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An Assessment of the Greenland Halibut Stock Component in NAFO Subareas 0+1

by

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1. TAC and description of the fishery and nominal catches.

TAC has remained unchanged at 25.000 tons since 1979.

In the period 1981-1989 nominal catches of Greenland halibut in Subareas 0+1 have been rather stable with an annual average of 9,000 tons. Since 1989 catches have increased considerably to about 20,000 tons in 1990, 22,000 tons in 1991 and 28,501 tons in 1992. The increase in catches from 1989 to 1990 was mainly due to a new trawl fishery by Canada in Division 0B, while the increase from 1991 to 1992 was due to a general increase in the catches in Subarea 0 and 1 both in- and offshore.

From 1981 to 1983 annual catches in Division 0B were at a level at about 4,000 tons, they then dropped to a level at 1,000 tons or lower were they remained until they increased from 727 tons in 1989 to about 10,500 tons in 1990 and 1991 and further to 11,706 tons in 1992. The fisheries took place in June-December and almost all the catches were taken by Canadian, Russian and Japanese trawlers (3,662, 7,169 and 235 tons, respectively), while 164 and 476 tons were taken by Canadian and Faroese longliners, respectively. 2 tons were taken as by-catch in the shrimp trawl fisheries (table I).

In Subarea 1 catches were at a level around 5,500 tons in the first part of the 80'ies. In 1985 the catch increased to about 9,000 tons and catches remained at that level until 1990. Then they increased to 10,853 tons in 1991 and further to 16,795 tons (including 1,457 tons non-reported catches) in 1992. (table II). Both the inshore and the offshore fishery has increased. 73% (12,181 tons) of the catches in Subarea 1 were taken inshore, of which 98% derived from Div. 1A. The bulk of the fishery in Div. 1A is taking place in three areas: Ilulissat, Uummannaq and Upernavik. Ilulissat makes up about 50% of the inshore catches. Traditionally the Greenland fishery was a longline fishery carried out either by boats below 20 GRT or by means of dog sledges, typically in the inner parts of the fjords at depths of 500-800 meters. Since the middle of the 80'ies gillnets were used more commonly in the inshore fishery and in the period 1986-89 gillnets and longlines accounted equally for the catches in Div. 1A. In 1990 and 1991 longline dominated again and comprised about 83% of catches in 1991. In 1992 gillnet catches comprised about 60% of the catches. In recent years catches in the inshore fishery in Subarea 1 seem to be rather evenly distributed throughout the year.

The offshore catches in Subarea 1 (Divs. 1C+1D) amounted to 4,614 tons (including 1457 tons non-reported) which is an increase from 861 tons in 1990 and 735 tons in 1991. 1629, 1074 and 6 tons were taken by Japanese, Norwegian and Russian trawlers, respectively; while 213 and 235 tons were taken by Faroese and Norwegian longliners, respectively. The increase in the catches offshore in Subarea 1 is mainly due to the introduction of the Norwegian trawl fisheries and more than a doubling of the Japanese catches.

2. Input data

2.1 Research trawl surveys

Since 1987 bottom-trawl surveys have been conducted in Subarea 1 jointly by Japan and Greenland. In 1992 two surveys were conducted, in August and in November/December (SCR Doc. 93/58). The first survey covered Division 1A (south of 70°N) to 1D at depths between 400 and 1500 m. The trawlable biomass was estimated to be 64,500 tons, which is somewhat lower than in 1991 (79,000 tons) but back at the level recorded in the period 1987-1990 (table III). The second survey covered Division 1C and 1D at depths between 400 and 1500 m and the biomass was estimated to be 50,600 tons, which is at the same level as in the comparable area in the first survey (51,820 tons). However, a larger part of the biomass was found at deep water in the second survey.

In November Russia conducted a stratified random bottom trawl survey in Div. 0B covering depths between 500 and 1500 m (SCR Doc. 93/15). Due to ice only 40 % of the area surveyed in 1991 was covered. The main part of the stock was found at depths between 1000 and 1250 m. The total abundance was estimated to be 37.5 mill.spec. and total biomass was estimated to be 31,700 tons. The biomass estimate is the lowest observed since 1986. Corrected for the area not surveyed, by the average results of the three previous years surveys, the abundance and biomass was estimated to be 55.2 mill. spec. and 38,100 tons, respectively, which is corresponding to the level found i 1991 (table III).

