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Polar I

SECTION I. SUBAREAS 0, 2 AND 3

Total yield taken by the USSR fleet in Subareas 0B, 2, 3 and 4 was equal to 133,378 tons (Table 1).

I - Subarea 0

A. State of fisheries

In 1985, the USSR yield in Div.0B amounted to 179 tons of Greenland halibut and 2 tons of roundnose grenadier. The conditions for trawl fishery were unfavourable. Greenland halibut fishery was conducted by one vessel in November and during first ten days of December.

B. Special scientific investigations

1. Oceanographic observations

Oceanographic observations in Subarea 0 were carried out on board the RV "Nikolai Kononov" (Table 2). The deep-water temperature measurements on by-trawl stations were included in the scientific program; the observations were conducted in accordance with standard methods by traditional equipment and devices. The Arctic waters of the Baffin Island Current with minimum temperature (-1.6°C) in the surface layer extended over a relatively shallow part of the region. The southwestern part of the subarea with depths

over 500 m was predominantly occupied by transformed Atlantic waters with maximum temperature of 5.1°C in a 100 m depth. Typical dynamic perturbations of thermohaline structure became apparent in zone of interaction of waters of the types mentioned and the increased horizontal gradients of water features relative to background were observed; the most intensified temperature contrasts reached 5°C per 10 miles were registered in the layer with extremely expressed heat feature of the transformed Atlantic waters, i.e., in a 100 m layer.

Estimated data-limit did not allow to assess reliably the year-to-year variations and anomalies of oceanographic conditions; nevertheless, the analysis of the material available indicated that in the period since autumn 1984 to the end of 1985 a somewhat reduction of the Arctic waters area in the region considered took place, particularly expressed in reduction of the area of extension of the waters with negative temperature.

This fact can be considered as a signal to change of tendencies of oceanographic conditions variation and transfer to the stage of warming in "upper reaches" of the Labrador Current.

2. Investigations of stocks

Our assessments of Greenland halibut stocks were mainly based on the results of the surveys carried out regularly in Div.0B since 1979. In 1985, the survey was conducted by the RV "Nikolai Kononov" from 5 November to 3 December (Table 3). As in previous years, a standard trawl with small-meshed insertion in the codend (10 mm mesh size) was used. The trawlings were made at random stations taking into account the stratification of the area and ground conditions. The vessel's speed while trawling was 3.5 knots, duration - one hour. The analysis of the data was conducted due to the standard methods.

In accordance with the survey data, Greenland halibut abundance on the continental slope constituted 85.4 mill. spec. or 114.5 thou t (Table 4), Greenland halibut in trawl catches occurred over the whole area of shelf and continental slope in depths from 200 to 1,400 m and deeper. The young halibut up to 30 cm long predominated in the catches taken on the shelf, as for the continental slope, the length was from 40 to 65 cm, mass - 0.8-2.5 kg.

In September 1984 and November 1985, Greenland halibut distributed more or less evenly on the continental slope, a slight increase of the catches was marked in depths of 700-1,000 m (Table 5). Those years, as above mentioned, were characterized with more increased heat content of water masses and were the transitional ones from a series of cold years to the stage of warming up in the Northwest Atlantic.

In the years with decreased heat content of water masses (1980-1983) a considerable growth of Greenland halibut catches was registered in connection with the trawling depth increase. For instance, in November-December 1980 the halibut catches in the 900-1,100 m depths, on the average, were equal to 1.3 t per hour trawling, but in the same period of 1982 - 2.1 t per hour trawling.

The variability of relative indices of Greenland halibut abundance and biomass in different depths of the continental slope for the period investigated, to our opinion, appeared as a consequence of discrepancies of feeding and spawning migrations, behaviour features, caused by variations in thermal conditions of water masses.

Thus, the assumption, adopted earlier (ICNAF Summ., Doc.77/VI/15, Serial 5071), was confirmed that year-to-year variations in hydrological conditions essentially influenced upon the distribution and density of halibut concentrations, therefore even at the stability of fish stocks, the fishing productivity and yield could sharply changed.

It is known, that Greenland halibut in Div.0B constitutesonly the part of great population inhabited in Northwest Atlantic, therefore it is necessary to assess the stocks state only at complete coverage of the whole area with survey. Halibut stocks in Subarea 0+1 are sufficiently high and are almost not touched with fishery. TAC can be not below 25 thou t.

II - Subareas 2, 3

A. State of fisheries

In 1985, the USSR commercial vessels conducted specialized fisheries on redfish and cod outside zone on the southern slopes of Grand Bank (Divs.3LNO) and in Flemish Cap Area (3M); on redfish and capelin - in a 200-mile fishing zone of Canada, in Divs.2J+3K, and also on grenadier - in Divs.of Subareas 2+3. The yield of other fish was dependent upon their by-catches during the specialized cod, redfish and grenadier fisheries.

Fishery conditions were in toto favourable for realization of national quotas.

B. Special scientific investigations

1. Oceanographic observations

Subarea 2. Oceanographic observations were conducted in the autumn-winter period during the trips of the RV "N.Kononov" and "Poisk" on 45 random stations of the section 8-A, crossing the Hamilton-Inlet Bank in the SW-NE directions. Thermohaline structure of waters on that section, given in Fig.1, by its main features was conditioned by predominance of cold and freshened waters of the Labrador Current over the Hamilton-Inlet Bank and the extension of relatively more warm and salt transformed Atlantic waters over the continen-

tal slope and in adjacent deepwater area. Vertical structure of temperature and salinity had the typical features of seasonal modification: (a) availability of cold subsurface layer with the most distinct features over the shelf, (b) weakly expressed warm intermediate layer in the Atlantic waters extension area and (c) catahaline accented in frontal zone over the upper part of the continental slope. Intrusion of the cold waters in the 100-150 m layer (Fig.1), registered on station 9, was the vivid feature of frontal zone structure in early November 1985.

Long-term mean data from Borovkov's paper (1985) were used to estimate the anomalies of thermohaline structure of waters compared to the norm. As comparison of materials showed, in autumn 1985 heat and salts deficit characterized with negative temperature and salinity anomalies (Fig.1) was peculiar to predominant part of waters on the section. The dominant role of heat deficit can be judged also by temperature anomalies averaged by layers and sectors of section 8-A (Table 6).

The data, given in Table 6, are also indicative of essential waters' warming observed in the Hamilton-Inlet Bank area in the period between the observations in November 1984 and November 1985. This tendency expresses the break in long-term variations of thermohaline state of waters in the area considered, which during a set of recent years (1982-1984) were expressed in progressing growth of heat and salts deficit (Borovkov and Burmakin, 1985).

Subarea 3. The data on deepwater measurements, made on stations of standard sections by the RV "Boguslav" (Table 2) in April-May, were mainly used for assessment of conditions.

The accent of the features typical for Arctic waters was the main peculiarity of thermohaline structure fixed in the periods of observations in the areas of the eastern slopes of the Grand Bank and over the Flemish Cap Bank. Due to the data, given in Table 7, the heat state level of the waters in those areas was everywhere below the norm and relative cooling, covering a considerable water stratum within the limits

of hundreds of meters, reached the value of -1.8°C in the upper 200 m layer and of -1.2°C in the intermediate 200-500 m layer. Contrary to that, the waters on the slopes of the SW Grand Bank (section SW Grand Banks) had the temperature corresponding to the norm (0-200 m layer) or significantly above it (200-500 m layer).

Thermohaline structure of the waters in zone of the greatest cooling is represented in details by schemes given in Fig.2. The analysis of these schemes showed that the cooling combined with salinity decrease; the waters' features in the upper 200-400 m layer were subjected to the greatest modification in this direction. Judging by occurrence of maximum negative temperature and salinity anomalies in the frontal zone in the Flemish Pass Channel and eastern part of the Flemish Cap Bank, it can be supposed that the transgression processes of the Labrador Current waters, connected, apparently with their advection intensification, participated in the formation of heat and salts deficit. Advection intensification of the Labrador Current waters in combination with their production increase under severe winter conditions explains not only the intensification of waters' features of this type, but also the increase of their mixture with transformed waters, formed during the interaction of the Labrador and North Atlantic Currents.

