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The total USSR catch in the ICNAF Convention Area in 1969 was 875,265 tons (Table 1), i.e. 133,965 tons more than in 1968.

There was a considerable increase in the catches of silver hake (particularly in Subarea 4), red hake, ocean pout and butterfish (in Subarea 5) and redfish (in Subarea 3).

The total herring catch increased slightly (by 14%), but its distribution over the fishing area was different as compared to that in 1968: there was a decrease in the catch in Subarea 5 and a sharp increase in Subarea 4.

The catches of cod and grenadier decreased.

S u b a r e a 1

A. Status of the Fisheries.

The USSR commercial fleet did not operate in Subarea 1. 245 tons of cod, grenadier, halibut and redfish were caught by scouting vessels, mainly in the summer months.

B. Special Research Studies.

I. Environmental Studies.

In September hydrographic Section 10-A was worked by R/V "Persey-III"; its eastern part (between 65°33'N, 53°45'W and 65°03'N, 58°16'W) crosses the West Greenland Current. As seen from Table 2, 1969 may be closed with the cold years. The cooling is most pronounced in the 200-500 m layer.

Table I. Species composition of the USSR catch in the Convention Area, 1968 and 1969.

Species	1969 (by subarea)					1969 total	1968 total
	I	2	3	4	5		
Herring	-	-	-	65,609	100,463	166,072	129,758
Argentine	-	-	-	4,075	1,632	5,707	3,374
C O D	21	130,550	56,882	2,784	646	190,883	245,956
Haddock	-	-	-	235	65	300	3,159
Pollock (saithe)	-	-	-	62	165	227	454
Silver hake	-	-	-	46,323	66,826	113,149	47,299
Red hake	-	-	-	1,358	45,051	46,409	11,873
Grenadier	68	651	11,682	-	-	12,401	26,812
Flounders	-	6,842	35,515	12,914	27,419	82,690	99,144
Greenland Halibut	123	7,386	2,814	-	-	10,323	6,515
Redfish	33	5,212	70,119	2,152	15	77,531	35,364
Wolffish	-	169	111	31	-	311	844
Ocean pout	-	-	-	89	19,996	20,085	4,324
Scup	-	-	-	14	200	214	1,782
Alewife (Pomolobus)	-	-	-	-	25,147	25,147	21,235
Mackerel	-	-	-	4,075	47,547	51,622	43,522
Butterfish	-	-	-	15	6,479	9,494	1,596
Sea robin	-	-	-	-	1,758	1,758	1,130
Angler fish	-	-	1,745	3,295	2,069	7,109	4,639
Dogfish and skate	-	-	2,562	2,633	12,630	19,825	13,582
Squid	-	-	-	65	1,182	1,247	2,473
Other	-	3,628	7,462	3,766	17,906	32,762	33,465
Total	245	154,437	188,892	151,495	380,196	875,265	741,300

Table 2. Average September water temperature (°C) along Section 10-A crossing the West Greenland Current.

Depth (m)	1961	1962	1963	1964	1966	1967	1969
0-50	4.20	4.70	4.25	4.38	2.72	1.62	2.75
0-200	2.78	2.92	3.25	2.83	2.81	0.97	1.25
200-500	3.60	3.98	3.34	4.84	5.02	3.50	3.26

II. Biological Studies.

Cod. In May-June over 2,5 thousand cod caught by the bottom trawl on the central West Greenland banks were measured on board the scouting vessel "Neptun" (Table 3): Length compositions based on Table 3 data show a peak (major or minor) on the right-hand side at 72-74 cm. The peak seems to be formed mainly by the 1962 year-class fish. Around 50 cm long fish were also relatively abundant. They probably belonged to the 1965 year-class. There is strong evidence pointing to this being a fairly rich year-class. This seems to be even more likely when it is considered that in 1965 a poor cod generation appeared in the Barents Sea and the strength of cod year-classes in the Barents Sea and in the West Greenland area tends to changing conversely.

Table 3. Size composition of cod catches (°/oo) in the West Greenland area, 1969.

Length, cm	May, 1 D	June	
		1 C	1 D
30 - 32			5
33 - 35	1		7
36 - 38	1		19
39 - 41	3		20
42 - 44	10	10	32
45 - 47	22	17	89
48 - 50	58	112	106
51 - 53	86	130	74
54 - 56	72	46	35
57 - 59	109	35	19
60 - 62	115	59	30
63 - 65	66	53	28
66 - 68	66	81	57
69 - 71	64	91	72
72 - 74	72	131	116
75 - 77	70	78	105
78 - 80	61	74	57
81 - 83	52	53	58
84 - 86	25	10	33
87 - 89	17		14
90 - 92	17	17	13
93 - 95	4		5
96 - 98	6	3	3
99 - 101	1		2
102 - 104	1		1
105 - 107	1		
Total, °/oo	1000	1000	1000
No of fish	1,381	285	953
Mean length	65.47	65.17	63.88

S u b a r e a 2

A. Status of the Fisheries

The annual catch is given in Table 4.

Table 4. The annual catch per hour trawling (metric tons)

Div	Total catch by trawls of all types (mt)							Average catch per hr trawling by BMRT
	Cod	Grena- die ^o	Red- fish	Floun- ders	Hall- but	Others	Total	
2C	248	387	48	20	215	26	944	1.86
2H	7,006	-	99	114	523	167	7,909	2.06
2J	123,295	264	5,064	6,708	6,648	3,605	145,584	3.23
Subarea 2	130,549	651	5,211	6,842	7,386	3,798	154,437	3.14

B. Special Research Studies.

1. Environmental Studies.

In July hydrographic Section 8-A across Hamilton Inlet Bank was made by the R/V "Persey III". Along the AB portion of the section between 53°40'N, 53°44'W and 54°50'N, 53°32'W the water temperature in the 0 - 200 m layer, as on July 15, was - 0.40°C, i.e. 0.49°C lower than the long-term summer average. Thus, the hydrographic forecast given in the USSR Research Report (ICNAF Redbook 1969, Part II) has come true.

In November hydrographic Section 8-A was repeated by the R/V "Rossiya" and again the water temperature in the 0-200 m layer (as on November 1) along the portion of the section crossing Hamilton Inlet Bank was found to be lower than the long-term normal; the temperature in the 200-500 m layer was found to be slightly higher than the long-term normal (Table 5).

Table 5. Average water temperature (0°C) along the AB portion of Section 8-A across Hamilton Inlet Bank (November 1).

Depth (m)	1958	1962	1964	1965	1966	1967	1968	1969	1958-1969	1969
									average	anomaly
0-50	1.28	1.58	0.98	1.30	2.41	2.00	2.29	0.82	1.58	-0.76
50-200	0.59	1.34	-0.18	1.06	1.44	0.89	-0.18	0.56	0.69	-0.13
0-200	0.79	1.49	0.17	1.13	1.72	1.19	0.50	0.50	0.94	-0.44
200-500	-	1.70	0.98	-	2.47	0.95	0.31	1.64	1.34	+0.30

II. Biological Studies.

1. Cod.

a) Age composition. As seen from Table 6 trawl catches taken off South Labrador in January-March were dominated by cod at the age of 6,7 and 8 full years belonging to the 1963, 1962 and 1961 year-classes. As repeatedly shown earlier (e.g. ICNAF Redbook 1969, Part II) the strength of these year-classes is slightly higher than the long-term average level. This conclusion is also supported by the results of young cod surveys. Table 11 shows that in Division 3K (where young cod are to be found which are brought by currents from the spawning grounds on the continental slope of the Labrador area) the three-year-olds and the four-year-olds belonging to the 1961, 1962 and 1963 year-classes were slightly more numerous than the three- and four-year-olds of other generations. By being gradually recruited to the commercial stock the cod of the three successive abundant year-classes contributed to an increase in the yield of the trawl fisheries in the Labrador area in 1968 and 1969.

Table 6. Age composition of cod (°/oo) from bottom trawl catches in the South Labrador area (Div. 2J)

Year-class (age)	January	February	March
1966 (3)	18		
1965 (4)	110	38	28
1964 (5)	157	130	92
1963 (6)	219	303	200
1962 (7)	139	235	213
1961 (8)	115	170	190
1960 (9)	67	50	107
1959 (10)	53	33	63
1958 (11)	51	18	37
1957 (12)	39	7	20
1956 (13)	22	12	23
1955 (14)	6	2	11
1954 (15)	2	2	7
1953 (16)	2		7
1952 (17)			1
1951 (18)			1
Total, °/oo	1000	1000	1000
No of fish	510	600	898
Mean age, years	7.08	6.89	7.73

b) Yields and forecast of cod fishery. Another factor which caused an increase in the yield of the trawl fishery in 1968 and 1969 was the pattern of cod distribution on the continental slope of the Labrador area. In hydrographically colder years the wintering and spawning cod keep southward and deeper than in warmer years. The descent of cod to deeper layers contributes to an increase in the density of the concentrations. Fig.1 shows the profile of the continental slope in the Labrador area. It can be seen that within the depth range of 300 to 400 m the cod concent-

rate on a smaller area (and thus form denser concentrations) than within the depth range of 200 to 300 m. The horizontal and vertical distribution of the Labrador cod in the first quarter of the ~~year~~ year was found to be closely related to the water temperature in the 50-200 m layer recorded in November of the ~~preceeding~~ ^{previous} calendar year. As shown by Table 5, on November 1, 1968 the water temperature along Section 8-A was lower than the long-term normal. This circumstance (combined with the recruitment to the commercial stock of individuals belonging to three relatively abundant year-classes) contributed to the higher ^{productivity} ~~yield~~ of the trawl fishery in the first quarter of 1969 (Fig.2).

Before the start of 1970 the water temperature along Section 8-A was also lower than the long-term normal, but the difference was quite small. Since the cooling and the warming of the sea occur periodically each 3 or 4 years the negative anomaly along Section 8-A may by November 1970 change into a positive one, which will affect unfavourably the ^{productivity} ~~yield~~ of the Labrador cod trawl fisheries in the first quarter of 1971. Besides, by 1971 the commercial stock of the Labrador cod may decrease because the relatively abundant 1961, 1962 and 1963 year-classes will have almost lost their significance for fishery whereas the new year-classes are less abundant. Consequently, in the first quarter of 1971 the commercial trawlers fishing in the Labrador area will probably have a slightly lower catch per hour trawling or day of fishing than in 1968 and 1969.

c) Marking. 2,338 cod were marked with hydrostatic tags and released in the South Labrador area (Div. 2J). Some of the tagged fish have been recaptured and the comparison of the release and recapture positions shows that the tagged fish (Table 7, Nos 1-2)

performed typical summer migrations from the continental slope shoreward.

