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Some recommendations for conservation of Georges Bank scallop stocks¹

by

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The history of the Canadian offshore scallop fishery and recent changes in this fishery have been described in a recent article in "Fisheries of Canada" (Caddy and Lord 1971), in a submission to ICNAF earlier this year (Caddy 1971) and in a recent Technical Report (Caddy and Sreedharan 1971).

To summarise briefly the important events:

- 1) The Canadian offshore fishery began in 1957 and grew rapidly following an unusually large recruitment to the Bank in 1959-60.
- 2) Recruitment was poor over the next 10 years and catch per hour showed a progressive decline.
- 3) The U.S. New Bedford fleet, which previous to 1957 had exclusive use of Georges Bank stocks progressively withdrew from this fishery, so that by 1969, Canada was taking 80% of the catch. The Canadian fleet has been able to remain operational solely because of lower operating costs than their U.S. counterparts (Doherty et al. 1964), and the rapid rise in landed price over the last few years. Table 1 shows that two indices of abundance, catch per day, and catch per hour dragged, have both gone down; the second index, which is the best measure of abundance, has gone down to 1/5 of the 1961 level. In the same period, the number of days fished by the Canadian fleet more than doubled, and the number of hours fished increased fourfold, indicating a considerable rise in fishing pressure on the stocks.

When one examines the economic returns from the fishery, the picture looks more favourable; a rapid rise in price in 1968 increased the value of daily landings by 38% over the previous year, and this figure has remained at \$1250-1400 per day for the last 4 years. Dollars per hour dragged also went up in 1968 by 33% to \$96/hr, and has remained at around \$85-100/hr since. Although these figures do not take into account rising operating and maintenance costs, it is difficult, without further information, to conclude that the fishery is economically in bad

¹ Also Fisheries Research Board of Canada original manuscript, Biological Station, St. Andrews, N.B., No. 1100, dated 14 December 1971.

Table 1. Summary of important statistics for the Canadian Georges Bank scallop fishery.

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Landings (millions of lbs)	10.1	12.5	13.1	13.2	10.1	10.7	11.1	10.6	9.6	8.9	8.7
Days fished	3,147	4,642	5,905	6,723	5,749	5,524	6,785	6,972	6,684	7,615	7,300
Hrs fished/day*	7.9	12.2	12.9	13.5	13.8	12.3	13.2	(13.7)	(14.3)	14.1	(14.2)
Catch/hr (lbs) dragged	406	221	172	145	125	160	124	111	99	83	84
Catch/day (lbs)	3,209	2,693	2,218	1,963	1,728	1,964	1,634	1,521	1,416	1,169	1,197
Value of catch											
Landed price/lb (¢)	29	34	39	44	55	41	58	86	89	109	115
\$/day fished	931	916	865	864	950	805	948	1,308	1,260	1,274	1,377
\$/hr dragged	118	75	67	64	69	66	72	96	88	91	97

*() 's = estimate from sample fleet of 5 boats

shape. However, it is clear that the rapid escalation of landed price has led to a considerable increase in fishing pressure on the bank, and the prospect of dangerous depletion of stocks must be considered a real one if the present trend continues.

- 4) In 1970, a dense but limited area of 3 ring scallops was located by the fleet on the Northern Edge. These were heavily fished in 1970 and 1971 by certain members of the Lunenburg and Riverport fleets (Yarmouth boats avoided the area; landed larger scallops, but made poorer catches).
- 5) A survey in June 1971 indicated that this area has now been largely fished out. The fleet have now located another area of predominantly small shell on the east side of the bank, which is being exploited by some of the offshore fleet.

It is instructive to note that the age at first exploitation has fallen from 5 to 3 years between 1961 and 1970. Up to 70 meats per pound were landed last year and there are unconfirmed reports of between 90 and 120 meats per pound in some of the catches landed so far this year.

It should be remembered that recruitment to this fishery is extremely irregular both in time and position, so that good year classes must support the fishery for several years. They will not do this under present conditions of high effort and low cull size; and it may be anticipated that even if economic returns are kept high by increase in the landed price, annual landings will become more irregular as they will depend largely on the entry of new year classes to the population.

Although there is some doubt as to the actual figure, it seems generally accepted that natural mortality is low on Georges Bank, so that the major cause of mortality is fishing. Since the weight of adductor muscles (meats) increases by more than 100% per year until age 4, and by about 30% per year between ages 4 and 7, it is clearly unwise to harvest scallops before the 4th year of life, and probably wise to postpone harvesting until years 5 or 6. It is therefore clear that the major requirements to protect this fishery are both a reduction in overall fishing effort and some means of increasing the age at first capture.

TYPES OF REGULATION DESIGNED TO INCREASE THE SIZE OF SCALLOP MEATS LANDED BY THE OFFSHORE FLEET

Regulations may be designed to operate at different stages of the fishing process. Some of the more feasible approaches are as follows:

1) Reduction of fishing pressure

Reduction of fishing pressure will allow scallops to reach a larger size before harvesting. The only suitable approach to this measure is a reduction in the number of boats fishing the banks. It should be stressed that any regulations such as the imposition of quotas, seasons, turn-round periods between trips, or reduced trip durations, will only increase pressure to fish the more abundant stocks of small scallops.

