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An Evaluation of the Status of Greenland Halibut (Reinhardtius
hippoglossoides) in NAFO Subarea 2 and Divisions 3KL

by

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INTRODUCTION

Greenland halibut landings from 1969 to 1976 averaged from about 25,000 t to 30,000 t annually with the highest annual catch experienced in 1978 at 39,000 t (Table 1). Although some catch is still taken by Poland, the Soviet Union and GDR most of the catch in recent years is taken by Canada (N) with substantial portions taken by inshore gillnet fishermen in the Northeast Newfoundland coast and in southern Labrador. Preliminary statistics for 1985 indicate a total catch of about 18,000 t which is the lowest in the 1969-85 period (Table 2).

The low catch in 1985 was mainly a result of reduced catch by the Canadian offshore component. Since catch rates declined rapidly late in the season, the effort was reassigned to a different fishery, although market conditions still demanded the product. As well, the catch by Poland was down due to mechanical problems with the vessels assigned to fishing the Polish allocation.

The main fishery for this stock generally occurs in the southern range of the stock area particularly Div. 3K, 2J, and 3L respectively with more interest developing in Div. 2H by the Canadian offshore component in recent years (Table 3). Catches in Div. 2G have fluctuated over the last 10 years from negligible levels in 1981 to over 2000 t in 1975 and 1976. These catches are usually by-catches of the roundnose grenadier fisheries by the Soviet Union and GDR and will fluctuate accordingly. Information on divisional catches by the foreign fleets for 1984 and 1985 are not yet available and are therefore not presented in the table.

A TAC of 30,000 t was placed upon this stock annually from 1976 to 1979 and was simply a pre-emptive quota based upon average catch levels around the period. It was subsequently raised to 35,000 t in 1980 when some indication of recruitment was available from data collected during stratified-random surveys in Div. 2J by FRG. With more detailed information on recruiting year-classes and low levels of fishing mortality in 1981 the TAC was raised to 55,000 t for Div. 2J3KL with an additional allocation of 20,000 t assigned to Div. 2GH by the Canadian government. This TAC of 75,000 t remained in effect through to 1985. At the 1985 assessment meeting an evaluation of this stock suggested that total fishing mortality was very low accompanied by what has been assessed as strong recruitment. Therefore, a TAC of 100,000 t was recommended for 1986 for NAFO Subarea 2 and Div. 3KL. Given the extent of the stock area, levels of overall biomass, good recruitment and generally low catch levels, it is considered that this TAC may still be conservative.

Research vessel surveys

i) Biomass estimates in Divisions 2J3KL

Results of stratified-random biomass surveys for groundfish in Div. 2J (1977-85) and Div. 3K (1978-85) are presented in Tables 4 and 5 respectively. Results of similar surveys in Div. 3L carried out by the A. T. CAMERON in the fall of 1981 and 1982, the WILFRED TEMPLEMAN in the fall of 1983, the summer of 1984, and all four seasonal surveys in 1985 are presented in Table 6.

For the area surveyed in Div. 2J during 1985 the estimated biomass was 62,603 t compared to 81,234 t in 1984 despite the fact that coverage was greater in 1985 (Table 4). The 1985 value is in fact the lowest in the series from 1977 to 1985. There were six strata not covered in 1985 and two of these have never been surveyed due to bad bottom. However, the other four strata have been surveyed on occasion and have yielded good catches. Therefore, the 1985 value is an underestimate although it would still likely be the lowest in the series if all strata were covered in all years.

For Div. 3K the 1985 biomass estimate for the area covered is 78,804 t, considerably lower than the 1984 estimate of 111,612 t and the 1983 estimate of 97,760 t (Table 5). It is still higher than the 1980-82 mean biomass estimates where coverage was similar.

In Div. 3L there was a strong seasonal trend in mean biomass estimates. During the winter and spring surveys the estimates were 9,519 t and 8,684 t respectively (Table 6). For the summer and fall surveys the estimates were 21,713 t and 23,848 t respectively and were more than twice the estimates earlier in the year. A similar survey in the summer of 1984 yielded an estimate of 17,548 t. While it is less than the 1985 estimate during summer, it is still about twice the spring and winter estimates in 1985. In viewing the mean catch per set in Table 6 it would appear that the same strata are important over all surveys even though the numbers are greatly different from one-half of the year to the next. Although it can only be speculated at this time, it may be that most Greenland halibut in the winter and spring migrate into much deeper water outside the range of the survey or are generally higher in the water column at this time affecting catchability.

The combined estimate of mean biomass for Div. 2J3KL from the fall surveys for 1985 is 162,255 t. Compared to 1984 this is a reduction of 21% in mean biomass or about 48,000 t. Although this level of reduction cannot be fully explained, it is clear that exploitation is unlikely to have played a significant role. It is important to note once again as in previous assessments that this estimate is probably minimal for several reasons:

- a) Most of the deep water at the continental slope is not surveyed and it is here that most of the large Greenland halibut are located.
- b) The only information on catchability suggests that as much as 80-85% of Greenland halibut passing in front of trawling gear can escape.
- c) It is known that as Greenland halibut grow and approach maturity, they migrate into deeper water and more northward. If fairly strong year-classes in the area of Div. 2J3KL undergo extensive migrations at a certain age or size then sudden drops in biomass may be noted in these areas although the overall stock may not change. Unfortunately Div. 2GH have not been surveyed in recent years although surveys in 1978, 1979 and 1981 suggested that minimum trawlable biomass levels in Div. 2GH may be in the order of 200,000 t.

ii) Catch numbers at age from surveys

Stratified mean numbers per tow at age for the Div. 2J3K autumn surveys are presented in Table 7 by division. Abundance indices and percent at age from the 1985 seasonal surveys are shown in Table 8.

For both Div. 2J and 3K (Table 7) there doesn't appear to be any particular trend in total numbers over the time series, however, variability in the abundance of particular year-classes is evident. It was shown in the 1985 assessment that the 1979 and 1980 year classes at ages 5 and 4 respectively may be as strong as those of the early 1970's, particularly the 1972-73 year-classes. In the 1985 survey the 1979 year-class at age 6 is stronger than anything in the series for Div. 2J and about the same level as both the 1972 and 1973 year-classes at age 6 in Div. 3K. While the 1974 year-class appeared strong, it fluctuated from year to year and it was difficult to compare.

Similarly in the Div. 3L seasonal surveys the 1979 and 1980 year-classes generally dominated the catches although the 1978 year-class was also quite prevalent and in fact appeared stronger than the 1980 year-class in the fall survey. In the Div. 2J3K surveys it also appeared as a good year-class although not considered to be as strong as the aforementioned.

iii) Length an age frequencies from shrimp surveys in Hopedale Channel (Div. 2H) and Cartwright Channel (Div. 2J)

Length frequencies presented as mean number per set are shown for the years 1980-85 inclusive for Div. 2H and 2J in Fig. 1 and 2 respectively. Age distributions were

available from the 1984 and 1985 surveys and these are presented for both years and division in Fig. 3.

The length frequency distributions in both divisions picked up the 1979 and 1980 year-classes at age 1 and identified them as being relatively strong. They were also strong at ages 2+3 however at age 4 it became difficult to distinguish them in the modes. The age composition in Div. 2H for 1984 indicated the 1979 year-class as being dominant followed by the 1980 year-class (Fig. 3). In 1985 the 1984 year-class is very dominant followed by the 1980 year-class. According to the length frequency distributions (Fig. 1) the 1984 year-class is stronger than either the 1979 or 1980 year-classes at the same age. In Div. 2J the age composition for 1984 shows the 1979 and 1980 year-classes as being strong compared to older ages, however, the 1981, 1982, and 1983 are all stronger in the survey with 1983 being the strongest. In the 1985 survey, the 1981, 1982, and 1983 year-classes are still dominant, however, the 1984 year-class also appears about as strong as the 1981 year-class. According to the length frequencies in Fig. 2 the 1984 year-class appears stronger than any in the series at age 1, with the 1983 year-class almost the same as the 1979 year-class at age 2. In general, from these data it would suggest that there are several strong year-classes that should recruit to the commercial fishery over the next several years.

Commercial data

i) Catch and effort

The fishery for Greenland halibut is highly variable in nature depending upon market conditions, ice conditions, and interest in other species. Furthermore, the species is highly migratory throughout the whole North Atlantic and its distribution and migratory patterns are still not fully understood. As a result, obtaining long-term catch and effort statistics as indicators of abundance is difficult. Some information from directed fisheries by Canada (N) and Polish otter trawlers are available for recent years. It should be pointed out, however, that the catch per unit effort information from these fisheries are based upon relatively low proportions of the total catch (Table 9).

The Canada (N) CPUE declined in Div. 3K from 1980-82 but increased from 0.416 t/hr in 1982 to 0.587 t/hr in 1983 and 0.901 t/hr in 1984 for the same months (Table 9). The Canada (N) CPUE in Div. 2J increased from 0.610 t/hr in 1982 to 1.153 t/hr in 1983 and 1.509 t/hr in 1984. A similar increasing trend occurred in Div. 2H from 0.924 t/hr in 1982 to 1.423 t/hr in 1983. The rate declined to 1.120 t/hr in 1984. In most cases, however, the catch rates improved as the fishery moved northward. The Polish catch rates showed an increase in catch rate in Div. 3K from 0.85 t/hr in 1983 to 1.07 t/hr in 1984 and a decline from 1.50 t/hr in 1983 to 1.31 t/hr in 1984 for Div. 2H. Overall, however, catch rates appear to be increasing over the last few years. This increase had been attributed to strong year-classes of the early 1970's but these have now essentially passed through the fishery.

