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# Northwest Atlantic



Fisheries Organization

Serial No. N1013

NAFO SCS Doc. 85/14

#### SCIENTIFIC COUNCIL MEETING - JUNE 1985

#### USSR Research Report for 1984

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SECTION 1. SUBAREAS 0, 2 AND 3

#### A. State of fisheries

In 1984, the USSR commercial ships fished for redfish, cod, witch on the southern slopes of the Grand Bank (3NO) and on the Flemish Cap (3M), silver hake in the 200-mile fishing zone, on the Scotian Shelf (4VWX), redfish and capelin in Divs. 2J+3K. For a very short period the USSR ships operated in the areas off North and Central Labrador (2GH) and also in the Baffin Island area (OB) fishing for roundnose grenadier and Greenland halibut. In 1984, the USSR total yield in the Northwest Atlantic amounted to 128, 827 tons, that was 51.4% higher than that of 1983.

An increase in total yield resulted from realization of national quotas for silver hake on the Scotian Shelf and capelin in the South Labrador (2J) and Div. 3K (Table 1).

## B. Special investigations

### 1. Hydrographic observations

Marine hydrological observations in Subareas 0-3 were conducted during 8 expeditions and mainly included the deepwater temperature and salinity measurements on standard oceanographic sections and grids of stations in the trawl surveys; during certain trips the thermal observations were added to be carried out by means of bathythermographs (Table 2). The duration of the period and number of deepwater observations, respectively, in different subareas essentially varied: minimum - in Subareas 0 and I, maximum - in Subarea 3.

These observations data and the estimated characteristics of hydrological conditions obtained on their basis, and also the information on surface water temperature were summarized in the scientific paper by Borovkov and Burmakin submitted to the present NAFO Scientific Council Meeting. The results of observations indicate a considerable cooling of waters combined with heavy ice conditions and abundance of icebergs in the areas off Labrador, North and East Grand Bank and Flemish Cap. A low heat water content kept there in the spring- summer period, caused by the extension of the cold sub-surface waters area. The tongue of those waters penetrated unusually far to the southeastern slopes of the Flemish Cap surrounding the latter from north and east. On the contrary, the water warming was registered on the southern slopes of the Grand Bank. A distinct heat "opposition" between northern and southern areas of the region considered had remained since 1983.

On the basis of the assessment of geostrophic water movement structure it was estimated to be well expressed anticyclonic circulations over the Grand Bank and Flemish Cap in springsummer that were caused by invasions of the slope waters on the Southwest Grand Bank and cold sub-surface waters over the northern and eastern slopes of the Flemish Cap.

# 2. Biological surveys

Brief information concerning the biological surveys conducted by the USSR ships in 1984 is given in Table 3.

# 2.1. Trawl survey of Greenland halibut stocks in Divs. OB, 2GHJ, 3K

In 1984, the investigations on the Greenland halibut stocks assessment by method of trawl survey were continued. In autumn-

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winter the researches were carried out in Divs. OB, 2GHJ (MB-2645 "Suloy", trip 31; MB-0023 "Nikolay Kuropatkin", trip 6), and in summer - in Div. 3K (MB-2645 "Suloy", trip 30). The trawling positions in the northern areas were chosen at random, mostly, at positions with suitable conditions for hauling, but in Div. 3K (1983/1984) - due to the NAFO methods.

Because of technical reasons and severe ice conditions, observed in autumn-winter in Subares 2 and Div. OB, the program of the Greenland halibut stocks trawl survey was restrictly carried out. However, these investigations allowed to obtain new data on distribution and density of the Greenland halibut concentrations in 1200-1500 m depths, and also on the availability of the stock in relation to the thermal conditions of water masses in different areas.

A catch per 1 hour trawling referred to the area trawled was accepted for indices of the Greenland halibut concentrations density. At a 3.5 knots speed of the vessel with 14.3 m horizontal opening of trawl, the hauled area constituted 0.027 sq. miles. Catchability coefficient for valid haul is taken to be equal to 1.0. In this case, we have estimated only the part of population, which was registered in the trawling zone at that moment and was available for assessment.

Due to materials of trawl surveys in the Baffin Island area, conducted along the continental slope in 1980-1984, the maximum biomass of halibut was 207.9 thou t in 1982 and a decline was registered in the subsequent years (Table 4). Year-to-year discrepancies in concentrations density in different depths of the continental slope were also observed (Table 5).

As mentioned above, in 1984 two surveys were carried out in the Baffin Island area: in September - by MB-2645 "Suloy", in November-December - by MB-0023 "Nikolay Kuropatkin" (Table 4). Proceeding from these estimates we cannot agree with a view

that an actual reduction in abundance and biomass of halibut throughout one year is the reason for so considerable variations in stock indices: 126.7 - 210.0 thou t. First of all, this fact can be explained by the effect produced by natural factors

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on the Greenland halibut distribution, which is revealed by

variations in the fish availability for bottom trawling. Thus, size composition analysis showed that in December a percentage of large mature specimens considerably decreased that was caused by their migration into the spawning grounds.

In Div. 3K the trawl surveys of Greenland halibut were chiefly carried out in July, but in some years were repeated in January.