Table 7. Data on the release and recapture of some tagged cod.

N/N	Released				Tag number	Recaptured			
	Date	Latitude (N)	Longitude (W)	Length of fish (cm)		Date	Latitude (N)	Longitude (W)	Country
1	May 20 1969	52°35'	53°48'	59	50251	July 4 1969	52°20'	55°50'	Canada
2	May 20, 1969	52°47'	53°46'	59	50468	July 7, 1969	51°32'	55°40'	Canada
3	April 21 1964	53°53'	53°20'	59	61637	April 10, 1969	56°14'	57°40'	Poland
4	April 25 1964	54°52'	54°45'	58	38005	April 10, 1969	56°14'	57°40'	Poland
5	June 30, 1964	54°55'	53°45'	50	57446	March 30, 1969	54°50'	54°05'	Poland

In 1969 some cod were also recaptured which had been tagged in the Labrador area in earlier years, e.g. in 1964 (Table 7, Nos 3-5). Thus it seems that the cod may carry the hydrostatic tags used by Soviet fishery biologists without shedding them for 5 and more years.

2. Redfish.

Table 8 shows the age composition of deepwater redfish (*Sebastes mentella* Travin) caught at the depth of 480-490 m on the eastern slope of Hamilton Inlet Bank in January. It is interesting to note that both for males and females the age composition has two peaks. One of the peaks is formed by small immature fish at the age of 10-11 years and the other by big mature fish aged 20 and more years. The fish of middle ages (13-15 years) are less numerous.

The double-peaked age (and length) composition of both mentella- and marinus-^{species of}~~type~~ redfish is a typical phenomenon observed in different areas of North Atlantic, the Norwegian and the Barents Seas. This phenomenon may be explained by the mixing of two (or several) ^{stocks}~~masses~~ differing in age, length and growth rate. But there may be another explanation which seems to be more correct: during the middle period of their life redfish disperse in the mid-layers and comparatively rarely descend to the bottom.

Table 8. Age composition of mentella- type redfish from bottom trawl catches in Division 2J in January.

Year-class (age)	Males	Females
1962 (7)	8	13
1961 (8)	41	44
1960 (9)	73	63
1959 (10)	65	95
1958 (11)	180	89
1957 (12)	81	44
1956 (13)	57	32
1955 (14)	57	57
1954 (15)	65	19
1953 (16)	81	6
1952 (17)	57	32
1951 (18)	41	50
1950 (19)	32	95
1949 (20)	81	70
1948 (21)	49	89
1947 (22)	24	95
1946 (23)	8	63
1945 (24)		25
1944 (25)		6
1943 (26)		13
Total, ‰	1000	1000
No of fish	123	158
Mean age, years	14.14	16.21

The movement of redfish to mid-layers is probably associated with intensive feeding before the onset of sexual maturation and it is common knowledge that redfish feed only on bathypelagic but

not on bottom organisms. During this period ^{of their life} redfish rarely occur in bottom trawl catches.

3. Grenadier.

In October concentrations of grenadier (*Macrurus rupestris*) were found in the North Labrador Division at the depth of 520 to 800 m. Of the 2,851 individuals measured 64.6% ranged from 60 to 74 cm (inclusive), the mean length was 67.1 cm. Some individuals were 90 cm long but all the fish were immature. The stomach contents were dominated by bathypelagic invertebrates (mainly ~~Themisto~~ Themisto) and fish (most often lantern anchovy). The successful autumn feeding was evidenced by the high fatness of the grenadier (liver weight to total fish weight relation), which averaged 11.3%.

In October 1,323 grenadier were measured which had been caught by a bottom trawl at the depths from 465 to 940 m in the Central Labrador Division. The mean length was 58.6 cm, i.e. less than that of grenadier caught in the North Labrador area. The males were also more numerous than females and no mature individuals were found in the catches. The food composition was the same and the fatness was 8.8%.

S u b a r e a 3

A. Status of the Fisheries.

The annual catch is given in Table 9.

Table 9. Annual catch and catch per hour trawling (metric tons)

Div.	Cod	Grenadier	Redfish	Phaun- ders	Half- but	Other	Total	Average catch per hour traw- ling by BMRT
3K	23,895	11,682	8,246	7,147	1,836	3,865	56,671	2.10
3L	665	-	391	533	57	141	1,787	1.65
3M	283	-	2,061	113	-	94	2,551	2.34
3N	8,384	-	22,068	9,324	441	3,268	43,485	2.11
3O	20,789	-	15,344	14,058	461	3,204	53,856	2.18
3P	2,866	-	22,009	4,340	19	1,308	30,542	2.47
Subarea 3	56,882	11,682	70,119	35,515	2,814	11,880	188,892	2.13

B. Special Research Studies.

I. Environmental Studies.

Temperature observations were made along standard hydrographic Sections 1-A, 2-A, 3-A, 4-A and 6-A.

Particular attention is to be given to the eastern portion (H₂) of Section 6-A (between 47°00'N, 46°30'W and 47°00'N, 46°00'W). The temperature along this portion of the section characterizes the intensity of the North Atlantic Current (Table 10).

Table 10. Water temperature (0°C) along H₂ of Section 6-A in April 1968 and 1969.²

Depth (m)	April 14, 1968	April 26, 1969
0 - 50	4.03	5.36
50 - 200	4.37	4.94
0 - 200	4.30	5.04
200 - 500	4.80	4.48

Thus, in the spring of 1969 the North Atlantic Current seems to have been more intensive than in the spring of 1968.

II. Biological Studies.

Cod. As in previous years young cod survey was made in Sub-area 3. Results for some Divisions are presented in Table 11.

Div. 3K contains young fish which at the stage of egg or larva are brought by currents from the spawning grounds off Labrador. The best indication of a year-class strength is the catch of young fish at the age of 2+.

Young fish aged 0+ and 1+ keep near the shore and rarely occur in our sampling trawls. At the age of 3+ cod often reach the length at which they are already placed into the group of "adult" fish. Besides, at the age of 3+ cod start moving ^(from Div. 3K) northward to the Labrador area.

Table 11 shows that young cod at the age of 2+ belonging to the 1961, 1962 and 1963 year-classes were fairly numerous in Div. 3K. It was mentioned above that these year-classes formed the bulk of trawl catches off South Labrador in 1969. The same year-classes predominated in Div. 3K (Table 12) where the cod of the same stock as in the Labrador area are to be found.

Table 11. Average catch (number of fish) of young cod per hour trawling with the sampling trawl.

Year-class	0+			1+			2+			3+		
	3K	3H	3P	3K	3H	3P	3K	3H	3P	3K	3H	3P
1958							10	1	0			
1959							21	8	1	4	1	1
1960				5	3	0	11	1	2	5	1	0
1961	1	1	1	3	4	3	20	5	1	6	4	1
1962	1	1	7	2	8	2	15	18	2	12	6	1
1963	1	1	1	1	5	1	36	30	1	17	7	3
1964	1	41	24	3	137	13	8	73	42	58	16	7
1965	1	1	1	1	14	12	15	23	20	25	60	9
1966	1	2	15	3	27	17	27	37	34	28		
1967	1	1	2	8	3	4	20					
1968	1	6	18	40								

Table 12. Age composition of cod (°/oo) from bottom trawl catches on North Newfoundland Bank (Div. 3K)

Year-class (age)	March	April	May
1965 (4)	17	37	20
1964 (5)	127	136	153
1963 (6)	280	234	260
1962 (7)	263	237	210
1961 (8)	163	197	247
1960 (9)	63	57	50
1959 (10)	27	63	27
1958 (11)	7	20	20
1957 (12)	27	13	3
1956 (13)	7	-	7
1955 (14)	10	3	3
1954 (15)	3		
1953 (16)	3	3	
1952 (17)	3		
Total, °/oo	1000	1000	1000
No of fish	300	300	300
Mean age, years	7.15	7.08	6.96

Coming back to Table 11 it can be seen that the 1964 and 1965 year-classes seem to be slightly less successful than those of the ^{previous} preceding years. This may unfavourably affect the abundance of the commercial stock of Labrador cod in 1971. In later years though, the stock may be expected to become more abundant again due to the very good 1966 year-class.

Table 11 also clearly shows the extremely high strength of the 1964 year-class on the southern slopes of Grand Bank and on St. Pierre Bank (Div. 3N, 3O and 3P). This explains the sharp in-

crease in cod catches in these areas in 1967-1969. It should be noted that the 1965 and 1966 year-classes are also good year-classes. The 1967 year-class is considerably poorer but the 1968 year-class seems to be very good.

Haddeek. During the past decade none of the haddock year-classes on the southern Grand Bank was good. One of the reasons could have been the generally severe hydrographic conditions which were favourable for the spawning of cod but not haddock

which is a much warmer-water species. The haddock stock on the southern slopes of Grand Bank was replenished mainly by young fish brought from St. Pierre Bank. During the past decade the best year-classes there were those of 1966 and 1967 but they were not nearly so good as the long-term average.

The young haddock survey and the analysis of the vertebrae numbers enabled the Soviet fishery biologists to reach the conclusion that in 1968 young haddock of local origin appeared on the southern slopes of Grand Bank. It is felt that now we have the first indications of the restoration of the South Newfoundland haddock stock.

Redfish. Regular redfish studies have been long conducted on Flemish Cap Bank where the Soviet commercial fleet started fishing as far back as 14 years ago. 3,197 ~~mentella-type redfish~~ ^{Sebastes mentella} were measured on Flemish Cap Bank in September 1969. The mean length was 32.53 cm for males and 33.48 cm for females.

As is known intensive fishery may cause a decline in the abundance of the ~~mentella-type redfish~~ ^{S. mentella} but their mean length in trawl catches has never been observed to decrease. The USSR Research Report, 1966 (Redbook 1967, Part II) quoted the mean lengths of the male and female ~~mentella-type redfish~~ ^{of the S. mentella} caught on Flemish Cap Bank in August 1962, 1964 and 1966. In September 1969 the mean lengths of males and females were slightly lower (by 1 and 2 cm respectively) but this cannot be considered as an indication of the diminishing size of the ~~mentella-type~~ redfish because the size composition of this fish changes with depth, month and the slope of the Bank. This matter is considered in more detail in a separate report.

