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Stock assessment and abundance of Greenland halibut in the Canadian North Atlantic (Subarea 2 and Divisions 3K and 3L)

by

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Landings and effort

Landings from 1970-77 have been generally stable in this fishery from year to year averaging around 30,000 t annually (Table 1). However, during the last couple of years landings have been well over 30,000 t. The highest landings ever from this stock have been recorded in the last two years at 38,203 t in 1978 and 33,958 t in 1979. The total landings, however, are not a true reflection of stock status since landings from the foreign fleet which comprised a substantial portion of the catch have been phased out. What is probably the better reflection is the trend shown by the Canada (N) landings which are essentially by gillnet fishermen. While the effort from gillnet fishermen has probably not increased to any large extent over the last four years, the landings have increased to about 3 times the 1976 level. With the phasing out of the foreign fleet, effort is totally Canadian (as of 1980). While Canadian effort is primarily by gillnet fishermen on the northeast coast of Newfoundland and more recently inshore fishermen of southern Labrador, effort has also picked up considerably by offshore Canadian trawlers. The Canadian offshore effort is mainly in the Funk Island Deep area in Division 3K where catch rates have also been increasing substantially since 1976 (Table 2). Catch per hour has increased from 0.187 t in 1976 to 0.780 t in 1979.

Research Surveys

NAFO Divisions 2GH - Age composition

In September of 1978, a research survey was conducted in NAFO divisions 2G and 2H by the Canadian research vessel "Gadus Atlantica". Since the area was not stratified, sets were made at fixed intervals across various depth ranges in the fishable region of both divisions. In August of 1979, the same survey was conducted by the same vessel, however, during 1979 with the knowledge gained during the 1978 survey, more sets were possible to be made in the area still within the previous depth range. Since the area was not stratified, it was not possible to calculate estimates of biomass, however, in order to make the two surveys comparable, the numbers caught at age were computed and standardized to average numbers at age caught per 30-minute set for each NAFO division separately. The results of Division 2G is presented in Fig. 1 and Division 2H in Fig. 2.

In Division 2G as indicated in previous assessments there was a larger percentage of older age groups comprised mainly of the commercial age classes, however, pre-recruiting year-classes were also present in large numbers (Fig. 1). Most startling is the large increase in CPUE in 1979 from the 1978 survey. While it is obvious that the increase is not real it does suggest a possible influx of year-classes from other areas possibly from statistical area "0". It should also be noted that there were more sets made in 1979 as opposed to 1978 which may have influenced the numbers presented.

In Division 2H, the difference in apparent abundance is even more marked (Fig. 2). What is most important in this presentation is that 1975, 1976 and 1977 year-classes appear in extremely high numbers much higher than any of the partially-recruited or fully recruited year-classes. Considering the year-class strengths indicated by Bowering, (1979), this is probably very significant.

Division 2J - Age composition

During November-December of 1977, 1978 and 1979 a stratified-random biomass survey was conducted each year in NAFO Division 2J. Unfortunately, the total area was not surveyed in each year. In order to compare the three surveys, the numbers caught at age were calculated for all strata that were surveyed in each year. The results are presented in Fig. 3 as average numbers at age caught per set. The age composition and abundance per set are not all that different for the three surveys. However, as in the Division 2H surveys the notable point is that the pre-recruiting year-classes in the 1979 survey, particularly the age-groups 2 and 3 are considerably more abundant than in the previous surveys.

Abundance indices from surveys

During the past three years, with the acquisition of the research vessel "Gadus Atlantica", several stratified random biomass surveys have been conducted in the northern regions with particular reference to NAFO Divisions 2J, 3K and 3L. It was not always possible to fish the total area due to various reasons. In most cases a survey was conducted in the shallower waters (< 400 meters) or in the deeper waters (> 300 meters). Average numbers and weights per set were calculated for all these surveys. The results for the surveys in Division 2J are presented in Tables 3 and 4, for Division 3K in Tables 5 and 6 and Division 3L in Tables 7 and 8. All strata are presented in the tables in order to indicate those that were and those that were not fished. The numbers in brackets signify the number of sets fished in each stratum.

While very few of the surveys are complete, it is obvious that the stock is most abundant in Division 2J and 3K with 3L being the southern limits of the stock and much less abundant in this division. The most thorough survey is by far Gadus 12 in 1978 which indicated a minimum trawlable biomass of about 200,000 t for the three divisions not to mention Division 2GH which is a major part of the stock area.

In order to obtain some gross estimates of biomass for the three divisions, all surveys were adjusted up to total division area and a total biomass for each division calculated. It should be pointed out that these estimates are crude and are biased depending upon if the survey was directed towards more shallow waters or deeper waters. The deepwater surveys would tend to overestimate whereas the shallow water surveys would tend to underestimate (Table 9).

Whichever surveys are taken into consideration, it is apparent from Table 9 that a crude average estimate of minimum trawlable biomass from the three divisions combined might be in the vicinity of 200,000 t. If this were combined with biomass estimates from 2GH, the total could easily exceed 300,000 t since GDR surveys indicate that Greenland halibut are probably more abundant in these divisions than in the more southerly divisions of the stock area.

Cohort analysis

Calculation of numbers

From 1975 to 1979 samples were available from the inshore gillnet portion of the fishery from every year and the inshore landings were broken down accordingly in the usual manner. For the offshore segment of the fishery, samples were available from the Canadian trawler fishery for each year with some samples from Poland, GDR and the USSR which comprise the rest of the fishery. For landings where samples were unavailable they were broken down by age-length keys from the same area and taken at a time closest to when the landings were taken. This was more the exception than the rule. I am confident that the numbers calculated are a fair representation of the fishery as a whole. The catch matrix is presented in Table 10.

Estimation of Terminal F

With the lack of a lengthy time series of catch and effort data or survey data it was virtually impossible to calculate a precise level of terminal F. Several attempts were made at calculating an estimated F.

a. Since CPUE data were available from the Canadian trawler fishery the numbers at age per unit of fishing effort were calculated for 1976-79. From these figures, survival percentage and mortality levels were computed between the years (Table 2). These calculations gave a very wide range of F's which were not considered very reliable for a couple of reasons: 1. With the influx of very strong year-classes the survival values are not reflecting a major portion of the landings, consequently, the total mortality would be overestimated. 2. With the large increase in CPUE it is possible that a learning factor may be involved.

b. A catch curve was computed on the total numbers removed from 1976-79 numbers at age for age 7+ (Table 2). This yielded a value of F=0.44 for M=0.20. This would represent average removals from about 1967 onwards when average removals were about 30,000 t. This estimate would also tend to be a maximum estimate for several reasons: 1. This would represent year-classes in the fishery for most years where year-class strength did not appear near that of recent years. 2. Because of very strong year-classes in the most recent data the slope of the catch curve ($\bar{Z}$) would tend to be larger than normal. 3. It has been well documented that there is an emmigration factor involved in this fishery where the older maturing fish would tend to move away from the fishing zone. If these fish were present then the numbers at older ages would be higher resulting in a lower slope.

c. Catch numbers per unit of effort for the 1967 and 1968 year classes were calculated for 1976-1979 in

order to follow these cohorts through the main portion of the fishery. Catch curves were constructed for these year classes separately and the results are presented in Table 11. The correlation was good in both cases with fishing mortalities very close. The best relationship was in the 1968 year-class which yielded an F value of F=0.44 the same as in the long term average. While this value is an average over the more recent years i.e. 1976-79 it is also most likely to be an upper estimate since it does not reflect the large year classes in the fishery in the last couple of years which comprise most of the fishery.

d. The final attempt at estimating fishing mortality was by research vessel data. The three surveys in NAFO Division 2J from 1977-79 were combined to give average numbers at age per set weighted by stratum area which should be a reflection of the existing population. A catch curve on age 7+ gave an F = 0.38, somewhat lower but within the same general vicinity as the previous estimates (Table12). This estimate as with the others is also an upper estimate for much the same reasons. From the several estimates made the average F over the past few years would appear to be about 0.40 which I would consider to be very inflated considering the proportions of the younger age groups making up the 1979 landings particularly.

Partial Recruitment

Because of the obvious change in exploitation pattern over the last couple of years due to changes in year class strength, average exploitation pattern was not considered to be a reliable estimate of partial recruitment. It was felt therefore that a very recent empirical estimate of partial recruitment pattern would be required to run the cohort analysis with any degree of reliability. The partial recruitment pattern was therefore derived by comparing the population estimates at age derived from the 1979 research surveys in Divisions 2J3KL with the numbers at age computed from the 1979 commercial landings (Table 13). The values and the partial recruitment curve are plotted in Fig. 4. The partial recruitment curve is clearly dome-shaped which is expected considering the nature of this fishery. First of all, the emmigration of the larger maturing fish into deeper water would reduce the exploitation coefficient in the older fish. Secondly, this fishery is now primarily prosecuted by inshore gillnet fishermen which do not fish the larger fish. A third factor which may not be quite as significant is that the relatively small mesh gillnets may not select the large fish even if they did come in contact with the gear.

