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The Greenland Halibut Fishery on the Continental Shelf of
ICNAF Subarea 2 and Div. 3KL

by

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Landings

The two main facets of this fishery are the Canadian (N) inshore fishery (mainly gillnets) and the offshore otter trawl fishery with most of the offshore effort coming from the USSR and Poland with increased effort from Canadian trawlers over the last three years. The inshore gillnet fishery was very lucrative during the mid-1960's when catches were over 15,000 tons for 1966 and 1967 (Fig. 1). It declined steadily until 1974 and has been on the upswing since then. The annual catch by gillnet fishermen has gone from 8,000 tons in 1974 to 22,000 tons in 1978, the highest ever recorded for Greenland halibut in this area. The otter trawl catches have fluctuated between 15,000 and 25,000 tons annually over the past 7-8 years and have been consistent at 15,000 over the past three years. However, this would be expected because of quota constraints. The total landings for both gears have consequently increased dramatically over the past three years and, as a result, 1978 was the best year recorded for landings of Greenland halibut for this stock area.

Commercial Age Composition, 1978

Commercial otter trawl samples were taken from Canadian otter trawlers fishing in ICNAF Div. 3K during the first quarter of 1978. These samples were assumed to be fairly representative of the offshore fishery, particularly Poland, whose Greenland halibut landings are almost totally from Div. 3K. Larger fish, particularly in USSR catches, may be somewhat under-represented, since the USSR fishes farther to the north and in deeper water. In any case, in respect to the total fishery, the number of large fish would not be all that meaningful.

The inshore gillnet samples were collected at shore-based processing plants along the east and northeast coast of Newfoundland with samples collected from both ICNAF Div. 3K and 3L (Fig. 2 and 3). These were collected during the summer of 1978 when the fishery was at its peak. The age composition of these catches represent approximately 60% of the total landings for 1978.

The age composition of males consisted mainly of 5- to 10-year-old fish (Fig. 2) with 6- to 8-year-olds making up the bulk of commercial gillnet catches for both Div. 3K and 3L, and 5- and 7-year-olds making up the bulk of the offshore catches. The slight difference between the two is undoubtedly the selectivity differences between the gears. The age composition of the females (Fig. 3) show a more distinct difference between gears. The gillnet catches are comprised of mainly 5- to 12-year-olds with evidence of some as old as 19 years in Div. 3K. The peak of the catch, however, is in the 6- to 9-year-old range. The otter trawl catches of females are essentially the same as the otter trawl males with the bulk of the catch being in the 5- to 7-year range with few fish beyond age 10.

Research Vessel Survey Data (Canadian)

Several research vessel surveys were carried out in Subarea 2 and Div. 3KL during 1978 and one in late 1977, all by the Canadian research vessel "*Gadus Atlantica*".

August-September Surveys, 1978

In September 1978, a survey was conducted in ICNAF Div. 2GH by line survey across depth ranges. There were 128 stations fished over the fishable area in both Divisions. The length composition of the catches (per 5 hours fished) are presented in Fig. 4 for both Divisions fished. The length composition between the two areas is quite different with Div. 2G consisting mainly of larger fish with little representation in the smaller length groups, except for 16-17 cm in the females. Div. 2H, on the other hand, consisted mostly of small fish, however, there were a considerable number of larger fish.

In August, a survey of ICNAF Div. 2J, 3K, and 3L was conducted using a stratified random type of survey. Except for Div. 3L in which the catch rates for small fish were considerably lower than in Div. 2J and 3K (Fig. 5), the length compositions were much similar to those found in Div. 2H. The frequency of larger fish did decrease a little, however, going from north to south.

The age composition of male Greenland halibut (Fig. 6) is generally the same for Div. 2H, 2J, 3K, and 3L, with the range from 2 to 11 years and the bulk of the catch in the 3-6 range. Div. 2G, on the other hand, had little in the way of 2- to 6-year-olds but had most 7- to 10-year-olds.

Except for the 2- to 16-year range, the age composition of the females had a similar pattern to that of the males (Fig. 7). The main portion of the catch consisted of 3- to 6-year-olds in Div. 2H, 2J, 3K, and 3L, and 5- to 9-year-olds in Div. 2GH. The catch per 5 hours was lower for the females than males at age in all Divisions.

November Surveys, 1977, 1978

In November of 1977 and 1978 a stratified random groundfish survey was conducted in ICNAF Div. 2J between the 100-500-m contours. In order to compare the results between years directly, only strata fished in both years were used for comparison. The numbers caught at age by sex for a total of 12 strata weighted by stratum area were averaged to give a mean number caught per age-group per set fished. Combining the 12 strata should considerably decrease the variances on the numbers caught at age and for the purpose of this document, no further consideration was given to variance. The average numbers caught per set at age are plotted in Fig. 8 and 9.

The age distribution pattern in the males is much the same for both years (Fig. 8), however, the average number caught per set in 1978 is only about 60% of the numbers caught in 1977. The main portion of the catches are made up, in both years, of ages 4-7 with a peak of ages 5-6.

The age distribution of females varies a little from 1977 to 1978 (Fig. 9), however, the major portion of the catch is between ages 4-7. The catch per set, as with males, is greatly reduced from 1977. For 1978, the numbers caught are only 66% of the 1977 numbers caught. While the catch per unit effort was down in 1978, there were more older fish caught. Age-groups were represented up to age 16 in 1978 as opposed to age 10 in 1977. Mortality estimates were calculated for the 1972+ year-classes according to Paloheimo's method and gave F values of 0.96 for males and 0.85 for females. The value for females is probably over-estimated considering the few numbers of old fish in the 1977 catches.

Survival and mortality rates were also calculated for the fully recruited age-groups as used in the commercial data. The F value for the males was too unrealistic for use since the numbers were too low in the fully recruited age-groups. The calculated F for males, however, was 1.90. The females, on the other hand, gave a value of F = 0.20 for the fully recruited age-groups which is not all that different from that of the commercial data.

Research Surveys by the Federal Republic of Germany

Research surveys in ICNAF Div. 2J were carried out in a relatively similar fashion of stratified random design as Canadian by the Federal Republic of Germany since 1973. The results are presented in Fig. 10 and are based upon six strata that were consistently fished from 1973 to 1977. The 1978 survey data were not yet available. The average number per set was low (35-45 fish per set) in 1973-74 and increased to a large extent to almost 80 fish per set in 1975

and has levelled at a high rate of about 60 fish per set for 1976-77. The low average weight per set in 1977 would appear to indicate large numbers of pre-recruits.

