

Conseil International pour l'Exploration  
de la Mer

C. M. 1953  
Contribution No.  
(North Sea Sub-Committee  
Comparative Fishing Committee)



A Note on Published Trawler-Seiner Comparisons

By

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There is published evidence that a seine with a 70 mm. mesh or thereabouts takes from a stock of plaice approximately the same sized fish as a trawler with a mesh 10 mm. greater. Four workers have described trials, one of them giving two sets. Taken by itself the evidence of any one trial would hardly be conclusive, and they vary in the meshes used and in the nature of the trials, but taken together they provide a convincing argument that the difference of about 10 mm. is real. How far it is due to different actions of fish or mesh in the two gears, or how far to explanation on Margetts' theory (1949) of pre-selection by seine warps, can not be determined from published data. Throughout this note the selection effect of both gears will be considered as a whole, because in the published work there are no data from which the selection in the cod-end is distinct from selection in or by other parts of the gear can be determined.

For dabs there are only two sets of trials, but these show a difference in the same direction.

For haddock there is only one set, which also shows a difference in the same direction.

The difference for plaice seems certain. Those for dab and haddock, so far as published evidence goes, can be classed as only probable.

In presenting the evidence, it is first necessary to decide on some index of the run of sizes of fish caught by each gear. The mean or average size would be affected rather much by a few extremely large or extremely small fish that might happen by chance to be taken in one gear or the other. The mode, or most common size, is unduly affected by what sizes of fish happened to be on the ground. The best index - not that it is entirely free from the faults mentioned - seems to be the half-way length, or "median" as it is called in statistical studies. Half the fish in the catch are bigger than the median size and half smaller. It will be realized that, as indeed with mean or mode, an apparently small difference in the position of the half-way point, e.g. 1 cm., reflects a considerable difference in the whole length distribution.

We must also consider how selection should be described, seeking for a single figure to express the selective properties of each net that was tried. Hollaston's theory of mesh selection (1927), which seems to give a fair and practical account of what happens, was based on the following considerations. Some fish will be altogether too big to go through the mesh of a cod-end in which they find themselves, and these will have no chance of escaping. At the other extreme, there are fish that are so small that they can hardly fail to get through the mesh and escape. They have a 100% chance of getting through. At some intermediate length of fish there is an even chance, say fifty-fifty, that a fish of that size will escape. This length is called the "50% point", and has proved a useful measure of the selective action of a net.

Throughout this note the mesh is considered to have been measured by a gauge 2 mm. thick, narrower at one end than the other, inserted within the lumen of the mesh, and the figure given is the breadth of the gauge in mm. as read when the progress of the gauge through the mesh is stopped, without force being used to push it further. All measurements are assumed to have been taken when the net was wet and in use.

A large number of experiments with trawl codends have all indicated that, as might reasonably be expected, there is, for each species of fish, a direct relationship between the size of mesh opening and the 50% point of the size of fish escaping or retained by that mesh. Whether or not a fish will escape through a certain size of mesh will depend largely on the girth of the fish,

and as the girth of the fish is directly proportional to the length of the fish, then the length of fish at the 50% point will be directly proportional to the mesh size. For plaice, it has been found that in trawl cod-ends the length of fish at the 50% point is 2.18 times the mesh size, while for haddock the similar proportionality factor is from 3.0 to 3.3.

The first worker to investigate the mesh selection of seine-nets was Bowman (1928). His fishing in the Moray Firth in 1921 gave the interesting result that the Danish fishermen were catching haddock in their seines with a median about 9 cm. higher than that being found in the research vessel's trawl catches close by. As mesh measurements are not given in Bowman's paper, it is not possible to make any use of those data in the present review. Two years later, in 1923, and again in 1924, Bowman fished trawl against seine net in St. Andrew's Bay, and measured the meshes. The species in these trials was plaice. The trials confirmed each other, in that, with meshes not very different, the seine gave a median higher by just over 1 cm.

Clark (1934) determined the population of plaice on the ground by fishing with a trawl covered with shrimp netting, and then fished seine nets of various mesh on the same ground. These trials did not yield usable data for our present purpose, but it is worth noting that his 50% point for the 90 mm. seine on plaice appears to be near 20.5 cm., which is little greater, if at all, than the 50% point that would be obtained with a trawl of the same mesh, according to our present appreciation of all published and unpublished data on selection in trawls. Clark's results did not show any reason for doubting the validity of the difference, of 1 cm. or so, discovered by Bowman.

Jensen (1949) gave no data, and was not very happy about his experiments, but he thought that the 50% point for plaice to be 17.5 cm. for a 70 mm. seine net. This would be roughly in keeping with Bowman's results, because the corresponding 50% point for a trawl with 70 mm. mesh is 15.5 cm.

