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The Greenland Halibut Resource in the Labrador and Eastern Newfoundland Area (NAFO Subarea 2 and Divisions 3K and 3L)

by

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Introduction

Catches of Greenland halibut from 1970 to 1976 averaged about 25,000 t-30,000 t annually with the level of 39,000 t in 1978 being the highest catch level since the fishery began in the early 1960's (Table 1). Catches declined steadily from this level to about 15,000 t in 1986 (Tables 1 and 2), the lowest catch since 1965. The low catches in the last couple of years can be attributed in part to the lower than usual levels of effort particularly in the offshore component. Poor catches in the inshore sector during the same period are a result of low gillnet catches particularly in the eastern Newfoundland area which has contributed significantly to the annual catch from this stock over the years (Table 3). It is considered that the anomalous environmental conditions experienced in this area in recent years may have had some effect on catchability or availability with respect to this fishery, however, such effects are difficult to quantify with the present database.

The first TAC (30,000 t) was put into effect on this stock in 1976 based upon average catches and remained through 1979. In 1980, the TAC was raised to 35,000 t based upon indications of good recruitment inferred from results of FRG surveys in Div. 2J. As indications of good recruitment became more apparent supplemented by low fishing mortality in 1981 the TAC was raised to 55,000 t for Div. 2J3KL with a additional allocation of 20,000 t placed upon that portion of the resource in Div. 2GH. With continued low fishing mortality and continued prospects for good recruitment evaluated from Canadian shrimp surveys and groundfish surveys the TAC was further raised to 100,000 t in 1986 and remained in effect for 1987.

It was emphasized in the previous assessment of this resource that this stock undergoes extensive migrations in its life history, with spawning mainly in the northern Davis Strait Area. Younger ages (6-10) which are immature are found to a greater extent in the southern range of the stock and it is these age groups that are being fished. It was advised that a TAC of 100,000 t was not detrimental to the stock provided that fishing mortality is exerted across all commercial age groups throughout the range of the stock by fishing further north and at greater depths. Should such fishing pressure be exerted on a small number of age groups in a fairly localized area a major component of the fishery could be adversely affected.

Research vessel surveys

i) Biomass estimates in Divisions 2J3KL

Results of stratified-random surveys for groundfish in Div. 2J (1977-86) and Div. 3K (1978-86), and Div. 3L (1981-86) are presented in Tables 4, 5, and 6 respectively. For the area surveyed in Div. 2J in 1986 the biomass estimate was 77,550 t compared to 62,603 t in 1985 where coverage was similar (Table 4). On the other hand, the 1985 estimate was believed to be low possibly due to the effects of adverse environmental conditions in as much as their effect upon availability. The estimate for 1986 was very close to the average over the series of surveys and quite similar to the 1983 and 1984 estimates although the 1984 estimate may have been biased downwards due to the exclusion of several important strata.

In Div. 3K, several important strata were missed in the 1986 survey, however, despite this the biomass was about 35% higher than that of 1985 at a level of 106,386 t (Table 5). As with Div. 2J it is very similar to the biomass levels estimated from the 1983 and 1984 surveys.

In Div. 3L, a spring and a fall survey were conducted in 1986, however, for both surveys several important strata for Greenland halibut were not surveyed (Table 6). The spring survey yielded an estimate of 5,897 t compared with 10,610 t in the fall survey. On a stratum by stratum basis the catches per set were not too different between the 1985 and 1986 spring surveys. Although the lack of coverage certainly would account for some of the decrease in the biomass estimate between the 1985 and 1986 fall surveys, however, it is noteworthy that the more important strata common to both years gave consistently lower catches per set in 1986 compared to 1985.

The total biomass for Div. 2J, 3K, and 3L fall surveys combined gave an estimate of about 195,000 t in 1986 compared with 165,000 t in 1985. The average biomass for the three divisions for 1983-84 was about 197,000 t.

As in the past it is important to reiterate the fact that this estimate is minimal since a) the deepwaters of the continental slope are not surveyed where the larger Greenland halibut live, b) catchability for this species could be as low as 15-20% according to experimental evidence and c) the large portion of the stock area i.e. Div. 2GH has not been surveyed since 1981 when biomass levels in these divisions were estimated to be about 200,000 t from 1978-81.

ii) Catch numbers at age from surveys

Stratified mean numbers per tow at age from the fall surveys in Div. 2J and 3K are shown in Table 7 by division for the years 1978-86 inclusive and illustrated in Fig. 1. It is difficult to depict any real pattern in the numbers at age for Div. 2J except that from 1980 a declining trend could be inferred. For Div. 3K, on the other hand, from about 1979 an increasing trend is evident. A combination of the two divisions would appear to cancel any particular trend and suggest some general stability (Fig. 1).

To illustrate the relative size of recruiting year-classes to the commercial fishery (i.e. at age 5) as shown by surveys, a plot of mean numbers caught per set at age 5 from 1978 to 1986 (or 1973-81 year-classes) is presented in Fig. 2. The surveys show a good 1973 year-class followed by average year-classes from 1974 to 1977. The 1978 year-class seems higher than average yet not as high as that of 1973. The 1979 year is the highest in the series followed by the 1980 and 1981 year-classes which are about the same as those of 1974-77. It should be noted, however, that the 1980 year-class is estimated from the 1985 survey where indices are believed to be biased downwards. Furthermore, this year-class has been predicted to be better than average according to evidence from the Labrador shrimp surveys presented in the previous assessment.

Age compositions from the shrimp surveys during 1984-86 are shown in Fig. 3 and 4 for Div. 2H and 2J respectively. In Div. 2H (Fig. 3) a distinct mode at age 5 in 1984 (1979 year-class) dominated the catch. In 1985 a smaller mode was apparent at age 5 (1980 year-class), however, age 1 (1984 year-class) was dominant. The 1979 year-class appeared in relatively small numbers. In 1986, the age 1 catch (1985 year-class) was the highest in the series with age 2 (1984 year-class) being higher than other year-classes at the same age.

In Div. 2J (Fig. 4), considerable numbers were caught for ages 1-5 for all three years and it was somewhat difficult to follow what might be good year-classes. However, in 1984 the dominant age groups were ages 1 and 2 (1983 and 1982 year-classes) and at ages 2 and 3 respectively in 1985 these year-classes still dominated the catch. In 1986, however, the 1985 year-class (age 1) was clearly dominant and as with Div. 2H it was higher than previous year-classes at age 1 for the three years examined.

