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Age Composition and Estimates of Total Mortality for Grand Bank Yellowtail Flounder (*Limanda ferruginea*)

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Abstract

Total landings of yellowtail flounder (*Limanda ferruginea*) in ICNAF Subarea 3 have increased from 3149 tons in 1965 to more than 20,000 tons in 1970. The fishery depends primarily on 6-, 7- and 8-year-old fish. Total mortality estimates from catch curves of commercial landings increased from 0.83 for 1965 data to 1.25 for 1969.

Introduction

The first significant quantities of yellowtail flounder from the Grand Bank were landed in 1965 when approximately 3000 metric tons were landed by Canadian trawlers primarily from ICNAF Division 3N (Table 1). A general increase in landings has occurred with the total from ICNAF Subarea 3 reaching 13,000 metric tons in 1969 with Canada taking about 80%. Preliminary statistics for 1970 indicate that Canada (N) landed approximately 20,000 metric tons.

Material and Methods

In calculating total yellowtail landings the landings by European trawlers were estimated by applying the percent that yellowtail was of the Canadian landings of plaice, yellowtail and witch to the reported European "unspecified flounder" in the Statistical Bulletins.

Ageing of the yellowtail was by otoliths from random samples taken from the landings at the fish plants and from the catches of the Fisheries Research Board's research vessels. Since yellowtail flounder has made up only a fraction of the total commercial landings in the past, some difficulty has been encountered in securing sufficiently large samples.

Estimates of total mortality (Z) were made using catch curves from research data (% at each age) (Fig. 3) and from commercial landing data (No. per 100 hours' fishing) (Fig. 4). Catch curves for 1970 commercial landing data were not presented because the effort data were not available. For the research data estimates of Z were made separately for males and females. Estimates of combined (Male and Female) catches are also given.

The effort used in calculating the No. per 100 hours was calculated from the catch per unit effort of Canada (N) stern trawlers in ICNAF Divisions 3L and 3N in depths less than 90 metres where catches of yellowtail were recorded on the log sheet and the total landings of yellowtail flounder for this area.

Results

Age composition

The age compositions of commercial landings and research catches (Fig. 2) indicate a succession of year-classes of approximately equal strength being recruited to the fishery each year. Except for the 3-year-olds, the lined research net takes approximately the same age groups as those of the commercial landings. The fishery appears to be dependent primarily on just three age groups, i.e., 6-, 7- and 8-year-olds; however the 1970 landings for 3L were dominated by 6- and 7-year-olds only.

Up to now research cruises caught only two 2-year-old yellowtail; one at 14 cm in April 1965 and one at 16 cm in June 1970, both in ICNAF Division 3N.

Total mortality (Z)

Total mortality estimates in Division 3N from research vessel catch curves 1951-52 (Fig. 3) were 0.89 (59%) for males and 0.62 (46%) for females and for the combined curve Z was 0.77 (54%). For 1961 research data values for Z were 0.64 (47%) and 0.78 (54%) for males and females respectively with the Z for the combined age distribution being 0.72 (51%). As a comparison with this early research data, collected before the beginning of the commercial fishery, the catch curves for 1970 gave estimates for Z as follows: males, 1.82 (83%) and for females, 1.27 (72%). Combined age frequency gave a Z of 1.57 (79%).

For the commercial data Z increased from 0.83 (56%) in 1965 to 1.25 (71%) in 1969 (Fig. 4).

Discussion

The abundance of yellowtail on the Grand Bank apparently increased since 1962 according to both research and commercial fishing records (Pitt, 1970). The only apparent factors to which this increase can be attributed were a very slight increase in bottom temperatures and a drastic reduction in the haddock stock. Haddock and yellowtail apparently have the same food spectrum (Pitt, 1970) and because of this it is possible that a reduction in the size of the haddock population has favoured an increase in yellowtail abundance.

From the late 1940's up until 1961-62, haddock were heavily exploited in ICNAF Divisions 3N and 30 with a large proportion of the effort extending into depths normally occupied by yellowtail (< 90 metres). Catches of yellowtail by research vessels during haddock surveys were almost invariably less than 50 Kg during this period. Yellowtail caught at this time by the commercial fleet were either discarded or small quantities were landed unsorted with American plaice. Thus, in spite of the fact that there was no fishery for yellowtail flounder, quantities were being removed possibly from a small population and hence the relatively high estimates of total mortality calculated for the pre-fishing period.

Lux (1969) suggested that natural mortality was probably less than 0.22 (20%). This would put the annual removal rate at about 42% (F = 0.55 for a Z of 0.77) during the late 1940's and early 1950's. Since the fishery began it is evident that the fishing mortality has increased rapidly. A total mortality rate of 1.25 in 1969 would indicate an annual fishing rate of about 64% (assuming M = 0.22) for the year-classes included in the catch of that year.