Catch Per Unit Effort and Mortality

Catch per unit effort was difficult to obtain for Greenland halibut since, in most cases, it was reported as mixed flounders. With the Canadian trawlers fishing more for Greenland halibut the past three years, some index of catch per unit effort was obtained for the Canadian offshore fishery when Greenland halibut was the main species. The Canadian offshore catch per unit effort for the last three years is as follows:

<u>Year</u>	<u>Catch per unit effort (tons/hr)</u>
1976	0.128
1977	0.240
1978	0.369

Using these values for 1977 and 1978 as a standard, a catch per unit effort at age by sex was calculated for the total fishery in the stock area. Survival and, consequently, mortality rates (Paloheimo's method) were calculated for the fully recruited age-groups. For the males, the value of F was 0.88 and for females, 0.14, both using M values of 0.20. These values when placed on a yield per recruit curve (Fig. 11) taken from Bowering (1978) indicate that the F value between 1977 and 1978 to be beyond $F_{0.1}$ (0.58) for the males and almost exactly at $F_{0.1}$ (0.18) for the females. This would probably represent removals in the order of 35,000 metric tons.

Summary

A good fishery for 1978 was not entirely unexpected. Bowering (1977) indicated the presence of very strong 1970-74 year-classes as found in research surveys in cooperation with the Federal Republic of Germany. These same year-classes have completely dominated the commercial fishery in 1978 as shown in this document. All research surveys in the area have also shown the dominating presence of these year-classes, but what is probably more important in the survey data is the presence of a very strong 1974 year-class which should recruit to the fishery in large numbers during 1979. It is difficult to determine the actual future contribution these year-classes will provide for the fishery, especially the 1970-74 year-classes, since the 1978 research survey at the end of the year indicates a reduction of 35% of the numbers of these from the 1977 survey.

The F values in Fig. 11 are probably maximal for the total stock since there are older and larger fish not available to the fishery (Bowering, 1978), however, for practical purposes, these fishing mortalities do represent the actual fishable stock.

For the immediate future, this stock appears to be in good condition and was generally being fished at $F_{0.1}$ during last season which represented removals of about 35,000 tons.

References

- Bowering, W. R. 1977. Trends in the Greenland halibut fishery in Subarea 2 and Divisions 3K and 3L. *ICNAF Res. Doc. 77/VI/11*, Serial No. 5031.
1978. The exploitation of the Greenland halibut stock complex of ICNAF Subarea 2 and Divisions 3KL. *ICNAF Res. Doc. 78/VI/39*, Serial No. 5201.

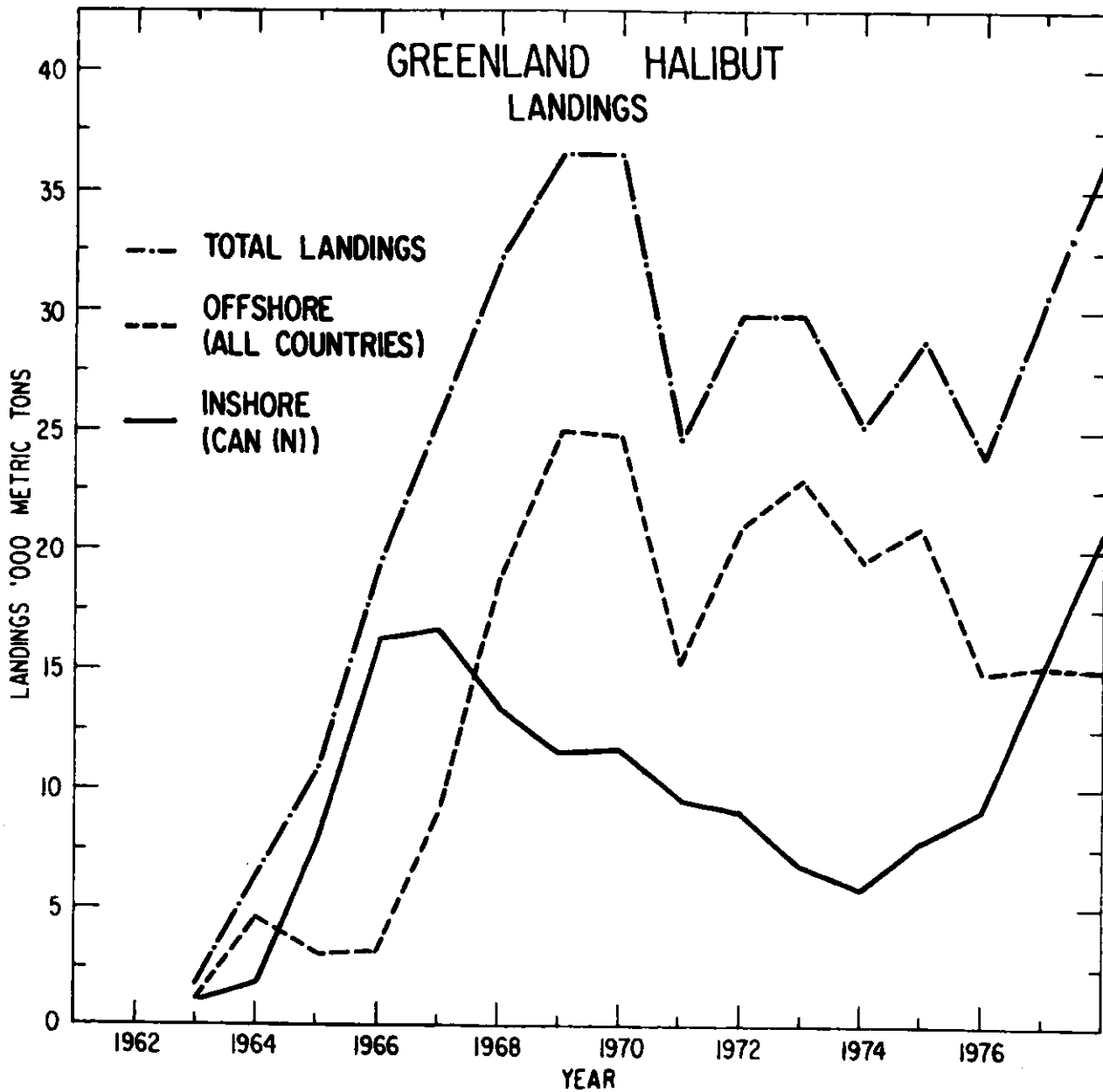


Fig. 1. Greenland halibut landings in ICNAF Subarea 2 and Divisions 3KL from 1963-78.

