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An analysis of the northern witch flounder stock, ICNAF Divisions 2J, 3K and 3L

by

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Introduction

Nominal catches for this stock increased from 4,000 tons in 1967 to over 23,000 tons in 1973 (Fig. 1). Since then the annual landings have been declining steadily and in 1977 the total catch was just a little over 8,000 tons, the lowest in 10 years. In the early 1970's, witch became one of the more important species fished by the Canadian inshore gillnet fishermen with up to 8,000 tons landed by inshore fishermen in 1971. However, these landings have also declined drastically and in 1977 the inshore fishery accounted for only 900 tons from this stock. In recent years, there has been an increased interest by the Canadian otter trawlers in this stock because of reductions in major fish stocks in other areas. In 1977 the Canadian otter trawlers accounted for almost half of the total landings (Fig. 1).

The first analytical assessment of this stock (Bowering and Pitt 1974) recommended a total allowable catch of 17,000 tons annually. This catch level was accepted by the Commission and has been in effect since 1975. This document is essentially an updated version of a previous assessment presented by Bowering and Pitt (1977).

Materials and Methods

Since gillnets are very selective gear and represented a small portion only of the total fishery (Fig. 1) it was considered that the offshore otter trawl samples would be more representative of the population, therefore the gillnet samples were not used in the calculations. Length frequency distributions from gillnets for male and female witch were presented however (Fig. 2) to indicate the general trend in inshore catches over the past eight years and how they relate to offshore trends.

Length and age distributions were available from Canadian commercial otter trawlers (Fig. 3) for 1974-77. These distributions were weighted by calculating the numbers caught at length and age for each year sampled and adding the four years together. Whether these distributions are totally representative of the stock is difficult to determine since some years samples were taken in one quarter only from one of the three ICNAF Divisions.

Estimates of total mortality (Z) were made from catch curves of the age data presented in Figure 3 and were calculated for males and females separately (Fig. 4). Values of M = 0.20 and M = 0.15 were assumed for the males and females respectively.

The Beverton and Holt yield-per-recruit model was applied to males and females separately (Fig. 5) according to the following parameters:

	Males		Females	
W_∞ - asymptotic weight	2.15	kg	2.68	kg
K - growth coefficient	0.068		0.077	
t_0 - theoretical age at length 0 cm	-8.71	yrs	-6.83	yrs
t_ρ - age at recruitment	5	yrs	5	yrs
t_{ρ^1} - age at mean selection length	11.52	yrs	8.45	yrs
t_λ - last age of significant contribution	20	yrs	25	yrs
M - natural mortality	0.20		0.15	

Results and Discussion

The inshore gillnet fishery is made up mostly of large female fish (Fig. 2) with the bulk of the catch in the 50-60 cm range. The length distributions of the females have been essentially the same over the past eight years with the exception of 1974 which peaked at 48-54 cm range. The males made up much less of the total catch and the length distributions of the catches have changed over the eight-year period. From 1970-73 the bulk of the males were in the 46-56 cm range but since 1974 were somewhat smaller at 36-46 cm. The 46-56 mode was still apparent but to a much lesser extent. The possible reason for this sudden change is that the inshore fishermen became more mobile about this time and began fishing farther offshore (up to 50 miles).

The females caught by offshore otter trawl have essentially the same length distribution as the inshore females (Fig. 3) but make up a much smaller proportion of the total catch. The offshore males have much the same length range as inshore but the modes of the catch are in reverse of that of the inshore. The offshore males also make up a larger proportion of the offshore catches than inshore. It is difficult to pinpoint the exact reasons for this difference. It is obvious that the male witch must have a more selective distribution pattern than the females since the differences cannot be attributed entirely to the selection activity of the gear.

The age composition of the offshore males ranges from 5-20 years with full recruitment at about nine years (Fig. 3). The females range from 5-25 years with full recruitment coming at about 11 years.

