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USSR Research Report for 1986*

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In 1986 the overall catch taken by the Soviet commercial ships in the NAFO Subareas 0, 2, 3 and 4 amounted to I4768I tons (Table 1).

SUBAREA 0

A. Status of the Fisheries

In 1986 the USSR catch from the NAFO Div.OB comprised 32 t of Greenland halibut and 1 t of roundnose grenadier.

B. Special Research Studies

1. Oceanographic Studies

Standard deep-water stations for temperature and salinity measurements were worked by the RV "Klintsy" south of 66°10'N in October (Table 2). The collected data give insight into the thermohaline structure which is characterized by the availability of two types of water vertical structure - Arctic and Subarctic. Waters with vertical variations of temperature from -1.8°C to 2-3°C and salinity from 32.0°/₀₀ to 34.5 - 34.7°/₀₀ were typical of the Arctic type of structure; these waters were in the north-west and west of the area where the depths were, as a rule, less than 500 m. Waters of the Subarctic type occupied a deeper south-eastern part and were characterized by the following ranges of vertical variations

* Subareas 0, 2 and 3 by A. K. Chumakov and V. A. Borovkov and Subarea 4 by A. S. Noskov.

in temperature and salinity: from 3.1 to 4.9°C and 33.7 to 34.9°/₀₀. The intermediate temperature maximum recorded in the 250-600 m layer was peculiar to the Subarctic type of water structure in the cold season.

The Arctic frontal oceanic zone formed a physical borderline between the two types of water structure, the position of which was in a general conformity with the 500-600 m isobaths. The maximum horizontal gradients of water temperature and salinity inside this zone recorded in the 100-200 m layer of the Cumberland Section amounted to 3.4°C and 0.6°/₀₀ per 10 miles.

The comparison of the results from the autumn 1985 and 1986 surveys shows the absence of prominent large scale changes both in position of water structure types and in their thermohaline state. The mesoscale differences in the distribution of water temperatures and salinities observed mainly in the frontal zone seem to be the result of rapid processes in the development of the front, and that is why they may not be taken into account while estimating the trends of year-to-year variations in the environmental conditions.

2. Biological Studies

Greenland halibut (OB). The survey was made by the RV "Klintsy" from 23 October to 8 November (Table 3). As previously, the standard research trawl with a fine mesh liner in the codend was employed. Hauls were made at random at a ship's speed 3.0 knots.

Table 4 represents the abundance and biomass of the fish in Div.OB for 1979-1986 estimated following the new stratification pattern suggested by Canadian scientists. The total abundance of Greenland halibut in trawlable areas of Div.OB amounted to 138.5 ± 32.9 mill.ind., the biomass - 158.6 ± 33.8 thou. t. The majority of the fish (≈ 92%) were distributed over the continental slope at the 500-1250 m depths occupying about 40% of the fish range. Though the previous trawl surveys did not cover the strata above 500 m, the obtained results, except for the unrepresentative data from the 1981 survey, give, to our opinion, an objective idea of the fish abundance and biomass in the surveyed division. As is seen from Table 4, the estimates of the fish abundance and biomass in 1986 are close to those for 1985 and lie within the error limits at the 0.95 confidence probability. Of all the observed biomasses those of 1984-1986 are the lowest.

The decline in the Greenland halibut biomass from 355.3 ± 102.4 thou. t in 1982 to 158.6 ± 33.8 thou. t in 1986 cannot be accounted for by the fishery as far as, according to "Statistical Bulletin", it was at the lowest level in this area, and since 1984 it has been actually ceased. As a whole, the annual catch of Greenland halibut taken by all countries in Subareas 0 + 1 averaged 8.2 thou. t (the TAC being 25 thou. t).

To our opinion, the reduction in the fish stock resulted from the re-distribution of this species in Subareas 0+1 owing to a higher heat content of water masses (see the report to the NAFO session in September 1987).

As for the length and age compositions of Greenland halibut, the number of large mature fish was relatively low in 1985 and 1986 (Tables 5, 6, Fig. 1). Fish 44-55 cm long aged 5-8 years were the majority in the research catches.

The halibut from Div. 0B are known to form only the part of a large population of the Northwest Atlantic, that is why estimation of the total stock dynamics is possible only with the full coverage of the range.

The survey results and the observed changes in the distribution of Greenland halibut indicate a high level of the stock and the necessity of extending such surveys to West Greenland (Subarea I). Before the reliable information on the status of halibut stocks in Subareas 0+1 is available, it is recommended that the TAC remain at the level of the previous years - 25 thou.t.

SUBAREAS 2, 3

A. Status of the Fisheries

In 1986 the USSR prosecuted the directed fishery for halibut (2GH), redfish and capelin (2+3K), grenadier (3K) in the Canadian 200-mile fishery zone and for redfish and cod on the southern slopes of the Grand Bank (3LNO) and on the Flemish Cap (3M) outside the zone. Other fishes were taken as by-catch in the directed fisheries for redfish, halibut, grenadier, cod (Table 1).

The conditions for realization of the national quotas were generally favourable throughout the year except for the grenadier and halibut fisheries in autumn/winter.

The USSR vessels fished for grenadier mainly in Div. 3K from August to December. Concentrations of grenadier were unstable and were distributed at great depths thus hampering the fishery. In October/November the air masses of high cyclonic activity interfered. The Greenland halibut short-term fishery was prosecuted in Central Labrador (2H) in December, but it had to be ceased because of heavy ice conditions.

B. Special Research Studies

1. Oceanographic Studies

Subarea 2. Standard oceanographic observations were carried out by the RVs "Vitebsk" and "Klintsy" at 34 random stations and 10 stations of Section 8-A crossing the Hamilton Bank from south-west to north-east mainly in autumn/winter (Table 2).

Thermohaline structure. The data on the vertical distribution of water temperature and salinity represent the thermohaline structure of waters as the combination of the Arctic and Subarctic types of water structure as had been observed in Subarea 0. The Arctic type related to the waters with the temperature varying vertically from -1°C to 2-3°C and the salinity from 32.2°/oo to 34.5 - 34.7°/oo. Such waters occupied mainly the shelf area. Waters of the Subarctic type having higher temperatures and salinities with less stratification were distributed in the deeper part of the area. In the zone where one type of structure becomes another the horizontal gradients of water temperature and salinity higher than the climatic mean and typical of the Polar front were observed. Such thermohaline structure is illustrated by the charts of water temperature and salinity distribution on Section 8-A (Fig. 2).

The distinctive feature of the autumn structure of shelf waters in the south of the subarea was in the absence of a cold sub-surface layer (Fig. 2) which is typical of the autumn distribution of temperature. Significant positive temperature anomalies reaching 1.7°C in the near-bottom layer at the top of the Hamilton Bank resulted from the collapse of this structural element. Higher temperatures of the Arctic waters but for the 50-100 m layer having negative temperature anomalies, alongside with the increased salinities partially eliminated the thermohaline properties of the Arctic type of water structure.

Judging by temperature and salinity anomalies in the oceanic region (Fig. 2), the Subarctic waters were colder than usual nearly in the whole water column surveyed, and the increase in their salinity in the upper 100-150 m layer was accompanied by the delution of underlying waters. Transformation of the vertical salinity profile exhibited in the lower degree of its stratification, the excess of salts in the upper layer as well as the combined shortage of heat and salts in deep layers are the after-effects of the intensive convective mixing of the Subarctic waters which seems to have happened the preceding winter.

The above thermohaline characteristics of the Arctic and Subarctic waters indicate clearly the convergence of of their properties in deep layers. This phenomenon points to the probability of the preceding winter being milder than usual in the shelf area and severer in the oceanic region which may be corroborated by the analysis of temperature anomalies in the surface layer.

Temperature anomalies in the surface layer. To describe the thermal state of surface waters the additional data on anomalies of water temperature monthly means issued in charts regularly by the USSR Hydrometeorological Centre (Moscow) are used.

These data relate to the knots of a regular grid the part of which corresponding to the surveyed area is shown in Fig. 3. The temperature anomalies were estimated based on the long term monthly means for 1957-1971.

To facilitate the analysis, the data were divided into three groups: "above the norm", "norm" and "below the norm", the norm ranging from -1.0° to 1.0°C. As is seen from Fig. 4, in 1986 the temperatures corresponding to the norm dominated in the central and southern parts of Subarea 2 (points 1-7); their recurrence during the year amounted to 56%. As for the temperatures below the norm and above the norm, their recurrence was 39% and 5%, respectively.

In the polar front zone over the continental slope (points 1, 3 and 5), where the variability of water temperature must be very high, the recurrence of "normal" temperatures approached 85%. In the north-eastern part (points 10, 13, 16) with the Subarctic waters the recurrence of relatively low temperatures amounted to 67-92% (averaging 80%), i.e. the temperatures below the norm dominated throughout the year. A low temperature of the surface waters in the oceanic region (Fig. 4) was typical of the period from January to April and of the end of the year (November - December)*. In other months the temperature was mainly about the norm.

A significant cooling of the Subarctic surface layer in winter 1986 could not but affect the temperature regime in the layer of convective mixing spreading down to great depths; it probably kept up the shortage of heat which had been formed in deep layers previously (Chumakov and Borovkov, 1986).