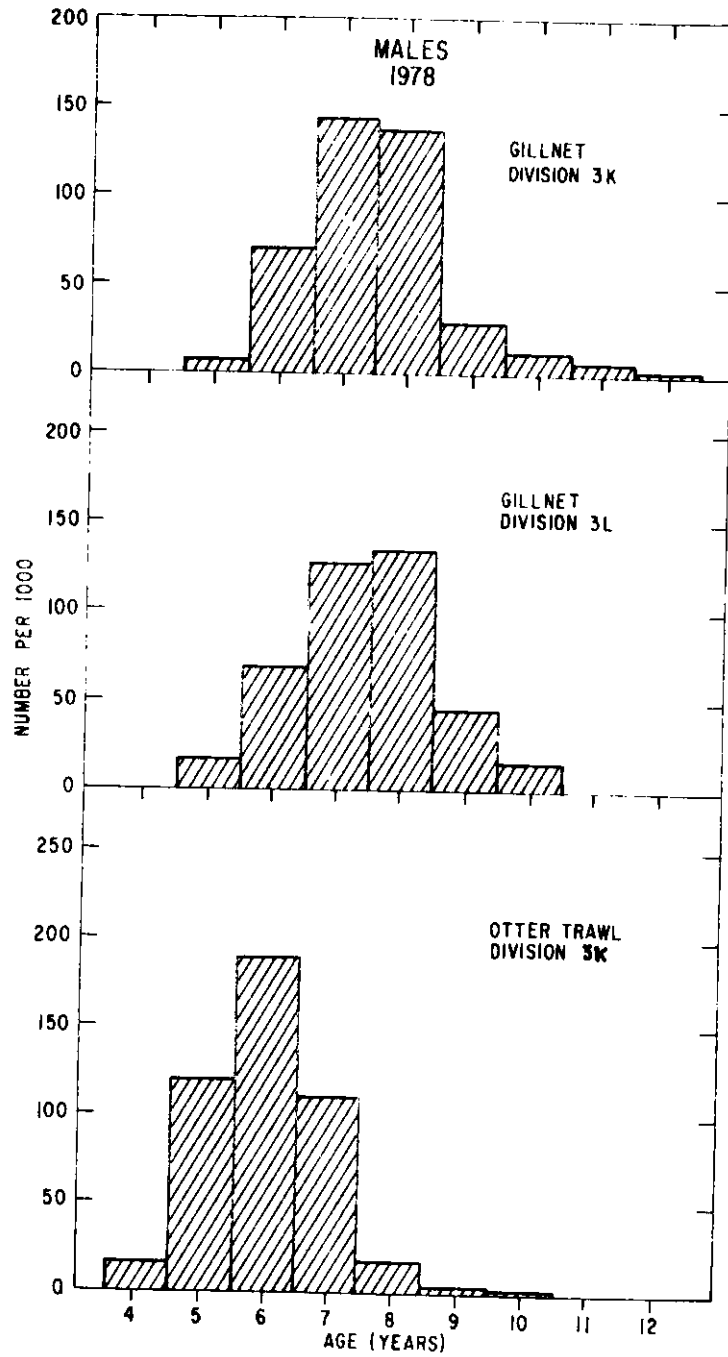


Fig. 2. Age composition of male Greenland halibut for 1978 from ICNAF Divisions 3K, 3L.

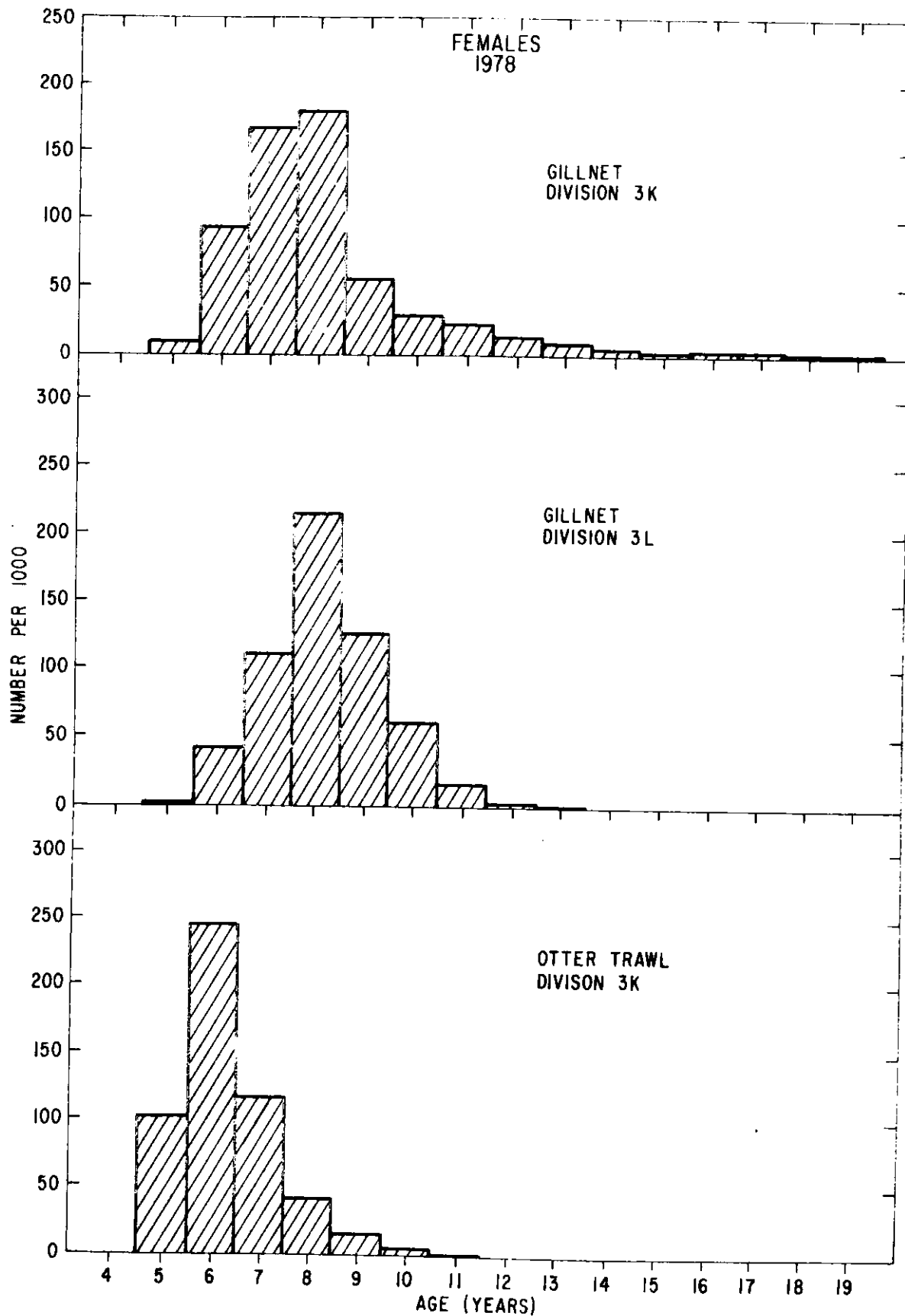


Fig. 3. Age composition of female Greenland halibut for 1978 from ICNAF Divisions 3KL.

