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Results of Russian Investigations for Greenland Halibut from  
the Norwegian/Barents Sea Stock in 1993

by

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Abstract

In November-December 1993 two Russian research vessels carried out a regular stratified survey for Greenland halibut stock from the Norwegian Barents Seas population.

The densest concentrations of Greenland halibut were registered over the continental slope where the species was spawning during the survey period.

Individuals of 40-45 cm long at age 4-7 years were predominant over the whole area. Mean length of halibut in 1993 was larger compared with that in 1991-1992.

Halibut abundance over the area investigated has been assessed at 54.5 mill.spec. and 69 thou.t of biomass. Besides, 8.2 mill.spec. or 9.6 thou. t seemed to be distributed over the area not covered by investigations. Thus, halibut stock over the study area at the end of 1993 was at a stable low level and made up about 63 mill.spec. or 79 thou.t.

Introduction

The Norwegian-Barents Sea population of Greenland halibut is in a depressive state. Nowadays, in order to monitor the situation as well as to evaluate efficiency of conservation measures, investigations aimed to determine stock abundance of this species become of paramount order. Due to prohibition of the directed halibut fishery and imperfection of statistics on halibut bycatch, Russian scientists do not have reliable fishing data necessary for mathematical modelling the stock size. The only available method to assess the stock size now is a trawl survey.

Results obtained by this method during 1990-1992 surveys turned out to be close enough to the estimates of the ICES Working Group, based on virtual-population analysis. Similarity of results obtained by different in principle approaches shows that results of trawl surveys of Greenland halibut abundance depict the actual picture of the stock state quite correctly.

## Materials and Methods

During the period from November 4 to December 25 1993 two Russian research vessels "Professor Marti" and "PINRO" carried out a regular stratified trawl survey for Greenland halibut stock over the standard area (Fig.1).

Methods for surveying and statistic data processing were similar to those used in previous surveys (Shevelev, Lepesevich, 1991; Smirnov, Shevelev, Lepesevich, 1993).

Unlike the previous three years, in 1993 works were carried out somewhat later. Besides, because of hard ice conditions 16 strata of 3 thou. square miles situated within the subarea 3 North of 77° 30'N were not covered by the survey. The main spawning grounds (subareas 1 and II, see Fig.1) were studied more thoroughly compared to 1992 (Table 1).

In total, the survey covered strata with general area of 55.8 thou.square miles, where 162 hauls were carried out.

## Results and Discussion

In November-December 1993 33-88 cm long halibut were caught over the studied area. Individuals of 40-55 cm long aged 4-7 made up the bulk of catches over the whole area (Tables 2,3).

Mean length of halibut has increased compared with 1991-1992 (Table 4). This may be explained, firstly, by the fact that the length distribution structure was influenced upon by a retarded period of maturation compared with previous years and that no investigations was carried out in areas off West Spitsbergen where mostly juveniles are concentrated. Secondly, we did not register small fish of up to 30 cm in length which testifies to poor recruitment. Thirdly, judging by the facts, halibut growth rate was increasing on the background of warmer masses, better state of food supply in late 80's - early 90's and weakened food competition caused by low stock abundance; all the above mentioned resulted in increase of halibut growth rate (Table 5).

During the survey the densest halibut concentrations were distributed over the continental slope, which was typical of the season (Fig. 2, Table 2). A well pronounced trend towards increase of halibut abundance indices with the depth was observed (Table 6). Such type of vertical distribution is characteristic for the period of wintering and spawning. In shallow waters with depths less than 100 m halibut were not found in catches.

During investigations, the largest halibut of older age groups were observed over the spawning grounds (Subarea 1) (Tables 3,4).

High concentrations of mature individuals, especially over the slope, many of those with ripe gonads, low intensity of feeding (Table 7) witness that halibut spawn here in November-December.

From the survey results halibut abundance over the area investigated was estimated at 54.5 mill. spec. or 69.0 thou.t,

which was much lower than in 1991-1992 (Table 1).

To some extent, this decrease may be explained by underestimate of halibut in Subarea III caused by the above reasons. Extrapolating abundance indices obtained in the study areas onto uninvestigated areas one may suppose that about 8.2 mill. spec. or 9.7 thou.t of halibut were distributed in those areas.

