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Conservation of the Georges Bank Sea Scallop Fishery

by

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Introduction

This valuable fishery increased rapidly for many years, reaching a peak in 1962. Landings are now declining due to decreased abundance; demand for the product is strong, with prices reaching all time highs. The decreased abundance is the result of lower recruitment and heavy fishing pressure by the United States and Canada.

Biologists of the Bureau of Commercial Fisheries Woods Hole Laboratory have determined that yields in this fishery would be greater if the smaller sizes of shellfish were not harvested and if fishing effort were reduced. It is, therefore, the Bureau's responsibility to investigate methods for delaying the age of harvesting and to consider limiting effort.

It is not efficacious to increase the minimum size of capture by increasing the ring size in the commercial dredges, but mechanical culling devices may offer a solution.

Recent work by the Woods Hole biologists show that there is a good relation between the shell size and the size of the adductor muscle (eye). Although the relation is not precise enough for landed

meats to be used in prosecuting violators, gross violations could be detected by this means.

Recommendations

1. That the Bureau consider a minimum shell size regulation for sea scallops in the ICNAF Convention Area.

2. That Exploratory Fishing and Gear Development be requested to develop an automatic screening device for culling sea scallops at sea.

3. That some thought be given to limiting effort on the Georges Bank sea scallop stocks.

Supporting Information

Landings, Effort and Abundance.

Table 1 presents catch and effort statistics for recent years. Total landing (Canadian and U.S. combined) increased in 1962 and then declined. United States landings declined after 1961; Canadian landings increased through 1963. United States effort decreased after 1962 while Canadian effort has continued to increase. Total effort (combined U.S. and Canadian), in terms of days fished, has declined slightly since 1962.

We have two measures of abundance of sea scallops on Georges Bank. The pounds of meats landed per day on the fishing grounds by commercial draggers provides an index which is available for all years back to 1945. A day fishing on the grounds includes shucking time. A second index is provided by surveys of

Table 1. --Sea scallop landings, effort, and abundance indexes.

(Landings in ~~thousands~~ millions of pounds.)

a. For last five years.

	United States		Canada		Total		
Year	Days fished	Landings	Days fished	Landings	Days fished	Landings	Pounds per/day
1964	6656	13.5	6723	13.0	13379	26.5	1981
1963	7718	17.6	5905	13.1	13623	30.7	2253
1962	9070	21.9	4642	12.5	13712	34.4	2509
1961	8671	23.6	3146	10.1	11818	33.7	2851
1960	8039	21.9	2282	7.5	10311	29.4	2851

b. Five-year averages

60-64	8031	19.7	4540	11.2	12571	30.9	2458
55-59	10339	17.2	1047	2.0	11386	19.2	1686
50-54	8384	13.6	140	0.2	8524	13.8	1619
45-49	5933	9.0	NA	0.0	5933	9.0	1517

Bureau research vessels. This index has been maintained since 1960. Each of these indexes have built-in inadequacies which must be taken into consideration when judging their significance, but the two series show the same trend in the years for which both indexes are available.

Prior to 1959 the commercial vessels shucked about 1600 pounds per day. In 1959 a very large year class entered the fishery and catches shot upward. Abundance was so high that vessels were able to load their decks with a few short hauls and then spend the rest of the day shucking the catch. Under these circumstances, fewer hours per day were spent in actual fishing, the rest of the time was devoted to shucking. Since the vessels were not fishing all day, the index of landings per day on the grounds was not equivalent to the landings per day fished index. Even so, landings per day on the grounds jumped to over 2800 pounds.

The large year class that entered the fishery in 1959 supported the fishery for several years and the resultant high abundance helped to attract many new boats from Canada (table 2). The commercial vessel index has slowly declined to less than 2000 pounds per day in 1964. The research vessel index shows an even more drastic decline (table 3). Future abundance is uncertain. So far we have no indication of another large year class. Abundance could very well drop to pre 1959 levels or lower.

Table 2. --Size of sea scallop fleets fishing Georges Bank

	Number of Vessels		
Year	United States	Canada	Total
1964	45	55	100
1963	51	49	100
1962	62	40	102
1961	63	28	91
1960	63	20	83
1959	64	15	79
1958	65	10	75
1957	74	4	78
1956	74	3	77

Table 3. --Abundance indices based on research vessel survey data.

