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

by

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Introduction

Landings of Greenland halibut averaged about 25,000-30,000 t annually from 1969-76 then increased to a peak of 39,000 t in 1978. Since that time landings have steadily declined to a level of near 24,500 t in 1983 and 1984 (Table 1). The main prosecutors of this fishery have been Canada, the Soviet Union, Poland, and GDR. In recent years, however, Canada (N) accounted for about 70-80% of the total catch. The main components of this fishery in 1984 were offshore otter trawlers from Canada, the Soviet Union, Poland, GDR, and Japan which, when combined, accounted for 55% of the landings with most of the remainder accounted for by Canada (N) gillnets. The landings in 1984 were within average levels despite a 6 month strike in the largest otter trawl fleet in Canada (N).

The TAC on this stock was 30,000 t annually from 1976-79 and was exceeded in 1977-79 inclusive. The TAC was increased to 35,000 t in 1980 due to some indication of good recruitment. In 1981, with more detailed data available on recruiting year-classes and fishing mortality, the TAC was raised to 55,000 t for Div. 2J3KL and remained in effect until 1985. An additional 20,000 t was allocated to Div. 2GH. In 1985 a TAC of 75,000 t was placed on the whole stock area (unsegregated) and is considered to be a conservative level for this stock given good recruitment and low fishing mortality.

Research vessel surveys

i) Biomass estimates in Divisions 2J3KL

Results of stratified-random biomass surveys for groundfish in Div. 2J (1977-84) and 3KL (1978-84) carried out in autumn by the research vessel GADUS ATLANTICA are presented in Tables 2 and 3. Results of the stratified-random biomass surveys in Div. 3L carried out in autumn by the A. T. CAMERON in 1981-82 are shown in Table 4. Results of the W. TEMPLEMAN survey in the autumn of 1983, summer of 1984, and winter of 1985 are also shown in Table 4.

The area surveyed in Div. 2J in 1984 gave a biomass estimate of 81,200 t, compared to 78,500 t in 1984 (Table 2). Compared to 1983, however, there were three strata not surveyed in 1984. These three strata in 1983 accounted for an estimated biomass of over 4,000 t.

In Div. 3K the 1984 estimate of biomass for the area covered was 111,600 t, compared to 97,800 t in 1983 (Table 3). Two deepwater strata (640, 642) were surveyed in 1984 but not in 1983. These strata accounted for about 6,000 t of the 1984 biomass estimate.

In Div. 3L the first complete survey was carried out by the research vessel W. TEMPLEMAN during the summer of 1984 and yielded a biomass estimate of 17,500 t (Table 4). It is clear from Table 4 that previous surveys did not cover the major concentrations of Greenland halibut in Div. 3L. A winter survey in 1985 with the same coverage as the 1984 summer survey provided an estimate of biomass of 9,500 t nearly half that of the previous survey. This would suggest that seasonal trends in distribution probably occur although the same strata seem to be most important in both surveys. It is likely that much of the biomass in wintertime moves into deeper water at the continental slope outside the range of the survey.

The combined estimate of biomass for 1984 for Div. 2J3KL from the surveys was 210,400 t. It should be pointed out, however, that this estimate is probably minimal since most deepwater areas at the slope of the continental shelf are not surveyed and it is these areas where most of the larger Greenland halibut are concentrated. It is further noted that the only available information on catchability coefficients for the species indicate that as much as 80-85% can escape trawling gear.

Although Canadian groundfish surveys have not been carried out in Div. 2GH in recent years, previous estimates (1978-81) suggest that minimum trawlable biomass estiamtes were probably in the order of 200,000 t.

ii) Catch numbers at age

Average numbers at age caught per 30 minute set (weighted by stratum area) for Div. 2J3K autumn surveys are presented in Table 5 for 1978-84. Only strata common to all years were used in the calculations.

The total numbers caught per tow (Table 5) range from 38.60 in 1981 to 54.48 in 1978. However, in general the numbers per tow have been relatively stable over the period for the area examined (Table 5). The strong year-classes of the early 1970's have now essentially passed through the fishery. However, there appears to be good recruitment from the more recent year-classes. The 1979 year-class which has been predicted to be relatively strong has shown up in the surveys at age 5 in 1984 as the strongest in the series. In standardizing these data to common strata from year to year, however, many of the more important deeper strata were eliminated. From 1981 to 1984 survey coverage was much more complete and for practical purposes can be directly compared. With the inclusion of the deeper strata, it is clear that the mean number per tow increased substantially (Table 6). However, the distributions were not greatly affected. From this table the 1979 year-class still appears strongest at age 5 in the four years for both divisions with the 1980 year-class also showing strength.

What is particularly evident from the survey data is that none of the year-classes stands out as being particularly poor.

iii) Length and age frequency distributions from shrimp surveys in Hopedale (Div. 2H) and Cartwright (Div. 2J) channels.

Research vessel surveys directed towards shrimp have been conducted annually in the month of July since 1979 in Hopedale (Div. 2H) and Cartwright (Div. 2J) channels off Labrador. Since Greenland halibut is such an important by-catch of these surveys, length frequencies have been obtained from each cruise (with the exception of 1979) and in 1984 these were further supplemented by an age sample. The length frequency distributions are shown in Fig. 1 with the 1984 age composition shown in Fig. 2. Both are shown separately by division.

From the length frequency distributions, it is clear there is a very high abundance of pre-recruits in all years, particularly in Div. 2J. The 1979 year-class (assuming the modes are representative of age-classes) stands out as being particularly strong and also possibly the 1980 year-class. The 1980 year-class at ages 1 and 2 is in fact more abundant in Div. 2J than the 1979 year-class although this is not quite true in Div. 2H. The 1984 survey length frequency shows the 1983 year-class at age 1 to be more abundant than any other at the same age throughout the series in Div. 2J.

The age composition from the 1984 survey in Div. 2H indicates that the 1979 year-class is by far the most abundant followed by the 1980 year-class with each preceding year-class weaker than the one following for pre recruits. In Div. 2J the opposite is true with the 1983 year-class being the most abundant folowed by the 1982, 1981, and 1979 respectively. Ages 6+ are much less abundant in Div. 2J than in Div. 2H. A comparison of the Div. 2H length and age distribution suggests that considerable overlap in the length frequency as early as age 2 can occur. The age structure (Fig. 2) suggests that age 2 is stronger than age 3, however, the length frequency shows a much stronger mode at what is believed to be age 3 than at what is believed to be age 2. One must, therefore, be careful when comverting length frequency modes directly into year-classes.

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 very 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 8).