The comparison with the results of the previous researches (Borovkov and Burmakin',1985) shows, that thermohaline structure of the waters over the greater part of the region considered, was not subjected to essential changes relative to that observed in spring 1984. Only the areas of "tail" of the Grand Bank and Flemish Cap were the exception, where the evolution of thermohaline features of waters in the period from spring 1984 to spring 1985 had sharply expressed tendency to heat and salts content decrease.

To summarise the results of the analysis conducted, it can be concluded that in 1985 within the limits of the shelf and continental slope of NAFO Subareas 0, 2 and 3, the waters with heat and salts deficit, the "hearth" of which located in

spring over the eastern slopes of the Grand Bank and Flemish Cap, had been prevailed. Tendencies of variations in thermohaline conditions from 1984 to 1985 were not unequivocal in different areas and defined:

- relative warming and increase of water salinity in Subareas 0, 2 and in Div.3O;

- conservation of substantial deficit of heat and salts in waters over the eastern slopes of the Grand Bank;

- sharp cooling and water salinity decrease in the areas of "tail" of the Grand Bank and over the Flemish Cap Bank.

2. Geostrophic circulation of waters

The estimates and charting of the sea surface dynamic topography were carried out to assess the qualitative features of horizontal circulation of waters in the surface layer. The estimates were made on the basis of the data of the detailed survey of the part of NAFO Subarea 3, which was conducted in the spring-summer season during the trips of the RV "Genichesk" and "Boguslav". The technology, analogous to that applied earlier (Borovkov and Kudlo, 1982), was used aimed at supplying with comparable analysis of the data obtained and the results of the previous investigations in estimates and charting.

The structure of waters circulation field over the Newfoundland banks and continental slope, illustrated in Fig.3, expresses a typical combination of the stream flow - the main branch of the Labrador Current and mesohigh dynamic perturbations of wave and eddy character. Eddies formations were the most developed over the shallow of the Grand Bank and Flemish Cap and they represented the systems of two adjacent anticyclonic hydrologic cycles (Fig.3), the usual isolated or two-center anticyclon (Fig.4).

The scheme of waters movement in Fig.5 was mostly unusual similar to that situation given by the spring-summer 1984 survey data (Borovkov and Burmakin, 1985), that was evidently

indicative of circulation stability in the corresponding year's time interval. Probably the circulation stability to some extent defined the above mentioned lack of essential year-to-year variations in thermohaline state of waters over a substantial part of Subarea 3.

Kinematic situation in the Flemish Cap area concerning April 1985 (Fig.3) had a specific feature, which was expressed in the exsistence of the branching of the Labrador Current, crossing the Flemish Pass Channel in the eastern direction and penetrating into the southwestern part of the bank. The unusual extension of the waters typical for the Labrador Current in that area and formation of significant anomalies of thermohaline structure were related with the circulation feature mentioned. It should be noted that in similar situation the character of the surface waters movement in the southwest of the bank, where the main cod spawning grounds observed, was rather unfavourable for survival of their new generation, because it could cause the mass irreversible loss of ichthyoplankton as a result of its outflow beyond the bank limits. The ichthyoplankton survey materials, submitted in Akhtarina's paper (this session), do not exclude such unfavourable effect anyhow.

3. Stocks investigations

Roundnose grenadier (2GHJ, 3K). The trawl survey conducted by PINRO in Divs.2GHJ and 3K in October-December 1985 showed that in the depths up to 1,300 m the grenadier concentrations were absent. Mass measurements of grenadier showed that the mean length of the fish in 1985 was lower than that of the previous years (Table 8). The total change of size composition of grenadier in the above regions in the recent years was accompanied with variation in ratio of small and large fishes in different depths. In 1985 the mean length of grenadier was 39.3 cm in the catches taken in the depths less than 800 m, and it was 59.7 cm - in the depths over 1,200 m, i.e. the large

fishes prevailed in the greatest depths of trawling (Table 9). A relative number of females was higher in the catches taken in depths over 1,200 m than that in smaller depths. In the years, prior to the cooling of the Northwest Atlantic waters, the grenadier fishery was mainly carried out in the depths up to 1,000 m. No variations in size composition of grenadier relative to trawling depths in the northern areas off the Canadian coast were registered.

The total yield of the roundnose grenadier in the Northwest Atlantic decreased since 1978 to 1983 from 26.5 to 3.6 thou t.

The USSR and DDR investigations showed that the re-distribution of the two main commercial deepwater species concentrations, Greenland halibut and roundnose grenadier, into the greater depths, caused by decrease of water masses heat content is considered to be one of the reasons of the grenadier yield reduction by all the NAFO Divisions, observed in 1978-1984. The great catches of Greenland halibut in these years were observed everywhere on the continental slope in the 700-1,200 m depths (Table 10).

The limitations on the halibut by-catch (up to 10%) also prevented from a specialized grenadier fishery development in the Northwest Atlantic.

Cod (3M). The trawl surveys conducted in 1983-1985 showed that the Flemish Cap cod stocks were at a low level.

In 1985, the specimens of the rich 1981 year class constituted the bulk of the catches,(they were close to the mean 1980 and 1982 year classes by abundance), and of not numerous 1983 and 1984 year classes. Biomass of the fish was close to the 1984 level and amounted to 28.1 thou t, and abundance decreased from 60.7 to 37.1 mill.spec. (Table 11). The cod at age of 3-5, 33-53 cm long dominated in the catches (Table 12).

In 1987, the cod at age of 5-7, 45-65 cm long, 1-3 kg by mass will constitute the bulk of the catches. Taking into a account a poor recruitment to the stock with the 1983 and 1984

year classes specimens, it is reasonable to conserve the existing level of fishery (TAC - 13 thou t).

Cod (3LNO). The cod biomass on the Grand Bank, which was available for bottom trawl, was maintained on the 1984 level, but abundance increased from 563 to 703 mill.spec. (Table 11). The cod at age of 3-5 of the 1980-1982 year classes dominated in the catches, the abundance of the classes was assessed as to be above the mean level. The smallest specimens 27-37 cm long prevailed in Div.3O, the cod 27-47 cm long constituted the bulk of the catches in Divs.3LN.

In 1987, the specimens at age of 4-7, 40-60 cm long, 0.5-2.5 kg by mass, of the abundant 1980-1983 year classes will dominate in the catches. The biomass of cod will gradually increase at the cost of the natural increment.

Taking into account a high abundance of the 1980-1982 year classes entering into the fishery, there are grounds for further increase of TAC for 1987.

The Labrador stock cod (2J+3K). In 1985, the trawl survey on this stock assessment was conducted within the limited area of Div.3K, that was explained by complicated ice conditions, observed in the period surveyed. However, due to incomplete data, the Labrador cod biomass in the microdistrict of Div.3K was 2.7 times higher than that, on the average, over that area for period 1973-1985 and was equal to 243.6 thou t. The abundance of the fishes was on the level of 1984 - 286 mill.spec.

The fish of 33-53 cm long, at age of 3-6 of the abundant 1979-1982 year classes dominated in the catches (Table 12).

In 1987, the strong 1982-1980 year classes will form the Labrador cod stock. A further stock biomass growth is expected. The commercial stock will be evidently underexploited.

Redfish Sebastes mentella (3M). Due to trawl surveys data, the indices of the abundance and biomass of the redfish

in 1985 were 2-2.5 times below those of the previous years (Table 11, Fig.5). However, on the basis of the acoustic survey conducted by the RV "Poisk" in 1985, a considerable part of the stock (about 200 thou t) was observed in pelagic waters and not available to assessment with bottom trawls. The data on acoustic surveys and size-age composition indicate the essential recruitment to the commercial stock with the specimens 17-21 cm long at age of 4-5, of the abundant 1980-1981 year classes (Fig.5, Table 13).

