

The Greenland Halibut Fishery in the Gulf of St. Lawrence

by

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Abstract

Landings have averaged 600-1000 t up to 1974 and subsequently increased to 4000 t in 1977 and 1978 to a high of 10,000 t in 1979. The fishery is made up of more than 80% 6-10 year old fish very similar to the strong recruiting year-classes found in the Labrador-northeast Newfoundland stock. Biomass surveys indicated stability in Division 4S with substantial reductions in biomass in Division 4R. There was no estimate of biomass in Division 4T which accounted for 60% of the catch in 1979. Fishing mortality estimates were similarly high from both commercial and research data. It was determined that the levels of fishing mortality do not reflect estimates of stock abundance in the Gulf of St. Lawrence unless there is significant immigration from other areas.

Résumé

Jusqu'en 1974, les débarquements ont été en moyenne de 600 à 1,000 t et ont augmenté par la suite pour passer à 4,000 t en 1977 et 1978, et à un sommet de 10,000 t en 1979. Les prises sont constituées à plus de 80% de poissons âgés de 6 à 10 ans, ce qui se rapproche beaucoup des abondantes classes d'âge qui rallient le stock Labrador-nord-est de Terre-Neuve. Les relevés de biomasse indiquent des conditions stables dans la division 4S et des réductions marquées de biomasse dans la division 4R. Il n'y a pas eu d'estimation de biomasse dans la division 4T, d'où provenait 60% des captures en 1979. Les estimations de mortalité par pêche, à partir de données commerciales ou de navires de recherche, sont pareillement élevées. La mortalité par pêche ne reflète pas l'abondance du stock dans le golfe Saint-Laurent, à moins qu'il n'y ait forte immigration d'autres régions.

Landings

Since the beginning of a recognizable fishery for Greenland halibut in the Gulf of St. Lawrence in about 1969, landings averaged 600-1000 t. Landings have increased up to 1974, since then to a level of almost 4000 t in 1977 and 1978. The provisional figures for 1979 show a marked increase of more than double that of the 1977 and 1978 level to 8976 t (Table 1). Over the past few years (except for 1979) (since this fishery has become significant) most of the landings have been taken in Div. 4S (about 55-60%). It appears that this was generally a by-catch fishery on the northwest side of Anticosti Island by Quebec fishermen fishing for shrimp during the summer. Approximately 30% was taken by Newfoundland trawlers in Div. 4R, southwest of St. George's Bay in the Esquiman Channel where these fish appear to be concentrated in the winter. The remaining portion was taken in Div. 4T.

During 1979, with record landings, this fishing pattern appears to have changed. Basically, the fishery in Div. 4S was practically non-existent, with a small catch of 251 t. Div. 4R still comprised approximately 30% in 1979 however the big change in fishing pattern was the landings from Div. 4T which in 1979 made up 65% of the total. While the area of fishing in 4T is really not known at present, it is likely that these landings come from the Esquiman Channel area just south of the Div. 4R fishery where the borders of Div. 4R, 4S and 4T meet.

Catch composition of the Newfoundland trawler fishery in NAFO Div. 4R, for 1979 and 1980 1st Quarter

A) Length

The Newfoundland trawler fishery for Greenland halibut in the Gulf of St. Lawrence occurs primarily in the southern Esquiman Channel area during the winter months. The first reliable sampling of the catches from this portion of the fishery occurred in the first quarter of 1979 and again in the first quarter of 1980. Sampling for the two years was as follows:

<u>Year</u>	<u>No. measured</u>	<u>No. aged</u>
1979	1902	405
1980	739	170

The length composition was essentially identical for both years for both males and females (Fig. 1). Males ranged from about 40-60 cm with the bulk in the 46-50 cm range. Females, on the other hand ranged from about 44-74 cm with the bulk in the 54-64 cm range. Although the trawler fishery is not very significant, it should be noted that there were male fish up to 68 cm and females up to 86 cm in the 1979 samples. In 1980 there were no males in the samples beyond 62 cm and no females beyond 74 cm indicating that these may be completely fished out.

B) Age

Males: For both years the age composition of the males consisted of 6 age groups from 5-10-yr, however, more than 80% of the males were comprised of 6-8-yr-old fish (Fig. 2). In 1980 the fishery appears to be more dependent on fewer year-classes than previously.

The females in 1979 were comprised of age-groups from 5-14 however, most of the catch was made up of 8-10-yr-old fish (Fig. 3). In 1980 the fishery was made up of 6-12-yr-old; with the bulk still in the 8-10-yr-old range.

The lack of the older fish in the 1980 catch may very well be real, however, the sampling in 1980 (although quite good) is considerably less than in 1979 which may also suggest a lack of old fish in the catch composition.

C) Average-lengths

From the age-length composition of the Newfoundland otter trawl fishery a mean length at age was calculated for males and females separately for both 1979 and 1980. The difference in mean lengths at age for both years was also calculated as well as the overall mean lengths of the total catch of males and females for both years. The percentage catch breakdown for both sexes in both years was also calculated. All this information is presented in Table 2.

The mean-lengths at age are essentially identical for both years and both sexes. In most cases the differences between the two years is less than one-tenth of one percent. The overall mean length between 1979 and 1980 for females is the same, for males only a 3 cm difference. The percent catch composition is also remarkably the same for both years and both sexes with less than 1% difference between the two years (Table 2).

Biomass Surveys

A) Distribution of fish

From 1978-80 during January, stratified random biomass surveys have been conducted in the Gulf of St. Lawrence area primarily in NAFO Div. 4R and 4S.

For the purpose of surveying Greenland halibut, which essentially occupies a niche greater than 100 fathoms depths, all strata were fished in Div. 4R and except for 1979 the same would apply to Div. 4S. The average numbers and weights caught per set in each stratum is presented in Table 3. All strata were fished a minimum of 2 sets per survey, however, in most cases 4 or more sets were fished.

The distribution pattern for January appears to be relatively consistent for the three years, with the highest abundance found in Stratum 802 in Div. 4R which is in the Esquiman Channel southwest of St. George's Bay. This is the same general region where the cod and greyscale accumulate in the winter months forming prespawning concentrations. In Div. 4S are found relatively large numbers all along the south coast of Anticosti Island and even in the outer portion of the mouth of the St. Lawrence River in Strata 803, 804, 805 and 806. Reasonable numbers were also located in Stratum 816 on the north side of Anticosti Island in 1978 however, this quantity appears to have been reduced in 1980.

