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Relative Rate of Fishing on Small Sea Scallops

By L. M. Dickie
Fisheries Research Board of Canada
Biological Station, St. Andrews, N. B.

In predicting the effect of a change in mesh size on the total catch of fish it is of particular importance to have precise information on the fishing mortality rate on the fish which are between the sizes taken by the two meshes under consideration (Holt, 1958, ICNAF Ann. Proc. 8) because these are the sizes directly affected by mesh changes. In studying the merits of a ring size increase for the scallop fishery of Georges Bank, Posgay (1958, Document 28, Serial 554) has reported data which go far towards establishing the relation between the present ring size of 3 inches inside diameter, and size at 50% retention by Georges Bank-type scallop gear, as well as the general relationship between size of scallops taken and ring size. However, ring size is only one factor (and often a minor one) in determining the size at which scallops are used. It is well known that when catches are high only the largest are culled out for shucking, and that large numbers of small scallops are returned to the beds. This paper describes data on cull sizes obtained during 1958 on two sea trips on Canadian vessels. It also describes observations which have been made on breakage among discards that are about to be dumped overboard from the Bay of Fundy (Digby) scallop fishing boats. These data provide a preliminary basis for judging the relative fishing mortality of the smaller scallops which are caught but discarded, and which would be an important fraction of the total numbers saved by an increase in ring size.

Relationship between catch, cull size, and landings

Figure 1A summarizes the first body of data obtained in August 1958 on a sea-sampling trip on one of the larger (130 gross tons) and more efficient of the Canadian scallop draggers. Visits were made to two areas, 41-66 E3 and F2 on the southeast part of Georges Bank. The Figure gives size composition of the total catch, the discards, and the marketed scallops in terms of numbers per drag per haul on each area. In Figure 2A these size-composition data are treated in standard fashion to show the size at which about 50% of scallops are culled.

The data indicate that although relative size composition was the same on the two areas, catch in numbers per haul was over twice as high on area E3 as on area F2, and presumably represents differences in the density of the fished stock. However, these differences in catch affected primarily the numbers discarded, rather than the numbers landed. In area E3, where catches were higher, there were large numbers of scallops between 80 and 100 mm. shell height. The 50% cull point was at 100 mm. The marketed catch of about 1,000 scallops per drag yielded 106 pounds of meats per hour (2,554 lb. per day fished). On area F2 where scallop catches were lower, the 50% cull point was also lower, at about 92 mm. The marketed catch of about 800 scallops per drag yielded 112 pounds per hour (2,690 lb. per day fished).

The second body of data was obtained in October 1958 on one of the smaller draggers (53 gross tons) fishing on two unit areas on the northeast peak (areas 42-66, A6 and B6). Figure 1B

