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Yield per recruit assessment of witch (Glyptocephalus cynoglossus) for
ICNAF Divisions 3N and 3Ø

by

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Introduction

For management purposes, witch in ICNAF Divisions 3N and 3Ø were considered to be a single stock. The main concentrations of witch on the Grand Bank apparently occur along the southwest slope (3Ø) to the southern tip of the Bank (3N). This document presents the first analytical assessment of this stock.

Removals during the 1950's and early 1960's by Canadian trawlers were primarily as by-catches of the haddock fishery. Fairly substantial quantities were landed from this stock since 1963, reaching a peak of about 15,000 tons in 1971 (Table 1), Canada and the USSR accounting for most of the fishery. Total allowable catches of 10,000 tons were agreed to at the 1973 and 1974 Annual Meetings of ICNAF and international quotas allocated for 1974 and 1975.

Materials and Methods

All samples were collected from catches of Canada (N) commercial trawlers for 1972 and 1974. As in Divisions 2J-3KL (Bowering and Pitt 1974) males and females were sufficiently different in age composition and growth to warrant separation of the sexes (Fig. 1 and 2). Since no data were available from the USSR, it was necessary to assume that the age and length composition of their catches were similar to that of the Canadian commercial trawlers for purposes of catch curve construction and mean selection length (l_c) calculations. The l_c was calculated from commercial length frequencies for 1972 and 1974 combined, as these were the only years in which data were available. The l_c for males is 38.8 cms and for females is 40.9 cms. The catch curves were computed from data of the same years.

Limited research vessel data for 2J-3KL from 1949-52, prior to the start of the commercial fishery on that stock suggested total mortality values of 0.25 for males and 0.20 for females (Bowering and Pitt 1974). Because this was a virgin stock, the mortality values were believed to be totally attributed to natural causes, therefore estimates of natural mortality.

Von Bertalanffy growth curves were fitted to the age-length data and the Beverton and Holt yield per recruit model was applied to males and females separately using the following parameters:

	<u>Males</u>	<u>Females</u>
W_{∞} - asymptotic weight	3.425 kg	10.319 kg
K - from von Bertalanffy equation	0.139	0.073
t_0 - from von Bertalanffy equation	1.50 yrs	0.76 yrs

	Males		Females	
t_D - age at recruitment	8	yrs	8	yrs
t_{D1} - age at mean selection	9.8	yrs	11.4	yrs
t_A - age at last significant contribution into the fishery	16	yrs	18	yrs

Yield per recruit curves were plotted for $M = 0.15, 0.20,$ and 0.25 (Fig. 4) and were computed up to $F = 2.5$.

Results

Catch curves from the commercial age composition gave estimates of instantaneous total mortality (Z) of 0.58 and 0.72 for females and males respectively (Fig. 3). The yield per recruit curves (Fig. 4) indicates that only for $M = 0.15$ is there a definitive maximum value so that essentially the curves are flat-topped. Levels for $F_{0.1}$ (Gulland and Boerema 1972) are indicated on the curves (Fig. 4).

Discussion

The level of removals from the stock is apparently dependent on the amount of effort directed to other fisheries. In the 1950's it was the haddock fishery, but at present the effort is directed towards cod. No information is available as to the amount of witch removed as a by-catch of countries that salt their cod. The total nominal catches presented in Table 1 therefore are minimal.

Values of $M = 0.25$ and 0.20 for males and females respectively are probably high for this species and Halliday (1973) assumed corresponding values of 0.20 and 0.15 for the Nova Scotian witch. In any case, average values of F for approximately the 1966-73 period indicated in Figure 4 are close to the $F_{0.1}$ level. This should represent removals during these years averaging approximately 9000 tons.

With improved sampling we should, in future, be able to obtain more up-to-date estimates of F for this stock. For the present, the 9,000-10,000 ton level should probably be maintained.

The difficulty of managing a stock such as this where a large proportion of the total removals are a by-catch of other fisheries should be emphasized. Unless we can obtain accurate figures on total removals, including all discards, it is difficult to see how this stock can be properly regulated.

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, Serial No. 3255.
- Gulland, J. A. and L. K. Boerema. 1972. Scientific advice on catch levels. Intern. Comm. Northw. Atlant. Fish. Res. Doc. 72/26, Serial No. 2717.

Table 1. Witch - ICNAF Divisions 3N and 3Ø (Southwest edge and southeast tip of Grand Bank) nominal catches.

Year	Country	Canada	France	USSR	UK	Poland	GDR	Total	No. Removed '000
1963		895	795	485	8	-	-	2,183	2,735
1964		1,055	-	-	11	-	-	1,066	1,335
1965		1,324	-	849	4	-	-	2,177	2,728
1966		3,644	-	3,828	-	16	4	7,522	9,426
1967		2,863	-	8,565	26	29	20	11,503	14,414
1968		1,503	18	9,078	-	-	-	10,599	13,282
1969		479	6	4,215	-	-	-	4,700	5,889
1970		723	1	6,039	-	-	-	6,763	8,745
1971		178	10	14,744	-	3	-	14,965	18,753
1972		3,419	17	5,738	-	-	-	9,177	11,500
1973		4,943	20	1,714	5	9	-	6,691	8,384
1974*		2,717	-	-	2	-	-	-	-

* USSR Landings not yet received.