Estimates of trawlable biomass in Div. 4S (although none was available in 1979) seems to be very consistent from 1978 to 1980 at 9.2 to 9.1 thousand t. On the other hand the estimates of trawlable biomass in Div. 4R show a decrease of 17% from 1978 to 1979 from 15.0 to 12.0 thousand t respectively and a marked decrease of 72% from 1979 to 1980 from 12.0 to 3.5 thousand t. This would seem to reflect the enormous increase in landings over the past few years particularly from 1978 to 1979.

B) Age composition from surveys

For Div. 4R there were 5 strata which showed relatively high levels of abundance. These were strata 801, 802, 810, 812, 813 and were also the general areas where the Newfoundland trawler fleet operated. For these five strata the average numbers of fish per set at age were calculated for males and females separately for each year of 1978 to 1980. An overall mean number per set was then computed for the five strata weighted by the area of each stratum in square nautical miles. The results of the calculations are presented in Tables 4 and 5 and shown pictorially in Fig. 4 and 5.

The males were comprised almost entirely of 3 age-groups of 6-8-yr-olds in 1978-79 and 5-7-yr-olds in 1980 (Fig. 4). However, the reduction from 1979 to 1980 indicates that the males have practically been decimated, again a probable reflection of the large catch in 1979 considering that males comprise 70% of the commercial catch.

The females were made up of essentially 4-11 yr-olds for all three years with most occurring in 6-9 yr-old range. Although the reduction of females is not as marked as males, the reduction is nevertheless substantial.

Fishing mortality and yield per recruit

With the lack of effort data and a reasonable time series of catch-at-age data it was difficult to obtain any real time estimate of fishing mortality. In order to arrive at some estimate of average mortality over the past several years, catch curves were constructed for both commercial otter trawl samples for 1979 and 1980 in Division 4R and from research survey data from 1978-80 combined from heavily fished strata in Division 4R.

Catch curves for the commercial data (Figure 6) yielded values of $F=1.45$ for males and $F = 0.69$ for females for $m = 0.20$. The survey data (Figure 7) yielded values of $F = 1.36$ for males and $F = 0.74$ for females for $M = 0.20$. The values for each independent set of data were reasonably close together.

Yield-per-recruit curves of the Beverton-Holt type were constructed using length composition data from the Can (N) otter trawl fishery in Division 4R and the Von Bertalanffy growth parameters produced by Trembley (1980). The parameters were as follows:

	<u>Females</u>	<u>Males</u>
Maximum age	15 years	11 years
Natural mortality	0.20	0.20
T_R - age at entry	5 years	5 years
t_0 - from growth curves	1.822	1.352
W_∞ - from growth equations	32.522 kgs	9.151 kgs.
K - from growth equations	0.048	0.088
Mean selection age	11.96 years	8.83 years

The yield curves are presented in Figure 8. The curves were essentially flat-topped with no F_{\max} up to $F = 2.5$. $F_{0.1} = 1.04$ for males and $F_{0.1} = 0.765$ for females.

The F values derived from the catch curves were also placed upon the yield curves.

REFERENCES

- Tremblay, C. and F. Axelsen 1980. Donnees sur la pêche, la biologie et l'abondance du fletan du Groenland (Reinhardtius Hippoglossoides) dans le Golfe du Saint-Laurent. CAFSAC Research Document 80/34: 25p.

Table 1. Greenland halibut landings in the Gulf of St. Lawrence 1969-79.

YEAR	4S	4R	4T	4RS	4RST
1969	345	248	209	593	802
1970	496	381	235	877	1112
1971	450	300	204	750	954
1972	379	199	105	578	683
1973	431	216	116	647	763
1974	752	167	92	919	1011
1975	1102	195	247	1297	1544
1976	1367	517	135	1884	2019
1977	2298	1108	555	3406	3961
1978	3549	1344	1354	4893	6247
1979	251	2858	5867	3109	8976*

*Any Maritime landings not included.

Table 2. Greenland halibut catch data (OT)NAFO Division 4R1st. Quarter 1979, 1980

AGE	<u>Males</u>			<u>Females</u>		
	\bar{L} 1979	\bar{L} 1980	$\bar{L}_{80} - \bar{L}_{79}$	\bar{L} 1979	\bar{L} 1980	$\bar{L}_{80} - \bar{L}_{79}$
4	43.00	43.08	+0.08	44.50	44.50	0.00
6	45.50	45.55	+0.05	45.00	44.46	-0.64
7	49.90	49.41	-0.51	49.70	49.79	+0.09
8	51.40	51.52	+0.12	53.30	53.36	+0.06
9	54.10	54.19	+0.09	57.60	57.66	+0.06
10	62.20	61.18	-1.02	60.40	60.08	-0.32
11				65.60	65.78	+0.18
12				69.90	69.73	-0.27
13				79.90	79.15	-0.75
14				80.50	80.50	0.00
15				84.50	84.50	0.00
[49.68	52.63		58.63	58.38	
% of Catch	69.3	68.7		30.7	31.3	

Table 3. Biomass Surveys
Greenland Halibut

STRATUM	Div. 4R Av. No. Set			Av. Wt. Set (kg)		
	1978	1979	1980	1978	1979	1980
801	17.67	14.67	19.00	24.97	14.98	14.75
802	257.00	246.00	56.67	420.18	368.19	96.08
809	2.93	5.67	0.67	5.15	9.38	0.68
810	29.67	3.00	2.75	48.88	5.45	6.13
811	0.00	0.60	0.50	0.00	0.64	0.65
812	5.00	2.00	0.67	6.22	3.50	0.12
813	1.00	2.75	1.50	0.91	2.38	0.65
814	1.33	1.67	-	1.44	2.65	-
820	0.00	0.00	0.00	0.00	0.00	0.00
821	0.00	0.00	0.00	0.00	0.00	0.00
822	0.00	0.00	0.00	0.00	0.00	0.00
823	0.00	0.00	0.33	0.00	0.00	1.13
824	-	-	0.50	-	-	0.20
825	0.00	0.00	-	0.00	0.00	-
826	-	-	-	-	-	-