Regular observations permitted the conclusion to be drawn as to the age at which ~~mentella-type redfish~~ ^{S. mentella} reach maturity in different areas (Table 13).

Table 13. The age of mass maturation of ^{S. mentella}~~mentella-type~~ ~~redfish~~ in different areas.

Area	Males	Females
South Labrador	11	13
North-eastern slope of Grand Bank	9	11
Southern slopes of ^V Grand Bank	8	10
Flemish Cap Bank	11	13

It can be seen that the first to reach maturity are redfish from the southern slope of Grand Bank. Commercial trawl catches of this fish always consist of though small (mainly 25 to 35 cm) but mature individuals. It should be noted that on the south-eastern slope of Grand Bank ^{S. mentella}~~mentella-type~~ redfish are slightly bigger than on the south-western slope because the biggest individuals generally move from the western to the eastern part of the Bank.

Grenadier. From June to December (inclusive) 9,737 grenadier (^{Macrurus}~~Macrurus~~) were measured in Div. 3K of which 5,846 fish were 45 to 62 cm long. As in other areas of the North American continental slope there was a sharp predominance of males in trawl catches (in August-December they formed 69.2% of the total, see Table 14).

No mature fish were found. The dominating food items found in the stomachs were shrimp, squid, ~~Thamno~~, Cumacea and fish. The average liver weight in November was 6.1% of the weight of fish.

By using an original method it was possible to obtain the first data on the age and growth rate of the North-American grenadier. These fish grow very slowly; the males of medium size (with the weight of 500 to 700 gm and the length of 65 to 70 cm including the tail) are aged 12 to 14 years. Females are slightly superior to males in both linear and weight growth.

Marking of commercial fish. Table 15 gives the numbers of fish tagged in various Newfoundland divisions.

Table 15. Tagging of commercial fish in Subarea 3.

Div.	Cod	American plaice	Yellowtail + Roundeye	Other	Total
3K	142	-	-	-	142
3L	1,854	26	-	2	1,882
3N	-	379	1,017	6	1,402
3O	345	36	31	28	440
3P	-	100	-	-	100
Subarea 3	2,341	541	1,048	36	3,966

Table 14. Length composition of grenadier (°/oo) in Div. 3K in November 1969.

Length (cm)	Males	Females
27 - 29	1	
30 - 32	2	
33 - 35	4	5
36 - 38	6	9
39 - 41	17	23
42 - 44	28	35
45 - 47	50	57
48 - 50	87	106
51 - 53	110	120
54 - 56	81	85
57 - 59	100	94
60 - 62	140	129
63 - 65	99	71
66 - 68	69	68
69 - 71	83	73
72 - 74	60	51
75 - 77	38	38
78 - 80	14	19
81 - 83	6	11
84 - 86	4	5
87 - 89	1	1
Total °/oo	1000	1000
No of fish	1,780	791
Mean length (cm)	59.4	58.7

S u b a r e a 4

A. Status of the Fisheries

Silver hake. The catch of silver hake increased sharply from 3.4 thousand tons in 1968 to 46.4 thousand tons in 1969. (Table 16) This increase is explained by the fact that commercial concentrations of silver hake appeared which were successfully fished by the BMRT-type vessels from spring to autumn. In 1966-1968 commercial concentrations were insignificant due to the depression of the stock and in those years silver hake were caught incidentally in fishing for other species.

Table 16. Silver hake catches in Subarea 4 in 1962-1969 (metric tons)

Year	1962	1963	1964	1965	1966	1967	1968	1969
Catch	8,825	123,023	81,147	49,987	10,323	2,476	3,441	46,323

In spring silver hake were caught at depths of 150-300 m on the southern slopes of Emerald Bank. Mackerel, herring and argentine were caught along with silver hake. In summer silver hake were fished on the slopes of Emerald and Middle Banks and on the Sable Island shoal. In autumn the proportion of silver hake in catches decreased and that of flounder and herring increased.

Silver hake was represented in catches by specimens with the body lengths ranging from 24 to 35 cm. Samples for age composition were taken in the 1-st, 2-nd and 4-th quarters of the year. In the 3-rd quarter when most of the catch was taken no samples for age studies were obtained. The age composition based on the samples taken in the 1-st, 2-nd and 4-th quarters is presented in Table 17.

Table 17. Age composition of silver hake in the Sable Island area in 1962-1969 (%).

Year	Age 1	2	3	4	5	6	7	8	9	Total (%)	Mean age
1962	27.70	36.96	20.93	9.09	2.11	0.21	+	+	-	100.0	2.19
1963	0.04	6.38	56.42	31.1	5.66	0.31	0.05	0.03	0.01	100.0	3.37
1964	0.28	2.23	31.57	45.13	16.41	3.96	0.42	-	-	100.0	3.89
1965	-	0.21	20.10	50.84	24.46	2.28	0.11	-	-	100.0	4.09
1966	-	13.10	22.80	38.50	22.30	3.20	0.10	-	-	100.0	3.80
1967	-	0.7	14.8	61.0	19.4	3.6	0.5	-	-	100.0	4.12
1968	0.3	11.1	31.9	34.9	15.7	5.3	0.7	0.1	-	100.0	3.74
1969	6.0	5.9	37.2	34.1	11.9	3.3	1.1	0.5	100.0	3.57	

The age composition of silver hake changed in the course of the year, with ^{the} number of two- and three-year-olds higher in autumn than in spring. This suggests that the stock is now replenished by the new 1966 and 1967 year-classes which are better than those of 1964 and 1965 and thus in 1970 the silver hake stock may be expected to remain at the 1969 level.

Haddock. In 1969 the haddock catch dropped to 0.2 thousand tons (Table 18). This is the lowest catch on record for the fishery. The decline in catches is explained mainly by the low-abundance of the stock and by the fact that fishing vessels started fishing for other species. It was not possible to sample haddock for size and age composition as practically only individual specimens were caught.

Table 18. Haddock catches in Subarea 4 in 1962-1969 (metric tons)

Year	1962	1963	1964	1965	1966	1967	1968	1969
Catch	2,567	3,701	5,499	45,458	20,566	753	589	235

No changes in the catch trend are expected in 1970 as compared to 1969 because all year-classes recruited to the stock are poor.

Argentine. The catch increased to 4.1 thousand tons in 1969 compared with 1.6 in 1968 but remained considerably lower than the catch in 1966 (Table 19). Generally, the Argentine fishery is underdeveloped and does not reflect the condition of the stock. At present Argentine is a potential object of fishery.

Table 19. Argentine catches in Subarea 4 in 1963-1969 (metric tons)

Year	1963	1964	1965	1966	1967	1968	1969
Catch	8,127	4,943	5,611	14,983	4,191	1,589	4,075

Argentine were mainly caught at depths of 150-250 m as a by-catch in the hake fishery on the slopes of Middle, Emerald and Browns Banks in spring and autumn.

In the catches taken by scouting vessels in the area of Emerald and La Have Banks in February, March and April argentine was represented by specimens at the age of 2 to 15 years (Table 20)

Table 20. Age composition of argentine from catches by scouting vessels in Subarea 4 in February-April 1969

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number (\$)	0.1	0.1	0.5	6.3	9.2	17.9	27.9	24.7	8.1	2.7	1.6	0.1	+	0.8

It is evident from the table that the bulk of the catch consisted of specimens at the age of 6 to 10 years and the modal age-groups were those of 8 and 9.

Mackerel. In 1969 the mackerel catch dropped to 4.1 thousand tons as compared to 9.4 thousand tons in 1968. The decline in the catch is explained by the fishermen paying more attention to fishing for other species, in particular for herring. The mackerel stock is not fished intensively and this species may be considered a potential object of fishery in this area.

Herring. Until 1969 in the area of Browns, Emerald and Banguereau Banks off Nova Scotia herring was caught in insignificant quantities in fishing for other species. From 1962 to 1968 the catches ranged from 0.6 to 5.9 thousand tons with the average of 2.5 thousand tons (Table 21).

Table 21. Herring catches in Subarea 4 in 1962-1969.

Year	1962	1963	1964	1965	1966	1967	1968	1969
Catch	900	2,700	2,500	5,900	2,200	600	2,800	65,609

In 1969 the herring catch rose sharply due to the intensification of the fishery on the slopes of Banguereau Bank in January-May. Herring concentrations were observed at the depths of 40 to 200 m in the eastern and south-eastern parts of the Bank in the near-bottom layers with the water temperature of 0.3 to 2.0°C. Concentrations were very dense and stable until May when herring

started their migration to the inshore waters of Cape Breton and the concentrations became more active. At the beginning fishing was conducted with pelagic trawls from the "Atlantic"-type RTM vessels but in March SRT and SRTR vessels also joined the fishery using pair seining and purse seining methods.

During the entire period the catches were high: for RTM the average catch per hour trawling was 8.6 t, for SRT and SRTR it was 1.3 t (pair seining) and 22.1 t (purse seining) per haul.

In winter and spring herring was represented in catches by specimens ranging from 25 to 43 cm in length; mean length was 34.6 cm (Fig.3).

The age composition of herring from two 450- fish samples taken in February is also given in Fig. 3. The age ranged from 4 to 12 years. Nine-year-olds were predominant (25.7%).

B. Special Research Studies.

I. Environmental Studies.

Hydrography. In 1969 hydrographic observations were continued^{by} conducting standard seasonal surveys (the station grid is given in the USSR Research Report, Redbook 1967, Part II). Temperature measurements were also taken on scouting vessels searching for fish concentrations. Four standard hydrographic surveys were conducted during the year: in January, April, August and October. The analysis of data shows that in 1969 the water temperature was higher than in 1968. In the area of the Nova Scotian channel the temperature near the bottom ranged from 5 to 10°C during the year whereas in 1968 it was 2 to 3°C lower (Fig.4). Elsewhere, the water temperature was at the level of 1968.

II. Biological Studies.

Argentine. A comparison was made of the meristic characters of argentine caught on the southern slopes of Browns Bank and on the slopes off Sable Island. The following characters were compared: the number of rays in the anal, pectoral, dorsal and pelvic fins; the number of gill rakers on the first arch and the number of vertebrae. Reliable differences were found in the number of vertebrae and the number of rays in the anal fin. On the average, the number of the anal fin rays and the vertebrae number were

found to be higher in argentine caught on Browns Bank than in the fish caught at Sable Island. Differences in growth rate were also observed. At the same age the Browns Bank argentine are longer than the Sable Island fish.