Average Weights

Average weights were derived by computing a weighted mean length at age from all samples available from the 1979 fishery. These mean lengths at age were then put into a length-weight equation in order to calculate a mean weight at age. These mean weights were used to compute biomass estimates in the cohort analyses as well as in the catch projections for 1980 and 1981 (Table 14).

Yield per recruit

Using the partial recruitment vector derived from the Commercial-Research data comparison and the average weights at age derived from the 1979 commercial catch data, a yield per recruit curve was generated (Fig. 5). The $F_{0.1}$ level on this curve was 0.525 with F_{max}=1.55. The $F_{0.1}$ was expectedly high since the exploitation pattern in the older age groups is low.

Cohort runs

Due to the uncertainty connected with estimating terminal F, a series of cohort runs were made with F_t ranging from 0.25 to 0.50 at increments of 0.05. The fishing mortality matrices from these runs are shown in Table 15. The population numbers, biomass calculations and selected fishing mortality computations are shown in Table 16 for F_t=0.25 to 0.50 at increments of 0.05.

While there were only three points available, attempts at running regressions of CPUE against biomass and F against effort for the various levels of terminal F were made. The r^2 values for all the regressions were greater than 0.85, however, the ratios of the predicted values to the calculated values in the cohort analyses were nearly the same for each of the six regressions of CPUE against biomass and nearly the same for each of the regressions of F against effort.

Catch projections

Since there were no data available to quantify recruitment at age 5, geometric means of age 5 from the population numbers generated by the cohort analyses were used in the projections. The means were taken over 1976-78 since the 1975 data did not reflect the strong year classes entering the fishery. Projections were made for all levels of terminal F from F=0.25 to F=0.50 at increments of 0.05. The population numbers for 1981 projections were derived from residual numbers of 1980 assuming the TAC of 35,000 t will be taken. The 1981 projections were projected at a fishing mortality on fully recruited groups of $F_{0.1}$=0.525. The projections for 1981 are shown in Table 17. A summary of projected TAC's for 1981 are shown in Table 18 at varying levels of terminal F in 1979.

Table 1. Greenland halibut landings (MT), by country, by year, 2+3KL

Country	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	Totals
CAN (MQ)	1	2				25	221	229	1182	1854	3514
CAN (N)	10,705	9406	8952	6840	5745	7782	9085	17,738	23,205	28,122	127,580
CUBA											
DEN (F)			970	950	4			350	268		2542
DEN (G)				65	2						67
DEN (M)											
FRA (M)					5						5
FRA (St. P)					6	48	32				86
FRG	13		86	707	515	622	927	755	1022		4647
GDR			402	1681	2701	2025	1512	1953	1636	98	12,008
ICE		2									2
JAP									3		3
NOR			1389	501	117		6	15	3		2031
POL	8266	5234	6986	9060	7105	8447	5942	5998	5215	1805	64,058
POR				207	161	231	73	119		31	822
ROM	225	7	120	80					3		435
SPA			3				1				4
USSR	7384	9094	10,183	8662	9650	9439	6799	4308	5613	1925	73,057
UK			731	201	1112	62		476	53		2635
Other		647								123	770
Totals	26,594	24,392	29,822	28,984	27,123	28,681	24,598	31,941	38,203	33,958	264,266

Table 2. Greenland halibut CPUE at age 2+3KL 1976-1979.

Age	1976 Nos. caught at age (000's)	1976 C/ 1000 hr. (nos.)	1977 Nos. caught at age (000's)	1977 C/ 1000 hr. (nos.)	1978 Nos. caught at age (000's)	1978 C/ 1000 hr. (nos.)	1979 Nos. caught at age (000's)	1979 C/ 1000 hr. (nos.)	(000's) Total nos. removed 1976-1979
4	1	8	18	140	176	1838	52	1194	247
5	19	144	464	3603	3016	31,500	2182	50,119	5681
6	680	5170	4351	33,783	8511	88,891	7980	183,297	21,522
7	3600	27,368	9374	72,783	9072	94,750	11,726	269,340	33,772
8	6030	45,842	6377	49,513	7662	80,023	5611	128,882	25,680
9	4199	31,922	2546	19,768	2898	30,267	1069	24,554	10,712
10	2457	18,679	879	6825	1454	15,186	440	10,107	5230
11	923	7017	191	1483	731	7635	262	6018	2107
12	290	2205	113	877	371	3875	136	3124	910
13	113	859	101	784	225	2350	131	3009	570
14	36	274	26	202	110	1149	84	1929	256
15	21	160	18	140	58	606	76	1746	173
16	1	8	22	171	54	564	56	1286	133
17	1	8	7	54	39	407	44	1011	91
Landings (MT)	24,598		31,941		38,203		33,958		107,084
CPUE	0.187		0.248		0.399		0.780		
Effort (hr.)	131,540		128,794		95,747		43,536		
Palaheimo Z's			$Z_{8+} = 1.26$		$Z_{8+} = 0.25$		$Z_{8+} = 0.99$		
			$Z_{7+} = 0.52$				$Z_{7+} = 0.26$		
Catch curves									Catch curve on total
Ages	8-15		7-17		7-17		7-17		$r^2 = 0.98$
r^2	.98		.96		.98		.88		Int. = 14.89
Int.	16.19		14.16		13.26		12.09		Slope = -0.64
Slope	-0.88		-.74		-.59		-.53		

Table 3. GADUS 2J Greenland Halibut Average number per set

Stratum	Gadus 3 1977	Gadus 12 1978	Gadus 15 1978	Gadus 27 1979	Gadus 29 1979
201	5.00(2)		1.00(3)		1.50(2)
202	39.00(2)	33.00(2)	49.50(2)	66.00(2)	22.50(2)
203	22.00(2)	66.00(2)		157.50(2)	
204	129.50(2)	105.50(2)		622.50(2)	
205	47.00(4)		19.25(4)		16.50(2)
206	27.09(11)		28.86(7)		11.38(8)
207	125.00(5)		47.00(4)		18.40(5)
208	206.75(4)	105.00(2)	232.00(3)	111.50(2)	164.50(2)
209	91.86(7)	54.50(2)	38.25(4)	235.50(2)	90.88(5)
210	14.00(6)	13.00(3)	8.00(4)	14.00(2)	4.50(2)
211	24.00(2)	105.00(2)	84.00(2)	58.00(2)	66.00(2)
212	88.72(4)	131.50(2)		206.50(2)	
213	10.12(8)	10.67(3)	11.50(4)	5.33(3)	3.25(4)
214	20.17(6)	16.67(3)	36.50(4)	11.00(2)	5.75(4)
215	36.00(4)	7.33(3)	37.40(5)	3.50(2)	10.50(4)
216	45.00(2)	88.50(2)		98.00(2)	52.00(2)
217	47.67(3)	60.50(2)		22.00(2)	
218	40.00(2)	89.00(2)			
219					
220		15.50(2)			
221					
222	33.25(4)	49.00(2)	21.33(3)	38.50(2)	5.50(2)
223	70.00(2)	28.50(2)		15.00(2)	
224	41.50(2)	20.00(2)		29.00(2)	
225	6.00(2)				
226		2.00(2)			
227	43.50(4)	53.00(2)		11.75(2)	
228	2.37(8)	3.33(3)		6.50(2)	4.75(4)
229	13.17(4)	7.50(2)	8.00(2)	9.00(2)	19.50(2)
230	70.93(3)	25.50(2)			
231	24.50(2)	52.50(2)			
232	12.50(2)	11.00(2)			
233					
234	147.00(2)	340.33(3)	34.50(2)	48.50(2)	275.00(2)
235	100.00(4)	100.00(2)		94.00(2)	
236	25.50(2)				
Total Number	89549280	85240016	43482480	82935168	42299986