Subarea 3. Oceanographic observations were carried out in six cruises of PINRO research vessels; 679 random stations and 139 ones on standard sections were made during the year (Table 2). Most of the data were collected in the period from April to June (at 489 stations accounting for 60% of

*The temperature estimate for Subarctic waters in November correlates well with that for Section 8-A.

their total number).

Thermohaline structure. The available data show a higher variability of temperature and salinity and a greater diversity of the curves representing them than in the northern subareas. A higher complexity of the thermohaline structure is related to a greater number of interacting objects owing to participation, alongside with Arctic and Subarctic, of waters belonging to the Subtropical type. The distribution of the mentioned types of waters may be represented schematically as follows:

- waters of the Arctic type dominate in the shelf area of Div. 3K and the Grand Bank;
- waters of the Subtropical type are distributed in the deep southern and south-eastern areas and depend on the Gulf Stream - North Atlantic Current system;
- waters of the Subarctic type dominate in the north-east, the Flemish Cap included, and farther to the south-west along the slopes of the Grand Bank.

The so-called slope waters (McLellan, 1957) produced by mixing of the Subarctic and Subtropical waters, located between them and having intermediate properties are the structural component specific for the surveyed area. The border-lines between these structures correspond to climatic frontal zones - Arctic (between the Arctic and Subarctic waters) and Subarctic going along the northern boundary of the Gulf Stream and separating the Subarctic waters from the Subtropical.

The variability of water temperature and salinity is strongly dependent on irregular changes of position and outline of border-lines between the water structures, besides the processes determining the seasonal variation of these factors. Judging by the data available, the greatest divergence from the normal scheme of temperature and salinity distribution in spring was observed along the eastern slope of the Grand Bank. This had resulted from the intrusion of the Arctic waters eastwards, the tongue of cold subsurface waters with negative temperatures at 45°30'N extending to 46°W. The extreme easterly distribution of the Arctic waters in the area between the Flemish Pass and 45° accompanied by the slope waters flowing onto the Grand Bank at 44°20'N determined a peculiar meshy distribution of water temperature and salinity and influenced the position and features of the polar frontal zone. Table 7 illustrating the above-said corroborates the extremity of spring temperature anomalies on sections 4-A (the zone of the Arctic waters intrusion) and CG-3 (the zone of the slope waters intrusion).

The disturbances of the thermohaline structure may be treated as resulting from a relatively prolonged (for some weeks) blocking up of the eastern periphery of the Labrador Current by a meander or eddy containing the slope waters. At any case, the analysis of the horizontal water circulation does not rule out this possibility.

Temperature anomalies in the surface layer. The thermal state of the surface layer may be estimated based on the data in Fig. 4. The analysis of these data indicates the possibility of dividing the survey area into two parts in conformity with the prevalence of that or other group of temperatures. In one of the parts corresponding to the Newfoundland shelf and continental slope as well as to the deep south-eastern region (points 8, 9, 11, 12, 14, 15, 18 and 19 in Fig. 3), i.e. in the areas of the Arctic waters, polar and Subarctic fronts the temperatures corresponding to the norm prevailed. The recurrence of these temperatures varied from 50 to 75% averaging 64%. In another area occupying the north-eastern part of the subarea (points 10, 13, 16) where the Subarctic waters were distributed the recurrence of relatively low temperatures amounted to 67-92% (80% on the average), i.e. the temperatures below the norm dominated throughout the year. A low level of the thermal state of the surface layer was observed in all seasons except late summer (August-September).

These estimates as well as the similar data on the environmental conditions in Subarea 2 indicative of the large scale peculiarities of the thermal state of waters reflect the effect of smoothing over the difference between the Arctic and Subarctic waters.

Geostrophic circulation. In order to form a clear picture of the horizontal circulation of waters in the surface layer the dynamic topography of the surfacewas calculated and charted. For this purpose the results of spring-summer surveys in Div. 3KLMNO were used and the methods described earlier (Borovkov and Kudlo, 1982) were followed.

Fig. 5 shows the stream over the Grand Bank slopes combined with a slow circulation of waters over the shelf and mesoscale disturbances in waves and eddies.

The stream in the main branch of the Labrador Current, while flowing out of the Flemish Pass, had the maximum velocity (ca. 41 cm/sec, according to our estimates). Southwards the stream went off the slope and suffered divergence resulting in the above-mentioned "spreading out" of the Arctic waters east of the slope. The formation of the anticyclonic meander in the main branch of the Labrador Current was accompanied by shaping within the limited slope area of the slow transport of waters in the direction opposite to the normal. The westward water transport was observed in the southern margin of the meander thus revealing the way of warm water intrusion into slope area.

As compared to the scheme of water circulation in spring 1985 (Chumakov and Borovkov, 1986), the Labrador Current was more intensive in the area between 50° and 46°N in 1986. The greater advection had possibly accelerated the downspream disposal of waters originated in winter and their replacement by those of the spring-summer generation. This factor cannot be neglected during the analysis of the extraordinary rise of deep water temperature in the vicinity of the Hamilton Bank in autumn.

The scheme of water circulation (Fig. 5) shows the existence of eddy-making in the area, the anticyclonic eddy localized in the south of the Grand Bank being the largest. As compared to spring 1985, this eddy became partially deformed, its dynamic relief less convex, however, its position remained nearly unchanged.

The next figure (Fig. 6) illustrates the features of evolution of the circulation field on the Flemish Cap in the first half-year. The instability of directions of slow water motion in the central part of the bank resulting from the weakening of the anticyclonic eddy is shown. Such situation seems to be unfavourable for preservation of the commercial fishes ichthyoplankton in the ecosystem of the bank and therefore nearly excludes the possibility of the 1986 year class being abundant.

2. Ichthyoplankton Studies

The ichthyoplankton survey was made by the RV "Boguslav" on the Flemish Cap from 22 April to 1 May 1986. It showed that the eggs of cod, American plaice, tusk and the larvae of redfish were the most abundant. In 1986 the total number of cod eggs at Stages I and II was higher than in previous surveys (1984-85) but they were distributed over great depths thus raising doubts as to their further successful development and stock recruitment.

The eggs of American plaice were distributed in the central part of the bank over the 100-200 m depths. Their number was close to the 1984-85 level.

The redfish larvae were the most abundant in the northwestern and eastern slopes of the bank. The tendency towards reduction in the number of Sebastes spp. larvae extruded annually in the area was exhibited.

3. Studies of the Stocks

Roundnose grenadier (2+3K). In October 1986 the RV "Klintsy" (MG-1330) made some bottom hauls in Div. 3K at the 790-1080 m depths. The catches ranged within 200 to 1500 kg per hour haul. The by-catch of Greenland halibut was constant - 150-300 kg - and did not depend on the trawled depth.

The fish 48-59 cm long (Table 8) aged 7-13 years (Table 9) were the majority. The mean length of the fish was smaller than last years (Table 10) as far as large fish were distributed at great depths. Thus, in Div. 3K small fish dominated up to 1200 m deep and in Div. 2GH - up to 1100 m deep. Large fish were dwelling deeper (Tables 11, 12). The relative percentage of females in the catches also increased with depth. The same pattern in grenadier distribution by depth in Subareas 0 and 2 was clearly seen in 1985 when cooling of waters was more notable than in 1986. The tendency towards the rise of water temperature both on the shelf and the continental slope (up to 1000 m deep) was exhibited in 1986. Based on the frequency structure regularities of the water temperature long term (1964-86) variations in the main branch of the Labrador Current, the general relative rise of temperature to the level of hydrologically normal years may be expected in South Labrador in 1986-88, which will generate stable concentrations of grenadier and the increase in fishing efficiency.

Greenland halibut (3K). The trawl survey made by the RV "Nikolay Kononov" (MB-0422) in May-June 1986, showed that the number of Greenland halibut in Div. 3K amounted to 266.4 mill.ind. and their biomass - 174.8 thou. t (Table 13). These data are more reliable than the 1985 survey results as far as in 1985 only the limited area was surveyed not covering the whole fish range. In 1986 the fish 28-33 cm long aged 3 - 7 years and belonging to the 1983-1979 year classes dominated in catches.

Cod (3M). The trawl survey of the Flemish Cap in June 1986 showed that the cod stock remained at a low level. The fish abundance and biomass were close to those of 1985 and amounted to 37 mill. ind. and 26 thou. t, respectively (Table 14).

The low fish abundance resulted from a poor recruitment of young fish from the 1983 and 1985 year classes to the stock (Tables 15, 16) as well as from the commercial removal of fish belonging to an abundant 1981 and close to average 1980 and 1982 year classes. In research catches immature cod of the 1984 year class dominated varying in length from 24 to 32 cm (Tables 15, 16, 17). The percentage of mature fish was not higher than 18%.

Proceeding from the age composition of cod, in 1987 and 1988 the 1984 year class will dominate on the Flemish Cap, the fish being 40-45 cm long in 1988. The biomass is expected to be at the 1986 level.