It is expected, that in 1987, the redfish 19-24 cm long will constitute a considerable part of the commercial catches. The fishes 32-36 cm long, at age of 12-17 of the 1975-1970 year classes will be not numerous because their abundance, to a greater extent, is reduced by fisheries in the previous years. In connection with the fact, that in 1987 a small redfish will constitute the bulk of the commercial stock, the protective fishery level at F=0.1 will be the most reasonable, TAC will be equal to 20 thou t (Table 14).

Redfish Sebastes mentella (3LNO, 3K). The data on size and age compositions in Divs.3NO are indicative of an essential recruitment to the stock with the specimens 17-21 cm long of the abundant 1981-1980 year classes (Fig.6, Table 13). The abundance and biomass of the redfish on the Grand Bank (Divs.3LNO) were at the level of the previous year (Table 11).

By VPA assessment the commercial stock of redfish in Divs.3LN amounted to 250 thou t. Coefficients of natural mortality differentiated by ages were determined due to V.L. Tretyak's method (Efimov, Savateeva, Tretyak, 1986, NAFO, this session). TAC's estimates for 1987 at different levels of fishery are given in Table 15.

The redfish stock in Div.3K is maintained at a high level (Table 11). In 1987, the redfish 26-40 cm long will constitute the bulk of the catches. The commercial stock in this area is evidently underexploited.

Capelin (2J+3K, 3LNO). According to the hydroacoustic survey data, conducted from 5 May to 13 June 1985, the total capelin abundance in Divs.3LNO was equal to about 290 billions spec., and biomass - 2.2 mill.t.

The main capelin concentrations distributed in the northwestern areas of Div.3L and consisted chiefly of immature fish 8-13 cm long of the 1983 year class. The percentage of mature fish of the stock estimated was 13.4% by abundance and about 30% by biomass. The specimens 12-17 cm long of the 1982 and 1981 year classes dominated among the mature fishes.

The greatest quantity of mature fish was observed in the central and southern parts of Div.3L and also in Div.3O beyond the limits of a 200-mile fishing zone of Canada.

The autumn survey conducted from 21 October to 7 November 1985 in Divs.2J3K showed that capelin distributed over a wide area from 51 to 55°N and between 53°40' and 56°00'W. The densest concentrations distributed on the southwestern slope of the Hamilton Bank. The total abundance of the capelin observed in the area in the period surveyed was 103 billions spec. or about 1.5 mill.t. The 1983 year class constituted the bulk of the catches in the control trawlings.

The results of the surveys showed that in the nearest two years (1986 and 1987) the rich 1983 year class will constitutes the bulk of the commercial stock.

The estimates of the commercial stock and TAC for 1987 by VPA were made on the basis of the results of the surveys conducted in 1985 (Table 15). The strength of the 1984 year class is conventionally accepted at a minimum level - 50 billions spec.

In 1987, somewhat reduction of the stocks will be possible to take place (Table 15). This is related with the fact, that the abundant 1983 year class will be represented by its remainder at age of 4+, but the 1984 year class, preliminary assessed as the poor one, and also the 1985 year class, the abundance of which is not possible to be projected at present time, will constitute the bulk of the stock. At the level of F=0.15, TAC in 1987 can constitute not less than 100 thou t.

Table 1 USSR catches in Subareas 0, 2, 3, 4 in 1984–1985
(tons)

Species	NAFO Divs.	1984	1985
Cod	2GH	9	-
	2 + 3KL	488	125
	3NO	3306	3968
	3M	910	1271
	4VWX	110	21
Haddock	4VWX	170	275
	3NO	48	2
Redfish Sebastes mentella	2 + 3K	3684	3689
	3LN	9277	10885
	30	7262	5905
	3M	15005	15703
	4VWX	22	111
Roundnose grenadier	0 + 1	25	2
	2 + 3	147	1018
American plaice	2 + 3K	2	7
	3M	711	971
	3LNO	360	81
	4VWX	65	-
Witch	2 + 3KL	1000	1006
	3NO	1955	1908
Greenland halibut	0 + 1	109	179
	2 + 3KL	440	149
Capelin	2J + 3K	17366	16838
Silver hake	4VWX	57423	56337
	3NO	189	170
Saithe	4VWX	97	336
Yellowtail flounder	3LNO	-	-
Herring	4VW	-	58
Mackerel	3 + 4	881	913
Argentine	4VWX	201	125
Squid Illex	3 + 4	191	252
Others		7374	11073
Total		128827	133378

Table 2 Oceanographic observations conducted by PINRO in NAFO Area in 1985

Vessel, trip	Sub-area	Stations of standard sections				Other stations						Equipment
						by seasons						
		Date	Section	Parameters (T,S, O_2,etc)	Number of stations	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Parameters (T,S, O_2,etc)	Number of stations	
N.KONONOV, 33	0								45	T,S	45	Bottle
N.KONONOV, 33	I								8	T,S	8	"-"
POISK, 54	2	0.6-0.7 Nov	8-A	T,S	I0				I7	T,S	I7	"-"
N.KONONOV, 33	2								28	T,S	28	"-"
KOKSHAISK, 9	3					30				T,S	30	"-"
BOGUSLAV, 1	3	I9.Apr	Coast Guard-4	T,S	5		I2			T	I2	"-"
		20 Apr	Coast Guard-3	T,S	3		65			T,S	65	"-"
		24-27 Apr	SW Grand Banks	T,S	2I							"-"
		30.Apr-04 May	Coast Guard-4	T,S	24							"-"
		04-06 May	Coast Guard-3	T,S	I7							"-"
		07-08 May	4-A	T,S	I4							"-"
		09-I2 May	Flemish Cap	T,S	25							"-"
		I5-I8 May	7-A	T,S	I3							"-"
GENICHESK, 2	3					I	3			T	4	Bottle
						3	3I4			T,S	3I7	"-"
							I6	36		T	52	MBT
POISK, 54	3	26 Nov	Coast Guard-3		4				5I	T,S	5I	Bottle
N.KONONOV, 33	3							3	63	T.S	66	"-"

Table 3 Biological surveys carried out by PINRO vessels in NAFO Area in 1985

Subarea	Division(s)	Month(s)	Survey type*	Survey char	No.of trawlings
3	LNO	5-6	O	Trawl-acoust.	53
3	M	3-4	S	Trawl	I26
	N	5	S	"-"	85
	L	5-6	S	"-"	I02
	O	5-6	S	"-"	79
	K	6	S	"-"	55
2+3	J+K	I0-II	O	Trawl-acoust.	22
3	M	5-6	O	Ichthyoplank.	42
0	B	II-I2	S	Trawl	78
2	G+H	I2	S	"-"	43
3	LNO	II	O	"-"	34

* / O - other surveys

3 - stratified surveys

Table 4 Greenland halibut abundance and biomass assessment in NAFO Area in 1980-1985 by trawl surveys data

Year, month	Investigated area, sq.miles	Number of trawlings	Abundance, mill.spec.	Biomass, thou t
		Div. 0B (continental slope)		
I980, Dec	8253	35	99,I	I56,5
I98I, Dec	4I93	II	39,2	56,2
I982, Nov	8653	5I	II4,4	207,9
I983, Nov	I2593	7I	I27,8	I68,4
I984, Sep	7733	32	76,4	I26,7
I984, Nov-Dec	9I04	2I	24,2	2I,0
I985, Nov-Dec	9I04	49	85,4	II4,5
		Div. 2GH (continental slope)		
I983 Nov-Dec	4II6	54	I25,3	225,8
I984, Dec	59I0	52	65,7	85,5
I985, Dec	4659	34	I7,3	I6,7
		Div. 3K (shelf, continental slope)		
I98I, Jan	9479	34	57,I	62,3
I98I, Jul	20755	48	II0,2	62,5
I982, Jul	23030	53	I54,9	98,4
I983, Jan	I99954	67	I20,2	96,7
I983, Jul	27926	94	587,8	I22,6
I984, Jul	3II85	II3	288,6	2I6,7
I985, Jun	I90I2	53	I27,I	72,9