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 8). 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 has been attributed to strong year-classes of the early 1970's but these have now essentially passed through the fishery. However, subsequent year-classes may also be moderate to strong which would keep catch rates up. Furthermore, with the catches considerably lower than the TAC's in recent years, there is probably substantial surplus stock which could result in relatively high catch rates.

ii) Numbers and weights at age

The numbers and weights at age for the commercial catch from 1975-83 were taken directly from NAFO SCR Doc. 84/VI/62. The 1984 catch numbers at age were computed by breaking down the catch weight according to the sampling scheme shown in Table 7. The results of the calculations are shown in Table 9a with the sum of products shown in 9b. A comparison of the sum of products for the 1984 catch breakdown suggests an error of about 1%. The catch matrix and weights at ages used in subsequent VPA's are shown in Table 10. More than 85% of the catch in 1984 was attributed to the 1975-78 year-classes with the 1976 and 1977 year-classes accounting for nearly 60% alone. The year-classes prior to 1975 now only account for less than 10% of the 1984 catch.

iii) Partial recruitment

Partial recruitment for 1984 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 11). Since numbers were low in the 13+ age groups, a mean of age 13, 15, and 16 was taken and applied to all 13+ age groups. This yielded a value = 0.40, compared to 0.39 used last year. In the 1984 fishery the only age group considered to be fully recruited was age 9, compared to ages 7 and 8 in last year's assessment. The vector is dome shaped, however, as normally expected from this fishery. 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 VPA 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 low level of catch in 1984, increasing catch rate and good recruitment, it is believed that the 1984 fishing mortality is at least as low or ever lower than in recent years. Since fully recruited F could not be accurately determined, a series of VPA's were run using fully recruited F's ranging from 0.05 to 0.20 at increments of 0.05. The results of these analyses are presented in Tables 12, 13, 14, and 15 respectively.

Yield per recruit

A Thompson and Bell yield per recruit analysis was performed and the results presented in Table 16. The partial recruitment vector and mean weights at age were those derived from the 1984 fishery. The $F_{0.1}$ value was calculated to be = 0.28. This compares well with $F_{0.1}$ = 0.29 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.

Country	Year															
	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83[a]	84[a]
Canada(M)	-	1	2	-	-	-	25	221	229	1182	1863	523	560	1554	632	333
Canada(N)	11553	10705	9406	8952	6840	5745	7782	9085	17738	23510	28077	31251	23565	17694	16235	19405
FRG	202	13	-	86	707	515	622	927	755	1022	15	55	-	57	-	6
Poland	5406	8266	5234	6986	9060	7105	8447	5942	5998	5215	1813	203	1806	1111	5258	1252
Iceland	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Norway	4	-	-	1389	501	117	-	6	15	3	8	1	-	-	-	8
USSR	9279	7384	9094	10183	8652	9650	9439	6799	4308	5632	1961	238	3325	1471	143	368
Romania	-	225	7	120	80	-	-	-	-	3	-	-	-	-	-	-
GDR	-	-	647	402	1681	2701	2025	1512	1953	1636	178	316	1350	2487	-	2499
Den-F	-	-	-	970	950	4	-	-	350	268	-	-	-	-	-	-
Spain	-	-	-	3	-	-	-	1	-	-	4	-	-	-	-	-
UK	-	-	-	731	201	1112	62	-	476	53	110	22	-	1	-	-
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	-	582
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2054	-
Total	26445	26594	24392	29822	28944	27123	28681	24598	31941	38532	34068	32642	30682	26206	24322	24453

[a]Provisional.

Table 2. 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 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58 1981	Gadus 71&72 1982	Gadus 86,87,&88 1983	Gadus 101,102,103 1984
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)
202	21.34(2)	25.20(2)	7.48(2)	51.00(2)	34.50(2)	45.50(2)	30.75(2)	92.75(2)
203	31.55(2)			25.75(2)	52.00(2)	64.33(3)	226.83(3)	179.25(2)
204	175.70(2)				170.50(2)	284.00(3)	250.83(3)	260.00(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)
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)
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)
208	186.14(4)	183.12(3)	127.46(2)	189.25(2)	240.75(2)	348.67(3)	110.00(2)	496.17(3)
209	65.25(7)	15.66(4)	47.61(5)	144.37(4)	55.67(6)	129.64(11)	52.77(7)	37.42(7)
210	19.41(6)	5.20(4)	4.09(2)	3.50(3)	5.00(3)	20.88(6)	41.50(2)	26.88(4)
211	34.96(2)	64.92(2)	36.28(2)	32.70(3)	35.75(2)	55.75(2)	134.75(2)	55.75(2)
212	189.61(4)				147.75(2)	144.10(5)	44.75(3)	70.83(3)
213	16.46(8)	17.59(4)	8.84(4)	11.70(5)	29.33(6)	34.19(10)	23.25(10)	20.50(5)
214	38.97(6)	67.76(4)	12.93(4)	11.33(3)	60.10(5)	84.31(8)	44.63(8)	59.75(4)
215	37.68(4)	34.14(5)	8.00(4)	23.00(2)	12.30(5)	38.28(9)	14.46(8)	42.00(3)
216	102.83(2)		111.58(2)	137.50(2)	63.25(2)	215.25(2)	102.67(3)	173.00(2)
217	141.95(3)				41.00(2)	58.25(2)	64.50(2)	
218	217.92(2)				156.50(2)	40.00(2)	39.00(2)	
219					48.00(2)		103.00(2)	
220								
221								
222	115.32(4)	42.07(3)	8.39(2)	16.25(2)	55.75(2)	188.00(3)	131.50(3)	27.67(3)
223	251.52(2)				94.75(2)	88.00(2)	61.75(2)	113.75(2)
224	173.65(2)				115.00(2)	36.50(2)	50.50(2)	37.50(2)
225	39.95(2)							
226								
227	115.32(4)				43.50(2)	54.90(5)	38.50(4)	36.67(3)
228	6.53(8)		4.88(4)	4.33(3)	8.00(6)	9.25(10)	10.33(6)	16.50(7)
229	39.03(4)	19.52(2)	28.35(2)	5.25(2)	30.50(2)	21.50(4)	36.50(4)	11.00(3)
230	243.28(3)				60.25(2)	30.80(2)	93.00(2)	21.50(2)
231	64.24(2)					93.75(2)	51.25(2)	98.75(2)
232	49.03(2)							
233								
234	49.03(2)	18.38(2)	101.38(2)	101.50(2)	52.00(2)	98.00(3)	46.71(3)	90.70(2)
235	117.59(4)				39.00(2)	89.67(3)	252.50(2)	82.00(3)
236	98.06(2)				44.75(2)	66.75(2)	101.00(2)	53.00(2)
Biomass (tons)	106,834	32,064	28,319	45,119	76,661	104,233	78,546	81,234

