RESTRICTED

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Serial No.1996
(D.a.67)

ICNAF Res.Doc.68/15

ANNUAL MEETING - JUNE 1968

USSR Research Report, 1967

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

The total Soviet catch in the ICNAF Convention Area in 1967 was 576,001 tons (Table 1), that is 135,200 tons less than in 1966. Catches of haddock decreased considerably (73.4 thousand tons in 1966 against 8.4 thousand tons in 1967). The catch of silver hake decreased from 131.7 to 72.5 thousand tons. Catches of red hake, argentine and other species also decreased, whereas the catches of cod, herring and mackerel increased.

S u b a r e a I

A. Status of the fisheries

Soviet commercial fleet did not work in Subarea I. About 800 tons of cod and redfish were caught by research and scouting vessels.

B. Research studies

1. Environmental Studies

Hydrographic observations were conducted by the vessels "Pobeda", "Volgograd" and "Novorossiisk". Data obtained by these vessels showed that since November 1966 to March 1967 the average temperature in the 0-50 meter layer along the south-western Greenland coast dropped from 1.08° to - 0.57°, and it dropped from 1.98° to -0.46° on Fyllas and Fiskenaes Banks. Cooling of water masses was uneven in the autumn-winter period 1966-1967: to the end of autumn the daily rate of cooling reached 0.05°, but to the end of winter the temperature dropped only by 0.01° per day.

Table 1

Species composition of USSR catches (in metric tons) in the Convention Area, 1966 and 1967.

Species	1967						1966
	1	2	3	4	5	Total catch	Total catch
Herring	-	-	-	581	123.572	124.153	119.573
Argentine			802	4.191	2.022	7.015	49.040
Cod	570	20.728	141.987	1.744	511	165.540	110.432
Haddock	-	-	5.317	753	2.316	8.386	73.410
Pollock (saithe)	-	-	66	299	345	710	10.5[illegible]
Silver hake	-	-	-	2.476	69.984	72.460	131.695
Red hake and white hake	-	-	1.684	311	37.593	39.588	85.106
Flounders	-	2.183	54.703	324	3.907	61.117	40.278
Halibut	-	2.424	5.334	-	15	7.773	473
Redfish	260	5.263	33. 388	67	-	38.978	48.725
Wolffish	-	56	304	-	-	360	506
Ocean pout	-	-	-	-	261	261	6.231
Scup	-	-	-	-	347	347	257
Mackerel	-	-	-	67	11.907	11.969	6.680
Butterfish	-	-	-	-	1.406	1.406	3.865
Sea robins	-	-	-	-	124	124	98
Angler fish	-	-	-	-	-	-	1.332
Dogfish and skate	-	-	-	-	3.961	3.961	6.780
Squid	-	-	-	6	330	336	445
Other	-	676	21.199	379	9.323	31.577	17.712
Total	830	31.330	264.724	11.193	267.924	576.001	711.201

The average water temperature (0°C) in 1967 in the near-bottom layer over some fished banks is shown in Table 2.

Table 2.

Bank, depth (m)	March	July	August	September
Frederikshab				
less that 100	2.40	0.52	1.68	-
100-200	4.90	4.54	3.51	-
Fiskenaes				
less than 100	2.13	0.39	0.81	0.96
100-200	3.86	3.77	-	4.50
Fyllas				
less than 100	-	-	1.89	1.79
100-200	-	-	-	4.91
Lille Hellefiske				
less than 100	-	-	1.26	1.88
100-200	-	1.33	1.66	3.56
Helder				
less than 100	-	-	1.53	0.93
100-200	-	-	-	3.43
Store Hellefiske				
less than 100	-	-	2.93	2.92
100-200	-	-	-	2.31

A marked inflow of cold waters of the Canadian Polar Current was observed at northern banks in August, and their mixing with warm current to the west of banks resulted in the decrease in the average temperature by 0.6-1.3° in comparison with other years (Table 3).

Table 3.

Bank, depth (m)	1961	1962	1963	1964	1966	1967
Lille Hellefiske						
less than 100	2.31	2.54	2.38	1.71	2.34	1.88
100-200	3.92	3.79	4.14	4.19	4.81	3.56
Store Hellefiske						
less than 100	-	4.48	3.44	2.97	3.74	2,91
100-200	-	3.91	4.28	4.87	2.60	2.31

In 1967, a very low water temperature was observed along the hydrographic section 10-A, crossing two continuous currents (Table 4).

Table 4.

Average water temperature along the section 10-A (Lille Hellefiske Bank), September

Depth (m)	Canadian Polar Current					West-Greenland Current					
0-50	0.42	1.44	-1.36	-1.01	-0.17	4.20	4.70	4.25	4.38	2.72	1.62
0-200	-0.58	-0.73	-0.99	-0.24	-1.18	2.78	2.92	3.25	2.83	2.41	0.97
200-500	2.80	2.21	-	2.28	0.79	3.60	3.98	3.34	4.84	5.02	3.50

As seen above, the average water temperature was lower in September 1967 than in September 1961-1965. In 1967, an extremel low temperature was observed in the layer 0-200 m of the West-Greenland Current. The fall of temperature was due to coming of cold waters of the Canadian Current from the North-West.

Water temperature of the West-Greenland Current on Fyllas (section 11-A)and Fiskenaes (section 12-A) Banks is given in Table 5.

Table 5. Average water temperature of the West-Greenland Current along the sections 11-A (Fyllas Bank) and 12-A (Fiskenaes Bank), September

Depth (m)	Section 11-A					Section 12-A				
	1961	1962	1963	1964	1967	1961	1962	1963	1964	1967
0 -50	5.21	4.38	4.75	4.09	2.52	5.05	4.01	3.68	5.10	3.11
0 - 200	5.07	3.94	4.99	4.88	2.71	5.78	5.25	5.66	4.92	3.77
200-500	4.38	4.55	4.87	5.34	4.47	4.76	4.74	5.08	5.46	4.86

Those data show that in September the water temperature was lower than in previous years. Thus, in 1967 the water temperature was 1° lower on the central banks, 2° and even 2.5° lower than in the previous years in the northern areas due to the influence of the Canadian Current.

II. Biological studies

1. C O D

a) Distribution and density of stocks

In March - April, July-September some scouting and research vessels type "Kreml" were working.

In March, off south-west Greenland at the depths 115-380 m, cod catches were not great in amount, not more than 100-200 kg per one hour trawling. Immature cod of the average size prevailed in catches taken from the depth less 200 m, this cod slightly fed on benthos organisms and on young redfish . Large spawning cod was observed at the depth more than 200 m.

In the first half of March in the area off Frederikshåb Bank at depths 300-350 m, the catches of prespawning and spawning cod of the average and large size made 2 -3 tons per one hour trawling. In the second half of March and early in April, catches decreased up to 200 - 300 kg, cod sizes also reduced. In that period cod, mainly immature and of middle and small sizes, began to concentrate at less 200 - 250 m depths (catches were up to 1.0 tons per trawling).

In March, commercial cod was observed in trawl catches at depths 150-400 m on Danas and Fiskenaes Banks, catches ranged from 0.2 to 3.0 tons per trawling. Small and medium immature cod feeding on benthos organisms in small numbers prevailed at depths 150-250 m, whereas at depths 250-400 m the bulk of catches was represented by spawning cod of middle and large sizes.

To the end of March - early in April, immature and post-spawning cod made concentrations on Fiskenaes and Fyllas Banks at depths 80 - 300 m. But, the fishery was not stable here. The catches fluctuated within large ranges, from 0.2 to 5-6 tons per trawling. The absence of mass concentrations of food organisms did not favoured the stability of cod concentrations.