Table 5 Greenland halibut catches from different depths over the continental slope in Div. 0B in 1979-1985, kg per trawling hour (in brackets - number of trawlings)

Depth, m	Area, sq.miles	Year, month							
		1979 Sep-Nov	1980 Nov-Dec	1981 Dec	1982 Nov	1983 Nov	1984 Sep	1984 Dec	1985 Nov-Dec
501-600	920	455(12)	45(4)	130(1)	170(4)	907(2)	-	52(2)	101(2)
601-700	1500	521(13)	71(4)	-	336(7)	242(7)	317(5)	31(3)	292(3)
701-800	1640	482(15)	130(2)	-	783(6)	247(9)	635(9)	23(2)	277(7)
801-900	2890	488(8)	918(4)	220(3)	986(11)	400(9)	490(7)	58(3)	466(15)
901-1000	911	398(5)	1379(11)	618(6)	934(9)	615(12)	369(3)	108(3)	497(11)
1001-1100	392	455(2)	1316(6)	761(3)	2130(13)	865(8)	280(5)	71(3)	224(4)
1101-1200	400	-	-	-	1681(1)	1482(11)	109(3)	69(2)	215(3)
1201-1300	451	-	-	-	-	1024(5)	-	254(3)	212(4)
501-1300	9104	478(55)	886(31)	522(13)	1101(51)	715(63)	425(32)	88(21)	360(49)
Biomass index		477	580	316	826	518	436	62	330
% of area surveyed		90,7	90,7	56,2	95,0	100	84,7	100	100

Table 6 Water temperature anomalies (°C) on oceanographic section 8-A in November 1985

Parts of section 8-A	Year	Layer, m			
		0-50	50-200	0-200	200-500
A	I984	-I,75	-0,9I	-I,I8	
(stations 3-5)	I985	-0,39	-0,65	-0,59	
B	I984	-I,46	-I,09	-I,20	-I,34
(stations 6-9)	I985	-0,45	-0,I3	-0,22	-0,I4
C	I984	-2,I6	-I,35	-I,58	-0,22
(stations I0-I2)	I985	0,00	0,07	0,03	-0,08
ABC	I984	-I,67	-0,94	-I,I3	
(stations 3-I2)	I985	-0,33	-0,I5	-0,I6	

Note: anomalies are estimated relative to the norms for period 1964-1985.

Table 7 Water temperature anomalies (°C) on standard oceanographic sections in NAFO Subarea 3 in 1985

Section (sector)	0-200 m layer		200-500 m layer	
	Apr	May	Apr	May
7A		-0,9		-0,5
Flemish Cap (G)		-I,8		-0,4
4A		-I,7		-0,4
CG-3		-I,0		-0,5
CG-4	-I,6	-0,2	-I,2	-0,6
SW Grand Bank	0,0		2,2	

Note: water temperature norms are adopted from Burmakin's paper (Burmakin, 1972, 1976)

Table 8 Mean length of roundnose grenadier in catches taken with bottom trawl in Subareas 0, 2 and Div. 3K in 1981-1985

Subareas, Div.	I981	I982	I983	I984	I985
0	-	-	62,3 ± 0,2 / 3525	59,4 ± 0,2 / 2720	53,7 ± 0,3 / 2157
2	62,0 ± 0,2 / 3215	58,7 ± 0,2 / 4386	62,7 ± 0,2 / 4025	6I,3 ± 0,2 / 5062	52,4 ± 0,2 / 2286
3K	56,I ± 0,2 / 3426	57,0 ± 0,2 / 2960	48,I ± 0,2 / 5746	53,9 ± 0,2 / 4014	5I,0 ± 0,2 / 23I4

Note: Numerator - mean length of fishes, cm;
denominator - number of fish, spec.

Table 9 Mean length of roundnose grenadier in catches taken with bottom trawl with small-meshed insertion in different depths in Subareas 0 and 2 in 1985

Depth, m	Mean length, cm	Number of females, %	Number of fish, spec.
under 800	39,3 ± I,I	39,3	I45
800-I000	50.3 ± 0.4	44.6	830
I000-I200	5I.7 ± 0.2	43.9	2355
over I200	59,7 ± 0.3	47.I	IIII3
T o t a l	53.0 ± 0.2	44.7	4443

Table 10 Greenland halibut catches taken in different depths of the continental slope of North and Central Labrador in 1979-1985, kg per trawling hour (in brackets - number of trawlings)

Depth, m	Area, sq.miles	Year, month						
		1979 Oct-Nov	1980 Nov-Dec	1981 Dec 81 -Jan 82	1982 Nov-Dec 82 -Jan 83	1983 Nov-Dec 83 -Jan 84	1984 Dec 84 -Jan 85	1985 Dec
301-400	543	426(16)	34(4)	33(13)	-	-	-	7(2)
401-500	612	295(16)	16(2)	113(3)	197(4)	22(3)	44(5)	4(3)
501-600	486	288(20)	218(2)	264(5)	439(4)	291(4)	49(5)	25(6)
601-700	487	344(11)	427(4)	427(4)	1379(3)	473(3)	115(5)	25(3)
701-800	486	384(15)	1737(3)	506(6)	1862(6)	1446(5)	319(6)	18(2)
801-900	530	697(6)	2783(6)	2865(6)	1732(7)	2914(8)	763(6)	110(8)
901-1000	430	440(3)	2762(10)	1753(9)	3520(5)	2686(16)	1088(7)	210(5)
1001-1100	536	938(4)	1831(6)	1504(1)	1139(7)	1492(10)	1220(4)	374(6)
1101-1200	549	-	1146(1)	-	623(1)	2749(5)	439(4)	136(5)
1201-1300	598	-	-	-	-	454(1)	265(3)	-
1301-1500	1196	-	-	-	-	-	101(7)	-
301-1500	6453	397(91)	1699(34)	879(47)	1518(37)	1914(55)	448(52)	147(34)
Biomass index		479	1183	912	1286	1351	357	106
% of area surveyed		63.7	72.2	63.7	63.8	73.1	91.6	72.2

Table 11 Abundance (mill.spec) and biomass (thou t) indices of cod and redfish Sebastes mentella on the Newfoundland shelf due to data of trawl surveys in 1984–1985

Species	Area	Biomass		Abundance	
		I984	I985	I984	I985
Cod	3K	355,3	243,6	295,9	286,0
	3L	383,3	I77,I	3II,9	I80,7
	3NO	262,5	458,9	25I,I	522,I
	3M	3I,I	28,I	60,5	37,I
Redfish Sebastes mentella	3K	3I9,8	356,9	749,I	8I0,3
	3LNO	308,I	2I5,8	I484,I	I485,3
	3M	I32,3	5I,9	376,7	I77,3

Table 12 Age composition of cod in Divs. 3KLMNO due to data of trawl surveys in 1984–1985, %.*/

Age	3K		3L		3NO		3M	
	I984	I985	I984	I985	I984	I985	I984	I985
I	-	-	I	6	I2	I7	3	I7
2	28	54	I07	III	I70	89	I78	24
3	I85	I34	I82	209	323	3I8	367	248
4	I43	305	I96	293	243	249	277	426
5	240	323	I75	2I7	I2I	I99	89	233
6	I46	I06	I28	88	57	63	30	42
7	99	3I	I28	43	34	33	I6	7
8	80	25	45	I8	I7	I4	5	2
9	45	I2	I5	6	II	5	2	+
I0	I4	7	8	6	8	7	I	+
II	6	2	5	I	2	3	I	-
I2	5	I	5	2	I	2	+	-
I3	3	+	2	+	+	+	-	-
I4	-	+	-	+	I	+	-	-
I5	-	-	-	-	-	+	-	-
I6	-	-	I	-	-	+	-	-
I7	+	-	I	-	-	-	-	-
Mean age	5,3	5,4	4,9	4,2	3,9	4,04	3,4	4,0

*/ Due to data of size frequencies, converted to age.