Sufficiently close values of halibut biomass in the surveys conducted during the same years are to be noticed. A regular biomass growth is observed from 1981 to 1984, resulted, to our opinion, from the recruitment of the rich 1979 and 1980 year classes to the commercial stock and fish availability increase for validity because of their migration out from the coastal waters under the temperature conditions influence.

In this connection a further development of common survey methods is needed with the reasonable use of the values, when hauling conditions were the most favourable and the stock availability - the highest. As far as the Greenland halibut is characterized with long life cycle, their biomass cannot vary greatly from year to year.

In 1984, larger specimens than those of 1983 (Table 7) were registered in all the catches, thus, the size composition analysis indicated a high level of halibut stocks.

## 2.2. Trawl surveys of bottom fish in Divs. 3KLMNO

In 1984, as in previous years, the main attention of PINRO was paid to the assessment of commercial fish stocks by trawl surveys.

In 1983/1984, the trawl surveys of bottom fish in Divs.3KLMNO were carried out by the NAFO methods. The trawlings were chosen at rendom. The duration of the hauling in 1983 was one hour, in 1984 - 0.5 hour. An acception of 0.5 hour trawlings allowed somewhat increase in number of hauls and to have 3 hauls as minimum in each stratum. Total number of hauls in all strata was determined, taking into account the catches dispersion and strate squares. While calculating the relative abundance and biomass the trawl catchability was conventionally taken for 1.0.

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<u>Cod in Div. 3KL</u> Due to the results of the trawl survey, the abundance and biomass of the Labrador cod in Divs. 3KL in 1984 were considerably higher than those of 1983 (Table 8). Thus, in Div. 3L the cod abundance was 2.6 times and biomass -1.9 times higher, in Div. 3K even higher indices were obtained: the abundance was 8 and biomass - 6 times higher.

The cod of 42-53 cm long in Div. 3K and 36-47 cm long in Div. 3L, at age of 3-6 of the 1981, 1980, 1979, 1978 year classes dominated in the catches taken with valid hauls (Tables 9, 10, 11). Cod abundance of the 1982 year class, due to the number of the young fish at age of 2, was preliminary assessed to be above the average norm.

In 1986, the Labrador cod stock will be recruited with the 1980, 1981, 1982 year classes of good abundance and the specimens of average 1979 year class.

<u>Cod in Div. 3M</u> The trawl surveys conducted in 1983 and 1984 by random trawl stations, showed that the Flemish Cap cod biomass was as usual at a low level (Table 8). For recent ten years only three good year classes recruited the stock (1973, 1978, 1981), all the rest were close to the average ones (1974, 1977, 1980, 1982) or the poor ones (1975, 1976, 1983).

In 1983, an essential recruitment to the stock with the 1980-1982 young cod year classes took place; among the fishes of all age groups the young fish at age of 1-3 constituted 79%. As in 1983, the immature fishes 30-44 cm, at age of 3-4 of the 1981 and 1980 year classes dominated in the catches (Tables 9, 10, 11). The cod abundance did not almost change, but biomass increased because of approximately 10 thou t natural increment and constituted 31.1 thou t (Table 8).

To judge the young cod quantity (1-2 year olds) in the

catches per 1 hour trawling, the 1982 year class was estimated as the average one by abundance, and the 1983 year class was weakly reflected (Tables 9, 10).

In 1986, the cod 45-60 cm long, at age of 5-6, 1-2 kg by mass of the 1981 and 1980 year classes, and partly the specimens at age of 4 of the 1982 year class will constitute the bulk of trawl catches. At the present level of exploitation the Flemish Cap cod biomass will be not less than that of the 1984 level.

It is reasonable to remain TAC for 1986 at the previous years' level for conservation of the spawning stock, the main portion of which will be consist of the two year classes (1980, 1981).

### Cod in Div. 3NO

Data on the Soviet trawl surveys indicate the Newfoundland cod stock increase.

In 1984, compared to 1983, the cod abundance increased by 1.8 times, and biomass - by 1.4 times (Table 8). In total, by two regions, mean biomass was 262.5 thou t, mean abundance -251.1 mill. spec. The fish 24-29 and 33-44 cm long, at age of 2-5 of the 1982-1979 year classes dominated in the catches. The cod of the rich 1981 year class was the most abundant (Table 9). Due to the 2-year olds catches, the 1982 year class is also can be considered as the above average one. The 1983 year class is poor on the basis of the preliminary assessment of the yearlings (Table 10).

In 1986, the 4-6-year olds of the 1982-1980 year classes will constitute the bulk of the catches, the length of fish will be, on the average, 45-58 cm, the mass - 0.8-1.7 kg.

Taking into account the above mentioned it will be reasonable to set TAC for 1986, amounted to 30-35 thou t.

<u>Beaked redfish</u> In 1984, some decrease in commercial stock (Table 8) took place. Canadian scientists also stated a gradual reduction in redfish biomass in that area (NAFO SCR Doc. '84/VI/23), that was mainly explained by poor recruitment to the stock with the young specimens in 1980-1984.