Commercial data

i) Catch and effort

Due to the nature of this fishery and the migratory behaviour of Greenland halibut it is particularly difficult to obtain catch and effort statistics which may be an accurate reflection of stock abundance. However, available catch rates from Canada (N) from NAFO Div. 2HJ3K can give some indication of when and where good classes are moving through the fishery (Table 8). A detailed discussion of this was presented in the previous assessment and, therefore, will not be repeated here. The data in Table 8 are, therefore, presented mainly as an information item particularly since very little directed catch was experienced in 1986. It can be noted, however, that the catch rate in Div. 2J has declined steadily since 1984 and is now at a level just below the 1982 level.

ii) Numbers and weights at age

The numbers and weights at age from the commercial catch for the 1975-85 period were taken directly from the previous assessment document (NAFO SCR Doc. 86/21). The 1986 catch at age was derived in the usual manner using 43 length frequencies for a total of 77,964 measurements and 25 age/length keys for a total of 7,775 age readings. The catch matrix and weights at age used in subsequent SPA's are presented in Table 9. The sum of products for 1986 indicated a difference of less than 3%.

iii) Partial recruitment

Partial recruitment in the past has usually been derived by comparison of research versus commercial catch at age for this stock despite the limited survey coverage of the resource. Due to the further lack of survey coverage in the 1986 survey the problem was further aggravated and it was decided to abandon this approach for this assessment period. Instead, an average partial recruitment based upon fishing mortalities was calculated for the 1980-86 period where the patterns of F's were considered similar from the previous assessment. The initial fishing mortality matrix was derived using last year's partial recruitment vector and a fully recruited fishing mortality value of F = 0.15. The average F-value at age 8 was then set to 1 assuming age 8 was fully recruited and all other values set proportional to the average of age 8. An average was then calculated for each age. This new vector was used in an iterative procedure until the final PR vector output showed less than a 3% difference form the last input vector. This was then used as the partial recruitment vector for the 1986 fishery.

iv) Fully recruited fishing mortality

As in the recent past, a precise level of fully recruited fishing mortality could not be calculated, therefore, several runs of SPA are presented in Tables 10, 11, and 12 for fully recruited F-values of F = 0.10, 0.15, and 0.20 respectively.

v) Yield per recruit

A Thompson and Bell yield per recruit analysis was performed and the results presented in Table 13. The partial recruitment vector and the mean weights were both from the 1980-86 average. The $F_{0.1}$ value was calculated to be 0.29.

Table 1. Greenland halibut landings (metric tons) by year and country for Subarea 2 and Division 3KL from 1970-86.

	Year																
Country	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85[a]	86[a]
Canada	10706	9408	8952	6840	5745	7807	9306	17967	24692	29940	31774	24125	19248	19031	17283	11979	8076
FRG	13	-	86	707	515	622	927	755	1022	15	55	-	57	2	9	482	16
Poland	8266	5234	6986	9060	7105	8447	5942	5998	5215	1813	203	1806	1111	5258	943	460	177
Iceland	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Norway	-	-	1389	501	117	-	6	15	3	8	1	-	-	15	18	1	-
USSR	7384	9094	10183	8652	9650	9439	6799	4308	5632	1961	238	3325	1471	937	440	149	770
Romania	225	7	120	80	-	-	-	-	3	-	-	-	-	-	-	-	-
GDR	-	647	402	1681	2701	2025	1512	1953	1636	178	316	1350	2487	2587	2498	1850	1867
Den-F	-	-	970	950	4	-	-	350	268	-	-	-	-	-	-	193	451
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	-	2612	2938	3107
Fra-M	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-
Fra-Sp	-	-	-	-	6	48	32	-	5	1	-	-	7	-	-	-	-
Japan	-	-	-	-	-	-	-	-	3	-	12	60	14	-	1003	257	744
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-
Total	26594	24392	29822	28944	27123	28681	24598	31941	38532	34068	32642	30682	26206	27839	24809	18309	15208

[a]Provisional.

Table 2. Catches of Greenland halibut in NAFO SA2+3KL during 1986.

Country		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	UK	Total
CAN(SF)	2H							2							2
	2J	1						14	8	27	2	1			52
	3K	1	1	1	1	1	1	1	1	1		5	2		16
	3L				1	1	1	6	4			21	1		35
EEC														6[a]	6
GDR									216	268	346	592	418	26	1866
Poland								90	67	13	7			582	759
USSR								8	46	81	67	82	459		743
Japan		1							72	35		125	491		724
Portugal															
Norway															
Spain															
Total															
Can(N)															
2H (OT)									29	18					57
2H (GN)									23						23
2J (OT)								147	975	8	1				1132
2J (GN)								2	89	741	207	3			1042
3K (OT)		259	22		3	4	6		35			1	3		333
3K (GN)						48	41	773	995	512	124				2493
3L (OT)					1	9	4		2		117	135	5		273
3L (GN)		3	1	3		161	90	911	693	425	136	9	4		2436
Total															11992

[a]January-June.

Table 3. Landings of Greenland halibut by NAFO Division from 1975-84.

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
1984	214	4663	6368	8432	5132

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,&88 1983	Gadus 101, 102,103 1984	Gadus 116, 117,118 1985	Gadus 131, 132,133 1986
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)	0.98(5)
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)	8.50(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)	108.00(2)
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)	267.50(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)	1.11(7)
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)	4.03(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)	2.18(13)	1.21(7)
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)	189.75(2)
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)	13.67(7)
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)	3.67(3)
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)	103.00(2)
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)	383.00(3)
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)	19.67(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)	8.87(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)	14.85(5)
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)	34.66(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)	108.75(2)
218	217.92(2)	238.14(2)	-	129.50(2)	156.50(2)	40.00(2)	39.00(2)	-	30.25(2)	82.25(2)
219	-	-	-	-	48.00(2)	-	103.00(2)	-	83.75(2)	286.25(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)	2.25(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)	127.00(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)	244.18(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)	20.67(3)
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)	10.41(6)
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)	14.67(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)	102.25(2)
231	64.24(2)	138.57(2)	-	186.50(2)	-	93.75(2)	51.25(2)	98.75(2)	119.75(2)	28.25(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)	12.75(2)
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)	182.75(2)
236	98.06(2)	-	-	-	44.75(2)	66.75(2)	101.00(2)	53.00(2)	85.25(2)	223.90(2)
Biomass (tons)	106,834	85,136	66,970	74,564	76,661	104,233	78,546	81,234	62,603	77,555

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	Gadus 131, 132,133 1986
618							1.50(5)	4.43(6)	0.20(5)
619							1.90(7)	0.57(7)	0.22(5)
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)	12.74(9)
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)	5.01(14)
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)	563.76(2)
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)	179.62(4)
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)	3.60(2)
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)	39.00(3)
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)	155.00(4)
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)	263.60(5)
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)	60.38(4)
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)	54.00(3)
630	27.23(2)	10.78(4)	21.37(4)	117.25(2)	-	67.75(2)	7.73(3)	33.16 (4)	30.75(2)
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)	67.58(4)
632	3.20(7)	2.83(4)	11.69(4)	6.25(2)	7.50(3)	3.43(3)	-	8.57(3)	2.25(2)
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)	19.70(8)
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)	3.72(5)
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)	11.02(6)
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)	3.40(4)
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)	10.95(4)
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)	25.45(4)
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)	7.33(6)
640	32.91(2)	-	59.25(2)	36.00(2)	21.50(2)	-	13.75(2)	18.50(3)	10.25(2)
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	106,386