Table 13 Age composition of redfish Sebastes mentella (converted data) from catches taken by trawls with small-meshed insertion in Divs. 3LNOM in 1985, %.

Year class, year	Age, years	Division 3L	3N	3O	3M
I984	I	-	-	-	-
I983	2	2	-	-	7
I982	3	I	I7	I0	34
I98I	4	I3	I64	I34	I03
I980	5	34	I24	I37	I98
I979	6	67	67	I07	93
I978	7	94	76	86	I6
I977	8	I3I	I55	I7I	8
I976	9	II9	9I	III	3I
I975	I0	I56	87	90	6I
I974	II	I06	47	30	63
I973	I2	I0I	44	26	83
I972	I3	65	52	30	97
I97I	I4	38	32	24	78
I970	I5	23	I3	I2	4I
I969	I6	I4	9	9	40
I968	I7	6	6	6	I3
I967	I8	6	5	5	II
I966	I9	5	3	4	5
I965	20	II	3	4	7
I964	2I	3	2	3	5
I963	22	3	I	I	2
I962	23	2	I	-	I
I96I	24	-	I	-	I
Mean age, years		I0,0	8,I	7,9	9,0
No.of spec. analysed		8I46	6876	I0007	I5243

Table 14 Redfish Sebastes mentella stock and TAC assessment in Divs. 3_M for 1987

Age, years	Abundance in 1985, thou spec.	Coefficients of instantaneous fishing mortality in 1985	Coefficients of instantaneous natural mortality	Stock by early 1986		Stock value (t) by early 1987 at different F in 1986					Catch value (t) in 1987 at				
				Abundance, thou spec.	Biomass, t	F_{01}=0.1	F = 0.125	$F_{av.}$ = 0.066	$F_{av.+25\%}$ = 0.083	$F_{av.-25\%}$ = 0.05	F_{01}= 0.1	F = 0.125	$F_{av.}$ = 0.066	$F_{av.+25\%}$ = 0.083	$F_{av.-25\%}$ = 0.05
5	I33272.2	0.006	0.I4	I3232I.7	I6408	I6408	I6408	I6408	I6408	I6408	I37	I7I	89	II3	68
6	I46589.I	0.0I2	0.II	II5I68.2	22573	I4438	I4373	I4526	I4482	I4568	243	302	I59	203	I23
7	7237I.7	0.030	0.08	I29753.I	29584	I9924	I9702	20230	20077	20376	839	I032	558	705	434
8	48747.7	0.053	0.06	64833.0	I6079	25740	25236	26443	26089	26780	I902	2309	I289	I6II	I009
9	39563.8	0.088	0.04	43539.0	I2I9I	I3545	I3I08	I4I64	I385I	I4466	I636	I948	II39	I404	902
I0	432I8.5	0.I46	0.02	348I0.3	II453	9608	9098	I0348	997I	I07I5	I865	2I50	I357	I635	I096
II	40794.6	0.I84	0.0I	36608.I	I4057	86I4	8042	9458	9026	9883	2060	2327	I544	I832	I263
I2	3I47I.0	0.I72	0.0I	33600.8	I5456	I0764	I0095	II747	II245	I2240	2427	2760	I802	2I49	I468
I3	20I54.3	0.206	0.0I	26234.3	I4062	II250	I04I7	I2490	II854	I3I20	2965	33I0	2260	2659	I862
I4	I0483.2	0.2I8	0.03	I6239.0	9938	9854	9083	II007	I04I4	II596	2700	2995	2076	243I	I7I7
I5	470I.5	0.232	0.04	8I80.7	566I	6752	6I92	7596	7I62	8030	I94I	2I37	I508	I756	I253
I6	2524.0	0.250	0.07	358I.9	2654	3639	33I0	4I25	3872	4379	I096	II95	863	998	72I
I7	I208.8	0.I97	0.II	I832.8	I44I	I772	I646	I958	I862	2052	429	48I	324	383	266
I8	78I.0	0.I93	0.I6	889.3	756	920	856	I0I5	966	I063	2I4	24I	I6I	I9I	I32
I9	463.0	0.2II	0.23	548.7	5I6	438	405	488	462	5I3	I06	II9	8I	96	67
20	246.7	0.203	0.32	297.9	302	277	257	307	292	322	62	70	47	56	39
2I	I67.I	0.I92	0.42	I46.2	I58	I49	I39	I64	I56	I72	3I	35	23	27	I9
22	5I.9	0.I92	0.56	90.6	I05	68	63	75	7I	78	I3	I5	I0	I2	8
23	23.8	0.I92	0,72	24.5	3I	38	36	42	40	44	7	8	5	6	4
Total	596833.9	2.977	3.I4	648700.I	I73424	I54I93	I48465	I6259I	I5830I	I66804	20673	23603	I5298	I8267	I2452

Table 15 Redfish Sebastes mentella stock and TAC assessment in Divs. 3LN for 1987

Age, years	Abundance in 1985, thou spec.	Coefficients of instantaneous fishing mortality in 1985	Coefficients of instantaneous natural mortality	Stock by early 1986		Stock value (t) by early 1987 at different F					Catch value (t) in 1987 at				
				Abundance, thou spec.	Biomass, t	F_{01}= 0.1	F_{opt}= 0.225	$F_{av.}$= 0.054	$F_{av.+25\%}$ = 0.067	$F_{av.-25\%}$ = 0.031	F_{01}= 0.1	F_{opt}= 0.225	$F_{av.}$= 0.054	$F_{av.+25\%}$ = 0.067	$F_{av.-25\%}$ = 0.031
5	350036.6	0.020	0,I0	I90339.8	3I2I6	3I2I6	3I2I6	3I2I6	3I2I6	3I2I6	906	2000	493	6I0	284
6	I2279I.2	0.060	0.08	3I0454.6	6923I	26260	2338I	27406	27077	27998	2240	4244	I289	I57I	764
7	59896.0	0.I00	0.06	I06749.5	26367	55849	46023	5997I	58776	62I45	7780	I3I6I	4670	5624	2827
8	85608.8	0.090	0.04	5I040.0	I53I2	22038	I85I6	23497	23075	24262	28II	4890	I670	20I7	I006
9	9I897.3	0.060	0.03	75I72.7	24882	I354I	I2057	I4I33	I3963	I4438	II84	224I	68I	830	404
I0	57703.8	0.080	0.02	83987.8	3I9I5	2I548	I8458	228I2	22447	2347I	2486	4446	I46I	I770	875
II	I9428.7	0.090	0.0I	522I2.6	227I2	27488	23095	29308	28782	30262	3558	6I86	2II4	2553	I273
I2	I3833.0	0.I00	0.02	I7579.8	8878	I9070	I57I5	20477	20069	2I220	2709	4579	I626	I958	985
I3	6I56.I	0.I20	0.03	I2273.2	7069	7I55	5672	7793	7607	8I33	II96	I9II	733	877	448
I4	40I2.9	0.I20	0.04	5298.6	3444	564I	4472	6I44	5997	64I2	938	I500	575	688	352
I5	3929.6	0.I30	0.07	34I9.6	2496	2626	2042	288I	2806	30I7	463	720	287	342	I76
I6	2794.7	0.I30	0.II	32I7.3	2574	I829	I422	2006	I954	2I0I	3I6	492	I96	234	I20
I7	I957.9	0.I30	0.I5	2I98.4	I886	I8II	I409	I987	I936	208I	307	479	I90	227	II7
I8	2I77.8	0.I30	0.2I	I479.7	I352	I250	972	I37I	I336	I436	206	322	I28	I52	78
I9	I565.9	0.I30	0.28	I550.I	I545	836	650	9I7	893	960	I34	209	83	99	5I
20	2443.7	0.I30	0.37	I039.2	I094	873	679	958	933	I003	I34	209	83	99	5I
2I	763.8	0.I30	0.49	I482.2	I669	548	426	60I	586	630	80	I25	49	59	30
22	208.7	0.I30	0.63	4I0.9	49I	727	565	797	777	835	99	I56	6I	73	38
23	206.9	0.065	0.80	97.6	II9	200	I76	209	206	2I4	I3	25	8	9	5
Total	827478.4		3.54	920003.6	254255	240505	206944	254483	250437	26I834	27559	47895	I6395	I979I	9883