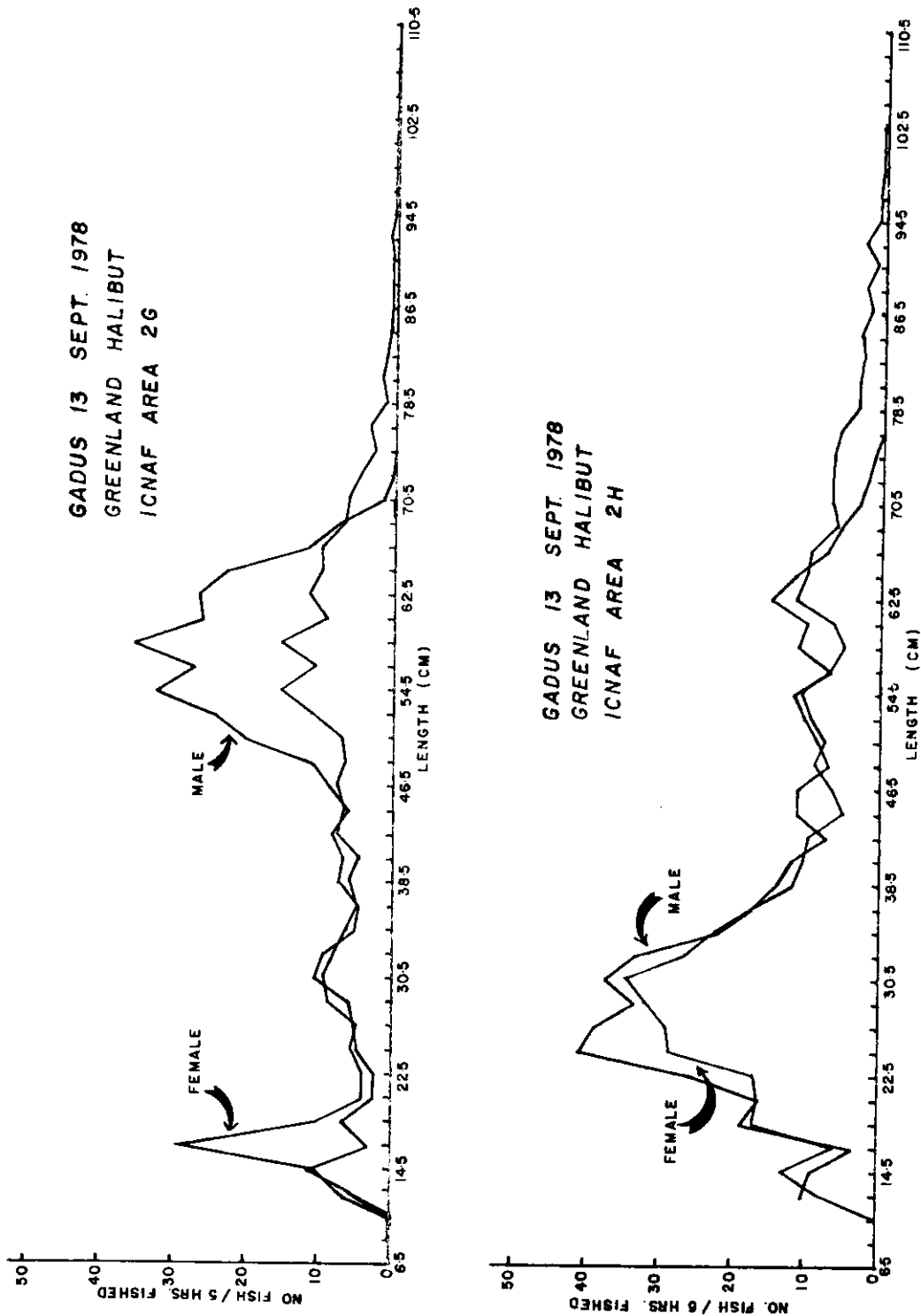


Fig. 4. Length composition of male and female Greenland halibut from a Canadian research survey during 1978 in ICNAF Divisions 2GH.