Joint USSR-US groundfish surveys in Subarea 4. During the joint USSR-US surveys in November and December, 95 hauls were made by SRTM N 806 "Ecliptika" with the American N 36 trawl and the 26.4 m Soviet redfish trawl. The hauls were made at random stations in the area of Banquereau, La Have and Browns Banks. The material obtained is being processed.

S u b a r e a 5.

A. Status of the Fisheries.

Silver hake. In 1969 the silver hake catch in Subarea 5 was 66.8 thousand tons (Table 22).

Table 22. Silver hake catches in Subarea 5 in 1962-1969 (metric tons)

Year	1962	1963	1964	1965	1966	1967	1968	1969
Catch	41,900	107,357	167,308	281,431	121,373	69,984	45,000 45,858	66,826

A slight increase in the catch in 1969 may be attributed to the general increase of the fishing effort in Subarea 5 and to the concentration of the fishing vessels in the Nantucket shoal area where the main silver hake concentrations were observed. As shown by the preliminary information from the joint USSR-US surveys the abundance of the silver hake stock in 1969 continued to decline and was found to be lower than the 1968 level. During the year BMRT-, RTM- and SRTM-type vessels caught silver hake along with other species. The bulk of the catch was obtained in summer and in autumn. During winter and spring silver hake were caught along with red hake at the depths of 150 to 350 m on the slopes off Block

and Veach Canyons. From May to December silver hake were fished on the Nantucket shallow. The catches contained red hake, mackerel, flounder, butterfish, ocean pout, skate and spiny dogfish.

On the southern and south-eastern slopes of Georges Bank, where until 1964 a very successful silver hake summer fishery had existed, no commercial concentrations were observed. Neither were any commercial concentrations found on the northern and north-western slopes.

As in the preceding years the major part of the catches was formed by three- and four-year-olds (Fig.5).

In 1962, 1963 and 1967 the four-year-olds were more numerous than the three-year-olds and in 1964, 1965, 1966 and 1969 the reverse was observed. These changes in the relative abundance of three- and four-year-olds may be attributed partly to the fluctuations in the abundance of year-classes and partly to the areas and periods in which the sampled catches were taken.

On the spawning grounds of the southern slopes of Georges Bank the proportion of four- and five-year-olds was higher than on the feeding grounds of the north-western slopes of Georges Bank or the Nantucket shoal. The relative abundance of two-year-olds in these years fluctuated between 0.2 and 11.4%, that of five-year-olds between 2.2 and 15.5% and that of six-year-olds from 0.9 to 5.7%. One-year-olds, seven-year-olds and older fish were represented in the catches only by individual specimens. Thus, no sharp changes in the age composition of the Georges Bank silver hake were recorded during the period from 1962 to 1969. It is true that in 1964-1966 the relative contribution of the four-year-olds followed a downward trend but they were again predominant in 1967.

However, significant changes in the stock abundance and in the catch took place during the same period. The size of commercial concentrations and the catches of silver hake on the eastern Georges Bank (5Ze) decreased as compared to 1964. A similar trend was observed in the western part of Subarea 5 (5Zw) beginning with 1967. The catch per unit effort declined at a higher rate than the total catch because the fishing effort increased almost

every year. Beginning with 1968 the silver hake concentrations decreased so much that these fish became only a by-catch in other fisheries, whereas in 1963-1966 they were the main object of the fishery.

The decline in the stock abundance takes place mainly due to natural causes as a result of the recruitment of relatively poor year-classes.

The annual recruitment of three-year-olds to the stock averages 30 to 50% and the remaining part (50 to 60%) which consists mainly of four - and partly five-year-olds is annually removed from the stock by natural mortality.

As the stock decline and, consequently, the drop in silver hake catches in Subarea 5 which took place recently is attributed mainly to natural causes fishery regulation measures may not have any decisive effect on their size.

Haddock. In 1969 no commercial concentrations were observed on Georges Bank and haddock were sometimes caught as individuals when the vessels were fishing for other species. The recorded haddock catch was less than 100 tons.

Table 23. Haddock catches in Subarea 5 in 1962-1969. (metric tons)

Year	1962	1963	1964	1965	1966	1967	1968	1969
Catch	1,131	2,361	5,489	81,882	48,409	2,316	1,397	65

Beginning with 1963 all haddock year-classes appeared to be poor and it is only the 1969 year-class that is estimated to be better than the 1967 and 1968 year-classes. The estimation is based on the preliminary results of the joint USSR-US survey. In 1970 and 1971 the haddock stock will remain at a low level and in 1972 an increase in the stock abundance may be expected.

Red hake. In 1969 the red hake catch in Subarea 5 increased to 45.0 thousand tons (Table 24).

Table 24. Red hake catches in Subarea 5 in 1963-1969 (metric tons)

Year	1963	1964	1965	1966	1967	1968	1969
Catch	3,500	3,600	58,500	82,900	37,600	11,300	45,051

The increase in the red hake catch in 1969 is attributed partly to an increase in the stock abundance and partly to an increase in the fishing intensity.

During summer and autumn red hake were caught along with other species on the Nantucket shoal. The major part of the catches consisted of three- and four-year-olds (75% on the average). Preliminary results of the stock estimation by control hauls show that in the autumn of 1969 the red hake stock was more abundant than in 1967 and 1968. With the same fishing intensity the catches in 1970 may be expected to remain at the 1969 level.

Herring. In 1969 the herring catch was 100.5 thousand tons, i.e. 26.5 less than the 1968 catch (Table 25). The drop in the catch is attributed to a decline in the stock abundance which is evident from a drop in the catch per unit effort. Though the fishing intensity in Subarea 5 was much higher in 1969 as compared to 1968 the catches were lower.

Table 25. Herring catches in Subarea 5 in 1962-1969 (metric tons).

Year	1962	1963	1964	1965	1966	1967	1968	1969
Catch	151,144	97,329	130,732	36,349	117,346	123,572	126,965	100,463

The decline in the abundance of the herring stock is largely attributed to the fact that the strong 1960 year-class and the moderate 1961 year-class have by now been removed from the stock by natural and fishing mortality while the year-classes of 1962 to 1965 which have been recruited to the fishery happen to be poor

(Table 26). Besides, there was a sharp increase in the total herring catch in the last two years: the total Subarea 5 catch by all countries went up from 166.3 thousand tons in 1966 to 423.1 thousand tons in 1968. All year-classes from 1962 to 1967 inclusive happened to be poor.

In 1970-1971 the fisheries will be based on the poor 1962-1967 year-classes and it should be noted that at the age of 1 to 3 years these year-classes have already been exploited by US fishermen in the coastal Gulf of Maine areas and on reaching sexual maturity the 1962 to 1965 year-classes have been quite heavily exploited on Georges Bank and in adjacent areas. In 1970 and 1971 there will be a further decline in the herring stock and the adult herring catches are likely to drop.

Table 26. Age composition (%) of herring catches on Georges Bank in 1961-1969.

Year	Age										%
	1	2	3	4	5	6	7	8	9	10	
1961		2.0	7.8	27.9	50.8	10.1	1.4	+	+	-	100.0
1962		+	0.5	8.1	16.3	52.0	15.3	6.2	1.2	0.4	100.0
1963		+	38.8	13.5	29.7	13.8	3.0	1.2	+	-	100.0
1964		2.5	22.9	35.0	19.5	14.8	5.3	+	+	-	100.0
1965		0.2	10.1	35.8	39.8	13.1	0.9	0.1	-	-	100.0
1966		0.4	0.9	4.7	28.2	50.0	12.6	3.2	-	-	100.0
1967		0.3	0.3	3.6	11.8	36.6	42.2	5.0	0.2	-	100.0
1968	0.1	0.5	5.3	8.0	20.1	22.5	37.3	6.1	0.1	-	100.0
1969	-	1.6	6.8	14.2	24.6	26.1	14.4	10.8	1.2	0.3	100.0

Mackerel. The contribution of mackerel to the total USSR catch has been increasing since 1967 (Table 27).

Table 27. Mackerel catches in Subarea 5 in 1962-1969 (metric tons)

Year	1962	1963	1964	1965	1966	1967	1968	1969
Catch	-	869	533	2,460	5,446	11,407	33,961	47,547

The considerable increase in the mackerel catches in 1968 and 1969 is explained by an increase in the stock abundance in recent years as well as by a more intensive fishery as following the decline in herring concentrations commercial vessels switched

over to the mackrel fishery. The mackrel fishery was conducted on Georges Bank and on the Nantucket shallow from April to December.

The bulk of the catches consisted of fish with the body length of 24 to 37 cm. During summer and autumn the mackerel in catches were bigger than in spring. The mean body length in monthly catches ranged from 27.6 cm in April to 34.2 cm in September. 95.0% of the mackerel catch was made up by two- and three-year-olds belonging to the 1966 and 1967 year-classes: in the four samples of 492 fish collected in May and June two-year-olds made up 79.9%, three-year-olds 15.7% and four-year-olds 4.4%. The 1966 and 1967 year-classes seem to be relatively more abundant as compared to other year-classes, which suggests that in 1970 the stock will remain at the level of 1969.

B. Special Research Studies.

I. Environmental Studies.

Hydrography. In 1969 hydrographic information in Subarea 5 was collected throughout the year by the AtlantNIRO research vessels. Four standard hydrographic surveys were made along the sections shown in Redbook 1967, Part II. Apart from standard surveys, bathythermograph stations were made at the time of control hauls and during searching. The data obtained allow the determination of the water temperature level in the area as compared to that of the preceding year. In the East Channel area and in the deep part of the Gulf of Maine the temperature level in 1969 was generally higher than in 1968. The temperature of the water over the central part of Georges Bank was close to the 1968 level while that of the water over the southern Georges Bank was lower than in 1968. In the area south of Nantucket Island the temperature level was similar to that in 1968 (Figs 6 and 7).

Zooplankton. In 1969 the collection of zooplankton samples on Georges Bank was continued. The samples were collected with a Juday net at the time of the hydrographic surveys and also on the spawning grounds of silver hake, red hake and herring during the survey aimed at estimating the spawning efficiency of these species. The samples collected in 1965-1967 have been processed.