The 1985 catch rates, however, all show declines from the previous year in both the Canada(N) and Polish catch rates (Table 9). It was not expected that these catch rates would decline quite so much or even decline at all. Although the strong year-classes of the early 1970's have passed through the fishery, subsequent year-classes also appeared at least moderate and the strong 1979 and 1980 year-classes were entering the fishery. On the other hand, the 1979 and 1980 year-classes did appear in large numbers in the 1985 fishery, however, may not have contributed significantly by weight as reflected by catch rates.

ii) Numbers and weights at age

The numbers and weights at age for the 1975-84 commercial catch were taken directly from NAFO SCR Doc. 84/VI/43 with the 1983 and 1984 catch at age adjusted to reflect more recent catch figures. The 1985 catch at age was derived by breaking down the catch weight according to the sampling scheme shown in Table 10. The results of the calculations are shown in Table 11a with the sum of products shown in 11b. The catch matrix and weights at age used in subsequent SPA's are shown in Table 12.

iii) Partial recruitment

Partial recruitment for 1985 was derived as in previous years by comparing the catch at age from the commercial fishery to the catch at age from the research vessel survey in NAFO Div. 2J+3K (Table 13). Because of the anomalous value at age 13 the PR value was made equal to that of age 12. Also because of very low values at ages 16 and 17 they were made equal to that of age 15 (Table 13). Age at full recruitment appeared to be

age 8, the only fully recruited age group in the dome shaped partial recruitment vector. The PR values in the younger ages were much higher than average, however, 12+ PR values were not that different than the 1976-84 average. It should be remembered, however, that the surveys do not cover the whole stock area and in particular, do not survey adequately the deep waters along the continental slope where most large Greenland halibut are concentrated. This would cause the partial recruitment values for older fish to be overestimated and subsequently any estimates of abundance and biomass from SPA to be underestimated.

Fully recruited fishing mortality

Determining an accurate level of fully recruited fishing mortality was not possible due to the short time series of catch and effort data as well as survey data. In recent assessments of this stock, however, it was the consensus of STACFIS that fishing mortality on this stock in recent years was quite low, probably below a level of $F = 0.10$. With the lowest level of catch since before 1969 in 1985, and good recruitment, it is believed that the 1985 fishing mortality is even lower than in recent years. Since fully recruited F could not be accurately determined, a series of SPA's were run using fully recruited F 's ranging from 0.05 to 0.15 at increments of 0.025. The results of these analyses are presented in Tables 14, 15, 16, and 17 respectively.

Yield per recruit

A. Thompson and Bell yield per recruit analysis was performed and the results presented in Table 18. The partial recruitment vector and mean weights at age were those derived from the 1985 fishery. The $F_{0.1}$ value was calculated to be 0.34. This compares reasonably well with $F_{0.1} = 0.37$ which is considered to be the long-term average for this stock barring any radical change in partial recruitment.

Table 1. Greenland halibut landings (metric tons) by year and country for Subarea 2 and Division 3KL from 1970-85.

Country	Year															
	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Canada	10706	9408	8952	6840	5745	7807	9306	17967	24692	29940	31774	24125	19248	19031	19794	14155
FRG	13	-	86	707	515	622	927	755	1022	15	55	-	57	2	9	-
Poland	8266	5234	6986	9060	7105	8447	5942	5998	5215	1813	203	1806	1111	5258	1252	410
Iceland	-	2	-	-	-	-	-	-	-	-	-	-	-	-	943	-
Norway	-	-	1389	501	117	-	6	15	3	8	1	-	-	15	20	-
USSR	7384	9094	10183	8652	9650	9439	6799	4308	5632	1961	238	3325	1471	937	440	149
Romania	225	7	120	80	-	-	-	-	3	-	-	-	-	-	-	-
GDR	-	647	402	1681	2701	2025	1512	1953	1636	178	316	1350	2487	2587	2498	1889
Den-F	-	-	970	950	4	-	-	350	268	-	-	-	-	-	-	-
Spain	-	-	3	-	-	-	1	-	-	4	-	-	-	-	-	-
UK	-	-	731	201	1112	62	-	476	53	110	22	-	1	-	3	-
Den-G	-	-	-	65	2	-	-	-	-	-	-	-	-	-	-	-
Portugal	-	-	-	207	161	231	73	119	-	38	21	16	1818	-	-	-
Fra-M	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
Fra-Sp	-	-	-	-	6	48	32	-	5	1	-	-	7	-	-	-
Japan	-	-	-	-	-	-	-	-	3	-	12	60	14	-	1003	257
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	548
Total	26594	24392	29822	28944	27123	28681	24598	31941	38532	34068	32642	30682	26206	27839	24710	17,408

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Table 2. Catches of Greenland halibut in NAFO SA2+3KL during 1985.

Country	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Can. (M)								189	285				474
2H								233	26	1	1	1	260
2J								3	1	7			8
3K	1				1								7
3L													
EEC				67	257				224				548
GDR	10						155	507	247	355	497	118	1889
Poland	199		7	39	33	24	108						410
USSR							5	3	40	25	70	6	149
Japan						1		1	1	239		15	257
Portugal													
Norway													
Spain													
Total													
Can. (N)								153	835				988
2H (OT)								278	1232	1153	636		3299
2H (GN)								45	104	1	3		210
2J (OT)					6	37	14	1187	1399	335			3849
2J (GN)					1	246	680	1	16	70	34	17	139
3K (OT)			1		1			1	16	70	34	17	139
3K (GN)								1	16	70	34	17	139
3L (OT)								1	16	70	34	17	139
3L (GN)	1	4	3	1	120	269	753	1224	626	144	28	14	3187
													17408

Table 3. Landings of Greenland halibut by NAFO Division from 1975-83.

Year	NAFO Divisions				
	2G	2H	2J	3K	3L
1975	2132	1707	8194	11901	4747
1976	2371	3177	3528	11212	4310
1977	1778	1524	8237	13446	6956
1978	1899	1207	3723	24107	7596
1979	577	1623	3415	19843	8610
1980	36	444	1416	17923	12773
1981	1799	2141	1358	16472	8912
1982	370	8984	5931	6794	4135
1983	111	5671	6028	11374	4655

Table 4. Average weight (kg) of Greenland halibut caught per set from research vessel surveys by the GADUS ATLANTICA in Division 2J. Numbers in parenthesis indicate the number of sets per stratum.

Stratum	Gadus 3 1977	Gadus 12&15 1978	Gadus 27&29 1979	Gadus 42&44 1980	Gadus 58 1981	Gadus 71&72 1982	Gadus 86, 87,888 1983	Gadus 101, 102,103 1984	Gadus 116, 117,118 1985
201	7.26(2)	1.36(3)	0.45(2)	2.83(3)	2.70(5)	9.67(6)	3.72(6)	4.83(3)	0.41(6)
202	21.34(2)	16.39(4)	22.00(4)	29.00(4)	34.50(2)	45.50(2)	30.75(2)	92.75(2)	10.05(2)
203	31.55(2)	40.08(3)	65.32(3)	21.13(4)	52.00(2)	64.33(3)	226.83(3)	179.25(2)	25.00(3)
204	175.70(2)	484.67(2)	260.36(2)	-	170.50(2)	284.00(3)	250.83(3)	260.00(2)	16.50(2)
205	20.97(4)	6.58(4)	10.21(2)	3.75(4)	14.94(8)	24.09(12)	14.25(8)	6.97(8)	1.44(8)
206	20.80(11)	7.78(7)	8.11(8)	10.11(7)	37.18(11)	18.72(18)	8.70(14)	10.86(11)	4.44(14)
207	77.77(5)	25.54(4)	10.39(5)	6.90(5)	18.22(9)	10.33(15)	7.65(10)	6.26(7)	2.18(13)
208	186.14(4)	145.98(5)	90.72(4)	149.62(4)	240.75(2)	348.67(3)	110.00(2)	496.17(3)	406.14(3)
209	65.25(7)	22.01(6)	88.44(7)	104.75(6)	55.67(6)	129.64(11)	52.77(7)	37.42(7)	34.47(9)
210	19.41(6)	8.81(7)	9.53(4)	10.80(5)	5.00(3)	20.88(6)	41.50(2)	26.88(4)	5.19(4)
211	34.96(2)	85.30(4)	46.97(4)	72.82(5)	35.75(2)	55.75(2)	134.75(2)	55.75(2)	164.00(3)
212	189.61(4)	150.82(2)	232.24(2)	103.50(2)	147.75(2)	144.10(5)	44.75(3)	70.83(3)	109.75(4)
213	16.46(8)	13.16(7)	9.59(7)	22.94(8)	29.33(6)	34.19(10)	23.25(10)	20.50(5)	35.83(9)
214	38.97(6)	48.18(7)	22.01(6)	15.40(5)	60.10(5)	84.31(8)	44.63(8)	59.75(4)	66.83(6)
215	37.68(4)	22.03(8)	7.11(6)	18.50(4)	12.30(5)	38.28(9)	14.46(8)	42.00(3)	16.21(6)
216	102.83(2)	145.78(3)	181.36(4)	186.25(4)	63.25(2)	215.25(2)	102.67(3)	173.00(2)	81.75(2)
217	141.95(3)	168.28(2)	87.15(2)	156.00(2)	41.00(2)	58.25(2)	64.50(2)	-	145.00(2)
218	217.92(2)	238.14(2)	-	129.50(2)	156.50(2)	40.00(2)	39.00(2)	-	30.25(2)
219	-	-	-	-	48.00(2)	-	103.00(2)	-	83.75(2)
220	-	56.92(2)	-	-	-	-	-	-	-
221	-	-	-	-	-	-	-	-	-
222	115.32(4)	64.52(5)	76.69(4)	90.38(4)	55.75(2)	188.00(3)	131.50(3)	27.67(3)	34.00(2)
223	251.52(2)	84.82(2)	63.98(2)	136.00	94.75(2)	88.00(2)	61.75(2)	113.75(2)	80.25(2)
224	173.65(2)	78.70(2)	122.47(2)	32.75(2)	115.00(2)	36.50(2)	50.50(2)	37.50(2)	28.00(2)
225	39.95(2)	-	-	-	-	-	-	-	-
226	-	3.17(2)	-	-	-	-	-	-	-
227	115.32(4)	86.86(2)	27.47(2)	73.75(2)	43.50(2)	54.90(5)	38.50(4)	36.67(3)	37.13(4)
228	6.53(8)	2.19(3)	8.39(6)	18.40(5)	8.00(6)	9.25(10)	10.33(6)	16.50(7)	6.36(7)
229	39.03(4)	14.40(4)	23.82(4)	25.63(4)	30.50(2)	21.50(4)	36.50(4)	11.00(3)	13.00(3)
230	243.28(3)	80.74(2)	-	169.44(2)	60.25(2)	30.80(2)	93.00(2)	21.50(2)	26.25(2)
231	64.24(2)	138.57(2)	-	186.50(2)	-	93.75(2)	51.25(2)	98.75(2)	119.75(2)
232	49.03(2)	27.21(2)	-	-	-	-	-	-	-
233	-	-	-	-	-	-	-	-	-
234	49.03(2)	98.53(5)	65.21(4)	79.00(4)	52.00(2)	98.00(3)	46.71(3)	90.70(2)	18.33(3)
235	117.59(4)	107.05(2)	83.99(2)	128.00(2)	39.00(2)	89.67(3)	252.50(2)	82.00(3)	85.00(2)
236	98.06(2)	-	-	-	44.75(2)	66.75(2)	101.00(2)	53.00(2)	85.25(2)
Biomass (tons)	106,834	85,136	66,970	74,564	76,661	104,233	78,546	81,234	62,603

Table 5. Average weight (kg) of Greenland halibut caught per set from research vessel surveys by the GADUS ATLANTICA in Division 3K. Numbers in parenthesis indicate the number of sets per stratum.