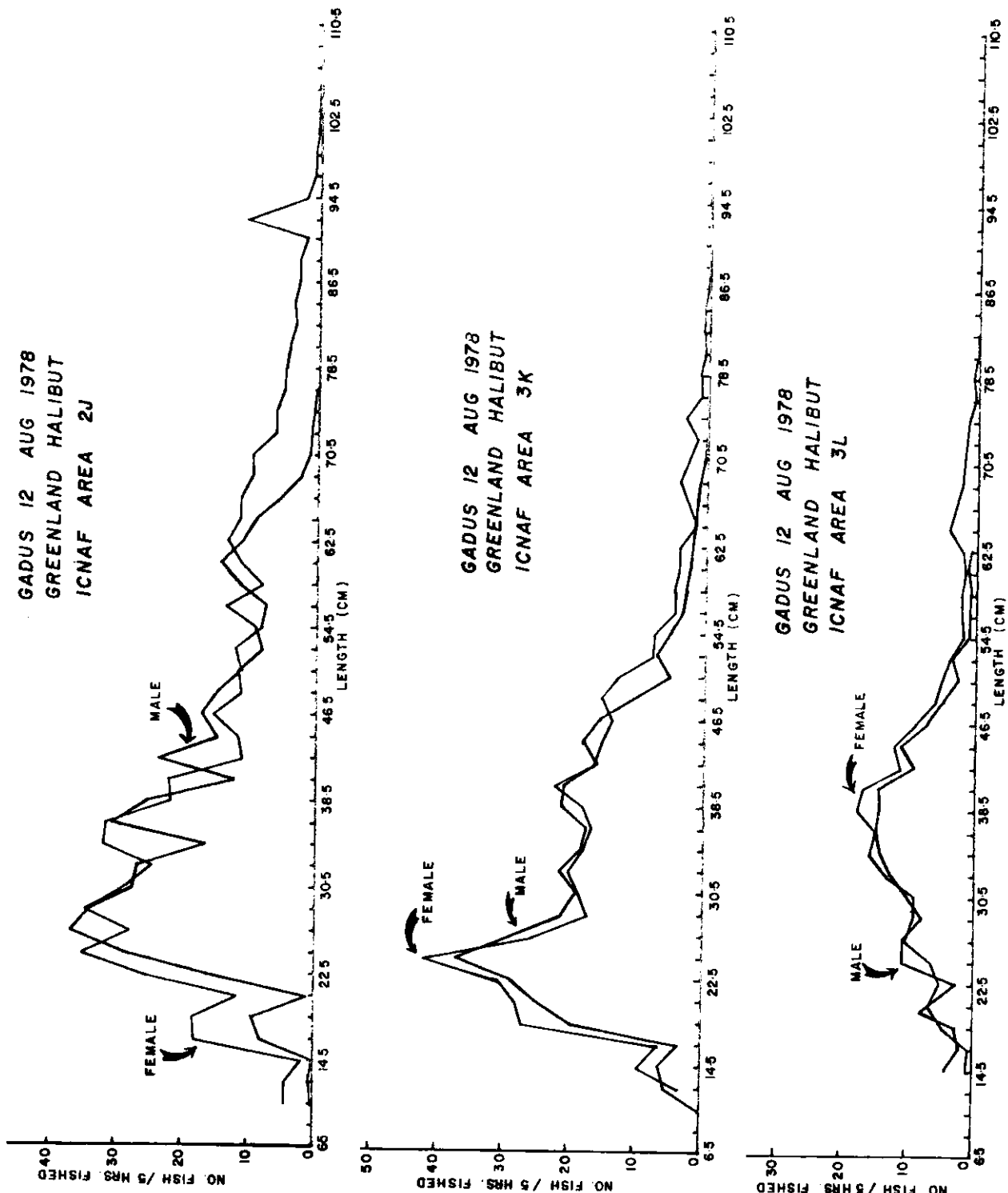


Fig. 5. Length composition of male and female Greenland halibut from a Canadian research survey during 1978 in ICNAF Divisions 2J, 3K and 3L.

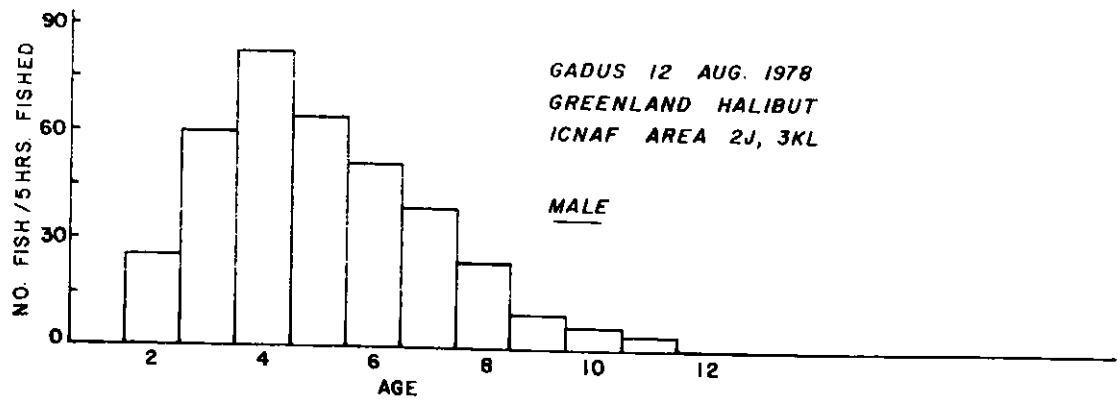
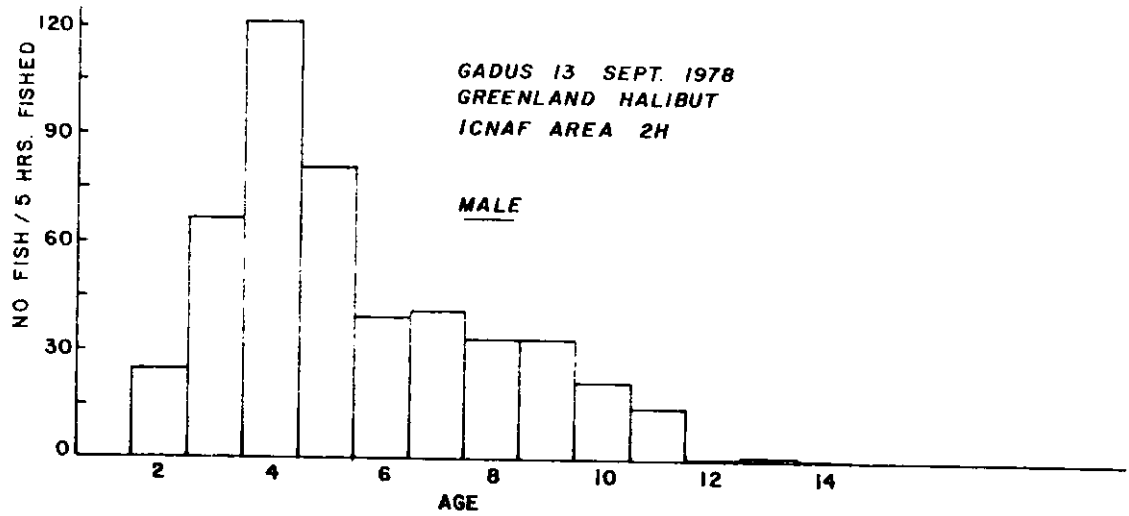
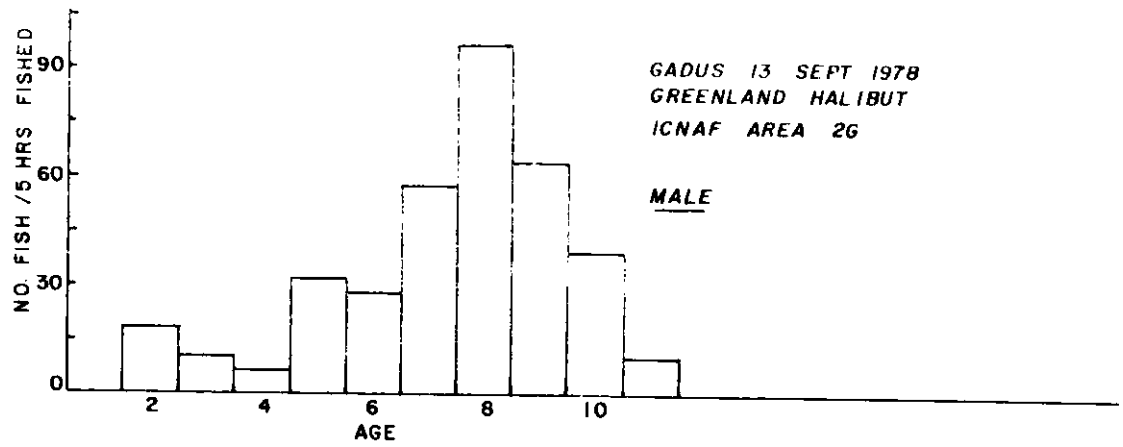


Fig. 6. Age composition of male Greenland halibut from Canadian research surveys during 1978 in ICNAF SA 2 and Divisions 3KL.

