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Catch per unit effort relationship in Grand Bank American plaice (ICNAF Divs. 3L and 3N)

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Introduction

Previous assessments of American plaice for ICNAF Divisions 3L and 3N (Pitt, 1970 and 1971) were based on the virtual population model as modified by Gulland (1965) and Jones (1961 and 1968). This model calculates fishing mortalities for fish of different year classes and age groups for the number of fish caught and does not require estimates of effort. This assessment is based on catch and effort data using the model developed by Schaefer (1954).

Commercial plaice fishery on the Grand Bank was to a considerable extent a Canadian fishery, since up to the mid 1960's, boats of the latter country landed 85-90% of the total catch from Divisions 3L and 3N. During the mid 1960's, however, European trawlers began taking plaice almost exclusively in Division 3N. Of the total landings Canada (N) has taken the greatest proportion (Table 1) and it is on these data that this document is based.

Materials and Methods

Most of the Newfoundland based trawlers have recorded fairly accurate log-sheets since the 1950's at the request of the St. John's Biological Station of the Fisheries Research Board of Canada. These logs recorded fishing location, catch and duration of the actual fishing time in each statistical unit area. The Grand Bank fishery has been entirely by otter trawler, which up to 1965 were primarily side trawlers (ICNAF Tonnage Class 4); however, in recent years the latter type was gradually replaced by stern trawler (Tonnage Class 5). Effort by the Newfoundland fleet was standardized by plotting catch per hour of side trawler on comparable monthly data for stern trawlers in the same statistical area. A line of best fit passing through the origin gave a slope of 0.8 (Fig. 1) which was used to convert Tonnage Class 4 to Class 5 effort.

The total effort was determined by dividing total landings (Nominal Catch for ICNAF Statistical Publ.) by the catch/effort of Canada (N) (Class 5 O.T.). Two categories of catch/effort were calculated: (1) Main species plaice where plaice was the species taken in the greatest proportion in a statistical area for a particular trip, and (2) catch and effort where any plaice was recorded in the catch although not necessarily caught in the greatest proportion.

The regression of catch/hour against a 5 year running average of standardized effort was plotted: (1) for main species plaice, and (2) plaice recorded in the catch (Fig. 2B and Table 1); that is, catch/hour in year i on the average of the effort in year i and in the preceding 4 years.

The nominal catches of plaice by European countries, particularly the USSR and Poland which up to 1970 reported flatfish as unspecified flounder, were broken down on the basis of 1970 proportions (Pitt, 1972).

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Results and Discussion

The regression equation (Fig. 2B) for catch per hour with (1) plaice main species, and (2) plaice in catch were as follows:

	Intercept	Slope	Correlation Coefficient
(1)	1058.720	-5.856	-0.932
(2)	967.126	-5.075	-0.936

The equilibrium yield curves (Fig. 2A) derived from the catch per unit effort on effort relationships have a maximum between 45 and 50 thousand tons at 90 thousand standard hours. The plot of actual yields from the fishery for years 1956-1971 corresponded to the equilibrium yield points up to 1964, but beyond this the points were all above the curve. The increase in the amount of effort expended in catching plaice when it was not the main species (dotted lines with arrows, Fig. 2A) can be attributed to the increase in the effort for yellowtail which replaced American plaice as the main species with greater frequency in recent years.

An annual yield of 35-40 thousand tons for 3L and 15-20 thousand tons for 3N was suggested in a previous assessment (Pitt, 1972). The sustainable yield for 3L and 3N at the optimal level from yield per recruit curves is 60 thousand tons which was the quota established for 1973 including an estimate of 8 thousand tons for Division 30.

The quotas were set at the "optimum" yield rather than at the M.S.Y. The type of yield curve produced for plaice had a rather indefinite M.S.Y. with a gradual increase in yield per recruit to values of F of 2.0 and beyond. The independent assessment produced here while indicating a M.S.Y. below the previous assessment confirms that the quotas arrived at in 1972 were within the range of the M.S.Y.

References

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Table 1. Catch and effort data for ICNAF Divisions 3L and 3N plaice 1956-71.