The yield curves were essentially flat-topped (Fig. 5) as is usually the case with all flatfish stocks with no maximum value of F obtained for up to F = 2.5, however beyond F = 0.80 the increments were exceedingly small. Estimated levels of $F_{0.1}$ yeilded values of 0.43 for males at M = 0.20 and 0.27 for females at M = 0.15. Estimates of total mortality (Z) (Fig. 4) from offshore otter trawl catches were 0.59 for males and 0.35 for females. For practical purposes it can be said that this stock is now being fished at the $F_{0.1}$ level. These estimates of mortality probably represents fishing over the last 10-15 years where the average annual catch has been about 12,000 tons.

References

Bowering, W. R. and T. K. Pitt. 1974. An assessment of witch (Glyptocephalus cynoglossus) for ICNAF Divisions 2J-3KL. Intern. Comm. Northw. Atlant. Fish. Res. Doc. 74/48, Ser. No. 3255.

1977. An evaluation of the status of witch flounder (Glyptocephalus cynoglossus) from ICNAF Divisions 2J, 3K and 3L. Intern. Comm. Northw. Atlant. Fish. Res. Doc. 77/VI/10, Ser. No. 5030.

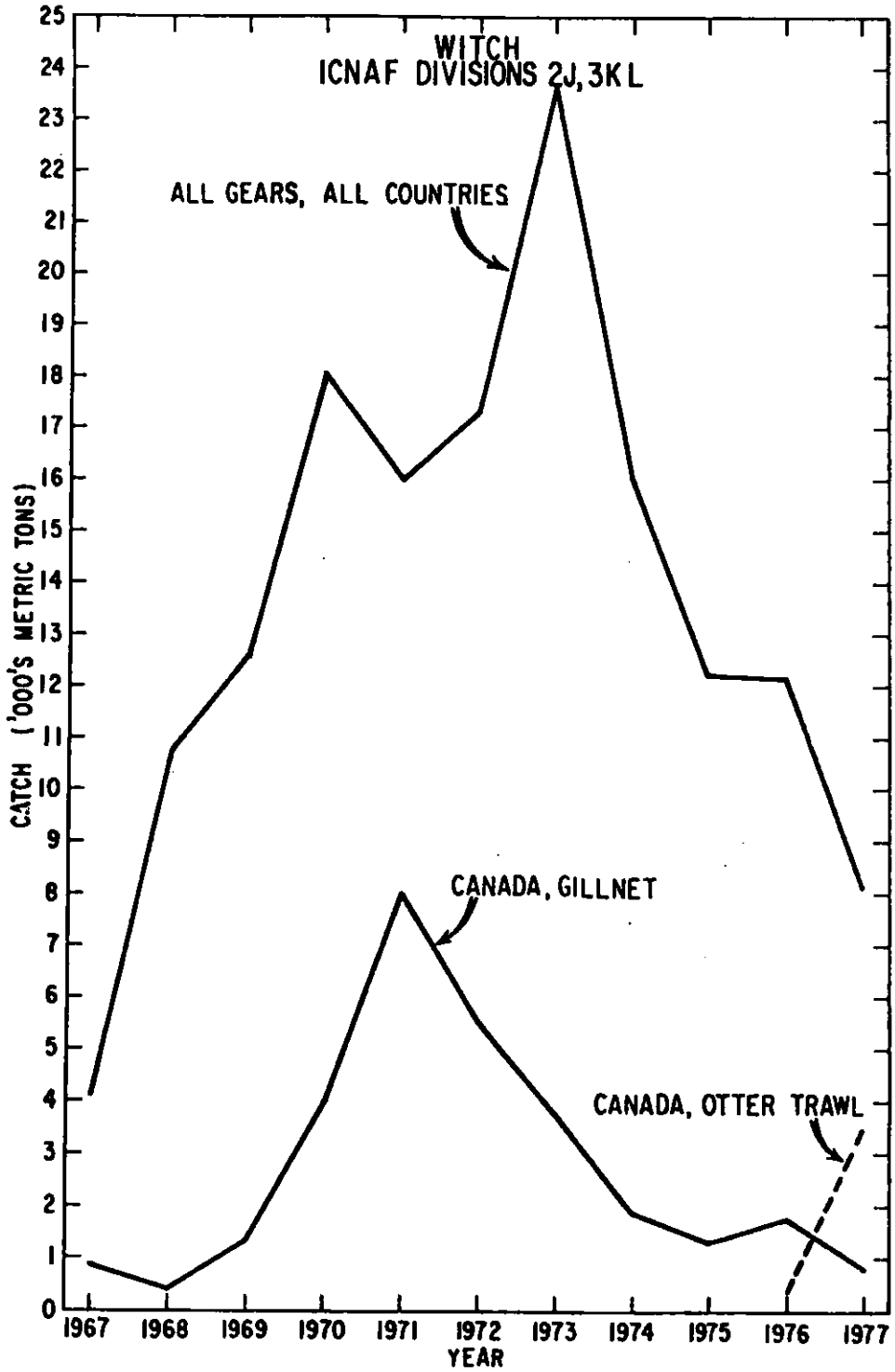

Fig. 1. Nominal catches of witch in ICNAF Divisions 2J-3KL from 1967-77.