Stratum	GADUS 12+15 1978	GADUS 27+29 1979	GADUS 42+44 1980	GADUS 58+59 1981	GADUS 71+72 1982	GADUS 86, 87, & 88 1983	GADUS 101, 102, 103 1984	GADUS 116, 117, 118, 1985
618							1.50(5)	4.43(6)
619							1.90(7)	0.57(7)
620	66.73(12)	29.39(10)	28.31(12)	25.72(10)	22.33(9)	19.25(10)	13.08(13)	14.68(14)
621	126.48(12)	114.39(11)	48.40(13)	32.77(11)	14.68(14)	31.87(12)	18.32(14)	30.53(15)
622	143.11(2)	119.44(3)	43.75(2)	132.50(2)	120.83(3)	224.00(2)	143.75(4)	60.38(4)
623	159.51(6)	33.53(4)	83.17(6)	83.33(4)	146.20(5)	217.17(6)	270.00(5)	67.50(6)
624	9.36(7)	10.60(4)	5.13(4)	3.75(2)	5.25(4)	2.38(4)	5.00(4)	4.97(4)
625	17.56(6)	14.24(5)	14.50(6)	31.50(4)	8.75(2)	66.33(3)	42.95(5)	55.60(5)
626	60.74(7)	42.18(5)	139.90(5)	58.20(5)	120.40(5)	101.75(4)	217.75(6)	124.69(5)
627	71.67(2)	41.73(3)	68.50(2)	189.75(6)	124.43(7)	220.83(6)	300.56(8)	140.36(7)
628	43.18(7)	35.75(5)	68.21(6)	16.33(6)	12.92(6)	36.08(6)	27.21(7)	81.96(6)
629	20.57(6)	13.38(2)	26.10(5)	31.33(3)	68.50(2)	65.67(3)	31.13(4)	22.00(4)
630	27.23(2)	10.78(4)	21.37(4)	117.25(2)	-	67.75(2)	7.73(3)	33.16 (4)
631	45.42(2)	23.30(3)	34.50(3)	68.60(5)	38.00(2)	66.70(5)	105.30(5)	70.86(7)
632	3.20(7)	2.83(4)	11.69(4)	6.25(2)	7.50(3)	3.43(3)	-	8.57(3)
633	8.10(9)	9.05(10)	16.10(10)	9.98(8)	7.93(7)	12.38(12)	12.05(10)	14.46(12)
634	6.31(9)	9.44(8)	5.29(7)	5.41(7)	14.09(11)	6.60(5)	5.93(7)	4.68(9)
635	6.69(9)	6.12(8)	19.25(6)	12.00(5)	17.10(5)	7.83(6)	10.19(8)	4.21(7)
636	5.58(7)	4.67(7)	11.79(7)	12.75(6)	21.85(10)	4.05(6)	7.40(8)	4.34(8)
637	3.93(9)	4.15(7)	6.00(6)	8.25(6)	9.71(7)	14.80(5)	4.97(6)	13.50(7)
638	15.15(8)	13.24(9)	11.11(9)	21.31(8)	20.39(15)	18.05(11)	12.55(10)	34.52(11)
639	5.13(9)	7.83(4)	6.58(6)	7.38(6)	19.05(10)	11.71(7)	2.41(8)	4.69(8)
640	32.91(2)	-	59.25(2)	36.00(2)	21.50(2)	-	13.75(2)	18.50(3)
641	5.45(2)	26.77(2)	31.75(2)	21.80(2)	24.50(4)	61.33(3)	62.50(3)	22.69(4)
642	18.63(2)	-	33.25(2)	9.33(3)	33.33(6)	-	81.35(6)	33.50(5)
643	7.49(2)	12.94(2)	-	-	-	-	-	-
644	15.22(2)	4.99(2)	-	-	-	-	-	-
645	18.61(2)	-	12.00(2)	21.75(2)	17.67(3)	3.25(2)	54.25(2)	41.83(3)
646	59.24(2)	88.96(2)	51.50(2)	63.25(2)	15.50(2)	91.25(2)	100.50(2)	66.50(3)
647	160.23(2)	48.13(2)	89.25(2)	82.50(2)	39.50(2)	-	-	114.72(3)
648	15.45(2)	-	-	-	-	-	-	-
649	10.91(2)	-	-	-	-	-	-	-
Total	99,134	66,330	70,623	77,966	70,870	97,790	111,612	78,804

Table 6. Average wt. (kg) of Greenland halibut per set from research vessel surveys in Division 3L in autumn. Numbers in parentheses indicate number of sets per stratum.

Stratum	ATC 323,324,325 1981 (Fall)	ATC 333,334 1982 (Fall)	W.T. 7,8,&9 1983 (Fall)	W.T. 16,17,18 1984 (Summer)	W.T. 22,23,24 1985 (Winter)	W.T. 28,29,30 1985 (Spring)	W.T. 32,33,34 1985 (Summer)	W.T. 37,38,39 1985 (Fall)
328	-	-	-	0.20(4)	0.19(6)	0.18(4)	0.00(4)	0.09(8)
341	0.50(3)	0.19(4)	0.80(4)	0.50(5)	0.15(8)	0.02(8)	0.00(4)	0.26(7)
342	1.33(3)	2.83(3)	0.87(4)	0.00(2)	0.20(3)	0.67(3)	0.25(2)	0.73(3)
343	0.88(4)	-	0.53(3)	0.00(4)	0.03(3)	0.02(3)	0.20(2)	0.08(3)
344	6.94(4)	1.00(3)	4.34(6)	0.18(6)	1.14(7)	0.00(5)	13.55(4)	2.46(9)
345	20.75(4)	8.67(6)	9.25(8)	39.60(7)	13.17(3)	16.16(5)	50.71(7)	36.61(9)
346	9.00(3)	11.63(4)	17.50(5)	27.33(6)	7.50(4)	12.25(2)	14.83(3)	35.80(5)
347	1.83(3)	3.02(4)	2.58(6)	0.17(6)	0.40(5)	0.76(5)	1.33(3)	0.76(4)
348	0.42(6)	2.08(5)	0.30(11)	0.11(11)	0.44(8)	0.15(18)	0.31(13)	0.61(14)
349	0.09(7)	0.03(5)	0.43(9)	0.10(14)	0.01(10)	0.07(14)	0.17(7)	0.07(10)
350	0.00(6)	0.00(2)	0.00(8)	0.00(12)	0.00(9)	0.00(12)	0.00(11)	0.00(9)
363	0.00(4)	0.00(3)	0.00(3)	0.00(8)	0.02(8)	0.00(8)	0.00(10)	0.00(10)
364	0.49(9)	0.25(11)	0.87(11)	0.00(10)	0.08(12)	0.22(17)	0.02(12)	0.05(18)
365	2.88(4)	2.75(4)	1.30(5)	0.30(4)	0.55(4)	0.02(7)	0.80(7)	0.12(8)
366	5.00(3)	9.58(6)	6.00(4)	6.23(11)	0.62(5)	0.43(6)	1.90(5)	18.09(9)
368	21.50(2)	28.75(2)	-	17.75(2)	5.75(2)	1.65(2)	35.50(2)	29.00(2)
369	13.25(2)	13.00(4)	14.00(6)	5.19(7)	0.63(5)	1.75(5)	11.80(6)	13.33(6)
370	0.00(4)	0.50(6)	0.44(6)	0.39(7)	0.06(7)	1.07(8)	0.01(6)	1.52(9)
371	0.01(4)	0.00(5)	0.00(5)	0.00(7)	0.00(6)	0.00(7)	0.00(6)	0.00(7)
372	0.00(5)	0.00(7)	0.00(4)	0.00(13)	0.00(11)	0.01(12)	0.00(10)	0.00(17)
384	-	0.00(4)	0.00(3)	0.00(6)	0.00(4)	0.00(6)	0.00(2)	0.00(8)
385	0.26(8)	2.19(8)	3.20(5)	0.50(12)	0.01(11)	0.35(15)	1.00(8)	1.24(12)
386	37.00(3)	21.75(4)	-	12.69(8)	0.35(5)	4.54(5)	7.78(5)	37.50(5)
387	67.50(2)	43.67(3)	-	49.00(3)	6.88(4)	6.70(6)	13.83(3)	42.25(4)
388	-	2.33(3)	-	24.00(2)	5.67(3)	6.00(2)	67.75(2)	24.75(2)
389	-	7.88(4)	-	19.25(6)	4.57(4)	1.92(5)	17.13(4)	26.80(5)
390	0.00(3)	3.50(4)	0.07(3)	0.00(3)	0.00(5)	0.07(9)	1.01(7)	2.72(7)
391	-	2.75(2)	21.50(2)	18.75(2)	4.75(4)	1.50(2)	4.10(2)	29.75(7)
392	-	14.00(2)	15.25(2)	26.50(2)	7.50(2)	5.00(2)	80.50(2)	25.00(2)
729	-	-	-	70.75(2)	54.75(2)	4.75(2)	24.00(2)	30.50(2)
730	-	-	-	12.25(2)	26.75(2)	6.75(2)	16.00(2)	6.75(2)
731	-	-	-	41.75(2)	46.50(3)	31.00(2)	39.75(2)	15.00(2)
732	-	-	-	12.63(2)	80.75(2)	7.50(2)	22.75(2)	21.00(2)
733	-	-	-	12.75(4)	17.50(3)	15.97(3)	69.00(2)	35.83(3)
734	-	-	-	17.67(3)	119.25(2)	81.00(2)	37.75(2)	37.00(2)
735	-	33.00(2)	-	42.00(3)	4.00(2)	66.00(2)	58.50(2)	29.25(2)
736	-	-	30.00(2)	-	-	32.50(2)	20.75(2)	70.00(2)
	12,722	11,649	6,634	17,548	9,519	8,684	21,713	23,848

Table 7. Age composition - numbers/standard tow from groundfish surveys in Div. 2J, 3K (all strata fished).