Margetts (1949) carried out trials with the seiner ARABIS, against which he fished the SIR LANCELOT and the PLATESSA, all three using meshes not very far from the 100 mm. His two trawlers used respectively 97 mm. and 100 mm. cod-ends while the seiner used both a 97 mm. and 105 mm. cod-end. The trawler's medians for plaice were both 3 cm. below the seiner's 97 mm. median, but were only 1-2 cm. below the seiner's 105 mm. median; the seiner's median dropped by just over 1 cm. with the change in mesh from 97 to 105 mm. while the trawlers' medians with unchanged meshes remained approximately the same. For dabs the difference in medians was greater, at about 3 cm., increasing to 4 cm. with the increase in seiner's mesh size.

Margetts also reported fishing the seiner PRIMUIA against the PLATESSA. The mesh of the PRIMUIA's plaice seine was 99mm. on the average, while that in the PLATESSA's trawl was 79 mm. The few hauls in this experiment renders the data suspect, but despite the seiner's considerably larger mesh the median of its plaice catch was found to be 2 cm. below the trawler's. For dabs the seiner's median was nearly 3 cm. higher than the trawler's.

Margetts also reported the medians for haddock in the same trial with the seiner using an intermediate seine with 67 mm. codend meshes and the trawler using 82 mm. codend meshes. That of the trawler's was 0.6 cm. higher than that of the PRIMUIA, suggesting that in so far as one can say anything from a single trial, the 15 mm. difference of cod-end mesh between the two gears was just more than enough to compensate for the different selective actions of the gears.

Of the work reviewed, Bowman's and Margetts' gives usable data. These are set out in Table I, of which columns C and E may be compared. It is seen in the first four lines, that when the meshes of the two gears did not differ very much, the trawler always caught a smaller run of plaice and dabs. The larger meshed trawlers' haddock were only slightly bigger than the seiner's.

The data appear to provide evidence for a firm conclusion that there is an overall difference in the selective effect of the two gears, with the seine liberating relatively larger fish than does the trawl.

A second conclusion is that, measured by medians, this difference amounts to 1 to 2 cm. in length of plaice. In a trawl, a change greater than the minimum one of 7 mm. in the codend mesh would be required to shift the median of the plaice catch 1.5 cm. Considering that it is impracticable to be very precise in this matter, there seems to be a reasonably well-established difference between the selective action of the two gears amounting to about 10 mm. in the mesh.

The results on dabs and haddock are too ~~meagre~~ meagre for numerical estimates to be made of the differences in the selective effect on these two species, but considered along with the results on plaice, there seems no doubt that there are selective effects in these species also, in the same direction as that in plaice, but of magnitude as yet unknown.

#### Literature

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|--------------------------|-----------------------------|
| Bowman (1928)            | Rapp. et Proc. Verb. LII.   |
| Buchanan-Wollaston, H.J. | Cons. Int. Journ. II, 1927. |
| Clark (1934)             | Rapp. et Proc. Verb. XC.    |
| Jensen (1949)            | Rapp. et Proc. Verb. CXXV.  |
| Margetts (1949)          | Rapp. et Proc. Verb. CXXV.  |

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August, 1953.

TABLE I

Fish	Source	No. of Hauls compared		A	B	C	D	E	F
		Trawl	Seine	Trawl Mesh (mm.)	Seine Mesh (mm.)	A - B (mm.)	Trawl Median (cm.)	Seine Median (cm.)	D - E (cm.)
Plaice	Bowman, 1923	?	?	86	80	+6	22.1	23.4	-1.3
Plaice	Bowman, 1924	?	?	80	80	0	23.1	24.2	-1.1
Plaice	Margetts, PLATESSA - PRIMULA	3	4	79	99	-20	30.5	28.5	+2.0
Plaice	Margetts, PLATESSA - ARABIS	7	6	97	97	0	31.2	34.5	-3.3
Plaice	Margetts, PLATESSA - ARABIS	13	14	97	105	-8	30.9	33.1	-2.2
Plaice	Margetts, SIR LANCELOT - ARABIS	7	6	100	97	+3	31.3	34.5	-3.2
Plaice	Margetts, SIR LANCELOT - ARABIS	13	14	100	105	-5	31.9	33.1	-1.2
Dab	Margetts, PLATESSA - PRIMULA	3	2	79	99	-20	19.3	22.2	-2.9
Dab	Margetts, PLATESSA - ARABIS	7	6	97	97	0	22.7	25.5	-2.8
Dab	Margetts, PLATESSA - ARABIS	13	14	97	105	-8	22.7	26.7	-4.0
Dab	Margetts, SIR LANCELOT - ARABIS	3	6	100	97	+3	22.6	25.5	-2.9
Haddock	Bowman, 1921	?	?	?	?	?	26.6	35.8	-9.2
Haddock	Margetts, PLATESSA - PRIMULA	3	4	82	67	+15	29.7	29.1	+0.6