/2

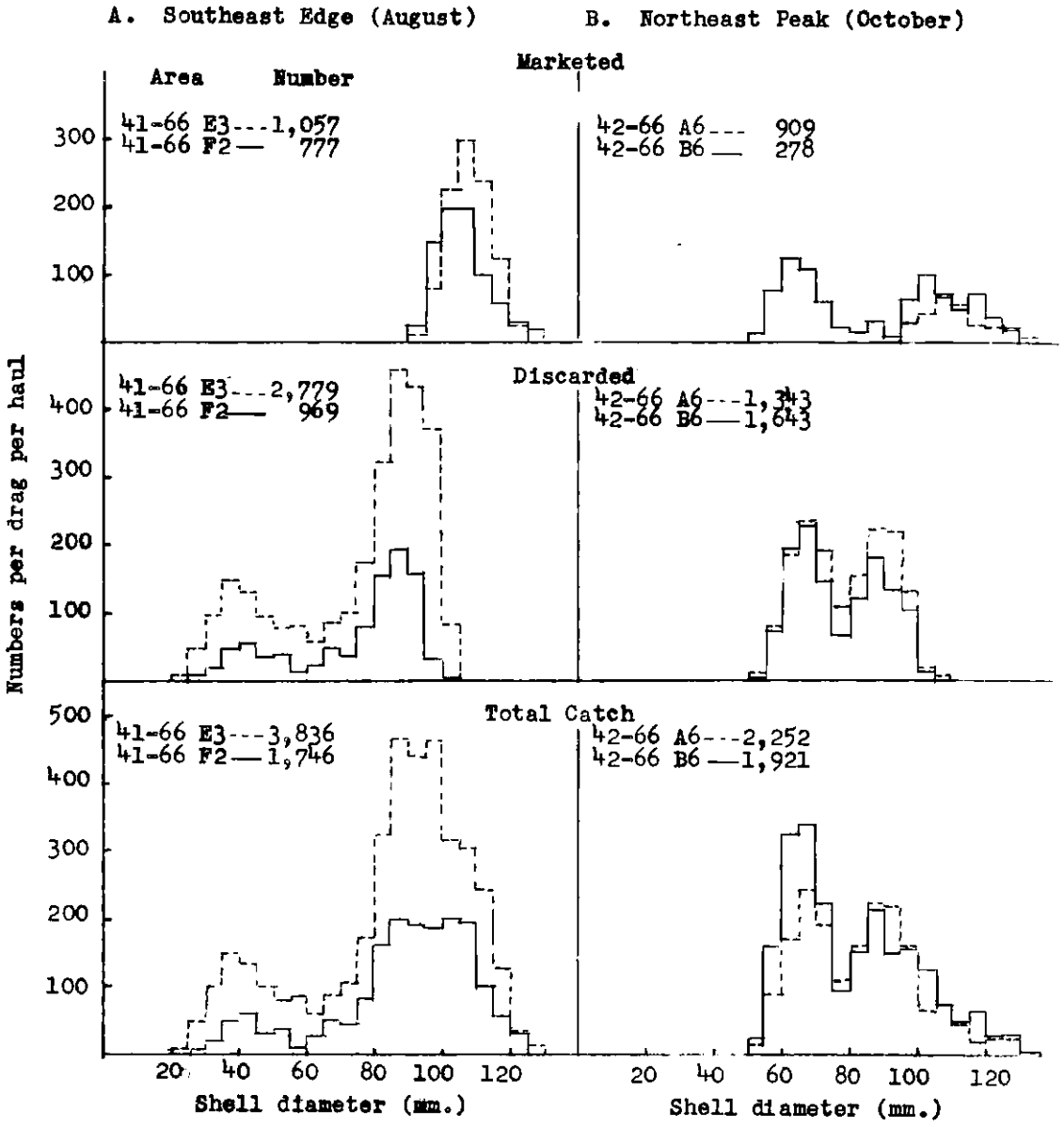

Figure 1. Size-frequency composition of Georges Bank scallops caught, discarded, and landed from:
A. 130-ton dragger on Southeast Edge in August;
B. 53-ton dragger on Northeast Edge in October.

/3

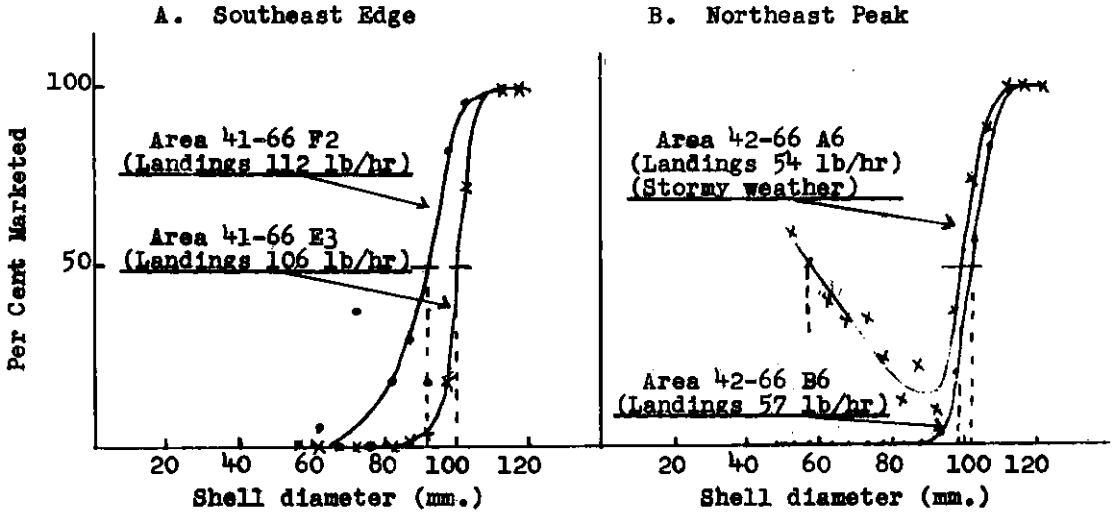

Figure 2. Cull curves for the Georges Bank sea-sampling trips described in Figure 1, showing approximate 50% cull size.

shows the size-composition data again in numbers per drag per haul. The relative size composition on the two unit areas visited was about the same, and the densities of scallops were also nearly the same. However, the relative size composition was quite different from that found on the unit areas visited in August; small scallops, between 55 and 75 mm. shell height, predominated in the catches on the northeast peak.

Data on landings per haul and on sizes culled are summarized in Figure 2B. The landings were low (55 lb./hr. or 1,300 lb./day) compared with those described above for large vessels. This was partly because of bad weather during parts of the cruise, but mostly because the smaller vessel had a lower fishing power. The cull data, however, indicate that the 50% cull point was again high -- about 100 mm. on the average, although in the bad weather encountered while fishing on area A6 it dropped below 100 mm. because considerable numbers of small, normally discarded scallops were shucked. Since size compositions were about the same on areas A6 and B6, it appears that poor catches due to bad weather lowered the cull point in much the same way as did poor catches from low density. However, the greatly increased relative numbers of small scallops found on the October cruise as compared with the August cruise were undoubtedly a factor which influenced the numbers of them which the crews decided to shuck.