Div	Age	1978	1979	1980	1981	1982	1983	1984	1985
3K	1	0.62	0.54	0.34	1.37	0.22	0.14	0.38	1.23
	2	7.64	3.20	2.53	4.89	1.35	1.09	1.55	2.99
	3	15.54	6.18	4.33	9.20	6.75	6.20	4.46	4.92
	4	13.45	5.39	6.03	5.33	6.63	10.75	11.67	6.32
	5	13.98	7.83	9.06	7.85	7.58	12.35	23.24	12.44
	6	11.41	9.57	10.91	11.38	7.46	9.94	9.92	12.69
	7	7.51	4.83	6.45	7.22	7.31	11.33	6.76	8.10
	8	2.88	1.72	1.68	2.32	7.29	9.39	3.58	2.49
	9	1.12	0.61	0.58	0.93	2.22	3.18	2.08	0.90
	10	0.79	0.49	0.46	0.42	0.56	0.73	0.68	0.66
	11	0.74	0.32	0.50	0.23	0.34	0.41	0.33	0.30
	12	0.42	0.30	0.28	0.09	0.24	0.21	0.22	0.21
	13	0.22	0.26	0.16	0.07	0.15	0.12	0.15	0.09
	14	0.05	0.11	0.07	0.01	0.15	0.06	0.11	0.08
	15	0.04	0.08	0.02	0.00	0.03	0.01	0.03	0.04
	16	0.03	0.04	0.01	0.01	0.01	0.00	0.01	0.02
	17	0.01	0.01			0.01			0.02
	18		0.01						0.01
	19		0.00						
	20								
unknown		0.01							0.03
TOTAL		76.46	41.50	51.31	51.51	48.33	65.90	65.16	53.54
2J	1	0.45	0.91	0.63	1.88	0.52	0.09	0.12	1.31
	2	3.36	7.92	0.79	5.68	0.92	0.37	1.62	1.53
	3	7.79	7.35	2.15	4.15	3.87	1.43	5.79	1.14
	4	10.66	5.64	3.32	4.04	8.07	3.55	4.24	2.06
	5	9.80	7.81	5.53	5.82	6.64	6.92	8.26	4.93
	6	7.07	7.23	6.56	5.68	5.27	6.73	6.93	7.06
	7	4.87	3.82	5.44	5.52	7.44	7.14	6.45	6.55
	8	3.00	1.87	2.49	3.53	9.05	5.52	5.99	3.81
	9	2.24	1.10	1.27	1.68	4.87	2.42	2.44	1.85
	10	1.73	1.20	0.98	1.03	2.32	0.86	1.18	1.25
	11	1.31	0.79	1.11	0.97	1.16	0.68	0.59	0.46
	12	0.83	0.68	0.78	0.46	0.71	0.58	0.39	0.44
	13	0.59	0.54	0.53	0.23	0.54	0.46	0.33	0.21
	14	0.19	0.29	0.31	0.14	0.55	0.33	0.31	0.25
	15	0.13	0.18	0.12	0.09	0.44	0.16	0.21	0.16
	16	0.10	0.19	0.07		0.17	0.04	0.16	0.09
	17	0.05	0.07	0.02		0.02	0.00	0.08	0.08
	18	0.00	0.03			0.01	0.02		0.02
	19	0.00	0.02						0.01
	20	0.01							
unknown		0.04		0.03	0.25	0.02			0.01
TOTAL		54.21	47.64	32.14	41.15	52.61	37.31	45.08	33.23
2J+3K		130.67	89.14	75.58	92.46	100.94	103.21	110.24	86.77

Table 8. Abundance estimates at age of Greenland halibut in NAFO Div. 3L from seasonal surveys during 1985, A) actual abundance indices ('000's), B) percent caught at age.

Age	Winter 1985	Spring 1985	Summer 1985	Fall 1985
A				
1	66	293	1312	1997
2	321	315	1451	2311
3	620	632	1223	1332
4	1204	1433	2698	2199
5	2157	3201	7478	4050
6	2417	3375	7357	7446
7	2082	2190	4177	4871
8	1159	1330	2005	2643
9	1060	473	686	1443
10	688	215	271	521
11	280	25	43	249
12	136	25	32	172
13	23	-	23	11
14	50	-	-	28
15	9	-	-	27
16	-	-	-	-
17	-	-	-	7
UK	9	-	-	-
Total	12281	13507	28756	29307
B				
1	0.54	2.17	4.56	6.81
2	2.61	2.33	5.05	7.89
3	5.05	4.68	4.25	4.54
4	9.80	10.61	9.38	7.50
5	17.56	23.70	26.01	13.82
6	19.68	24.99	25.58	25.41
7	16.95	16.21	14.53	16.62
8	9.44	9.85	6.97	9.02
9	8.63	3.50	2.39	4.92
10	5.60	1.59	0.94	1.78
11	2.28	0.19	0.15	0.85
12	1.11	0.19	0.11	0.59
13	0.19	-	0.08	0.04
14	0.41	-	-	0.10
15	0.07	-	-	0.09
16	-	-	-	-
17	-	-	-	0.02
U.K.	0.07	-	-	-

Table 9. Catch and effort statistics of Greenland halibut in NAFO Div. 2HJ3K from Canada(N) and Poland where effort was considered directed in 1979-85.

Year	NAFO Div.	Months	Mean CPUE (t/hr.)	Sets observed	Directed catch (t)
<u>Canada(N) (TC 5)</u>					
1980	3K	Mar.-May	0.559	-	1148
1981	3K	Mar.-May	0.485	-	3118
1982	3K	May	0.416	-	304
	2J	Aug.-Sept.	0.610	-	1132
	2H	Aug.-Sept.	0.924	-	3406
1983	3K	May-July	0.587	-	1471
	2J	Aug.	1.153	-	1465
	2H	Aug.-Sept.	1.423	-	2168
1984	3K	May-July	0.901	-	1838
	2J	Aug.	1.509	-	1140
	2H	Aug.-Sept.	1.120	-	1541
1985	3K	May-Sept.	0.269	-	151
	2J	July-Sept.	0.655	-	1796
	2H	Aug.-Sept.	0.832	-	973
<u>Poland (TC 7)</u>					
1979	3K	May-June	1.53	88	-
	2H	Aug.	0.51	25	-
1981	3K	Jan.-June	1.54	117	-
	2H	Q3	0.71	103	-
1982	2H	July-Aug.	1.53	61	-
1983	2H	July-Aug.	1.50	63	-
	3K	May-June	0.85	221	-
1984	2H	Dec.	1.31	44	-
	3K	May-June	1.07	37	-
1985	3K	Jan.	1.12	32	-
	2J	July	0.53	31	-
	3K	July	0.37	16	-
	2H	Nov.	0.15	24	-

Table 10. List of age length keys and length frequencies used to calculate the 1985 commercial catch at age.

AGE/LENGTH KEYS

NAME	NO. AGED
ALKOT2CH3L	189
ALKOT3CH3K	482
ALKOT3CH3L	974
ALKOT4CH3K	494
ALKOT4CH3L	915
ALKOT4IR2J	606
ALKSO1FL3K	75
ALKSO3CH2H	415
ALKSO3CH2J	774
ALKSO3GD3K	62
ALKSO4GD2H	140
ALKSO4GD3K	327
ALKSO4IR2J	65
ALKSO4IR3K	141
ALKSO4JF2J	9
ALKSO4FL2H	103

TIME LIMIT
 ENTER T TO CONTINUE OR CR KEY TO STOP:
 T

LENGTH FREQUENCIES

NAME	NO. MEASURED	AV. WEIGHT
LFGHAUGCH3K	3198	0.910
LFGHAUGCH3L	1069	0.930
LFGHAUGIR2J	3927	1.160
LFGHJULCH3K	582	0.910
LFGHJULCH3L	2683	0.980
LFGHJURCH3L	2442	0.900
LFGNMATCH3L	669	0.960
LFGHNOVIR2J	5848	1.300
LFGHOCTIR2J	4695	1.270
LFGHSEPCN3K	2115	0.900
LFGHSEPCN3L	3815	0.920
LFGHSEPIR2J	3948	1.340
LFOTAPRFL3K	1393	1.310
LFOTAUGCH2H	810	0.780
LFOTAUGCH2J	1339	1.210
LFOTAUGGD2J	5599	1.170
LFOTAUGGD3K	185	1.830
LFOTDECCH3K	1278	0.740
LFOTDECJP3K	253	0.720
LFOTJANFL3K	895	0.640
LFOTJULCH2J	329	1.320
LFOTJULGD2J	1305	1.110
LFOTJULGD3K	986	0.930
LFOTJULFL2J	1336	1.620
LFOTJULFL3K	1114	0.850
LFOTMAYFL3K	1432	1.580
LFOTNOVFL2H	79	2.000
LFOTOCTCH2J	257	1.160
LFOTOCTGD3K	517	2.210
LFOTOCTJP2J	308	1.570
LFOTOCTJP3K	1787	0.680
LFOTOCTFL2H	235	1.650
LFOTSEPCN2H	473	1.400
LFOTSEPCN2J	409	1.310

SMALLEST LENGTH: 23
 LARGEST LENGTH : 103

Table 11a. Calculated catch numbers at age for the 1985 Greenland halibut fishery in NAFO Subarea 2 and Division 3KL.