Table 3. 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 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58&59 1981	Gadus 71&72 1982	Gadus 86,87,&88 1983	Gadus 101,102,103 1984
618							1.50(5)
619							1.90(7)
620	24.13(7)	37.32(7)	24.80(9)	25.72(10)	22.33(9)	19.25(10)	13.08(13)
621	159.03(7)	120.09(8)	54.42(10)	32.77(11)	14.68(14)	31.87(12)	18.32(14)
622				132.50(2)	120.83(3)	224.00(2)	143.75(4)
623	154.06(3)	36.55(3)	111.00(4)	83.33(4)	146.20(5)	217.17(6)	270.00(5)
624	14.57(3)	11.34(2)	1.25(2)	3.75(2)	5.25(4)	2.38(4)	5.00(4)
625	21.49(3)	11.19(3)	10.25(4)	31.50(4)	8.75(2)	66.33(3)	42.95(5)
626	51.87(4)	35.08(3)	178.50(3)	58.20(5)	120.40(5)	101.75(4)	217.75(6)
627				189.75(6)	124.43(7)	220.83(6)	300.56(8)
628	39.95(5)	72.13(2)	36.56(4)	16.33(6)	12.92(6)	36.08(6)	27.21(7)
629	8.63(3)	13.38(2)	19.83(3)	31.33(3)	68.50(2)	65.67(3)	31.13(4)
630		11.11(2)	11.25(2)	117.25(2)		67.75(2)	7.73(3)
631				68.60(5)	38.00(2)	66.70(5)	105.30(5)
632	4.15(3)	2.04(2)	3.88(2)	6.25(2)	7.50(3)	3.43(3)	
633	7.49(5)	5.41(6)	14.64(7)	9.98(8)	7.93(7)	12.38(12)	12.05(10)
634	5.72(5)	9.26(6)	5.80(5)	5.41(7)	14.09(11)	6.60(5)	5.93(7)
635	6.06(5)	5.17(5)	23.13(4)	12.00(5)	17.10(5)	7.83(6)	10.19(8)
636	1.97(3)	4.40(5)	14.00(5)	12.75(6)	21.85(10)	4.05(6)	7.40(8)
637	5.11(4)	6.58(4)	6.63(4)	8.25(6)	9.71(7)	14.80(5)	4.97(6)
638	10.73(5)	11.97(7)	12.50(6)	21.31(8)	20.39(15)	18.05(11)	12.55(10)
639	5.33(5)	4.31(2)	7.88(4)	7.38(6)	19.05(10)	11.71(7)	2.41(8)
640				36.00(2)	21.50(2)		13.75(2)
641				21.80(2)	24.50(4)	61.33(3)	62.50(3)
642				9.33(3)	33.33(6)		81.35(6)
643							
644							
645				21.75(2)	17.67(3)	3.25(2)	54.25(2)
646				63.25(2)	15.50(2)	91.25(2)	100.50(2)
647				82.50(2)	39.50(2)		
648							
649							
Biomass (tons)	65,695	52,641	52,819	77,966	70,870	97,790	111,612

Table 4. 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)
328				0.20(4)	0.19(6)
341	0.50(3)	0.19(4)	0.80(4)	0.50(5)	0.15(8)
342	1.33(3)	2.83(3)	0.87(4)	0.00(2)	0.20(3)
343	0.88(4)		0.53(3)	0.00(4)	0.03(3)
344	6.94(4)	1.00(3)	4.34(6)	0.18(6)	1.14(7)
345	20.75(4)	8.67(6)	9.25(8)	39.60(7)	13.17(3)
346	9.00(3)	11.63(4)	17.50(5)	27.33(6)	7.50(4)
347	1.83(3)	3.02(4)	2.58(6)	0.17(6)	0.40(5)
348	0.42(6)	2.08(5)	0.30(11)	0.11(11)	0.44(8)
349	0.09(7)	0.03(5)	0.43(9)	0.10(14)	0.01(10)
350	0.00(6)	0.00(2)	0.00(8)	0.00(12)	0.00(9)
363	0.00(4)	0.00(3)	0.00(3)	0.00(8)	0.02(8)
364	0.49(9)	0.25(11)	0.87(11)	0.00(10)	0.08(12)
365	2.88(4)	2.75(4)	1.30(5)	0.30(4)	0.55(4)
366	5.00(3)	9.58(6)	6.00(4)	6.23(11)	0.62(5)
368	21.50(2)	28.75(2)		17.75(2)	5.75(2)
369	13.25(2)	13.00(4)	14.00(6)	5.19(7)	0.63(5)
370	0.00(4)	0.50(6)	0.44(6)	0.39(7)	0.06(7)
371	0.01(4)	0.00(5)	0.00(5)	0.00(7)	0.00(6)
372	0.00(5)	0.00(7)	0.00(4)	0.00(13)	0.00(11)
384		0.00(4)	0.00(3)	0.00(6)	0.00(4)
385	0.26(8)	2.19(8)	3.20(5)	0.50(12)	0.01(11)
386	37.00(3)	21.75(4)		12.69(8)	0.35(5)
387	67.50(2)	43.67(3)		49.00(3)	6.88(4)
388		2.33(3)		24.00(2)	5.67(3)
389		7.88(4)		19.25(6)	4.57(4)
390	0.00(3)	3.50(4)	0.07(3)	0.00(3)	0.00(5)
391		2.75(2)	21.50(2)	18.75(2)	4.75(4)
392		14.00(2)	15.25(2)	26.50(2)	7.50(2)
729				70.75(2)	54.75(2)
730				12.25(2)	26.75(2)
731				41.75(2)	46.50(3)
732				12.63(2)	80.75(2)
733				12.75(4)	17.50(3)
734				17.67(3)	119.25(2)
735		33.00(2)		42.00(3)	4.00(2)
736			30.00(2)		
	12,722	11,649	6,634	17,548	9,519

Table 5. Average numbers caught per set for 2J+3K November surveys weighted by stratum area. Only common strata fished in each survey were used in calculation.

Age	Gadus 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58,59 1981	Gadus 71,72 1982	Gadus 86,87,88 1983	Gadus 101,102,103 1984
1	0.60	0.54	0.22	1.57	0.35	0.09	0.15
2	3.61	3.58	0.79	3.14	0.90	0.47	0.73
3	7.22	5.27	1.79	5.56	4.25	3.34	2.21
4	9.04	5.59	3.60	4.90	6.54	7.16	6.34
5	12.78	10.61	8.64	7.00	7.85	9.55	15.13
6	10.59	9.05	13.32	7.44	7.15	8.34	8.70
7	6.82	3.30	8.05	5.13	7.81	7.68	5.66
8	1.82	0.79	1.78	2.11	7.82	4.67	3.26
9	0.59	0.30	0.42	0.82	2.84	1.54	1.36
10	0.37	0.35	0.27	0.35	0.94	0.44	0.57
11	0.46	0.13	0.34	0.26	0.48	0.31	0.27
12	0.27	0.12	0.20	0.10	0.28	0.21	0.16
13	0.13	0.12	0.07	0.05	0.19	0.13	0.13
14	0.06	0.03	0.07	0.02	0.18	0.09	0.09
15	0.02	0.01	0.00	0.01	0.11	0.03	0.03
16	0.04	0.01	0.01	0.00	0.03	0.00	0.03
17	0.02	0.00	0.00	0.00	0.00	0.00	0.02
18	0.00	0.00	0.00	0.00	0.01	0.00	0.00
UK	0.03	0.00	0.01	0.14	0.01	0.00	0.00
Total	54.48	39.79	39.60	38.60	47.75	44.03	44.83

Table 6. Age composition-numbers/standard tow from autumn groundfish surveys in Div. 2J, 3K (all strata fished).