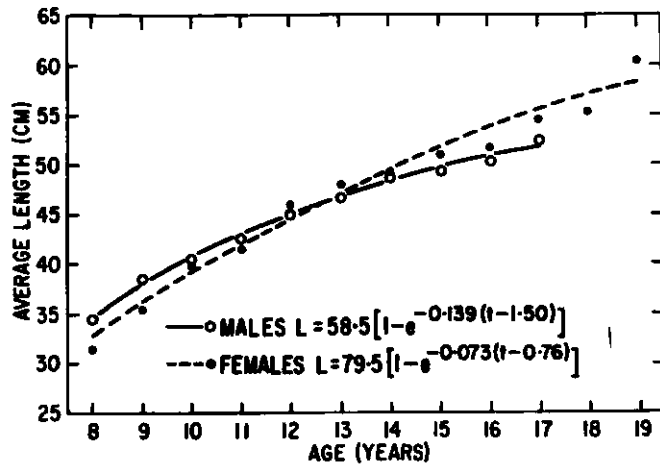


Fig. 1. Growth curves for male and female witch in ICNAF Divisions 3N and 30.

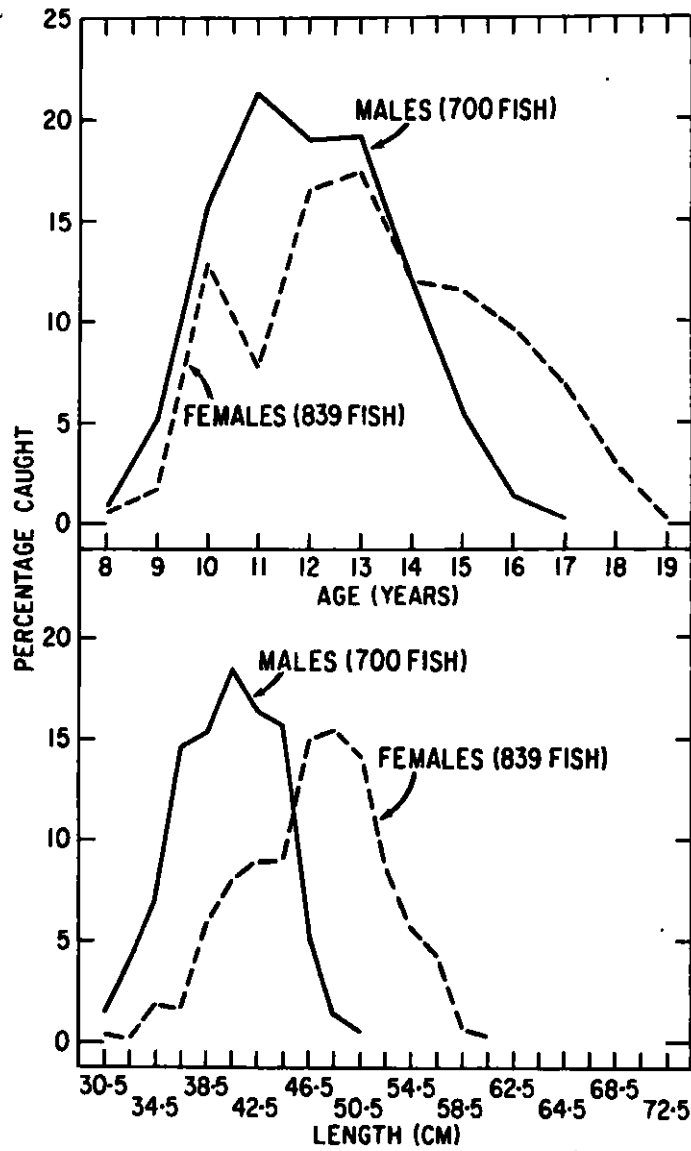


Fig. 2. Age and length distributions for male and female witch for 1972 and 1974 combined Canadian commercial otter trawl.