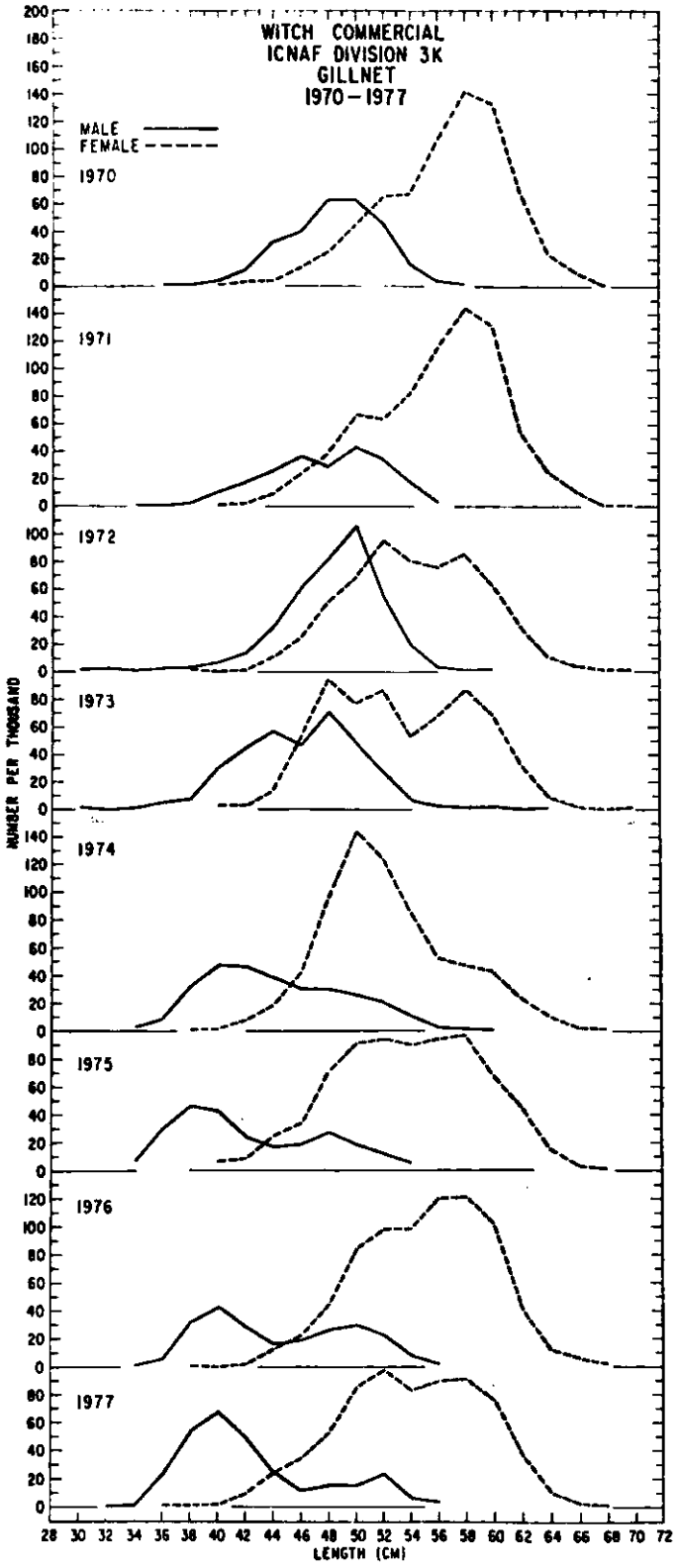

Fig. 2. Length composition of male and female witch from Canadian gillnet catches during 1970-77 in ICNAF Division 3K.

