm increases from May through October to 22 cm, while the next spring again, only small squid are found. Summer catches often bring out immature individuals; it appeared that males have gonads in October in the 3rd and 4th maturity stages, and females in the 1st and 2nd stages (on a five-point scale). Most probably, the female ovaries reach maturity during the period when the squid migrate for spawning to the open ocean. The primary food of the shortfin squid is euphausids and fish fry (5-10 cm in length). Smaller squid feed mainly on small crustacean and larger species on fish and other squid.

3. Trawl survey.

In September and October trawl surveys were carried out from the east slopes of Georges Bank to Cape Hattaras. SRTM *Blesk* completed a comparative test program, using 27.1-m and Yankee - 41 trawls. It was established that the increase in the number of silver and red hake is due to the abundant 1970 and 1971 year-classes. The stocks of yellowtail flounder remained about the same in Georges Bank and increased in the southern portion of New England.

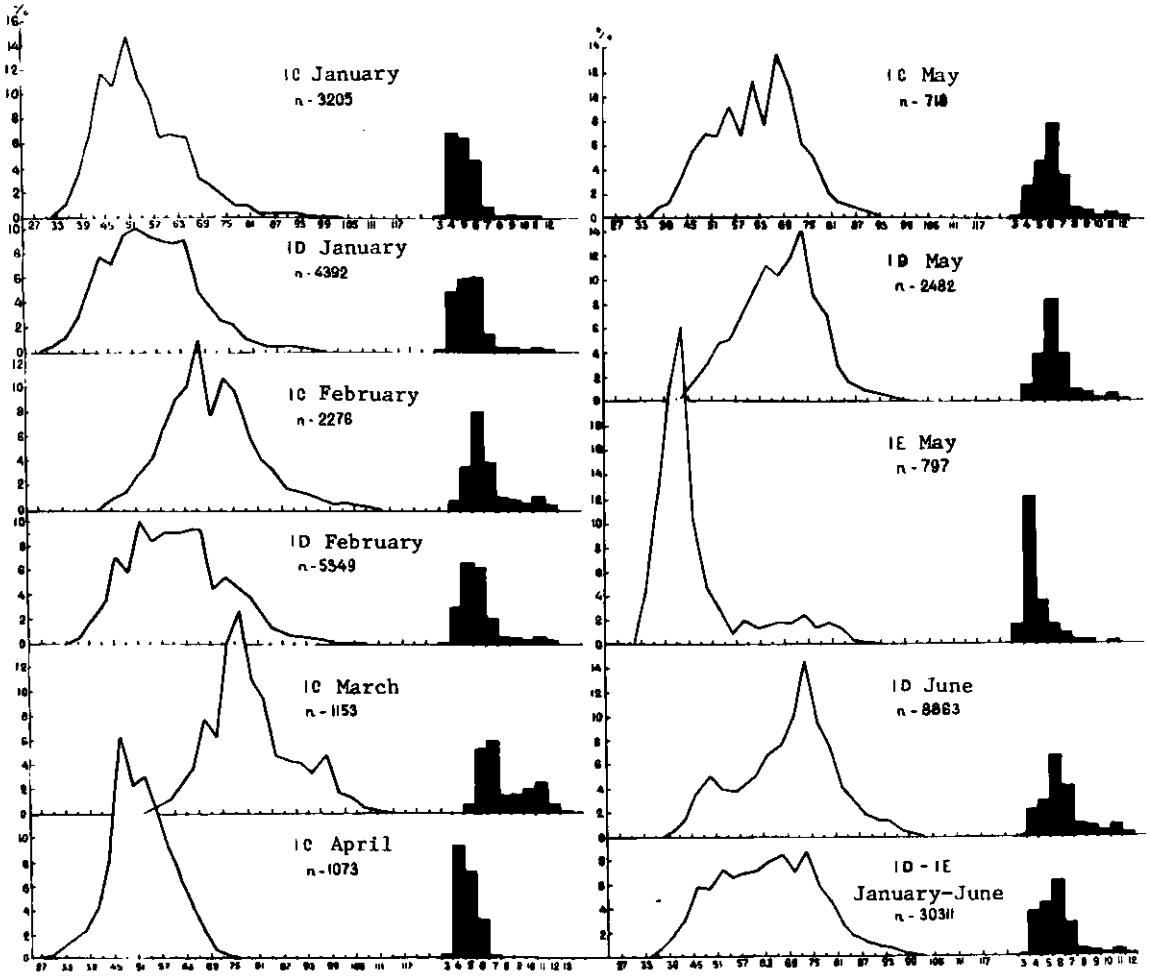

Fig. 1. Age and size composition of cod in Subarea 1.

