



Serial No. 2708
(B.g.7)

ICNAF Res.Doc. 72/17
(also ICNAF SAC No.72/16
- Revised)

ANNUAL MEETING - JUNE 1972

DIV. 4V-W HADDOCK: SOME IMPLICATIONS
OF RESEARCH VESSEL SURVEY RESULTS

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INTRODUCTION

The St. Andrews Biological Station of the Fisheries Research Board of Canada has carried out quantitative research vessel groundfish surveys in ICNAF Div. 4W, in July of the three years 1969-71 (Halliday and Kohler, MS 1971). Estimates of haddock abundance from the 1969-70 surveys have been used in recruitment predictions (Halliday, 1970, MS 1971) and in estimation of mortality rates (ICNAF, 1971). This document discusses these and 1971 survey results in relation to current status of the Div. 4V-W haddock stock.

RECRUITMENT

Results of the July 1971 survey confirm that the 1967-69 year-classes are poor and indicate that the 1970 year-class is also poor, being of comparable strength to the previous three (Table 1). The 1967-70 year-classes are likely to be comparable in abundance to the very poor year class of 1958, which earlier research vessel surveys estimated to number 4 million and 2 million, at ages 1 and 2, respectively. In contrast, the good year class of 1956 numbered 46 million and 36 million, at ages 2 and 3, respectively, as estimated from the same research vessel survey series.

It is of interest to note that the 1969 year-class, although certainly poor, is stronger than the others spawned in the 1967-70 period - a comparable situation to that in the Div. 4X and Div. 5Z haddock stocks (Grosslein, personal communication).

MORTALITY

Estimates of mortality independent from commercial statistics are provided by these research vessel surveys. These estimates for fully recruited age groups are $Z = 1.29$ in 1969-70 and $Z = 0.90$ in 1970-71 (Table 2). The comparable estimate of Z from 1970-71 commercial statistics is not yet available. However, that for 1969-70 is $Z = 0.66$, considerably lower than that from surveys.

A comparison of mortality estimates from commercial and survey data are available for an earlier period, 1958-60. At that time the commercial fishery was relatively stable and stock abundance high (Halliday, 1971). Mortality estimates (Z) from these independent sources were remarkably similar at that time:

	1958-59	1959-60
Survey data	0.89	0.98
Commercial data	0.91	0.98

The values of Z from commercial statistics were derived by dividing total haddock landings from Div. 4T-V-W by the Canadian catch-per-unit effort in Div. 4W to obtain an estimate of total effective effort in each calendar year. The efforts for 1958 and 1959 were averaged giving 78,800 hours and for 1959 and 1960 giving 85,700 hours, and these values substituted in the equation $Z = qf + M$ where q (= catchability coefficient) = 0.000 009 068 and M (= instantaneous natural mortality) = 0.20 (Halliday, 1970, 1971) and f = fishing effort.

The experimental design of the 1958-60 and 1969-71 survey series were not identical but were closely similar, and it is likely that the results of the two series are comparable. However, there have been radical changes in the commercial fishery between these two periods. With rapidly declining stock abundance, major discrepancies have been found among estimates of population for recent years derived from commercial statistics. This probably reflects major changes in the catchability coefficient caused by changes in the distribution of fishing effort and of the fish stock in response to the very low population abundance (ICNAF, 1971). Thus, it is likely that survey values of Z are currently more accurate than those from commercial statistics, and thus Z in 1969-71 was high - probably 0.90 or greater.

DISCUSSION

Stock abundance is currently lower than at any time previously recorded. Recruitment, at least through 1974, will be poor, and mortality has been higher in recent years than at any time in the last 20 years (McCracken, 1968; Halliday, 1971). This mortality rate is considerably higher than that giving maximum yield per recruit ($Z = 0.70$). However, it is probably considerably more important that it is resulting in continued stock decline and may be reducing the probability of good recruitment.

In view of the serious condition of this stock, complete cessation of fishing for haddock throughout Divisions 4W and 4V is the most suitable regulatory measure which can be applied.

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TABLE 1. POPULATION NUMBERS PER AGE GROUP OF HADDOCK IN DIV. 4W ESTIMATED FROM RESEARCH VESSEL SURVEYS IN JULY OF 1969-71

Age	1969	1970	1971
1	2,330,000	6,151,000	3,689,000
2	4,529,000	1,779,000	8,936,000
3	7,465,000	3,656,000	2,858,000
4	6,638,000	2,973,000	3,888,000
5	3,332,000	1,108,000	1,491,000
6	3,366,000	959,000	796,000
7+	1,979,000	1,467,000	988,000

TABLE 2. INSTANTANEOUS TOTAL MORTALITY, Z, OF HADDOCK IN DIV. 4W ESTIMATED FROM RESEARCH VESSEL SURVEYS IN JULY 1969-71.

Ages	Z 1969-70	Z 1970-71
1-2	0.27	-
2-3	0.21	-
3-4	0.92	-
4-5	1.79	0.69
5-6	1.25	0.33
6+-7+	1.29	0.90