Another reason of halibut abundance decrease over the study area seems to be a certain redistribution of their stock to the east. As Fig.2 shows, considerable halibut concentrations were in the "mixed area" where later, in early January 1994 R/V "Fridtjof Nansen" registered them spawning.

### Conclusions

1. In November-December 1993 abundance and biomass of Greenland halibut were estimated as 54.5 mill.spec. or 69.0 thou.t. Taking into account uninvestigated strata it may be supposed that about 63 mill. spec. or 79 thou.t were distributed over the whole study area which shows that the stock is stabilized at a very low level.

2. Halibut of 40-55 cm long, at age 4-7 years made up the bulk of catches. Mean length of halibut has increased compared with that in 1991-1992.

3. The stock was stabilized at a low level which testifies that the existing protective measures are insufficient. To recover the population a further restriction of Norwegian coastal fishery and may be even a prohibition of halibut bycatch during trawl fishery for other fish species would be recommended.

### References

SHEVELEV M.S. and LEPSEVICH Yu.M. 1991. Results of Soviet investigations of the Norwegian-Barents Sea Greenland halibut stock assessment in 1990. ICES C.M. 1991/G:24, 13p. (mimeo)

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Table 1. Abundance and biomass of Greenland halibut in 1991-1993

Subarea	Years	Area, mile <sup>2</sup>	Numbers of trawlings	Abundance, fishx10 <sup>-6</sup>	Biomass, '000 tons
I	1991	8461.4	31	2.1	2.8
	1992	4930.5	14	13.8	16.0
	1993	8372.9	29	15.2	21.4
II	1991	3893.6	23	3.6	4.3
	1992	4158.6	18	15.6	17.6
	1993	4158.6	29	9.5	11.0
III	1991	5870.0	29	11.0	9.9
	1992	6119.2	48	21.8	19.3
	1993	3163.8	19	7.3	8.2
IV	1991	44948.7	105	46.2	56.3
	1992	41645.7	89	20.9	23.8
	1993	40080.2	85	22.9	28.4
Over the whole area suveyed	1991	63173.7	188	63.0	73.3
	1992	56854.0	169	72.1	76.7
	1993	55775.5	162	54.5	69.0

Table 2. Abundance indices of Greenland halibut of different length by areas of survey in 1993, fish / mile <sup>2</sup>

Subarea	Length, cm										Total
	≤ 30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	> 70	
I	-	5	68	425	591	334	144	121	85	44	1817
II	-	4	141	603	809	430	154	70	34	32	2277
III	-	12	139	519	758	464	175	77	38	19	2201
IV	-	4	33	109	172	165	53	23	9	3	571
Mean for the area surveyed	-	4	52	230	325	203	77	45	26	15	977

Table 3. Distribution of Greenland halibut of different age by areas of survey in 1993, %

Subarea	Age, years old									Mean age, years old
	3	4	5	6	7	8	9	10 and older		
I	+	9	24	37	14	7	6	3	6.2	
II	1	11	27	39	14	4	2	2	5.9	
III	1	11	25	39	15	5	3	1	5.9	
IV	1	9	21	40	19	6	3	1	6.0	
Mean for the area surveyed	1	10	24	38	15	6	4	2	6.0	
Data for 1992 I-IV	1	14	42	26	10	6	2	2	5.7	

Table 4. Mean length and weight of Greenland halibut in 1991-1993 \*

Subarea	Years		
	1991 **	1992 **	1993 **
I	46.1 / 1139	47.2 / 1076	50.8 / 1345
II	43.8 / 929	49.8 / 1272	48.8 / 1161
III	43.2 / 843	44.2 / 825	49.1 / 1172
IV	48.7 / 1249	49.7 / 1208	49.8 / 1214
Over the whole area surveyed	45.9 / 1055	45.9 / 954	49.7 / 1274

\* Numerator - mean length ; denominator - mean weight

\*\* 1991,1992 - October-November; 1993 - November-December

Table 5. Mean length of Greenland halibut of different age  
on the surveyed area \*