With data from a few more years it should be possible to do a more comprehensive assessment of Grand Bank yellowtail using the "virtual population" method.

Because of the difference in growth rate, yellowtail from the Grand Bank do not enter the fishery until age 4, whereas off New England they enter at age 2 (Lux, 1969). The effect of the relatively heavy fishing for this species has rapidly removed the older fish from the stock so that by 1969 the commercial fishery consisted of only 4 age groups (Fig. 2). This reduction in the numbers of old fish is also reflected in the research vessel samples.

References

Lux, F. E. 1969. Landings per unit effort, age composition, and total mortality of yellowtail flounder, *Limanda ferruginea* (Storer), off New England. Int. Comm. Northwest Atl. Fish. Res. Bull. 6: 47-52.

Pitt, T. K. 1970. Distribution, abundance, and spawning of yellowtail flounder, *Limanda ferruginea*, in the Newfoundland area of the Northwest Atlantic. J. Fish. Res. Bd. Canada, 27: 2261-2271.

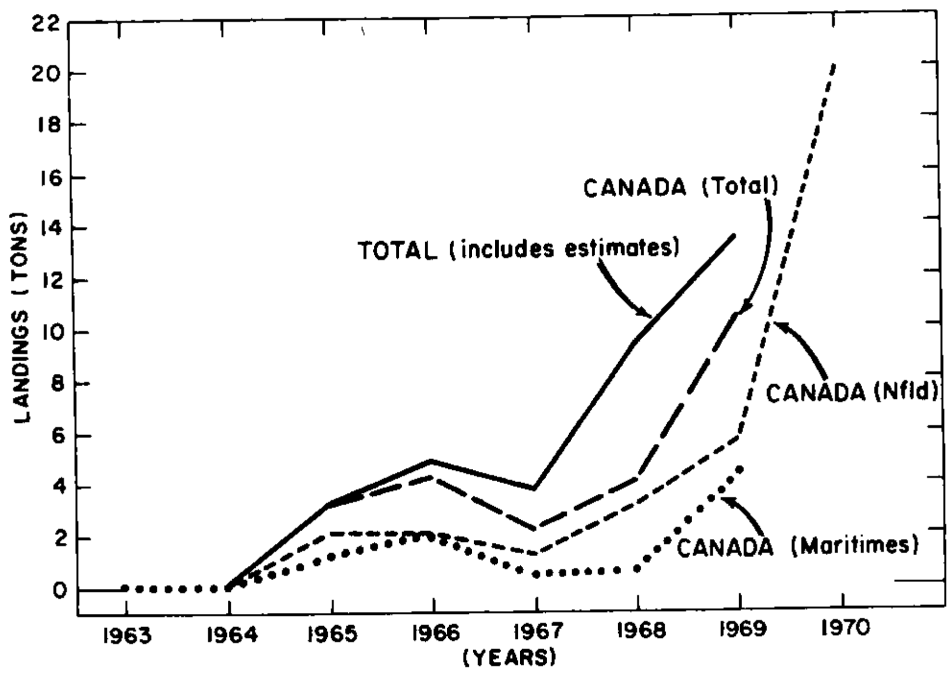

Fig. 1. Landings of yellowtail flounder in ICNAF Subarea 3.