While considering the data on size and age compositions of the beaked redfish (Tables 12, 13), it is important to notice that a high abundance of the young fish 16-20 cm long, at age of 4-5 of the 1979 and 1980 year classes, which will recruit the commercial stock in 1985-1986, has confirmed on the Flemish Cap Bank.

In 1984, the redfish 31-35 cm long, at age of 10-13 of the 1971, 1972, 1973, 1974 year classes constituted the bulk of the catches (Table 13).

It is expected that in 1986, as a consequence of the entering the fishery of the abundant 1979, 1980 redfish year classes, the average length and weight of fish will decrease, the total biomass of the stock and its abundance will increase.

Taking into account a considerable recruitment and projected tendency to increase of the commercial stock by 1986, it is reasonable to remain the fishery level reached in 1983-1984. At the exploitation level  $F_{max} = 0.15$  TAC in 1985 will amount to 22 thou t. These data are correlated with biomass evaluation, obtained by VPA (the paper will be submitted to the NAFO Meeting).

In accordance with the data on the Soviet trawl survey of 1984, the commercial redfish stock on the Grand Bank (3LNO) is on a good level.

As seen from the data on size composition (Table 10) in 1984, in the South and Southwest Newfoundland the specimens 21-30 cm long, at age of 7-9 of the 1975, 1976, 1977 (Table 11) will constitute the bulk of the catches. In 1986, the fishery will be also based mainly on the fishes of the length mentioned. Throughout 1983-1984 the entering of the young fish 16-20 cm long, which in 1986 would recruit the commercial stock in 1986, was obviously observed. Due to the data on the 1984 trawl survey in Divs. 3NO the summarized mean biomass in 1983 was equal to 188 thou t, in 1984 - 244 thou t. The abundance and biomass of redfish in Div. 3L available for valid bottom trawl did not practically change (Table 8).

The redfish abundance and biomass in Div. 3K are on a high level. The commercial stock in this region is obviously underexploited (Table 8).

Limanda In accordance with the data of NAFO the Limanda yield on the Grand Bank fluctuated within the limits of 39-22 thou t in 1971-1975 and 8-18 thou t in 1976-1983 constituting on the average in recent years 12.6 thou t. Mean catch per hour trawling in 1983 was equal to 0.56 t.

Limanda population size in Divs 3NO was relatively stable. By data on the trawl surveys of 1983 and 1984 close abundance and biomass values were obtained: 257.4 and 261.0 mill. spec. and 113.3 and 96.9 thou t, respectively (Table 8).

The similarity of size frequencies and mean lengths in the catches for 1982-1984 is also evidence of relative Limande stocks stability. During three years the fish of 34-40 cm long dominated in the catches taken with valid hauls.

TAC for Limanda for 1985 is estimated to be 15 thou t. It is reasonable and in 1986 to remain TAC at the same level.

<u>American plaice</u> Since 1971 throughout 1983 the American plaice yield in Div. 3K fluctuated within the limits of 1.1-7.4 thou t, on the Flemish Cap - 0.5-1.9 thou t, in Div. 3L - 16-37 thou t.

According to the materials of the 1984 survey in Divs. 3LNO some biomass growth was registered: total biomass for all three areas was equal to 642 thou t in 1984 and 533.8 thou t in 1983.

In Divs. 3K and 3M the stocks of the species remained close to the 1983 level (Table 8).

The fishes of 30-37 cm long constituted the bulk of the catches in all the areas. On the Grand Bank TAC is estimated to be 49 thou t. Taking into account the stock stability, it is expected that TAC for 1986 will be remained at the level of the previous years.

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<u>Haddock</u> Data on trawl surveys indicate the gradual renewal of the haddock stock on the Grand Bank. During many years the haddock fishery was prohibited, they were taken as by-catch in other species fishing.

In 1984, mean biomass in total for two areas was estimated to be 229.8 thou t, and abundance - 440.8 mill. spec. (Table 8). Low indices of abundance and biomass obtained in 1983, were caused by insufficient number of trawlings in 100-200 m depths and underestimate of fish.

2.3. Hydroacoustic surveys of capelin stocks

In 1984, the observations on annual assessment of abundance and biomass of the Newfoundland capelin were continued.

Acoustic survey on the capelin stocks assessment on the spawning grounds was carried out on board the RV "Poisk" from 1 May to 13 June in Divs. 3LNO. The survey was carried out due to the method earlier accepted by means of "Simrad" EK-38 echo sounder and home-made "SIORS" echo integrator with the Norwegian "Simrad" QD-200 digital echo integrator connected in parallel for more qualitative size-species identification of echo recordings. The biological material was collected by a mid-water trawl with a small-meshed netting.

The results of the survey showed that juvenile and immature fish, the abundance of which was 507 billions spec. and biomass - 1.4 mill.t, made up the main part of the capelin stock on the bank. The mature fish stocks constituted 44.7 billions spec. or 1.2 mill.t. The results obtained indicate a continuous renewal of capelin stocks and recruitment to the commercial stock with the 1982 and 1983 year classes of high abundance in the nearest years.