A policy designed to reduce the fleet size would probably be long term and might take the form of a fixed number of licences, restricted to boats presently fishing scallops. The licence would not be transferable between vessels and would lapse if no scalloping was carried on for a period of, say, 1 year. It would also be a very desirable feature of the licence if it carried the obligation of

filling out a log record of catches and areas fished. (It might be noted that this restricted licence could be usefully applied to inshore vessels also, since Canadian inshore scallop grounds are also being overfished.)

2) Restrictions on the area fished to protect small scallops

This measure is the one most favoured by fishermen and there have been suggestions from some skippers recently that the Bank east of the Loran 143-2300 line be closed to fishing because of the large numbers of small scallops in this area. This measure makes sense from a biological point of view, but poses formidable problems both of surveying the area of small scallops (which changes from year to year) and enforcing the ban on fishing. Vastly extended research vessel coverage supplemented by full log book coverage of the U.S. and Canadian fleets will be needed to be sure of rapidly locating and delimiting areas of young scallops on the 9000 square miles of the bank; and patrolling these areas will require a year-round offshore vessel patrol, or system of fly-overs. Since fishing goes on after dark and in the foggy weather so typical of Georges Bank, it seems likely that this type of regulation could be broken without great risk of detection.

3) Restrictions on shucking power of the vessels, making it unprofitable to take small scallops

It is well established that the major limitation on the fishing power of a scalloper is the shucking operation and this is particularly the case when the scallops are small. On Georges Bank in the early 1960's when small scallops were abundant, it was the general practice to take on up to 7 extra hands solely for the purpose of shucking (Bourne 1964), and there is some evidence that this practice occurred (to a lesser extent) during the much smaller recruitment in 1970. A restriction of crew size to 12-15 men (depending on boat size and considerations of safe operation) would make it unprofitable to fish areas of predominantly small scallops, both because of the excessive time taken in shucking them, or because of the extra labour of hand culling large scallops from a catch of predominantly small ones.

It should be noted at this point that a fishery has developed for the small calico scallop of the Florida coast which employs automatic shucking machines to avoid the limitations of manual shucking. It seems inevitable that these machines will eventually be adopted by the Georges Bank fishery. Now seems a good time to stipulate that such machines designed for sea scallops should be designed so as not to accept scallops below a certain size (90-100 mm; about 5 years).

4) Modifications to the gear to protect small scallops

- a) The most obvious measure to improve the selectivity of the dredge is to increase the ring size from 3" to 4". This measure is immediately attractive in that it requires a minimum of inspection.

The effect of this measure on dredge selectivity was tested in the early 1960's in the hope of increasing the age at first capture from 5 to 6 years (96-108 mm). It was found that the 4" ring was not much more effective than the 3" ring for this purpose and the idea of increasing ring size was therefore abandoned (Bourne 1965). However, the investigators at that time did not envisage that age at first exploitation might fall to the present level of 3 years, and there

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is now good reason to suppose that the adoption of a 4" ring might at least restore the age at first retention to its former level. More recent research indicates that dredges are more efficient at selecting for large scallops when overall catches are low, than during periods of high abundance, such as were prevailing in 1960-61 when the last experiments were carried out. Since the main purpose of the regulation is to protect the stocks during periods of low abundance, this type of measure now seems more appropriate. Two major disadvantages of this measure are 1) that 4" rings were found to be more susceptible to distortion and breaking than 3" rings, and 2) that recent work has shown that incidental damage to scallops passing through the dredge rings may be high, since a large part of the selection takes place through the belly of the dredge. This type of incidental mortality would obviously continue for a longer period with 4" ring drags.

- b) It is evident that in the long run, an efficient savings gear will require major changes in dredge design, principally to prevent damage to uncaught scallops and improve mesh selection, and work to this end is being given high priority.

5. On-deck culling and grading operations designed to ensure that small scallops be returned to the sea

This type of measure would necessarily rely on the cooperation of the fishing skipper supplemented by some form of port inspection for its success. To be acceptable to the fishermen, it would have to fit in with existing deck operations, and if possible, provide some saving in manpower. Two approaches can be pursued:

- a) The adoption of a mechanical grader, such as is used in the Florida scallop fishery, would eliminate the necessity of manually culling market scallops from trash and could be designed to reject undersized scallops over the side together with trash.
- b) A wire mesh basket or mechanical grader could be designed to fit into the washing trough to divide the shucked meats into two size categories, each of which could be bagged separately and labelled with a distinctive colour tag. It is suggested that the knife-edge selection size of 100 mm be chosen (12-15 gm meat weight). The regulation would specify the maximum allowable proportion of bags containing meats smaller than 12-15 gm (30-38 meats/lb). The number of bags in each category could be checked at the point of landing, and spot checks run on the larger meat sizes to ensure that sieving had been carried out to a specified degree of efficiency; a proportion of small meats in the large size category in excess of a specified level would be penalised. Without a method of measuring meat sizes at sea, it can also be claimed with some justification by the skipper that he was not aware of the exact proportion of small meats in the catch until landing.