From July to August 1992 a trawl survey was conducted with a commercial shrimp trawler off West Greenland between 59°N and 72°N from the 3-mile limit to the 600 m depth contour line. (SCR Doc. 93/52). The biomass of Greenland halibut was estimated to be 8,800 tons and the abundance index was 290 mill. The length distributions of the catches in NAFO divisions 1A and 1B showed modes at 11-12 cm and 17-18 cm supposedly representing the age groups 1 and 2. The inshore area Disko Bay in Div. 1A was surveyed at depths between 150 and 500 m in August/September. The biomass and abundance of Greenland halibut was estimated to be 3,960 tons and 69 mill spec., respectively. The length distributions showed modes at 12 and 18 cm, respectively. From 1991 to 1992 there have been an overall increase in the abundance indices and biomass of Greenland halibut probably due to a new strong year class. However, the stratification of the survey area has been changed and the sampling has been improved in relation to previous years, thus the increase in abundance and biomass should be interpreted with caution.

2.2 Research longline fishery.

A trial longline fishery was conducted in Divs. 1D+1E in May-June 1992 by the Norwegian vessel SKARHEIM (SCR Doc. 93/53). The fishery was directed towards resources down to 2200 m. Two commercially interesting species appeared in the catches, namely Greenland halibut and roughhead grenadier. Mean CPUE of Greenland halibut was 122 kg/1000 hooks, however this value is influenced by low catches of Greenland halibut at shallow water, where the effort was directed towards cusk. Mean CPUE of Greenland halibut increased with depth. Length distributions of the catches ranged between 30 cm and 120 cm, with modes at 60 cm and 85 cm, representing two unimodal distributions for males and females, respectively, very similar to previous longline fisheries in 89-91 in the same area, and different form the length distributions found ind the trawl catches.

2.3 Commercial fishery data.

Sparse samples from the commercial fishery in 1992 impede catch in numbers calculations from the inshore fishery. Length frequency samples were taken from the offshore fishery in both Subarea 0 and 1.

The length frequencies in the samples taken from the commercial trawl fisheries in 1992 in 0B and 1C+1D are almost identical (fig. 1) and thus catch at age is calculated for the total offshore area (table IV) using age/length samples from 1987-1989 as no recent data are available. However, Boje and Jørgensen showed in 1991 that there was no significant difference in growth of 5-11 year old

Greenland halibut at a number of different locations in the Northwest Atlantic. One should therefore not expect great variation in growth within years in the same area.

3. Assessment.

A sequential population analysis was performed on the Greenland halibut offshore stock component in Subarea 0+1. Catch-at-age for the total offshore fishery in Subarea 0+1 was calculated by raising the Japanese catch-at-age data to the total catches for the period 1987-1992. Catch weight-at-age and stock weight-at-age was calculated by pooling data from the Japanese surveys and Norwegian longline surveys in the period 1987-1989. The same weight-at-age data were used for the whole period 1987-1992. No maturity data were available. Natural mortality was set to 0.15 per year for all ages. The total CPUE by the Japanese trawler Shinkai Maru in 1987-1992 (table V) was used to calculate the total effort for Subarea 0+1 subsequently used to tune the SPA.

However, the tuning data seemed unreliable, since a shift in catchability occurred between 1989 and 1990. Using a separable SPA instead to calculate the terminal F's gave unrealistic high F values for 87-88, when the fishing level was only about 1000 tons in the area. Further it resulted in an unrealistic increase in biomass with a factor of about 3 in the period 87-92. Choosing realistic terminal F's directly did not eliminate this problem.

Instead a Pope's Cohort analysis was performed. Based on the relatively stable biomass estimates from the surveys in Subarea 0 and 1 (table III), the relatively stable CPUE data from Shinkai Maru (table V) and the stability in the catch compositions it was aimed at tuning the biomass of age 5 and older to a constant level. This was done by choosing low F's for the oldest ages and by applying a dome shaped distribution of fishing mortality (Terminal F's). This distribution is considered acceptable, when the difference in length distributions in the trawl and longline fisheries (Boje and Hareide, 1993), and the decreasing catchability from about 60 cm in trawl compared to longline (Jørgensen and Boje, 1992) is taken into account.

Both the SPA and the Cohort analysis presume that the stock, on which the analysis is done, is separated from other stocks, or at least that the extend of migration to and from the stock is known. These analysis are applied to the offshore component in Subarea 0 and 1 only. STACFIS felt that the knowledge of the relationship between the inshore and offshore stock components in Subarea 1 is to sparse to accept a separation of the two components for assessment purposes. Further, it was noted that the connection between the stock component in Subarea 0 and 1 and the rest of the offshore stock is not known. STACFIS accepted the other presumptions for the Cohort analysis: the relatively stable biomass and CPUE in the period analyzed and the dome shaped distribution of the fishing mortality, and agreed that the fishing mortality has increased especially in the last part of the period, but argued that the level of the fishing mortality could not be determined exactly. Based on the uncertainty of the stock separation and the failure to determine fishing mortality exactly, it was agreed not to accept the outcome of the Cohort analysis.