Table 4. GADUS 2J Greenland halibut Average Weight per set

Stratum	Gadus 3 1977	Gadus 12 1978	Gadus 15 1978	Gadus 27 1979	Gadus 29 1979
201	7.26(2)		1.36(3)		0.45(2)
202	21.34(2)	7.59(2)	25.20(2)	36.51(2)	7.48(2)
203	31.55(2)	40.82(2)		87.09(2)	
204	175.70(2)	484.68(2)		260.36(2)	
205	20.97(4)		6.58(4)		10.21(2)
206	20.80(11)		7.78(7)		8.11(8)
207	77.77(5)		25.54(4)		10.39(5)
208	186.14(4)	90.26(2)	183.12(3)	53.97(2)	127.46(2)
209	65.25(7)	34.70(2)	15.66(4)	190.51(2)	47.61(5)
210	19.41(6)	13.62(3)	5.20(4)	14.97(2)	4.09(2)
211	34.96(2)	105.69(2)	64.92(2)	57.65(2)	36.28(2)
212	189.61(4)	150.82(2)		232.24(2)	
213	16.46(8)	7.26(3)	17.59(4)	10.59(3)	8.84(4)
214	38.97(6)	22.07(3)	67.76(4)	40.18(2)	12.93(4)
215	37.68(4)	1.86(3)	34.14(5)	5.34(2)	8.00(4)
216	102.83(2)	170.78(2)		251.14(2)	111.58(2)
217	141.95(3)	168.28(2)		87.15(2)	
218	217.92(2)	238.14(2)			
219					
220		56.92(2)			
221					
222	115.32(4)	98.20(2)	42.07(3)	144.98(2)	8.39(2)
223	251.52(2)	84.82(2)		63.99(2)	
224	173.65(2)	78.70(2)		122.47(2)	
225	39.95(2)				
226		3.18(2)			
227	115.32(4)	86.86(2)		27.47(2)	
228	6.53(8)	2.19(3)		15.43(2)	4.88(4)
229	39.03(4)	9.28(2)	19.52(2)	19.29(2)	28.35(2)
230	243.28(3)	80.74(2)			
231	64.24(2)	138.57(2)			
232	49.03(2)	27.21(2)			
233					
234	49.03(2)	151.96(3)	18.38(2)	29.04(2)	101.38(2)
235	117.59(4)	107.05(2)		83.99(2)	
236	98.06(2)				
Total Weight (Tons)	106834	77127	32064	80140	28319

Table 5. GADUS 3K - Greenland halibut average number per set

Stratum	Gadus 12 1978	Gadus 15 1978	Gadus 27 1979	Gadus 29 1979
620	198.00 (5)	55.00 (7)	24.33 (3)	54.29 (7)
621	158.40 (5)	300.86 (7)	214.33 (3)	180.75 (8)
622	506.50 (2)		142.00 (3)	
623	369.67 (3)	215.67 (3)		53.00 (3)
624	12.50 (4)	9.33 (3)	11.00 (2)	10.00 (2)
625	15.00 (3)	20.33 (3)	28.00 (2)	19.33 (3)
626	167.00 (3)	97.25 (4)	81.00 (2)	40.67 (3)
627	164.50 (2)		69.00 (3)	
628	132.00 (2)	51.00 (5)	15.33 (3)	82.50 (2)
629	187.67 (3)	17.00 (3)		18.50 (2)
630	59.00 (2)		20.00 (2)	12.50 (2)
631	112.00 (2)		43.67 (3)	
632	2.50 (4)	3.00 (3)	5.00 (2)	1.50 (2)
633	5.75 (4)	7.48 (5)	19.25 (4)	6.79 (6)
634	13.00 (4)	8.80 (5)	2.50 (2)	10.67 (6)
635	23.25 (4)	24.20 (4)	13.00 (3)	8.00 (5)
636	30.00 (4)	9.67 (3)	4.50 (2)	4.20 (5)
637	8.80 (5)	12.50 (4)	2.00 (3)	10.75 (4)
638	30.33 (3)	15.60 (5)	19.50 (2)	11.14 (7)
639	5.00 (4)	5.00 (5)	8.00 (2)	2.50 (2)
640	35.50 (2)			
642	9.50 (2)			
643	3.00 (2)		2.50 (2)	
644	3.00 (2)		2.50 (2)	
645	9.50 (2)			
646	13.00 (2)		28.50 (2)	
647	83.00 (2)		15.50 (2)	
648	3.50 (2)			
649	5.00 (2)			
641	4.50 (2)		17.50 (2)	
Total Number	204,025,056	115,420,720	89,586,880	72,963,696

TABLE 6 GADUS 3K - Greenland halibut average weight per set

Stratum	Gadus 12 1978	Gadus 15 1978	Gadus 27 1979	Gadus 29 1979
620	126.38 (5)	24.13 (7)	10.89 (3)	37.32 (7)
621	80.92 (5)	159.03 (7)	99.18 (3)	120.09 (8)
622	143.11 (2)		119.44 (3)	
623	164.96 (3)	154.06 (3)		36.55 (3)
624	5.45 (4)	14.57 (3)	9.87 (2)	11.34 (2)
625	13.63 (3)	21.49 (3)	18.82 (2)	11.19 (3)
626	72.58 (3)	51.87 (4)	52.85 (2)	35.08 (3)
627	71.67 (2)		41.73 (3)	
628	51.25 (2)	39.95 (5)	11.49 (3)	72.13 (2)
629	32.51 (3)	8.63 (3)		13.38 (2)
630	27.23 (2)		10.44 (2)	11.11 (2)
631	45.42 (2)		23.30 (3)	
632	2.50 (4)	4.15 (3)	3.63 (2)	2.04 (2)
633	8.85 (4)	7.49 (5)	14.52 (4)	5.41 (6)
634	7.04 (4)	5.72 (5)	9.98 (2)	9.26 (6)
635	7.48 (4)	6.06 (5)	7.72 (3)	5.17 (5)
636	8.28 (4)	1.97 (3)	5.33 (2)	4.40 (5)
637	2.99 (5)	5.11 (4)	0.90 (3)	6.58 (4)
638	22.53 (3)	10.73 (5)	17.71 (2)	11.97 (7)
639	4.88 (4)	5.33 (5)	11.34 (2)	4.31 (2)
640	32.91 (2)			
641	5.45 (2)		26.77 (2)	
642	18.63 (2)			
643	7.49 (2)		12.94 (2)	
644	15.22 (2)		4.99 (2)	
645	18.61 (2)			
646	59.24 (2)		88.96 (2)	
647	160.23 (2)		48.13 (2)	
648	15.46 (2)			
649	10.91 (2)			
Total Weight (tons)	105,020	65,695	57,262	52,641

Table 7. GADUS 3L - Greenland halibut average number per set

Stratum	GADUS 12 1978	GADUS 21 1979	GADUS 25 1979
328		1.00 (5)	
341		3.50 (4)	
342		11.75 (4)	
343		6.25 (4)	
344	75.33 (3)	23.00 (4)	
345	64.50 (2)		71.25 (4)
346	52.50 (2)	17.67 (3)	20.25 (4)
347	27.31 (3)	21.75 (4)	13.00 (2)
348		14.93 (7)	
349		16.00 (5)	
350		0.0 (8)	
363		0.0 (7)	
364		0.64 (10)	
365		5.25 (4)	
366	7.00 (3)	4.00 (4)	1.00 (2)
368	33.50 (2)	23.75 (4)	6.00 (3)
369	4.00 (3)	13.00 (4)	2.00 (2)
370		4.75 (4)	
371		0.0 (4)	
372		0.0 (9)	
384		4.29 (7)	
386	10.67 (3)	14.00 (4)	7.00 (2)
387	22.50 (2)	11.95 (4)	8.40 (5)
388	9.50 (2)	17.50 (4)	17.33 (3)
389	5.67 (3)	13.25 (4)	
390		0.60 (5)	
391	6.00 (2)	8.33 (3)	9.00 (2)
392		37.25 (4)	17.67 (3)
729			21.67 (3)
730	6.50 (2)		27.33 (3)
731	9.00 (2)		33.33 (3)
732	16.50 (2)		40.00 (2)
733	41.50 (2)		16.00 (3)
734	22.50 (2)		15.67 (3)
735	68.00 (2)		29.33 (3)
736	84.50 (2)		36.33 (3)
385		4.29(7)	
Total Number	28,424,880	18,877,856	14,298,252

TABLE 8. GADUS 3L - Greenland halibut average weight per set

Stratum	GADUS 12 1978	GADUS 21 1979	GADUS 25 1979
328		0.36 (5)	
341		1.77 (4)	
342		3.06 (4)	
343		3.43 (4)	
344	36.04 (3)	10.21 (4)	
345	27.69 (2)		48.99 (4)
346	25.43 (2)	11.94 (3)	17.92 (4)
347	15.45 (3)	12.25 (4)	4.08 (2)
348		6.22 (7)	
349		8.81 (5)	
350		0.0 (8)	
363		0.0 (7)	
364		0.51 (10)	
365		2.10 (4)	
366	4.88 (3)	2.27 (4)	0.45 (2)
368	11.80 (2)	17.12 (4)	8.47 (3)
369	0.76 (3)	4.99 (4)	2.72 (2)
370		1.93 (4)	
371		0.0 (4)	
372		0.0 (9)	
384		0.0 (4)	
385		1.98 (7)	
386	2.42 (3)	6.69 (4)	4.09 (2)
387	6.35 (2)	6.95 (4)	10.34 (5)
388	2.72 (2)	9.70 (4)	20.26 (3)
389	1.51 (3)	6.69 (4)	
390		0.41 (5)	
391	2.88 (2)	3.70 (3)	4.99 (2)
392		23.49 (4)	12.70 (3)
729			22.39 (3)
730	5.22 (2)		36.29 (3)
731	7.94 (2)		42.04 (3)
732	14.53 (2)		42.18 (2)
733	23.83 (2)		27.06 (3)
734	41.54 (2)		31.15 (3)
735	43.15 (2)		52.01 (3)
736	75.91 (2)		62.29 (3)
Total Weight (tons)	13,856	9,493	12,083

Table 9. Greenland halibut biomass adjusted to total area.