Div. 4S

803	17.50		24.43	21.11		32.14
804	19.33		17.00	18.92		16.25
805	12.58		19.67	12.72		18.58
806	4.67		3.33	5.45		3.93
807	5.33	2.00	2.00	7.11	2.95	3.50
808	2.33	2.33	1.00	3.86	1.79	1.67
815	6.67	1.50	2.67	4.69	1.02	2.30
816	46.40	10.33	3.67	33.69	6.51	2.33
819	0.50	0.00	0.33	0.57	0.00	0.25

Mean Trawlable
Biomass In

Div. 4R	14,984	12,477	3502
Div. 4S	9,263	-	9079
(for the above strata)			

Table 4. Greenland Halibut Biomass Survey Division 4RAverage number fish per 30-minute setMaleGADUS 4, January 1978

Age	Stratum	801	802	810	812	813	Mean No./Set Wtd. by Stratum Area
	Area (sq. miles)	354	399	223	1355	1154	
4		0.03	0.06	0.02	0.15	0.00	0.070
5		0.41	1.34	0.19	0.74	0.00	0.495
6		1.34	27.11	3.21	0.44	0.00	3.616
7		2.76	144.31	14.94	0.35	0.00	17.895
8		0.46	25.86	1.97	0.31	0.00	3.254
9		0.00	0.00	0.00	0.00	0.14	0.001
10		0.00	0.48	0.00	0.00	0.19	0.118
Total		5.00	199.16	20.33	1.99	0.33	

GADUS 16, January 1979

3	0.33	0.00	0.00	0.00	0.00	0.034
4	0.00	0.00	0.00	0.00	0.00	0.000
5	0.33	0.00	0.00	0.00	0.00	0.034
6	0.94	19.29	0.22	0.13	0.17	2.425
7	1.50	94.35	0.93	0.07	0.15	11.091
8	0.89	58.86	0.19	0.20	0.18	6.979
Total	3.99	172.50	1.34	0.40	0.50	

GADUS 31, January 1980

3	0.00	0.00	0.00	0.17	0.00	0.07
4	1.60	0.00	0.00	0.17	0.30	0.33
5	3.77	1.63	0.11	0.00	0.39	0.71
6	2.64	6.61	0.12	0.00	0.06	1.06
7	2.19	6.30	0.05	0.00	0.00	0.95
8	0.29	2.46	0.21	0.00	0.00	0.32
9	0.00	0.17	0.00	0.00	0.00	0.02
10	0.00	0.17	0.00	0.00	0.00	0.02
Total	10.49	17.34	0.49	0.34	0.74	

Table 5. Greenland Halibut Biomass Survey Division 4RAverage number per 30-minute set

<u>Female</u>		<u>GADUS 4, January 1978</u>					Mean No./Set Wtd. by Stratum Area
Age	Stratum	801	802	810	812	813	
	Area (sq. miles)	354	399	223	1355	1154	
3		0.00	0.00	0.00	0.20	0.00	0.078
4		0.14	0.00	0.07	0.36	0.07	0.177
5		1.64	0.60	0.22	0.16	0.29	0.408
6		3.85	5.21	0.08	0.42	0.24	1.235
7		4.42	15.33	0.88	1.03	0.08	2.687
8		1.75	21.08	1.38	0.46	0.00	2.858
9		0.50	7.71	0.30	0.16	0.00	1.015
10		0.04	4.75	0.00	0.00	0.00	0.548
11		0.00	3.16	0.00	0.20	0.00	0.440
12		0.00	0.00	0.00	0.00	0.00	0.021
13		0.00	0.00	0.00	0.00	0.00	0.000
14		0.33	0.00	0.00	0.00	0.00	0.034
Total		12.67	57.84	2.93	2.99	0.68	
<u>GADUS 16, January 1979</u>							
3		0.33	0.00	0.00	0.20	0.00	0.111
4		0.00	0.00	0.00	0.00	0.00	0.000
5		0.00	0.00	0.00	0.00	0.82	0.083
6		0.76	0.14	0.10	0.06	0.55	0.395
7		5.18	5.77	0.24	0.28	0.12	1.493
8		2.72	41.43	0.51	0.15	0.25	5.150
9		0.19	21.75	0.34	0.52	0.00	2.816
10		0.21	1.67	0.21	0.27	0.00	0.331
11		0.07	1.43	0.07	0.13	0.00	0.226
12		0.20	1.30	0.20	0.00	0.00	0.182
Total		9.66	73.49	1.67	1.61	1.74	
<u>GADUS 31, January 1980</u>							
3		0.05	0.00	0.00	0.00	0.00	0.05
4		0.08	0.02	0.00	0.00	0.25	0.17
5		0.60	0.13	0.00	0.00	0.25	0.16
6		2.54	0.87	0.08	0.00	0.25	0.45
7		2.77	7.30	0.47	0.00	0.00	1.15
8		1.20	9.54	0.30	0.00	0.00	1.23
9		0.08	10.96	0.48	0.00	0.00	1.29
10		0.00	6.36	0.43	0.00	0.00	0.76
11		0.00	3.81	0.38	0.00	0.00	0.46
12		0.00	0.17	0.13	0.00	0.00	0.03
Total		7.32	39.16	2.27	0.00	0.75	