Division	Age	1981	1982	1983	1984
3K	1	1.37	0.22	0.14	0.38
	2	4.89	1.35	1.09	1.55
	3	9.20	6.75	6.20	4.46
	4	5.33	6.63	10.75	11.67
	5	7.85	7.58	12.35	23.24
	6	11.38	7.46	9.94	9.92
	7	7.22	7.31	11.33	6.76
	8	2.32	7.29	9.39	3.58
	9	0.93	2.22	3.18	2.08
	10	0.42	0.56	0.73	0.68
	11	0.23	0.34	0.41	0.33
	12	0.09	0.24	0.21	0.22
	13	0.07	0.15	0.12	0.15
	14	0.01	0.15	0.06	0.11
	15	0.0	0.03	0.01	0.03
	16	0.01	0.01	0.0	0.01
	17		0.01		
	18				
	Total	51.31	48.33	65.90	65.16
2J	1	1.88	0.52	0.09	0.12
	2	5.68	0.92	0.37	1.62
	3	4.15	3.87	1.43	5.79
	4	4.04	8.07	3.55	4.24
	5	5.82	6.64	6.92	8.26
	6	5.68	5.27	6.73	6.93
	7	5.52	7.44	7.14	6.45
	8	3.53	9.05	5.52	5.99
	9	1.68	4.87	2.42	2.44
	10	1.03	2.32	0.86	1.18
	11	0.97	1.16	0.68	0.59
	12	0.46	0.71	0.58	0.39
	13	0.23	0.54	0.46	0.33
	14	0.14	0.55	0.33	0.31
	15	0.09	0.44	0.16	0.21
	16		0.17	0.04	0.16
	17		0.02	0.0	0.08
	18		0.01	0.02	
	Unknown	0.25	0.02		
	Total	41.15	52.61	37.31	45.08

Table 7. List of length frequency and age-length key samples available for the Subarea 2 and Div. 3KL Greenland halibut stock for 1984.

Month	Country	Gear	NAFO Div.	No. measured	No. aged	Catch (MT)
July	CAN(N)	OT	2H	328		53
August	CAN(N)	OT	2H	627		927
September	CAN(N)	OT	2H	1139		956
August	CAN(N)	OT	2J	661		1328
September	CAN(N)	OT	2J	326		867
July	CAN(N)	OT	3K	1714		888
June	CAN(N)	GN	3K	1499		629
July	CAN(N)	GN	3K	1744		1356
August	CAN(N)	GN	3K	1570		1817
September	CAN(N)	GN	3K	3486		1069
October	CAN(N)	GN	3K	324		334
May	CAN(N)	GN	3L	1641		264
June	CAN(N)	GN	3L	1846		750
July	CAN(N)	GN	3L	1347		1336
August	CAN(N)	GN	3L	2875		1778
September	CAN(N)	GN	3L	1149		894
May	CAN(N)	OT	3K	1528		1384
August	CAN(N)	GN	2J	2456		45
September	CAN(N)	GN	2J	4538		211
October	CAN(N)	GN	2J	6795		547
November	CAN(N)	GN	2J	1267		46
October	GDR	OT	2H	703		390
November	GDR	OT	2H	1791		966
December	GDR	OT	2H	1060		1143
September	Japan	OT	2J	6172		346
November	Japan	OT	2J	1900		257
September	Japan	OT	3K	492		15
November	Poland	OT	2H	2384		61
December	Poland	OT	2H	2377		230
May	Poland	OT	3K	800		927
June	Poland	OT	3K	733		34
Q2	Can(N)	OT	3K		345	
Q2	Can(N)	GN	3L		387	
Q3	Can(N)	OT	2H		712	
Q3	Can(N)	OT	2J		412	
Q3	Can(N)	GN	3K		958	
Q3	Can(N)	OT	3K		515	
Q3	Can(N)	GN	3L		988	
Q4	Can(N)	GN	3K		834	
Q4	Can(N)	GN	3L		421	
Q4	Can(N)	GN	2J		787	

Table 8. Catch and effort statistics of Greenland halibut in NAFO Div. 2HJ3K from Canada(N) and Poland where effort was considered directed in 1979-84.

Year	NAFO Div.	Months	Mean CPUE (t/hr.)	Sets observed	Directed catch (t)
			Canada(N) (TC 5)		
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
			Poland (TC 7)		
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	-

Table 9a. Calculated catch numbers at age for the 1984 Greenland halibut fishery in NAFO Subarea 2 and Divisions 3KL.

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
* 3	0.133	27.000		0.01	0.01
* 4	0.257	32.744	118	20.85	0.18
* 5	0.394	37.190	809	38.35	0.05
* 6	0.607	42.266	2086	60.85	0.03
7	0.856	46.847	5245	102.48	0.02
8	1.134	50.922	6894	116.15	0.02
9	1.507	55.404	3668	84.16	0.02
*10	1.998	60.267	1130	41.06	0.04
*11	2.700	65.972	365	19.68	0.05
*12	3.568	71.678	128	12.30	0.10
*13	4.585	77.263	95	8.97	0.09
*14	5.848	83.047	52	9.81	0.19
*15	6.982	87.493	69	10.79	0.16
*16	8.482	92.762	26	5.13	0.20
*17	9.740	96.450	17	6.34	0.38
*18	11.007	100.139	3	1.78	0.63
*19	14.554	109.000	1	0.01	0.01

Table 9b. Sum of products of the catch numbers and mean weights at age for the Greenland halibut fishery in NAFO Subarea 2 and Divisions 3KL, 1975-84.

TABLE , CALCULATED CATCH BIOMASS(T) AT AGE,

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	196	12	283	1837	1329	105	318	129	290	319
6	2066	517	3307	6468	6065	1339	2537	1436	2231	1266
7	5297	3438	8952	9864	11198	7745	7266	5124	8383	4490
8	5699	7188	7601	9133	6688	9891	10592	5915	8755	7818
9	6037	6634	4023	4579	1689	6020	4996	4494	3735	5528
10	3596	5428	1942	3212	972	4684	1421	2722	1529	2258
11	1827	2491	516	1973	707	1553	590	1281	619	985
12	438	978	381	1251	458	338	466	800	296	457
13	1045	439	392	874	509	162	192	659	527	436
14	598	164	119	502	383	62	160	418	507	304
15	373	124	107	343	450	45	161	422	485	482
16	293	7	157	386	400	14	113	256	79	221
17	339	8	55	308	347	10	48	164	138	166
5+	27805	27427	27834	39529	31196	31969	28860	23819	27564	24728

Table 10. Catch numbers at age, percent catch numbers at age and mean weight at age of Greenland halibut from the commercial fishery in NAFO SA 2+Div. 3KL, 1975-84.

CATCH NUMBERS AT AGE (x10^3).

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	322	19	464	3016	2182	204	810	236	672	809
6	2719	680	4351	8511	7980	2032	4242	2020	3411	2086
7	5547	3600	9374	9072	11726	8913	9209	5552	9398	5245
8	4781	6030	6377	7662	5611	9429	10753	5064	7206	6894
9	3821	4199	2546	2898	1069	5258	4045	3112	2201	3668
10	1628	2457	879	1454	440	3729	836	1480	663	1130
11	677	923	191	731	262	987	240	524	201	365
12	130	290	113	371	136	125	133	225	73	128
13	269	113	101	225	131	52	40	143	102	95
14	131	36	26	110	84	14	27	70	82	52
15	63	21	18	58	76	9	20	55	65	69
16	41	1	22	54	56	2	13	29	9	26
17	43	1	7	39	44	1	5	14	12	17
5+	20172	18370	24469	34201	29797	30755	30373	18524	24095	20584

PERCENT CATCH AT AGE.

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

WEIGHTS AT AGE (KG).