Cod (3LNO). In 1986 the abundance of cod in Div.3NO declined and in Div.3L grew compared to 1985, which may be accounted for by fish migration within the area (Table 14). The total abundance of cod on the Grand Bank (summed for the three divisions) reduced from 703 to 566 mill.ind., while their biomass increased from 636 to 863 thou. t. This increase may have occurred at the expense of a higher portion of large fish (Tables 15, 18). Cod aged 4-5 of the 1982 and 1981 year classes were the majority. The abundance of the 1983 year class was close to the average, while those of the 1984 and 1985 year classes were low (Tables 15, 16, 18).

Cod (3K). The fish abundance and biomass were at the 1985 level (Table 14). Cod 40-50 cm long aged 4-6 of the 1980-1982 year classes dominated (Tables 15, 19), those of the 1981 year class being the most numerous.

American plaice, dab, haddock (3K, 3LNO, 3M). In Div.3K the abundance and biomass of American plaice was at the 1985 level (Table 14). On the Grand Bank (3LNO) their abundance increased, the biomass remaining at the same level, while on the Flemish Cap both indices grew by a factor of 2-2.5.

The abundances and biomasses of dab and haddock have been on the decline since 1984.

American plaice 34-35 cm long, dab 37-40 cm long and haddock 38-47 cm long were the majority in the catches.

Beaked redfish (3M). The trawl survey made in June 1986 indicated that the fish abundance and biomass were much higher than in April 1985 (Table 14). This increase is rather related with the seasonal peculiarities of fish distribution and their availability for the bottom trawl. In April 1985 the fish kept mainly in the pelagial, while in July 1986 their majority were distributed near the bottom which was confirmed by echo surveys. The fish biomasses (estimated from the summed results of trawl and echo surveys) in 1985 and 1986 are nearly the same, relatively high and amount to 300 thou. t thus being indicative of a high level of the stock. The fish 20-23 cm long aged 5-7 of rich 1979-1981 year classes and those 30-37 cm long aged 10-14 of the 1972-1976 year classes were the majority (Table 20).

The VPA estimates given by Vaskov et al. (this session's report) show that the exploitable biomass is above the long term mean while the spawning stock biomass is as low as 50 thou. t. On this basis it is recommended that the TAC for 1988 remain at the 1987 level, i.e. 20 thou. t.

Beaked redfish (3LNO, 3K). The data on the redfish abundance and biomass on the Newfoundland shelf (3LNO) obtained during the multi-species trawl survey are unrepresentative both for 1985 and especially for 1986 because in these years the fish were distributed mainly in the pelagial and, for this reason, underestimated (Table 14).

The VPA estimates show that the redfish commercial stock in Div. 3LN is at a high level, its average biomass amounting to 170 thou. t for the 1975 to 1986 period. In 1986 the exploitable biomass totalled 243 thou. t.

Owing to the recruitment of rich 1979-1981 year classes to the commercial stock a further increase in its abundance and biomass is expected. With the current exploitation level ($F_{0.1} = 0.15$) in Div. 3LN the TAC for 1988 will be 40 thou. t. Table 21 shows the TAC's for 1988 at different rates of exploitation.

The redfish stock in Div 3K remains stable (Table 14). Therefore, the rate of exploitation may be much higher here.

Capelin (2J+3K and 3LNO). In 1986 the USSR carried on the routine echo surveys for the Newfoundland capelin stock assessment.(Table 3). The RV "Artemida" surveyed the Newfoundland Shoals (3LNO) in late June, i.e. much later than usual, and, consequently, underestimated a great portion of mature fish having migrated to spawn into the territorial waters of Canada. The immature fish estimate was also conservative because of their earlier migration for feeding in the northern areas (3K). As a result, the estimated biomass (1.49 mill.t) was more than two times lower than the biomass determined in the similar Canadian survey (3.7 mill.t) in May 1986.

The similar estimation of the capelin stock was made during the second survey made by the RV "Vitebsk" in Div. 2J3K in November, when the stormy weather affected the quantitative estimate of the stock.

The fish from an abundant 1983 and, to a lesser degree, from the 1984 and 1982 year classes were the majority during the two surveys.

Thus, though the estimates of capelin stocks are conservative, still they confirm the possibility of a significant increase in catches even with the precautionary rate of exploitation.

Subarea 4

A. Status of fishery

Silver hake (*Merluccius bilinearis* M.)

In 1986 the Soviet fishery for the Nova Scotia silver hake was successful due to good state of stocks and dense and stable aggregations of silver hake constantly observed in the region allowed by Canada for foreign fishing.

The 66 thous. tons quota allocated for the USSR was fully taken. As usual, fishing for silver hake was carried out on the southern slope of the Shelf at 120-250 m depths. During the fishery on the shelf, lower temperatures were observed in the near-bottom water layers which is indicative of increased penetration of cold waters onto the Scotian Shelf from the Labrador area and Grand

Bank. In 1986 this process was confirmed by predominant western winds in these areas and by negative anomalies of upper water layer temperatures. For this reason, cold waters reached the very shelf slope and kept the silver hake aggregations within the fishing ground, and prevented from their massive migration northward of SMGL during the entire fishing period.

Specimens of 26 to 35 cm body length with the mean length of 29.8 cm and the mean weight of 189 g made a bulk of the silver hake catches (Table 22). A relatively strong 1983 year class which accounted for 45.1% on the average, and the 1982 year class of the strength below average which made up 18.8% were predominant in the catches (Table 23) . The strong 1981 year class at age 5 in 1986 was practically absent in the catches and accounted for only 5.3%.

Herring, mackerel, blue whiting, flounder and haddock were present in the silver hake catches as a by-catch and accounted for 0.2 to 0.7 %.

B. Special investigations

Hydrology. Oceanographic observations were made in 1986 during the inventory trawl survey of O-group silver hake. The analysis was made of thermal conditions at some layers and these were compared with the standard for 1962-1972. The results will be presented in a separate paper.

To investigate the availability of silver hake for the Soviet fishing vessels in the Nova Scotia region allowed for fishing, an attempt was made to reveal any relationship between the catch per effort and hydrological conditions. For this purpose, the monthly average catches per hour trawling were compared with more than 40 hydrological characteristics. However, only in a few cases the relationships found were worthy of note.

Silver hake. In October and November of 1986, annual inventory trawl survey of O-group silver hake was carried out by SRTM-8099 "Torok" under the joint USSR-Canada programme. A total of 125 tows were completed on the Scotian Shelf in the dark hours of the day.

From the results of the survey the total abundance of juvenile silver hake was estimated at 32 x 10^7 sp.

The 1986 year class appeared to be fairly abundant compared to the others. So, it may be expected that this year class at age 3 will considerably replenish the stocks in 1989.

Table 1. USSR catches from NAFO Subareas 0, 2, 3, 4 in 1985-1986 (tons)

Species	Divs.	1985	1986
Cod	2GH	-	-
	2+3KL	125	I46
	3NO	3968	II8I
	3M	1271	I23I
	4VWX	21	28
Haddock	4VWX	275	322
	3NO	2	-
Beaked redfish	2+3K	3689	3528
	3LN	10885	I0885
	3O	5905	6099
	3M	15703	I5045
	4VWX	111	9
Roundnose grenadier	0+1	2	I
	2+3	1018	280I
American plaice	2+3K	7	39
	3M	971	962
	3LNO	81	I88
	4VWX	-	6
Witch flounder	2+3KL	1006	2I
	3NO	1908	I724
Greenland halibut	0+1	179	32
	2+3KL	149	770
Capelin	2J+3K	16838	I6757
Silver hake	4VWX	56337	6057I
	3NO	170	67
Saithe	4VWX	336	564
Yellowtail flounder	3LNO	-	-
Herring	4VW	58	508
Mackerel	3+4	913	689
Argentine	4VWX	125	I08
Squid _Illex_	3+4	252	39
Other species		11073	I7360
Total		133378	I4768I

Table 2. Inventory of oceanographic observations made by PINRO in NAFO Subareas in 1986

Ship's name, cruise number	NAFO Sub-areas	Standard sections: Date Span	Section	Para-meters	Tot. Stns	Other stations: Seasons JFM	AMJ	JAS	OND	Para-meters	Tot. Stns.	Type: STD-probe or bottle
Klintsy, 1/3	0	23-25 Oct	34-A	T,S	6				2	T,S	2	Bottle
	0	28-29 Oct	Cumberland	T,S	8				3	T	3	Bottle/MBT
	1								2	T,S	2	Bottle
	1								2	T	2	MBT
N.Kononov,33	2					5				T,S	5	Bottle
Vitebsk, 6	2	07 Nov	8-A	T,S	10				14	T,S	14	Bottle
	2								1	T	1	MBT
Klintsy,1/3	2								12	T,S	12	Bottle
	2								7	T	7	MBT
N.Kononov,33	3					46				T,S	46	Bottle
Artemida, 25	3						34			T,S, O_2,P	34	Bottle
Klintsy,1/3	3							12	39	T	51	MBT
Boguslav,1/86	3	09-13 Apr	CG-4	T,S	22		9			T	9	Bottle/MBT
	3	02-04 May	CG-3	T,S	13		56			T,S	56	Bottle
	3	04-05 May	4-A	T,S	11							Bottle
	3	05-07 May	45°W	T,S	11							Bottle
	3	07-08 May	7-A	T,S	4							Bottle
	3	09-11 May	Flemish Cap	T,S	18							Bottle
N.Kononov,34	3	21 Apr	CG-3	T,S	3		287	12		T,S	299	Bottle
	3	26 Apr	CG-4	T,S	5							Bottle
	3	01-02 May	SW Grand B.	T,S	8							Bottle
	3	16 May	7-A	T,S	8							Bottle
Vitebsk, 6	3	01-02 Sep	Flemish Cap	T,S	7			50	60	T,S	110	Bottle
	3	03-04 Sep	4-A	T,S	7			28	46	T	74	Bottle/MBT
	3	20-23 Oct	CG-4	T,S	22							Bottle