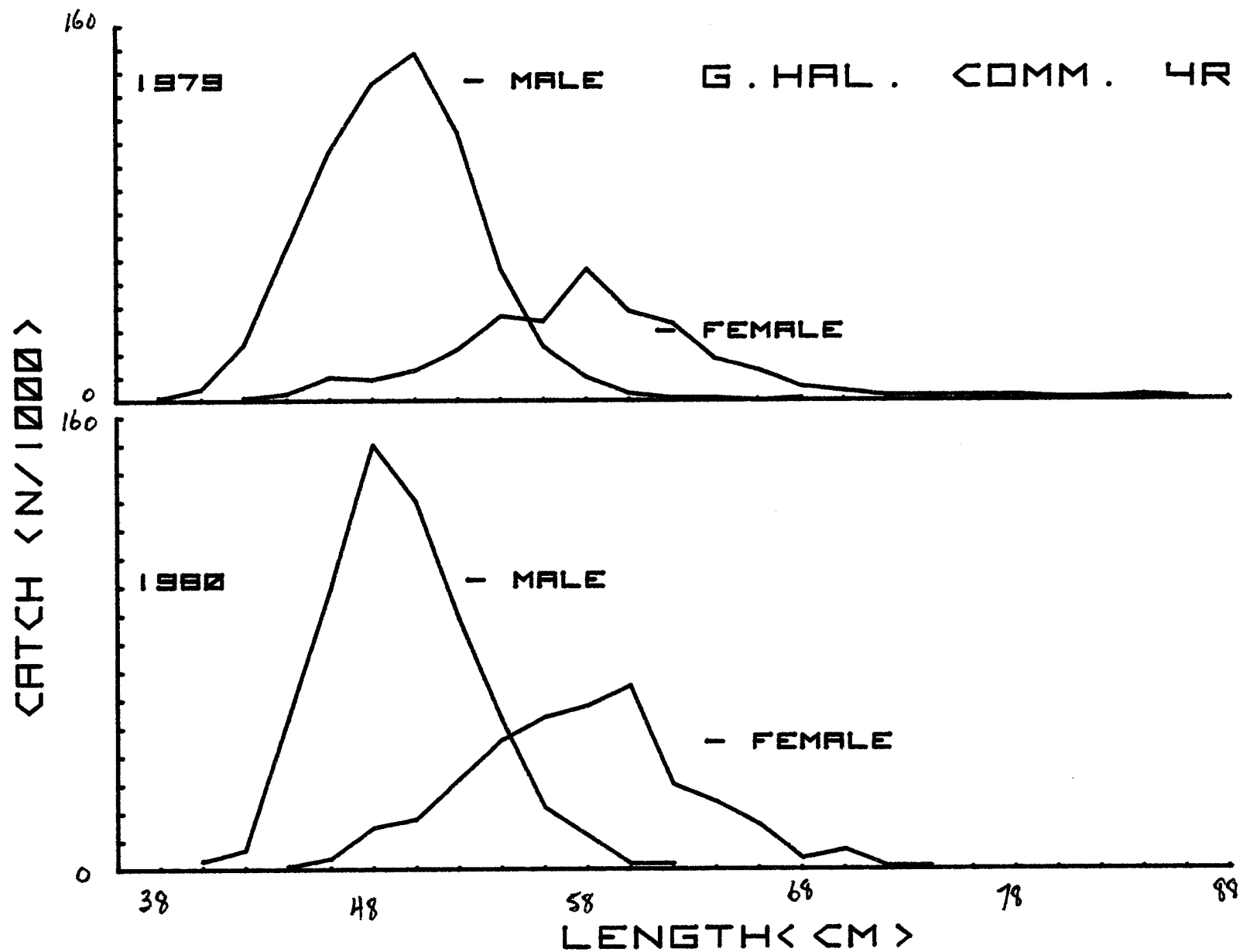


Fig. 1. Length composition of commercial male & female Greenland halibut for 1979 and 1980. 1st Quarter-Division 4R.

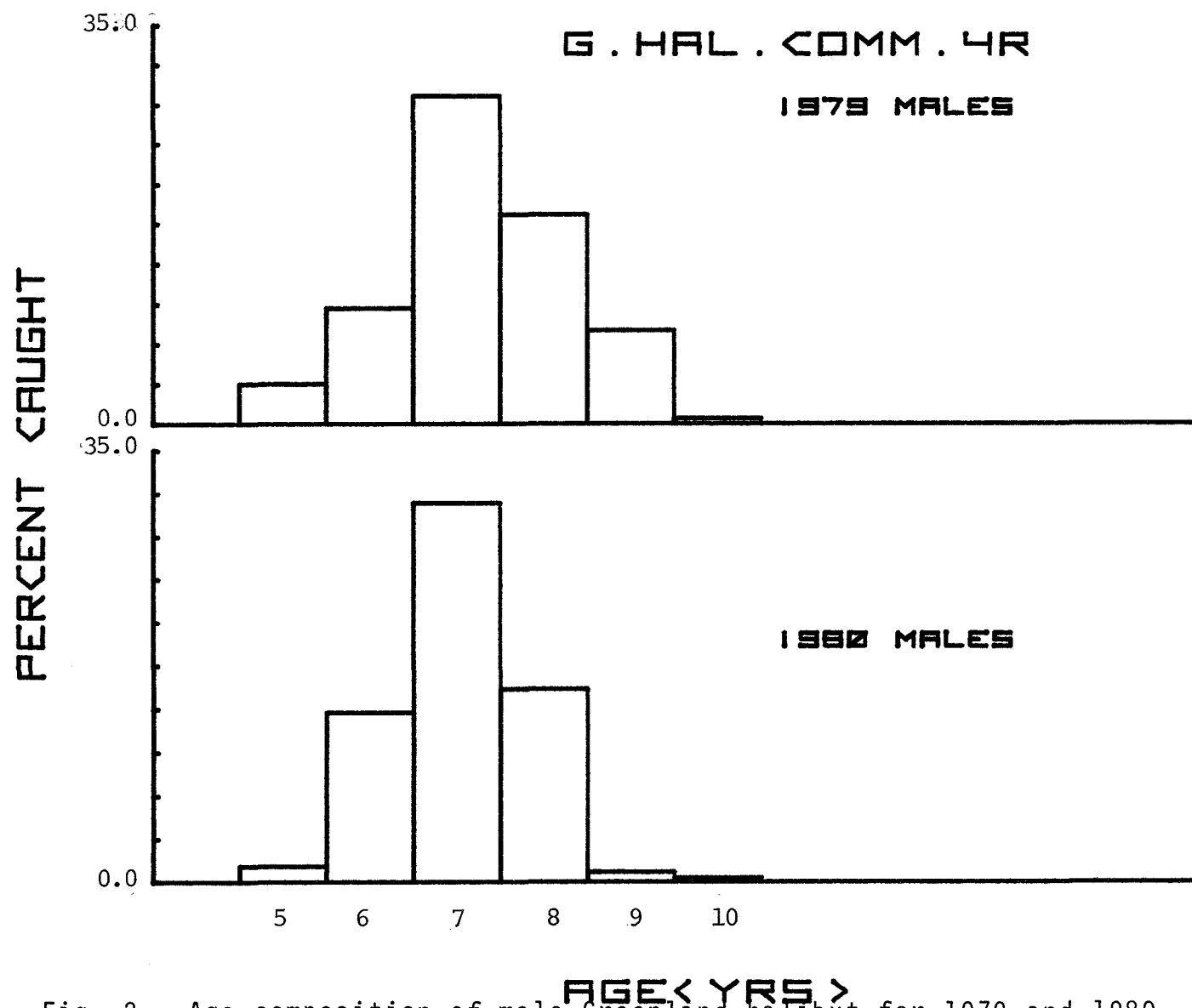


Fig. 2. Age composition of male Greenland halibut for 1979 and 1980
1st Quarter - Division 4R.