The information collected allows a preliminary conclusion to be reached on a considerable decrease in the zooplankton and seston biomass in 1967 as compared to 1965 and 1966 (Table 28).

Table 28. Zooplankton (abundance) and seston biomass in 1965-1967.

Month	1965		1966		1967	
	Abundance (thousands under m ²)	Biomass (ng/m ³)	Abundance (thousands under m ²)	Biomass (ng/m ³)	Abundance (thousands under m ²)	Biomass (ng/m ³)
January	-	-	-	-	29	112
April	160	514	154	600	33	180
June	300	640	150	400	110	200
August	173	373	121	353	260	210
November	114	483	82	510	128	286

The causes of changes in the plankton productivity in 1967 are not clear.

Ichthyoplankton. The examination of the gut contents in silver hake larvae collected in July and August 1967 and 1968 shows that in 1967 the larvae which were 2.2 to 3.2 mm long mainly fed on the naupliar and copepodite stages of Copepoda sp. In 1968 the length of the larvae in samples ranged from 4.2 to 6.5 mm and the principal food items were the copepodite stages of various Copepoda while nauplii occurred in insignificant quantities. The silver hake larvae were found to have the diurnal rhythm of feeding: at 2-3 p.m. the proportion of full guts was 46%; at 4-5 p.m. it was zero and during the remaining part of the day the larvae were feeding intensively.

II. Biological Studies.

Studies on the spawning of herring on Georges Bank. In September and October 1969 studies on the spawning of herring were continued with the aim of estimating the amount of eggs spawned and the abundance of spawning herring and of obtaining information on the distribution and drift of herring larvae. It was found that the spawning took place on two small spawning grounds (eastern and western). The eastern spawning locality was found and investigated on September 20-21. Its central part was posi-

tioned at 67°16'5 W, 41°57'0 N. The area under eggs was found to be 1.8 km² and the weight of the spent herring was estimated to be 35 thousand tons.

The western spawning ground was located on two areas close to each other with the centers positioned at 67°29'03W, 41°58'0N and 67°30'0W, 41°57'6N. The total area of the western spawning ground was 2.2 km² and the weight of spent herring was estimated to be 22 thousand tons. In 1969 the spawning population was estimated to be about 60 thou.tons whereas it was 150 thou.tns in 1966; 530 thou.tns in 1965 and 1,180 thou.tns in 1964. Thus, there was a sharp decline in the abundance of spawning herring on the main Georges Bank spawning grounds in 1969 as compared to 1964 and 1965. The decrease in the amount of herring arriving to spawning grounds is mainly due to a considerable reduction of the stock.

In October ichthyoplankton was collected with the IKS-80 net. On October 11 to 16 ichthyoplankton was sampled on the northern part and from October 21 to November 1 at standard stations all over Georges Bank. Larvae occurred all over the Bank with the main mass in the central part.

Joint USSR-US studies on the distribution and abundance of groundfish. In late October and early November the USSR "Ecliptica" and the US "Albatross IV" conducted a joint survey to study the abundance of groundfish on Georges Bank and in the Gulf of Maine by trawling. The "Ecliptica" made 54 and the "Albatros IV" 94 hauls of 30 m duration each. The "Ecliptica" used a 24.6 m redfish trawl and the "Albatross IV" used a N 36 trawl. Preliminary results show that in 1969 the abundance of silver hake was slightly lower and that of red hake was higher than in 1968.

Statistical S u b a r e a 6.

A. Status of the Fisheries.

In 1969 the Soviet catch in Statistical Subarea 6 increased to 107.3 thou.tons. The increase is due to the intensification of the herring and mackerel fisheries.

Table 29. Catches in Statistical Subarea 6 in 1963-1969
(thousand metric tons)

Species	Year						
	1963	1964	1965	1966	1967	1968	1969
Silver hake	4.2	16.9	17.3	92.9	18.6	15.0	7.2 ^A
Red hake	0.8	8.4	11.7	25.7	14.9	1.9	4.1
Herring	0.5	0.2	1.9	2.8	3.2	16.1	38.2
Mackerel	0.3	0.1	0.1	1.2	6.1	7.3	37.5
Other	2.1	2.6	2.4	8.4	4.3	12.4	20.3
Total	7.9	28.2	33.4	131.0	47.1	52.7	107.3

Silver hake. The 1969 silver hake catch of only 7.2 thou. tons was considerably lower as compared to 92.9 in 1966, 18.6 in 1967 and 15.0 thousand tons in 1968. The reduction is due to a decrease in the concentration resulting from a decline in abundance as well as the closure of the silver hake fishery on the edge of the shelf from January to March. In previous years the major part of the catch had been obtained in the first quarter of the year. Best silver hake catches were taken by the BMRT-type vessels on the shelf slope in the Hudson Canyon area in April. The main part of the catches was made up by specimens with the body length of 26 to 32 cm. The mean length in April was 31.5 cm. As in the previous years three- and four-year-olds were predominant. Five-year-olds were also fairly numerous (Table 30).

Table 30. Age composition (%) of silver hake catches in Subarea 6 in 1966-1969

Year	Age										Total
	1	2	3	4	5	6	7	8	9	10	
1966	-	15.55	38.16	29.77	12.28 ²⁸	3.62	0.58	0.04	-	-	100.0
1967	2.00	2.44	44.65	46.64	4.03	0.22	0.02	-	-	-	100.0
1968	-	10.47	60.58	27.55	0.93	0.42	0.05	-	-	-	100.0
1969	-	8.5	27.0	30.8	15.5	7.2	5.1	3.3	2.2	0.4	100.0

The results of the autumn survey in 1969 showed that the abundance of silver hake was lower than in 1968, therefore no increase in the catches is expected in 1970 as compared to 1969.

Red hake. In 1969 red hake were caught practically only off Hudson Canyon in April as in January-March the area of the red hake concentrations was closed and in May the red hake migrated to the coastal Nantucket area (Subarea 5).

Red hake was represented in catches by specimens at the age of 1 to 6 years. Three- and four-year-olds belonging to the 1965 and 1966 year-classes were predominant (Table 31).

Table 31. Age composition (%) of red hake catches in Subarea 6 in 1969.

Age	1	2	3	4	5	6	Total	Mean age
Number (%)	8.3	10.8	50.2	25.1	5.5	0.1	100.0	3.1

Specimens belonging to the 1966 year-class made up 50.2%, which suggests a higher abundance of this year-class as compared to other year-classes. The prospects for the red hake fishery in 1970 are quite limited due the closure of the fishing area in the first quarter of the year when red hake concentrations are formed.

Herring. In 1969 the herring catch increased to 38.2 thousand tons compared to 16.1 thousand tons in 1968. Herring were caught at the depths of 40 to 70 m from Delaware to Norfolk. The majority of the fish caught ranged from 27 to 33 cm; the mean length was 29 cm. (Table 32).

Table 32. Age composition (%) of herring catches in Subarea 6 in 1966-1969.

Year	Age								%
	2	3	4	5	6	7	8	9	
1966	0.1	1.6	1.6	13.1	46.1	30.5	7.0	-	100.0
1967	-	0.4	2.4	13.0	41.9	39.5	2.8	-	100.0
1968	0.8	1.2	4.4	26.9	37.4	27.7	1.6	-	100.0
1969	0.2	6.2	10.3	30.2	18.8	16.6	16.1	1.6	100.0

Mackerel. The mackerel stock seems to be in good condition. Due to more intensive fishing the mackerel catch in 1969 rose to 37.5 thousand tons from 7.3 thousand tons in 1968. Mackerel was fished from February to May with the best effect achieved in the Delaware - Norfolk area (6B and 6C). The catches taken by the SRTR- and SRT-type vessels amounted to 6 to 10 tons per day fished.

B. Special Research Studies.

I. Environmental Studies.

Hydrography. In 1969 no hydrographic observations were made in Subarea 6 except in August when standard Section XXV (Hudson Canyon) was worked. The temperature and salinity distribution along this section is presented in Fig.8.

II. Biological Studies.

Squid. In 1969 the material on the biological and fishery characteristics of the long-finned squid was summarized. The material had been collected in the Cape Hatteras- Cape Cod area in 1967 and 1968. Seasonal distribution was charted. From October to April long-finned squid form considerable concentrations at the depths of 100 to 250 m in the continental slope area from the south-western Georges Bank to Cape Hatteras. During November-December the concentrations in the southern part increase and in March-April the northward movement of the concentrations is observed. With the warming-up of the coastal waters in May-June the squid move to shallow waters. In winter the highest quantities of squid occur in areas with the water temperature of 9 to 12°C. The spawning lasts from May to September.

A five-degree scale has been worked out for the visual determination of the state of gonad development.

Joint USSR-US groundfish surveys. The joint studies on the abundance and distribution of groundfish from Cape Cod to Cape Hatteras were continued in 1969 (the methods used are described in ICNAF Res.Doc.68/87). During the period from October 8 to 19 the Soviet "Ecliptika" made 66 hauls with a 24.6 trawl and the American "Albatross IV" made 100 hauls with a N 36 trawl.