These data confirm verbal reports we have from Canadian scallop vessels that there are relatively large numbers of small scallops now on the beds which are caught by present gear but normally rejected in culling and returned to the beds. They also show, what our fishermen tell us, that the cull point varies from place to place and with fishing conditions, and is related to the "shucking power" of the vessels rather than to their "fishing power". That is, fishing gear now used is efficient enough so that with present densities of scallops, it catches more than the crews can process. When catches are heavy the crews cull out large scallops because they require less shucking effort, and they cull only as many as they can shuck, discarding the rest which are almost all

/4

small. When catches are light the cull point tends to drop as the crews still pick up enough to keep busy even if this means shucking small scallops.

We have insufficient information to show the variation in cull point under all the different circumstances in the Georges Bank fishery. Canadian fishermen interviewed during our sea trips in 1958 regarded their catches described here as fairly representative of conditions during the year. It therefore appears that the 50% cull point for Canadian vessels lies between about 95 and 100 mm. shell height. It is probable that if densities of scallops become lower, the cull point with present catching gear would drop accordingly. We can expect this from what we know of the Digby (Bay of Fundy) fishery.

In the Bay of Fundy, where average size of scallops caught is smaller than on Georges Bank, and where catches are usually insufficient to keep crews busy full-time, the 50% cull size is about 75 mm., or about the same as the 50% retention size of the gear (ring size 3¼ inches, inside diameter). However, when relative abundance of small scallops is higher and abundance of larger scallops is lower than normal, the drags do not select as sharply as ordinarily, and more small (60 to 80 mm.) scallops are caught. At such times boat captains consider it profitable to carry additional crew to shuck all the catch. We may assume, therefore, that in times of lower abundance, Georges Bank fishermen have shucked and will likely shuck smaller sizes than they now do.

Posgay (1958, ICNAF Serial No. 554) has shown that to take 50% of the scallops of a given size requires a ring with maximum inter-ring space about 28 mm. greater than that of the scallops. This means that 95 mm. scallops have a 50% chance of being taken by drags with an inter-ring space of 123 mm. or 4.85 inches. This is the equivalent of a ring with about a 4-inch inside diameter. It appears, therefore, that ring size used by the scallop fishery could be increased to 4 inches without initially altering Canadian landings. However, the amount of long-term benefit to the scallop fishery of a change in ring size depends upon saving young scallops from fishing mortality, with the expectation that they will be available to capture later. The above observations indicate that with the present cull size of 95 mm. these small sizes may already be "saved" by the fishery, since they are largely discarded. Long-term benefits of an increase in ring size from 3 to 4 inches therefore depend upon the mortality of the current discards, or the protection they will be afforded should fishing practices be altered.

Mortality among discards

It is possible that when scallops are disturbed by dragging their mortality rate is increased through air exposure, or increased exposure to enemies after they are returned to the beds. Furthermore, even superficial examination of the piles of scallops, rocks, and detritus which are discarded from the catches shows that there is breakage during the handling. Success with tagging experiments indicates that "indirect" fishing mortalities among discards through exposure and handling may be relatively low, and Canadian scientists have no observations of deck breakage from vessels fishing Georges Bank. However, some observations have been compiled for the Bay of Fundy fishery, and the unpublished data have been made available through the kindness of Dr. J. C. Medcof and Dr. N. Bourne of the Biological Station, St. Andrews, N. B. They are summarized in the following table:

/5

Mesh size	Ground	No. of hauls	Total number in sample of discards	% mortally damaged	Remarks
2 5/8"	Gullivers Head	11	945	15	Few rocks.
	Gullivers Head	7	605	23	Very rocky.
	Broad Cove	9	624	11	Less rocky than Gullivers.
	Hour Ground	8	712	14	Small rocks.
	Hour Ground	7	560	12	Small rocks.
	Hour Ground	1	78	42*	Small rocks.
3 1/4"	Gullivers Head	4	228	16	Few rocks.
	Gullivers Head	2	54	26	Very rocky.
	Hour Ground	8	154	14	Small rocks.

*This sample of discards was trampled over by two fishermen in process of changing over the drags.

There is a direct relation between the amount of rock in the drags and the frequency with which scallop shells were broken to the extent that the observer, Dr. Medcof, judged them to have been mortally injured. The extent to which trampling was also important is indicated by results in the one sample so treated.

Scallop catches from Georges Bank rarely contain as much rock as at Digby, and catches are not normally trampled while being dumped to the extent that Digby catches are. However, Georges Bank fishing may be regarded as somewhat similar to that on Hour Ground at Digby, where the data indicate that there is a mortality of the order of 15% among discards from the mechanical damage during handling. Therefore, although we need further information on the "indirect" fishing mortality on Georges Bank proper, it is not unreasonable to conclude that it must be of this same order of magnitude, because deck damage seems likely to be the major component in "indirect" fishing mortality of discards. It appears that the "indirect" fishing mortality among the small Georges Bank scallops which are taken by the 3-inch ring but culled from the catch is about 15% of the fishing mortality rate of scallops larger than the present cull size.