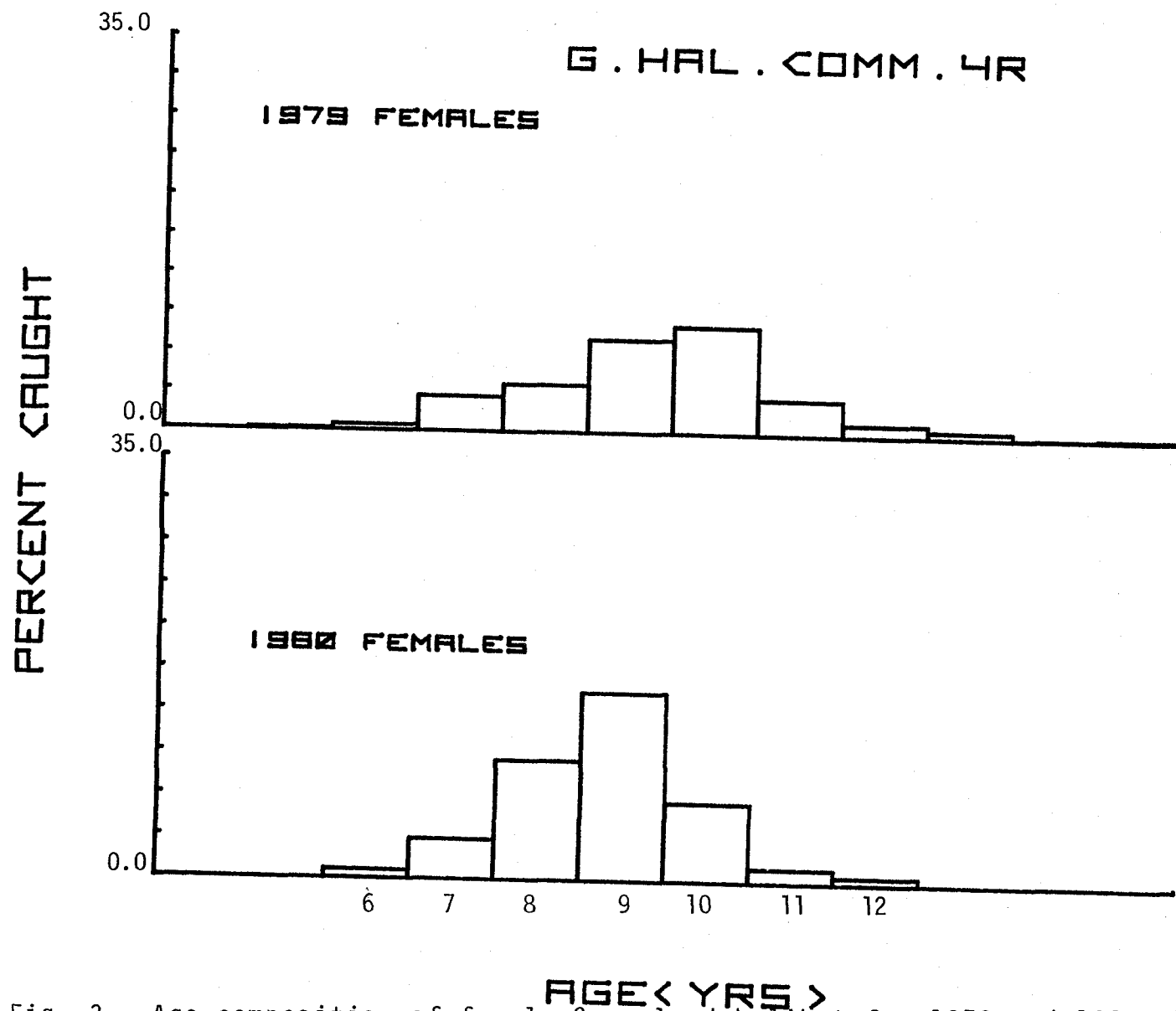


Fig. 3. Age composition of female Greenland halibut for 1979 and 1980, 1st Quarter - Division 4R.