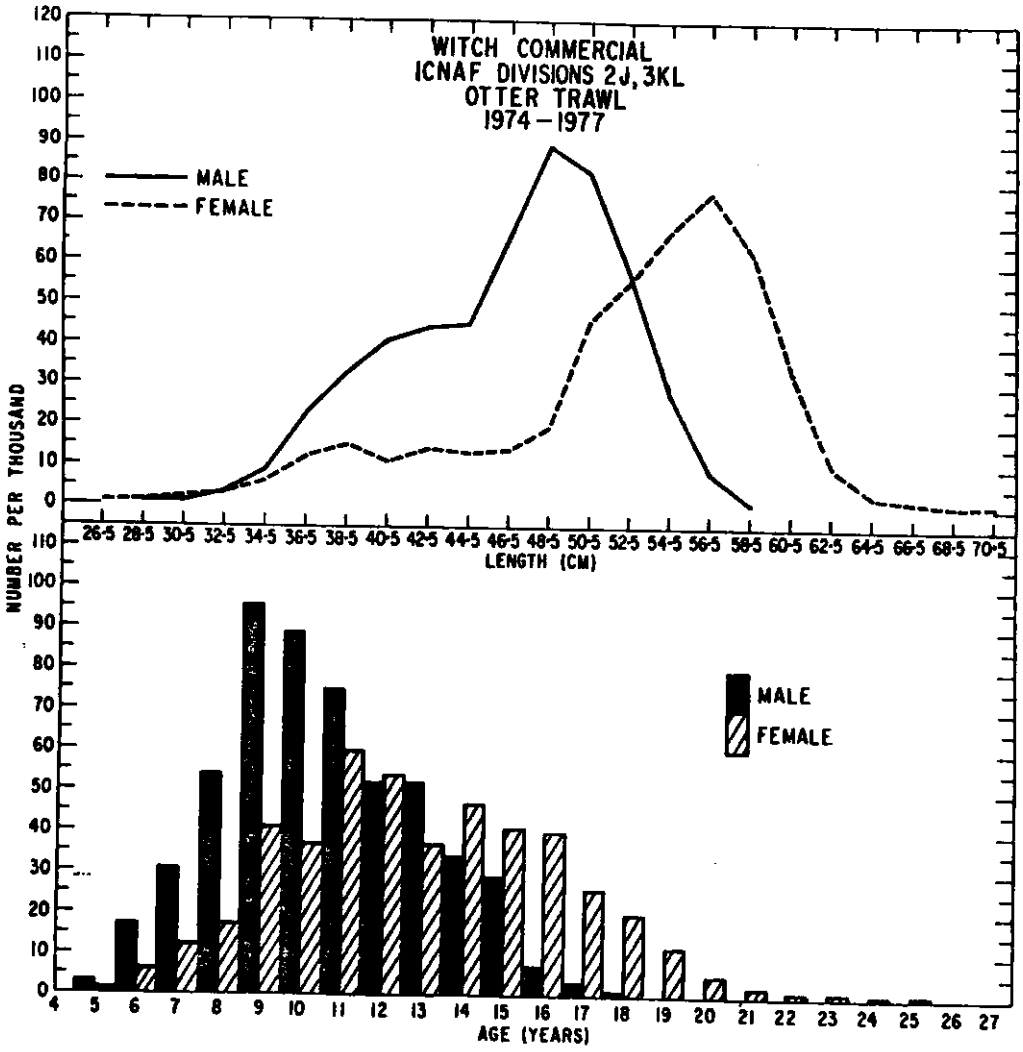

Fig. 3. Length and age compositions from Canadian commercial otter trawl catches, 1974-77, combined for ICNAF Divisions 2J-3KL.