Table 6. Average wt. (kg) of Greenland halibut per set from research vessel surveys in Division 3L. 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)	W.T. 48 1986 (Spring)	A.N. 72 1986 (Fall)
328	-	-	-	0.20(4)	0.19(6)	0.18(4)	0.00(4)	0.09(8)	0.02(9)	0.52(6)
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)	0.01(9)	0.04(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)	0.00(3)	0.20(3)
343	0.88(4)	-	0.53(3)	0.00(4)	0.03(3)	0.02(3	0.20(2)	0.08(3)	0.00(4)	0.02(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)	0.25(8)	4.63(7)
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)	12.29(7)	6.26(4)
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)	12.40(5)	26.06(3)
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)	0.05(5)	2.94(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)	0.09(12)	0.88(5)
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)	0.00(14)	0.09(9)
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)	0.00(11)	0.00(11
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)	0.00(10)	0.0(7)
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)	0.01(17)	0.14(5)
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)	0.04(5)	1.08(5)
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)	1.55(8)	10.90(4)
368	21.50(2)	28.75(2)	-	17.75(2)	5.75(2)	1.65(2)	35.50(2)	29.00(2)	34.75(2)	6.66(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)	9.17(6)	6.36(3)
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)	0.02(8)	2.30(2)
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)	0.00(6)	0.04(3)
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)	0.0(14)	0.01(9)
384	-	0.00(4)	0.00(3)	0.00(6)	0.00(4)	0.00(6)	0.00(2)	0.00(8)	0.0(6)	0.08(5)
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)	0.01(13)	4.67(8)
386	37.00(3)	21.75(4)	-	12.69(8)	0.35(5)	4.54(5)	7.78(5)	37.50(5)	4.50(6)	8.34(4)
387	67.50(2)	43.67(3)	-	49.00(3)	6.88(4)	6.70(6)	13.83(3)	42.25(4)	11.00(4)	8.00(2)
388	-	2.33(3)	-	24.00(2)	5.67(3)	6.00(2)	67.75(2)	24.75(2)	8.00(2)	-
389	-	7.88(4)	-	19.25(6)	4.57(4)	1.92(5)	17.13(4)	26.80(5)	5.80(5)	9.80(4)
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)	1.44(8)	3.62(6)
391	-	2.75(2)	21.50(2)	18.75(2)	4.75(4)	1.50(2)	4.10(2)	29.75(7)	9.50(2)	8.25(2)
392	-	14.00(2)	15.25(2)	26.50(2)	7.50(2)	5.00(2)	80.50(2)	25.00(2)	14.50(2)	18.00(2)
729	-	-	-	70.75(2)	54.75(2)	4.75(2)	24.00(2)	30.50(2)	-	17.92(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)	-	47.50(2)
736	-		30.00(2)	-	-	32.50(2)	20.75(2)	70.00(2)	-	52.53(2)
	12,722	11,649	6,634	17,548	9,519	8,684	21,713	23,848	5,897	10,610

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	1986
3K	1	0.62	0.54	0.34	1.37	0.22	0.14	0.38	1.23	1.95
	2	7.64	3.20	2.53	4.89	1.35	1.09	1.55	2.99	4.81
	3	15.54	6.18	4.33	9.20	6.75	6.20	4.46	4.92	9.64
	4	13.45	5.39	6.03	5.33	6.63	10.75	11.67	6.32	14.90
	5	13.98	7.83	9.06	7.85	7.58	12.35	23.24	12.44	10.32
	6	11.41	9.57	10.91	11.38	7.46	9.94	9.92	12.69	12.72
	7	7.51	4.83	6.45	7.22	7.31	11.33	6.76	8.10	11.08
	8	2.88	1.72	1.68	2.32	7.29	9.39	3.58	2.49	3.36
	9	1.12	0.61	0.58	0.93	2.22	3.18	2.08	0.90	0.65
	10	0.79	0.49	0.46	0.42	0.56	0.73	0.68	0.66	0.14
	11	0.74	0.32	0.50	0.23	0.34	0.41	0.33	0.30	0.11
	12	0.42	0.30	0.28	0.09	0.24	0.21	0.22	0.21	0.16
	13	0.22	0.26	0.16	0.07	0.15	0.12	0.15	0.09	0.03
	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	0.03
	TOTAL	76.46	41.50	43.41	51.51	48.33	65.90	65.16	53.54	69.90
2J	1	0.45	0.91	0.63	1.88	0.52	0.09	0.12	1.31	0.67
	2	3.36	7.92	0.79	5.68	0.92	0.37	1.62	1.53	0.76
	3	7.79	7.35	2.15	4.15	3.87	1.43	5.79	1.14	0.98
	4	10.66	5.64	3.32	4.04	8.07	3.55	4.24	2.06	2.49
	5	9.80	7.81	5.53	5.82	6.64	6.92	8.26	4.93	4.99
	6	7.07	7.23	6.56	5.68	5.27	6.73	6.93	7.06	8.33
	7	4.87	3.82	5.44	5.52	7.44	7.14	6.45	6.55	8.66
	8	3.00	1.87	2.49	3.53	9.05	5.52	5.99	3.81	3.85
	9	2.24	1.10	1.27	1.68	4.87	2.42	2.44	1.85	1.59
	10	1.73	1.20	0.98	1.03	2.32	0.86	1.18	1.25	0.58
	11	1.31	0.79	1.11	0.97	1.16	0.68	0.59	0.46	0.45
	12	0.83	0.68	0.78	0.46	0.71	0.58	0.39	0.44	0.29
	13	0.59	0.54	0.53	0.23	0.54	0.46	0.33	0.21	0.24
	14	0.19	0.29	0.31	0.14	0.55	0.33	0.31	0.25	0.17
	15	0.13	0.18	0.12	0.09	0.44	0.16	0.21	0.16	0.18
	16	0.10	0.19	0.07		0.17	0.04	0.16	0.09	0.10
	17	0.05	0.07	0.02		0.02	0.00	0.08	0.08	0.03
	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	0.01
	TOTAL	54.21	47.64	32.13	41.15	52.61	37.31	45.08	33.23	34.37
	2J+3K	130.67	89.14	75.54	92.46	100.94	103.21	110.24	86.77	104.27

Table 8. Catch and effort statistics of Greenland halibut in NAFO Div. 2HJ3K from Canada(N) where effort was considered directed in 1979-86.

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
1985	3K	May-Sept.	0.269	-	151
	2J	July-Sept.	0.655	-	1796
	2H	Aug.-Sept.	0.832	-	973
1986	2J	Jul.-Aug.	0.559	-	1098

Table 9. Catch numbers and mean weights at age from the 1975-86 commercial catches.

CATCH NUMBERS AT AGE (x10^-3)

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	322	19	464	3016	2182	204	810	236	766	858	1662	186
6	2719	680	4351	8511	7980	2032	4242	2020	3889	2211	4449	1487
7	5547	3600	9374	9072	11726	8913	9209	5552	10714	5560	4955	4256
8	4781	6030	6377	7662	5611	9429	10753	5064	8215	7308	2933	3380
9	3821	4199	2546	2898	1069	5258	4045	3112	2509	3888	1156	975
10	1628	2457	879	1454	440	3729	836	1480	756	1198	429	313
11	677	923	191	731	262	987	240	524	229	387	133	162
12	130	290	113	371	136	125	133	225	83	136	83	93
13	269	113	101	225	131	52	40	143	116	101	73	46
14	131	36	26	110	84	14	27	70	93	55	40	37
15	63	21	18	58	76	9	20	55	74	73	18	24
16	41	1	22	54	56	2	13	29	10	28	12	15
17	43	1	7	39	44	1	5	14	14	18	2	1
5+	20172	18370	24469	34201	29797	30755	30373	18524	27468	21819	15945	10975