Table 16 Capelin stock and TAC assessment in North Atlantic for 1987 on the basis of hydroacoustic surveys in 1985

Age, years	Coefficients of instantaneous natural mortality	Mean mass of 1 spec., kg	Stock by early 1986		Stock value (thou t) for early 1987 at diff.F in 1986			Catch (thou t) in 1987		
			Abundance, mill. spec.	Biomass, thou t	F=0.2	F=0.1	F=0.15	F=0.2	F=0.1	F=0.15
2	0.7I0	0.005	50000.0	250	250	250	250	22	II	I7
3	0.380	0.0I3	77977.3	I0I4	I30	I49	I40	26	I6	2I
4	0.260	0.022	I6625.5	366	726	753	739	46	24	35
5	0.420	0.029	2736.3	79	I89	2I3	20I	33	20	27
6	I.040	0.034	295.7	I0	24	26	25	2	I	2
Total	2.8I	-	I47634.8	I7I9	I3I9	I392	I354	I29	72	I02

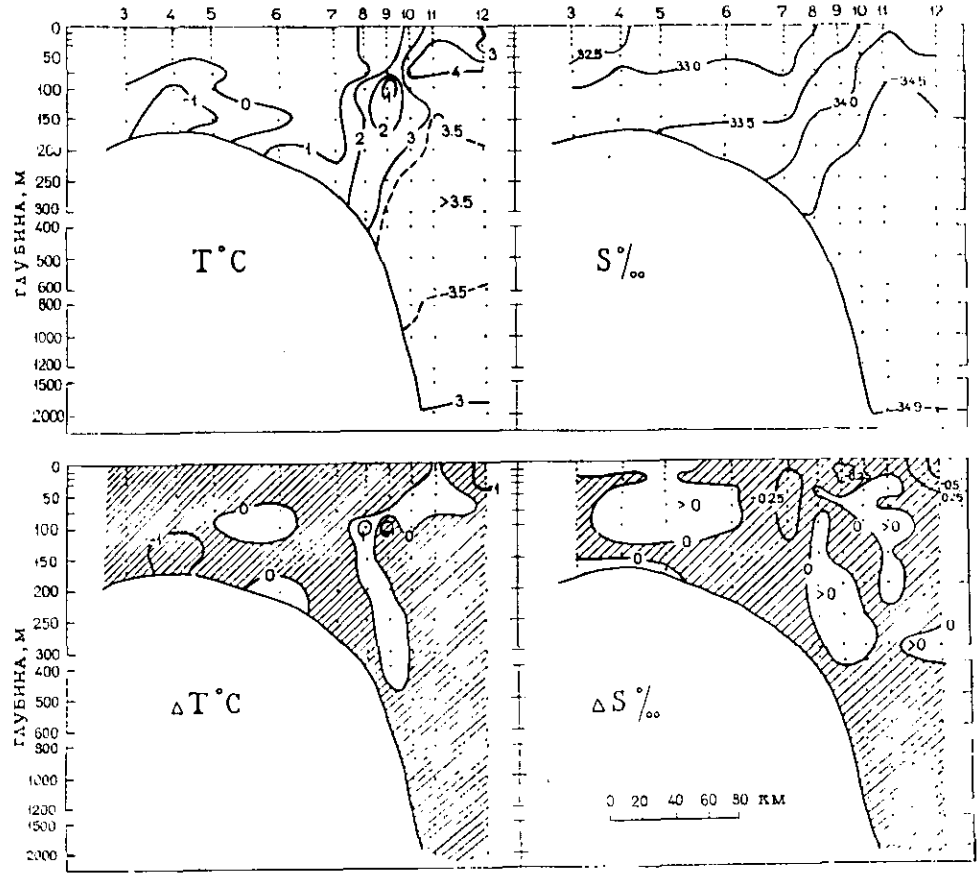

Fig. 1 Distribution of water temperature (T°C) and salinity (S‰) and corresponding anomalies (ΔT°C and ΔS‰) on oceanographic section 8-A in November 1985. Anomalies are estimated relative to norms for periods of 1962, 1964-77 and 1979-80 (Borovkov, 1982).

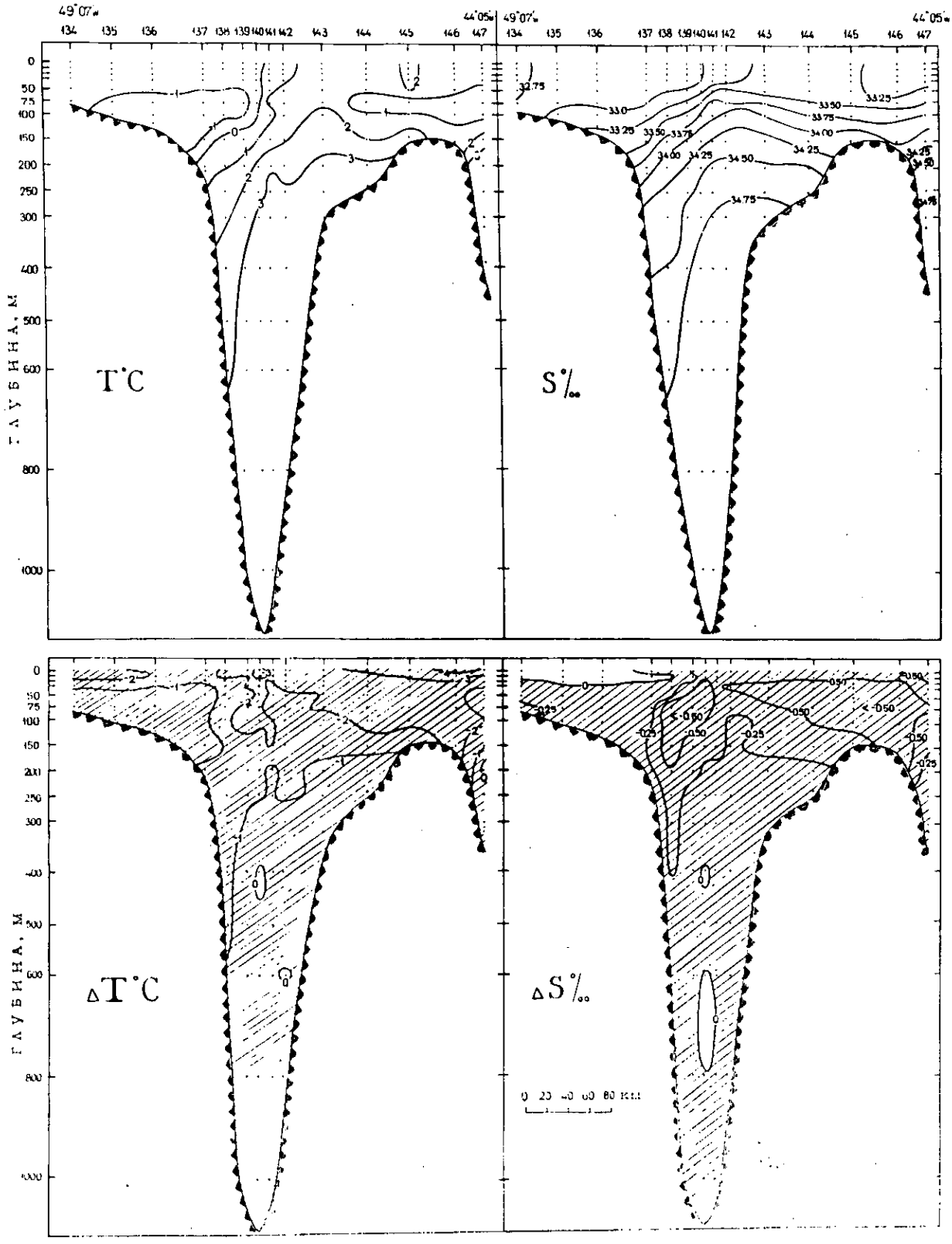

Fig. 2 Distribution of water temperature (T°C) and salinity (S‰) and corresponding anomalies (ΔT°C and ΔS‰) on oceanographic section Flemish Cap in May 1985. Anomalies are estimated relative to norms for a 43-year set of observations from the period of 1910-1980 (after Keeley, 1981).