4. Prognosis.

For the fjord areas in Subarea 1, catches increased from 10,200 in 1991 to 12,200 tons in 1992 probably due to an increase in effort, especially around Ilulissat in Div. 1A. In this area catches have increased from about 2,500 tons in 1989 to about 6,000 tons in 1992. The increase has resulted in a dramatic change in the catch composition, where large fish are almost absent (90% < 70 cm in 1992; 50% < 70 cm in 1988). A reduction in the catch level in the Ilulissat area from 6,000 tons to 3,500 tons, which has been estimated by Greenland Fisheries Research Institute as sustainable yield for this area, has been proposed. The changes in catch compositions are restricted to this area. A fishing level at about 7,000 tons in the other inshore areas of Div. 1A combined does not seem to affect the size composition in these areas.

For the offshore areas of Subarea 0+1, biomass estimates from the Russian/German, Russian and Japanese/Greenlandic surveys have shown a declining trend since 1989. In the same period the offshore fishery has increased from less than 1,000 tons in 1989 to around *16,000* tons by *1992. In 1992 the biomass in Div. 0B was estimated* to be 38,100 tons which is at about the same level as in 1991 while the estimated biomass has decreased by about 20% in Subarea 1 from 79,000 tons in 1991 to 64,500 tons in 1992, which is the same level as in the period 87-90. However, there is no indication of a change in catch composition or in CPUE in the offshore fishery in Subarea 1. Based *on* the *information* available it *seem* appropriate to maintain a total TAC on 25,000 tons for Subarea 0+1.

5. References

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<u>Table I.</u> Greenland halibut landings (metric tons) by year and country for Subarea 0 from 1981 to 1992.

Country	81	82	83	84	85	YEAR 86	87	88	89	90[a]	91[a]	92[a]
Can-M	-	-	-	-	-	-	-	-	-	-	256[b]	3826[b]
Can-N	-	-	-	-	-	-	-	2	-	6194	-	-
Can-Q	-	-	-	-	-	-	-	-	-	-	-	-
E/DEU	-	-	-	-	335	-	-	-	-	-	-	-
E/FRA-M	-	-	-	-	-	-	-	-	-	-	-	-
E/FRA-Sp	-	-	-	-	-	-	-	-	-	-	-	-
E/GBR	-	-	-	-	-	-	-	-	-	-	-	-
E/GRL	-	-	-	-	-	-	-	-	-	-	-	-
FRO	170	337	765	370	525	240	388	963	698	2540	2350	476
JPN	-	-	-	-	-	-	-	-	-	-	1016	235
NOR	-	-	-	-	-	-	-	-	-	-	3959	-
POL	-	-	-	-	-	-	-	-	-	-	-	-
PRT	-	-	-	-	-	-	-	-	-	-	-	-
SNG	3626	3468	3772	109	179	32	-	59	29	1540	3203	7169
USA	-	-	-	-	-	-	-	-	-	-	-	-
Total	3796	3805	4537	479	1039	272	388	1024	727	10242	10784	11706

[a] Provisional data. [b] Canada M+N+Q .

Table II. Greenland halibut landings (metric tons) by year and country for Subarea 1 from 1981 to 1992.

	YEAR											
Country	81	82	83	84	85	86	87	88	89	90[a]	91[a]	92[a]
Can-M	-	-	-	-	-	-	-	-	-	-	-	-
Can-N	-	-	-	-	-	-	-	-	-	-	-	-
Can-Q	-	-	-	-	-	-	-	-	-	-	-	-
E/DEU	33	9	14	15	-	-	-	-	-	-	3	-
E/FRA-M	-	-	-	-	-	-	-	-	-	-	-	-
E/FRA-Sp	-	-	-	-	-	-	-	-	-	-	-	-
E/GBR	-	-	-	-	-	-	-	-	-	-	-	-
E/GRL	5755	5397	4136	6509	9127	8705	8668	7003	7492	8352	10209	12181
FRO	-	-	-	-	-	-	-	-	-	131	73	213
JPN	-	-	-	26	5	-	906	1581	1300	861	571	1629
NOR	-	-	-	2	-	-	-	-	-	-	-	1309
POL	-	-	-	-	-	-	-	-	-	-	-	-
PRT	-	-	-	-	-	-	-	-	-	-	-	-
SNG	-	-	-	-	-	-	-	-	-	-	-	6
USA	-	-	-	-	-	-	-	-	-	-	-	-
Total	5765	5406	4150	6552	9132	8705	9574	8584	8792	9344	10853	16795[b]

[a] Provisional data. [b] Including 1457 tons non-reported catches.