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	0.609	0.609	0.609	0.609	0.609	0.514	0.392	0.547	0.431	0.394
6	0.760	0.760	0.760	0.760	0.760	0.659	0.598	0.711	0.654	0.607
7	0.955	0.955	0.955	0.955	0.955	0.869	0.789	0.923	0.892	0.856
8	1.192	1.192	1.192	1.192	1.192	1.049	0.985	1.168	1.215	1.134
9	1.580	1.580	1.580	1.580	1.580	1.145	1.335	1.444	1.697	1.507
10	2.209	2.209	2.209	2.209	2.209	1.256	1.700	1.839	2.292	1.998
11	2.699	2.699	2.699	2.699	2.699	1.573	2.460	2.445	3.081	2.700
12	3.371	3.371	3.371	3.371	3.371	2.708	3.507	3.554	4.055	3.568
13	3.884	3.884	3.884	3.884	3.884	3.115	4.794	4.605	5.169	4.585
14	4.563	4.563	4.563	4.563	4.563	4.418	5.944	5.966	6.180	5.848
15	5.918	5.918	5.918	5.918	5.918	5.037	8.055	7.669	7.454	6.982
16	7.144	7.144	7.144	7.144	7.144	7.022	8.710	8.841	8.755	8.482
17	7.887	7.887	7.887	7.887	7.887	10.147	9.576	11.719	11.507	9.740

Table 11. Calculation of partial recruitment for the 1984 Greenland halibut fishery in NAFO Subarea 2 and Division 3KL

Age	1984 Survey index 2J+3K	1984 Commercial catch	% At age research	% At age comm.	Rel. PR	PR	
5	67,580	861	40.88	4.34	0.11	0.04	
6	34,674	2,015	20.98	10.17	0.48	0.15	
7	26,574	4,774	16.08	24.09	1.50	0.48	
8	18,468	6,344	11.17	32.01	2.87	0.92	
9	8,958	3,347	5.42	16.89	3.12	1.00	
10	3,578	1,105	2.16	5.57	2.58	0.83	
11	1,756	467	1.06	2.36	2.23	0.71	
12	1,176	280	0.71	1.41	1.99	0.64	
13	904	128	0.55	0.65	1.18	0.38	
14	790	53	0.48	0.27	0.56	0.18	$\bar{x}$=0.40
15	417	69	0.25	0.35	1.40	0.45	
16	286	38	0.17	0.19	1.12	0.36	
17	136	65	0.08	0.33	4.13		
T =	165,297	19,546					

Table 12. Fully recruited F = 0.05.

POPULATION NUMBERS

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	65960	76054	83630	98414	119261	214140	327161	368768	376919	446729
6	53091	53712	62251	68051	77845	95669	175138	267124	301708	307987
7	31993	41007	43361	47030	48014	56514	76488	139553	216875	243931
8	20487	21175	30316	27019	30296	29700	38205	54291	109232	169059
9	12132	12448	11880	19050	15188	19727	14966	21550	39867	82912
10	5648	6475	6392	7423	12975	11468	11394	8593	14828	30649
11	2637	3151	3078	4438	4762	10225	6015	8572	5696	11540
12	829	1546	1745	2348	2972	3662	7478	4707	6544	4482
13	1183	561	1004	1326	1586	2310	2885	6002	3650	5292
14	669	725	357	730	882	1180	1844	2326	4785	2896
15	268	429	561	269	498	646	954	1486	1841	3843
16	73	163	332	443	168	339	521	763	1167	1448
17	184	23	132	252	314	86	276	415	598	947
5+	195154	217469	245039	276792	314762	444666	663325	884149	1083710	1311715
6+	129194	141415	161409	178378	195501	230527	336164	515381	706792	864986
7+	76103	87703	99158	110328	117655	134858	161026	248257	405083	556999
8+	44110	46696	55798	63298	69641	78344	84538	108704	188208	313068

MEAN POPULATION BIOMASS (KG)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	36313	41974	46024	53426	65182	99709	116083	182762	147097	159373
6	35559	36747	41257	43663	50625	56490	93690	171442	177755	168827
7	25033	33800	32993	36339	35844	40637	51093	114244	171242	187072
8	19233	19170	28904	24482	29365	22127	28650	54555	115994	169952
9	14235	14356	14975	24994	20921	17382	14186	25963	59491	110554
10	9452	10091	11830	13241	25504	10613	16857	12957	30060	54403
11	5515	6421	7278	9868	11302	13811	13123	18368	15605	27761
12	2313	4233	5144	6547	8856	8822	23544	14772	23907	14272
13	3634	1753	3340	4231	5334	6443	12441	24732	16846	21779
14	2465	2919	1418	2770	3460	4696	9858	12372	26556	15205
15	1249	2241	2958	1267	2449	2929	6884	10120	12200	24088
16	307	1050	2075	2678	876	2153	4058	5986	9218	11027
17	1142	158	919	1650	2072	790	2373	4327	6172	8279
5+	156451	174913	199114	225156	261789	286603	392839	652600	812141	972590
6+	120138	132939	153090	171730	196607	186895	276757	469838	665044	813217
7+	84579	96192	111834	128067	145982	130405	183067	298396	487288	644390
8+	59545	62392	78841	91728	110139	89767	131974	184152	316046	457319

FISHING MORTALITY

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	0.005	0.000	0.006	0.034	0.020	0.001	0.003	0.001	0.002	0.002
6	0.058	0.014	0.080	0.149	0.120	0.024	0.027	0.008	0.013	0.008
7	0.213	0.102	0.273	0.240	0.315	0.192	0.143	0.045	0.049	0.024
8	0.298	0.378	0.265	0.376	0.229	0.451	0.373	0.109	0.076	0.046
9	0.428	0.467	0.270	0.184	0.081	0.349	0.355	0.174	0.063	0.050
10	0.384	0.544	0.165	0.244	0.038	0.445	0.085	0.211	0.051	0.041
11	0.334	0.391	0.071	0.201	0.063	0.113	0.045	0.070	0.040	0.036
12	0.190	0.232	0.074	0.192	0.052	0.038	0.020	0.054	0.012	0.032
13	0.289	0.252	0.118	0.208	0.096	0.025	0.015	0.027	0.031	0.020
14	0.244	0.056	0.084	0.182	0.111	0.013	0.016	0.034	0.019	0.020
15	0.300	0.056	0.036	0.273	0.185	0.016	0.023	0.042	0.040	0.020
16	0.970	0.007	0.076	0.145	0.461	0.007	0.028	0.043	0.009	0.020
17	0.297	0.050	0.060	0.186	0.167	0.013	0.020	0.038	0.022	0.020
9+	0.385	0.436	0.189	0.200	0.067	0.269	0.147	0.124	0.049	0.043

WEIGHTED FISHING MORTALITIES

1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
0.1305	0.1108	0.1232	0.1525	0.1159	0.0891	0.0567	0.0243	0.0252	0.0176

Table 13. Fully recruited F = 0.10.