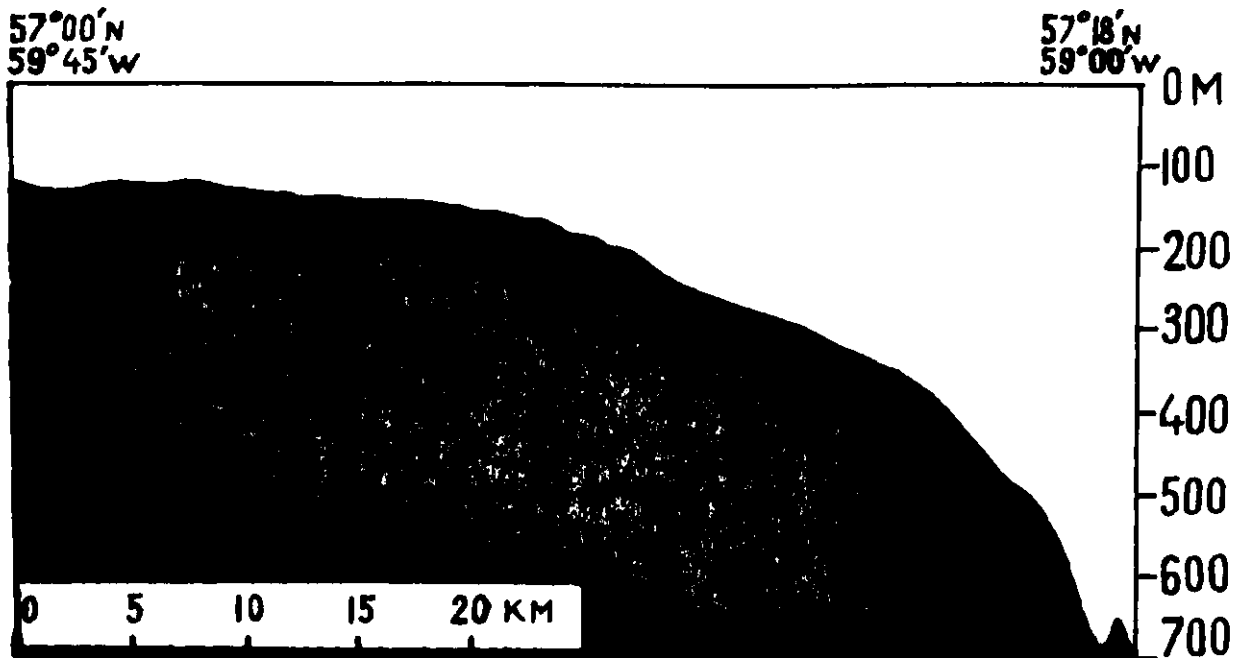


Fig. 1. The profile of the continental slope in ^{Subarea 2} the (Labrador) ~~Subarea 2~~.

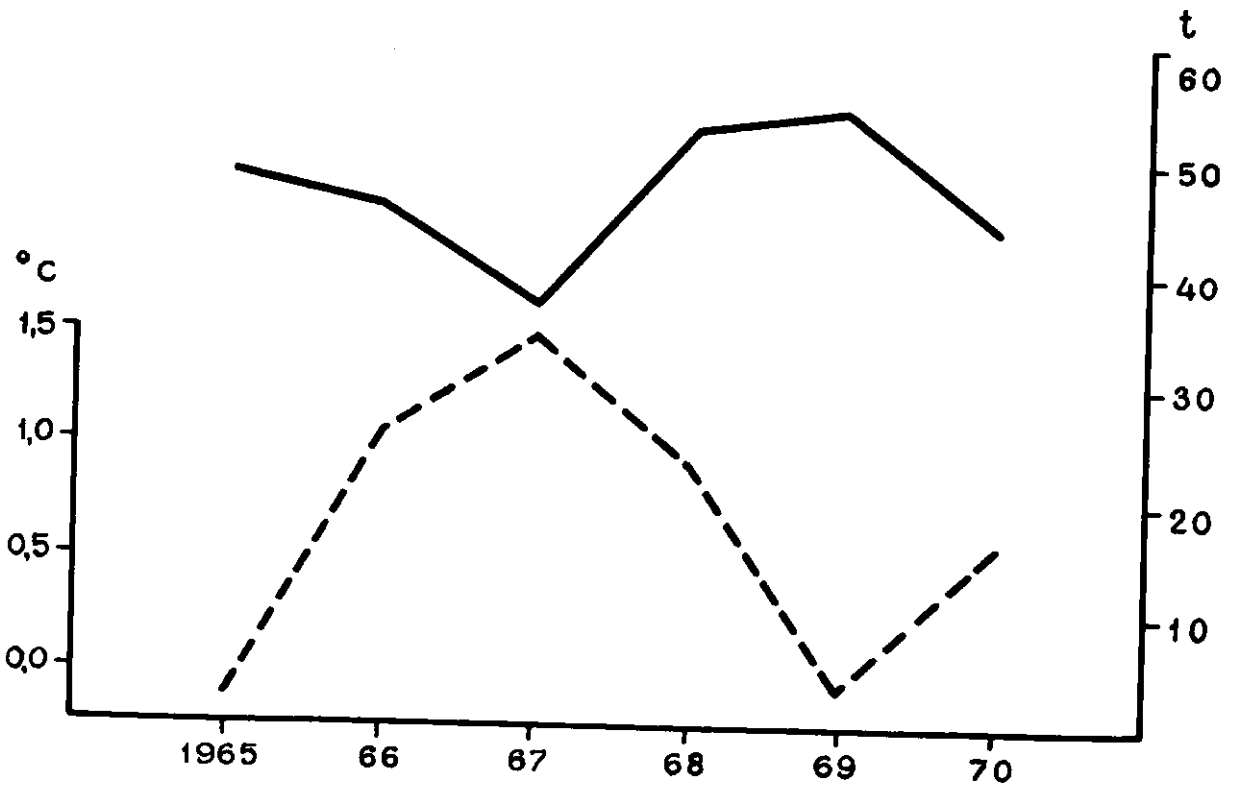


Fig. 2. Average catch by BIRT-type vessels per day fished in ^{Subarea 2} the (Labrador) ~~Subarea 2~~ in February (solid line) and the water temperature in the 50-200 m layer along the AB portion of Section 8-A on November 1 of the ~~previous~~ ^{previous} calendar year (broken line).

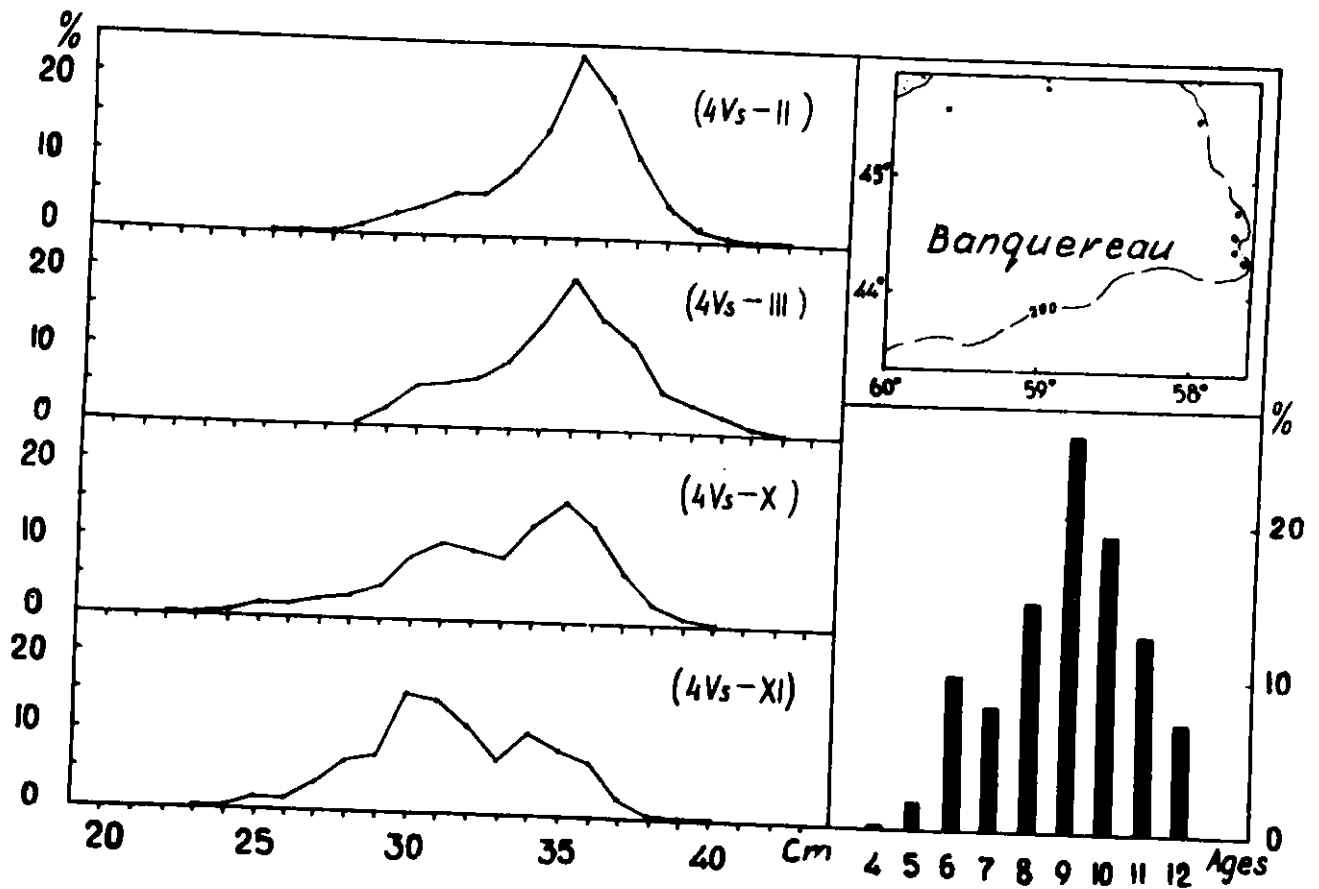


Fig. 3. Size and age composition of herring catches on Banquereau Bank (20 4Vs).