In July, trawlings off the southwest Greenland were almost not conducted due to great concentrations of ice formed. In that period, commercial concentrations of cod (catches from 0.5 to 0.3 tons) were found on Danas, Fiskenaes and Banan Banks, where sanderling* were in great numbers at depths 40-80 m. Cod stomachs were filled with sanderling. Sizes of cod on all the banks varied widely from 35 to 85 cm and even more, the feeding concentrations consisted of immature as well as of mature and post-spawning cod.

In August, a lot of banks were investigated, but relatively stable commercial concentration of cod could be observed only at few banks. During the intensive feeding cod was very mobile. In the area of Store and Lille Hellefiske Banks at depths 40 - 300 m catches of cod did not exceed 1.0 ton per trawling, in most cases they were 200-300 kg. Small and the average immature and post-spawning cod feeding on sanderlings, srimps and other bottom organisms, prevailed in catches. The lack of great concentrations of cod on the said banks was caused by their feeding for the most part in a narrow coastal zone.

The most dense concentrations were observed at that time on Banan and Fyllas Banks in depths 30-120 m (catches 1-3 tons per hour trawling), where great concentrations of sanderling were observed. Stomachs of cod of all sizes were filled with sander-

---

*sanderling = sand eel, sand launce (*Ammodytes* sp) ling. But, cod was very mobile also on those banks making horizontal and vertical migrations. In comparison with the northern areas, where catches consisted mainly of small and medium sized cod, the catches taken on Banan and Fyllas Banks were mainly of big-sized cod.

On Fiskenaes Bank cod also intensively fed on sanderling, but did not form stable concentrations, the catches did not exceed 200 - 300 kg.

Very unstable concentrations of small and medium sized cod were found on Frederikshåb Bank in depths 60 - 250 m, sometimes catches amounted to 1-2tons per trawling. But, the bulk of cod was apparently keeping in the water column and fed on the pelagic organisms, - Ctenophora, Appendicularia, Amphipoda, Euphausids, luminous anchovy etc. The readings of instruments for fish finding in this region were not bad, nevertheless the catches, in the most, did not attain 200-400 kg per hour trawling.

In September, commercial cod concentrations were nowhere observed throughout all the area from Danas Bank to the shallow of the Disko Island. The catches were not more than 300-600 kg per trawling. Cod concentrated throughout a large area in search of food.

b. Age composition

In March-April the bulk of catches consisted of 1967 and 1962 year-classes (the medium size of six-year old cod ranged between 64.9 - 65.2 cm, those of five-year olds were from 57.2 to 57.9 cm). Rich 1960 year-class which prevailed in catches in previous two years sharply decreased in catches at the age of seven. Only in the division 1E in March, the share of 1960 year-class was great (up to 22% by the number of specimens). In March-April, the cod at the age more than 7 years was negligible (1-4%).

In the second half, of the year the number of cod elder 6 years increased slightly. Thus, in September nine-year old specimens made up 10% of trawl catches in the area 1G. Cod of the 1963 year-class appeared in the catches. In the first half of the year four-year old cod made 1-12% (by number of specimens), whereas in the second half they increased in numbers up to 35% in some areas (medium sizes of four-year olds were from 44.8 cm to 55.0 cm). In the next two years some decrease in stocks of the West-Greenland cod and, apparently, in fishery productivity is to be expected as the abundance of the 1962-1964 year-classes is average and even below the average.

SUBAREA II

A. Status of the Fisheries

The annual catch is given in Table 6.

In comparison with 1966, the total catch of fish by the Soviet trawl fleet in Subarea 2 changed slightly. It is necessary to note the following important facts:

A relative significance of div. 2J. fell some more. In 1965 the ratio between fish catch in the area 2J and this one in the areas 2H + 2G was 10:1, in 1966 - only 4:1, and in 1967 - only 2:1. In other words, fish concentrations (mainly cod) located further to the north from year to year. Simultaneously the average catch of fish per hour trawling also decreased. A gradual shifting of the area of cod distribution to the north and the decrease in the productivity of their trawl fishery are regularly connected. Successful trawl fishery in Subarea 2 was favoured by the southern distribution of cod. Thus, early in 1968 the main cod concentrations were distributed further south than in previous years, a relative significance of the division 2J increased, and the average catch per hour trawling sharply increased. The relation between cod distribution in subarea 2 and the productivity of their trawl fishery depends on the condition of fleet work. This problem is discussed in a special report by Dr. Konstantinov (Res. Doc. 68/36).

As seen from Table 6, in 1967, redfish catch in Subarea 2 was relatively higher than previously. The increase of redfish share in trawl catches was partially caused by the worsening of conditions for cod fishery and the transition of some vessels for redfish fishery.

Table 6. Annual catch and catch per hour trawling, Subarea 2

(in metric tons)

Divisions	Total catch by trawls of all types						Average catch per hour trawling by BMRT
	Cod	Redfish	Flounders	Halibut	Others	Total	
2G	449	135	-	-	-	584	1.81
2H	5913	1003	719	1775	200	9610	2.25
2I	14366	4125	1464	649	532	21136	1.97
Subarea 2	20728	5263	2183	2424	732	31330	2.05

B. Research Studies

1. Environmental studies

Hydrographic research accomplished in Subarea 2 showed that in 1967 the main constant currents including the cold Labrador branch intensified. To the end 1967, water temperature was below than in late 1965 and 1966 in the main hydrographic sections. The data on the thermal sea condition in Subarea 2 are considered in details by a special report by Dr. Burmakin.

II. Biological Studies

I. C O D

a) Mean length and changes in abundance

200 thousand specimens caught by bottom trawl were measured, age was determined for 2197 individuals. Table 7 shows mean cod length in division 2J for the same months of 1960 and 1964–1968.

Table 7 Mean length (cm) of cod from trawl catches, division 2J

Year	January	Fabruary
1960	57.3	57.2
1964	52.2	53.9
1965	51.5	54.2
1966	51.9	52.2
1967	50.2	47.9
1968	52.2	51.5

One can see that the mean length of cod began to decrease from year to year (undoubtedly, influenced by the increased fishery) and then became stable. The average age of cod changed in the same way. Thus the dynamic equilibrium was, apparently observed between the commercial catch and the annual natural recruitment of cod stock. This equilibrium was not also effected by natural fluctuations in the abundance of year classes (fluctuations), as the strength of year-classes of the Labrador cod was stable enough (due to slightly varied conditions of spawning as well as due to the south drift of eggs and larvae). Table 9 shows a relative number of cod youngs in different areas; the strength of year-classes of the Labrador cod may be determined from the catches of the young specimens in div. 3K, where larvae of the Labrador cod are brought with current. It is evident that the abundance of year-classes of the Labrador cod varied very slightly in comparison with the cod of the southern part of the Grand Bank and of St. Pierre Bank.

b) Marking

In 1967, in Subarea 2 4,158 specimens of tagged cod were released from the research and scouting vessels. Up to 1 March 1968 30 specimens (72%) were returned. Besides that, in 1967, 66 specimens marked in 1963-1966 were caught. All the specimens for which the locality of their recapture was known were caught in divisions 2H, 2J, 3K and 3L. Thus, those data confirm once more the availability of one common cod stock on the Labrador Shelf and in the southern part of the Grand Bank.

c) Forecast of cod fishery

In 1968, the hydrographic conditions continue to become colder in the Labrador area. Thus, early in 1969 cod concentrations will be distributed southerner than in 1967. Division 2J will be of greater importance for trawl fishery, the catch per hour trawling will increase (in comparison with figures of 1967).

S u b a r e a 3

A. Status of fisheries

The annual catch is given in Table 8.