CATCH AT AGE AS PERCENTAGES

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	1.6	0.1	1.9	8.8	7.3	0.7	2.7	1.3	2.8	3.9	10.4	1.7
6	13.5	3.7	17.8	24.9	26.8	6.6	14.0	10.9	14.2	10.1	27.9	13.5
7	27.5	19.6	38.3	26.5	39.4	29.0	30.3	30.0	39.0	25.5	31.1	38.8
8	23.7	32.8	26.1	22.4	18.8	30.7	35.4	27.3	29.9	33.5	18.4	30.8
9	18.9	22.9	10.4	8.5	3.6	17.1	13.3	16.8	9.1	17.8	7.2	8.9
10	8.1	13.4	3.6	4.3	1.5	12.1	2.8	8.0	2.8	5.5	2.7	2.9
11	3.4	5.0	0.8	2.1	0.9	3.2	0.8	2.8	0.8	1.8	0.8	1.5
12	0.6	1.6	0.5	1.1	0.5	0.4	0.4	1.2	0.3	0.6	0.5	0.8
13	1.3	0.6	0.4	0.7	0.4	0.2	0.1	0.8	0.4	0.5	0.5	0.4
14	0.6	0.2	0.1	0.3	0.3	0.0	0.1	0.4	0.3	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	0.2
16	0.2	0.0	0.1	0.2	0.2	0.0	0.0	0.2	0.0	0.1	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	0.0

WEIGHTS AT AGE (KG)

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	0.609	0.609	0.609	0.609	0.609	0.514	0.392	0.547	0.431	0.394	0.591	0.367
6	0.760	0.760	0.760	0.760	0.760	0.659	0.598	0.711	0.654	0.607	0.777	0.608
7	0.955	0.955	0.955	0.955	0.955	0.869	0.789	0.923	0.892	0.856	0.974	0.841
8	1.192	1.192	1.192	1.192	1.192	1.049	0.985	1.168	1.215	1.134	1.284	1.133
9	1.580	1.580	1.580	1.580	1.580	1.145	1.235	1.444	1.697	1.507	1.735	1.628
10	2.209	2.209	2.209	2.209	2.209	1.256	1.700	1.839	2.292	1.998	2.303	2.183
11	2.699	2.699	2.699	2.699	2.699	1.573	2.460	2.445	3.081	2.700	3.027	2.958
12	3.371	3.371	3.371	3.371	3.371	2.708	3.507	3.554	4.055	3.568	3.798	3.977
13	3.884	3.884	3.884	3.884	3.884	3.115	4.794	4.605	5.169	4.585	4.956	5.060
14	4.563	4.563	4.563	4.563	4.563	4.418	5.944	5.966	6.180	5.848	6.257	6.212
15	5.918	5.918	5.918	5.918	5.918	5.037	8.055	7.669	7.454	6.982	7.300	7.781
16	7.144	7.144	7.144	7.144	7.144	7.022	8.710	8.841	8.755	8.482	9.081	9.978
17	7.887	7.887	7.887	7.887	7.887	10.147	9.576	11.719	11.507	9.740	12.028	10.278

Table 10. Fully recruited F 0.10.

POPULATION NUMBERS

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	52033	53769	73546	69910	55343	54201	51339	45941	83288	140095	145943	102709
6	30778	42309	44005	59794	54509	43337	44192	41300	37399	67497	113924	117984
7	23682	22739	34025	32092	41255	37407	33643	32343	31986	27102	53261	89248
8	15317	14370	15360	19375	18066	23166	22562	19212	21456	16494	17158	39123
9	9383	8214	6309	6805	8930	9714	10435	8742	11147	10134	6892	11394
10	4175	4225	2926	2862	2950	6344	3195	4884	4342	6856	4779	4596
11	1856	1945	1236	1600	1028	2017	1820	1860	2659	2871	4529	3524
12	629	907	757	839	649	604	758	1273	1048	1970	2000	3588
13	683	397	480	518	351	408	382	500	839	783	1490	1563
14	409	316	223	302	220	169	287	276	280	581	550	1154
15	167	216	226	159	147	104	126	211	163	145	426	414
16	58	79	158	169	78	52	77	85	123	66	52	333
17	115	11	64	110	89	13	41	52	43	91	29	32
5+	139285	149498	179315	194535	183614	177537	168856	156677	194773	274685	351035	375662
6+	87252	95729	105769	124624	128271	123336	117517	110736	111485	134590	205092	272953
7+	56474	53420	61764	64830	73762	79999	73325	69436	74086	67092	91168	154969
8+	32791	30681	27739	32738	32507	42591	39683	37094	42100	39991	37906	65721
9+	17474	16310	12380	13363	14442	19425	17121	17882	20644	23497	20748	26598
10+	8092	8096	6070	6558	5512	9711	6686	9140	9497	13363	13856	15204

POPULATION BIOMASS (MID-YEAR)

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	28625	29673	40458	37691	29899	25199	18086	22713	32375	49864	77698	34131
6	20183	28893	28679	37964	34521	25230	22700	25912	20911	36480	78543	64578
7	17802	17962	24845	23312	29935	25515	20322	24486	20865	18620	44638	66283
8	13588	11673	12526	16074	16045	16746	14358	17304	18339	12477	18079	38295
9	10213	8094	6890	7287	11950	6713	9030	9079	14982	10736	9832	16033
10	6449	5371	4853	3956	5420	4551	4195	6730	8150	11214	9488	8760
11	3576	3399	2765	2844	2152	2023	3764	3461	7078	6505	12231	9215
12	1700	2261	2124	1888	1750	1312	2175	3699	3687	6132	6732	12754
13	1850	1172	1491	1352	967	1072	1563	1749	3629	3025	6516	7053
14	1380	1226	863	983	708	646	1467	1280	1268	2922	2996	6385
15	697	1099	1161	672	541	454	836	1247	800	635	2755	2829
16	199	511	945	893	258	323	554	545	929	384	376	2935
17	644	71	431	623	452	114	329	464	369	716	308	294
5+	106906	111406	128032	135539	134600	109899	99379	118669	133382	159712	270190	269546
6+	78281	81733	87574	97848	104700	84699	81293	95955	101007	109848	192492	235415
7+	58098	52840	58895	59884	70179	59469	58594	70043	80096	73368	113950	170837
8+	40296	34878	34050	36572	40244	33954	38271	45557	59231	54748	69312	104554
9+	26708	23205	21524	20497	24199	17208	23914	28253	40892	42270	51233	66258
10+	16495	15110	14634	13211	12249	10495	14884	19174	25910	31535	41401	50225

FISHING MORTALITY

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	0.007	0.000	0.007	0.049	0.045	0.004	0.018	0.006	0.010	0.007	0.013	0.002
6	0.103	0.018	0.116	0.171	0.176	0.053	0.112	0.056	0.122	0.037	0.044	0.014
7	0.300	0.192	0.363	0.375	0.377	0.306	0.360	0.210	0.462	0.257	0.108	0.054
8	0.423	0.623	0.614	0.575	0.420	0.598	0.748	0.344	0.550	0.673	0.209	0.100
9	0.598	0.832	0.591	0.636	0.142	0.912	0.559	0.500	0.286	0.552	0.205	0.099
10	0.564	1.029	0.403	0.824	0.180	1.049	0.341	0.408	0.214	0.215	0.104	0.078
11	0.516	0.743	0.187	0.703	0.331	0.778	0.158	0.373	0.100	0.161	0.033	0.052
12	0.259	0.436	0.180	0.671	0.264	0.260	0.216	0.217	0.092	0.079	0.047	0.029
13	0.571	0.377	0.265	0.654	0.532	0.152	0.123	0.380	0.166	0.153	0.056	0.033
14	0.437	0.135	0.138	0.516	0.547	0.096	0.110	0.329	0.460	0.111	0.084	0.036
15	0.541	0.114	0.092	0.516	0.844	0.100	0.194	0.341	0.699	0.816	0.048	0.066
16	1.510	0.014	0.167	0.436	1.591	0.044	0.205	0.475	0.097	0.616	0.292	0.051
17	0.527	0.111	0.128	0.494	0.768	0.089	0.145	0.354	0.427	0.245	0.078	0.035

WEIGHTED FISHING MORTALITIES

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
	0.1937	0.1830	0.1834	0.2359	0.2079	0.2542	0.2509	0.1514	0.1894	0.1076	0.0529	0.0333

Table 11. Fully recruited F 0.15.