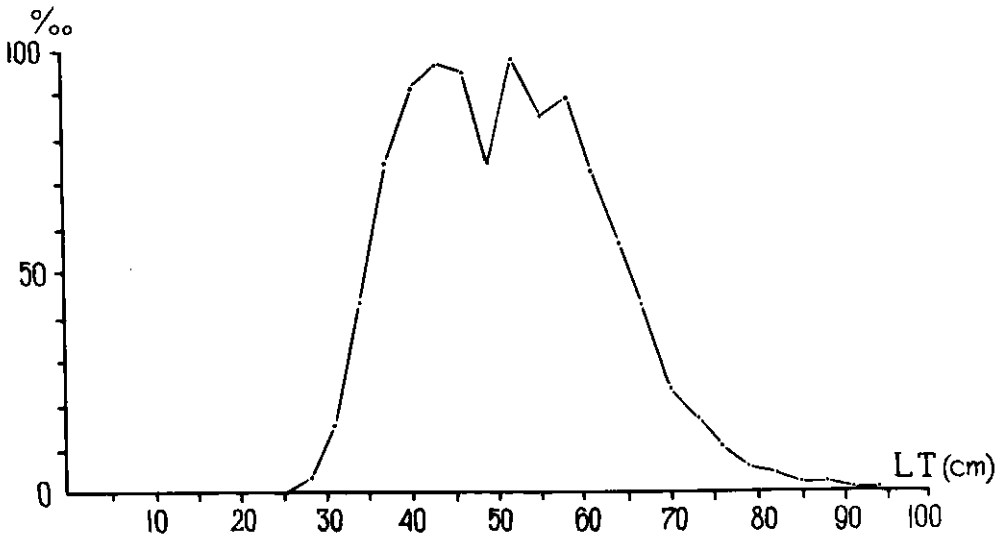

Fig. 2. Size composition of cod in Div. 2J.

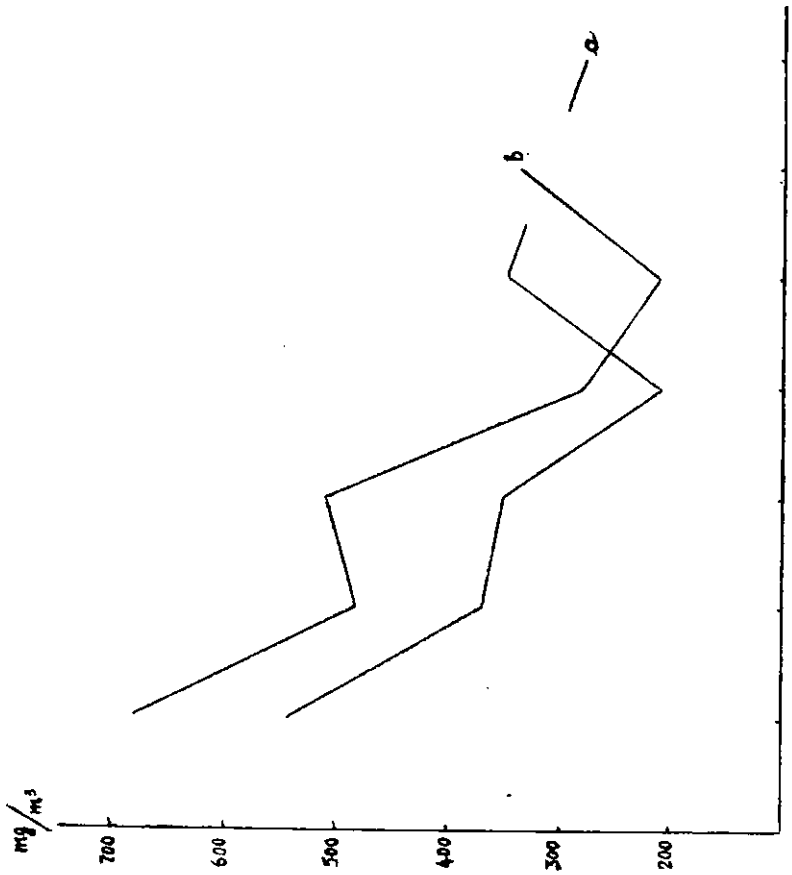

Fig. 4. Variation of plankton biomass on Georges Bank in (a) August and (b) October, 1964-70.

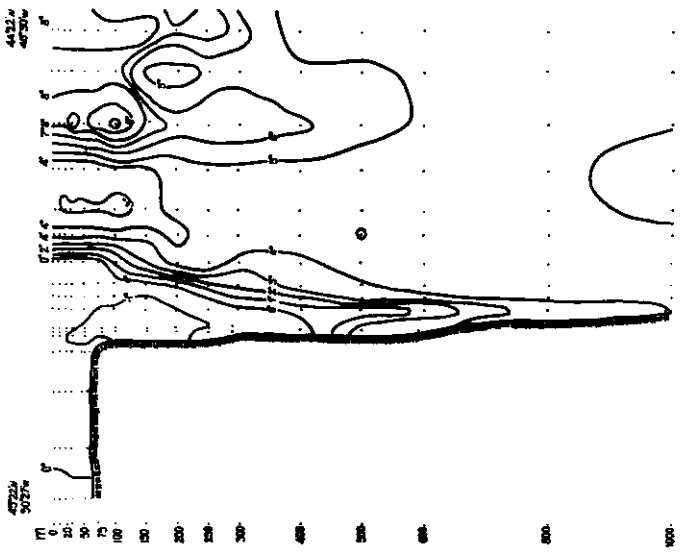

Fig. 3. Water temperature at hydrological section 3-A, 21-24 April 1972.