Acoustic survey on capelin stock assessment of feeding concentrations in Divs. 2J and 3K was conducted on board the RV "Kokshaisk" in two stages: 4-10 December on the southern and 17-24 December - on the northern sections of the mentioned

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area. The survey was enalogously carried out according to the methods applied earlier with use of EK-400 echo sounder within regime of 38 kHz and echo integrator "SIORS".

Because of some technical reasons the survey was conducted almost 1.5 months later than usually, therefore a considerable part of fish, which by that time distributed in the southernmost sections of Div. 3K, had not been covered with the survey. Besides, the investigations were impossible to be conducted in the northwestern parts of Div. 2J because of solid ice fields. The abundance of the capelin stock part evaluated constituted 199 billions spec., biomass - 268 thou t.

Due to the same reasons, the pre-recruits survey (0+, I+ year olds) was carried out considerably later, than in the previous year. The survey was conducted on board the RV "Kokshsisk" in the southern parts of Div. 3K and in the northern ones of Div. 3L from 11 to 15 December and in Divs. 3LNO from 30 December 1984 to 14 January 1985. The survey was mainly carried out analogously due to the methods applied in 1983: the fingerlings stocks were estimated by results of the catches with fry trawl, the fishes at age of I+ as well as the adult fishes were estimated by trawl-acoustic method.

The capelin abundance at age of I+, estimated by results of the survey since 11 to 14 December in Divs. 3KL, was equal to 25.2 billions spec., and biomass - 139.5 thou t. The fingerlings abundance index, estimated due to the methods applied last year, was 66.5, i.e. almost 4 times lower than that of 1983. Abnormal severe hydrological conditions on the Grand Bank throughout 1984 are probably to be considered as the main reason of possible reduction in fingerlings abundance in 1984.

The results of acoustic capelin surveys in 1984 and trawl survey of pre-recruits are considered in more details in special papers.

The estimates of capelin stock parameters by VPA are indicative of steady growth of abundance and biomass of commercial stock since 1981. It is expected that by 1985, the total capelin abundance will constitute 129 billions spec., biomass - 2.3 mill.

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t. Even at the sparing level of exploitation F = 0.1, TAC in 1985 and 1986 will be equal to 200 thout (see the NAFO paper by Bakanev, Lugovaya, Tretyak, 1985).

Species	NAFO Divs	1983	1984
Cod	2GH	-	9
	2+3KL	159	488
	3NO	3238	3306
	3M	1264	910
	4VWX	201	110
Haddock	4VWX	166	170
	3NO	44	48
Beaked redfish	2+3K	3722	3684
( <u>Sebastes mentella</u> )	3LN	9012	9277
Roundnose grenadier	50 3M 4V₩X 0+1	5670 14517 44 46	15005 22 25
American plaice	2+3	933	147
	2+3K	11	2
	3M	1238	711
	3T.NO	120	360
Witch	4 <b>VWX</b>	32	65
	2+3KL	516	1000
	3NO	1942	1955
Greenland halibut	0+1	818	109
	2+3KT	176	440
Capelin Silver hake	2J+3K 4VWX 3NO	10497 27377	17366 57423 189
Saithe Yellowtail flounder Herring	4VWX 3LNO 4VW	- 226	97
Mackerel	3+4	8	- 881
Argentine	4VWX	351	201
Others	2+4	2717	7374
Total		85101	128827

Table 1. USSR catches in Subareas 0, 2, 3, 4 and 6 in 1983-1984 (t).

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NA	AFO Area in	1984.	ns carried of	IC DY PINRO Ve	ssels in
Vessel, ! trip	Period of observa- tions	Standard sections	Number o Bathomet- ric measu- rements T°C, S %0	f stations Bathyther- mographic measure- ments, T°C	T o t a l
	S	ubareas O	and 1		
"Suloy", 3I	19-29.09 <u>s</u>	ubarea 2	II	3	14
'Kokshaisk",9	02.11-25.12	8-A	25		25
"Suloy", 3I	14-18.09 <u>s</u>	ubarea 3	5	4	9
Kokshaisk",4	01.01-23.01	_	II	36	47
"Suloy", 29	03.01-30.01		31	IO	41
"Suloy", 30	18.03-19.08	CG4 <sup>¥</sup> 4A <sup>¥</sup> 7A <sup>¥</sup>	446	38	484
		SW <sup>X</sup>			
"Poisk", 49	29.03-13.06	-	79	123	202
"Lensk", I8	18.04-13.06	CG-3	13	113	I26
	<u>1</u>	lemish Car	0. 4 749		TAR
"Vilnyus", 2	22.06-25.08	5 G <del>-</del> 3,	CG-4 148	-	140.
"Suloy", 3I	05.10-24.11	-	28	14	42
"Kokshaisk"9	06.11-30.12	-	51	÷	51
• '	·	Τοτ	al 848	341	1189

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\*/ Section was carried out partly