On comparison with 1966, an increase in catch was observed for all Subarea 3, and, also, almost for each of its divisions, especially for the divisions 3N and 30 (mainly, due to the growth in cod catches) and for div. 3K (due to a specially fished grenadier, Macrurus rupestris, at depths 600 - 800 m).

B. Research studies

I. Environmental studies

Oceanographic investigations accomplished at standard sections showed some intensification of the Gulf Stream and its approaching the southern slope of Grand Bank. More detailed results of oceanographic observations are given in a special paper by Dr. Burmakin (Res. Doc. 68/37).

II. Biological studies

I. COD

a) Changes in the abundance

During the first months 1967, the estimation of the youngs of cod was made in Subarea 3. The main results obtained are given in Table 9.

The conclusion of the availability of an extremely high abundance of 1964 year-class cod in the waters of Grand Bank and St. Pierre Bank was confirmed once more. Cod of this year-class has already reached the commercial size and increased considerably its total stock. Apparently, the cod abundance of the 1963 year-class was also somewhat higher the average level. Thus, in 1969, the condition of cod stocks will be satisfactory enough in the southern part of the Grand Bank and on St.Pierre Bank.

b) Marking

In 1967, 2980 cod specimens were marked in Subarea 3, of ~~th~~ them 21 specimens (0.70%) were returned up to 1 March, 1968. Besides that, 27 specimens marked in 1961 - 1966 were caught. The marking confirmed that the limits of distribution of two main cod stocks (Labrador and southern-Newfoundland) lie approximately along the 46° latitude; northerner of this parallel lies the zone of stock mixing. The cod of Flemish Cap Bank is to be considered as a fully separated stock.

Table 8. Annual catch and catch per hour trawling, Subarea 3 (tons)

Divisions	Total catch by trawls of all types							Average catch per hour trawling by BMRT
	Cod	Grenadier	Redfish	Flounders	Holibut	Others	Total	
3 K	9.241	15.692	839	1802	3.160	921	31.655	2,04
3 L	3.536	17	769	-	-	110	4.432	1,67
3 M	5.886	-	65	-	-	150	6.101	1,78
3 N	45.723	3	12.793	17.007	2.071	2.496	80.093	2,42
3 O	73,122	-	17.706	33.438	69	8.990	133.325	2,37
3 P	4.479	190	1.216	2.456	34	743	9.118	2,02
3	141.987	15.902	33.388	54.703	5.334	13.410	264.724	2,27

Table 9. Average catch (number of individuals) of the youngs of cod per hour trawling

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

2. R e d f i s h

Studies on the size and age composition in trawl catches of redfish, their maturity stage and feeding were carried out in all the areas of mass distribution of redfish. Thus, for exemple, it was confirmed that the larvae extrusion took place in April - May in the northern part of division 3K at depths 200-400 m. In 1967, very dense concentrations of redfish (type Mentella) kept on there; 80% of specimens were females at an extrusion stage. The mean length of females was 43.5 cm, the average age -21.5 years.

In January, redfish concentrations (type mentella) were found between 48° and 49°N on the continental slope, depths 400-500 m; females at the stage of eggs maturity made 70% of all individuals caught. The meen length of females was 38.4 cm, the average age - 18.5 years.

3. Grenadier (Macrurus rupestris)

From October to the beginning of December, dense concentrations of grenadier (Macrurus rupestris) were fished by some BMRT in div. 3K at depths 600 - 800 m. The length of grenadier in trawl catches varied from 35 to 95 cm, the mean length was 64.7 cm, the average weight - 618 kg. The weight of liver made about 5.8 % of the total fish weight. Males made 64.4%, females - 35.6% of the total catch. Grenadier concentrations were kept at the same area of slope some months in succession.

S u b a r e a 4

A. Status of Fisheries

1. Silver hake

In 1967, catches of silver hake continued to decrease sharply and made 2.5 thousand tons in total. This catch was the least for the total period of hake fishery (see Table 10).

Table 10. Silver hake catches in Subarea 4, 1962 - 1967 (thousand tons)

Years	1962	1963	1964	1965	1966	1967
Catches	8.0	123.0	81.1	50.0	10.3	2.5

The reduction of silver hake catches began since 1964 and was especially great in the period 1966-1967. It may be explained by the decline in its abundance which is due to the presence of poor year-classes, as well as by a considerable decrease in fishing effort, as the trawls went to other regions. There are no data testifying the fact that stock concentrations will be restored in the nearest future and its catches will increase.

II. Haddock

In 1966, Soviet haddock catches decreased up to 20.6 thousand tons and in 1967 - up to 0.7 thousand tons in comparison with 45.5 thousand tons in 1965 (see Table 11).

Table 11. Soviet haddock catches in 1962 - 1967, Nova Scotia Area (in thousand tons)

Years	1962	1963	1964	1965	1966	1967
Catches	2.6	3.7	5.5	45.5	20.6	0.7

A sharp decrease in catches taken in 1967 can be explained by the fact that vessels did not meet sufficient haddock concentrations and it was occasionally caught together with other specimens. The main reason of decrease of concentrations is the decrease in stocks, as very rich 1962 and 1963 year-classes were followed by poor year-classes.

Due to random catches of haddock, a little quantity of age samples were taken. Thus, in 4X, one sample of 99 specimens was taken in April and the other from 98 individuals in May. It turned that the four-year olds prevailed in samples: in April they made 88.0% and in May - 81.9%. Thus, judging by limited samples, the catches consisted mainly of the 1963 specimens.

In May, the sample of 196 specimens taken in 4W consisted of one-year olds (3,5%) two-year olds (0.5%), three-year olds (24.4%) four year olds (33.6%), five-year olds (26.3%), six-year olds (9.0%) and seven-year olds (0.5%).

III. ARGENTINE

In 1967, catches of argentine in the area of slopes of the Nova Scotia Shelf (4X, 4W) decreased in total and made 4.2 thousand tons in comparison with 15.0 thousand tons in 1966 (see Table 12). But, a relative share of argentine in the USSR catches increased from 14% in 1966 to 41% in 1967. Fishing for argentine was mainly conducted in 4X, from April to October.

Tablo 12. USSR argentine catches in the Nova Scotia area, 1963 - 1967 (in thousand tons)

Years	1963	1964	1965	1966	1967
Catches	8.1	4.9	5.6	15.0	4.2

B. Special investigations

I. Status of fisheries

In 1967, four standard hydrographic surveys were made in the ICNAF Area. The position of stations and sections is represented on Fig. 2. Besides these observations, bathythermograph surveys in some sections of Subarea 4 were completed throughout the year. The distribution of water temperature along sections I and VI is represeuted in Figs. 2 and 3. The data obtained show that in 1967, the processes of the winter cooling in the Nova Scotia area were less intensive than in 1966.. The temperature in the surface layer was 2 - 2.5° higher than in 1965, 1966. In winter 1967, the bottom temperature was 1° higher in the deep Sambro in comparison with 1966, and the temperature from surface to bottom was at an average 3-5° higher. The winter temperature of the surface and bottom layers in the Cabot Strait was 2° higher than in 1966.

In spring, the water temperature in total approached the 1965 level for exception April, when temperature was the same as in 1966.

In summer, the temperature in surface layers of the considerable part of Nova Scotia Shelf was 2-3° higher in comparison with 1966 level, for exception the areas of Browns, Roseway, La Have Banks and the shallow of the Sable Island. Data obtained at the Halifax section show on 1° rise of temperature in the centre of the cold intermediate layer, and 2° - 3° rise in the near bottom layer. In August, the surface temperature was 5° higher at stations along the section I (Cabot Strait), as compared to this one in August 1965, and the data on the temperature distribution at depths show that modified Gulf Stream waters (6.1° - 7.5° in its central part) enter the Cabot Strait.