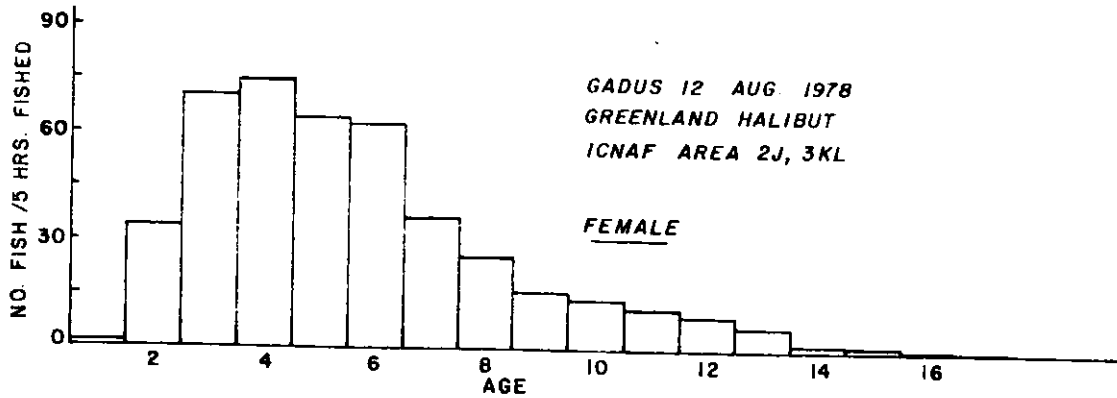
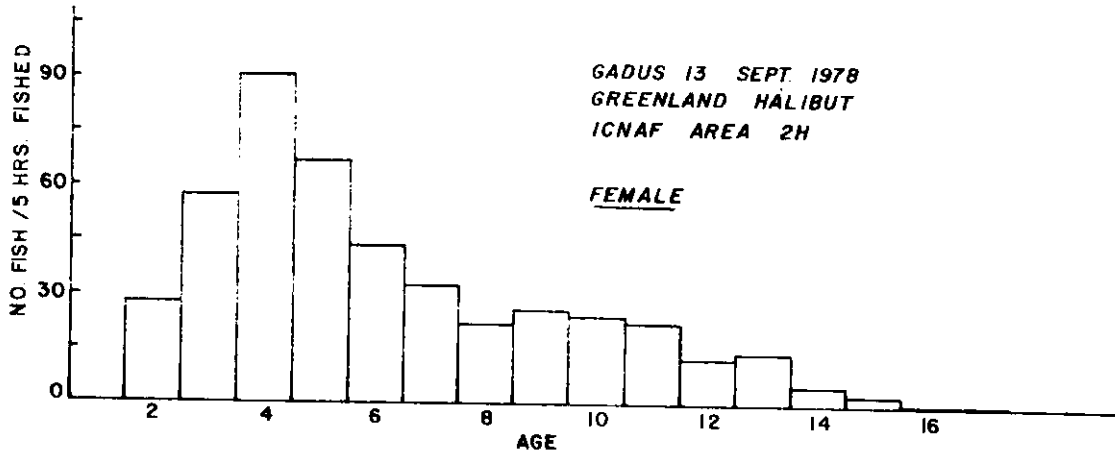
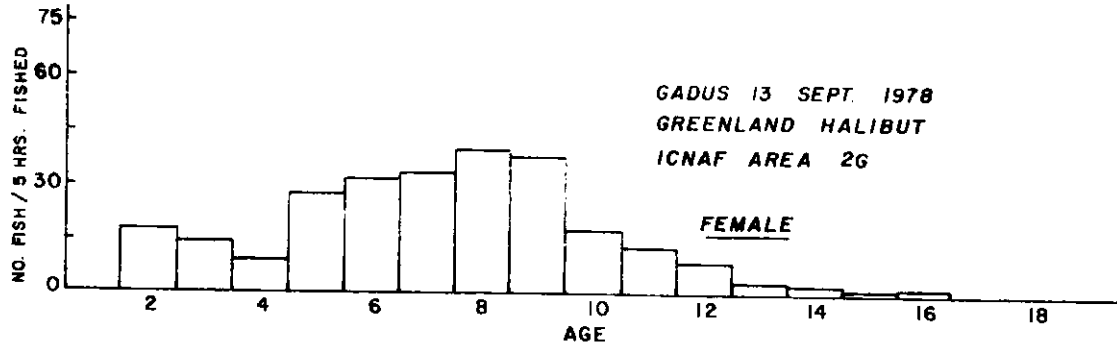


Fig. 7. Age composition of female Greenland halibut from Canadian research surveys during 1978 in ICNAF SA 2 and Divisions 3KL.