Year	Canada(N) (tons)	Total catch (tons)	Main sp. plaice		Plaice in catch	
			Hours ('000)	C.P.U.E. (Kg)	Hours ('000)	C.P.U.E. (Kg)
1956	7,336	12,386	10.1	1226	11.7	1059
1957	6,477	11,664	10.6	1100	12.6	926
1958	9,304	17,295	15.5	1116	19.3	896
1959	11,688	17,208	16.6	1037	19.5	882
1960	14,274	23,153	21.7	1067	23.7	696
1961	11,166	15,970	16.9	945	19.2	831
1962	12,341	16,495	21.0	785	23.7	696
1963	15,392	23,993	26.2	916	28.7	836
1964	24,744	35,155	36.9	953	41.1	855
1965	35,550	50,342	54.7	920	58.9	854
1966	36,566	52,345	59.9	874	65.7	797
1967	43,290	61,435	73.3	838	82.2	747
1968	41,224	57,280	90.8	631	100.6	569
1969	57,843	64,217	117.8	545	126.3	508
1970	46,977	58,886	115.2	511	145.4	405
1971	42,668	60,115	127.0	473	167.5	359

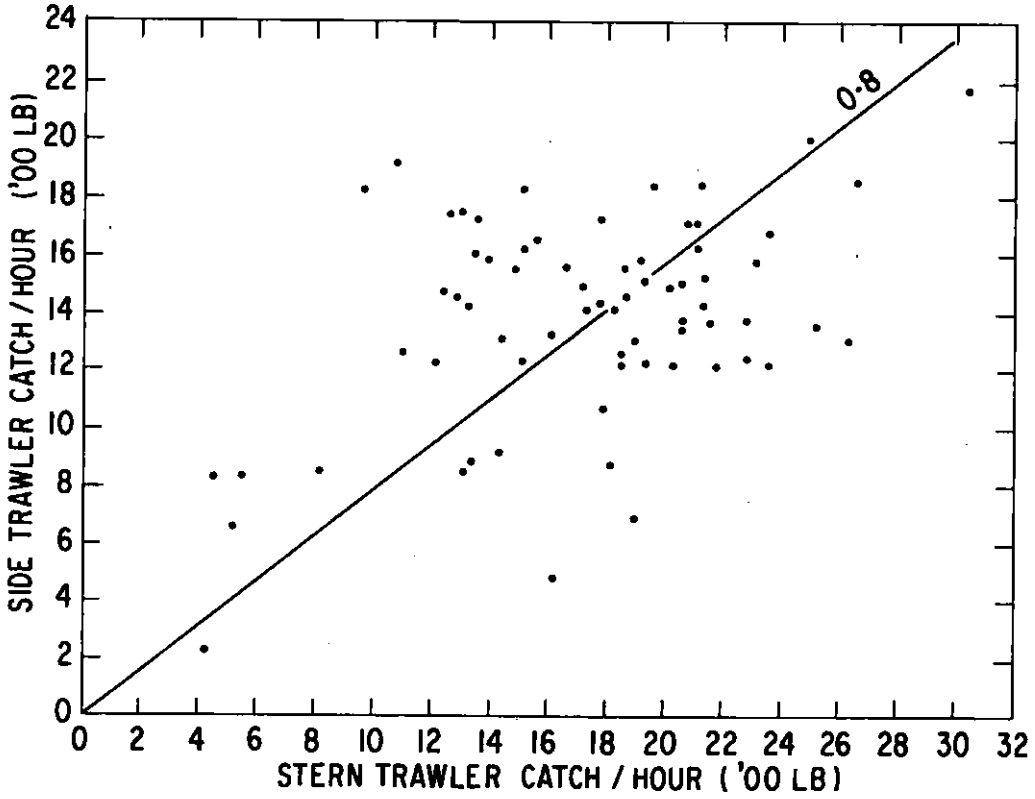

Fig. 1. Plot of catch/effort side trawl (Canada(N) O.T. 4) on catch/effort stern trawler (Canada(N) O.T. 5).