II. Biological Studies

Silver hake

In 1967, studying of the age composition of silver hake catches was continued. Otoliths kept in the ethyl alcohol were taken for age determination.

Age studying showed that in 1967 the catches consisted mainly of three-, four- and - five year olds. The four-year old specimens made 61,0%, that is the maximum value for the period 1963 - 1967 (see Table 13), and the three-year olds were the least (14.8%) for the same period. Table 4 show that in 1964 the share of three-year olds decreased, but four-and-five-year olds increased. Total catches and catch per hour trawling reduced. This allow to conclude that the recruitment of silver hake stosks decreased from year to year. Due to this fact the decline in the abundance was observed.

In 1967, the study of silver hake feeding was continued, the table was made to show their stomach content index, the frequency of occurrence of the organisms in the food lump of fish collected in 1965-1967 on board the scouting vessels in subareas 4 and 5 of the ICNAF Area and further to south-west.

Table 13. Age composition of silver hake catches in the area of the Sable Island 1963 - 1967 (%)

Age / Years	1	2	3	4	5	6	7	8	9	Total	Medium age
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

Argentine. In 1967, the morphology and the growth rate of argentine were studied. Preliminary results of the comparison of argentine from catches taken on the shelf slopes off the Sable Island and on Browns Bank showed that two independent stocks inhabited these areas.

S u b a r e a 5

A. Status of fisheries

1. Silver hake

In 1967, Soviet catches of silver hake decreased sharply and made only 70.0 thousand tons in comparison with 281.4 thousand tons in 1965 and 121.4 thousand tons in 1966 (see Table 14)

Table 14.

USSR catches of silver hake (in thousand tons), Subarea 5, 1962 - 1967

Years	1962	1963	1964	1965	1966	1967
Catches	41.9	107.4	163.3	281.4	121.4	70.0

The main reason of constant decrease in silver hake catches is the reduction in their stocks. In 1967, a sharp decrease in catches was also due to the fact that some vessels changed their areas of fisheries, and commercial effort decreased considerably.

Thus, in 1967 the total number of trawling hours was 40.683 and in 1966 - 123704 for BMRT which took the bulk of silver hake, i.e. in 1967 the fishery intensity by BMRT decreased thrice.

II. Haddock

In 1967, the USSR haddock catches on Georges Bank decreased sharply up to 2.3 thousand tons in comparison with 81.9 thousand tons in 1965 and 48.4 thousand tons in 1966 (see Table 15). The decrease in haddock catches was due to the reduction in commercial concentrations and in commercial effort. In the nearest future the stocks will not increase, thus, haddock catches will apparently be small in number.

Table 15 USSR catches of haddock on Georges Bank (in thousand tons), 1962 - 1967

Years	1962	1963	1964	1965	1966	1967
Catches	1.1	2.4	5.5	81.9	48.4	2.3

III. Red hake

Red hake was fished by Soviet vessels both in the subarea 5, and southerner of the ICNAF Area.

Table 16. USSR catches of red hake (in thousand tons), the subarea 5 and southerner of the ICNAF Area, 1963 - 1967

Years / Area	1963	1964	1965	1966	1967
5	3.4	3.6	58.5	85.1	37.6
Southerner of 5	0.8	8.3	11.7	25.7	14.9
Total	4.2	11.9	70.2	110.8	52.5

As seen from Table 16, red hake catches increased sharply in 1965 and 1966, but decreased in 1967. The growth in catches in 1965 - 1966 was caused by the increase in commercial concentrations and commercial effort, the reduction in catches in 1967 was due to the decrease in red hake stocks and commercial effort.

IV. HERRING

In 1967, the USSR herring catches on Georges Bank somewhat increased and made 123.6 thousand tons in comparison with 117.3 thousand tons in 1966 (see Table 17).

Table 17.

USSR herring catches (in thousand tons), Georges Bank, 1962 - 1967

Years	1962	1963	1964	1965	1966	1967
Catches	151.1	97.3	130.7	36.3	117.3	123.6

The rise of herring catches during the last two years was caused by the increased commercial effort. At the same time, herring stocks in 1966 and especially in 1967 were lower than in 1964 and 1965. Decrease in herring stock in 1966 - 1967 was caused by the decrease in the abundance of a relatively rich 1960 year-class and of the average 1961 year-class due to natural and commercial mortality.

B. Special studies

1. Environmental studies

OCEANOGRAPHY.

Throughout 1967, four seasonnal standard oceanographic surveys were completed in Subarea 5 according to the scheme represented in Fig. 2. In winter, survey was made in January - February, in spring - in April, in summer - in August, in autumn - in November. In addition, throughout all the year bathy thermograph observations were made during micro-surveys in some areas of Georges Bank and the Gulf of Maine. In winter, the temperature was 1° higher throughout all the water mass along the section III (Fig. 5a), and 4 - 6° higher along the section V in comparison with 1966 (Fig. 7a). In summer, there was observed an intensive influx of warm oceanic waters into the deep-water part of the Gulf of Maine (Fig. 6b). An intensive approach of warm waters to the East Channel also was observed, in the section III, whereas the core of a cold intermediate layer either was not observed at all or it slightly modified (Fig. 5c). In the area of the eastern slopes of Georges Bank (section IV) the temperature of core of an intermediate layer was 1° higher than in summer 1966.

A comparatively higher water temperature in deep-water areas in Subarea 5 in 1967 than in 1966, can be, apparently explained by a more intensive advection of slope waters to the shelf.

Plankton

In 1967, plankton research was continued in the area of Georges Bank. In January, April, July, August, October and November standard stations were made by scouting vessels and plankton samples were collected by Dzeddy net. The results of treatment of zooplankton samples taken in 1966 showed that zooplankton biomass was at an average lower than in 1965.

Ichthyoplankton.

To study the distribution and the abundançe of silver hake, red hake and herring eggs and larvae the collection of ichthyoplankton was made at the southern slopes of Georges Bank twice in June and once in August, whereas on the northern slopes it was made in August, October and November.

Besides that, 112 samples were collected by planktonsamplers during the joint investigations with USA scientists. At presernt the sample treatement was made in laboratory conditions.

II. Biological studies.

Silver hake

a) Studies on the age composition of catches

The analisys of the age composition of catches was made throughout all the year. The age determination was made by otoliths for 3100 fish in total. By the tables of age - length data the results of the age determination were converted to mass measurements of catches. The analisys of the age composition of catches showed that in 1967 the bulk of catches consisted of three - five -year olds (see Table 9).

The share of three-year olds was at an average 29.7%, that of four-year olds - 47.8% and that of five-year olds - 15.2%. One-and-two-year olds were small in number (1.1% and 2.7%), six-year olds and the elder ones made in total 3.5%. In comparison with previous three years, when the share of three-year olds was higher than that of four-year olds, in 1967 the number of the latters was considerably higher than of three- year olds. This can be explained by the fact that in 1964-1965, the "rejuvenation" of silver hake stock was observed due to an intensive fishery and to its relatively even recruitment. In 1967, due to the recruitment of the commercial stock by a relatively poor 1964 year-class, the role of the three-year olds became less, whereas the four-and-five-year olds became of greater importance. Simultaneously, the silver hake stocks decreased as it is evident from the size of concentrations of fish and their catches per effort.

b) Race studies

In 1967, studies were continued on the locality of silver hake stocks in the area of Georges Bank and in the area of the USA Middle - Atlantic states by methods of precipitation (in the agar), immuno-phoresis and the reactions of hemo-agglutination. For this purpose 1075 blood serums of silver hake were collected in the above mentioned areas. Of them, 635 samples were treated on board the vessel and methods of precipitation and hemo-agglutination were used. The rest 440 samples from the said areas were taken to a laboratory for electrophoretic and immunophoretic analyses of serum albumin of silver hake blood. During the cruise 281 specimens were analysed in agar by method of precipitation and 3525 reactions were made. 354 specimens were analysed and 2124 reactions made by method of hemo-agglutination. Basing on the data obtained, some distinct antigenic divergences were found between the hake of Georges Bank and that from Middle-Atlantic states. Simultaneously, an attempt was made to establish the percentage of mixing of these two local stocks during the automn-winter period.