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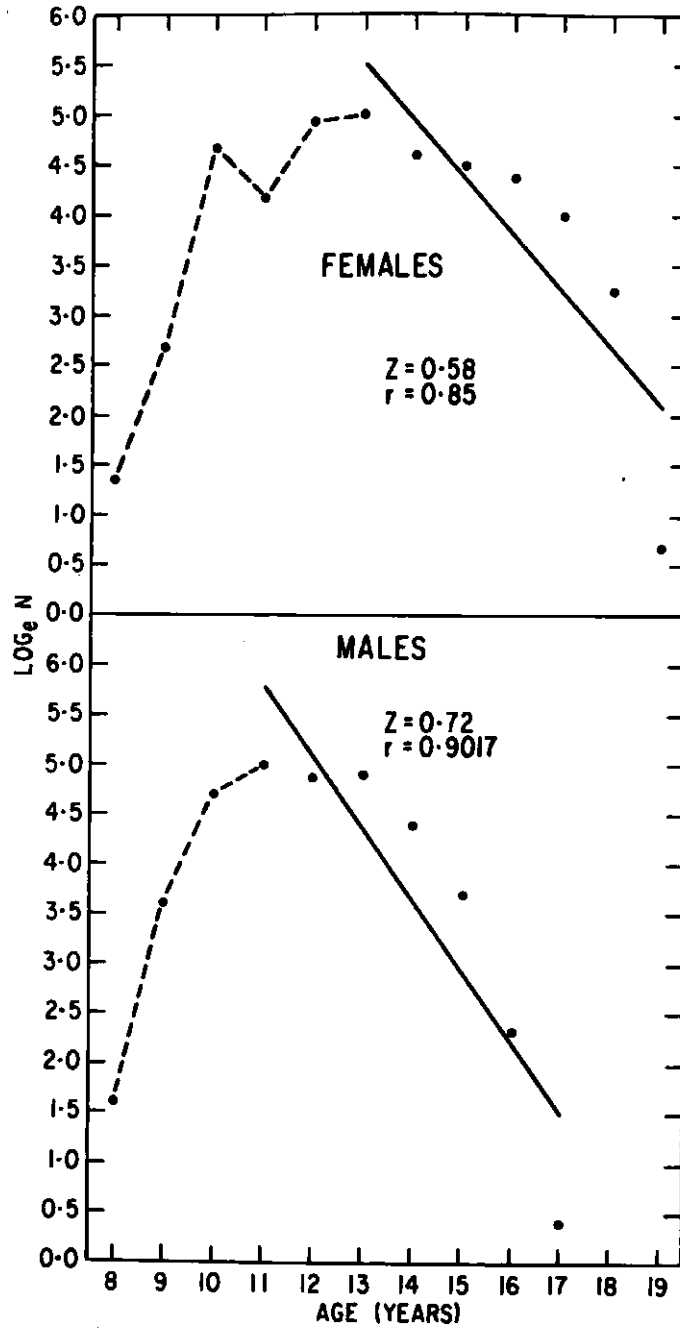


Fig. 3. Catch curves for male and female witch for 1972 and 1974 combined Canadian commercial otter trawl in Areas 3N and 30.

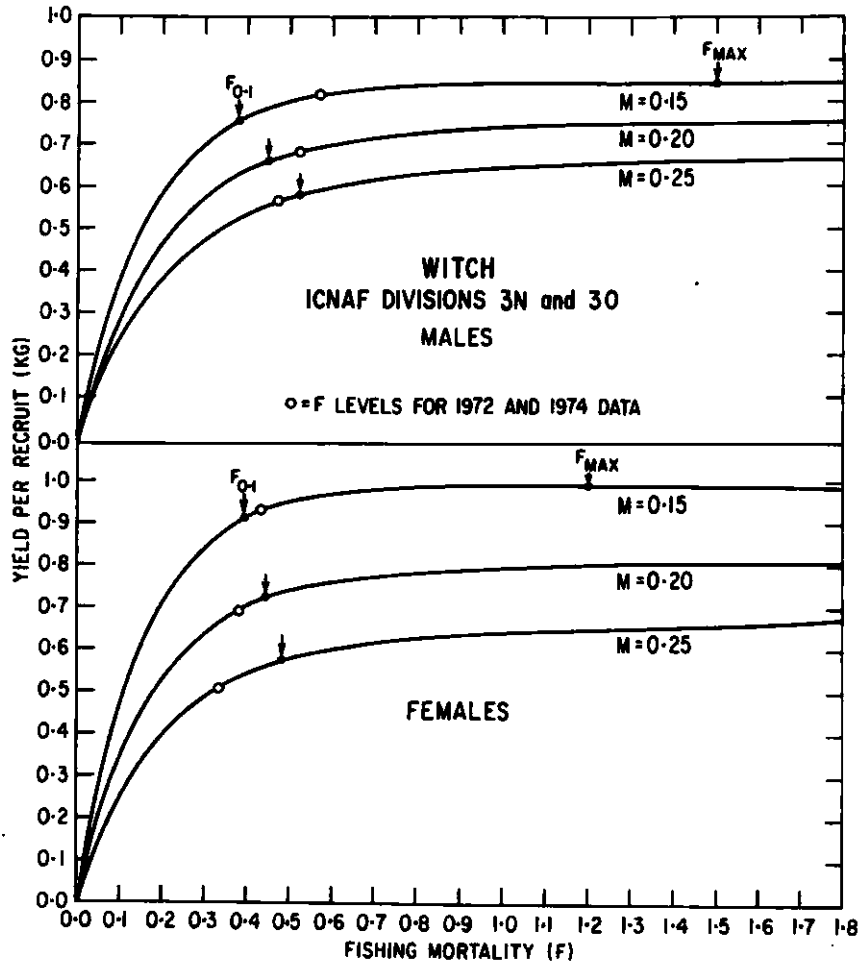


Fig. 4. Yield per recruit curves for male and female witch in Divisions 3N and 30 for 1972 and 1974 combined Canadian commercial otter trawl.