POPULATION NUMBERS

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	51057	52781	71260	67371	50561	50398	47330	37888	60663	96867	98232	68506
6	30684	41510	43197	57923	52430	39422	41078	38018	30807	48973	78532	78922
7	23620	22661	33370	31429	39722	35705	30437	29794	29299	21704	38095	60271
8	15197	14319	15296	18839	17524	21911	21168	16587	19369	14294	12739	26706
9	9369	8116	6268	6753	8492	9270	9408	7601	8998	8425	5090	7776
10	4157	4213	2846	2828	2907	5985	2832	4042	3408	5097	3380	3122
11	1843	1931	1226	1534	1000	1982	1526	1562	1970	2106	3089	2379
12	627	896	745	831	595	581	730	1032	805	1406	1374	2409
13	677	396	471	508	345	364	363	477	642	584	1028	1050
14	405	311	222	295	212	164	251	261	261	420	387	776
15	165	213	222	158	142	98	121	181	150	129	294	280
16	58	78	156	165	77	47	72	81	98	56	40	224
17	114	10	63	107	86	12	37	47	40	71	21	22
5+	137973	147437	175342	188743	174092	165940	155353	137573	156510	200132	242301	252443
6+	86916	94656	104082	121372	123531	115542	108023	99684	95848	103265	144069	183937
7+	56232	53146	60885	63449	71101	76120	66945	61666	65041	54292	65537	105015
8+	32612	30484	27515	32020	31379	40415	36508	31873	35742	32588	27442	44744
9+	17415	16165	12219	13180	13855	18503	15339	15286	16373	18294	14703	18038
10+	8047	8048	5951	6427	5363	9233	5932	7684	7375	9869	9613	10262

POPULATION BIOMASS (MID-YEAR)

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	28086	29128	39196	36290	27259	23428	16662	18721	23537	34427	52141	22754
6	20117	28342	28121	36671	33086	22891	21010	23797	16998	26287	53612	43052
7	17747	17895	24273	22732	28592	24164	18002	22344	18648	14403	31231	44189
8	13456	11616	12455	15479	15450	15514	13048	14493	15973	10108	12910	25530
9	10193	7945	6829	7210	11321	6217	7845	7548	11648	8324	6985	10689
10	6412	5346	4689	3883	5335	4098	3629	5303	6200	8011	6564	5840
11	3545	3361	2742	2676	2083	1971	3107	2792	5153	4628	8278	6144
12	1694	2229	2087	1863	1584	1255	2084	2919	2791	4308	4576	8503
13	1826	1167	1461	1317	944	947	1482	1650	2703	2194	4442	4702
14	1365	1204	858	953	674	625	1272	1196	1159	2066	2070	4256
15	690	1082	1137	667	509	424	805	1039	712	529	1881	1886
16	197	504	929	869	252	294	511	516	737	302	269	1956
17	636	70	425	608	430	108	296	417	339	540	216	196
5+	105966	109891	125203	131218	127519	101935	89753	102736	106596	116127	185175	179697
6+	77880	80763	86008	94928	100260	78508	73091	84015	83059	81700	133033	156943
7+	57762	52420	57886	58257	67174	55617	52081	60218	66062	55413	79421	113891
8+	40015	34526	33614	35525	38582	31453	34080	37874	47413	41010	48191	69702
9+	26559	22909	21158	20046	23132	15939	21032	23381	31440	30902	35281	44172
10+	16366	14964	14330	12837	11811	9723	13187	15833	19792	22578	28296	33483

FISHING MORTALITY

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	0.007	0.000	0.007	0.051	0.049	0.004	0.019	0.007	0.014	0.010	0.019	0.003
6	0.103	0.018	0.118	0.177	0.184	0.059	0.121	0.061	0.150	0.051	0.065	0.021
7	0.300	0.193	0.372	0.384	0.395	0.323	0.407	0.231	0.518	0.333	0.155	0.081
8	0.427	0.626	0.618	0.597	0.437	0.645	0.824	0.412	0.632	0.832	0.294	0.150
9	0.599	0.848	0.596	0.643	0.150	0.986	0.645	0.602	0.368	0.713	0.289	0.148
10	0.567	1.034	0.418	0.840	0.183	1.167	0.395	0.519	0.281	0.301	0.151	0.117
11	0.521	0.752	0.189	0.748	0.342	0.799	0.191	0.463	0.138	0.227	0.049	0.078
12	0.260	0.442	0.183	0.680	0.291	0.271	0.225	0.276	0.121	0.113	0.069	0.043
13	0.579	0.379	0.270	0.672	0.545	0.172	0.130	0.403	0.224	0.212	0.082	0.049
14	0.442	0.137	0.139	0.532	0.575	0.099	0.127	0.352	0.504	0.157	0.121	0.054
15	0.546	0.115	0.094	0.520	0.899	0.107	0.201	0.409	0.788	0.983	0.070	0.099
16	1.523	0.014	0.170	0.448	1.632	0.048	0.223	0.501	0.122	0.786	0.408	0.076
17	0.533	0.112	0.130	0.506	0.807	0.094	0.162	0.394	0.465	0.325	0.112	0.052

WEIGHTED FISHING MORTALITIES

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
	0.1958	0.1860	0.1880	0.2445	0.2207	0.2782	0.2799	0.1771	0.2426	0.1556	0.0783	0.0503

Table 12. Fully recruited F-0.20

POPULATION NUMBERS

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	50569	52288	70117	66102	48170	48497	45327	33867	49363	75260	74377	51404
6	30636	41111	42792	56987	51391	37464	39522	36378	27514	39722	60841	59391
7	23589	22623	33043	31099	38956	34855	28834	28519	27956	19008	30521	45787
8	15137	14294	15264	18572	17253	21284	20472	15275	18326	13194	10532	20505
9	9362	8067	6247	6727	8272	9048	8894	7031	7924	7571	4190	5969
10	4148	4207	2805	2811	2886	5806	2650	3622	2941	4217	2681	2385
11	1837	1923	1221	1501	986	1964	1379	1414	1626	1724	2369	1806
12	626	891	739	827	568	570	715	912	683	1124	1061	1819
13	674	395	467	503	342	342	353	465	543	484	798	794
14	404	308	221	291	208	161	233	253	252	339	305	587
15	165	212	220	158	139	95	119	166	144	121	228	214
16	58	78	154	164	77	45	69	80	86	51	33	170
17	114	10	63	107	85	12	35	45	39	61	17	16
5+	137318	146407	173355	185848	169331	160143	148604	128027	137397	162877	187953	190848
6+	86749	94120	103239	119746	121161	111645	103277	94160	88034	87617	113576	139444
7+	56113	53009	60446	62759	69770	74181	63755	57782	60520	47895	52734	80052
8+	32523	30386	27403	31660	30814	39327	34921	29263	32564	28887	22214	34265
9+	17387	16092	12139	13089	13562	18043	14449	13988	14238	15693	11682	13760
10+	8025	8025	5892	6361	5289	8994	5555	6957	6314	8122	7491	7791