Haddock

In 1967, a very little number of age samples were taken from haddock catches, as it was caught in very small numbers.

Table 18. Age composition of silver hake catches (in %) in the area of Georges Bank, 1962 - 1967

Years \ Age	1	2	3	4	5	6	7	8	9	Total	Mean age
1962	0.24	6.78	36.36	50.43	4.01	1.43	0.76	-	-	100	3.59
1963	-	0.20	34.32	48.34	16.44	0.45	0.13	0.07	0.05	100	3.84
1964	0.14	11.36	45.44	28.58	10.68	2.92	0.78	0.10	-	100	3.51
1965	0.92	10.40	58.07	28.02	2.22	0.31	0.04	0.02	-	100	3.21
1966	4.5	17.3	45.5	27.3	4.1	0.9	0.4	+	-	100	3.14
1967	1.1	2.7	29.7	47.8	15.2	2.5	0.7	0.2	0.1	100	3.85

Of 199 specimens taken on northern slopes of Georges Bank, the four-year olds of 1963 year-class made 48.7%, five-year olds of 1 1962 year-alass - 33.1% and six-year olds of 1961 - 7.5%. Other age groups were very slightly represented. In a sample taken from catches in March, the four-year olds made 45.0%, and five-year old - 47.0%. Those data allow to assume that in 1967 the bulk of haddock catches was represented by previously numerous 1962 an 1963 year-classes.

Red hake

In 1967, the work was completed to summarize the data on catch composition, biologic characteristics and stock locality of red hake. The type of population dynamics was determined, the figures of total fishing and natural mortality were calculated. It was assertained that the mass hake attained maturity at the age of 2 - 3. The rate of total instantenous mortality - Z - made 1.3, natural M - 0.9 and fishing F - 0.4. Two local stocks were determined: one at the south-western slope of Georges Bank and the other in the area of Hudson Canyon (see special report by Dr. Richter).

Herring

a) The analysis of the age composition of herring catches showed that they were represented by specimens at the age from 2 to 9 years old, and the bulk of catches was represented by six-and-seven-year olds. Thus, the two-year olds made, at an average, 0.3% for the year, the three-year olds - 0.3%, the four- year olds - 3.6%, the five-year olds - 11.8%, the six-year oilds - 36.6%, the seven-year olds - 42.2%, the eight-year olds - 5.0% and the nine-year olds - only 0.2%.

Thus, in 1967 the bulk of catches made 1960 and 1961 year-classes, as it was in 1964, 1965 and 1966. 1963 and, apparently, 1964 years-classes were poor.

Thus, if the stock is not recruited by the abundant year-classes in the next few years, the further reduction in the herring abundance on Georges Bank should be expected.

b) Studies on the feeding of herring larvae

The analysis of intestine content was made for 323 herring larvae collected in September and October 1965 on southern slopes of Georges Bank. It was found that the body length of larvae sampled ranged mainly from 5.5 mm to 8.7 mm. Food was not found in intestines of the bulk of larvae (84.5%). In October the most of 5.5 - 7.9 mm larvae fed on nauplia and larvae *Lamellibranchiata* and some different *Copepoda*. In November, larvae of 8.8 mm to 9.9 mm long fed mostly on *Copepoda* and nauplia, and the share of *Lamellibranchiata* decreased.