Subarea	Divs	Survey period	Vessel, trip	Survey method	No.of trawls	Species
0	OB	Sep	MB-2645 "Suloy",	trawl.	33	Greenland halibut
	OB	Nov - Dec	MB-0023 "N.Kuro- patkin",	_"_"_	25	<u></u>
2	2 <b>G</b>	Sep	o MB-2645 "Suloy", 31	_"_"	17	_n_n_
2	2GH	Dec	MB-0023 "N.Kuro- patkin",	ft ft	50	17 <b>1</b> 3
2+3	2J+3K	No <b>v -</b> Dec	6 MG-1356 "Kok-	trawl	52 14	Canalin
3	3K	Jan	MB-2645 "Suloy",	10 + row]	74	Greenland
3	3LNO	May -	Z7 MI-0833 "Poisk".	trawl	<u>)</u> )	halibut
3	3KLNO	May - Jul	49 MB-2645 "Suloy".	ic	33	Capelin
z	3KT.NO	Dec	30 MG-1356	_!!_!!_	390	Bottom fish
)	Jitaito	1984- Jan 1985	"Kok- shaisk", 9		38	Capelin
3	3M	Mar - Apr	MI-0833 "Poisk", 49	icht <b>hy-</b> oplank- ton	42	bre-recruite
3	3M	Apr	MB-2645 "Suloy", 30	trawl.	124	Bottom fish

Table 3. Biological surveys carried out by PINRO vessels in NAFO Area in 1984.

		. *	-		
Year, month	Investi- gated area, so,miles	Number of trawlings	Abundance, mill.spec.	Biomass, thou t	
		Div. OB (cont	inental slope	)	
1980,					
Dec	8253	35	99.I	156.5	•
1981, Dec	4193	II	39.2	56.2	
1982, Nov	8653	51	II4.4	207.9	
1983, Nov	I2593	7I <sub>.</sub>	127.8	168.4	
<b>1984,</b> Sep	7733	32	76.4	I26.7	
1984, Nov - Dec	9104	2I Div. 2GH (con	24.2 ntinental slop	2I.0 e)	• .
1983.			•		
Nov - Dec	4116	54	I25.3	225.8	
1984, Dec	5910	52 Div 3K (sha)	65.7	85.5	
		· · · · · · · · · · · ·	i, continenta	I STOPE)	
1981, Jan	9479	34	57.I	62.3	
1981, Jul	20755	48	110.2	62.5	
1982, Jul	23030	53	154.9	98.4	
1983, Jan	199954	67	<b>2</b> 20.2	96.7	
1983, Jul	27926	94	5 <b>8</b> 7.8	122.6	
1984, Jul	31185	113	288.6	216.7	

Table 4. Greenland halibut abundance and biomass assessment in NAFO Area in 1980-1984 by trawl surveys data.

x/ Because of ice conditions the investigations were not carried out completely Greenland halibut catches from different depths over the continental slope in Div. OB in 1979-1984, kg per trawling hour (in brackets - number of trawlings). Table 5.

		1	I						
Depth.	Area,		Y e a	0   8   8	ם 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	] ] [ ]		1. 1. 1. 1. 1.	   
	miles	1979 Sep - Nov	1980 Nov - Dec	1981 Dec	1982 I	1983 Nov	1984 -	1984 -	1
501-600	920	455(12)		I30(I)		907(2)	t           	<u>-</u>	1 1
601-700	I500	52I(I3)	71(4)	ł	336(7)	242(7)	317(5)	31(3)	
70I-800	1640	482(15)	I30(2)	1	783(6)	247(9)	635(9)	23(2)	
80I-900	2890	488(8)	918(4)	220(3)	(11)986	400(9)	490(7)	58(3)	
0001-106	116	398(5)	I379(II)	618(6)	934(9)	6I5(I2)	369(3)	108(3)	
10011-1001	392	455(2)	I3I6(6)	761(3)	2I30(I3)	865(8)	280(5)	71(3)	
II01-I200	400	ŀ	I	1	(I)I89I	I482(II)	I09(3)	69(2)	
I201-I300	451	ı	ı	ł	I	I024(5)	I	254(3)	
50I-I300	9104	478(55)	886(3I)	522(I3)	II01(2I)	7I5(63)	424.8(32)	88.2(21)	
Biomass ind.	. X0	477	580	316 <sup>.</sup>	826	518	436	8	
% of area surveyed		90.7	90.7	56.2	95.0	100	84.7	100	
						•		:	

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Greenland halibut catches from different depths over the continental slope of the North and Central Labrador in 1979-1984, kg per trawling hour (in brackets -Table 6.