Years	Age, years old												Total
	3	4	5	6	7	8	9	10	11	12	13	14	
1990	31.7	36.5	40.9	45.8	49.8	53.9	59.0	63.0	70.1	74.5	85.6	93.1	44.3
	66	384	988	831	367	127	72	50	17	7	4	1	2917
1992	35.0	40.0	42.7	46.6	52.1	54.3	59.6	67.1	68.4	76.0	80.6	-	45.9
	76	1096	4216	2560	1034	641	194	84	80	22	6	-	10009
1993	36.4	41.2	44.9	49.1	54.1	60.7	63.4	69.3	72.7	76.1	83.1	83.1	49.7
	29	400	1005	1581	620	228	147	60	27	5	4	1	4107

\* Numerator - mean length, denominator - number of measured fish



Table 6. Abundance indices of Greenland halibut of different length by depth in 1993, fish / mile <sup>2</sup> ( subarea I-IV )

Depth, m	Length, cm										Total	
	<30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	>70		
0-100	-	-	-	-	-	-	-	-	-	-	-	-
100-200	-	-	-	11	3	-	3	-	-	-	-	17
200-300	-	5	19	54	100	113	30	16	3	5	345	
300-400	-	7	53	186	418	358	120	54	31	10	1237	
400-500	-	-	54	188	312	188	89	56	58	59	1004	
500-600	-	6	73	529	955	651	261	176	73	61	2785	
600-700	-	16	240	1301	1564	782	208	168	160	88	4527	
700-900	-	28	488	2171	2465	1223	524	308	124	14	7345	
Over the whole area surveyed	-	4	52	230	325	203	77	45	26	15	977	

Table.7. Maturity and feeding of Greenland halibut  
in 1991-1993 \*

Subareas	Years	Percentage of mature fish, %		Percentage of prespawning and spawning individuals among mature fish, %		Mean degree of stomach fullness
		males	females	males	females	
I-III	1991	66	27	75	13	0.76
	1992	45	27	71	58	0.32
	1993	79	66	79	34	0.20
IV	1991	33	9	11	-	2.51
	1992	14	7	21	-	1.94
	1993	49	12	46	4	0.90
I-IV	1991	53	18	59	9	1.53
	1992	36	18	65	51	0.93
	1993	68	44	71	30	0.47