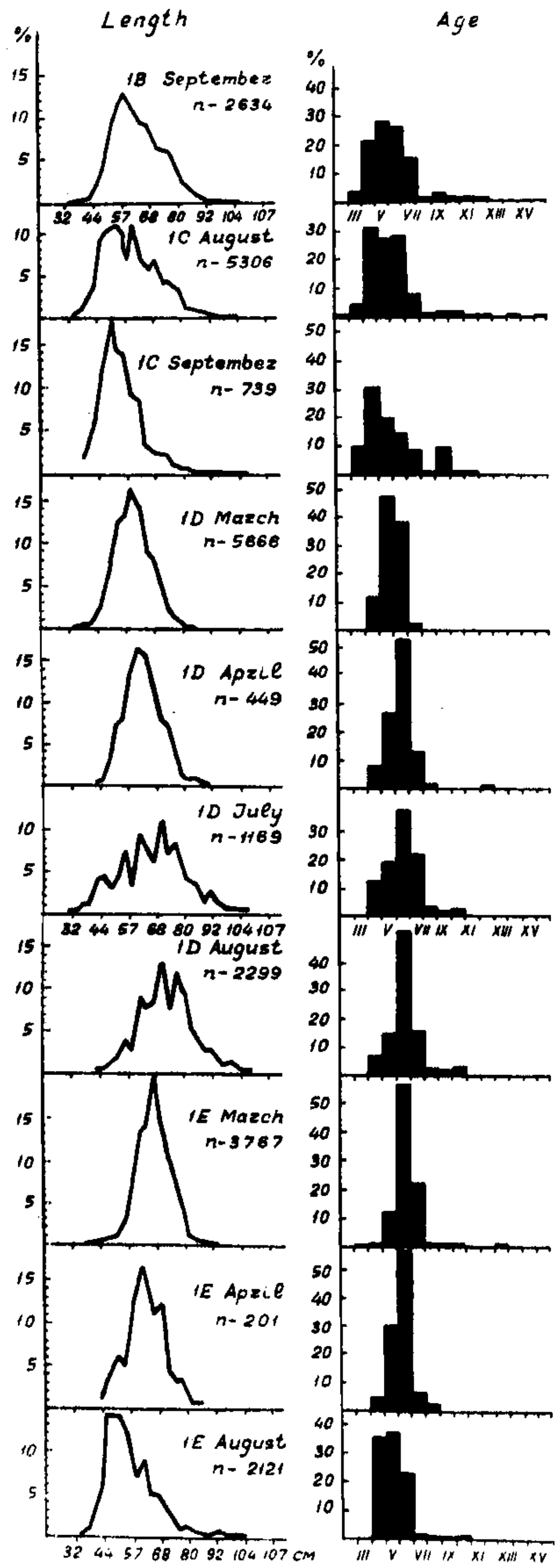

Fig. 1. Size and age composition of cod catches

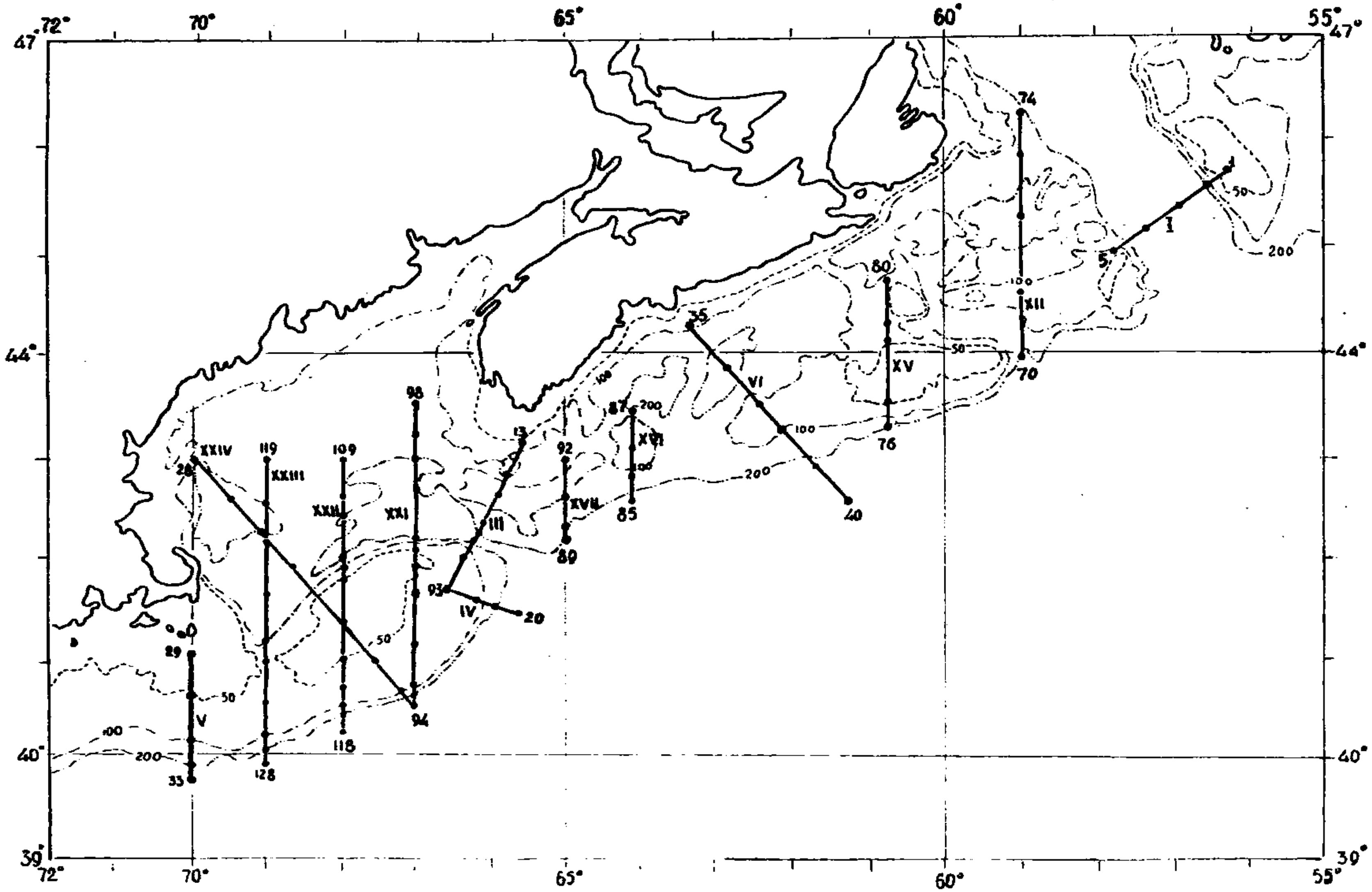

Fig. 2. Scheme of distribution of standard oceanographic sections.

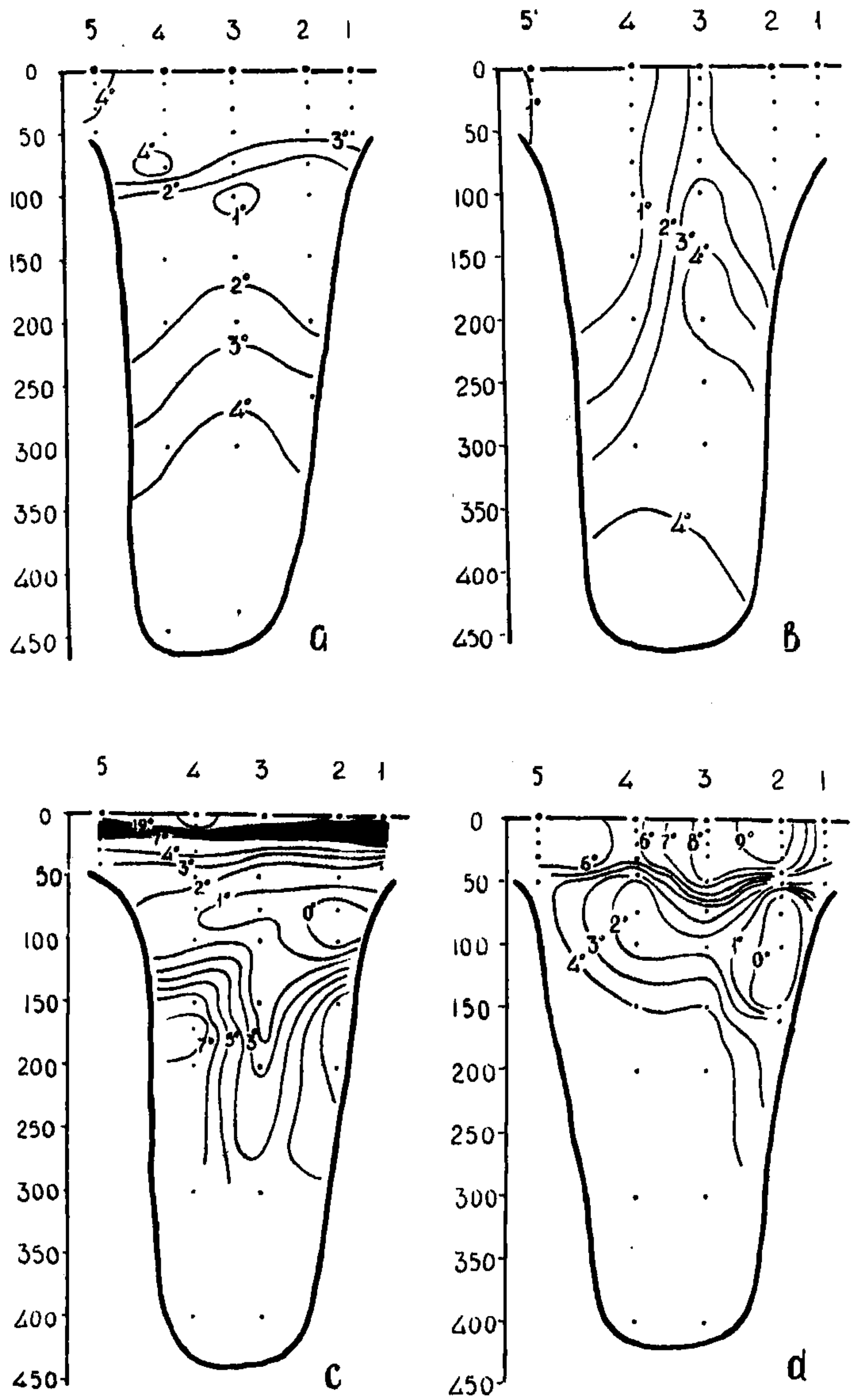

Fig. 3. Distribution of water temperature along the section 1, 1967: a) 8-9 January; b) 13 April; c) 11-12 August; d) 22 November.