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	Area.		ם ה ו ה ו ה ו ה ו ו ו ו ו ו ו ו ו ו ו ו				
Depth, B	s 1 1 0 0 1 0 0 0 0 1 0 0	1979 Oct - Nov	1980 Nov - Dec	1981 Dec 61 - Jan 82 -	1982 Nov - Dec 82-Jan 83	1983 Nov - Dec 83-Jan 84	1984 Dec 84 - Jan 85
	543		34(4)	33(I3)	         	9 8 8 - 1 8 - 1 1 8	1 1 1 1 1 1 1
40I-500	612 _	295(16)	I6(2)	II3(3)	I97(4)	22(3)	44(5)
501-600	486	288(20)	218(2)	264(5)	439(4)	291(4)	49(5)
601-700	487	344(11)	427(4)	-427(4)	I379(3)	473(3)	II5(5)
701-800	486	384(15)	I737(3)	506(6)	1862(6)	I446(5)	319(6)
801-900	530	697(6)	2783(6)	2865(6)	1732(7)	2914(8)	763(6)
000II-I00I 000I-I06	430 536	440(3) 938(4)	2762(10) 1831(6)	1753(9) 1504(1)	3520(5) 1139(7)	2686(16) 1492(10)	1088(7) 1220(4)
1101-1200	549	Î	II46(I)	1	623(1)	2749(5)	439(4)
I20I-I300	598	I	1	I	í	454(I)	265(3)
1301-1500	9611	I	1	1	ı		(2)IOI
30I-I500	6453	397(91)	I699(34)	879(47)	I5I8(37)	1914(55)	447.6(52)
Biomass' in	lex.	479	1183 -	-912	I286	1351	357
% of area surveyed		63.7	72.2	63.7	<b>63.</b> 8	73.1	9.16

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Length, cm	Males 1983	<u>3K</u> 1984	Female 1983	■ <u>丞</u> 1984	Males 1983	 1984	Femal 1983	es OB 1984	 
I2- I3 I4- I5 I6- I7 I8- 19 20- 21 22- 23 24- 25 28- 29 30- 31 32- 33 34- 35 36- 37 38- 39 40- 41 42- 43 44- 45 50- 51 52- 53 54- 57 58- 61 62- 63 64- 65 66- 67 68- 67 68- 67 72- 73 74- 75 76- 77 78- 81 82- 83 84- 85 88- 87 88- 89 90-91 92-95 96- 97 98-99 100-103 I02-I03 I04-I05 I06-I07 I08-I09 Relative amount, 9	1982 1982 1985	44 4496457820760000 1002669959820760000 12229595969661503947799121177 100266696661503947799121177 1007		4 499938142920409684508257459532149594920409122 000 1 - 0027472769560826074178053554432222110100 000 1 000	21 22890186141041376233209150515683722221 9001212121133479616458908332222254842000011111111111111111111111111111111	1984 	21 HH720H7838H2470H204303064H70068H72050H0279256303 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	41 4 007.938H0354306284400H34G86835509986384H0466734 4 0	
Number of spec.	5084	2436	4588	5609	13026	5584	7844	2336	

Table 7. Length composition of Greenland halibut in Div. 3K and Div. 0B in 1983-1984 in the catches taken with small-meshed trawl, °/...

					•
Area	1 Abundance,	mill.spec.	! Biomass, t		
	1 1983		1983		
, ~~~~~	05 0	000	55.0	<b>DEE</b> 0	
36	30.2	290.9	20.8	300.3	
3L	121.5	311.9	202.5	383.3	
3N	77.I	92.3	122.0	<b>II6.4</b>	
30	60.I	<b>158.</b> 8	61.8	<b>I46.I</b>	
3M	65.4	60.5	23.0	3I.I	
		Haddoc	k		
3N	12.1	190.0	3.4	95.4	
30	65.8	250.8	15.9	<b>I34.4</b>	
		Witch			
3N	180.5	132.6	77.2	41.5	
30	76.9	<b>I28.4</b>	36.I	55.4	
		Americ	an plai	c e	
3K	<b>I44.</b> 7	93.3	64.5	52.7	
3L	996.3	1010.1	348.6	475.4	
3N	269.3	<b>I34.</b> 9	III.2	78.3	
30	174.6	I50.6	74.0	88.4	
3M	20.4	26.5	8.9	7.5	
		Beaked	redfis	h	
3K	964.3	749.I	376.6	319.8	
3L	149.3	135.7	63.2	63.0	
3N	279.0	584.6	61.5	136.4	
30	II87.8	763.8	127.3	108.7	,
3 <b>m</b>	644.0	376.7	154.9	132.3	

Table 8. Bottom fish abundance and biomass assessment over the Newfoundland shelf by data on trawl surveys for 1983-1984.

1

Year class, 3K	! <sub>3L</sub>	! <sub>3N</sub>	1 30	1 <u>3M</u>
I983 +   I982 28   I981 I85   I980 I43   I979 240   I978 I46   I977 99   I976 80   I975 45   I974 I4   I972 5   I971 3   I970 -   I969 -   I968 -   I967 +	I 107 182 196 175 128 128 45 128 45 55 2 - - -	7 142 322 264 142 54 31 15 13 77 1 	17 198 323 221 100 60 38 19 10 10 10 10 10 10 10 10	3 178 367 277 89 30 16 5 2 1 1 + -
Number of fish <b>9609</b> Mean weight 5.3	I0447 4.9	645I 3.9	4897 3.8	894I 3.4

Table 9. Age composition of the Newfoundland shelf cod in the catches taken with valid haul in 1984,  $^{\circ}/_{\circ\circ}.$ 

Table. 10. Quantity of cod of different age in catch per trawling hour in 1983-1984.