Table 3. Biological surveys made by PINRO research vessels in NAFO area in 1986

Subarea	Div.	Month	Type of survey*	Object/method of survey	No. of hauls
3	LNO	6	O	Trawl/acoustic	I0
3	L	4-5	S	Trawl	I20
	N	4-5	S	Trawl	82
	O	4-5	S	Trawl	79
	K	5-6	S	Trawl	I22
	M	6-7	S	Trawl	I27
2+3	J+K	II	O	Trawl-acoustic	8
3	M	4-5	O	Ichthyoplankton	56
2+3	J+K	I0-II	S	Trawl	23
2	G+H	I0-II	S	Trawl	28
0	B	I0-II	S	Trawl	66

* S - stratified survey

O - other types of survey

Table 4. Results of Greenland halibut trawl surveys in NAFO Subarea OB in 1979-1986

	I979 Sep-Nov	I980 Nov-Dec	I98I Dec	I982 Nov	I983 Nov	I984 Sep	I985 Nov-Dec	I986 Oct-Nov
Abundance, mill.ind.	I09,I	I6I,3	64,5	I9I,0	I79,0	72,6	I22,7	I38,5
± error, mill. ind.	±I4,7	±26,5	±I9,6	±49,5	±43,0	±I6,9	±37,8	±32,9
Biomass, thou. t	200,9	240,0	I05,I	355,3	304,I	II9,I	II0,2	I58,6
±error, thou. t	±27,9	±48,9	±38,7	±I02,4	±80,5	±23,0	±27,0	±33,8
No. of hauls	98	39	I3	53	7I	33	77	66
Depth range	40I-I250	30I-I250	50I-I250	40I-I500	40I-I500	50I-I250	20I-I500	200-I250
% of surveyed area	44,I	56,7	23,8	40,7	48,2	35,4	77,5	95,5

Table 5. Length composition of Greenland halibut from research catches taken in Divs. OB and 3K in 1986, ‰

Length, cm	OB (October-November)		3K (May-June)	
	Males	Females	Males	Females
8-9	-	-	-	+
I0-II	-	-	+	I
I2-I3	-	-	I	I
I4-I5	+	I	2	2
I6-I7	+	I	5	5
I8-I9	I	I	8	I2
20-2I	I	2	6	I0
22-23	I	I	5	7
24-25	3	2	8	I2
26-27	3	2	I5	22
28-29	5	4	I7	23
30-3I	5	3	I5	I6
32-33	5	5	23	23
34-35	6	5	28	3I
36-37	5	7	29	36
38-39	7	5	38	39
40-4I	II	7	44	45
42-43	2I	II	54	55
44-45	54	24	45	43
46-47	70	25	39	46
48-49	96	35	29	34
50-5I	97	35	I6	I9
52-53	73	25	I2	I5
54-55	70	25	6	8
56-57	44	I3	6	7
58-59	4I	I2	4	6
60-6I	30	9	2	4
62-63	I7	5	2	5
64-65	I4	7	+	3
66-67	4	4	+	2
68-69	4	4	+	I
70-7I	2	5	+	I
72-73	I	3	-	I
74-75	+	4	-	I
76-77	+	2	-	+
78-79	-	2	-	I
80-8I	-	3	-	+
82-83	-	2	-	+
84-85	-	I	-	+
86-87	-	I	-	+
88-89	-	I	-	+
90-9I	-	I	-	+
92-93	-	+	-	+
94-95	-	+	-	+
96-97	-	+	-	+
98-99	-	+	-	-
I00-I0I	-	I	-	-
No. of spec.	9268	408I	7002	8I63
Average length, cm	50.54±0,08	5I.25±0.I98	39.6I±0.II	40.04±0.I2I

Table 6. Age composition of Greenland halibut (calculated) from research catches taken in Divs. OB and 3K in 1986, °/₀₀

Year class	age, years	OB (Oct-Nov) Males	OB (Oct-Nov) Females	3K (May-Jun) Males	3K (May-Jun) Females
I985	I			2	3
I984	2	3	I7	38	6I
I983	3	I7	32	97	II4
I982	4	27	46	I50	I38
I98I	5	62	II0	236	2I3
I980	6	2I4	I93	258	237
I979	7	329	260	I56	I4I
I978	8	22I	I49	45	50
I977	9	99	66	I5	2I
I976	I0	23	45	3	I0
I975	II	3	I8	+	3
I974	I2	I	2I	+	3
I973	I3	I	I6		3
I972	I4		II		I
I97I	I5		6		I
I970	I6		4		I
I969	I7		2		+
I968	I8		I		+
I967	I9		2		
I966	20		+		
Mean age, years		7.0I	7.I6	5.32	5.34
No. of spec.		9268	408I	7002	8I65

Table 7. Water temperature anomalies (°C) on standard oceanographic sections in NAFO Subarea 3 in 1986

Section (part)	0-200 m				200-500 m			
	Apr	May	Sep	Oct	Apr	May	Sep	Oct
7-A		-0,3				0,3		
Flemish Cap (G)		0,3	-I,6			-0,I	-0,4	
Flemish Cap (H_2)		-0,4	-0,9			-0,3	0,2	
4-A		-I,6	-0,4			-I,3	0,5	
CG-3		3,2				2,0		
CG-4	0,5			0,3	0,9			-0,2
SW Grand Banks		0,I				0,6		

Note: Position of sections and their parts, norms of water temperature were described by V.V.Burmakin (Burmakin, 1972, 1976).

Table 8. Length composition of roundnose grenadier in research catches from NAFO Subareas 0, 2, Div. 3K in 1986, °/oo

Length, cm	Div. 0B October, November		Subarea 2 January, November		Div. 3K May, October	
	males	females	males	females	males	females
I8–20					I	I
2I–23					3	2
24–26			2		5	5
27–29			3	2	I3	I4
30–32			7	2	I0	I2
33–35	4		I7	9	I5	I7
36–38	39	9	27	I2	20	I6
39–4I	26	30	29	I5	25	28
42–44	5I	26	40	26	3I	28
45–47	6I	22	37	26	37	30
48–50	6I	56	4I	34	63	38
5I–53	56	30	49	33	53	42
54–56	26	22	54	37	55	34
57–59	43	48	49	48	62	38
60–62	26	35	5I	38	44	29
63–65	6I	30	62	39	44	30
66–68	48	22	32	32	34	2I
69–7I	22	26	27	I9	22	I4
72–74	22	I7	I5	2I	I2	I6
75–77	I3	26	6	20	6	7
78–80	I7	4	8	9	4	6
8I–83	4	9	2	4	I	4
84–86	4	4	2	7		4
87–89			2	2	I	I
90–92				I	I	I
93–95				2		
Relative number, °/oo	584	4I6	562	438	562	438
Mean length, cm	55.3±I,0	57.5±I.2	54.7±0.3	58.I±0.4	53.2±0.2	52.7±0.3
Number, ind. examined	I35	96	I380	I077	224I	I750

Table 9. Age composition of roundnose grenadier in NAFO Subareas 0, 2, Div. 3K in 1986, °/oo

Year class	Age, years	0		2		3 K	
		males	females	males	females	males	females
I984	2			3	I	I2	I2
I983	3	5		II	5	I7	I8
I982	4	I4	5	20	I0	I8	I7
I98I	5	43	24	33	I7	29	29
I980	6	58	29	39	24	36	32
I979	7	72	43	53	37	59	44
I978	8	67	48	66	48	74	52
I977	9	67	53	68	5I	73	50
I976	I0	67	43	7I	54	7I	47
I975	II	53	49	60	48	57	38
I974	I2	53	43	55	45	49	34
I973	I3	43	34	37	35	33	25
I972	I4	29	I9	2I	22	I7	I5
I97I	I5	I0	I4	I2	I7	9	II
I970	I6	5	5	7	I3	5	7
I969	I7	5		4	7	2	4
I968	I8			I	2	I	I
I967	I9				2		I
I966	20				–		I
I965	2I				I		
I964	22						
Mean age, years		9,2±0,3	9,7±0,3	9,3±0,I	I0,I±0,I	8,9±0,I	8,9±0,I
Number of ind.		I35	96	I380	I077	224I	I750

Table 10. Mean length of roundnose grenadier in research catches from NAFO Subareas 0, 2, Div. 3K in 1981–1986