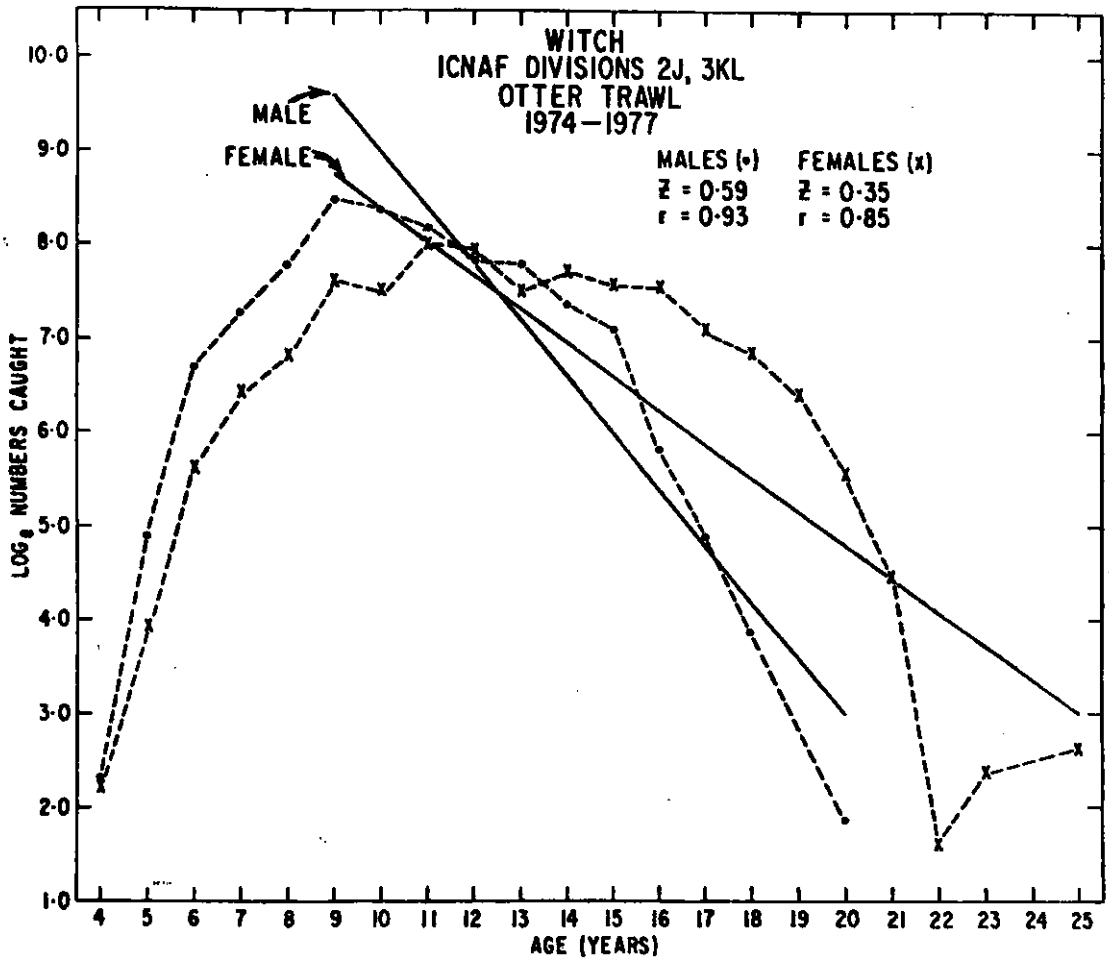

Fig. 4. Catch curves of male and female witch from commercial otter trawl, 1974-77, for ICNAF Divisions 2J-3KL.