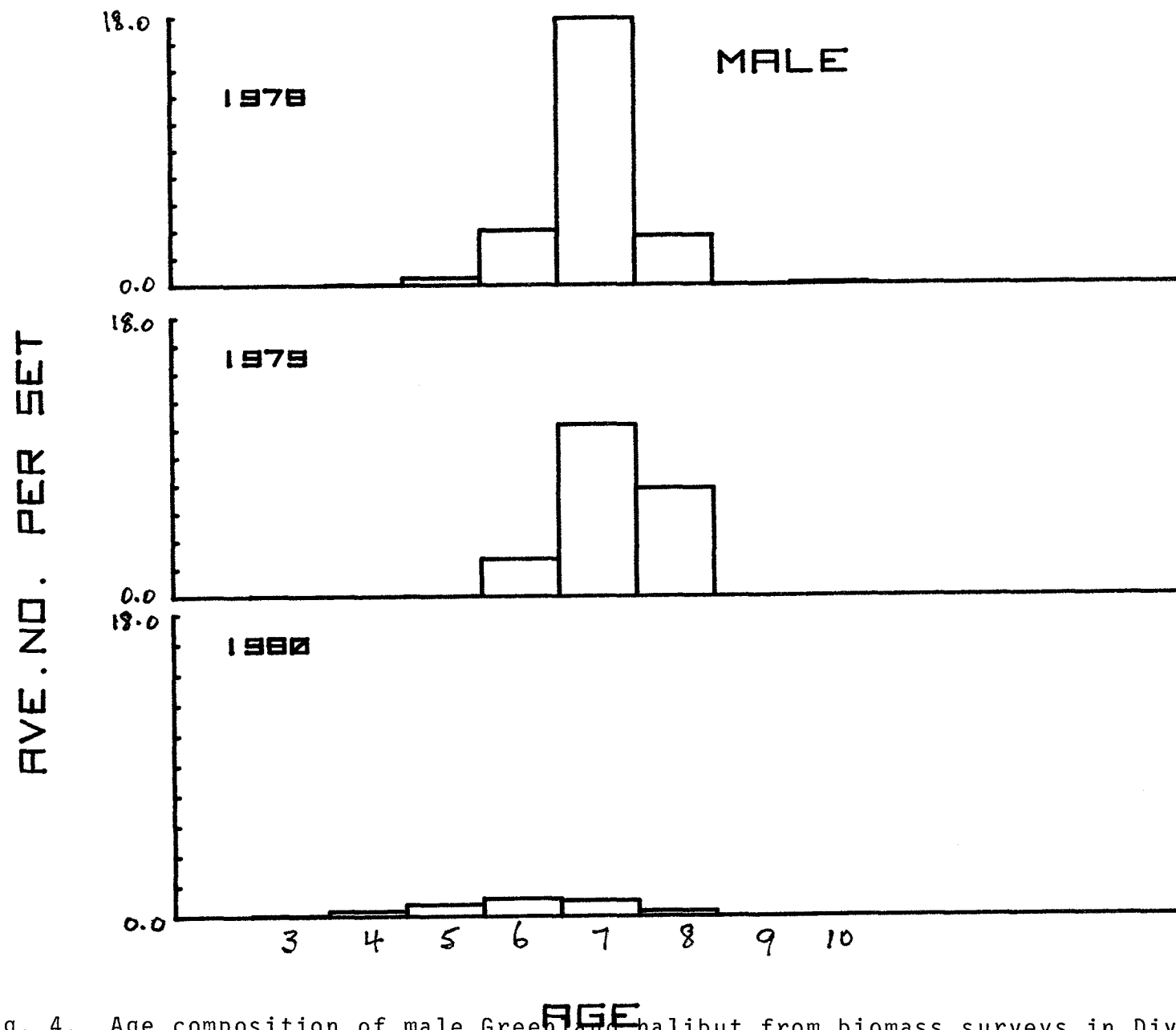


Fig. 4. Age composition of male Greenland halibut from biomass surveys in Div. 4R for January 1978-80.

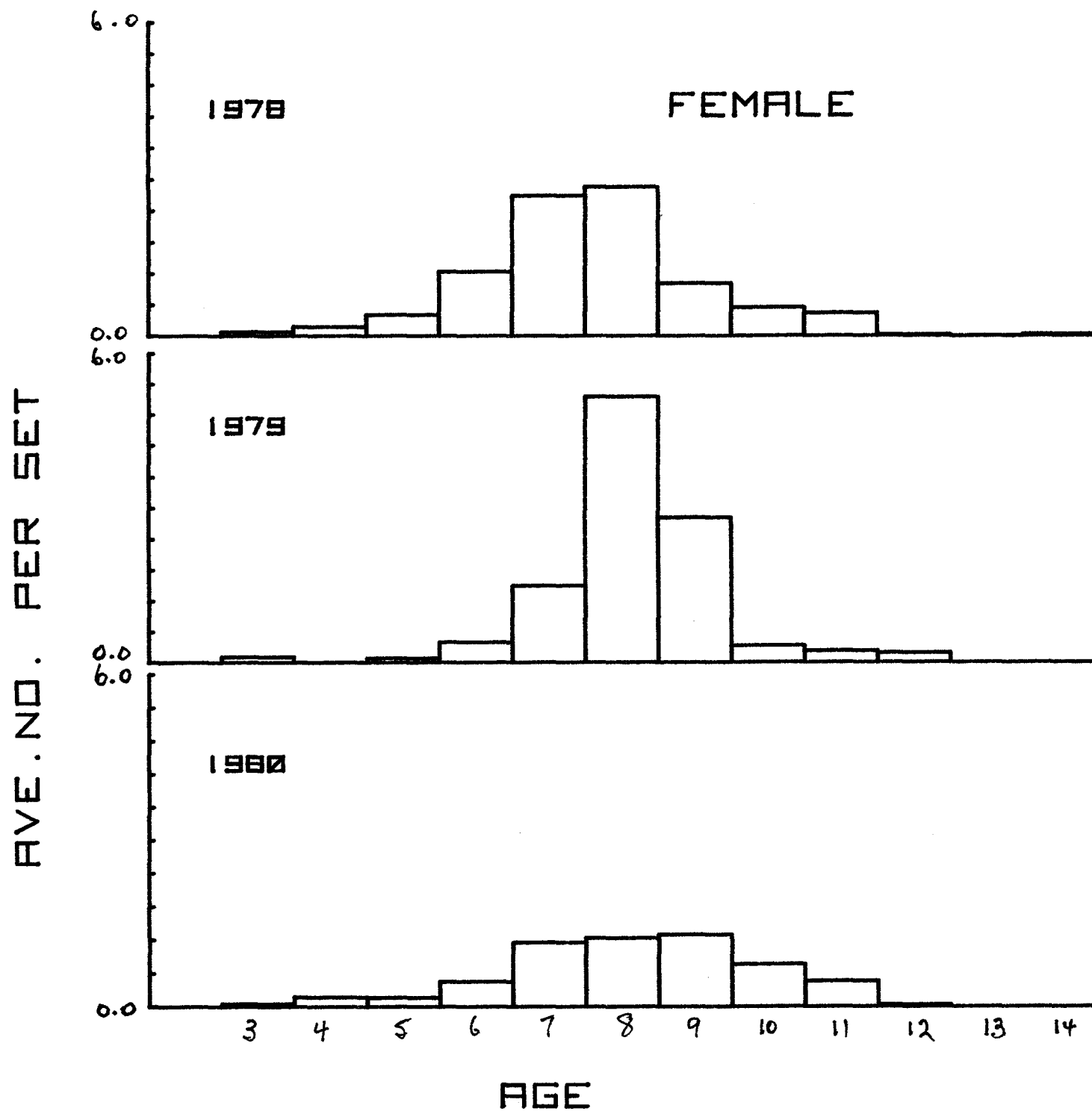


Fig. 5. Age composition of female Greenland halibut from biomass surveys in Div. 4R for January 1978-80.