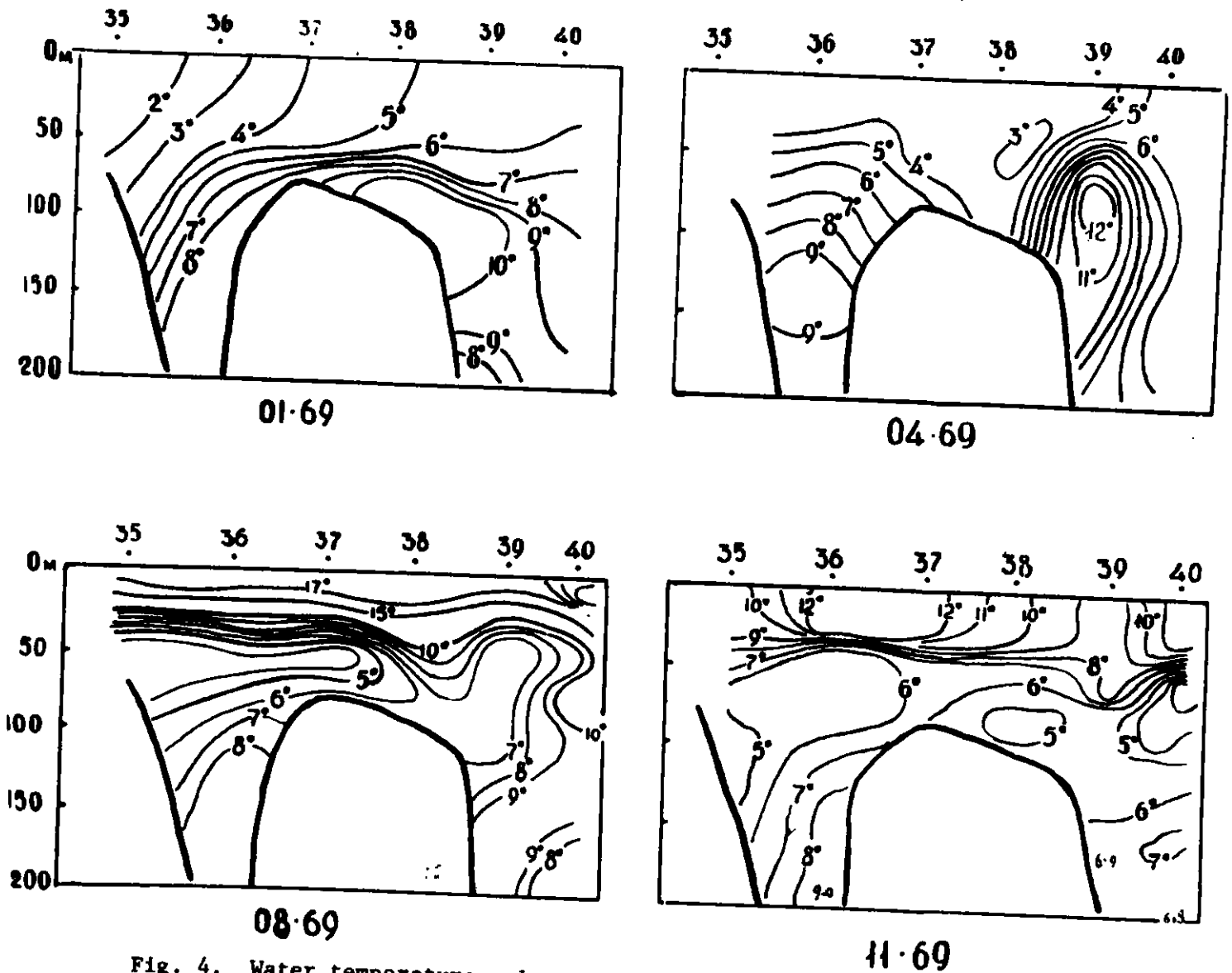


Fig. 4. Water temperatures along the Halifax section in January, April August and November 1969.

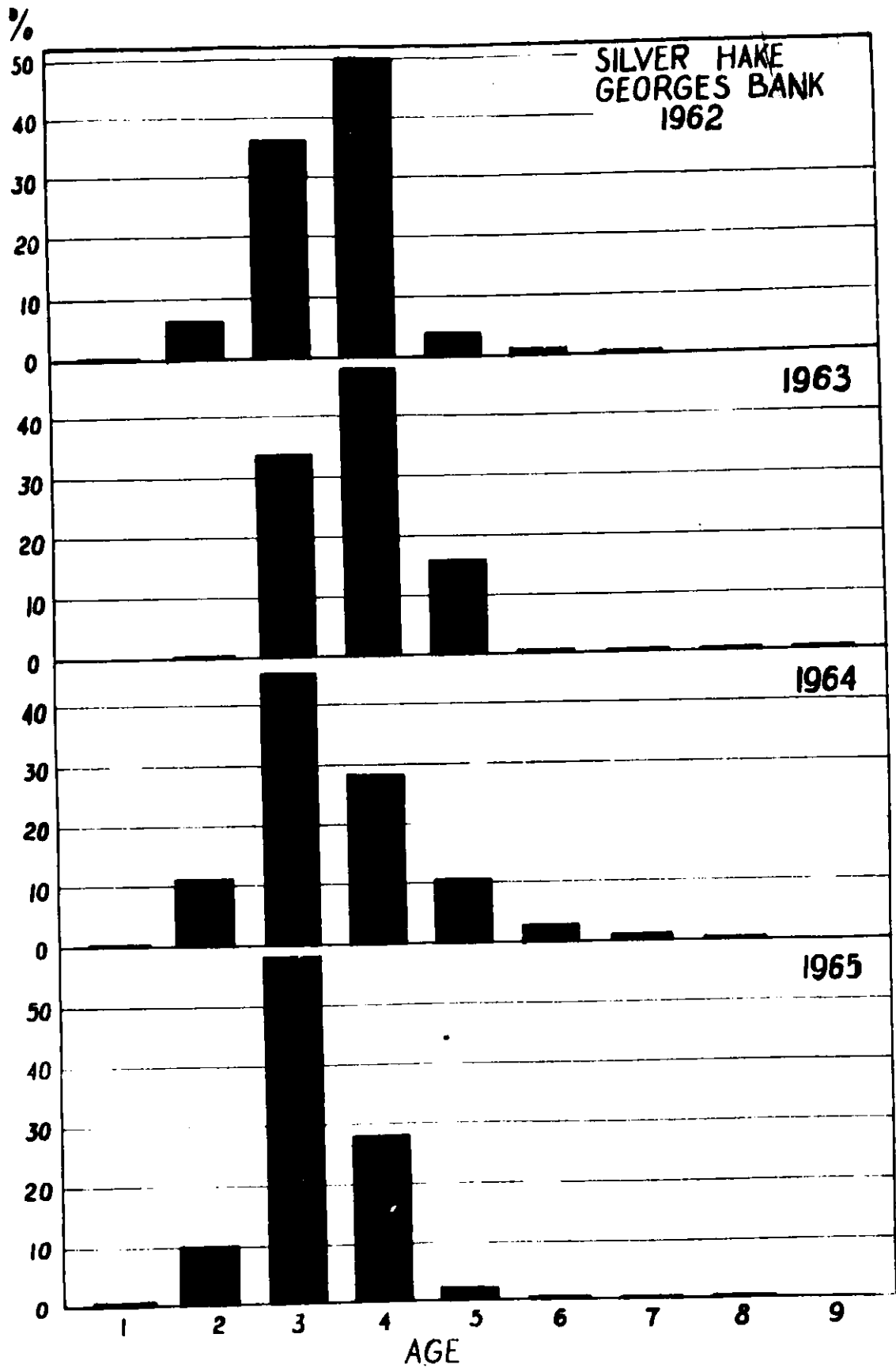


Fig. 5. Age composition of silver hake catches on Georges Bank in 1962-1969.

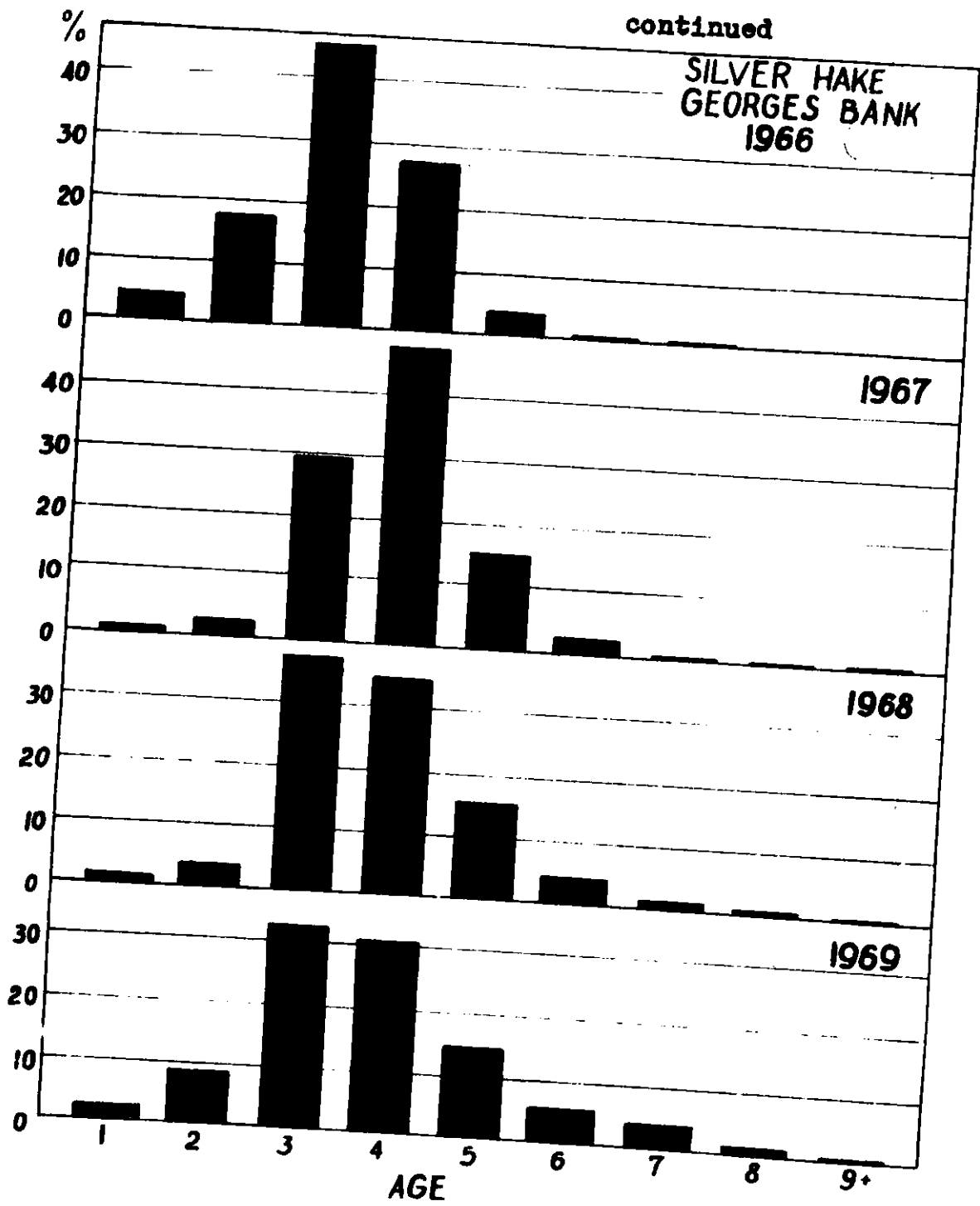


Fig. 5. (continued) Age composition of silver hake catches on Georges Bank in 1962-1969.