\* 1991,1992 - October-November; 1993 - November-December

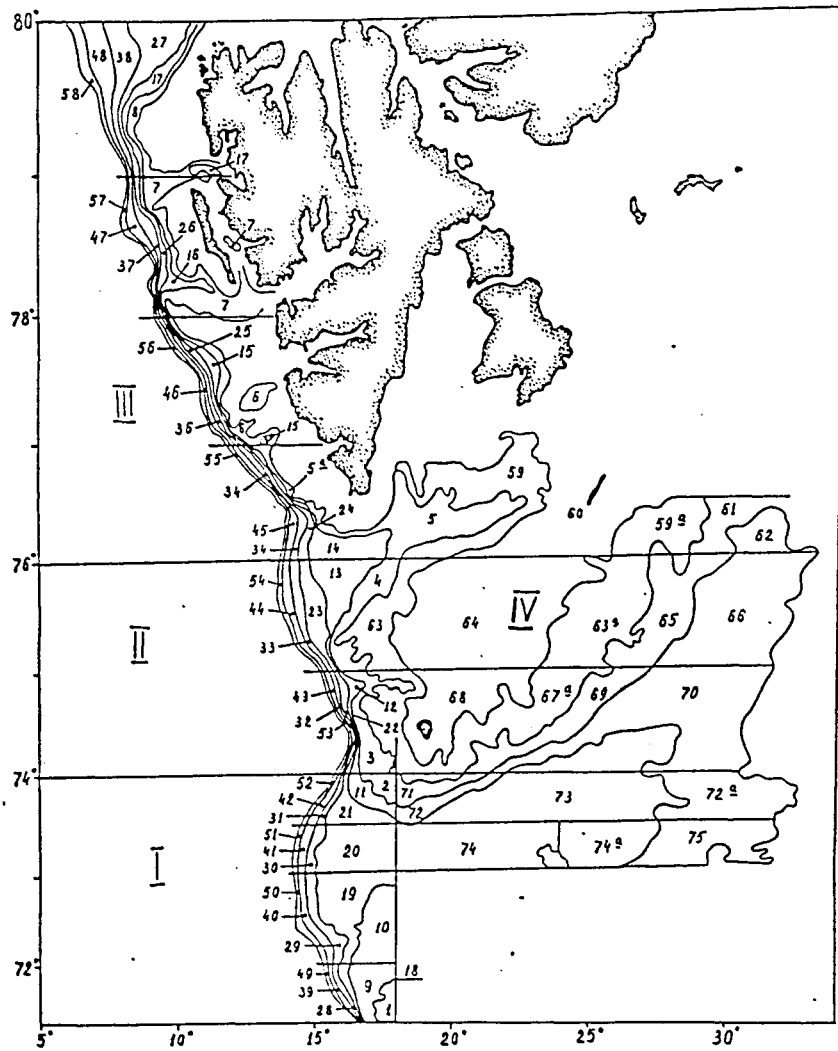


Fig.1. Position and numbers of strata in the directed trawl survey for Greenland halibut.

I - 71° 40' N - 74° 00' N ;

II - 74° 00' N - 76° 00' N ;

III - 76° 00' N - 80° 00' N ;

IV - str. numbers 59 - 75.

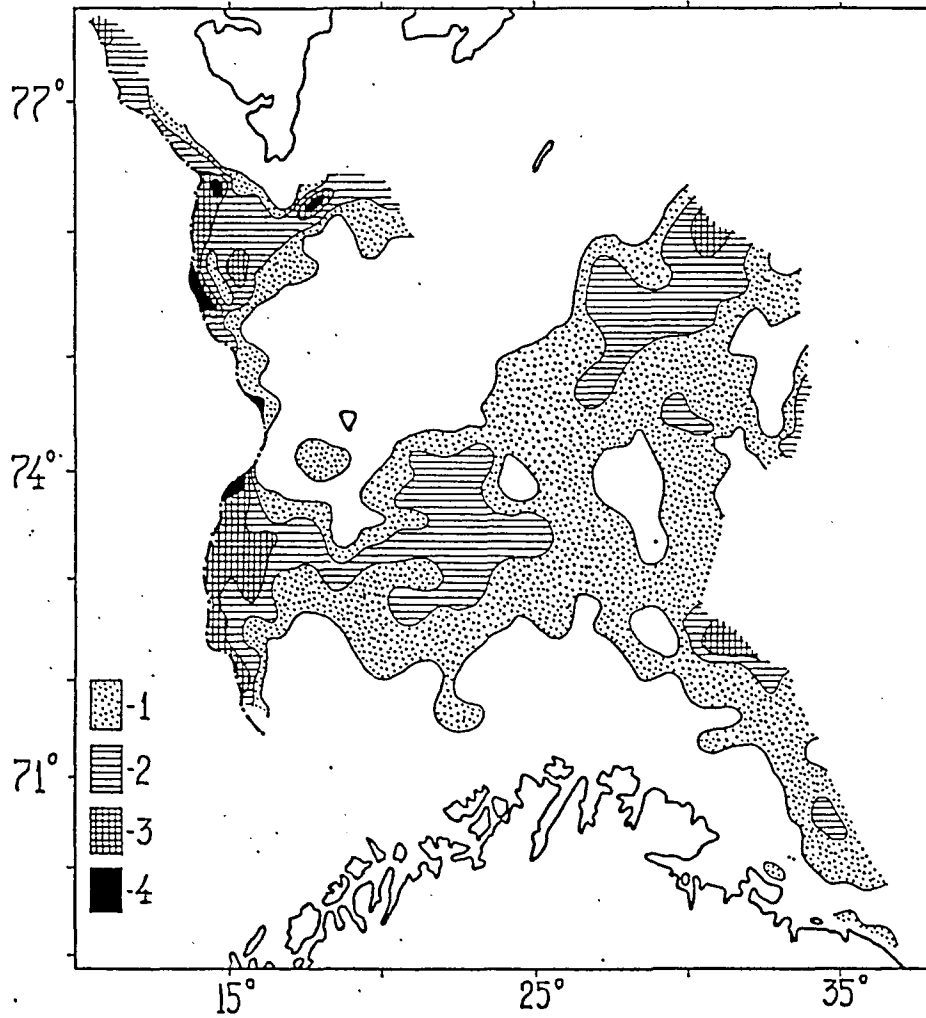


Fig.2. Distribution of Greenland halibut  
in November-December 1993

Legend: 1 - 0-10;  
2 - 11-50;  
3 - 51-100;  
4 - over 100 fish / hour.