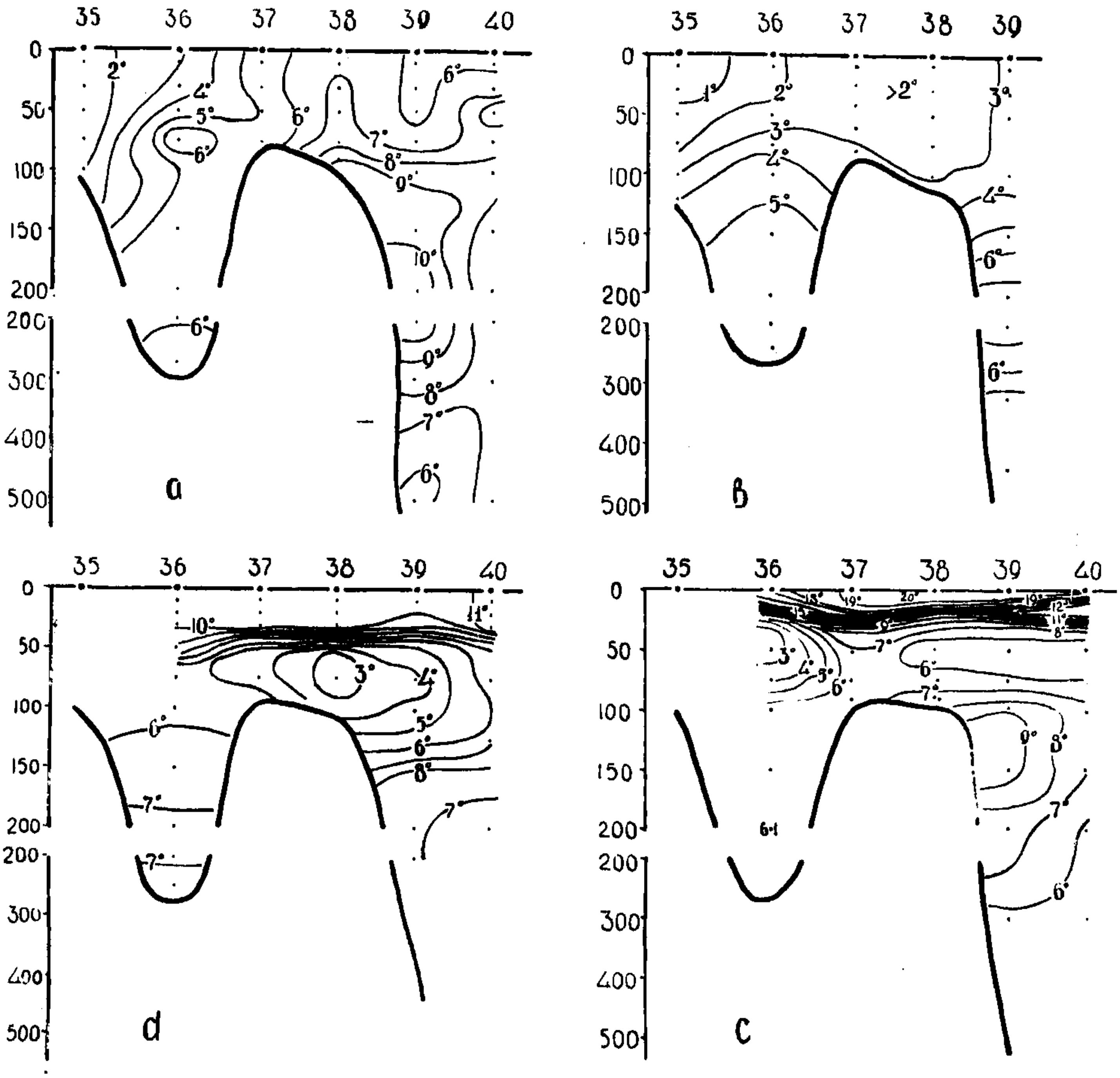

Fig. 4. Distribution of water temperature along the section VI, 1967:
a) 30 January; b) 9 April; c) 14 August; d) 12-16 November.

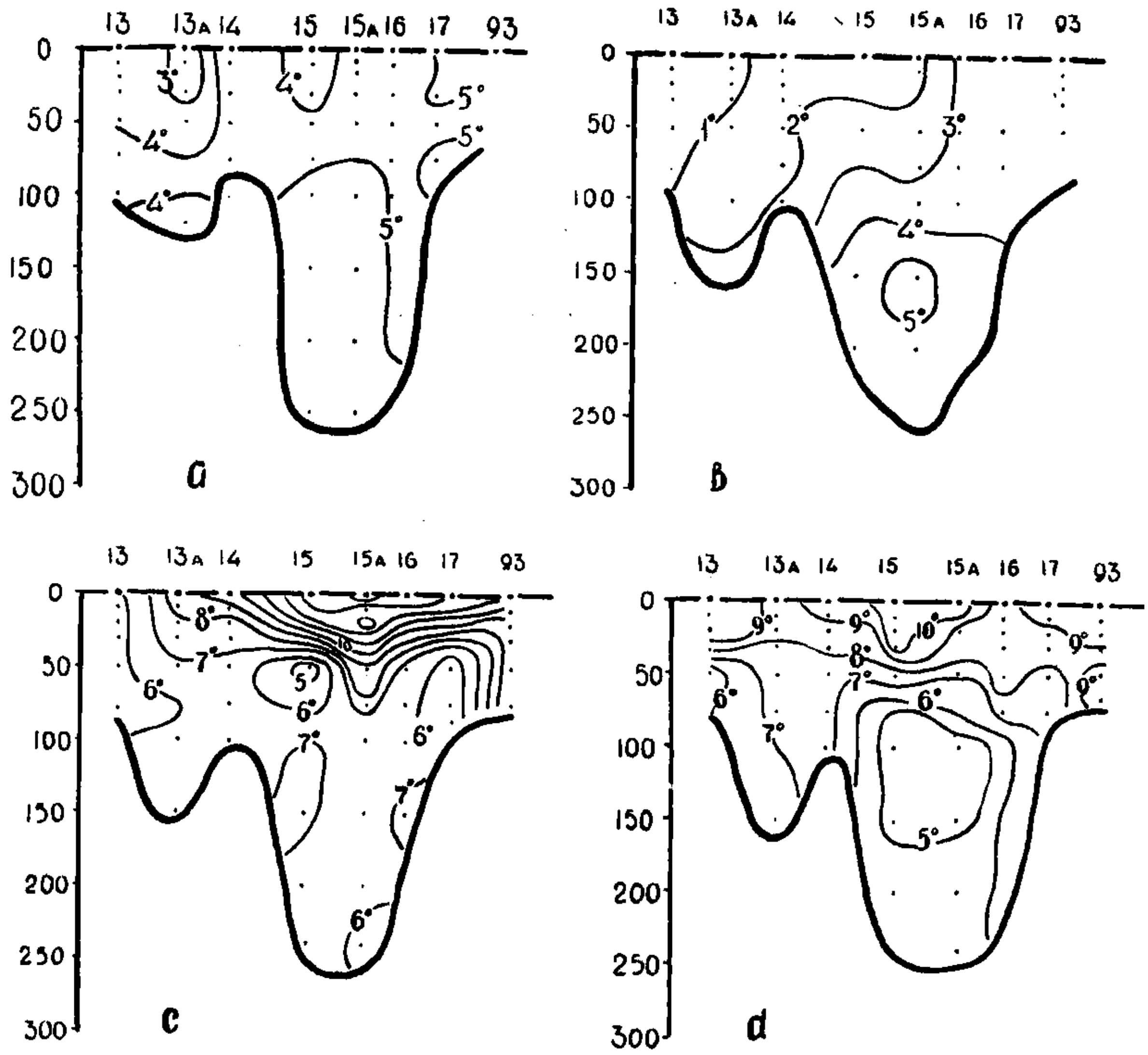

Fig. 5. Distribution of water temperature along the Section III, 1967: a) 27 January; b) 6 April; c) 13 August; 13-14 November.