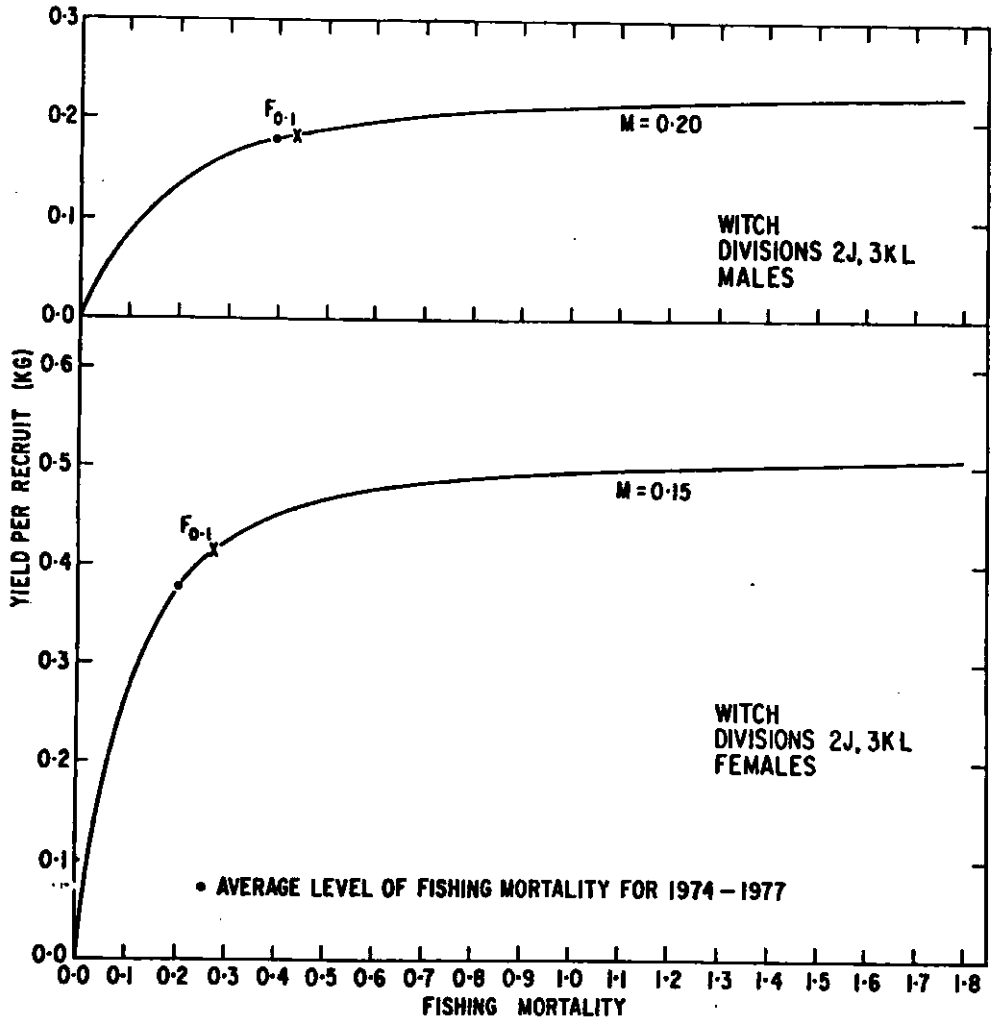

Fig. 5. Yield-per-recruit curves of male and female witch for ICNAF Divisions 2J-3KL.