6. In-plant inspection of landed meat weights

Recent studies carried out in cooperation with the Inspection Branch of the Department of Fisheries have illustrated the value of information on landed meat weights in following changes in the fishery. When used in conjunction with an efficient log book system, this allows rapid location of areas of recent recruitment. Recent studies have also indicated that polymodal analysis of meat weight distributions allow one to identify the proportion of meats in the 3rd and 4th year classes with a reasonable degree of certainty, so that this data may also be used to obtain mortality figures, which are at present difficult to obtain for this fishery. The use of some form of meat size inspection on landing is really the only sure method of determining whether any other regulation is proving effective.

In deciding which of the above regulations might be the most desirable, it is obviously necessary to take into account the effectiveness of the measure, the speed with which it can be implemented and begin to take effect, and the effort needed to make it effective. The author has attempted to take these factors into consideration in the following summary, but he realises that one or several of the suggested approaches may be unfeasible because of economic or legal considerations beyond his competence.

PRACTICAL CONSIDERATIONS AFFECTING IMPLEMENTATION OF SUGGESTED MEASURES

1) Restricted licensing of vessels

Some measure to regulate fishing effort is essential to the continued well-being of the fishery, and should not involve a major increase in the work load of the enforcement branch. Most offshore scallopers land at one of three ports, Lunenburg, Riverport and Yarmouth, and offshore vessels can be readily distinguished from inshore boats by length (over 80 ft) and licensed separately. Unless there is a programme of vessel purchase, this measure will only have a long-term effect on the fishery, but none the less, a freeze on new vessels entering the fishery is desirable at this time.

2) Restrictions on area fished

Although favoured by fishermen, this measure would require greatly increased effort:

- a) In the survey and stock delimitation functions of the research branch. This would require considerable expansion of existing staff and available vessel time (The Canadian complement devoted exclusively to scallop present problems is one scientist and one technician, with responsibility for both inshore and offshore fisheries: the U.S. has no full-time scientific staff devoted to the offshore scallop fishery).
- b) A year-round vessel patrol or fly over.
- c) An efficient log book scheme and meat sampling programme to detect infringements and pinpoint new areas of seed scallops.

In conclusion, it can be said that this measure is not feasible under present conditions, although it should be seriously considered if high priority is ever given to operating this fishery at close to its maximum sustained yield.

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3) Restrictions on crew size

This measure has the advantages a) that it can be applied rapidly and b) that in order to avoid the extra labour of culling the catch and shucking small scallops, vessels with smaller crews will avoid areas of seed scallops. From our limited data, it appears that vessels with crews larger than 14-15 were responsible for most catches exceeding 40 meats/ lb in 1970.

One approach to this measure might be the licensing of individual fishermen, with a maximum number of licenses per boat. Although this measure would result in some unemployment (probably less than 50 men), these would not be the trained fishermen, since extra hands taken on for shucking work are usually casual labour. This measure is recommended for immediate implementation following discussion with the industry.

4) Increased ring size

As explained earlier, this measure should increase size at first capture during periods of low abundance and is an alternative to 3 above. One disadvantage of this measure compared with 3 is that it will allow fishing in areas of predominantly small scallops containing a proportion of large scallops. Even if the small ones are lost through the mesh, they will still suffer incidental mortalities. This measure does have one advantage over 3, namely, that after acceptance of the regulation and a changeover period of three months or so to use up existing stocks of 3" rings, this measure would require only cursory inspection by the enforcement branch.

5) On-deck culling and grading

This measure must await discussion with industry to decide on its feasibility, as well as a period of design for the sorting gear. Not for immediate implementation.

6) A limit on landed meat size

This is the only direct approach to increasing cull size now available without new developments in the design of savings gear, or methods of mechanically grading the catch on deck.

Without some form of at-sea grading of meat sizes, a regulation prohibiting possession of meats below a certain size is impractical. This measure would still be impractical even if some efficient method of grading the catch by shell size were devised, since shell length/meat weight ratios for scallops show wide individual variations. The most feasible approach would seem to be to specify an upper limit for the mean number of meats per pound in the catch. Existing methods of subsampling research catches can be modified to provide a rapid and accurate estimate of the average meat size in the catch. A conversion of meat weights to volumetric measure may be convenient in practice, particularly for use at sea by the fishing skipper to monitor the size of meats being shucked.

FINAL RECOMMENDATIONS

It is therefore recommended that measures 1, 3 or 4 and 6 be considered for immediate implementation. If agreement cannot be achieved bilaterally with the U.S. on these measures, it would probably be still to Canada's advantage as the principal offshore scallop fishing nation, to implement the measures unilaterally.

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