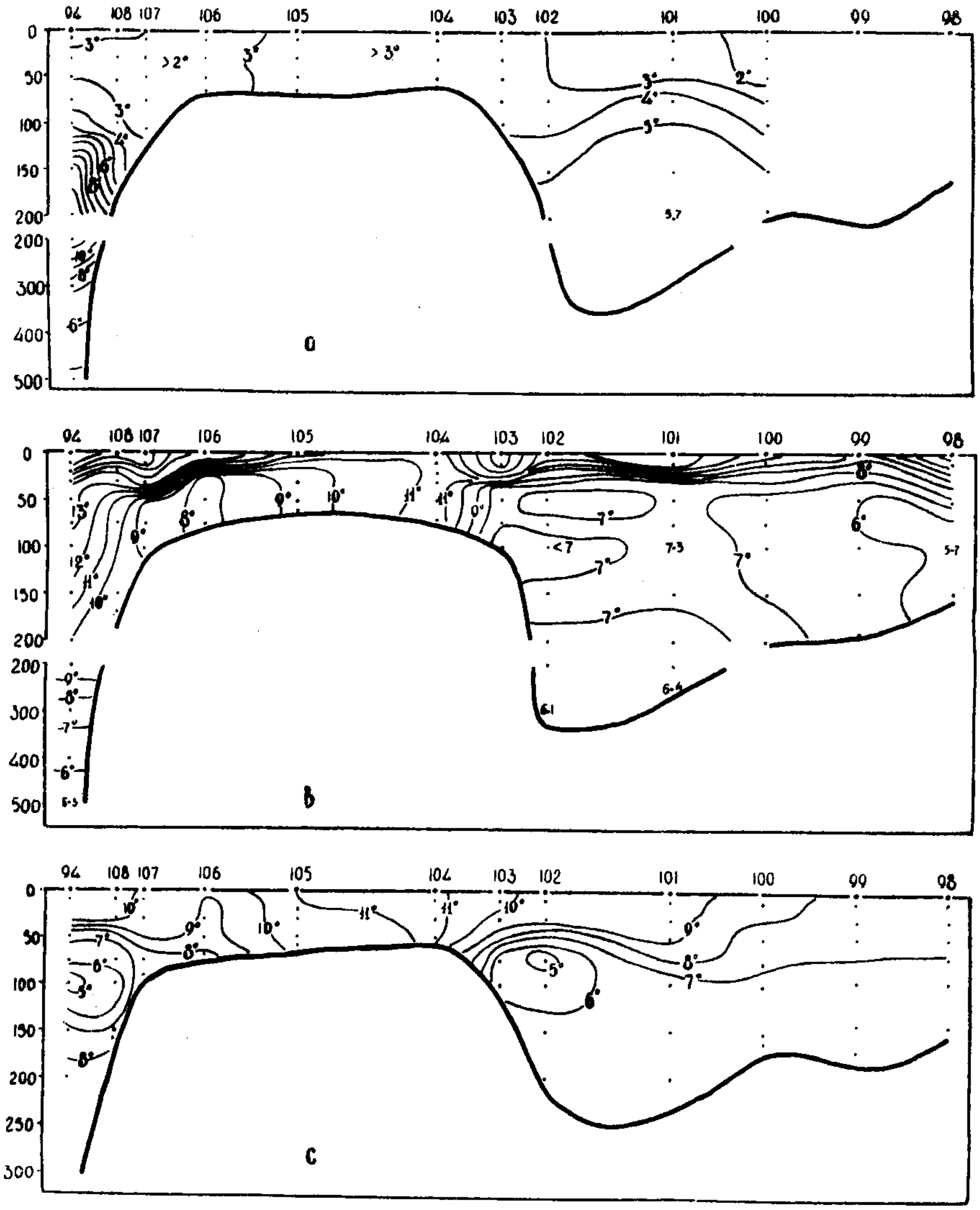

Fig. 6. Distribution of water temperature along the Section XXI, 1967:
a) 4-5 April; b) 10-12 August; c) 11-12 November.

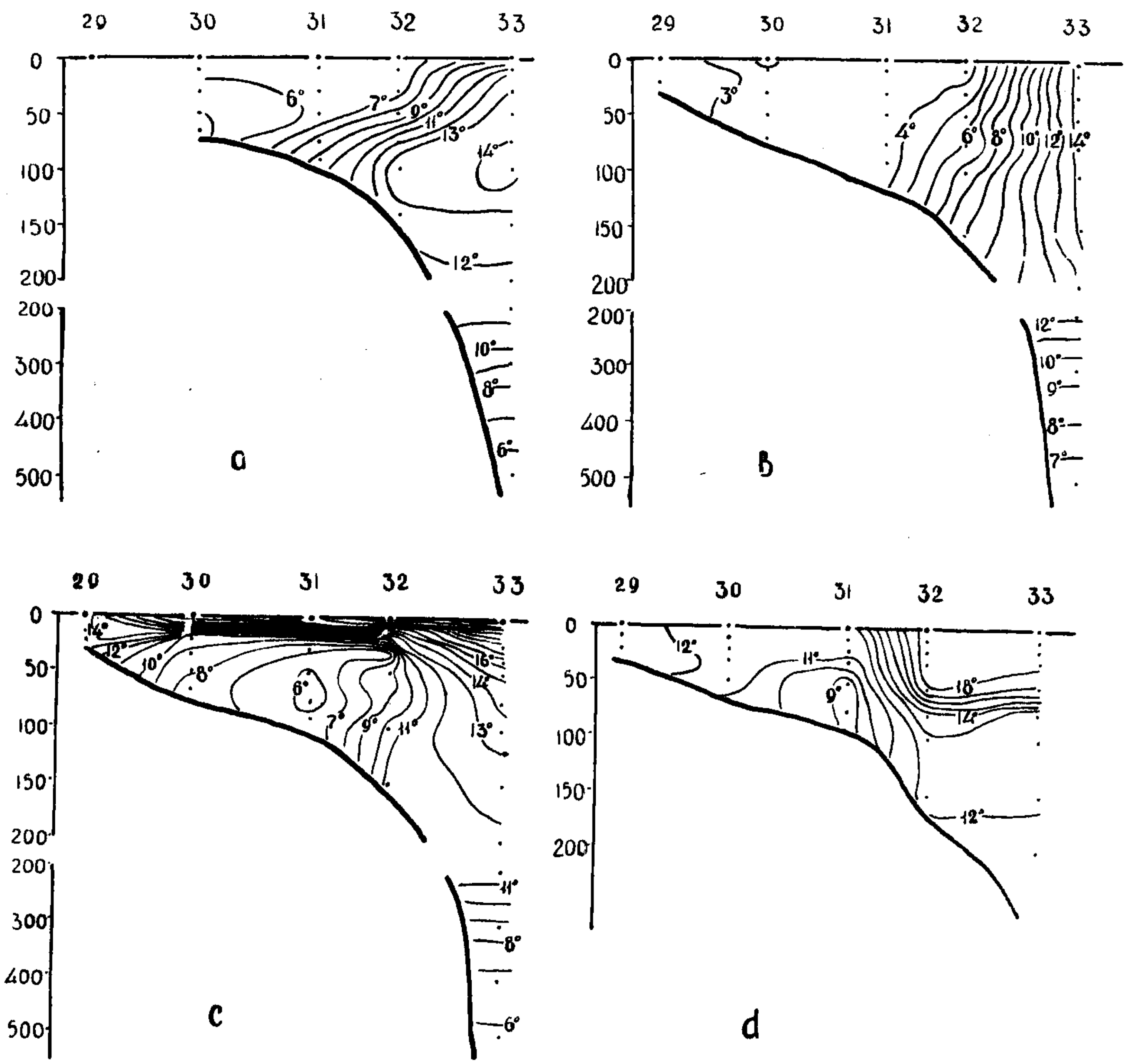

Fig. 7. Distribution of water temperature along Section V, 1967:
a) 24-25 January; b) 1 April; c) 4 August; d) 4-5 November.