NAFO	Trip	Year	Area Surveyed	Biomass from Survey	Percent Coverage	Biomass adjusted to total area	Greatest depth range
2J	GADUS 3	1977	23,868	106,834	95%	112,457	> 400 m
	GADUS 12	1978	15,995	77,127	64%	120,510	> 400 m
	GADUS 15	1978	17,360	32,064	69%	46,470	2 strata >300 m
	GADUS 27	1979	14,416	80,140	58%	138,172	> 400 m
	GADUS 29	1979	19,172	28,319	77%	36,778	2 strata >300 m
3K	GADUS 12	1978	31,185	105,020	100%	105,020	> 400 m
	GADUS 15	1978	22,239	65,695	71%	92,528	$\leq$ 400 m
	GADUS 27	1979	27,251	57,262	87%	65,528	> 400 m
	GADUS 29	1979	22,783	52,641	73 %	72,054	$\leq$ 400 m
3L	GADUS 12	1978	11,680	13,856	31%	44,697	> 400 m
	GADUS 21	1979	35,345	9,493	93%	10,207	$\leq$ 200 m
	GADUS 25	1979	9,600	12,083	25%	48,332	> 400 m

Table 10.

C A T C H M A T R I X

AGE/YEAR	1975	1976	1977	1978	1979
5	322.	19.	464.	3016.	2182.
6	2719.	680.	4351.	8511.	7980.
7	5547.	3600.	9374.	9072.	11726.
8	4781.	6030.	6377.	7662.	5611.
9	3821.	4199.	2546.	2898.	1069.
10	1628.	2457.	879.	1454.	440.
11	677.	923.	191.	731.	262.
12	130.	290.	113.	371.	136.
13	269.	113.	101.	225.	131.
14	131.	36.	26.	110.	84.
15	63.	21.	18.	58.	76.
16	41.	1.	22.	54.	56.
17	43.	1.	7.	39.	44.

TABLE 11.

Greenland Halibut 2+3KL
CPUE (nos.) for
1967&1968 year-classes

Year Class	CPUE 1976	CPUE 1977	CPUE 1978	CPUE 1979
1967	31,922	6,825	7,635	3,124
1968	45,842	19,768	15,186	6,018

	1967 YC	1968 YC
r^2	0.84	0.96
Intercept	16.25	15.78
Slope (Z)	-0.69	-0.64

Table 12. Greenland Halibut
Population Numbers
Av. No. Per Set At Age
Weighted by Stratum Area
M+F

Age	Nov. 77 GAD 3	Nov. 78 GAD 15	Nov. 79 GAD 29	Total Total
1	0.01	0.56	0.97	1.54
2	0.29	2.17	5.28	7.74
3	2.46	3.78	5.54	11.78
4	7.46	6.13	5.33	18.92
5	15.82	8.47	7.86	32.15
6	16.96	7.24	5.40	29.60
7	9.49	4.90	2.27	16.66
8	3.99	1.57	0.64	6.20
9	1.49	0.72	0.30	2.51
10	0.50	0.36	0.43	1.29
11	0.14	0.45	0.11	0.70
12	0.01	0.34	0.10	0.45
13		0.18	0.10	0.28
14		0.11	0.05	0.16
15		0.04	0.01	0.05
16		0.08	0.02	0.10
17		0.04		0.04
Catch Curve results (7+)				
r^2	0.95	0.92	0.92	0.96
Int.	11.79	3.95	3.93	6.29
Slope	-1.30	-0.44	-0.52	-0.58

Table 13. Greenland halibut, 2+3KL, M+F 1979.

Age	Comm. No.at age ('000's)	Comm. no/1000	Research no. at age ('000's)	Res no/1000	Relative Partial Recruitment	Partial Recruit-ment
1			2698			
2			18141			
3			29827			
4	52	2	23522	174	0.011	0.004
5	2182	73	28629	211	0.346	0.129
6	7980	267	36748	271	0.985	0.367
7	11726	393	19191	142	2.768	1.000
8	5611	188	9425	70	2.686	1.000
9	1069	36	4361	32	1.125	0.419
10	440	15	3580	26	0.577	0.215
11	262	9	2824	21	0.429	0.160
12	136	5	2736	20	0.250	0.093
13	131	4	1964	15	0.267	0.099
14	84	3	901	7	0.429	0.160
15	76	3	631	5	0.600	0.223
16	56	2	626	5	0.400	0.149
17	44	1	278	2	0.500	0.186
	28,849		135,416 (Tot.Ages 4-17)			

* Population numbers from Gadus surveys in 3L (1) and 2J3K(1)

Res. no/1000 based on total of ages 4-17.

Table 14. Greenland halibut, Commercial 2+3KL, Male + Female, 1979.

Age	('000's) Total number at age	(cm) Weighted average length	(kg) Weighted average weight
4	52	38.60	0.527
5	2182	42.44	0.715
6	7980	45.33	0.885
7	11726	48.51	1.101
8	5611	51.82	1.363
9	1069	56.34	1.786
10	440	60.69	2.271
11	262	66.06	2.987
12	136	70.57	3.697
13	131	73.60	4.235
14	84	77.21	4.943
15	76	83.41	6.344
16	56	88.21	7.601
17	44	90.84	8.358

TABLE 15a

G.HALIBUT 2+3KL
F I S H I N G M O R T A L I T I E S

AGE/YEAR	1975	1976	1977	1978	1979
5	.006	.000	.005	.027	.032
6	.069	.016	.086	.124	.092
7	.177	.123	.315	.258	.250
8	.206	.297	.335	.461	.250
9	.216	.281	.197	.249	.105
10	.225	.210	.087	.164	.054
11	.163	.192	.022	.097	.040
12	.035	.097	.032	.055	.023
13	.351	.038	.044	.083	.025
14	.626	.071	.011	.062	.040
15	1.581	.187	.046	.031	.056
16	3.143	.078	.305	.190	.037
17	3.143	.297	.335	.461	.046

G.HALIBUT 2+3KL
F I S H I N G M O R T A L I T I E S

AGE/YEAR	1975	1976	1977	1978	1979
5	.007	.000	.006	.032	.039
6	.075	.017	.096	.144	.110
7	.192	.135	.344	.297	.300
8	.227	.330	.375	.528	.300
9	.243	.320	.225	.291	.126
10	.252	.243	.101	.193	.065
11	.186	.221	.026	.115	.048
12	.041	.113	.038	.066	.028
13	.384	.045	.052	.098	.030
14	.637	.079	.013	.074	.048
15	1.611	.192	.052	.036	.067
16	3.182	.081	.315	.217	.045
17	3.182	.330	.375	.528	.056

G.HALIBUT 2+3KL
F I S H I N G M O R T A L I T I E S

AGE/YEAR	1975	1976	1977	1978	1979
5	.007	.000	.007	.037	.045
6	.080	.018	.105	.163	.128
7	.204	.145	.369	.332	.350
8	.245	.358	.410	.590	.350
9	.267	.354	.251	.331	.147
10	.276	.274	.115	.222	.075
11	.207	.248	.030	.132	.056
12	.047	.128	.043	.076	.033
13	.410	.052	.060	.113	.035
14	.645	.087	.015	.085	.056
15	1.634	.195	.057	.042	.078
16	3.211	.083	.323	.241	.052
17	3.211	.358	.410	.590	.065

G.HALIBUT 2+3KL
F I S H I N G M O R T A L I T I E S

AGE/YEAR	1975	1976	1977	1978	1979
5	.007	.000	.007	.042	.052
6	.084	.019	.113	.180	.147
7	.214	.153	.390	.365	.400
8	.261	.382	.442	.647	.400
9	.288	.385	.274	.369	.168
10	.297	.304	.128	.249	.086
11	.225	.273	.034	.149	.064
12	.052	.142	.048	.086	.037
13	.433	.058	.067	.128	.040
14	.651	.093	.017	.097	.064
15	1.651	.198	.061	.048	.089
16	3.236	.085	.329	.263	.060
17	3.236	.385	.442	.647	.074