POPULATION NUMBERS

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	57283	63076	74683	79585	78440	124105	176560	188926	189512	223580
6	41577	46608	51625	60725	62430	62247	101424	143822	154466	154552
7	27655	31580	37544	38330	42017	43893	49125	79201	115924	123380
8	17651	17623	22598	22257	23173	23790	27872	31887	59821	86407
9	10697	10125	8972	12732	11289	13896	10946	13090	21525	42457
10	4867	5300	4490	5042	7802	8276	6619	5302	7901	15632
11	2217	2511	2116	2881	2812	5989	3401	4663	3002	5869
12	723	1202	1221	1560	1697	2066	4011	2568	3344	2276
13	917	475	722	897	941	1267	1578	3163	1899	2671
14	530	508	286	500	531	652	990	1256	2460	1462
15	214	315	383	211	310	359	521	786	965	1940
16	65	118	239	297	120	185	286	409	594	731
17	147	16	96	176	194	48	149	222	308	478
5+	164543	179459	204977	225194	231758	286772	383483	475295	561721	661435
6+	107259	116383	130294	145608	153318	162666	206922	286369	372208	437854
7+	65682	69774	78669	84883	90888	100420	105498	142546	217742	283303
8+	38027	38194	41125	46553	48871	56527	56373	63345	101818	159923

MEAN POPULATION BIOMASS (KG)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	31523	34810	41085	43032	42649	57765	62576	93602	73890	79686
6	27626	31854	33933	38607	39990	36526	53733	91984	90475	84413
7	21262	25632	27922	28763	30602	30656	31471	63741	89596	93536
8	16141	15275	20498	19260	21624	17356	19265	30797	61532	84976
9	12143	10950	10775	15905	15334	11235	9616	14841	31261	55277
10	7864	7661	8011	8437	15144	6886	9493	7435	15665	27202
11	4475	4830	4923	6038	6531	7761	7294	9699	8078	13880
12	1990	3175	3543	4129	4960	4904	12521	7877	12144	7136
13	2689	1447	2346	2713	3061	3497	6763	12881	8637	10889
14	1886	2018	1126	1812	2005	2582	5255	6586	13535	7602
15	956	1630	2002	955	1431	1616	3728	5257	6281	12044
16	251	763	1471	1731	561	1169	2200	3150	4674	5513
17	875	112	659	1102	1215	434	1273	2279	3149	4139
5+	129681	140156	158292	172483	185107	182387	225188	350129	418917	486295
6+	98158	105345	117207	129451	142458	124622	162612	256527	345027	406609
7+	70532	73491	83274	90844	102468	88096	108879	164543	254552	322195
8+	49270	47860	55352	62081	71866	57439	77408	100803	164956	228659

FISHING MORTALITY

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	0.006	0.000	0.007	0.043	0.031	0.002	0.005	0.001	0.004	0.004
6	0.075	0.016	0.098	0.168	0.152	0.037	0.047	0.016	0.025	0.015
7	0.251	0.135	0.323	0.303	0.369	0.254	0.232	0.081	0.094	0.048
8	0.356	0.475	0.374	0.479	0.311	0.576	0.556	0.193	0.143	0.092
9	0.502	0.613	0.376	0.290	0.111	0.542	0.525	0.305	0.120	0.100
10	0.462	0.718	0.244	0.384	0.064	0.689	0.150	0.369	0.097	0.083
11	0.412	0.521	0.105	0.329	0.109	0.201	0.081	0.133	0.077	0.071
12	0.221	0.310	0.108	0.305	0.093	0.069	0.037	0.102	0.024	0.064
13	0.392	0.305	0.168	0.324	0.167	0.046	0.028	0.051	0.061	0.040
14	0.319	0.082	0.106	0.279	0.192	0.024	0.031	0.064	0.038	0.040
15	0.393	0.076	0.053	0.362	0.317	0.028	0.043	0.080	0.077	0.040
16	1.192	0.009	0.107	0.224	0.723	0.012	0.052	0.082	0.017	0.040
17	0.387	0.071	0.084	0.279	0.286	0.023	0.038	0.072	0.044	0.040
9+	0.463	0.579	0.272	0.316	0.106	0.448	0.256	0.228	0.095	0.087

WEIGHTED FISHING MORTALITIES

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	0.1588	0.1410	0.1520	0.1935	0.1613	0.1466	0.1040	0.0468	0.0498	0.0355

Table 14. Fully recruited F = 0.15.

POPULATION NUMBERS

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	54392	58750	71701	73312	64840	94117	126392	128990	127045	149198
6	37740	44241	48084	58284	57293	51112	76871	102748	105394	103407
7	26209	28439	35606	35431	40018	39687	40008	59099	82295	83203
8	17651	16439	20026	20670	20799	22154	24428	24423	43362	58874
9	10291	10125	9003	10626	9990	11952	9606	10271	15414	28982
10	4699	4968	4490	4249	6078	7212	5028	4205	5593	10628
11	2169	2374	1844	2881	2163	4578	2530	3360	2104	3979
12	699	1163	1108	1337	1697	1534	2855	1855	2277	1540
13	868	454	690	805	759	1267	1143	2217	1315	1798
14	509	467	270	473	456	503	990	899	1686	984
15	204	298	350	197	288	297	399	786	673	1306
16	64	110	225	270	109	167	235	309	594	492
17	141	15	89	164	172	39	135	181	227	478
5+	155634	167844	192487	208700	204663	234618	290621	339342	387978	444870
6+	101242	109094	120786	135388	139823	140501	164230	210352	260933	295673
7+	63502	64853	72702	77104	82530	89389	87358	107604	155539	192265
8+	37293	36414	37096	41673	42512	49702	47350	48505	73244	109062

MEAN POPULATION BIOMASS (KG)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	29927	32423	39440	39569	35142	43795	44752	63887	49488	53124
6	24981	30223	31491	36921	36444	29875	40422	65514	61386	56276
7	20003	22908	26228	26233	28851	27324	24915	46912	62379	62357
8	16141	13969	17681	17509	19035	15752	16095	22863	43364	56651
9	11549	10950	9368	12863	13471	9156	8074	11113	21846	36851
10	7522	6964	8011	6824	11691	5614	7035	5579	10865	18134
11	4357	4485	4257	6038	4940	5739	5351	6805	5569	9254
12	1914	3054	3198	3442	4960	3598	8846	5577	8224	4757
13	2514	1375	2233	2385	2417	3497	4871	8930	5901	7260
14	1798	1852	1057	1703	1692	1984	5255	4657	9195	5068
15	902	1537	1926	881	1315	1334	2835	5257	4307	8029
16	241	710	1379	1556	485	1057	1800	2347	4674	3676
17	832	104	611	1018	1057	350	1149	1839	2295	4100
5+	122680	130553	146779	156941	161499	149075	171400	251281	289491	325537
6+	92753	98130	107340	117372	126357	105281	126648	187394	240003	272413
7+	67771	67907	75848	80451	89913	75406	86226	121880	178618	216137
8+	47768	44999	49620	54218	61062	48082	61311	74969	116238	153780