Subarea, Div.	I98I	I982	I983	I984	I985	I986
0	63,I ± 0,4 663	53,5 ± 0,4 899	62,3 ± 0,2 3525	59,4 ± 0,2 2720	53,7 ± 0,3 2I57	56,2 ± 0,8 23I
2	62,0 ± 0,2 32I5	58,7 ± 0,2 4386	62,7 ± 0,2 4025	6I,3 ± 0,2 5062	5I,6 ± 0,3 I366	56,2 ± 0,2 2457
3K	56,I ± 0,2 3426	57,0 ± 0,2 2960	48,I ± 0,2 5746	53,9 ± 0,2 40I4	5I,0 ± 0,2 23I4	53,0 ± 0,2 399I
0,2,3K	59,4 ± 0,I 7304	57,5 ± 0,I 8245	56,3 ± 0,I I3296	58,3 ± 0,I II796	52,I ± 0,2 5837	54,3 ± 0,I 6679

Note: Mean length of fish in cm is given in the numerator and the number of ind. – in denominator

Table 11. Mean length of roundnose grenadier in research catches from different depths in Div. 3K

Depth, m	Mean length, cm	Percentage of females	Number of ind.
Above 800	53,0 ± 0,3	4I,9	I045
800-I000	45,I ± 0,4	4I,I	960
I000-I200	53,3 ± 0,4	46,0	9I3
Below I200	59,6 ± 0,4	46,3	I073
The whole water column	53,0 + 0,2	43,8	399I

Table 12. Mean length of roundnose grenadier in research catches from different depths in Subareas 0 and 2 in 1986

Depth, m	Mean length, cm	Percentage of females	Number of ind.
Above 900	44,I ± I,7	44,3	6I
900-I000	55,0 ± 0,3	43,3	I397
I00I-II00	56,2 ± 0,4	42,I	I042
Below II00	68,7 ± 0,7	54,3	I88
The whole water column	56,2 ± 0,2	43,6	2688

Table 13. Abundance and biomass of Greenland halibut in Div. 3K in 1981-1986 (based on research catches)

Year, month	Surveyed area, sq.miles	Number of hauls	Abundance, mill.ind.	Biomass, thou. t
I98I, January	9479	34	57,I	62,3
I98I, July	20755	48	II0,2	62,5
I982, July	23030	53	I54,9	98,4
I983, January	I9954	67	I20,2	96,7
I983, July	27926	94	587,8	I22,6
I984, July	3II85	II3	288,6	2I6,7
I985, June	I90I2	53	I27,I	72,9
I986, May-June	3II85	I22	266,4	I74,8

Table 14. **Abundance** and biomass of bottom fishes in **NAFO** Subarea 3 in 1983–1986
(based on research catches)

Species	Abundance, mill. ind.				Biomass, thou. t			
	I983	I984	I985	I986	I983	I984	I985	I986
Cod								
3K	35,3	295,9	286,0	270,4	56,9	355,3	243,6	27I,3
3L	I2I,5	3II,9	I80,7	297,0	202,3	383,3	I77,I	437,2
3NO	I37,2	25I,I	522,I	269,8	I83,8	262,5	458,9	425,5
3M	65,4	60,5	37,I	37,2	23,0	3I,I	28,I	26,I
Redfish								
3K	964,3	749,I	8I0,3	8I6,I	376,6	3I9,8	356,9	372,8
3LNO	I6I6,I	I484,I	I485,3	884,0	252,0	308,I	2I5,8	I56,2
3M	644,0	376,7	I77,3	I200,2	I54,9	I32,3	5I,9	309,5
American plaice								
3K	I44,7	93,3	48,8	48,3	64,5	52,7	I7,9	I8,9
3LNO	I440,2	I295,6	693,9	826,8	533,8	642,I	325,6	348,6
3M	20,4	26,5	I5,8	33,4	8,9	7,5	7,8	20,2
Dab								
3NO	257,4	26I,0	I94,0	89,6	II3,3	96,9	84,5	39,5
Haddock								
3NO	77,9	440,8	I52,5	49,3	I9,3	229,8	85,2	37,I

Table 15. Age composition of cod in NAFO Divs. 3K, 3L, 3N, 3O, 3M in 1984–1986, °/₀₀ (based on research catches)

Age, years	3 K			3 L			3 N + 3O			3 M		
	I984	I985	I986	I984	I985	I986	I984	I985	I986	I984	I985	I986
I	+	-	-	I	6	-	I2	I7	2	34	I7	7
2	28	54	5	I07	III	7	I70	89	42	I78	24	472
3	I85	I34	79	I82	209	87	323	3I8	II7	367	248	I74
4	I43	305	2I4	I96	293	287	243	249	392	277	426	I49
5	240	323	434	I75	2I7	332	I2I	I99	2I9	89	233	I76
6	I5I	I06	I46	I28	88	I48	57	63	96	30	42	I4
7	99	3I	52	I28	43	84	34	33	43	I6	7	3
8	80	25	4I	45	I8	23	I7	I4	40	5	2	I
9	45	I2	I7	I5	6	II	II	5	2I	2	+	I
I0	I4	7	6	8	6	II	8	7	I2	I	+	+
II	6	2	2	5	I	7	2	3	9	I	-	I
I2	5	I	2	5	2	2	I	2	4	+	-	-
I3	3	+	I	2	+	+	+	+	2	-	-	I
I4	-	+	I	I	+	-	I	+	I	-	-	+
I5	-	-	+	-	-	-	-	+	+	-	-	-
I6	-	-	-	+	-	-	-	+	-	-	-	-
I7	+	-	-	-	-	-	-	-	+	-	-	-
I8	-	-	-	I	-	-	-	-	+	-	-	-
Relative number of fish, °/₀₀	999	I000	I000	I000	I000	999	I000	999	I000	I000	999	999
Number of fish key-aged	9609	62I6	II449	I0447	6II4	8990	II348	II998	76I3	8946	5944	4954
Number of fish otolith-aged	299	285	440	300	203	64I	600	797	654	293	447	489
Mean age, years	5,30	5,40	5,I3	4,90	4,24	5,06	3,90	4,04	4,79	3,4I	4,00	3,II

Table 16. Average number of cod (per 0.5 hr haul in the area of 0.0135 sq.mi) by age groups and divisions for 1983–1986

Age	3 L				3 NO				3 M			
	I983	I984	I985	I986	I983	I984	I985	I986	I983	I984	I985	I986
I	0,39	0,I9	0,46	–	3,05	I,08	3,40	0,20	I4,65	3,09	0,95	0,40
2	I,57	I3,55	8,59	0,84	4,66	I5,97	I7,77	4,3I	38,06	I6,02	I,3I	26,I0
3	7,07	22,98	I6,I8	I0,47	I2,I4	30,98	63,56	I2,05	22,43	33,00	I3,69	9,62
4	6,77	24,75	22,67	34,53	9,I8	23,63	49,96	40,54	5,30	24,87	23,47	8,25
5	8,78	22,II	I6,80	39,94	7,52	II,94	39,77	22,64	9,36	7,99	I2,85	9,75
6	II,86	I6,II	6,8I	I7,8I	7,44	5,43	I2,58	9,87	3,93	2,68	2,30	0,77
7	9,I4	I6,II	3,32	I0,II	3,24	3,25	6,64	4,46	I,7I	I,40	0,39	0,I7
8	3,57	5,69	I,39	2,77	I,94	I,58	2,76	4,I5	0,88	0,46	0,I2	0,06
9	I,40	I,89	0,46	I,36	I,87	I,I3	0,92	2,I4	0,35	0,20	0,0I	0,06
I0	0,70	I,05	0,46	I,29	0,88	0,83	I,36	I,27	0,22	0,07	0,0I	0,0I
II	0,28	0,63	0,07	0,84	0,42	0,I8	0,70	0,82	0,24	0,09	–	0,05
I2	0,27	0,64	0,I5	0,24	0,I4	0,05	0,34	0,39	0,I2	0,03	–	–
I3	0,09	0,25	0,03	0,05	0,0I	0,04	0,06	0,20	0,I0	–	–	0,05
I4	0,07	0,I2	0,0I	–	0,04	0,05	0,04	0,05	–	–	–	0,0I
I5	–	–	–	–	0,07	–	0,04	0,02	–	–	–	–
I6	0,03	0,04	–	–	–	–	0,04	–	–	–	–	–
I7	–	–	–	–	–	–	–	0,0I	–	–	–	–
I8	+	0,I5	–	–	–	–	–	0,0I	–	–	–	–
I9	–	0,0I	–	–	–	–	–	–	–	–	–	–
20	+	0,03	–	–	–	–	–	–	–	–	–	–
Total	52,00	I26,30	77,40	I20,25	52,60	96,I4	I99,94	I03,20	97,35	89,90	55,I0	55,30
Number of hauls above 548 m	86	95	9I	I08	I32	I53	I46	I43	I03	I03	I06	I08

Table 17. Length composition of cod on the Flemish Cap (3M) based on research catches of 1983–1986, °/oo