TABLE 15 b

G.HALIBUT 2+3KL
F I S H I N G M O R T A L I T I E S

AGE/YEAR	1975	1976	1977	1978	1979
5	.008	.000	.008	.046	.058
6	.087	.020	.121	.197	.165
7	.223	.160	.408	.395	.450
8	.274	.404	.470	.700	.450
9	.307	.414	.296	.405	.189
10	.315	.331	.140	.275	.097
11	.242	.297	.038	.166	.072
12	.057	.155	.053	.096	.042
13	.453	.065	.074	.142	.045
14	.657	.098	.019	.108	.072
15	1.665	.201	.065	.054	.100
16	3.258	.087	.334	.283	.067
17	3.258	.414	.470	.700	.084

G.HALIBUT 2+3KL
F I S H I N G M O R T A L I T I E S

AGE/YEAR	1975	1976	1977	1978	1979
5	.008	.000	.008	.051	.065
6	.090	.020	.127	.212	.183
7	.231	.166	.424	.423	.500
8	.286	.422	.495	.749	.500
9	.324	.440	.316	.439	.210
10	.332	.358	.152	.300	.108
11	.258	.319	.042	.183	.080
12	.063	.167	.058	.106	.046
13	.470	.071	.080	.156	.050
14	.661	.103	.021	.118	.080
15	1.677	.202	.069	.059	.111
16	3.277	.088	.339	.302	.074
17	3.277	.440	.495	.749	.093

TABLE 16a

G.HALIBUT 2+3KL
P O P U L A T I O N N U M B E R S $F_T = 0.25$

AGE/YEAR	1975	1976	1977	1978	1979
5	58507.	71636.	98895.	125814.	75820.
6	44842.	47610.	58634.	80548.	100279.
7	37792.	34253.	38364.	44068.	58246.
8	28399.	25922.	24787.	22928.	27871.
9	21754.	18925.	15767.	14523.	11839.
10	8941.	14354.	11695.	10605.	9269.
11	4966.	5848.	9529.	8780.	7367.
12	4214.	3453.	3952.	7628.	6527.
13	1003.	3333.	2565.	3134.	5910.
14	311.	578.	2626.	2009.	2362.
15	88.	136.	441.	2127.	1545.
16	47.	15.	93.	345.	1689.
17	46.	2.	11.	56.	233.

POPULATION BIOMASS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
BIOMASS	258493.	280992.	323855.	385242.	394696.

FISHING MORTALITY-WINTERS METHOD AGES 7 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.193	.202	.220	.243	.177

FISHING MORTALITY-WINTERS METHOD AGES 8 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.202	.241	.173	.233	.124

TOTAL POPULATION NUMBERS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	210911.	226065.	267358.	322566.	308957.

TOTAL POPULATION NUMBERS AGES 7 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	107562.	106818.	109830.	116203.	132858.

TABLE 16 b

G.HALIBUT 2+3KL
POPULATION NUMBERS $F_T = 0.3$

AGE/YEAR	1975	1976	1977	1978	1979
5	54334.	64158.	86099.	106294.	63379.
6	41492.	44194.	52511.	70072.	84297.
7	35112.	31511.	35568.	39055.	49669.
8	26005.	23728.	22541.	20638.	23767.
9	19588.	16965.	13971.	12685.	9964.
10	8082.	12580.	10090.	9135.	7764.
11	4408.	5144.	8077.	7466.	6163.
12	3599.	2997.	3376.	6440.	5451.
13	933.	2829.	2191.	2662.	4937.
14	307.	521.	2214.	1703.	1976.
15	87.	133.	394.	1789.	1294.
16	47.	14.	90.	306.	1412.
17	46.	2.	11.	54.	202.

POPULATION BIOMASS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
BIOMASS	236250.	252853.	285885.	332468.	332296.

FISHING MORTALITY-WINTERS METHOD AGES 7 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.214	.226	.249	.282	.212

FISHING MORTALITY-WINTERS METHOD AGES 8 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.226	.274	.199	.273	.148

TOTAL POPULATION NUMBERS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	194042.	204775.	237133.	278299.	260276.

TOTAL POPULATION NUMBERS AGES 7 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	98215.	96423.	98523.	101933.	112600.

TABLE 16c.

G.HALIBUT 2+3KL
POPULATION NUMBERS $F_T = 0.35$

AGE/YEAR	1975	1976	1977	1978	1979
5	51355.	58828.	76980.	92356.	54493.
6	39100.	41755.	48147.	62606.	72885.
7	33198.	29552.	33571.	35483.	43556.
8	24295.	22161.	20938.	19003.	20842.
9	18041.	15565.	12688.	11372.	8626.
10	7468.	11314.	8944.	8084.	6689.
11	4010.	4642.	7040.	6527.	5303.
12	3160.	2671.	2965.	5591.	4683.
13	883.	2469.	1924.	2325.	4242.
14	305.	480.	1919.	1484.	1700.
15	87.	131.	360.	1548.	1115.
16	47.	14.	88.	279.	1215.
17	46.	2.	10.	52.	179.

POPULATION BIOMASS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
BIOMASS	220364.	232763.	258789.	294801.	287753.

FISHING MORTALITY-WINTERS METHOD AGES 7 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.231	.248	.275	.319	.248

FISHING MORTALITY-WINTERS METHOD AGES 8 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.247	.303	.223	.310	.173

TOTAL POPULATION NUMBERS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	181994.	189582.	215574.	246710.	225529.

TOTAL POPULATION NUMBERS AGES 7 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	91539.	88999.	90447.	91749.	98150.

TABLE 16 d

G.HALIBUT 2+3KL
P O P U L A T I O N N U M B E R S $F_T = 0.40$

AGE/YEAR	1975	1976	1977	1978	1979
5	49122.	54841.	70158.	81905.	47829.
6	37306.	39926.	44883.	57021.	64329.
7	31762.	28084.	32074.	32810.	38984.
8	23013.	20985.	19736.	17778.	18654.
9	16881.	14515.	11725.	10388.	7622.
10	7008.	10364.	8085.	7296.	5883.
11	3711.	4265.	6262.	5824.	4658.
12	2830.	2426.	2656.	4954.	4107.
13	845.	2199.	1724.	2073.	3720.
14	302.	449.	1699.	1320.	1493.
15	86.	129.	335.	1367.	981.
16	47.	14.	87.	258.	1067.
17	46.	2.	10.	51.	162.

POPULATION BIOMASS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
BIOMASS	208450.	217704.	238488.	266575.	254371.

FISHING MORTALITY-WINTERS METHOD AGES 7 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.246	.267	.297	.353	.283

FISHING MORTALITY-WINTERS METHOD AGES 8 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.265	.330	.245	.346	.197

TOTAL POPULATION NUMBERS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	172960.	178198.	199433.	223044.	199490.

TOTAL POPULATION NUMBERS AGES 7 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	86532.	83431.	84391.	84118.	87331.

TABLE 16e

G.HALIBUT 2+3KL
P O P U L A T I O N N U M B E R S $F_T = 0.45$

AGE/YEAR	1975	1976	1977	1978	1979
5	47386.	51750.	64868.	73781.	42646.
6	35911.	38505.	42352.	52690.	57677.
7	30645.	26942.	30910.	30738.	35438.
8	22015.	20071.	18800.	16825.	16957.
9	15978.	13699.	10977.	9622.	6842.
10	6650.	9625.	7416.	6683.	5256.
11	3479.	3972.	5657.	5276.	4156.
12	2574.	2236.	2416.	4459.	3658.
13	816.	1990.	1568.	1876.	3315.
14	301.	425.	1527.	1192.	1333.
15	86.	128.	315.	1226.	877.
16	47.	13.	86.	242.	952.
17	46.	1.	10.	50.	149.

POPULATION BIOMASS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
BIOMASS	199185.	206000.	222717.	244643.	228429.

FISHING MORTALITY-WINTERS METHOD AGES 7 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.260	.284	.318	.386	.318
EFFORT	.000	.000	.000	.000	.000

REGRESSION VALUES ARE: A= -14.6305 B= $$$$$$$$$$$$$$$ RS0=

FISHING MORTALITY-WINTERS METHOD AGES 8 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.282	.354	.265	.380	.222

TOTAL POPULATION NUMBERS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	165935.	169355.	186902.	204661.	179256.

TOTAL POPULATION NUMBERS AGES 7 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	82638.	79100.	79682.	78190.	78932.

TABLE 16 F.

G.HALIBUT 2+3KL
POPULATION NUMBERS $F_T = 0.50$

AGE/YEAR	1975	1976	1977	1978	1979
5	45998.	49284.	60650.	67284.	38500.
6	34796.	37368.	40333.	49236.	52358.
7	29752.	26028.	29979.	29085.	32610.
8	21217.	19340.	18052.	16063.	15604.
9	15257.	13045.	10378.	9010.	6218.
10	6364.	9034.	6881.	6193.	4755.
11	3293.	3737.	5173.	4839.	3755.
12	2369.	2084.	2225.	4062.	3300.
13	793.	1822.	1444.	1719.	2990.
14	299.	406.	1389.	1090.	1204.
15	86.	127.	300.	1114.	793.
16	47.	13.	85.	229.	860.
17	46.	1.	10.	49.	139.