Figure 6. Greenland Halibut 4RST Commercial OT Can(N) 1979 + 1980

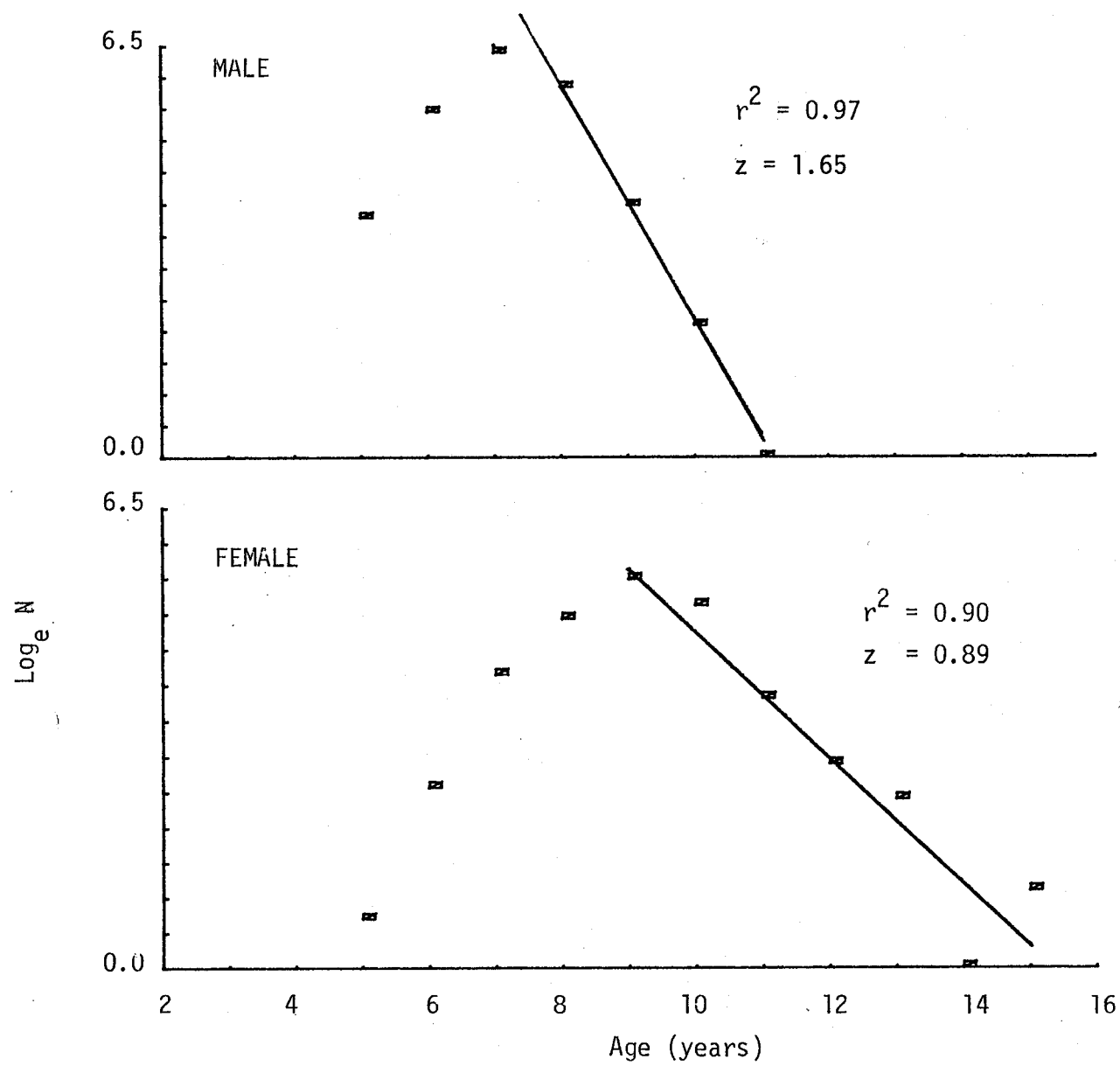
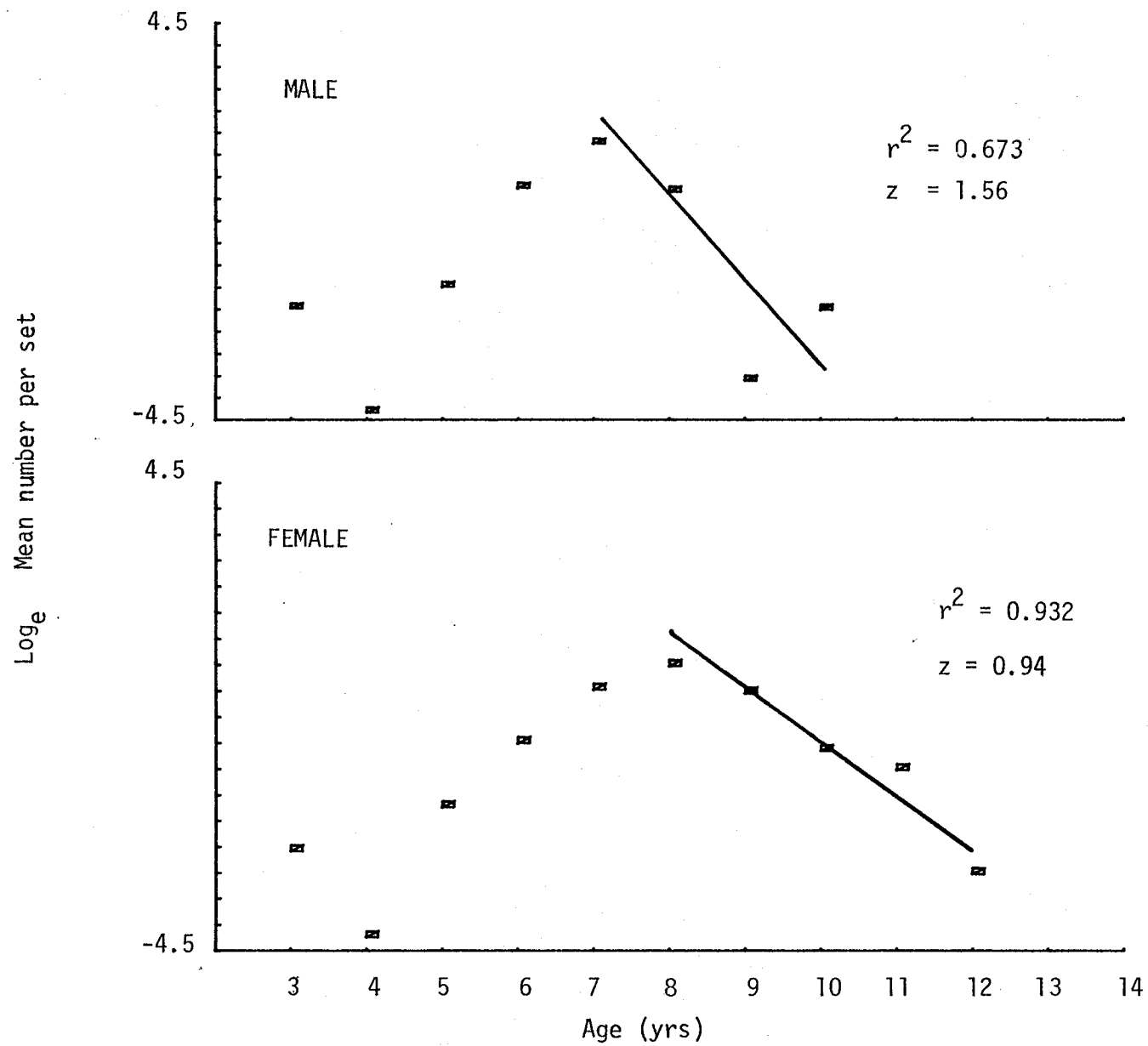