Table III. Biomass estimates (000' tons) from Greenland/Japanese surveys and USSR/DDR surveys for the years 1987-1991 in Subareas 0+1.

	USSR/DDR		Japan/GRL		
Year/Div.	0B	1BCD	1ABCD	1BCD	0B+1ABCD
1987	37	56	54[a]	54[a]	81
1988	55	47	63	53	118
1989	79	no survey	63	63	142
1990	72	88	56[b]	53[b]	128
1991	46	no survey	79	77	125
1992	38	no survey	64	62	102

[a] In 1987 the survey did not cover the depth stratum 1000-1500 m.
[b] Average values of two surveys.

Table IV. Catch in numbers (-000) offshore in div. 0B and 1CD

Year	1987	1988	1989	1990	1991	1992
Age						
5	2	2	2	21	29	24
6	31	47	58	299	533	447
7	182	308	382	1687	2666	2559
8	296	569	630	2797	3839	4514
9	193	383	315	1459	1735	2631
10	77	156	96	406	417	845
11	40	87	49	199	223	519
12	18	44	24	93	107	241
13	10	25	14	50	58	109
14	9	22	9	36	48	72
15	6	15	6	36	29	60
16	3	5	2	14	1	12
17	4	7	3	14	17	24
18	2	3	2	7	1	12
Nos.	873	1673	1592	7118	9703	12070
Tons	1294	2592	2027	11266	11414	16320

Table V. CPUE in Div. 1C+D by the Japanese trawler Shinkai Maru in the period 1987-1992

Year	min.	Catch (kg)	CPUE kg/h
1987	39285	877028	1339
1988	75878	1,565728	1238
1989	61845	1,298264	1259
1990	52020	963193	1111
1991	42210	657156	933
1992	16000	328218	1229

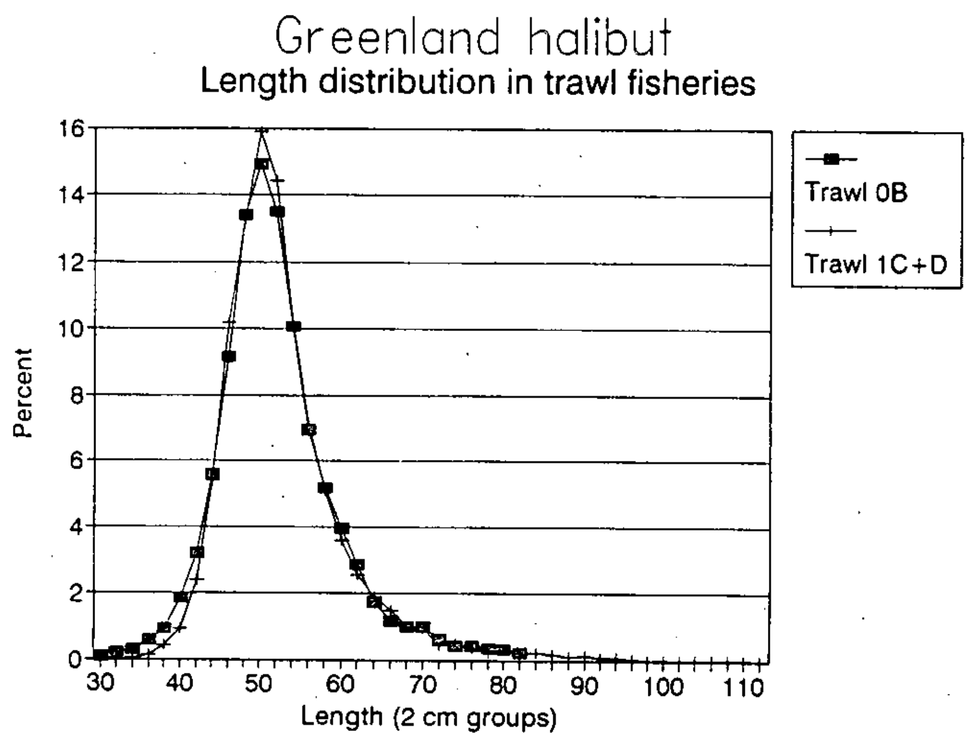

Fig 1. Length distribution in commercial trawl catches from Div 0B and 1CD.