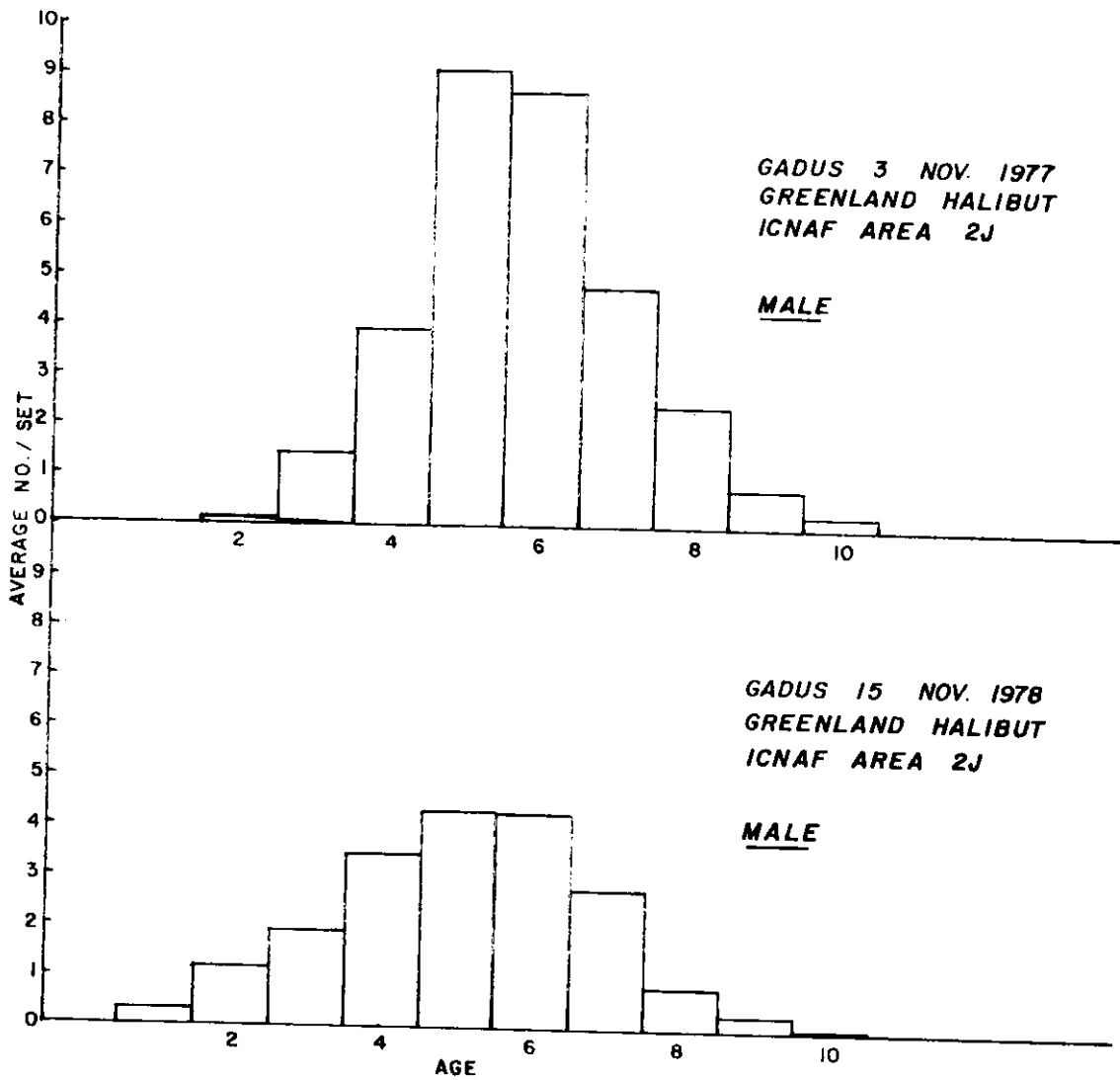


Fig. 8. Average number per set at age of male Greenland halibut from research surveys during 1977 and 1978 in ICNAF Division 2J.

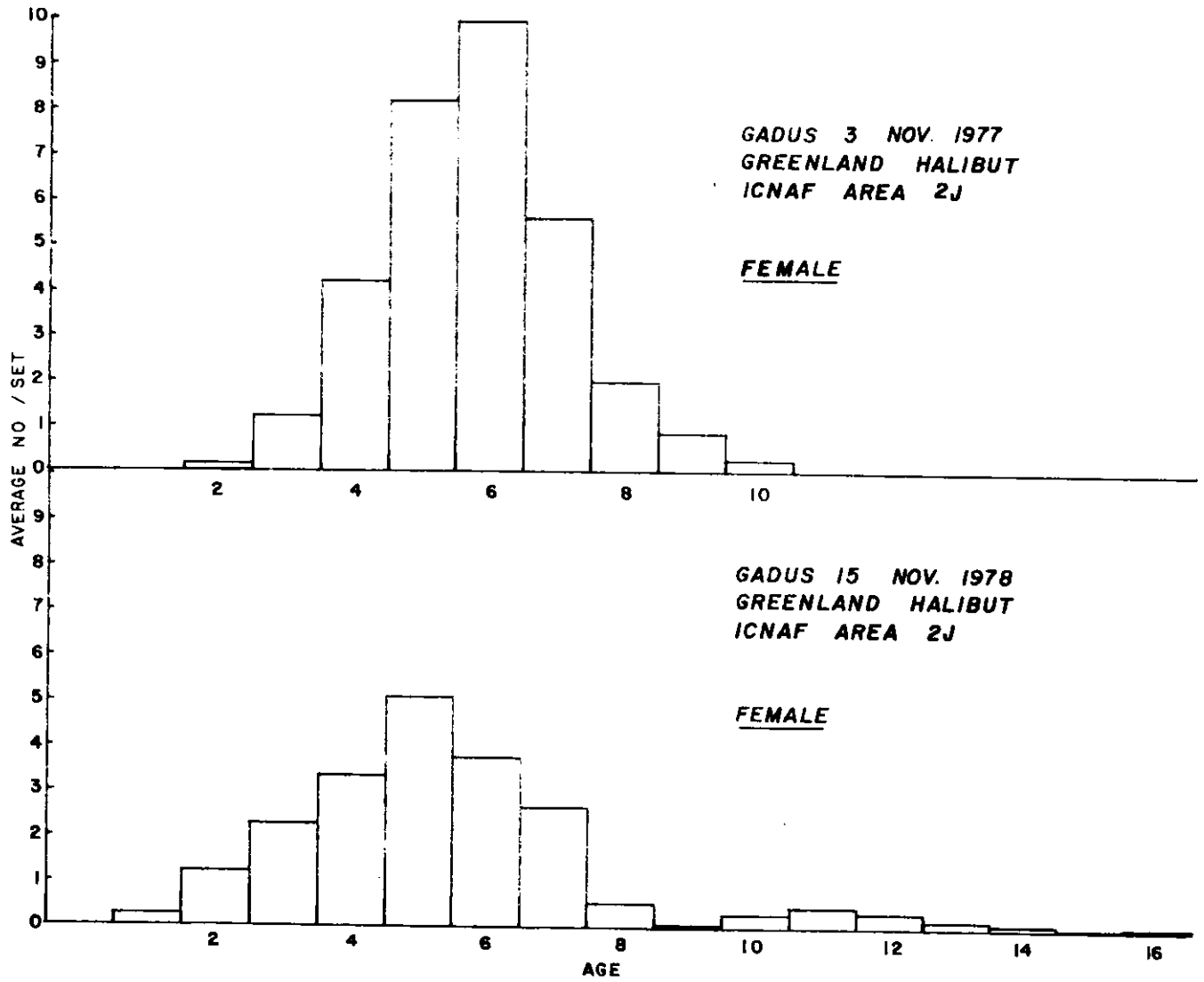


Fig. 9. Average number per set at age of female Greenland halibut from research surveys during 1977 and 1978 in ICNAF Division 2J.