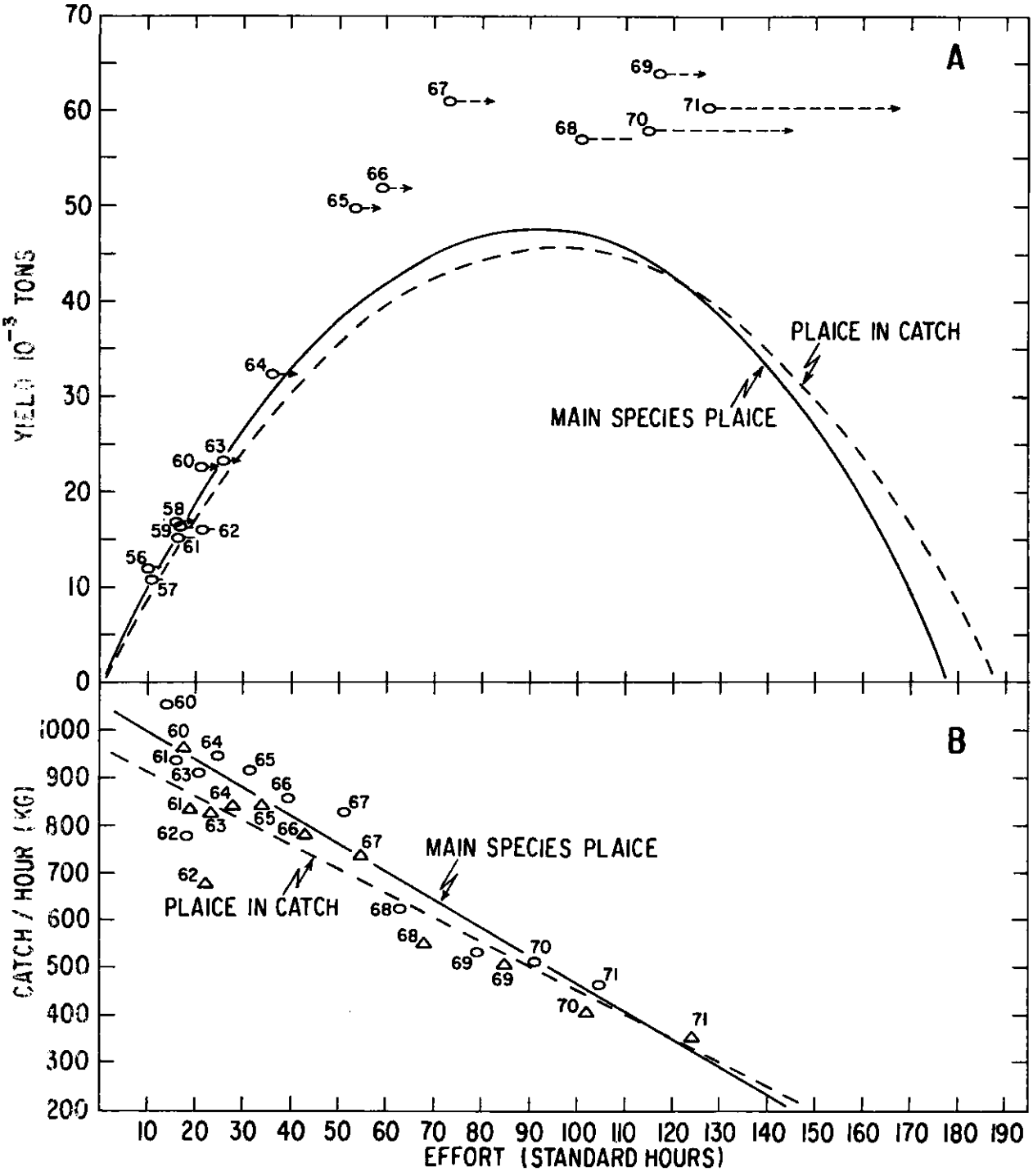

Fig. 2. A. Equilibrium yield curves for American plaice Divisions 3L and 3N (1) solid lines; main species plaice and (2) broken lines; plaice in the catch. Actual yield for the various years plotted, with arrows indicating position on X axis (effort) for "plaice recorded in the catch".

B. Catch/effort or effort for (1) main species plaice and (2) plaice in catch.