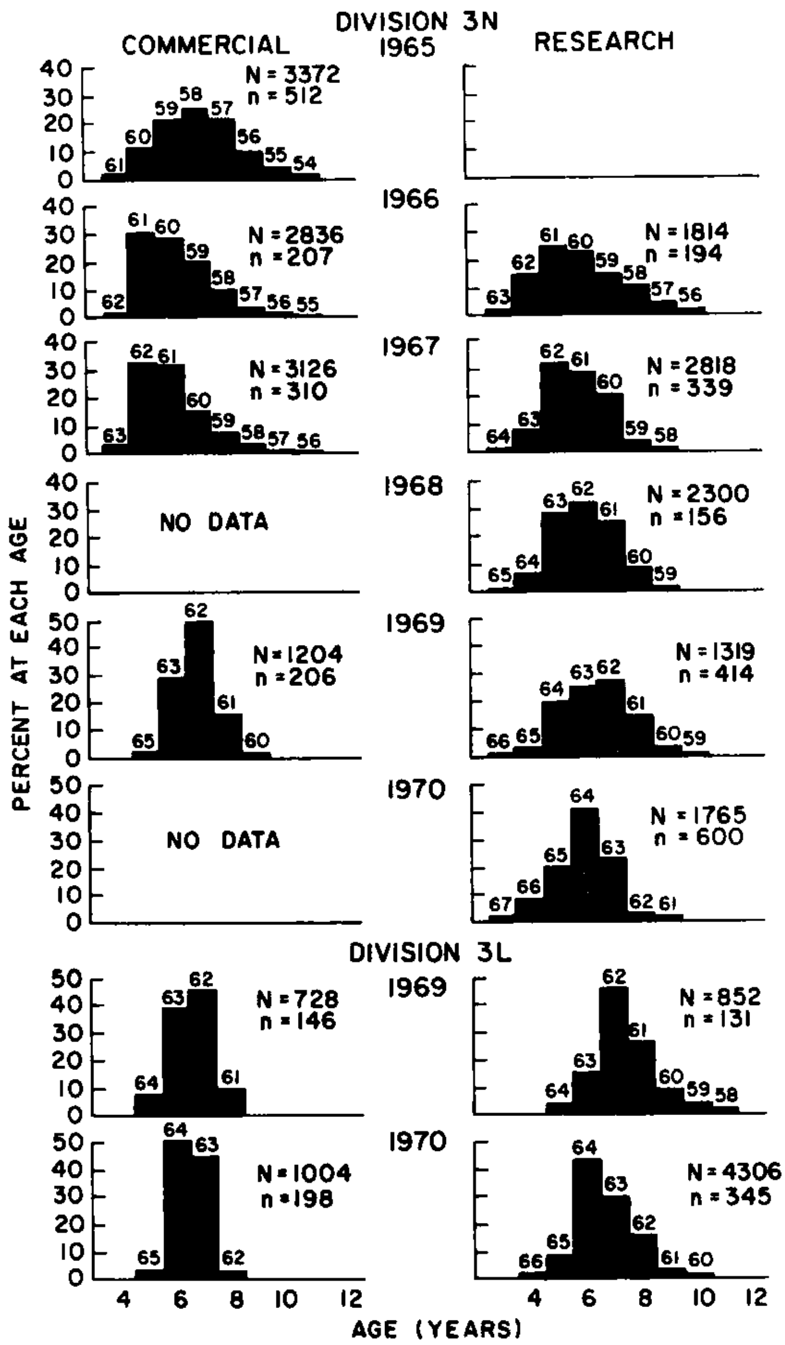

Fig. 2. Age composition of (A) commercial landings and (B) research vessel catches. N = number measured, n = number aged.