FISHING MORTALITY

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	0.007	0.000	0.007	0.047	0.038	0.002	0.007	0.002	0.006	0.006
6	0.083	0.017	0.105	0.176	0.167	0.045	0.063	0.022	0.036	0.022
7	0.266	0.151	0.344	0.333	0.391	0.285	0.294	0.110	0.135	0.072
8	0.356	0.520	0.434	0.527	0.354	0.636	0.666	0.260	0.203	0.138
9	0.528	0.613	0.433	0.359	0.126	0.666	0.626	0.408	0.172	0.150
10	0.483	0.791	0.244	0.475	0.083	0.847	0.203	0.493	0.140	0.124
11	0.423	0.562	0.122	0.329	0.144	0.272	0.111	0.189	0.112	0.106
12	0.230	0.322	0.120	0.366	0.093	0.094	0.053	0.144	0.036	0.096
13	0.419	0.321	0.176	0.369	0.212	0.046	0.039	0.074	0.090	0.060
14	0.335	0.089	0.113	0.297	0.228	0.031	0.031	0.090	0.055	0.060
15	0.417	0.081	0.058	0.393	0.345	0.034	0.057	0.080	0.113	0.060
16	1.243	0.010	0.114	0.249	0.838	0.013	0.063	0.110	0.017	0.060
17	0.407	0.076	0.090	0.302	0.328	0.029	0.042	0.089	0.060	0.060
9+	0.486	0.604	0.300	0.376	0.126	0.564	0.331	0.312	0.136	0.130

WEIGHTED FISHING MORTALITIES

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	0.1689	0.1529	0.1643	0.2120	0.1847	0.1853	0.1423	0.0674	0.0736	0.0537

Table. 15. Fully recruited F = 0.20.

POPULATION NUMBERS

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	52946	56588	70211	70177	58045	79139	101331	99029	95812	112006
6	35822	43057	46313	57064	54727	45549	64609	82230	80864	77836
7	25486	26868	34637	33981	39019	37586	35454	49059	65497	63120
8	17651	15847	18740	19876	19613	21336	22708	20694	35142	45120
9	10088	10125	7518	9573	9340	10980	8937	8862	12361	22252
10	4615	4802	4490	3852	5216	6680	4232	3657	4440	8129
11	2145	2305	1708	2881	1838	3872	2095	2709	1655	3035
12	686	1144	1052	1226	1697	1268	2277	1498	1744	1173
13	844	444	674	759	668	1267	925	1744	1023	1361
14	498	447	261	460	418	428	990	721	1298	745
15	199	289	334	190	277	266	338	786	527	989
16	63	106	218	257	103	158	210	259	594	373
17	137	14	86	158	161	34	128	160	186	478
5+	151179	162037	186244	200455	191123	208564	244233	271408	301142	336617
6+	98233	105449	116032	130279	133078	129425	142902	172379	205330	224611
7+	62412	62392	69719	73215	78352	83876	78293	90149	124466	146775
8+	36926	35524	35082	39233	39332	46290	42840	41090	58969	83655

MEAN POPULATION BIOMASS (KG)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	29129	31229	38617	37838	31391	36817	35848	49033	37287	39843
6	23659	29408	30270	36078	34672	26552	33774	52291	46843	42207
7	19374	21545	25381	24966	27975	25657	21630	38502	48772	46768
8	16141	13315	16268	16630	17739	14947	14494	18388	34273	42488
9	11251	10950	8662	11337	12539	8105	7297	9239	17135	27638
10	7350	6613	8011	6013	9964	4966	5804	4643	8464	13601
11	4297	4312	3924	6038	4144	4726	4379	5357	4314	6940
12	1876	2994	3026	3098	4960	2944	7009	4426	6264	3568
13	2426	1339	2177	2220	2095	3497	3925	6955	4532	5445
14	1753	1769	1022	1648	1535	1685	5255	3692	7024	3801
15	873	1490	1738	844	1257	1193	2389	5257	3320	6022
16	235	682	1332	1468	446	1001	1601	1946	4674	2757
17	807	99	586	976	977	308	1086	1619	1868	4061
5+	119172	125744	141014	149154	149693	132398	144491	201849	224770	245139
6+	90043	94515	102397	111316	118303	95581	108643	152816	187483	205296
7+	66384	65108	72126	75238	83631	69029	74870	100524	140639	163089
8+	47010	43562	46745	50272	55656	43372	53239	62022	91867	116321

FISHING MORTALITY

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
5	0.007	0.000	0.007	0.049	0.042	0.003	0.009	0.003	0.008	0.008
6	0.088	0.018	0.110	0.180	0.176	0.051	0.075	0.028	0.048	0.030
7	0.275	0.160	0.355	0.350	0.404	0.304	0.338	0.134	0.173	0.096
8	0.356	0.546	0.472	0.555	0.380	0.670	0.741	0.315	0.257	0.184
9	0.542	0.613	0.469	0.407	0.135	0.753	0.694	0.491	0.219	0.200
10	0.494	0.833	0.244	0.540	0.098	0.960	0.246	0.593	0.180	0.166
11	0.429	0.584	0.132	0.329	0.171	0.331	0.135	0.241	0.144	0.142
12	0.235	0.329	0.126	0.407	0.093	0.115	0.067	0.182	0.047	0.128
13	0.434	0.330	0.181	0.397	0.244	0.046	0.049	0.095	0.117	0.080
14	0.344	0.093	0.116	0.307	0.251	0.037	0.031	0.114	0.072	0.080
15	0.431	0.084	0.061	0.410	0.361	0.038	0.068	0.080	0.147	0.080
16	1.272	0.010	0.118	0.264	0.912	0.014	0.071	0.132	0.017	0.080
17	0.420	0.079	0.094	0.315	0.355	0.033	0.044	0.101	0.074	0.080
9+	0.498	0.617	0.317	0.417	0.140	0.649	0.387	0.383	0.174	0.174

WEIGHTED FISHING MORTALITIES

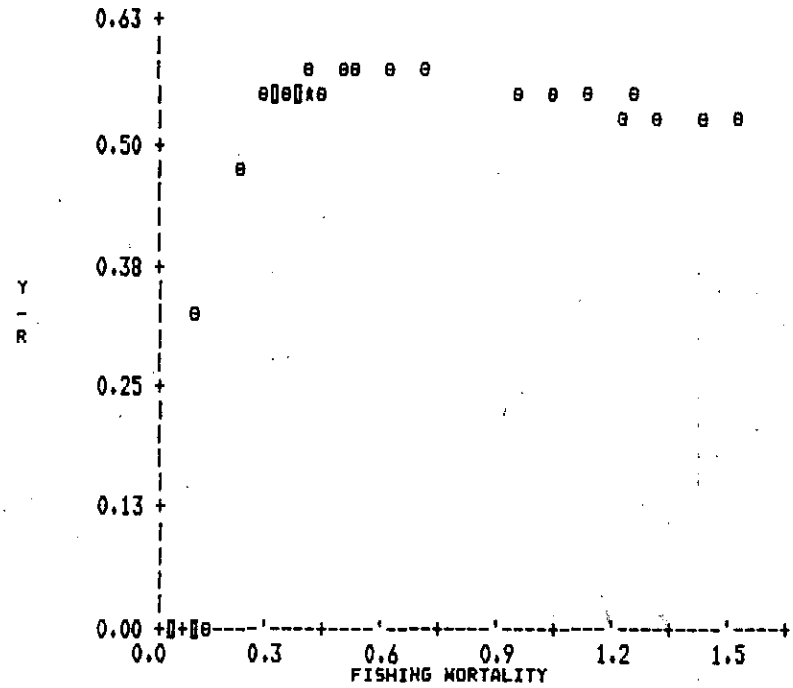
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	0.1745	0.1597	0.1714	0.2229	0.1991	0.2131	0.1735	0.0863	0.0966	0.0722

Table 16. Yield per recruit analysis for Greenland halibut in NAFO SA2+Div. 3KL.