Age, years	-1 <u>9</u> 831		- 31 - 1983	1984	3N - 1983!	1984	30 1983		31 1983	1 <u>9</u> 84	-
123456789011234 <u>5</u> 67	208999881963 124184243100	+8.6.4.6.5 43.4.5.7.3.4.7.3 430.4.7.3.4.1.5.9 1.1	1.32 45.0 368568449 16585230.441	0.2005223448023352 2769442221132211000 00	44146293410 11122293410	0.17 20.95 46.59 21.99 4.89 1.11 0.11 0.11	20.6 11.6 12.1 9.4 3.3 3.2 0.1	46.32.620444477.21 46.52349422000	12.7874288236123612386423542361442 235423542361442 2000442 	6.00 32.00 49.04 16.52 00.48 0.42 0.21 1 1 1	
lean	<b>36.</b> 2	304.8	103.3	252.6	121.8	145.7	88.I	236.2	<b>I94.</b> 7	I79.9	

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M number

1	L	eng	th,	сm				<u>ī</u>	Number	of
Year ,	up to	,-	,-				,-	over !-	specime	ns
	10	11-19	16-20	21-25	26-3Q	31-39	36-4q	40	шеазите	a
				Div.	3K	غنا فد مد	·		· · · · · · ·	
1980		7	130	258	259	162	116	68	17696	
<b>1981</b>	-	I	90	257	338	<b>I6</b> 6	<b>I0</b> 6	42	12450	
1985	-		24	269	426	<b>I</b> 5I	84	46	II293	
1983	-	-	12	<b>I</b> 99	399	236	113	41	29362	
<b>I984</b>	2	4	9	<b>I</b> 57	396	276	103	53	18029	
				Div.	3L					
1980	-	<b>I</b> 5	37	122	256	311	181	78	735I	
1981	-	4	45	272	265	218	118	78	5049	
1982	-	-	22	214	423	200	87	54	5723	
1983	-	-	9	207	409	242	80	53	10657	
<b>1984</b>	-	-	4	110	357	337	<b>I</b> 50	42	11201	
				Div.	3N		~ .			
1980	19	24	100	504	265	60	24	4	4211	
<b>I98I</b>	54	18	58	566	231	47	21	5	7205	
1982	<b>4</b> I	I23	86	517	187	16	15	15	4181	
1983	3	32	<b>I3</b> 6	356	345	88	3I	9	14273	
<b>1984</b>		<b>I</b> 6	223	286	280	<b>I</b> 2I	50	24	11665	
	-	~ .		Div.	30	••	•			
1980	1	64	133	560	218	18	6	-	10620	
<u>1</u> 981	288	83	88	417	109	12	3	-	8138	
1982	77	<b>I</b> 85	4 <b>I</b>	335	273	54	30	5	6919	
1983	II	179	279	253	206	38	27	7	14045	
1984	-	33	275	257	294	84	47	10	14867	
-		+0	**	Div.	3M	000	<b>TO</b> 0	00	0.7050	
1980	11	10	10	233	294	200	193	38	STJ2A	
1981	58	10	20	130	44'/	×18	101	10	7980	
1982	113	163	10	14	302	204	152	42	21291	
1983	150	173	109	27	236	211	169	25	29767	
1984	6	53	275	25	218	265	<b>I3</b> 5	23	25233	

Table 11. Length groups of beaked redfish in Divisions of NAFO in 1980-1984 in catches taken with small-meshed trawl,  $\circ/_{\circ\circ}$ .

				nani, 7a <b>q</b> ∙	
Length, cm	_38!	3L	<u>3M</u>	<u>3N</u> !	30
9- II I2- I4 I58-223 226 223 226 229 235 336-22 229 235 336-22 229 235 336-22 229 235 235 235 235 235 235 235 235 235 235	++6677736475994699016588837432++++++++++++ =+ 37	I27244044587997553400265877442221111+21224+++	I 4 20 34 37 570 131 142 167 100 50 37 89 4 84 111121 121 142 142 167 100 50 37 89 4 84 111121 120 105 137 89 4 84 1111221 142 158 10 10 10 10 10 10 10 10 10 10 10 10 10	I 48445454844700223306804186324332422211 + + + + + + + + + + + + + + + + +	I 224020388798480160147752086533334344211 +1 + + + + + + + + + + + + + + + + +
Number of ener	9609	10477	8946	645T	4807
HUMBOL OF SDEC?			00.30	~101	2071

Table 12. Length composition of cod in NAFO Divisions in 1984 in the catches taken with valid haul,  $^{\circ}/_{ee}$ .

Table 13. Age composition of beaked redfish in Divisions of NAFO in 1984 in the catches taken with small-meshed trawl,  $^{\circ}/_{\circ\circ}$ .