AGE	AVERAGE		CATCH		
	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
* 3	0.112	25.497	6	0.71	0.12
* 4	0.285	33.586	166	13.14	0.08
* 5	0.591	41.818	1662	57.85	0.03
* 6	0.777	45.457	4449	91.02	0.02
* 7	0.974	48.668	4955	91.42	0.02
* 8	1.284	52.870	2933	62.80	0.02
* 9	1.735	57.845	1156	37.49	0.03
*10	2.303	62.930	429	18.64	0.04
*11	3.027	68.288	133	10.38	0.08
*12	3.798	73.020	83	8.94	0.11
*13	4.956	79.019	73	9.09	0.12
*14	6.257	84.624	40	7.90	0.20
*15	7.300	88.663	18	5.24	0.29
*16	9.081	94.714	12	3.32	0.28
*17	12.028	103.000	2	0.01	0.01

Table 11b. Calculated catch biomass from catch numbers and mean weights at age for the Greenland halibut fishery in NAFO Subarea 2 and Division 3KL.

AGE	CALCULATED CATCH BIOMASS(T) AT AGE										
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	196	12	283	1837	1329	105	318	127	330	338	982
6	2066	517	3307	6468	6065	1339	2537	1436	2543	1342	3457
7	5297	3438	8952	8664	11198	7745	7266	5124	9557	4759	4826
8	5699	7188	7601	9133	6688	9891	10592	5915	9981	8287	3766
9	6037	6634	4023	4579	1689	6020	4996	4474	4258	5859	2006
10	3596	5428	1942	3212	972	4684	1421	2722	1732	2393	988
11	1827	2491	516	1973	707	1553	590	1281	706	1045	403
12	438	978	381	1251	458	338	466	800	337	484	315
13	1045	439	392	874	509	162	192	659	501	462	362
14	598	164	119	502	383	62	160	418	578	322	250
15	373	124	107	343	450	45	161	422	552	511	131
16	293	7	157	386	400	14	113	256	90	234	109
17	339	8	55	308	347	10	48	164	157	176	24
5+	27805	27427	27834	39529	31196	31969	28860	23819	31423	26211	17619

Table 12. Catch numbers at age, percent catch numbers at age, and mean weight (kg) at age of Greenland halibut from the commercial fishery in NAFO Subarea 2 and Div. 3KL, 1975-85.

CATCH NUMBERS AT AGE (x10³)

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	322	19	464	3016	2182	204	810	236	766	858	1662
6	2719	680	4351	8511	7980	2032	4242	2020	3689	2211	4449
7	5547	3600	9374	9072	11726	8913	9209	5552	10714	5560	4955
8	4781	6030	6377	7662	5611	9429	10753	5064	8215	7308	2933
9	3821	4199	2546	2898	1069	5258	4045	3112	2509	3888	1156
10	1628	2457	879	1454	440	3729	836	1480	756	1198	429
11	677	923	191	731	262	987	240	524	229	387	133
12	130	296	113	371	136	125	133	225	83	136	83
13	269	113	101	225	131	52	40	143	116	101	73
14	131	36	26	110	84	14	27	70	93	55	40
15	63	21	18	58	76	9	20	55	74	73	18
16	41	1	22	54	56	2	13	29	10	28	12
17	43	1	7	39	44	1	5	14	14	18	2
5+	20172	18370	24469	34201	29797	30755	30373	18524	27468	21819	15945

CATCH AT AGE AS PERCENTAGE

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	1.6	0.1	1.9	8.8	7.3	0.7	2.7	1.3	2.8	3.9	10.4
6	13.5	3.7	17.8	24.9	26.8	6.6	14.0	10.9	14.2	10.1	27.9
7	27.5	19.6	38.3	26.5	39.4	29.0	30.3	30.0	39.0	25.5	31.1
8	23.7	32.8	26.1	22.4	18.8	30.7	35.4	27.3	29.9	33.5	18.4
9	18.9	22.9	10.4	8.5	3.6	17.1	13.3	16.8	9.1	17.8	7.2
10	8.1	13.4	3.6	4.3	1.5	12.1	2.8	8.0	2.8	5.5	2.7
11	3.4	5.0	0.8	2.1	0.9	3.2	0.8	2.8	0.8	1.8	0.8
12	0.6	1.6	0.5	1.1	0.5	0.4	0.4	1.2	0.3	0.6	0.5
13	1.3	0.6	0.4	0.7	0.4	0.2	0.1	0.8	0.4	0.5	0.5
14	0.6	0.2	0.1	0.3	0.3	0.0	0.1	0.4	0.3	0.3	0.3
15	0.3	0.1	0.1	0.2	0.3	0.0	0.1	0.3	0.3	0.3	0.1
16	0.2	0.0	0.1	0.2	0.2	0.0	0.0	0.2	0.0	0.1	0.1
17	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0

WEIGHTS AT AGE (KG)

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	0.609	0.609	0.609	0.609	0.609	0.514	0.392	0.547	0.431	0.394	0.591
6	0.760	0.760	0.760	0.760	0.760	0.659	0.598	0.711	0.654	0.607	0.777
7	0.955	0.955	0.955	0.955	0.955	0.869	0.789	0.923	0.892	0.856	0.974
8	1.192	1.192	1.192	1.192	1.192	1.049	0.985	1.168	1.215	1.134	1.284
9	1.580	1.580	1.580	1.580	1.580	1.145	1.235	1.444	1.697	1.507	1.735
10	2.209	2.209	2.209	2.209	2.209	1.256	1.700	1.839	2.292	1.998	2.303
11	2.699	2.699	2.699	2.699	2.699	1.573	2.460	2.445	3.081	2.700	3.027
12	3.371	3.371	3.371	3.371	3.371	2.708	3.507	3.554	4.055	3.568	3.798
13	3.884	3.884	3.884	3.884	3.884	3.115	4.794	4.605	5.169	4.585	4.956
14	4.563	4.563	4.563	4.563	4.563	4.418	5.944	5.966	6.180	5.848	6.257
15	5.918	5.918	5.918	5.918	5.918	5.037	8.055	7.669	7.454	6.982	7.300
16	7.144	7.144	7.144	7.144	7.144	7.022	8.710	8.841	8.755	8.482	9.081
17	7.887	7.887	7.887	7.887	7.887	10.147	9.576	11.719	11.507	9.740	12.028

Table 13. Partial recruitment calculation for the 1985 Greenland halibut fishery in NAFO Subarea 2 and Divisions 3KL.

Age	1985 Survey mean no. per tow 2J+3K	1985 Comm. catch ('000's)	% At age survey	% At age comm.	Rel. PR	PR
5	17.37	1662	26.63	10.70	0.40	0.22
6	19.75	4429	30.28	28.51	0.94	0.51
7	14.65	4848	22.46	31.21	1.39	0.76
8	6.30	2748	9.66	17.69	1.83	1.00
9	2.75	1085	4.22	6.98	1.65	0.90
10	1.91	406	2.93	2.61	0.89	0.49
11	0.76	128	1.17	0.82	0.70	0.38
12	0.65	83	1.00	0.53	0.53	0.29
13	0.30	73	0.46	0.47	1.02	0.29 ^a
14	0.33	40	0.51	0.26	0.51	0.28
15	0.20	18	0.31	0.12	0.39	0.21
16	0.11	12	0.17	0.01	0.06	0.21 ^b
17	0.10	2	0.15	<0.01		0.21 ^b
18	0.03		0.05			
19	0.01		0.02			
Total	65.22					

^aMean of ages 12 and 14.

^bMade equal to value at age 15.

Table 14. Fully recruited F = 0.05.

POPULATION NUMBERS											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	62931	69642	93872	87590	66183	94351	100463	135478	222423	238976	167591
6	39756	51232	57001	76436	68983	52212	77064	81519	110707	181412	194881
7	25027	30089	41330	42731	54879	49258	40909	59256	64914	87121	146527
8	17625	15471	21377	25356	26777	34321	32264	25161	43491	43453	66298
9	10259	10104	7210	11732	13827	16846	19568	16686	16018	28174	28964
10	4475	4942	4473	3600	6983	10353	9035	12361	10846	10844	19549
11	2146	2191	1823	2867	1632	5319	5103	6640	8761	8196	7794
12	687	1144	958	1320	1686	1099	3462	3960	4763	6782	6360
13	816	445	674	682	745	1257	786	2714	3039	3988	5594
14	493	424	262	461	355	491	982	608	2093	2383	3174
15	196	285	315	191	278	215	389	780	434	1629	1901
16	62	103	215	241	104	159	168	301	589	288	1267
17	136	14	84	156	149	34	128	125	220	473	211
5+	164609	186087	229595	253363	242581	265916	290321	345590	488517	613918	650111
6+	101678	116445	135723	165774	176397	171565	189858	210112	266094	374942	482520
7+	61922	65213	78722	89337	107414	119353	112795	128593	155387	193530	287639
8+	36895	35124	37392	46606	52535	70095	71886	69337	90473	106410	141113

POPULATION BIOMASS (MID-YEAR)											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	34641	38434	51677	47451	35883	43904	35539	67104	86726	85175	89295
6	26371	35039	37638	49448	44512	30532	40527	51833	64382	99153	135564
7	18973	24339	31224	32599	41828	34902	25563	47043	47693	65258	127004
8	16113	12898	19162	22663	25543	27544	23271	23648	42866	40507	75319
9	11501	10919	8212	14462	18970	14355	19377	19576	22508	35565	44570
10	7064	6908	7976	5494	13505	9321	13219	19253	21680	18452	40326
11	4299	4023	4204	6004	3637	6802	11088	14085	24178	19546	21189
12	1879	2995	2739	3387	4926	2529	10777	12366	18075	22344	21740
13	2326	1343	2178	1946	2366	3471	3323	11006	13944	16347	24951
14	1734	1674	1026	1649	1273	1936	5214	3079	11440	12473	17877
15	856	1470	1637	847	1258	958	2764	5213	2656	10058	12514
16	231	666	1312	1368	450	1002	1268	2283	4628	2102	10378
17	800	96	571	958	886	312	1087	1252	2217	4088	2291
5+	126788	140803	169557	188277	195038	177569	193018	277742	362992	431066	623019
6+	92148	102368	117879	140826	159155	133665	157479	210638	276266	345891	533725
7+	65777	67329	80241	91378	114643	103133	116952	158805	211884	246738	398161
8+	46804	42991	49017	58779	72815	68231	91389	111761	164190	181481	271157