Length, cm	I983	I984	I985	I986
9–II	–	I	2	–
I2–I4	65	4	I3	I
I5–I7	55	20	4	5
I8–20	98	34	I6	I
2I–23	I47	37	55	7
24–26	I67	53	6I	II9
27–29	I42	70	55	29I
30–32	73	I3I	66	II7
33–35	22	I42	68	53
36–38	I3	I67	80	72
39–4I	I4	I20	89	53
42–44	I8	I00	II2	4I
45–47	39	50	94	28
48–50	50	I3	76	28
5I–53	38	7	82	22
54–56	I8	8	50	22
57–59	5	9	34	30
60–62	2	I4	2I	25
63–65	2	8	8	2I
66–68	5	4	4	I4
69–7I	6	I	3	I2
72–74	5	I	3	I4
75–77	5	I	2	8
78–80	3	I	I	4
8I–83	I	2	+	2
84–86	I	I	+	2
87–89	I	+	I	I
90–92	–	+	+	I
93–95	I	+	+	I
96–98	I	+	–	I
99–I0I	I	+	–	2
I02–I04	I	+	+	–
I05–I07	–	+	–	–
I08–II0	–	+	–	+
III–II3	I	+	–	–
II4–II6	–	–	+	+
II7–II9	–	–	–	I
Relative number of fish, °/oo	I000	999	I000	999
No. of measured fish	I0989	8946	5944	4954
Mean length, cm	30,00	35,80	40,48	37,76

Table 18. Length composition of cod in Div. 3N and 3O based on research catches in 1985-1986, °/oo

Length, cm	3N		3O	
	1985	1986	1985	1986
9-II	8	2	–	–
I2-I4	I0	2	I	–
I5-I7	I	+	I	–
I8-20	I6	9	6	I
2I-23	42	38	20	I
24-26	53	35	45	4
27-29	57	29	84	6
30-32	I20	68	I86	I9
33-35	99	I03	I62	40
36-38	79	I29	I00	94
39-4I	72	I23	60	II3
42-44	I02	I00	56	II6
45-47	89	74	52	87
48-50	64	67	43	80
5I-53	54	5I	38	7I
54-56	28	39	23	50
57-59	22	24	I9	52
60-62	2I	I7	20	42
63-65	I3	I4	I4	27
66-68	II	I2	8	28
69-7I	9	7	6	23
72-74	5	7	7	20
75-77	6	5	7	I8
78-80	3	5	5	24
8I-83	2	6	4	I7
84-86	I	4	4	I6
87-89	I	4	2	I3
90-92	I	3	4	I0
93-95	I	3	4	7
96-98	I	3	3	6
99-I0I	I	3	3	3
I02-I04	I	I	4	2
I05-I07	I	2	I	3
I08-II0	2	3	2	I
III-II3	+	2	4	I
II4-II6	+	2	–	+
II7-II9	+	I	+	I
I20-I22	+	I	I	I
I23-I25	+	+	–	+
I26-I28	–	+	+	+
I29-I3I	–	+	I	I
I32-I34	+	–	–	+
I35-I37	–	+	–	+
I38-I40	+	–	–	–
I4I-I43	–	–	–	–
I44-I46	+	+	–	–
Relative number of fish, °/oo	996	998	I000	998
Number of fish measured	8624	3789	3374	3824
Mean length, cm	40,40	43,58	40,70	52,76

Table 19. Length composition of cod in Div. 3K and 3L based on research catches in 1985-1986, ‰

Length, c m	3K		3L	
	I985	I986	I985	I986
I2-I4	-	-	+	-
I5-I7	+	-	2	+
I8-20	2	+	22	I
2I-23	I0	+	45	4
24-26	38	2	65	9
27-29	52	9	75	24
30-32	69	29	94	45
33-35	8I	60	86	68
36-38	I02	98	83	94
39-4I	79	I06	77	99
42-44	94	I32	96	I05
45-47	90	I30	73	88
48-50	97	III	6I	93
5I-53	I00	95	52	74
54-56	58	77	34	60
57-59	36	62	3I	62
60-62	29	32	29	43
63-65	23	2I	22	39
66-68	II	I2	I6	2I
69-7I	9	8	I2	I4
72-74	8	5	7	I3
75-77	4	3	4	9
78-80	3	3	3	6
8I-83	I	2	I	4
84-86	I	I	2	4
87-89	+	I	I	2
90-92	I	I	2	3
93-95	I	+	I	3
96-98	I	+	+	3
99-I0I	-	+	I	2
I02-I04	+	+	+	I
I05-I07	-	+	I	2
I08-II0	+	+	I	2
III-II3	-	-	+	I
II4-II6	-	-	+	I
II7-II9	-	-	+	I
I20-I22	-	-	-	+
I23-I25	-	-	+	-
I26-I28	-	-	-	+
I29-I3I	-	-	-	-
I32-I34	-	-	-	+
I35-I37	-	-	-	-
I38-I40	-	-	-	-
I4I-I43	-	-	-	+
Relative number of fish, ‰	I000	I000	999	I000
Number of fish measured	62I6	II449	6II4	8990
Mean length, cm	44,I3	44,86	4I,I7	48,45

Table 20. Age composition of beaked redfish (by length-age keys) from research catches in Div. 3LNOM in 1986, °/oo

Age	3 L	3 N	3 O	3 M
I	-	-	-	-
2	3	-	-	I
3	2	5	2	3
4	23	99	4I	I3
5	23	I53	80	72
6	39	I47	I29	I77
7	66	89	I30	III
8	I02	I6I	206	38
9	II8	I06	I42	32
I0	I72	86	I26	63
II	II8	35	39	76
I2	II9	34	28	I06
I3	72	36	27	97
I4	42	2I	I7	80
I5	26	8	8	45
I6	I7	5	6	38
I7	9	4	4	I3
I8	I0	4	4	I2
I9	8	2	3	6
20	I9	2	3	8
2I	8	I	2	5
22	2	I	I	2
23	2	I	I	I
24	-	-	I	I
Mean age	I0,5	7,8	8,4	I0,2
Number of ind.	6056	448I	I0I83	279I4

Table 21. Abundance, biomass and catches of beaked redfish in Div. 3LN at different rates of exploitation in 1986-1988

Age	1986			1987			1988		
	Abundance, thou.ind.	Fishing mortality rates	Natural mortality rates	Abundance, thou.ind.	Biomass, t	Fishing mortality rate with TAC of 27 thou.t	Biomass, t	Catch (t) with $F^{*}=0,I5$	Catch (t) with $F_{max}=0,25$
5	I23762	0,070	0,I00	I90339	3I2I6	0,096	3I2I6	2748	4299
6	309290	0,026	0,080	I044I4	23284	0,035	3490I	II87	I890
7	I06448	0,046	0,060	278I83	687II	0,063	22982	I378	2I76
8	5III8	0,I83	0,040	95742	28722	0,256	73823	I6220	24284
9	75387	0,077	0,030	4090I	I3538	0,I05	23573	235I	3666
I0	84I70	0,055	0,020	67737	25740	0,075	I3573	986	I552
II	5I8I2	0,036	0,0I0	78088	33968	0,049	26795	I297	2057
I2	I7529	0,I08	0,020	49483	24989	0,I49	37I78	5II7	7882
I3	I2258	0,I67	0,030	I5423	8884	0,233	24076	4902	7382
I4	5308	0,238	0,040	I0066	6543	0,337	7708	2I25	3II8
I5	3428	0,I39	0,070	4020	2935	0,I93	504I	854	I300
I6	32I6	0,096	0,II0	2782	2225	0,I32	2473	292	452
I7	2206	0,I0I	0,I50	26I7	2246	0,I39	I874	228	352
I8	I477	0,I50	0,2I0	I7I6	I568	0,208	I792	304	462
I9	I553	0,099	0,280	I030	I027	0,I36	II26	I26	I96
20	I04I	0,I28	0,370	I063	II20	0,I77	7I6	98	I50
2I	I472	0,05I	0,450	633	7I3	0,069	693	37	59
22	4II	0,I62	0,630	857	I024	0,225	432	65	99
23	203	0,I78	0,800	I86	227	0,247	445	68	I03
Total	852089			945279	278680		3I04I6	40363	6I480

*Corresponds to the rate of exploitation in 1987

Table 22. Length composition (%) of commercial silver hake catches in the Nova Scotia area in 1982-1986.

Length, cm	1982	1983	1984	1985	1986
12-13	+	-	-	-	+
14-15	0.1	-	-	+	0.1
16-17	0.4	0.2	+	0.1	0.8
18-19	1.0	0.5	0.9	0.6	2.2
20-21	2.2	0.4	2.6	1.5	3.0
22-23	2.1	1.4	2.9	2.0	1.8
24-25	1.9	9.7	1.7	2.9	1.4
26-27	6.5	21.2	2.5	13.6	6.7
28-29	11.9	21.2	15.1	23.5	21.4
30-31	20.7	18.5	32.5	22.4	31.6
32-33	23.5	14.5	23.2	17.7	21.4
34-35	16.6	6.8	10.7	9.4	6.8
36-37	7.6	3.2	4.9	3.8	2.0
38-39	3.3	1.3	1.9	1.4	0.6
40-41	1.3	0.6	0.8	0.6	0.2
42-43	0.6	0.3	0.3	0.3	+
44-45	0.2	0.1	+	0.2	+
46-47	0.1	0.1	+	+	+
48-49	+	+	+	+	+
50-51	+	+	+	+	+
52-53	+	+	-	+	+
54-55	-	-	-	-	+
56-57	-	-	-	-	+
58-59	-	-	-	-	-
60-61	-	-	-	-	-
62-63	-	-	-	-	-
Mean length, cm	31.4	29.4	30.8	30.1	29.8
Mean weight, g	238	198	197	198	189
No. of sp.	32603	45506	38036	109337	55606
Fishing gear	Trawl Hake 815	Trawl Hake 815	Trawl Hake 815	Trawl Hake 815	Trawl Hake 815
Mesh size, mm	60	60	60	60	60

Table 23. Age composition (%) of commercial silver hake catches in the Nova Scotia area in 1982-1986.