Figure 7. Greenland Halibut Division 4R, Strata 801, 802, 810, 812, 813 (1978-80)



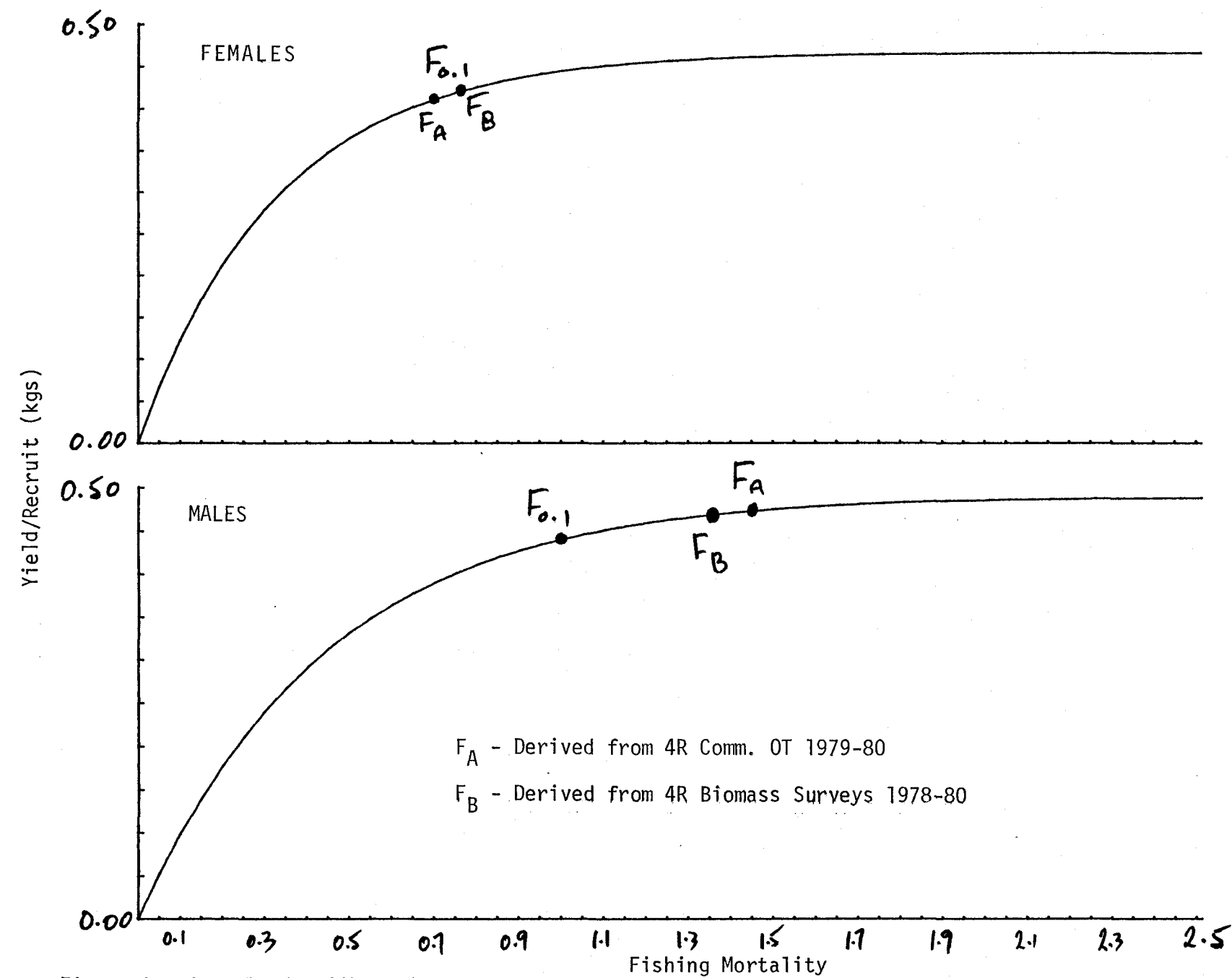


Figure 8. Greenland Halibut Division 4RST