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On the Measurement of Demersal Fishing Effort

by
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The present paper is a summarized version of a fuller paper at present in the press (Fishery Investigations, Series II, Vol. XX, No. 5) in which the fishing efforts of the various vessels and gears comprising the major part of the English demersal fishery are compared and a method obtained of expressing them in a standard form. Following the usage of Beverton and Parrish in their paper given at the 1954 meeting of the International Council for the Exploration of the Sea, the two quantities studied were fishing power of a ship - defined as the ratio of its catch per unit time to that of a standard vessel fishing on the same density of fish, and fishing effort - defined as the product of the vessel's fishing power and the appropriate unit of time that the gear is in operation.

The basic data used were the "D" forms, which give for each individual vessel landing at an English port the fishing grounds, the catch of each species, the number of days away from port, and the number of hours spent fishing. Comparisons to give the fishing power were made between the catch per hour of vessels fishing at the same time and in the same statistical rectangle. The groups of vessels considered were distant water steam trawlers of from 300-800 gross tons fishing the Skolpen Bank and at Iceland, steam trawlers of from 100-300 gross tons based at Milford Haven, and fishing to the south of Ireland, small steam and motor trawlers of from 60-200 tons based on Lowestoft, and fishing on the southern North Sea, and Danish seiners, and a few steam trawlers based on Grimsby, fishing the Central North Sea. The main results are summarised below.

For steam trawlers above about 150 gross tonnage, the fishing power is approximately proportional to gross tonnage. Steam trawlers of less than 150 gross tonnage, which group is comprised almost entirely of drifter-trawlers of 95-110 gross tons, are ton for ton, about 1.3 times as powerful as the larger trawlers. For motor trawlers fishing power is also closely related to gross tonnage, and the smaller ships are also ton for ton more powerful than the larger ones. Motor trawlers are, ton for ton, 1.4 times as powerful as the larger steam trawlers.

The variations in fishing power of a ship about the mean for its size may be largely ascribed to the fluctuations in the success of different trips by the same vessel.

Fishing power of trawlers is also closely correlated with the length of a ship, its net tonnage and horse power. These factors are all closely correlated. Calculating the partial correlation coefficients between fishing power and tonnage and horse power, and thus estimating the effect of each factor above, the other being held constant, showed that both gross tonnage and horse power influenced the fishing power. For motor trawlers the brake horse power had the slightly greater effect, but for steam trawlers the nominal horse power had a smaller effect than gross tonnage.

It is suggested that some standardized unit of fishing power is necessary and a possible one is the equivalent tonnage which may be defined as being proportional to the fishing power of a ship. For large and medium steam trawlers the equivalent tonnage is equal to the gross tonnage, but is 1.3 times the gross tonnage for steam drifter-trawlers, and 1.4 times the gross tonnage for motor trawlers.

The fishing power of Danish seiners worked at anchor is independent of the size of ship over the range 20-80 gross tons. Compared with trawlers fishing the same grounds, seiners catch a much larger proportion of plaice, so that they have a greater fishing power when based only on catches of plaice, than when based on catches of all fish. The equivalent tonnage in the sense defined above, c.f. English seiners, is 250 tons (based on catches of plaice) or 160 (based on catches of all species). The equivalent tonnage of a pair vessel (based on rather few observations) is 320 tons.

The number of hours fishing, and of days absent from port were compared as units of fishing time. For Arctic fisheries, where some appreciable time may, when fishing is good, be spent laid to clear decks, the number of days' absent can be very unreliable at high fish densities - for English trawlers at densities greater than about one ton per hour's fishing. Above this level the number of days' absent can over-estimate the effort by 100 % or more.