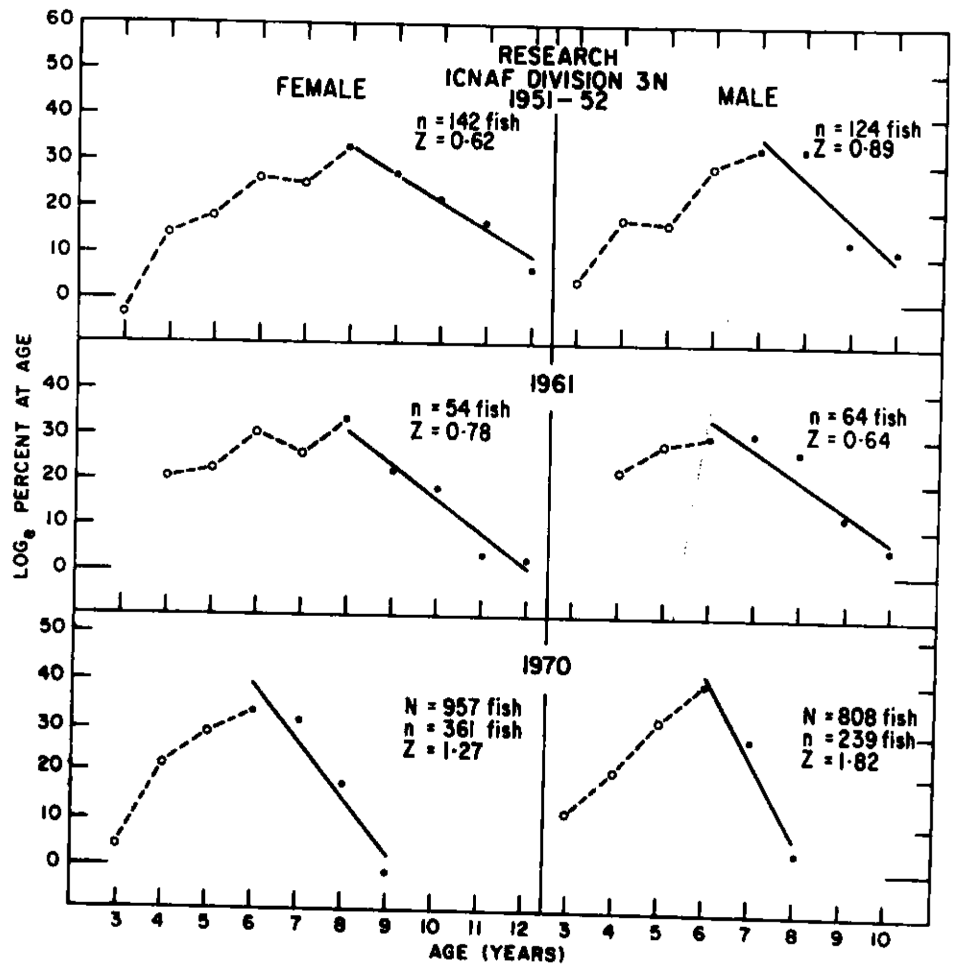

Fig. 3. Catch curves of male and female yellowtail from research data from ICNAF Division 3N. N = number measured, n = number aged.

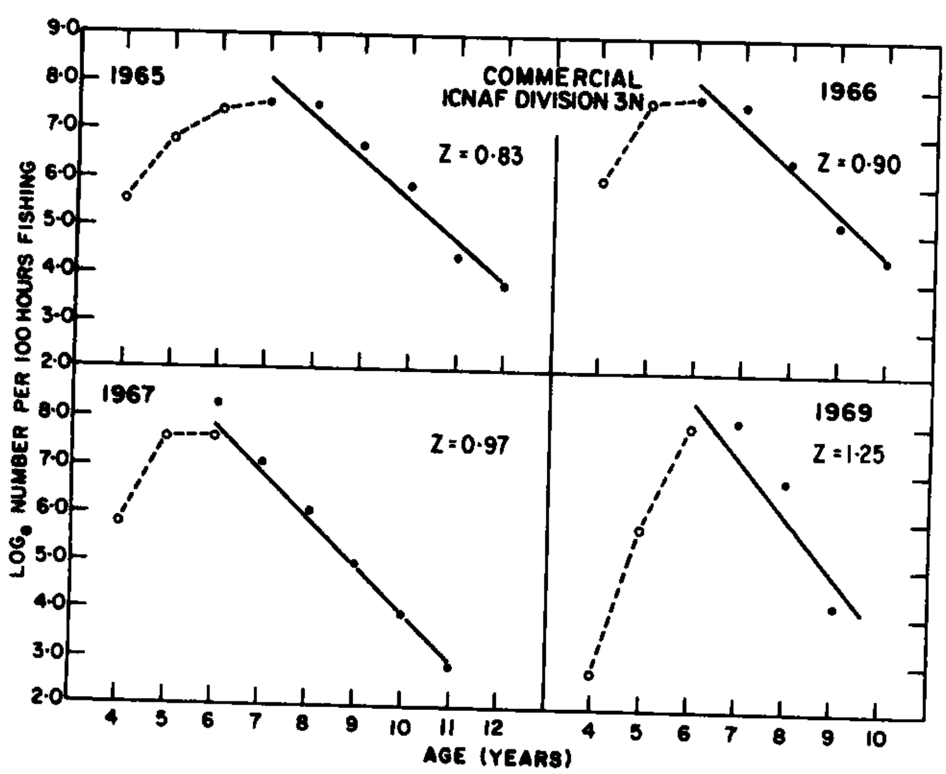

Fig. 4. Catch curves from commercial yellowtail landing data (sexes combined) from ICNAF Division 3N. N = number measured, n = number aged.

Table 1. Nominal catches of yellowtail flounder from Subarea 3 in metric tons (1970 is provisional).

Year	Country	Division 3L	3N	30	3Ps	Total
1965	Canada (M)	115	951		32	1,098
	Canada (N)		2,001	6	23	2,030
	Other*		19	1	1	21
	Total	115	2,971	7	56	3,149
1966	Canada (M)	57	1,737	300	132	2,226
	Canada (N)	5	1,948	138		1,891
	Other*		736	2	71	809
	Total	62	4,421	440	203	4,926
1967	Canada (M)	118	429	81	31	659
	Canada (N)	334	1,081	78	31	1,524
	Other*		1,670	37	10	1,717
	Total	452	3,180	196	72	3,900
1968	Canada (M)	632	149		202	983
	Canada (N)	2,164	1,081	107	441	3,792
	France (S.P.)	3	5	6	178	192
	Other*	60	2,955	638	724	4,377
	Total	2,859	4,190	751	1,545	9,345
1969	Canada (M)	3,217	1,048	273	59	4,597
	Canada (N)	2,033	3,840	54	19	5,946
	Other*	19	2,592	281	17	2,909
	Total	5,269	7,480	608	95	13,452
1970	Canada (N)	6,657	13,003	183	195	20,035

* Calculated, see text.