FISHING MORTALITY											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	0.006	0.000	0.005	0.039	0.037	0.002	0.009	0.002	0.004	0.004	0.011
6	0.079	0.015	0.088	0.131	0.137	0.044	0.063	0.028	0.040	0.014	0.025
7	0.281	0.142	0.289	0.267	0.269	0.223	0.286	0.109	0.201	0.073	0.038
8	0.356	0.563	0.400	0.406	0.263	0.362	0.459	0.252	0.234	0.206	0.050
9	0.530	0.615	0.495	0.319	0.089	0.423	0.259	0.231	0.190	0.165	0.045
10	0.514	0.797	0.245	0.591	0.072	0.508	0.108	0.142	0.080	0.130	0.025
11	0.429	0.627	0.123	0.331	0.195	0.229	0.053	0.091	0.029	0.054	0.019
12	0.234	0.329	0.140	0.372	0.093	0.134	0.043	0.065	0.019	0.022	0.014
13	0.453	0.329	0.181	0.453	0.216	0.047	0.058	0.060	0.043	0.028	0.014
14	0.347	0.098	0.116	0.306	0.303	0.032	0.031	0.136	0.051	0.026	0.014
15	0.439	0.085	0.065	0.406	0.360	0.047	0.058	0.081	0.209	0.051	0.011
16	1.296	0.011	0.120	0.284	0.904	0.014	0.090	0.113	0.019	0.112	0.011
17	0.424	0.082	0.097	0.321	0.392	0.032	0.044	0.131	0.071	0.043	0.011

WEIGHTED FISHING MORTALITIES											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
	0.1603	0.1391	0.1361	0.1702	0.1503	0.1496	0.1338	0.0641	0.0678	0.0418	0.0275

Table 15. Fully recruited F = 0.075.

POPULATION NUMBERS											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	58272	63285	84701	79053	57636	76847	79441	96180	150893	160609	112024
6	36650	47418	51796	68928	61994	45214	62733	64308	78532	122847	130719
7	24509	27546	38207	38470	48732	43536	35180	47523	50823	60778	98578
8	16729	15047	19296	22800	23288	29288	27579	20470	33885	31916	44730
9	9951	9370	6863	10028	11734	13990	15448	12850	12177	20309	19519
10	4366	4690	3872	3316	5588	8640	6696	8987	7705	7700	13110
11	2036	2101	1617	2375	1399	4177	3699	4726	6019	5624	5220
12	666	1055	895	1151	1283	908	2527	2812	3395	4721	4255
13	767	428	601	622	607	928	631	1946	2098	2704	3742
14	462	384	248	401	306	378	712	480	1466	1613	2123
15	185	260	282	180	229	175	297	559	330	1115	1271
16	61	95	194	215	95	118	135	225	408	203	847
17	128	13	77	139	127	27	95	99	158	325	141
5+	154783	171692	208640	227676	213017	224225	235172	261166	347888	420464	436279
6+	96511	108407	123938	148623	155380	147378	155731	164986	196995	259855	324255
7+	59861	60989	72142	79695	93387	102164	92998	100678	118464	137008	193535
8+	35351	33443	33935	41225	44654	58628	57818	53156	67641	76230	94957

POPULATION BIOMASS (MID-YEAR)											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	32069	34929	46615	42738	31165	35749	28070	47621	58784	57190	59530
6	24230	32412	34050	44268	39689	26352	32756	40741	45306	66933	90376
7	18522	22134	28501	28886	36470	30374	21433	37215	36250	44807	84670
8	15134	12427	16876	19857	21749	22695	18997	18649	32222	28590	50213
9	11050	9830	7705	11996	15971	11334	14730	14526	16576	24767	29713
10	6840	6374	6766	4907	10709	7315	9611	13617	15151	12747	26884
11	4027	3796	3699	4787	3066	5164	7959	9838	16464	13251	14126
12	1815	2719	2515	2865	3694	2061	7803	8663	12313	15030	14494
13	2151	1281	1919	1731	1877	2539	2646	7808	9537	11013	16634
14	1602	1509	968	1399	1068	1484	3759	2388	7926	8391	11918
15	798	1332	1461	785	991	775	2088	3676	1947	6808	8343
16	219	609	1176	1193	384	746	1008	1675	3192	1443	6919
17	742	87	520	834	727	241	802	965	1570	2779	1527
5+	119200	129436	152773	166245	167561	146830	151662	207381	257238	293769	415346
6+	87131	94510	106158	123506	136395	111080	123592	159761	198454	236579	355816
7+	62901	62099	72107	79238	96707	84729	90836	119019	153148	169646	265441
8+	44379	39965	43607	50352	60236	54355	69403	81804	116898	124839	180771

FISHING MORTALITY											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	0.006	0.000	0.006	0.043	0.043	0.003	0.011	0.003	0.006	0.006	0.016
6	0.086	0.016	0.097	0.147	0.153	0.051	0.078	0.035	0.056	0.020	0.038
7	0.288	0.156	0.316	0.302	0.309	0.257	0.342	0.138	0.265	0.107	0.057
8	0.380	0.585	0.455	0.464	0.310	0.440	0.564	0.319	0.312	0.292	0.075
9	0.552	0.684	0.528	0.365	0.106	0.537	0.342	0.311	0.258	0.238	0.067
10	0.531	0.865	0.289	0.663	0.091	0.648	0.148	0.201	0.115	0.189	0.037
11	0.458	0.665	0.140	0.416	0.232	0.303	0.074	0.131	0.043	0.079	0.028
12	0.243	0.362	0.152	0.440	0.125	0.165	0.060	0.093	0.027	0.032	0.022
13	0.491	0.345	0.205	0.510	0.273	0.064	0.073	0.085	0.063	0.042	0.022
14	0.376	0.109	0.123	0.362	0.362	0.042	0.043	0.176	0.073	0.039	0.021
15	0.472	0.094	0.073	0.441	0.458	0.059	0.077	0.115	0.286	0.075	0.016
16	1.367	0.012	0.134	0.326	1.062	0.019	0.113	0.154	0.028	0.163	0.016
17	0.457	0.091	0.106	0.369	0.477	0.042	0.060	0.170	0.100	0.063	0.016

TEDΔFMORT

WEIGHTED FISHING MORTALITIES											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
	0.1718	0.1534	0.1521	0.1930	0.1738	0.1837	0.1707	0.0869	0.0979	0.0628	0.0413

Table 16. Fully recruited F = 0.10.

POPULATION NUMBERS											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	55943	60107	80116	74784	53363	68096	68932	76536	115133	121428	84241
6	35077	45511	49194	65174	58499	41716	55567	55704	62448	93570	98641
7	24250	26275	36646	36340	45659	40675	32315	41656	43779	47610	74608
8	16281	14835	18255	21521	21544	26772	25237	18125	29082	26149	33949
9	9798	9003	6690	9176	10687	12561	13387	10932	10257	16377	14797
10	4311	4564	3572	3174	4890	7783	5527	7301	6135	6128	9890
11	1982	2056	1514	2129	1283	3606	2998	3769	4638	4339	3933
12	656	1010	848	1066	1082	813	2059	2237	2611	3590	3202
13	742	419	564	592	537	763	553	1565	1628	2063	2816
14	446	364	241	371	281	322	577	416	1152	1228	1598
15	180	247	266	174	204	154	251	448	277	859	955
16	60	90	183	201	90	98	118	187	317	160	637
17	124	12	73	130	116	23	79	85	127	250	106
5+	149870	164495	198162	214832	198235	203380	207600	218962	277586	323750	329374
6+	93927	104388	118046	140048	144872	135285	138668	142426	162452	202322	245133
7+	58830	58877	68852	74874	86373	93569	83100	86722	100004	108752	146492
8+	34579	32602	32206	38534	40714	52894	50785	45065	56225	61142	71884

POPULATION BIOMASS (MID-YEAR)											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	30784	33171	44084	40382	26806	31672	24337	37882	44815	43198	44647
6	23160	31098	32257	41677	37277	24261	28870	35196	35770	50825	67782
7	18297	21031	27137	27026	33787	28107	19362	32299	30516	34578	63502
8	14644	12191	15733	18449	19843	20259	16842	16142	26882	22609	37660
9	10825	9283	7450	10759	14470	9811	12397	11991	13603	19383	22285
10	6728	6106	6160	4611	9311	6299	7806	10793	11884	9889	20163
11	3891	3683	3447	4175	2780	4342	6394	7713	12606	10103	10594
12	1793	2581	2403	2602	3077	1827	6316	6812	9433	11373	10870
13	2063	1251	1790	1623	1632	2074	2307	6209	7332	8346	12475
14	1536	1426	938	1274	966	1257	3032	2041	6169	6350	8939
15	768	1262	1373	753	857	683	1750	2906	1591	5183	6257
16	213	580	1107	1105	350	618	878	1371	2473	1114	5189
17	713	82	494	771	647	206	659	822	1246	2125	1146
5+	115404	123745	144374	155208	153809	131416	130949	172175	204321	225076	311510
6+	84621	90574	100289	114826	125003	99744	106612	134294	159505	181878	266862
7+	61461	59476	68033	73149	87726	75482	77742	99097	123735	131053	199081
8+	43164	38445	40895	46122	53939	47375	58380	66799	93220	96474	135578

FISHING MORTALITY											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	0.005	0.000	0.006	0.046	0.046	0.003	0.013	0.003	0.007	0.008	0.022
6	0.090	0.017	0.103	0.156	0.163	0.055	0.088	0.041	0.071	0.026	0.051
7	0.291	0.164	0.332	0.323	0.334	0.277	0.378	0.159	0.315	0.138	0.076
8	0.392	0.596	0.482	0.500	0.339	0.493	0.637	0.369	0.374	0.369	0.100
9	0.564	0.724	0.546	0.429	0.117	0.621	0.406	0.378	0.315	0.304	0.090
10	0.540	0.904	0.317	0.706	0.105	0.754	0.183	0.254	0.146	0.243	0.049
11	0.474	0.685	0.150	0.477	0.256	0.360	0.093	0.167	0.056	0.104	0.038
12	0.247	0.382	0.159	0.485	0.150	0.186	0.074	0.118	0.036	0.043	0.029
13	0.512	0.354	0.220	0.544	0.314	0.078	0.083	0.106	0.082	0.055	0.029
14	0.392	0.116	0.137	0.397	0.400	0.049	0.053	0.206	0.094	0.051	0.028
15	0.490	0.099	0.078	0.460	0.531	0.067	0.092	0.146	0.350	0.099	0.021
16	1.406	0.012	0.143	0.352	1.167	0.023	0.130	0.188	0.036	0.211	0.021
17	0.476	0.096	0.112	0.399	0.536	0.049	0.073	0.200	0.126	0.083	0.021

WEIGHTED FISHING MORTALITIES											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
	0.1781	0.1617	0.1616	0.2069	0.1986	0.2076	0.1979	0.1056	0.1255	0.0836	0.0552

Table 17. Fully recruited F = 0.15.