POPULATION BIOMASS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
BIOMASS	191774.	196643.	210118.	227117.	207696.

FISHING MORTALITY-WINTERS METHOD AGES 7 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.271	.299	.337	.417	.353

FISHING MORTALITY-WINTERS METHOD AGES 8 TO 16

YEAR	1975	1976	1977	1978	1979
TOTAL F	.296	.376	.284	.413	.246

TOTAL POPULATION NUMBERS AGES 5 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	160316.	162289.	176899.	189974.	163086.

TOTAL POPULATION NUMBERS AGES 7 TO 17

YEAR	1975	1976	1977	1978	1979
TOTAL N	79523.	75636.	75916.	73454.	72228.

Table 17a.

CATCH PROJECTION FOR 1981 USING POPULATION ESTIMATES FROM COHORT WITH TERMINAL F OF .250

AGE	POPULATION NUMBERS (000S)	POPULATION WEIGHT (MT)	FISHING MORTALITY	CATCH NUMBERS (000S)	CATCH WEIGHT (MT)	RESIDUAL NUMBERS (000S)	RESIDUAL WEIGHT (MT)
5	96238.	68810.	.068	5718.	4088.	73633.	52648.
6	76668.	67852.	.193	12217.	10812.	51770.	45817.
7	45529.	50127.	.525	17001.	18719.	22051.	24278.
8	49616.	67627.	.525	18528.	25253.	24030.	32753.
9	24601.	43937.	.220	4419.	7892.	16164.	28869.
10	13314.	30237.	.113	1290.	2931.	9737.	22113.
11	6828.	20397.	.084	499.	1492.	5140.	15354.
12	5691.	21041.	.049	246.	909.	4438.	16406.
13	4652.	19701.	.052	214.	905.	3616.	15313.
14	4186.	20691.	.084	306.	1513.	3151.	15575.
15	3736.	23699.	.117	375.	2378.	2721.	17259.
16	1451.	11029.	.078	99.	753.	1099.	8350.
17	2140.	17890.	.098	181.	1511.	1589.	13284.
TOTAL	334651.	463035.		61093.	79156.	219139.	308020.

CATCH PROJECTION FOR 1981 USING POPULATION ESTIMATES FROM COHORT WITH TERMINAL F OF .300

AGE	POPULATION NUMBERS (000S)	POPULATION WEIGHT (MT)	FISHING MORTALITY	CATCH NUMBERS (000S)	CATCH WEIGHT (MT)	RESIDUAL NUMBERS (000S)	RESIDUAL WEIGHT (MT)
5	83737.	59872.	.068	4975.	3557.	64069.	45809.
6	66282.	58660.	.193	10562.	9347.	44757.	39610.
7	37129.	40879.	.525	13865.	15265.	17983.	19799.
8	38961.	53104.	.525	14549.	19830.	18870.	25720.
9	18986.	33910.	.220	3410.	6091.	12475.	22281.
10	10577.	24021.	.113	1025.	2328.	7736.	17567.
11	5568.	16631.	.084	407.	1216.	4191.	12519.
12	4679.	17297.	.049	202.	748.	3648.	13487.
13	3843.	16273.	.052	177.	748.	2987.	12649.
14	3462.	17115.	.084	253.	1252.	2606.	12883.
15	3081.	19546.	.117	309.	1961.	2244.	14235.
16	1191.	9052.	.078	81.	618.	902.	6854.
17	1764.	14748.	.098	149.	1246.	1310.	10951.
TOTAL	279262.	381108.		49965.	64207.	183777.	254364.

CATCH PROJECTION FOR 1981 USING POPULATION ESTIMATES FROM COHORT WITH TERMINAL F OF .350

AGE	POPULATION NUMBERS (000S)	POPULATION WEIGHT (MT)	FISHING MORTALITY	CATCH NUMBERS (000S)	CATCH WEIGHT (MT)	RESIDUAL NUMBERS (000S)	RESIDUAL WEIGHT (MT)
5	74784.	53471.	.068	4443.	3177.	57219.	40911.
6	58795.	52033.	.193	9369.	8291.	39701.	35135.
7	31111.	34253.	.525	11617.	12791.	15068.	16590.
8	31377.	42767.	.525	11717.	15970.	15197.	20713.
9	15025.	26834.	.220	2699.	4820.	9872.	17632.
10	8630.	19599.	.113	836.	1900.	6312.	14334.
11	4667.	13941.	.084	341.	1019.	3513.	10494.
12	3954.	14619.	.049	171.	632.	3083.	11399.
13	3264.	13823.	.052	150.	635.	2537.	10744.
14	2945.	14558.	.084	215.	1065.	2217.	10959.
15	2611.	16566.	.117	262.	1662.	1902.	12065.
16	1005.	7635.	.078	69.	521.	761.	5781.
17	1496.	12501.	.098	126.	1056.	1111.	9283.
TOTAL	239664.	322601.		42016.	53539.	158492.	216040.

CATCH PROJECTION FOR 1981 USING POPULATION ESTIMATES FROM COHORT WITH TERMINAL F OF .400

AGE	POPULATION NUMBERS (000S)	POPULATION WEIGHT (MT)	FISHING MORTALITY	CATCH NUMBERS (000S)	CATCH WEIGHT (MT)	RESIDUAL NUMBERS (000S)	RESIDUAL WEIGHT (MT)
5	68050.	48656.	.068	4043.	2891.	52066.	37227.
6	53117.	47008.	.193	8464.	7491.	35867.	31742.
7	26581.	29265.	.525	9926.	10928.	12874.	14174.
8	25714.	35048.	.525	9602.	13088.	12454.	16975.
9	12097.	21606.	.220	2173.	3881.	7949.	14196.
10	7178.	16301.	.113	696.	1580.	5249.	11922.
11	3991.	11920.	.084	292.	872.	3004.	8973.
12	3410.	12606.	.049	147.	545.	2659.	9829.
13	2829.	11983.	.052	130.	551.	2199.	9314.
14	2556.	12636.	.084	187.	924.	1924.	9512.
15	2259.	14334.	.117	227.	1438.	1645.	10439.
16	865.	6572.	.078	59.	449.	655.	4976.
17	1292.	10802.	.098	109.	912.	960.	8021.
TOTAL	209939.	278738.		36055.	45549.	139505.	187301.

CATCH PROJECTION FOR 1981 USING POPULATION ESTIMATES FROM COHORT WITH TERMINAL F OF .450

AGE	POPULATION NUMBERS (000S)	POPULATION WEIGHT (MT)	FISHING MORTALITY	CATCH NUMBERS (000S)	CATCH WEIGHT (MT)	RESIDUAL NUMBERS (000S)	RESIDUAL WEIGHT (MT)
5	62050.	44366.	.068	3687.	2636.	47476.	33945.
6	47970.	42453.	.193	7644.	6765.	32392.	28667.
7	22913.	25227.	.525	8556.	9420.	11097.	12218.
8	21010.	28637.	.525	7846.	10694.	10176.	13870.
9	9709.	17341.	.220	1744.	3115.	6380.	11394.
10	6015.	13661.	.113	583.	1324.	4399.	9991.
11	3452.	10310.	.084	252.	754.	2598.	7761.
12	2978.	11011.	.049	129.	476.	2322.	8585.
13	2487.	10533.	.052	114.	484.	1933.	8187.
14	2251.	11126.	.084	165.	814.	1694.	8375.
15	774.	4910.	.117	78.	493.	564.	3576.
16	.	.	.078	.	.	.	.
17	1131.	9454.	.098	96.	798.	840.	7020.
TOTAL	182741.	229029.		30893.	37772.	121871.	153589.

CATCH PROJECTION FOR 1981 USING POPULATION ESTIMATES FROM COHORT WITH TERMINAL F OF .500

AGE	POPULATION NUMBERS (000S)	POPULATION WEIGHT (MT)	FISHING MORTALITY	CATCH NUMBERS (000S)	CATCH WEIGHT (MT)	RESIDUAL NUMBERS (000S)	RESIDUAL WEIGHT (MT)
5	58589.	41891.	.068	3481.	2489.	44828.	32052.
6	45017.	39840.	.193	7173.	6348.	30398.	26902.
7	20197.	22237.	.525	7542.	8304.	9782.	10770.
8	17857.	24339.	.525	6668.	9089.	8649.	11788.
9	8105.	14475.	.220	1456.	2600.	5325.	9511.
10	5162.	11723.	.113	500.	1136.	3775.	8573.
11	3041.	9084.	.084	222.	664.	2289.	6838.
12	2646.	9780.	.049	114.	423.	2063.	7626.
13	2220.	9400.	.052	102.	432.	1725.	7306.
14	2011.	9941.	.084	147.	727.	1514.	7483.
15	1763.	11186.	.117	177.	1122.	1284.	8146.
16	668.	5074.	.078	46.	347.	505.	3842.
17	1008.	8422.	.098	85.	711.	748.	6254.
TOTAL	168283.	217392.		27714.	34392.	112885.	147091.