POPULATION BIOMASS (MID-YEAR)

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	27817	28855	38565	35589	25939	22542	15950	16728	19123	26711	39363	17066
6	20085	28067	27843	36025	32368	21721	20166	22739	15042	21196	41149	32289
7	17720	17861	23986	22442	27920	23488	16838	21274	17537	12288	24527	33142
8	13390	11588	12420	15181	15153	14895	12388	13082	14782	8902	10318	19148
9	10182	7871	6798	7171	11007	5966	7248	6776	9973	7098	5557	8017
10	6394	5333	4608	3847	5292	3868	3345	4583	5222	6403	5101	4380
11	3529	3343	2730	2591	2048	1945	2778	2456	4189	3688	6302	4608
12	1692	2213	2069	1851	1501	1227	2039	2529	2343	3395	3498	6377
13	1815	1164	1446	1299	933	884	1441	1600	2240	1778	3404	3527
14	1357	1193	856	939	657	615	1175	1154	1104	1638	1606	3192
15	687	1075	1126	664	493	409	790	935	667	475	1444	1415
16	197	502	922	858	249	279	490	502	640	260	216	1467
17	635	70	423	601	419	105	280	393	324	452	170	147
5+	105501	109135	123791	129057	123978	97945	84927	94752	93185	94283	142654	134773
6+	77684	80280	85226	93469	98039	75403	68977	78024	74063	67572	103291	117708
7+	57599	52213	57384	57444	65671	53681	48811	55285	59021	46376	62143	85418
8+	39879	34351	33397	35002	37751	30194	31973	34011	41484	34087	37616	52277
9+	26489	22763	20977	19821	22598	15298	19585	20929	26702	25186	27298	33129
10+	16306	14893	14180	12650	11592	9332	12337	14153	16729	18088	21741	25112

FISHING MORTALITY

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
5	0.007	0.000	0.007	0.052	0.051	0.005	0.020	0.008	0.017	0.013	0.025	0.004
6	0.103	0.018	0.119	0.180	0.188	0.062	0.126	0.063	0.170	0.063	0.084	0.028
7	0.301	0.193	0.376	0.389	0.404	0.332	0.435	0.242	0.551	0.390	0.198	0.108
8	0.429	0.628	0.619	0.609	0.445	0.673	0.869	0.456	0.684	0.947	0.368	0.200
9	0.600	0.856	0.599	0.646	0.154	1.028	0.698	0.672	0.431	0.838	0.364	0.198
10	0.569	1.037	0.425	0.848	0.185	1.237	0.429	0.601	0.334	0.377	0.195	0.156
11	0.523	0.756	0.190	0.772	0.348	0.810	0.214	0.527	0.169	0.285	0.064	0.104
12	0.261	0.446	0.185	0.684	0.307	0.278	0.230	0.318	0.145	0.143	0.090	0.058
13	0.582	0.380	0.273	0.682	0.551	0.184	0.134	0.415	0.270	0.261	0.107	0.066
14	0.444	0.138	0.139	0.540	0.590	0.101	0.137	0.365	0.529	0.198	0.156	0.072
15	0.548	0.116	0.095	0.522	0.929	0.111	0.205	0.455	0.841	1.097	0.091	0.132
16	1.526	0.014	0.171	0.454	1.654	0.050	0.232	0.516	0.141	0.915	0.510	0.102
17	0.534	0.113	0.130	0.512	0.828	0.096	0.171	0.417	0.486	0.388	0.142	0.070

WEIGHTED FISHING MORTALITIES

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
	0.1968	0.1876	0.1904	0.2490	0.2277	0.2920	0.2972	0.1937	0.2814	0.1988	0.1030	0.0676

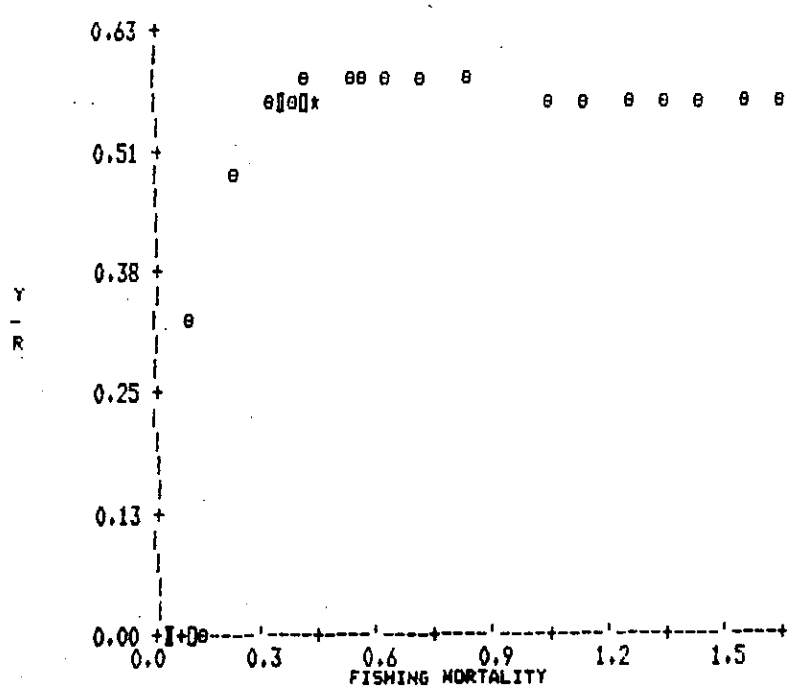
Table 13. Yield per recruit analysis.

AGE	WEIGHT-AT-AGE	PARTIAL RECRUITMENT
5	0.462	0.020
6	0.659	0.140
7	0.878	0.540
8	1.138	1.000
9	1.484	0.990
10	1.939	0.780
11	2.606	0.520
12	3.595	0.290
13	4.612	0.330
14	5.832	0.360
15	7.183	0.660
16	8.696	0.510
17	10.714	0.350

YIELD PER RECRUIT ANALYSIS

	FISHING MORTALITY	CATCH (NUMBER)	YIELD (KG)	AVG. WEIGHT (KG)	YIELD PER UNIT EFFORT
	0.1000	0.170	0.325	1.911	1.750
	0.2000	0.282	0.478	1.694	1.288
F0.1---	0.2929	0.354	0.543	1.532	1.000
	0.3000	0.359	0.546	1.521	0.982
	0.4000	0.414	0.573	1.386	0.773
	0.5000	0.454	0.581	1.281	0.627
FMAX---	0.5314	0.464	0.581	1.253	0.590
	0.6000	0.484	0.580	1.199	0.521
	0.7000	0.508	0.576	1.134	0.444
	0.8000	0.527	0.571	1.083	0.385
	0.9000	0.543	0.566	1.042	0.339
	1.0000	0.556	0.561	1.009	0.303
	1.1000	0.568	0.557	0.982	0.273
	1.2000	0.578	0.554	0.959	0.249
	1.3000	0.586	0.551	0.939	0.228
	1.4000	0.594	0.548	0.922	0.211
	1.5000	0.602	0.546	0.907	0.196