Year class, year	Age, years	3L	3N	30	3M
1982	2			I	
1981	. 3	· _	I	6	18
1980	4	4	220	27I	175
1979	5	16	64	63	IOI
1978	6	4I	90	86	37
1977	7	63	89	<b>9</b> I	16
1976	8	89	III	120	- 34
1975	9	89	92	86	63
1974	10	125	102	9I	IIO
1973	II	121	65	50	I19
1972	12	<b>I35</b>	52	43	87
1971	13	100	31	27	74
1970	14	67	17	19	54
1969	<b>I</b> 5	47	12	15	39
1968	16	28	9	9	28
1967	17	<b>I</b> 3	7	4	14
1966	18	I4	8	5	. IO
1965	19	IO	6	3	8
1964	20	24	15	6	6
1963	21	6	4	2	4
1962	22	5	3	I	2
1961	23	3	I	I	I
ative amount,	%0	1000	1000	1000	1000
age, years		II.33	8.25	7.67	9.50

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## SECTION 11. SUBAREA 4

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## A. Status of the fishery

<u>Silver hake</u>. In 1984 the Soviet silver hake catch made up 57,4 thous. t of the 56 thous.t quota allocated for the USSR, and has been the largest since imposing restrictions in 1977. The 1984 allocations were completely caught due to presence of dense and stable silver hake aggregations.

In 1984 the catch per fishing day by a BMRT class ships was  $35,5 \pm compared$  with  $26,6 \pm in$  1983, and  $21,3 \pm in$  1980.

The silver hake catches were mainly represented by the specimens of 28-35 cm body length at the age of 2-5 (Tables 1,2). The 1981 year class was predominant, and averaged to 38.6% in the catches. Silver hake stocks are large at present. The analytical method gives the values of 1 025 thous.t for 1985 and 900 thous.t for 1986. Given the optimum fishing intensity the TAC of 150 thous.t can be recommended for 1986.

### B. Special investigations

<u>Hydrology</u>. Year to year changes of the water temperatures on the Scotian Shelf have been analysed for summer seasons of 1978-81 and the fall seasons of 1977-84. As is evident from the analysis, in summer longterm temperature variation at the surface and at lower depths was in opposite phase during the reference period. The surface temperatures in the fall are characterized by a marked year to year variability, and at lower depths a temperature wave can be observed between 1977-78 and 1982-83,

## with the peak in 1980-81.

<u>Cruises</u>. In the fall of 1984, a trawling inventory survey of 0-group silver hake was carried out on the Scotia Shelf by the SRTMK "1500 Let Kievu", according to a cooperative research programme with the Canada scientists participating. Total abundance of 0-group silver hake was estimated at 11 x  $10^7$  sp., which is lower than the 1983 value amounting to 34 x  $10^7$  sp. The abundance of the 1984 year class is below average.

	· · · _ · ~ _ ~				
Length, cm	1980	1981	1982	1983	1984
10-11	+	_		-	<b>.</b> .
12-13	+	-	<u>,+</u>	-	-
14-15	+	<del></del> '	0.1	-	-
16-17	0.2	+	0.4	0.2	÷
18–19	0.4	0.2	1.0	0.5	0.9
20-21	0.7	0.4	2.2	0.4	2.6
22-23	1.8	0.3	2.1	1.4	2.9
24-25	3.5	0.8	1.9	9.7	1.7
26-27	7.8	3.9	6.5	21.2	2.5
28-29	14.0	16.4	11.9	21.2	15.1
30-31	24.5	32.1	20.7	18.5	32.5
32-33	24.2	24.4	23.5	14.5	23.2
34-35	14.1	13.0	16.0	6.8	10.7
36-37	5.0	5.2	7.6	3.2	4.9
38-39	2.2	2.1	3.3	1.3	1.9
40-41	0.7	0.7	1.3	0.6	0.8
42-43	0.3	0.3	0.6	0.3	0.3
44-45	0.4	0.2	0.2	0.1	+
46-47	0.1	+	0.1	0.1	+
48-49	+	+	· +	+	· <b>+</b>
50-51	0.1	+	+	+	-
52-53	+	+	+	+	-
5455	+.	+	-	-	-
56-57	+	+	-	-	-
58-59	+	+	`	-	-
60-61	-	+	-	-	-
62-63	-	÷	-	-	-
Mean length, cm	<b>'</b> 31.1	31.5	31.4	29.4	30.9
Mean weight g	<b>2</b> 02	224	238	198	197
No. of sp.	56 701	36 482	32 603	42 506	38 036
Fishing gear	Hake trawl 815	Hake trawl 815	Hake trawl 815	Hake trawl 815	Hake 5 trawl 815
Mesh size, mm	60	60	60	60	60

Table 1. Length (cm) composition (%) of commercial silver hake catches from the Scotian Shelf area taken in 1980-84.

•••	-	 		***	••	 -	-	-

Age,years	1980	1981	1982	1983	1984
1	1.4	0.7	4.9	1.4	5.0
2	16.8	9.9	14.9	42.6	10.1
3	36.2	42.6	24.1	27.0	38.6
4	32.4	33.0	37.6	20.6	33.1
5	9.6	10.3	12.8	5.8	10,5
6	2.2	2.6	4.1	1.9	2.0
7	0.6	0.7	1.1	0.5	0.6
8	0.5	0.1	0.4	0.1	0.1
9	0.2	0.1	0.1	0.1	· _
10	0.1	+	+	-	-
Mean age, years	3.1	3.5	3.6	3.0	3.4

Table 2. Age composition (%) of silver hake commercial catches from the Scotian Shelf area taken in 1980-84.

. . . .