POPULATION NUMBERS											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	53614	56928	75531	70516	49090	59345	58429	56903	79386	82253	56459
6	33544	43604	46592	61420	55005	38217	48403	47105	46374	64302	66567
7	23992	25004	35085	34209	42585	37814	29451	35791	36738	34450	50645
8	15832	14623	17214	20243	19799	34256	22874	15780	24279	20385	23174
9	9644	8637	6517	8323	9641	11133	11327	9015	8337	12445	10077
10	4256	4438	3272	3032	4192	6926	4358	5614	4565	4556	6671
11	1927	2012	1411	1883	1166	3034	2296	2811	3257	3053	2646
12	645	965	812	982	860	718	1591	1663	1828	2459	2150
13	718	411	528	562	468	598	475	1182	1158	1421	1891
14	430	344	234	341	237	265	442	352	839	843	1072
15	174	234	249	168	179	134	204	338	225	602	640
16	59	86	172	188	85	78	102	149	227	117	427
17	120	11	69	121	105	19	62	72	96	176	71
5+	144957	157297	187685	201989	183454	192537	180035	176774	207308	227062	222491
6+	91343	100369	112154	131473	134364	123192	121606	119871	127923	144809	166032
7+	57799	56765	65562	70053	79359	84975	73203	72767	81549	80507	99465
8+	33807	31761	30477	35844	36774	47161	43752	36976	44810	46057	48820

POPULATION BIOMASS (MID-YEAR)											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	29498	31417	41554	38026	26447	27596	20605	28148	30851	29209	29765
6	22090	29785	30463	39086	34834	22171	24985	29654	26237	34722	45188
7	18071	19928	25773	25165	31100	25838	17286	27380	24765	24345	42335
8	14153	11955	14584	17037	17943	17811	14668	13625	21515	16591	25106
9	10598	8732	7195	9517	12970	8271	10052	9443	10618	13955	14857
10	6616	5835	5553	4314	7913	5267	5998	7961	8614	7022	13442
11	3755	3569	3194	3560	2494	3517	4828	5585	8749	6953	7063
12	1750	2443	2291	2339	2461	1592	4828	4958	6552	7716	7247
13	1975	1220	1660	1514	1387	1808	1968	4608	5128	5678	8317
14	1470	1343	909	1148	862	1031	2304	1695	4412	4309	5959
15	739	1193	1285	722	721	591	1412	2136	1233	3557	4171
16	207	552	1039	1018	315	490	748	1066	1755	783	3459
17	684	78	468	709	567	170	516	678	922	1470	764
5+	111607	118050	135968	144153	140044	115953	110197	136937	151350	156310	207673
6+	82109	86633	94414	106127	113597	88357	89592	108789	120499	127102	177908
7+	60019	56848	63952	67041	78733	66185	64608	79135	94263	92380	132720
8+	41948	36920	38179	41876	47633	40348	47322	51756	69498	68035	90386

FISHING MORTALITY											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	0.007	0.000	0.007	0.048	0.050	0.004	0.015	0.005	0.011	0.012	0.033
6	0.094	0.017	0.109	0.166	0.175	0.061	0.102	0.049	0.097	0.039	0.076
7	0.295	0.173	0.350	0.347	0.363	0.302	0.424	0.188	0.389	0.196	0.114
8	0.406	0.608	0.527	0.542	0.376	0.561	0.732	0.438	0.466	0.505	0.150
9	0.576	0.771	0.535	0.486	0.131	0.738	0.502	0.481	0.404	0.424	0.135
10	0.549	0.946	0.352	0.755	0.123	0.904	0.233	0.344	0.202	0.343	0.074
11	0.491	0.707	0.162	0.560	0.285	0.445	0.123	0.231	0.081	0.151	0.057
12	0.252	0.404	0.167	0.540	0.187	0.214	0.097	0.162	0.052	0.063	0.043
13	0.535	0.362	0.235	0.584	0.370	0.101	0.098	0.143	0.118	0.082	0.043
14	0.410	0.123	0.131	0.441	0.448	0.060	0.070	0.248	0.131	0.075	0.042
15	0.510	0.105	0.083	0.480	0.631	0.077	0.115	0.198	0.452	0.144	0.031
16	1.447	0.013	0.152	0.382	1.298	0.029	0.152	0.242	0.051	0.301	0.031
17	0.496	0.102	0.118	0.434	0.612	0.060	0.093	0.242	0.171	0.119	0.031

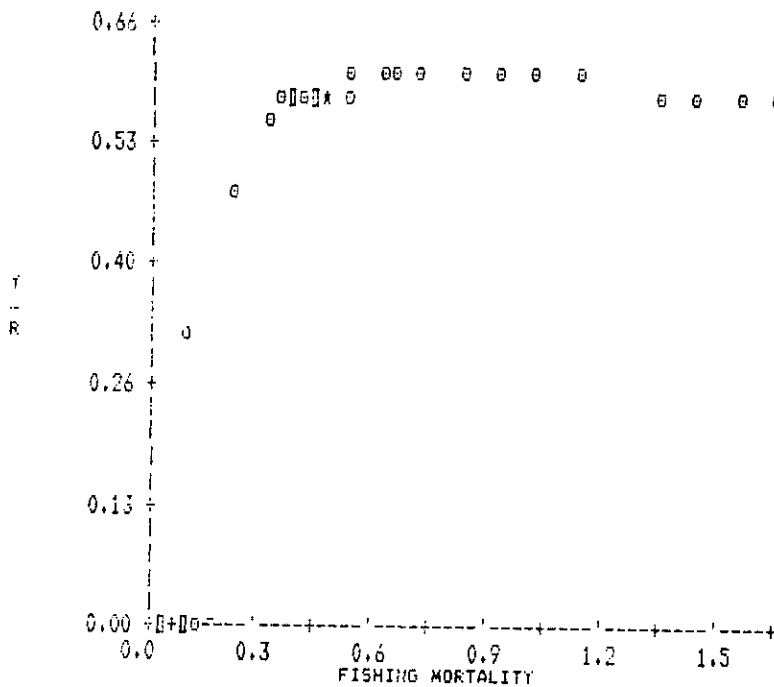
WEIGHTED FISHING MORTALITIES											
AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
	0.1850	0.1710	0.1723	0.2231	0.2062	0.2391	0.2353	0.1344	0.1739	0.1245	0.0830

Table 18. Yield per recruit analysis for Greenland halibut in NAFO Subarea 2 and Div. 3KL from 1985 commercial weights at age and partial recruitment.

YIELD PER RECRUIT ANALYSIS

	FISHING MORTALITY	CATCH (NUMBER)	YIELD (KG)	AVG. WEIGHT (KG)	YIELD PER UNIT EFFORT
	0.1000	0.198	0.309	1.567	1.829
	0.2000	0.332	0.470	1.416	1.390
	0.3000	0.427	0.551	1.292	1.086
F0.1---	0.3362	0.454	0.569	1.253	1.000
	0.4000	0.495	0.590	1.191	0.871
	0.5000	0.546	0.606	1.110	0.716
	0.6000	0.585	0.611	1.045	0.602
FMAX---	0.6309	0.595	0.611	1.027	0.572
	0.7000	0.515	0.610	0.992	0.515
	0.8000	0.640	0.607	0.949	0.449
	0.9000	0.660	0.603	0.914	0.396
	1.0000	0.678	0.599	0.884	0.354
	1.1000	0.693	0.596	0.860	0.320
	1.2000	0.706	0.593	0.840	0.292
	1.3000	0.717	0.590	0.822	0.268
	1.4000	0.728	0.587	0.807	0.248
	1.5000	0.737	0.585	0.794	0.230