Age, years	1982	1983	1984	1985	1986
1	4.9	1.4	5.0	5.4	7.4
2	14.9	42.6	10.1	33.7	12.9
3	24.1	27.0	38.6	29.9	45.1
4	37.6	20.6	33.1	21.8	28.8
5	12.8	5.8	10.5	7.7	5.3
6	4.1	1.9	2.0	1.2	0.4
7	1.1	0.5	0.6	0.3	0.1
8	0.4	0.1	0.1	+	+
9	0.1	0.1	+	+	+
10	+	-	-	-	+
Mean age, years	3.0	3.0	3.4	3.0	3.1
Fishing gear	Trawl Hake 815	Trawl Hake 815	Trawl Hake 815	Trawl Hake 815	Trawl Hake 815
Mesh size, mm	60	60	60	60	60

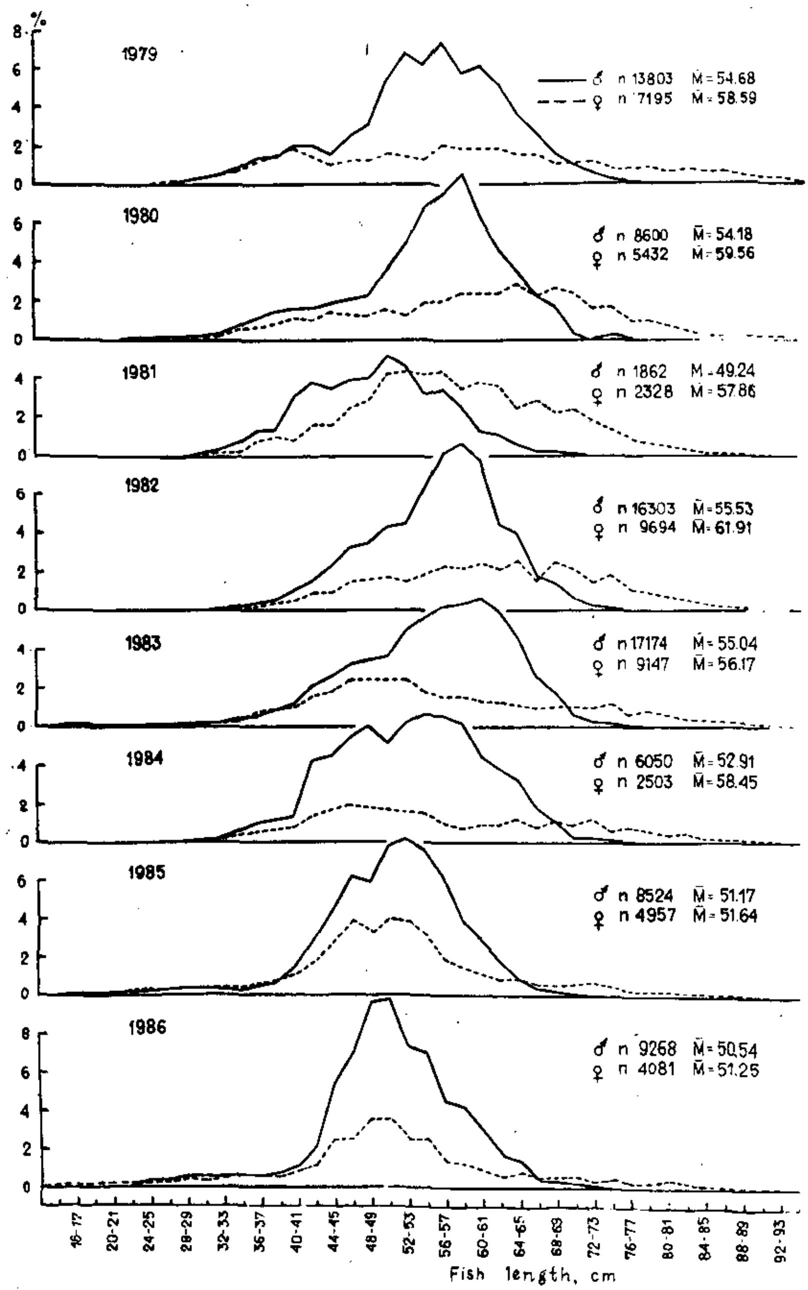

Fig. 1. Length composition of Greenland halibut from research catches taken in Div.0B in 1979-1986

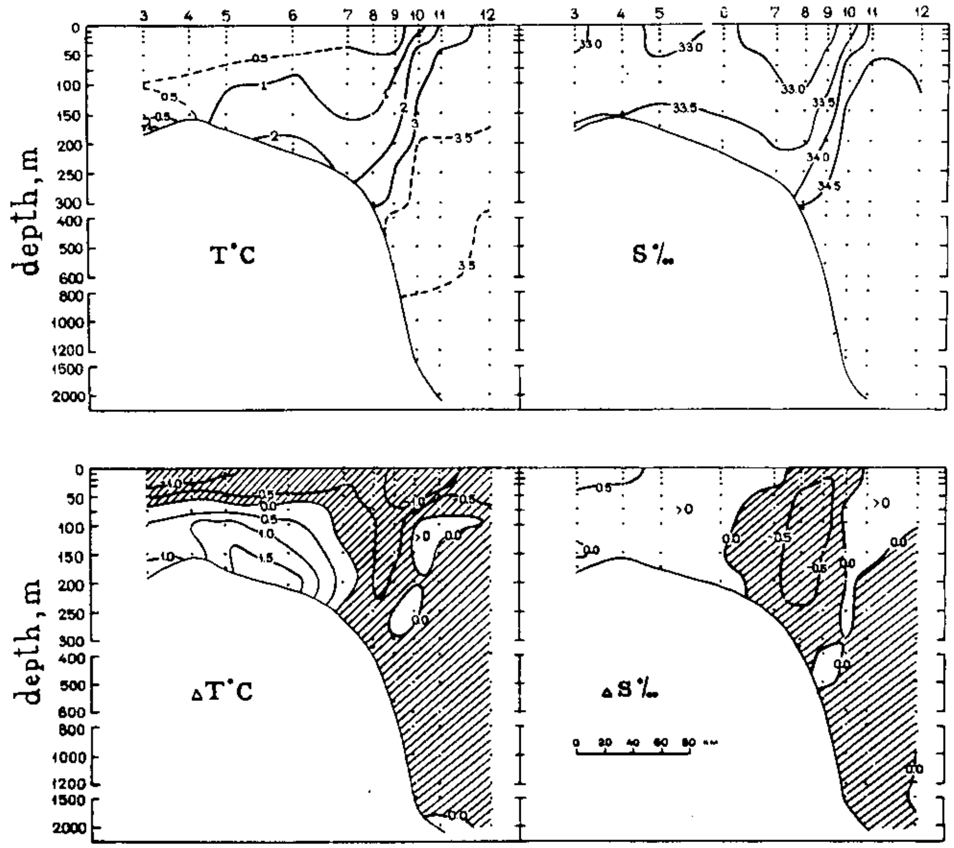

Fig. 2. Distribution of temperature (T°C) and salinity (S°/₀₀) and their anomalies (Δ T°C and Δ S°/₀₀) on Section 8-A in November 1986 relatively the norms calculated from the data series for 22 years of observations on the section in October/November (1962, 1964-1977, 1979 - 1985). The areas with negative anomalies are shaded.