Table 18. Greenland Halibut

Catch Projections 1981

Partial Recruitment from Research Vs. Commercial 1979

Terminal F	GM Age 5 1976-1978 ('000's)	Catch at $F_{0.1}$ 1981 (MT)
0.25	96,238	79,156
0.30	83,737	64,207
0.35	74,784	53,539
0.40	68,050	45,549
0.45	62,050	37,772
0.50	58,589	34,392

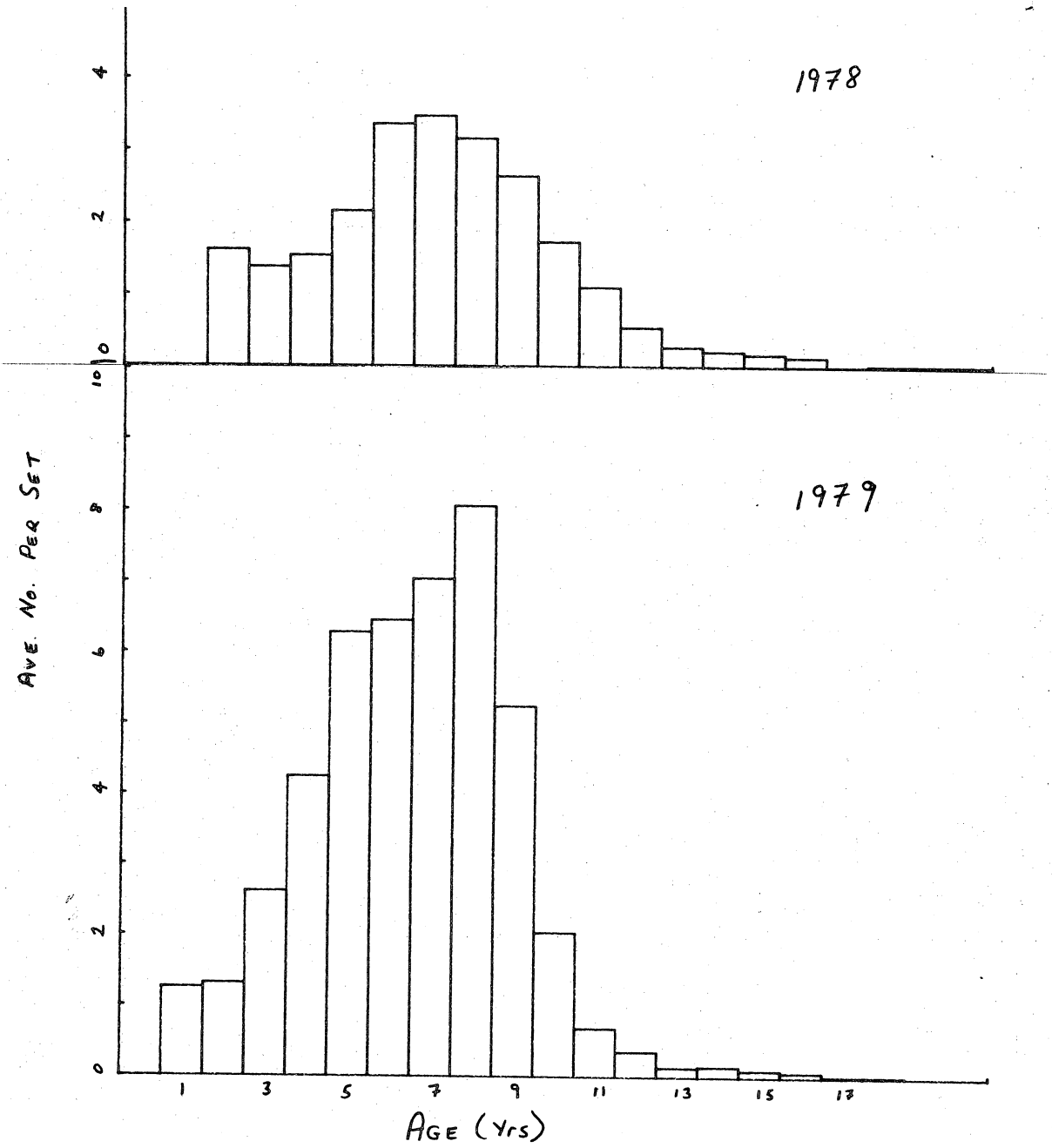

Fig 1 G. HALIBUT AVE. NO. PER SET
RESEARCH CRUISES 1978 - 1979

2G

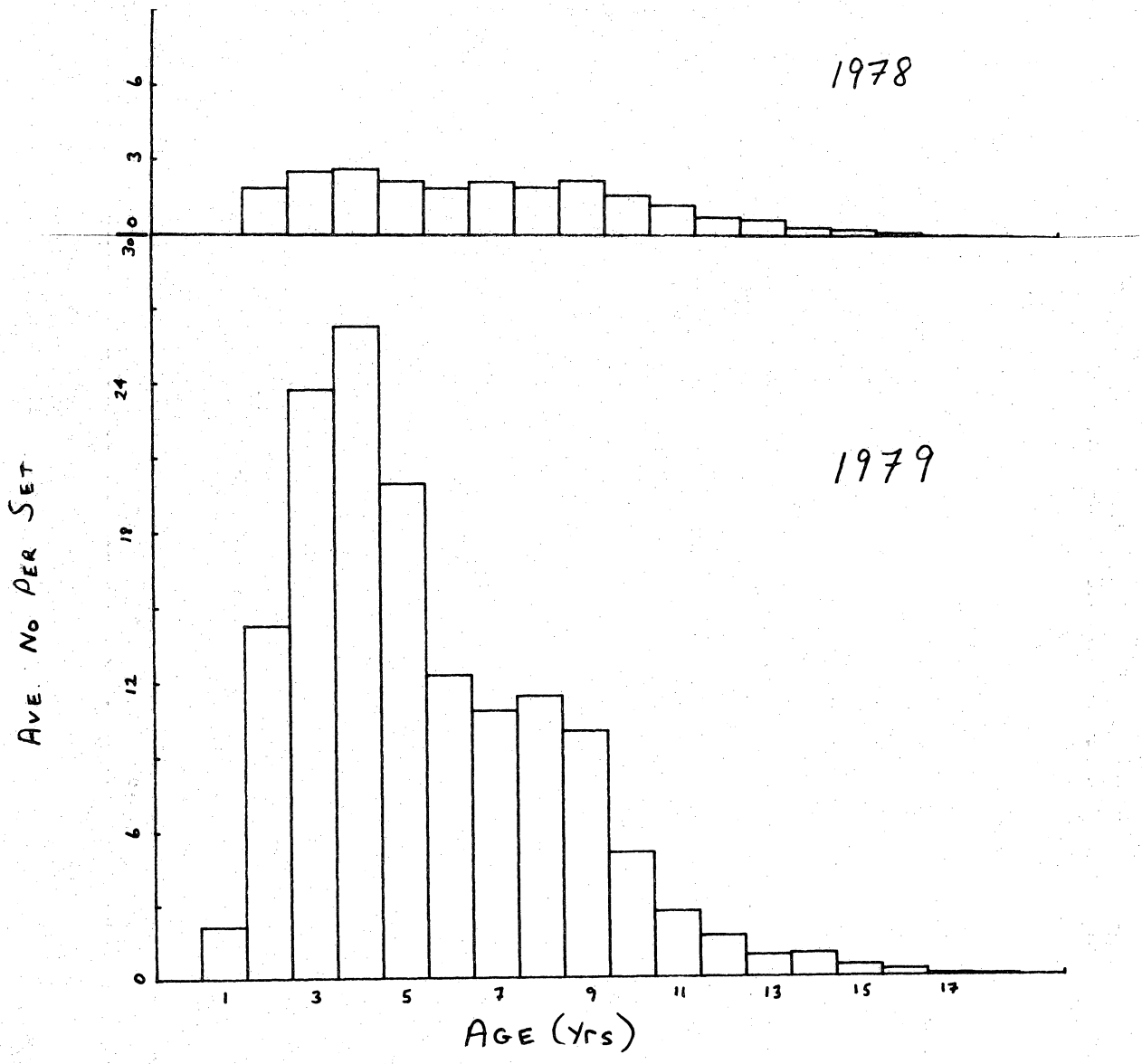

Fig 2 G. HALIBUT AVE. NO. PER SET
RESEARCH CRUISES 1978 - 1979
2H

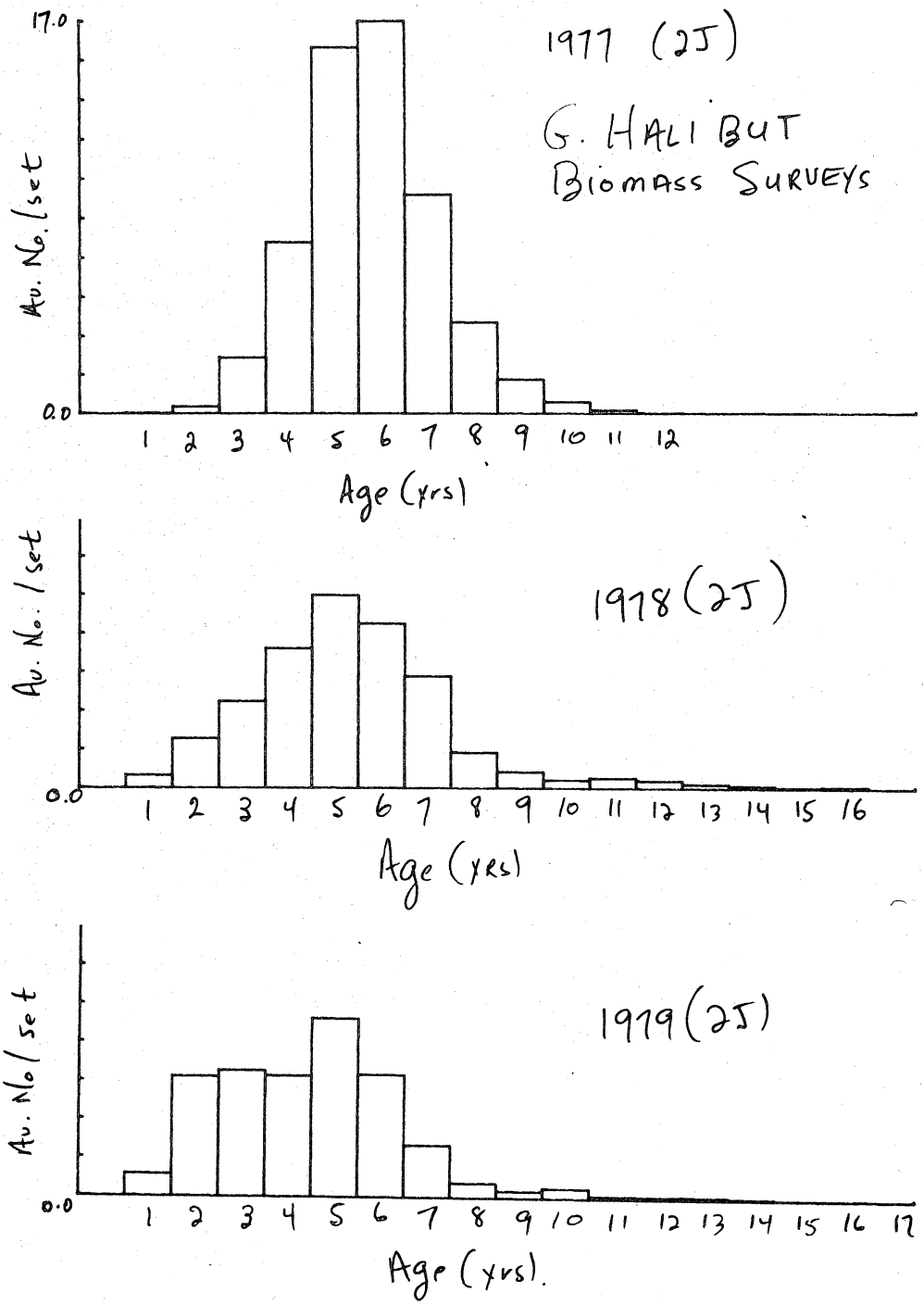