COMPUTED YIELD PER RECRUIT VS. FISHING MORTALITY



Y/R AT F0.1 IS INDICATED BY ■

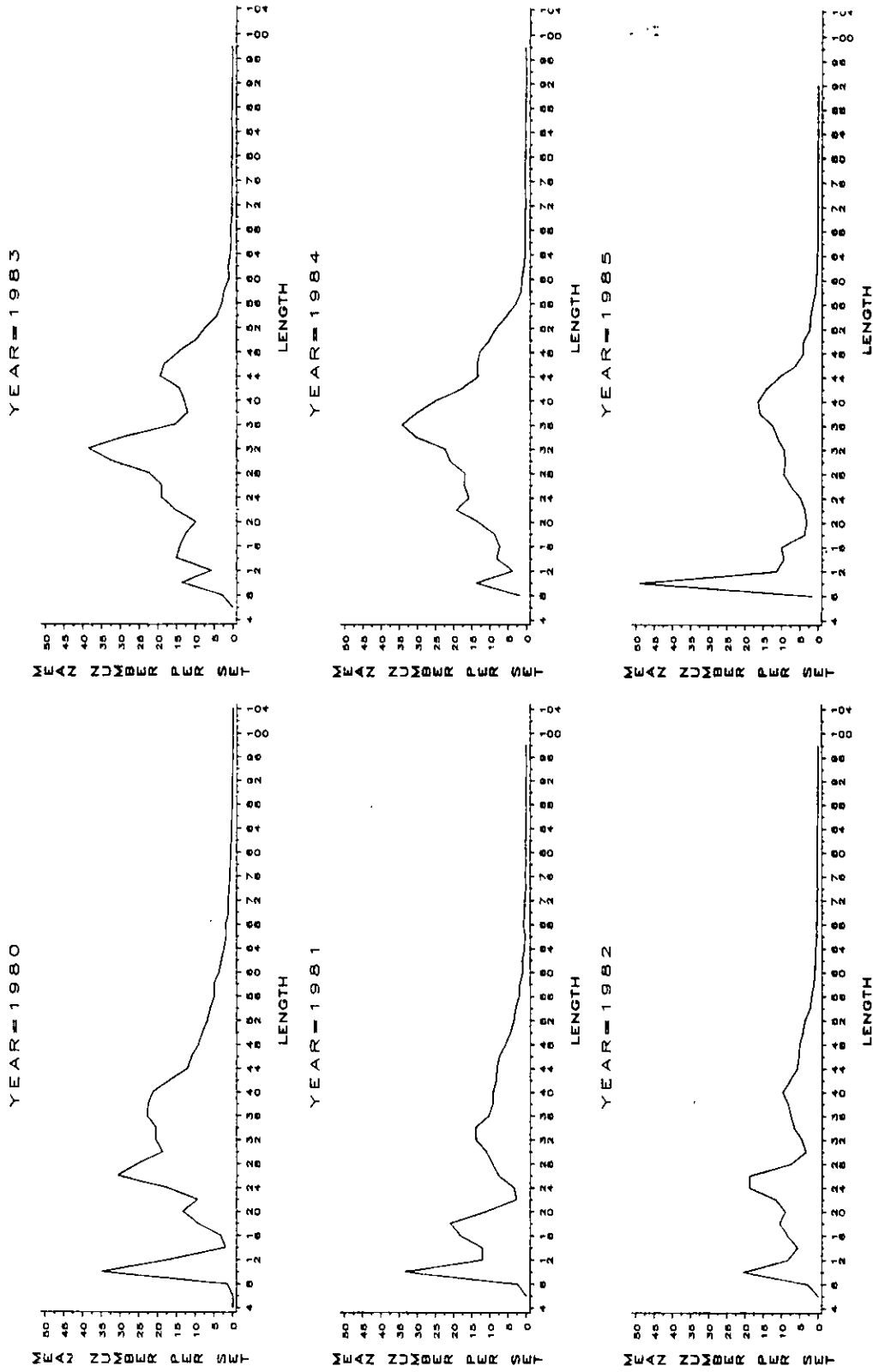


Fig. 1. Length frequency distribution of Greenland halibut from shrimp surveys in Hopedale Channel (Div. 2H) 1980-85.

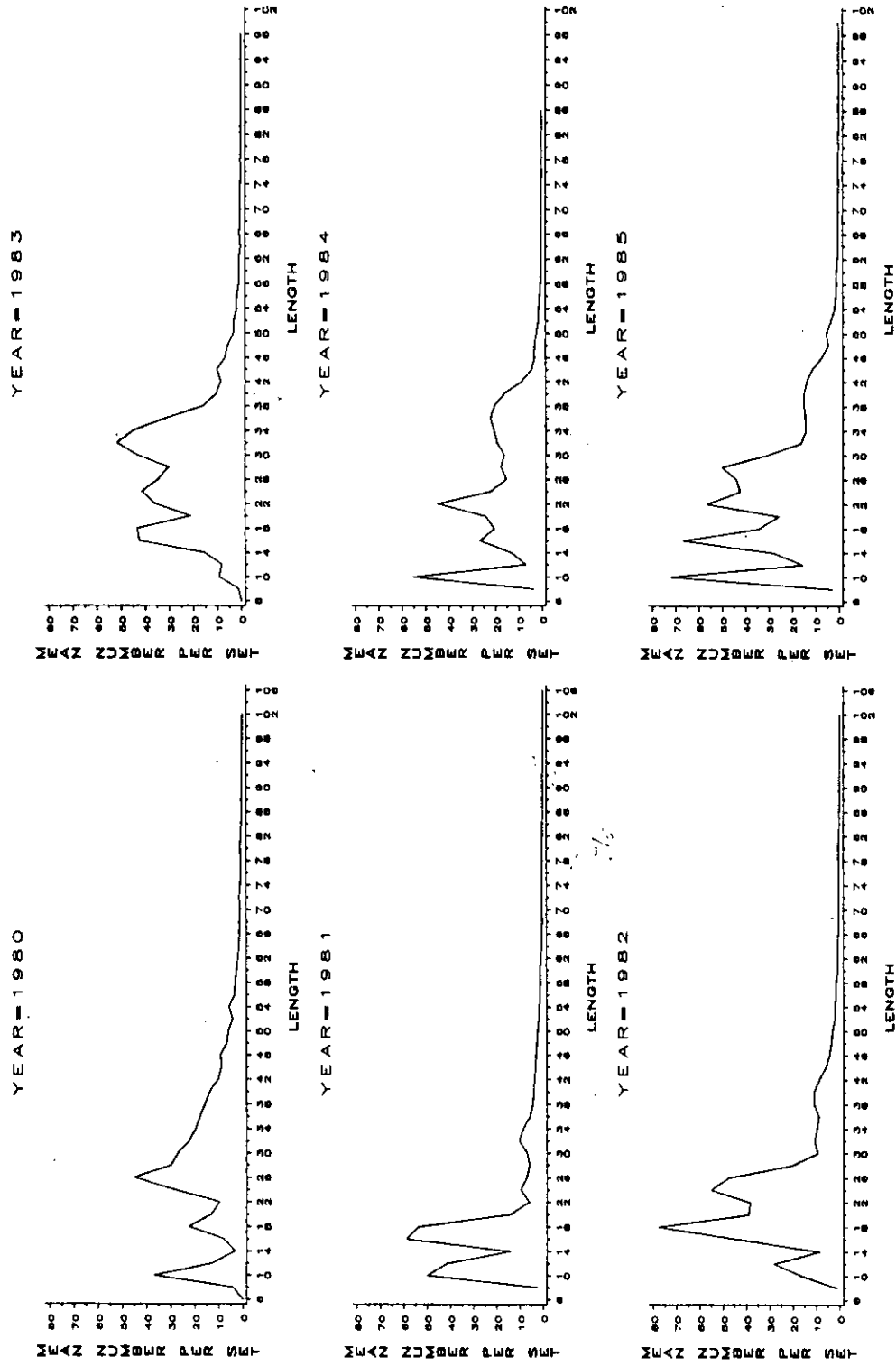


Fig. 2. Length frequency distributions of Greenland halibut from shrimp surveys in Cartwright Channel (Div. 2J) 1980-85.

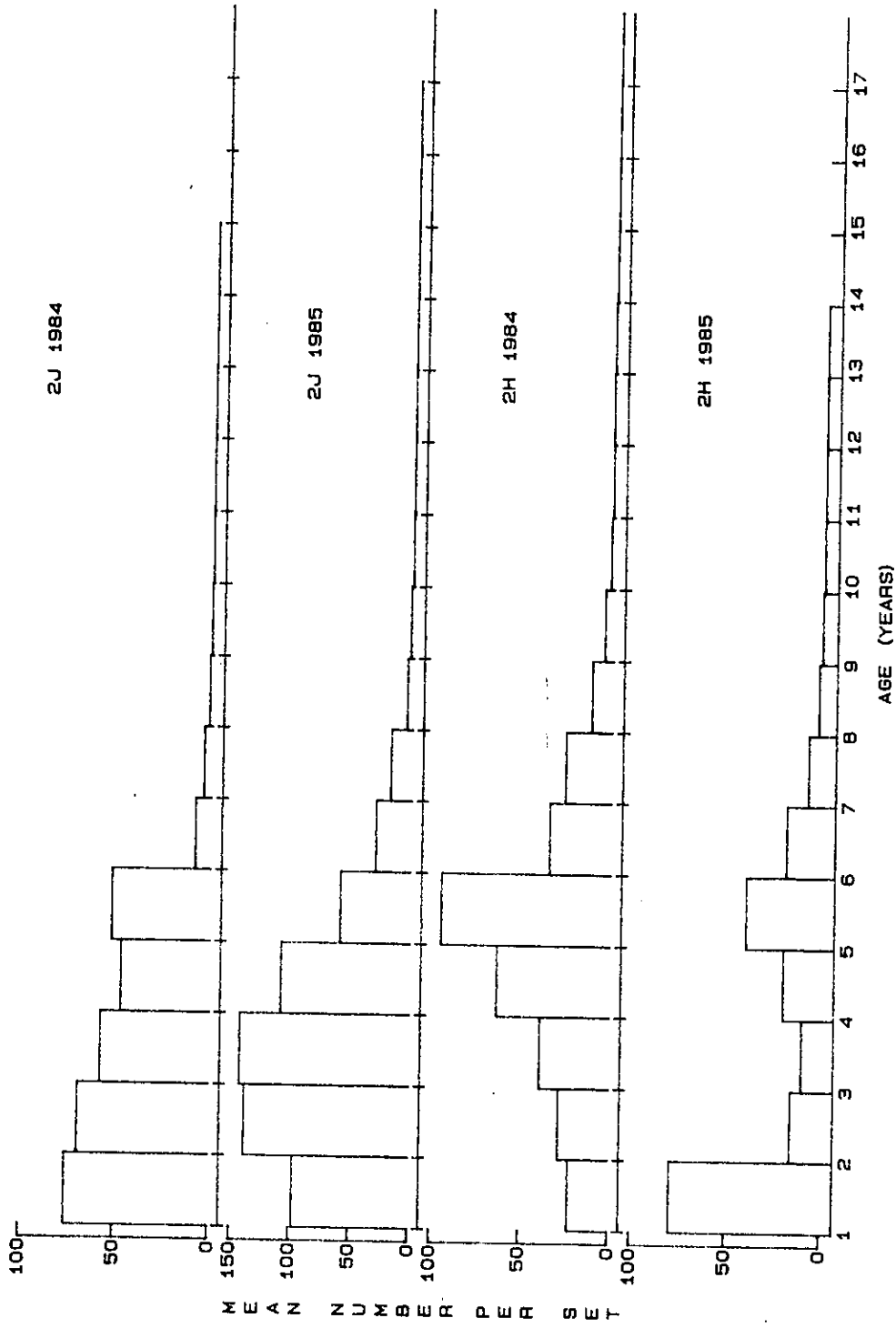


FIG. 3 STRATIFIED MEAN NUMBER PER SET OF GREENLAND HALIBUT AT AGE FROM SHRIMP SURVEYS.