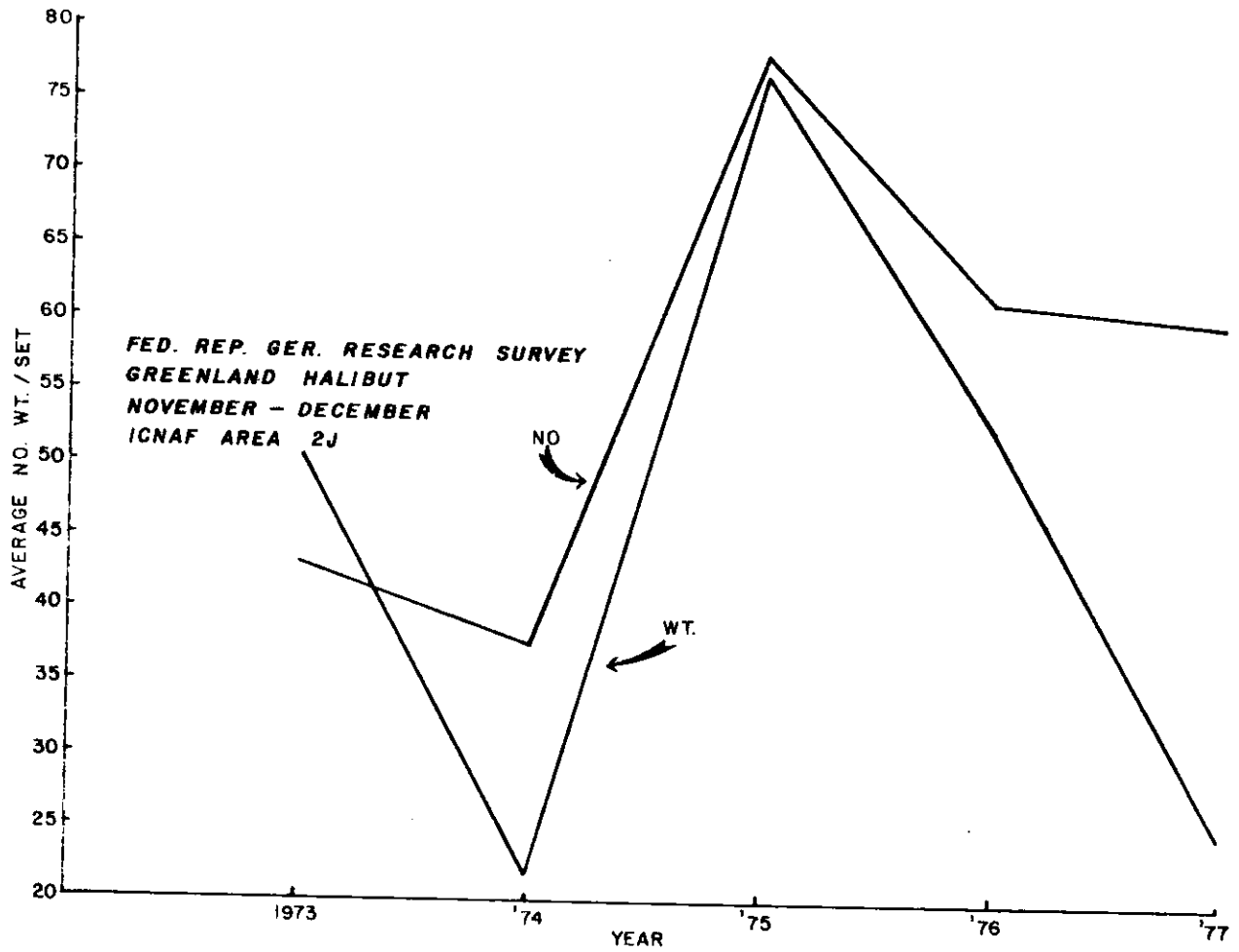


Fig. 10. Average number and weight per set of Greenland halibut from Federal Republic of Germany research surveys in ICNAF Division 2J from 1973-77.

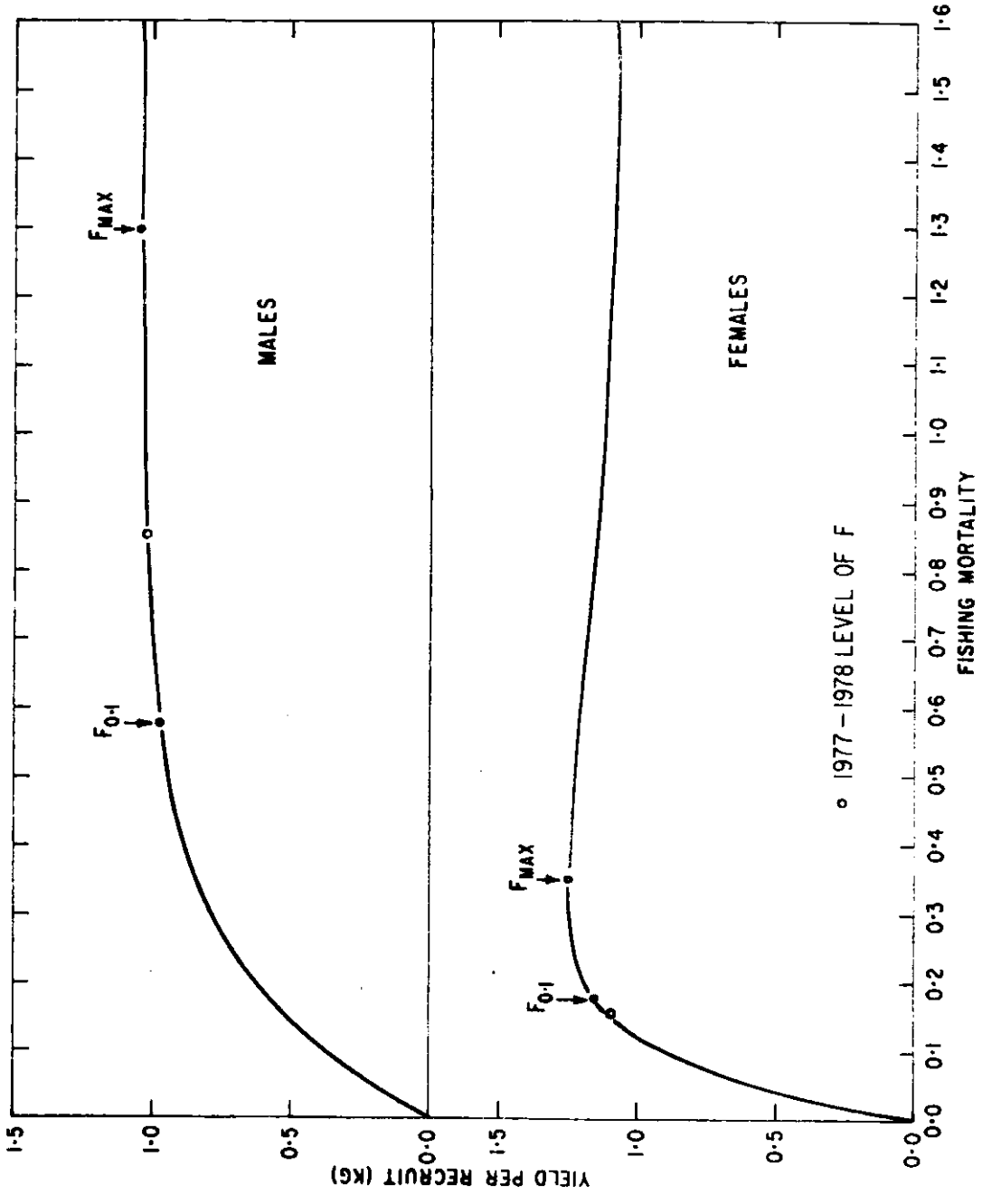


Fig. 11. Yield per recruit curves for male and female Greenland halibut from ICNAF Subarea 2 and Divisions 3KL.