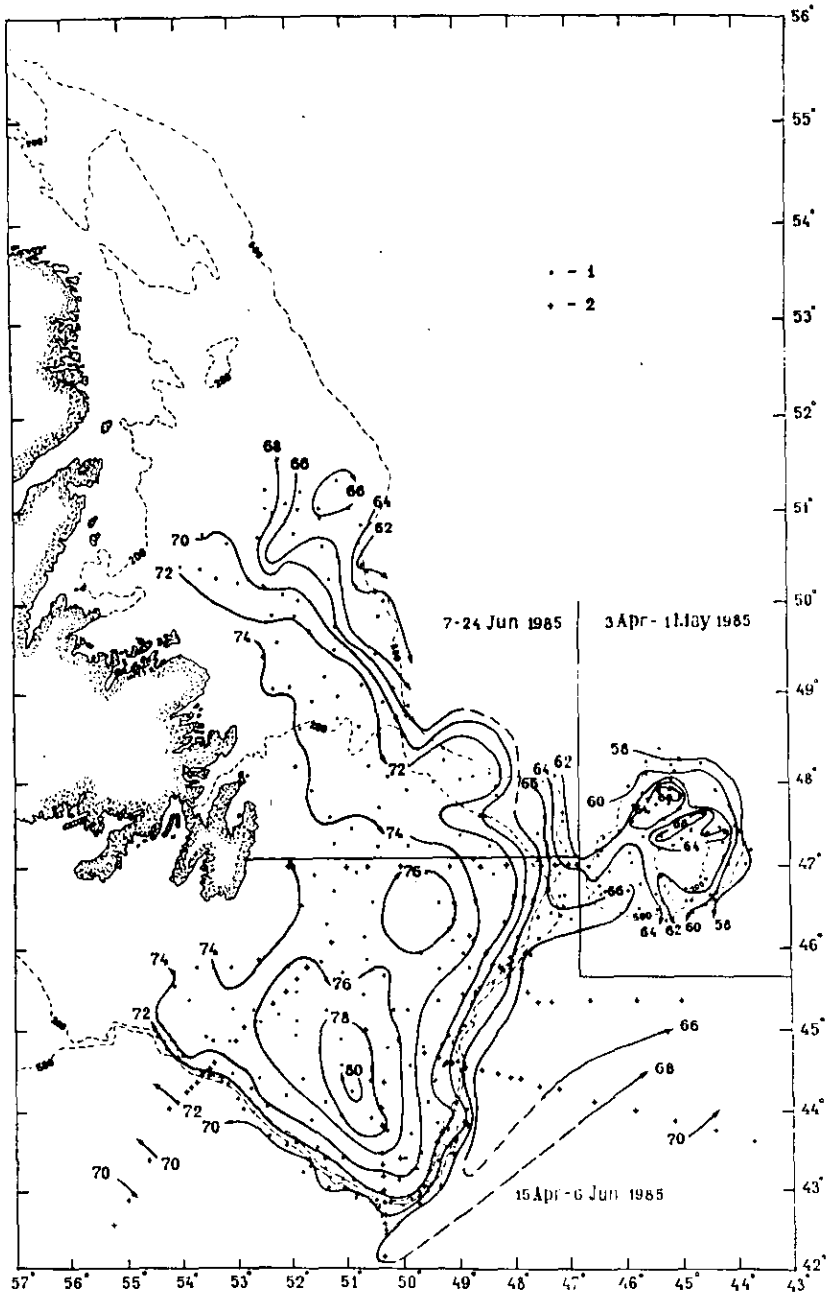

Fig. 3 Dynamic topography of sea surface relative to 2MPa level (200 dB) in April-June 1985. Chart is plotted on the basis of the data of RV "Genichesk", trip 2 (1) and "Boguslav", trip 1 (2); isolines of dynamic heights are given with a 2 dyn.cm interval.

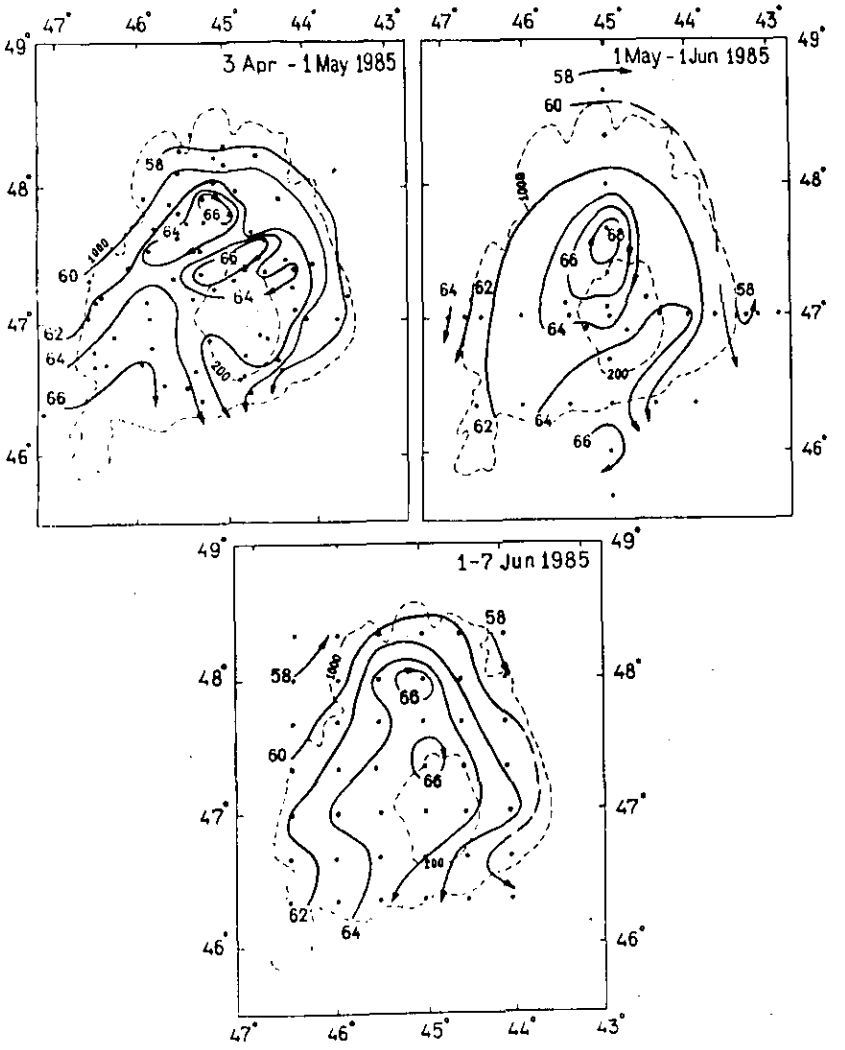

Fig. 4 Dynamic topography of sea surface in the Flemish Cap area in April-June 1985. Chart is plotted on the basis of the data of RV "Genichesk", trip 2 (3 Apr-1May) and "Boguslav", trip 1 (1May-1Jun and 1-7 Jun). Reading level - 2MPa; isolines of dynamic heights are given with a 2 dyn.cm interval.