17.0
0.0
Av. No. / set
1977 (2J)
G. HALI BUT
BIOMASS SURVEYS
1 2 3 4 5 6 7 8 9 10 11 12
Age (yrs)
Av. No. / set
0.0
1978 (2J)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Age (yrs)
Av. No / set
0.0
1979 (2J)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Age (yrs).

Fig 3

G. HALIBUT 2+3KL
PARTIAL RECRUITMENT FROM
RESEARCH VS. COMMERCIAL DATA 1979

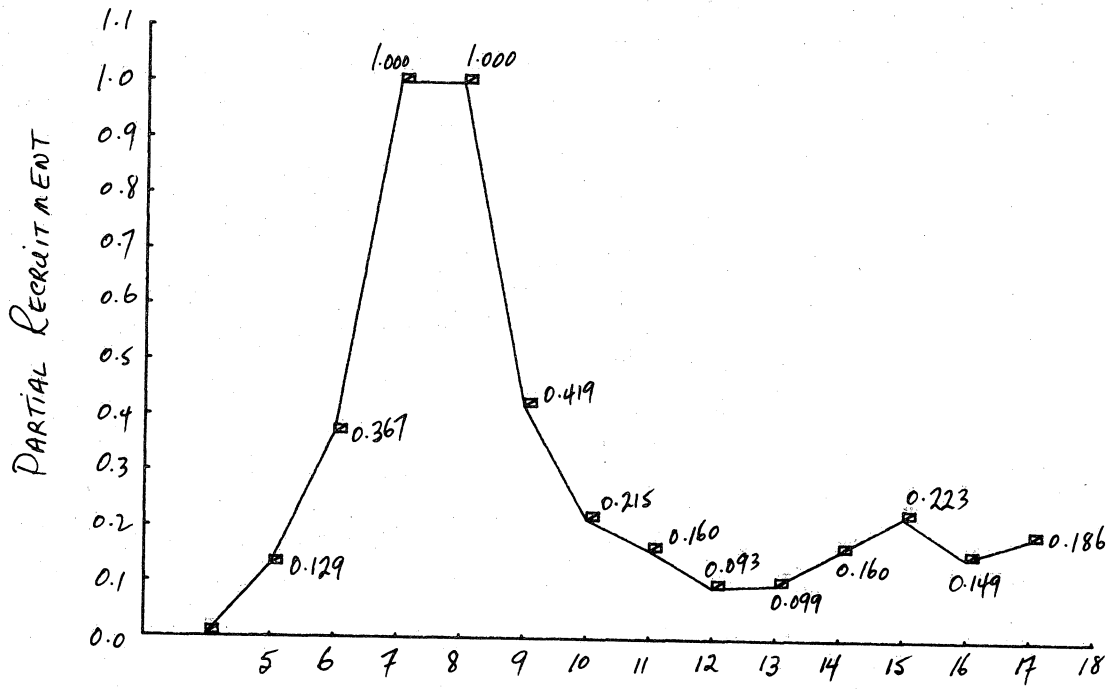

Fig 4.

G. HALIBUT 2+3KL
YIELD PER RECRUIT
FROM RES. VS. COMM. PR. 1979

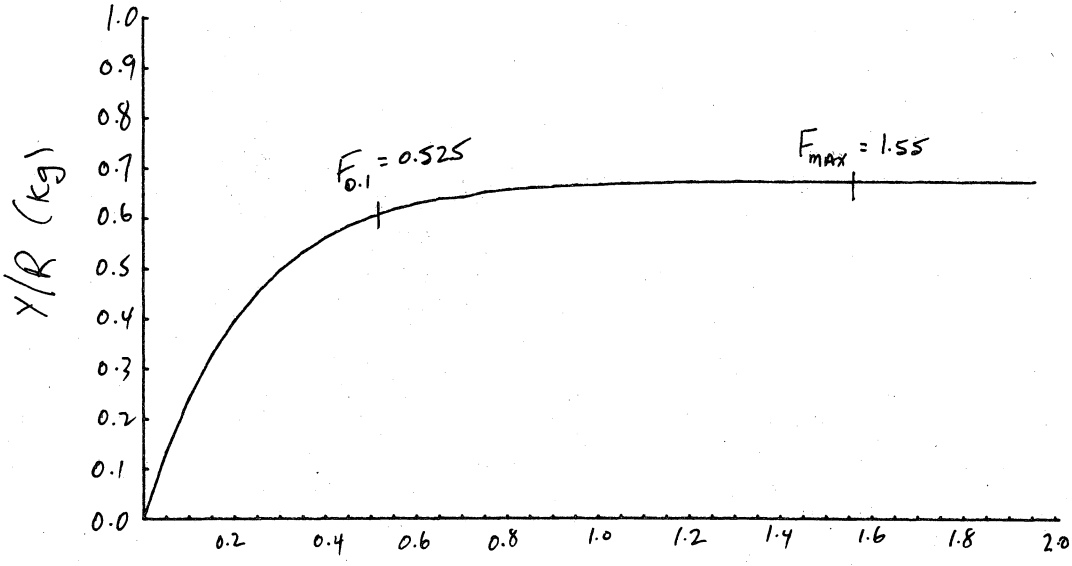

Fig 5.