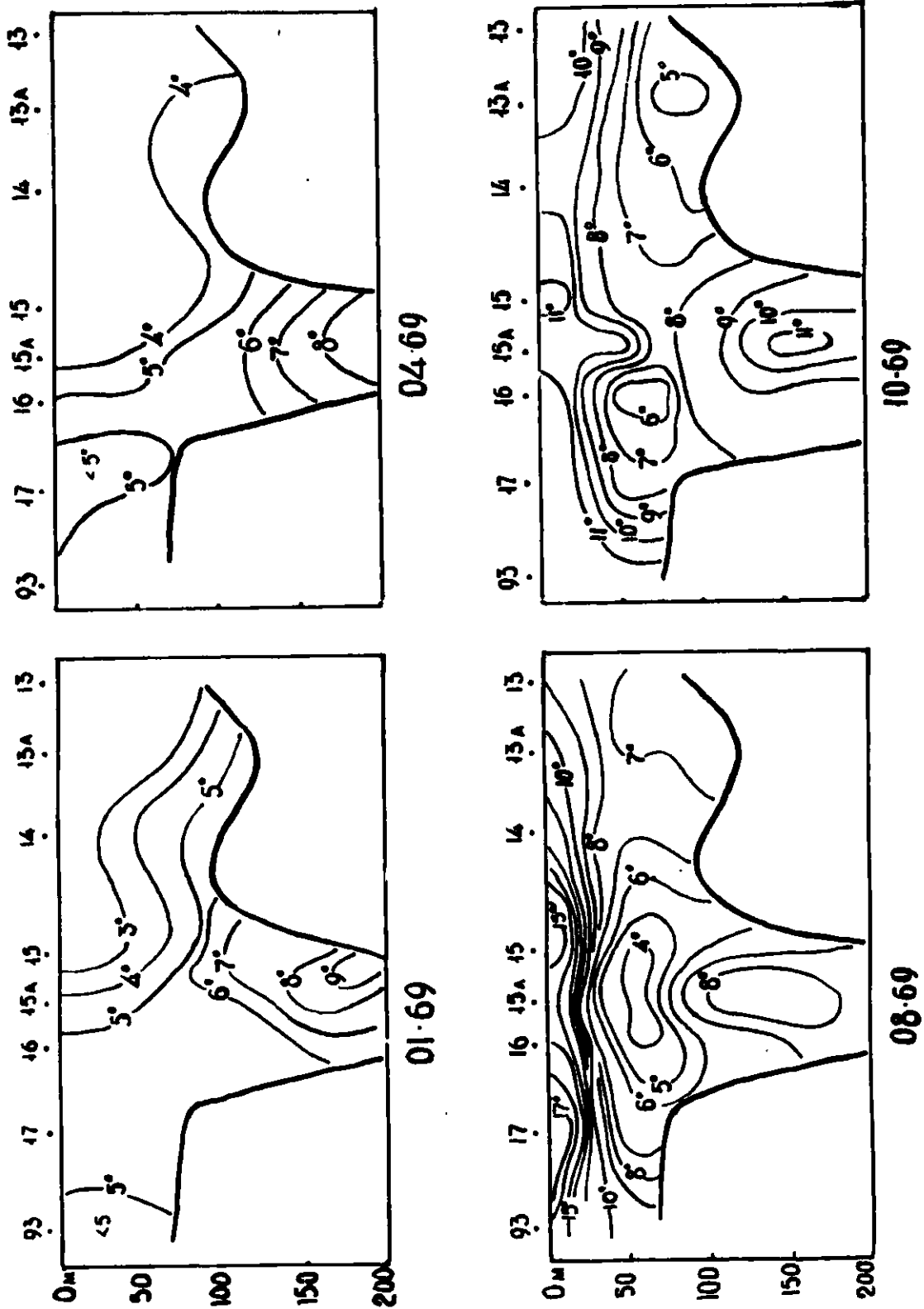


Fig. 6. Water temperatures in the East Channel in January, April August and October, 1969.

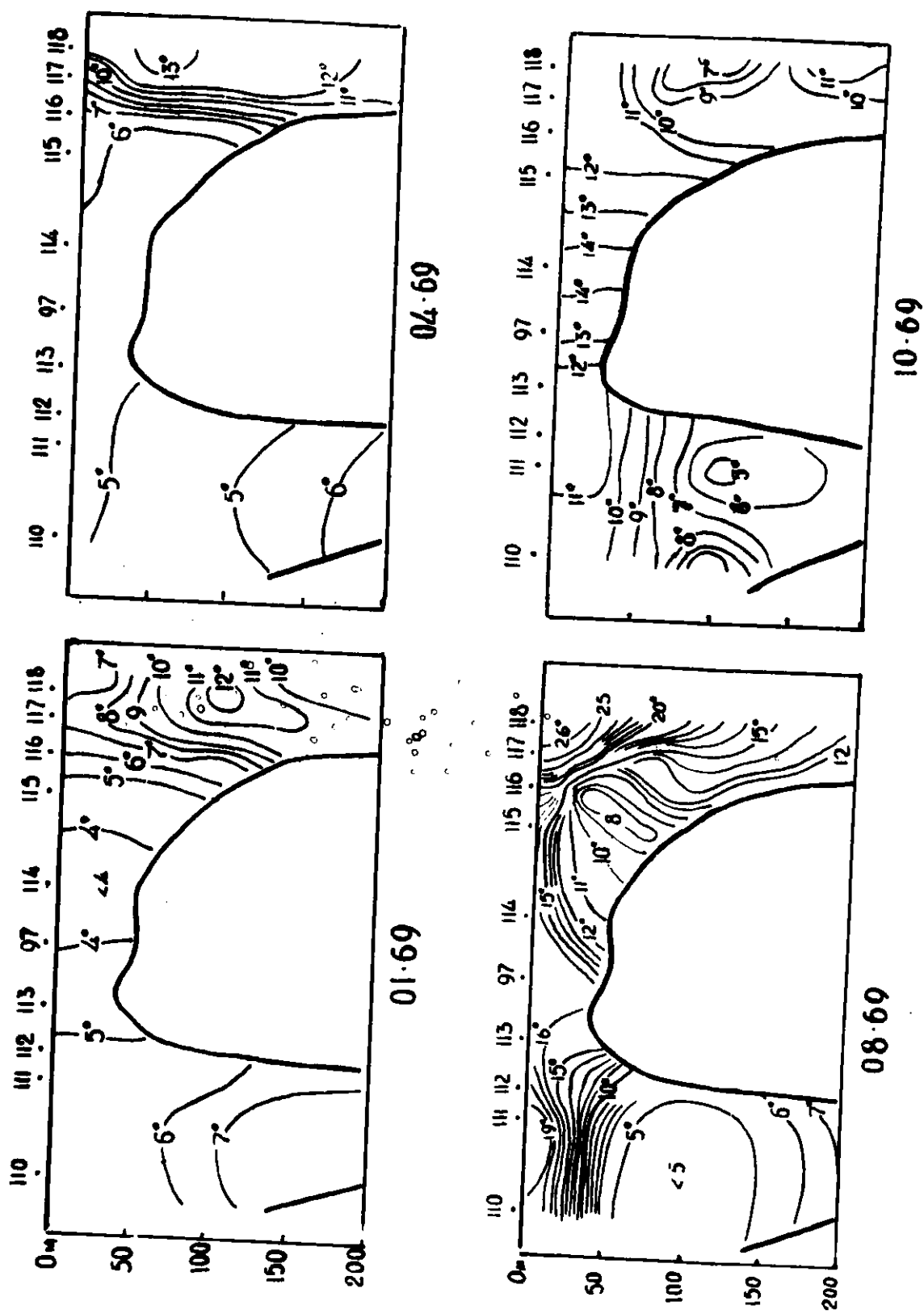


Fig. 7. Water temperature along Section XXII (38°W) in January, April, August and October 1969.

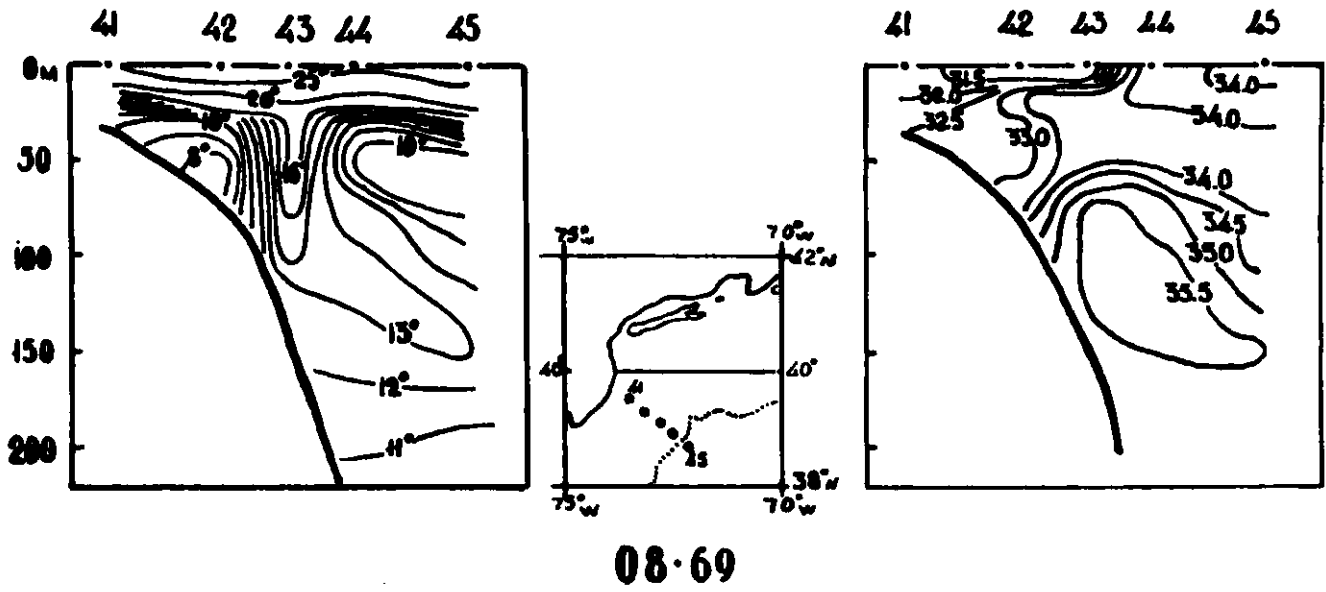


Fig. 8. Temperatures and salinities along the Hudson section in August 1969.