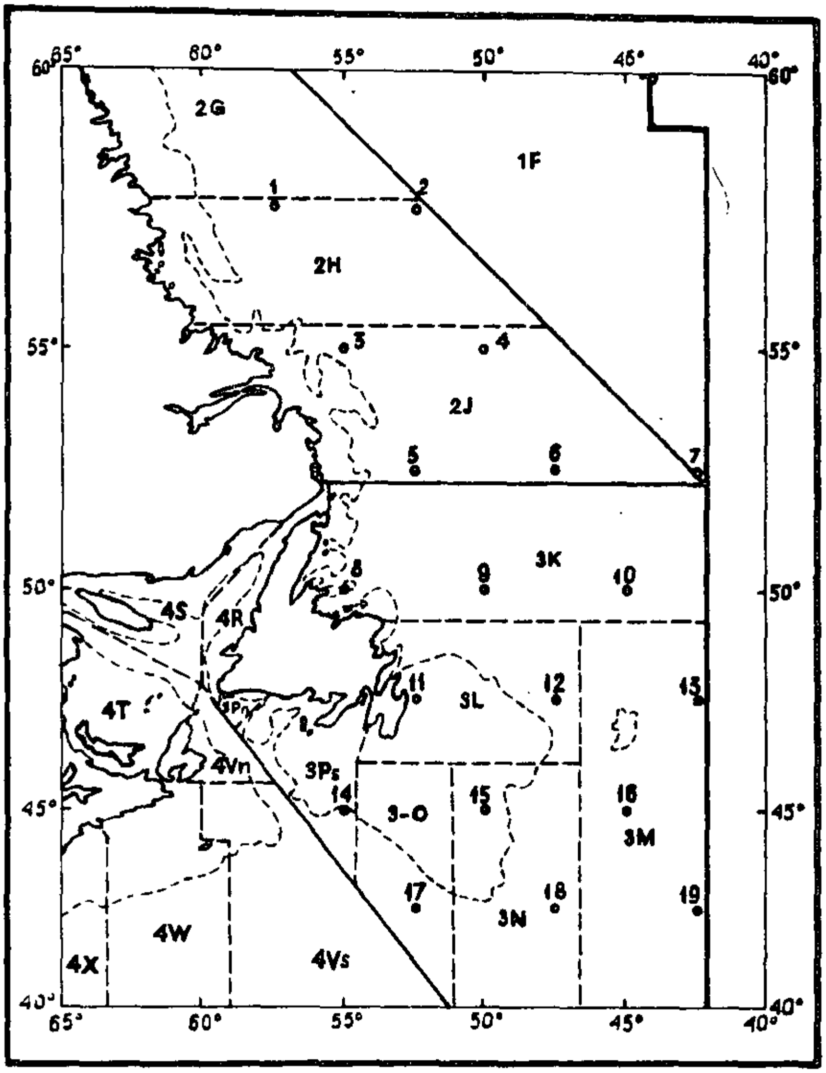

Fig. 3. Regular grid with 19 points chosen for estimation of the temperatures in the surface layer of NAFO Subareas 2 and 3

NAFO Subarea	No points	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Okt	Nov	Dec
	1	•	•	•	•	•	+	•	•	—	•	•	•
	2	—	•	—	—	•	•	•	•	—	—	—	—
	3					•	+	•	•	•	—	•	•
2	4	—	—	—	•	•	•	•	•	•	•	—	—
	5						•	•	•	•	•	•	•
	6	—	—	—	—	•	•	•	—	+	•	—	—
	7	•	—	—	—	•	•	—	—	+	—	—	—
	8						+	•	•	•	•	—	
	9	—					•	•	•	•	•	•	—
	10	—	—	—	—	—	—	—	•	+	—	—	—
	11	•	•		•	•	•	•	+	+	•	•	—
	12	—	—	•	•	•	•	•	•	+	•	•	—
3	13	•	•	—	—	—	—	—	—	•	—	•	—
	14	—	•	•	•	+	•	—	—	•	—	—	•
	15	•	•	•	•	•	+	•	•	•	—	—	•
	16	—	—	—	—	—	•	—	—	—	—	—	—
	17	—	•	—	—	•	•	—	•	—	—	—	—
	18	+	•	•	•	+	+	•	•	—	—	+	•
	19	•	•	•	•	•	—	•	—	•	—	•	—

Fig. 4. Surface temperatures in the knots of a regular grid covering NAFO Subareas 2 and 3 (Fig. 3):
+ - above the norm; • - norm; - below the norm

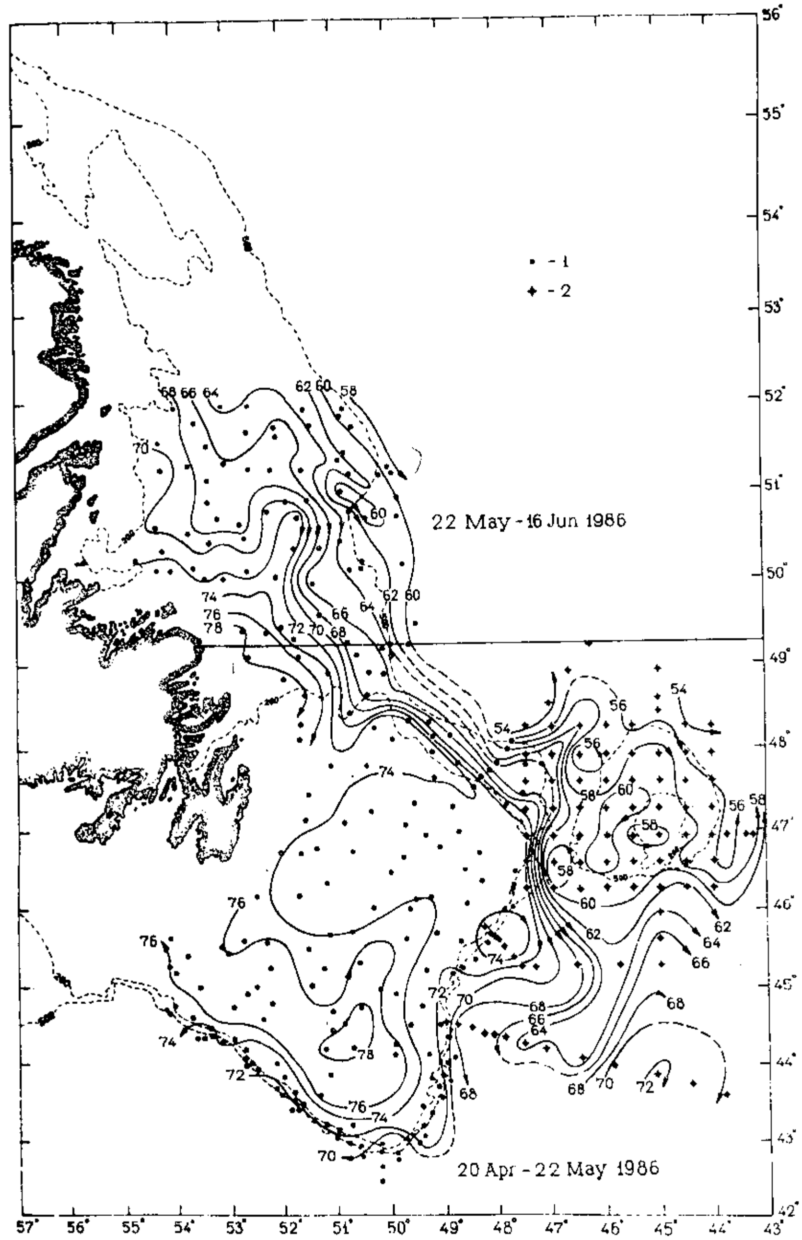

Fig. 5. Dynamic topography of the sea surface relatively the 2 MPa level in April to June 1986 (based on the data from Cruise 34 of the RV "Kononov" (1) and Cruise 1/86 of the RV "Boguslav"(2); isolines of dynamic heights are drawn with the interval of 2 dyn. cm)

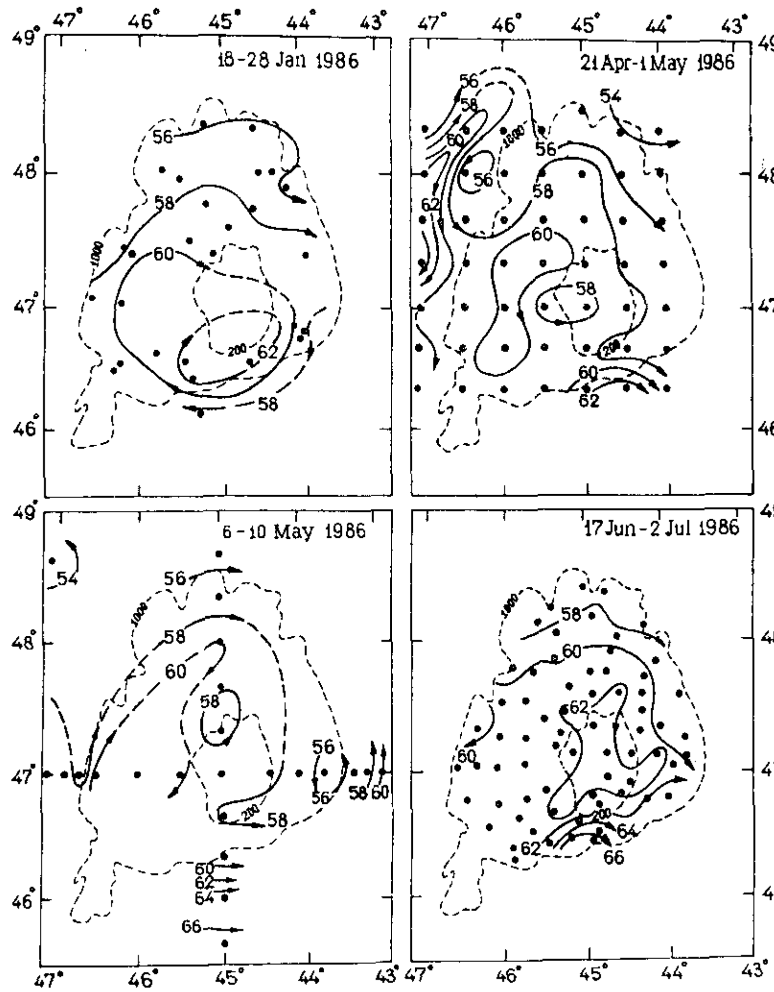

Fig. 6. Dynamic topography of the sea surface in the Flemish Cap area in January to July 1986. The charts are based on the data from Cruises 33 (18-28 January) and 34 (17 June - 2 July) of the RV "N. Kononov" and Cruise 1/86 (21 April - 1 May and 6-10 May) of the RV "Boguslav"