(Number of scallops larger than 70 mm. per 10,000 square feet.)

Year	1960	1961	1962	1963	1964
Index	112	92	98	46	40

Cull Size and Yield.

Fishermen in both fleets, United States and Canadian, now cull the catch at about 95 mm. (3.7 inches). The larger scallops are shucked out; the smaller ones are discarded whole. Our best evidence indicates that the mortality of these discarded scallops is very low, especially if they are returned to the sea promptly.

Our studies of growth and mortality rates of the Georges Bank scallop stocks indicate that the present yield per recruit is considerably below maximum. Yield per recruit could be increased by either advancing the age of shucking or by decreasing the fishing effort. With present fishing effort, the maximum yield would be obtained with a minimum shucking size of 130 mm. (5.0 inches). This would represent a delay in utilization of 3-1/2 years; the increase in yield would amount to about 30 percent. Table 4 presents benefits to be expected with various minimum sizes.

With the present minimum size of 95 mm. the Georges Bank scallop stocks are being overfished. Yields per recruit would increase somewhat if fishing pressure were lessened; halving present effort would increase the yield per recruit by 5 percent. A 5 percent increase in yield per recruit is hardly sufficient to substantiate a recommendation for limiting effort, but it is important to bear in mind that further increases above the present level of effort will result in further decreased yields per recruit. ICNAF may well wish to hold total effort at present levels to prevent further declines in yield.

Table 4. --Increases in yield per recruit with increasing minimum size (with present fishing effort).

Minimum Size	% Increase
95 mm.	0
105 mm.	10
115 mm.	22
130 mm.	30

One further point should be brought out. When a fishery is heavily exploited, changes in effort are accompanied by rather marked changes in catch per effort. Thus, in the scallop fishery, halving the fishing effort would approximately double the yield per day fished. An increase above present effort would result in a proportionate decrease in yield per day fished.

This information is of only academic interest at present since the terms of reference under which ICNAF operates call for management only toward maximum sustained yield without any reference to economic yield. The point is raised here simply to emphasize that under present conditions restricting effort would carry the added advantage of insuring present yields per day fished.

Savings Gear

Hoping that the minimum size might be controlled by adjusting the ring size in the dredge bag, U.S. and Canadian scientists conducted a number of experiments with rings of larger sizes. Unfortunately the selection of the dredge bag under commercial operations was so imprecise as to require the use of impracticably large rings as a savings gear.

Mechanical Culler

Unless an altogether new device for catching sea scallops can be designed, the most practical method of controlling the cull size seems to be the design of some arrangement on deck that will automatically cull the catch.

The design of a mechanical culler should not be difficult and there is no reason that it should be expensive. The harvester used in the Maryland soft clam fishery, for instance, automatically discards clams smaller than the legal limit. Properly designed, it could significantly increase the efficiency of the handling process so that the fishermen would have more time to shuck. The introduction of a culling machine would make a minimum size regulation feasable.

Few regulatory and enforcement measures are so sophisticated that they cannot be circumvented. Even though automatic culling of scallops would increase the fishermen's efficiency and be for the long term benefit of the fishery, some fishermen would attempt to retain and shuck the smaller scallops for immediate gain. How could they be detected?

Relation of Meat Weight to Shell Size.

The weight of the adductor muscle in a scallop is related to the size of the scallop. We have investigated this relation and measured the amount of variation (Table 5). The meat of a 95 mm. scallop, for instance, weighs on the average 13.3 grams, and 95 percent of the weights fall between 8.5 and 20.6 grams. A 120 mm. scallop has a meat averaging 26.5 grams with 95 percent of them falling between 17.9 and 41.4 grams. Sampling and weighing the meats landed could, therefore, be used as an adjunct to enforcement of a minimum size regulation.

Table 5. --Relation of adductor muscle weight to shell size.

Shell	Meat Weight (grams)	
	Mean	95% limits
80 mm	8.0	5.1 - 12.5
95 mm	13.3	8.5 - 20.6
120 mm	26.5	17.9 - 41.4
130 mm	33.6	21.5 - 52.2

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