COMPUTED YIELD PER RECRUIT VS. FISHING MORTALITY



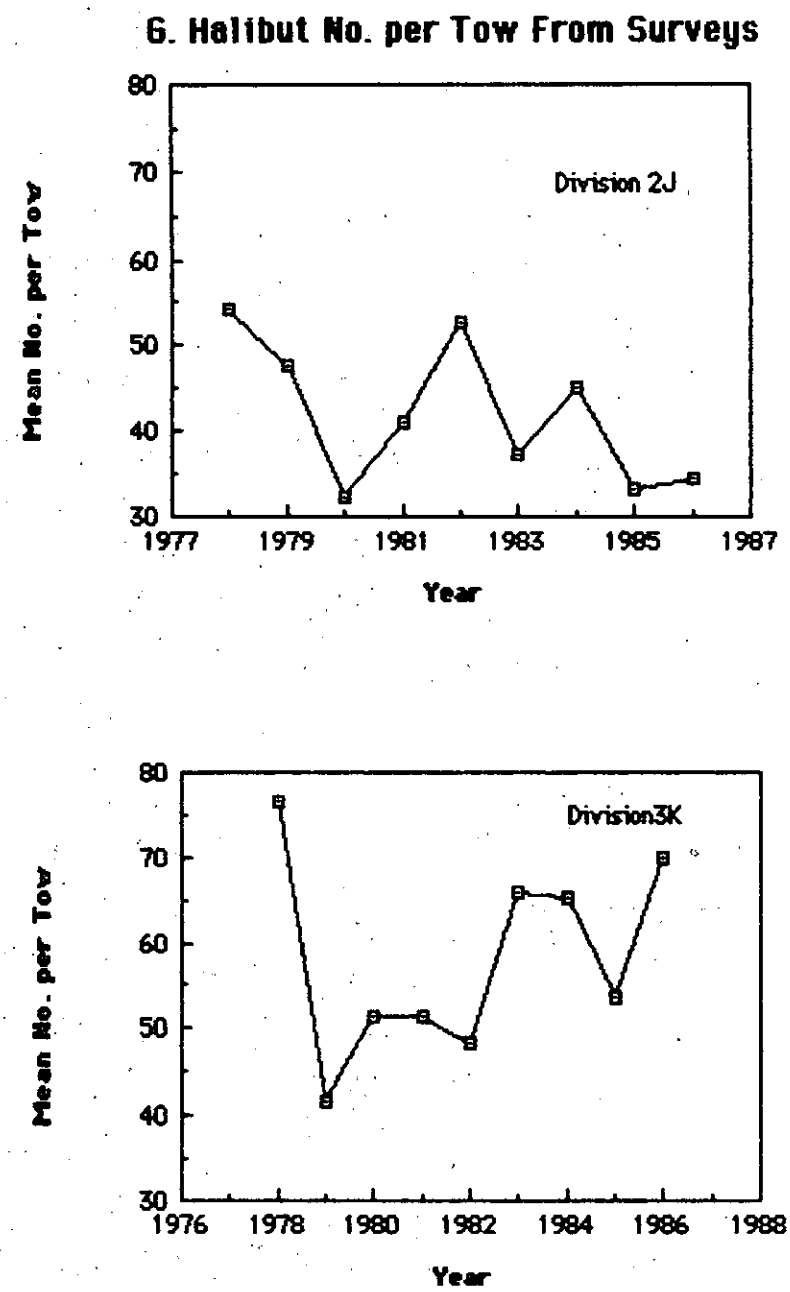


Fig. 1 Stratified mean number per tow of G.halibut from surveys in Divisions 2J and 3K, 1978-1986.

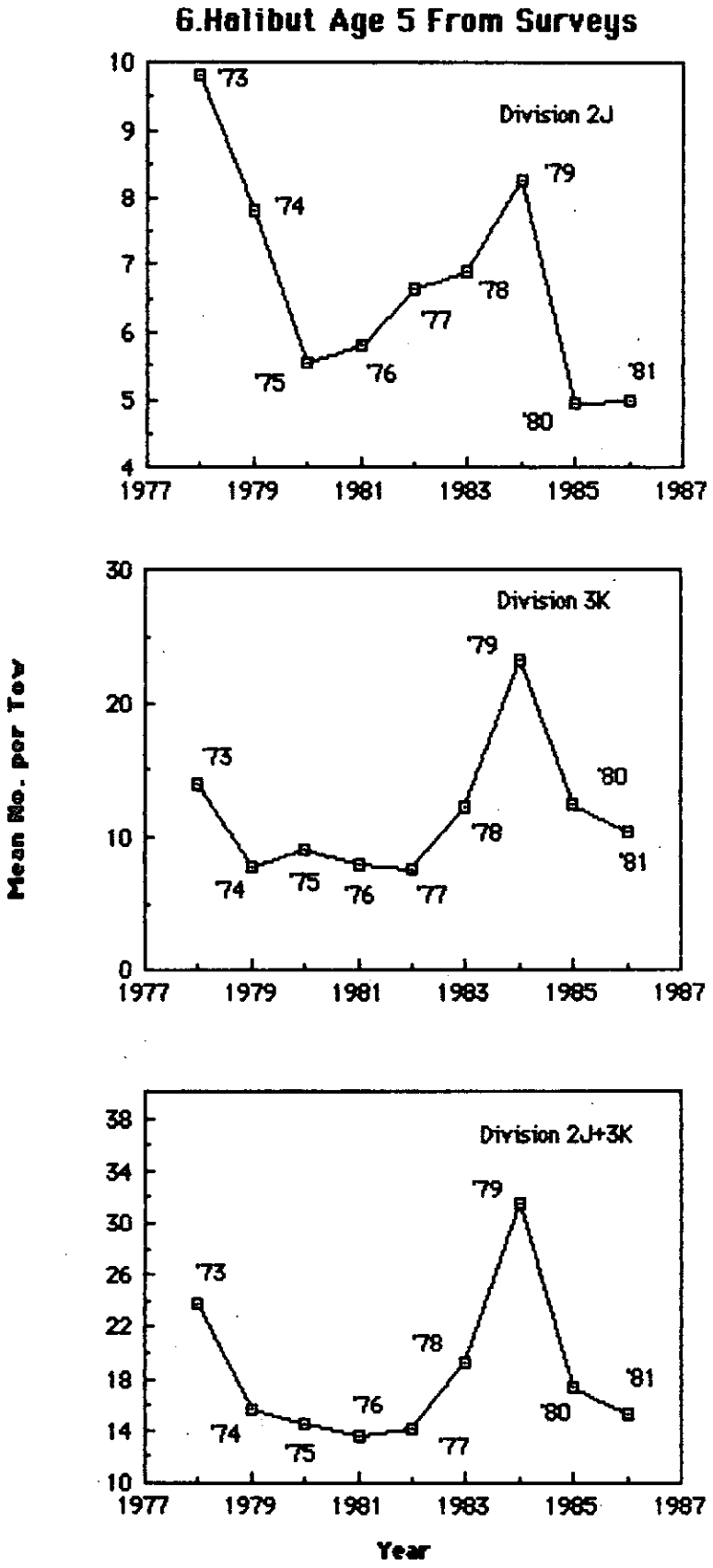


Fig. 2 Mean number per tow at age 5 from surveys in Divisions 2J and 3K, 1978-1986 (Nos. in plots indicate year-classes).