YIELD PER RECRUIT ANALYSIS

	FISHING MORTALITY	CATCH (NUMBER)	YIELD (KG)	AVG. WEIGHT (KG)	YIELD PER UNIT EFFORT
	0.1000	0.174	0.333	1.913	1.725
	0.2000	0.287	0.486	1.693	1.258
F0.1---	0.2813	0.351	0.543	1.548	1.000
	0.3000	0.363	0.552	1.519	0.952
	0.4000	0.417	0.575	1.381	0.744
FMAX---	0.4928	0.454	0.580	1.279	0.609
	0.5000	0.456	0.580	1.272	0.600
	0.6000	0.486	0.577	1.187	0.497
	0.7000	0.510	0.570	1.119	0.422
	0.8000	0.529	0.563	1.065	0.364
	0.9000	0.545	0.556	1.020	0.320
	1.0000	0.559	0.550	0.984	0.285
	1.1000	0.571	0.544	0.954	0.256
	1.2000	0.581	0.539	0.928	0.233
	1.3000	0.591	0.535	0.905	0.213
	1.4000	0.599	0.531	0.886	0.196
	1.5000	0.607	0.527	0.868	0.182

COMPUTED YIELD PER RECRUIT VS. FISHING MORTALITY



Y/R AT F0.1 IS INDICATED BY ▮

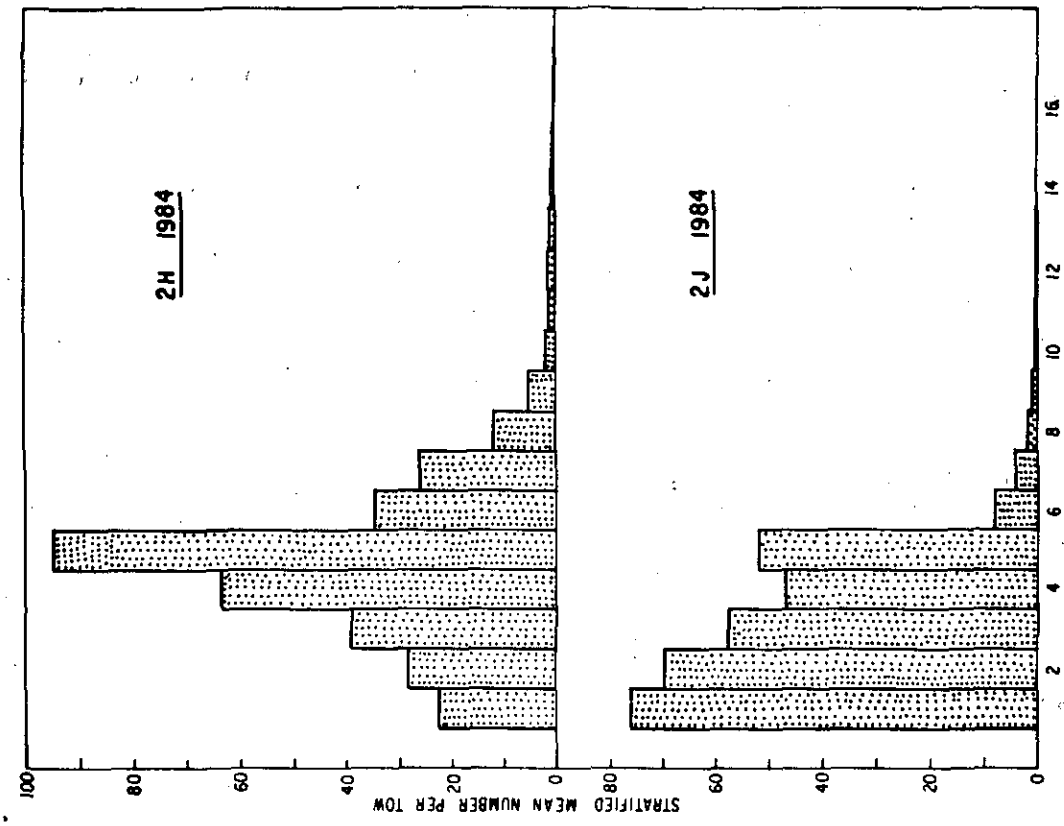


Fig. 2. Age compositions of Greenland halibut from the 1984 shrimp survey in Hopedale (Div. 2H) and Cartwright (Div. 2J) channels off coastal Labrador in 1984.

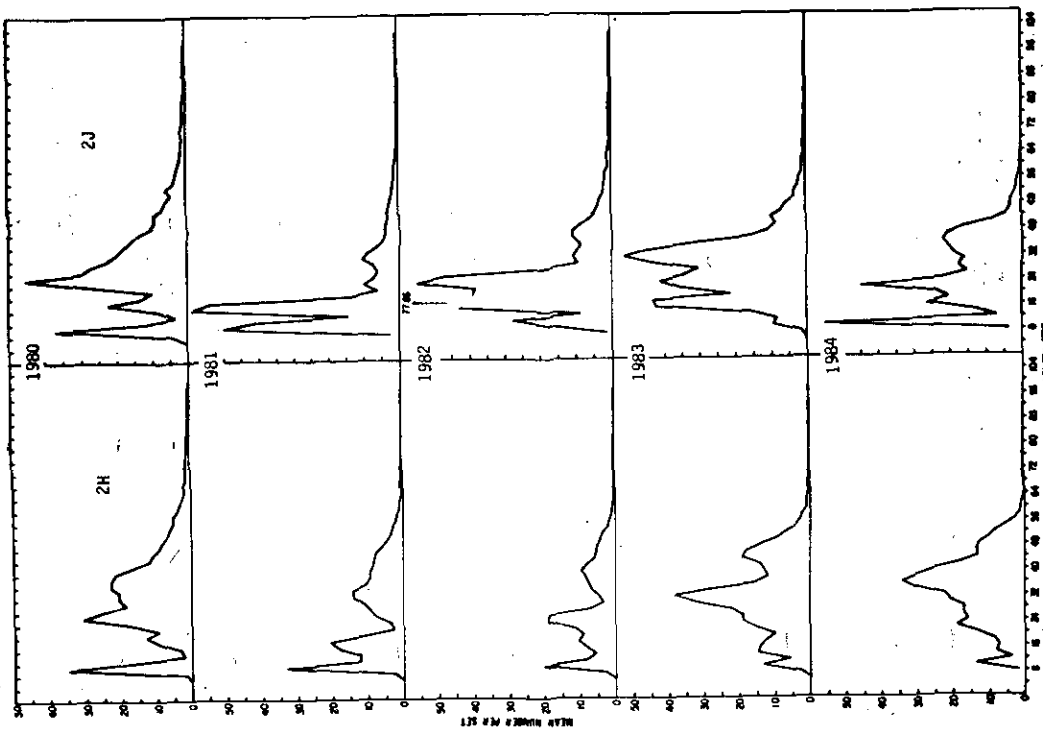


Fig. 1. Length frequency distributions of Greenland halibut from shrimp surveys in Hopedale (Div. 2H) and Cartwright (Div. 2J) channels off coastal Labrador 1980-84.