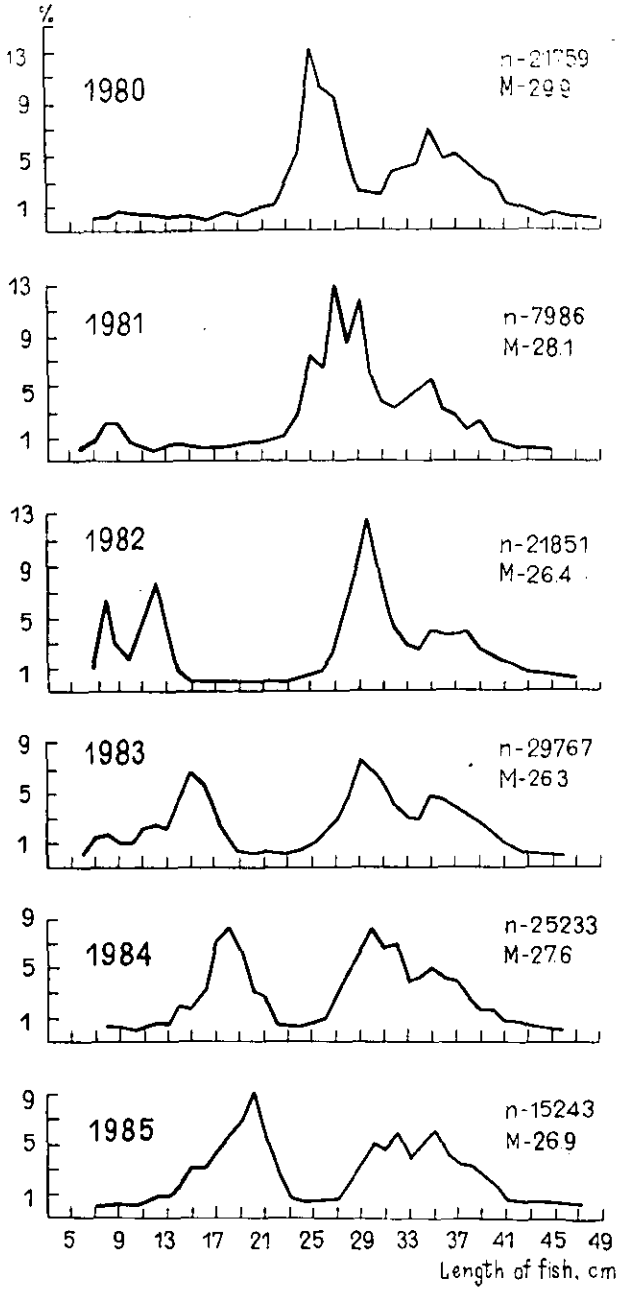

Fig. 5 Size composition of the redfish Sebastes mentella from the catches taken with small-meshed trawl on the Flemish Cap Bank in the spring-summer months of 1980-1985.

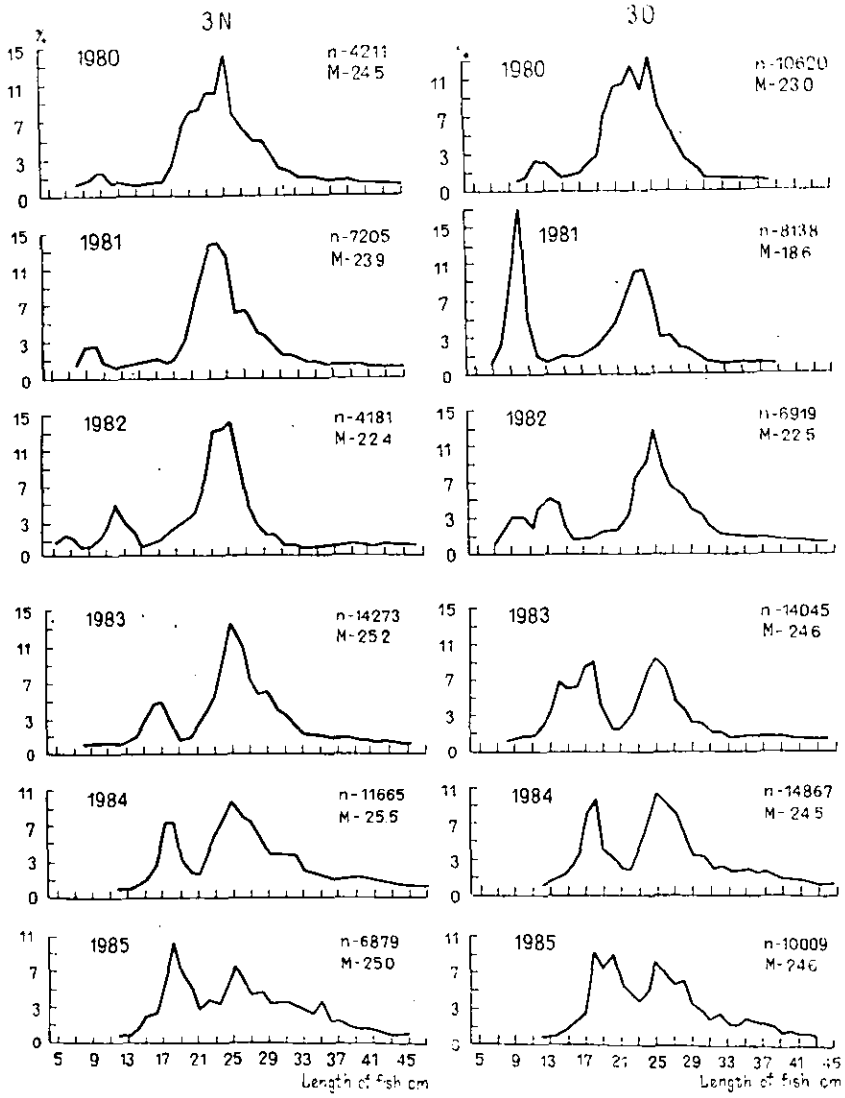

Fig. 6 Size composition of the redfish Sebastes mentella from the catches taken with small-meshed trawl in the South and Southwestern Newfoundland areas in the spring-summer months of 1980-1985.

SECTION II. SUBAREA 4

Status of the fishery

Silver hake. In 1985 conditions for fishing for silver hake were favourable due to good state of stocks and dense aggregations. Although the vessels could start fishing only from mid-May, the 56.6 thous. t quota allocated for the USSR was almost caught. The silver hake catches were represented by the specimens of 26-35 cm body length with mean length of 30.1 cm and mean weight of 198 g. In the age composition of the catches the strong 1983 year-class (33.7%), average 1982 year-class (29.9%) and strong 1981 year-class (21.8%) were predominant. The 1985 year-class which is estimated as a strong one, average 1984 year-class and the rest of the strong 1983 year-class will make a bulk of the catches in 1987. The results of VPA with regard for recruitment from the data on trawl surveys on 0-group abundance indicated that the stock size in 1987 will be 1000 thous. t. Given the optimum fishing intensity the TAC of 200 thous. t can be recommended for 1987.

Special investigations. A trawl inventory survey of 0-group silver hake was carried out on the Scotian Shelf from October 18 to November 1, 1985 by SRTM 8095 "Tava" with the Canada scientists participating. A total of 125 tows were completed. Juvenile silver hake were encountered in great numbers. From the results of the 1985 survey total abundance of juvenile silver hake was estimated at $62 \cdot 10^7$ sp. which is only twice lower than the strong 1981 year class but much higher than other year-classes. In 1985 comparative age reading experiments by Canadian and USSR scientists were continued. Independent age reading indicated good agreement (85%).