6. Halibut From Shrimp Surveys in Div. 2H

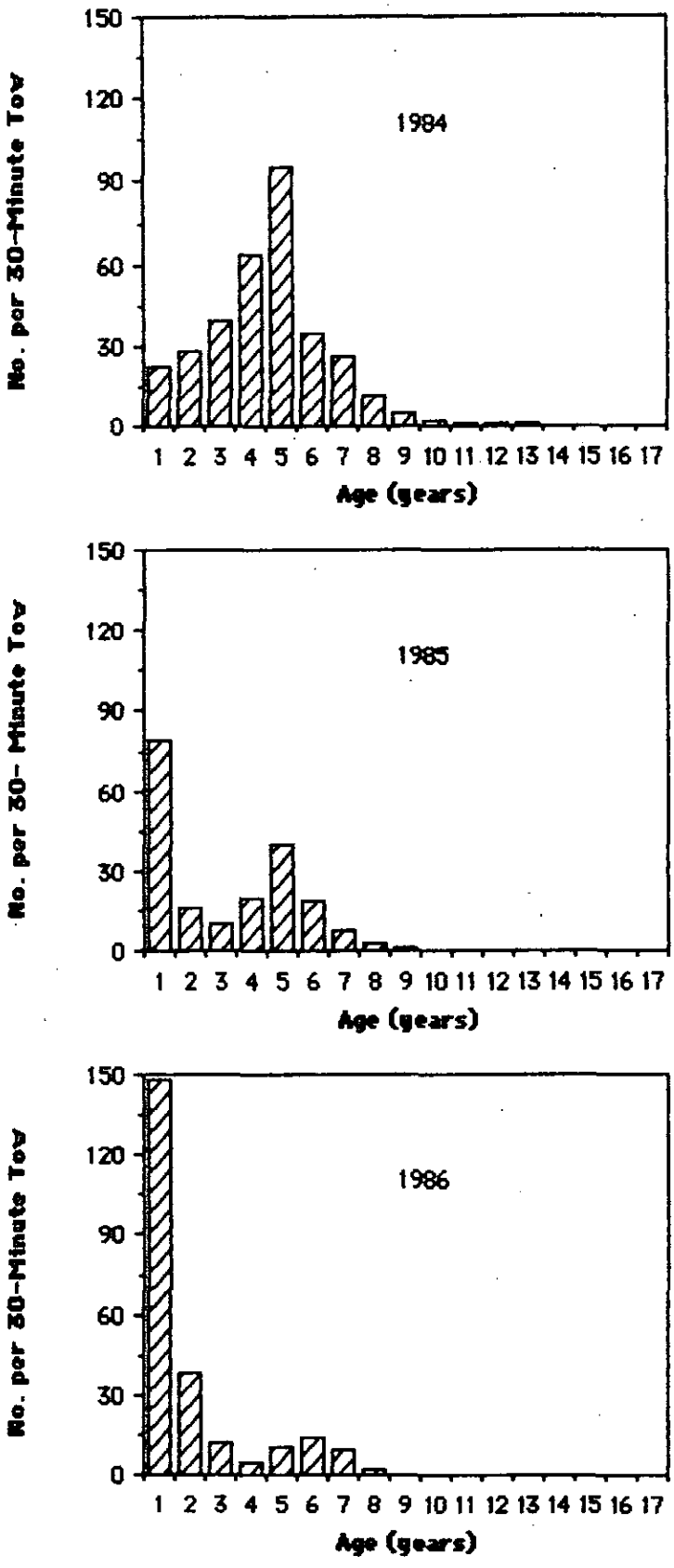


Fig. 3 Mean number at age of Greenland halibut per tow from shrimp surveys in Div. 2H, 1984-1986.

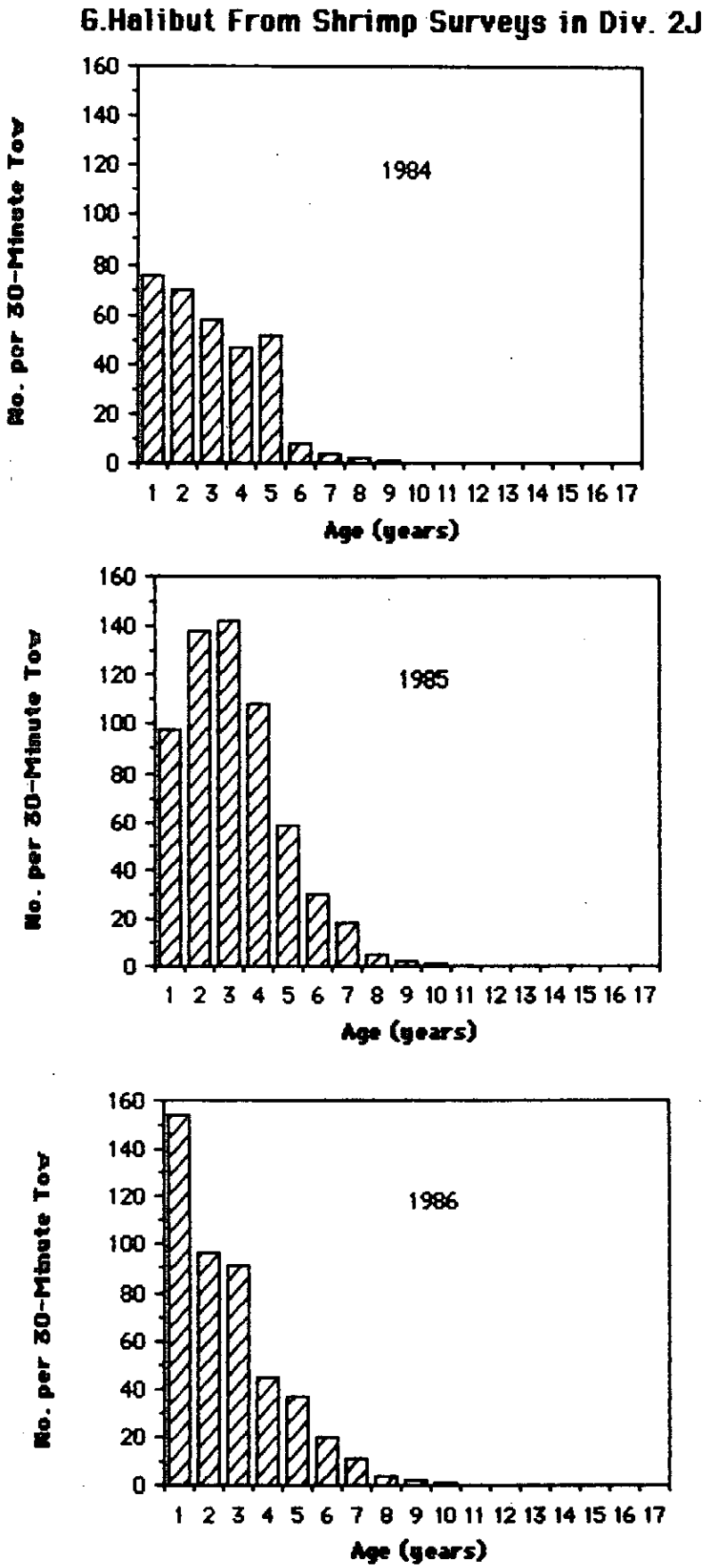


Fig. 4 Mean number at age of Greenland halibut per tow from shrimp surveys in Div. 2J, 1984-1986.