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Further Investigations on the Selectivity of Beam Trawls in the German Shrimp Fishery

by

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Introduction

At the last Council Meeting a paper on mesh selection experiments with shrimp trawls has been submitted to the Comparative Fishing Committee dealing with investigations carried out off the North Frisian Coast by the Institut für Netzforschung, Hamburg, during the late autumn 1961 (BOHL, H. and R. KOURA, 1962). These experiments were continued in the same season of the following year. While in 1961 only the cod-end mesh selection had been considered, it was tried, in 1962, also to clarify the question whether the anterior parts of the net bag are important for the selection process.

In the case of bottom trawls used for catching fish, which are usually large-meshed and towed with a relatively high speed, an escapement of the animals caught takes place generally through the meshes of the cod-end ("cod-end mesh selection"). In the case of small-meshed trawls, however, on principle the towing speed has to be low due to the high towing resistance. Therefore, conditions for escapement may be different. The German shrimp trawls having mesh bars *) of 11 mm in their most anterior parts and 8 mm in their cod-ends are normally towed with an average speed of 1.5 - 2.0 knots. In this case the possibilities for escaping before reaching the cod-end may be increased ("net mesh selection").

The investigations conducted in 1961 have shown that an 11 mm cod-end takes more large edible shrimps than the 8 mm cod-end used in the commercial fishery. In order to follow a standard principle of trawl construction, it is necessary that the mesh bars increase gradually from the cod-end to the net mouth. But the use of mesh sizes larger than 11 mm may reduce the efficiency of the beam trawl. Therefore,

*) The mesh bar is defined as the distance between the middle of a knot to the middle of the next knot.

investigations had to be done in this field.

Method and gear

The experiments were made between November 8th and 14th, 1962, with a commercial shrimp cutter (total length 12.9 m, diesel engine 75 h.p.) in the coastal area of Büsum. The method of investigation was the same as described by BOHL and KOURA (1962). Again parallel hauls with a single boat were made, which was possible, because the craft towed two beam trawls simultaneously. During the first trials, in 1961, both trawls were identical except for the cod-ends. In 1962, however, owing to the different aims of these experiments, the cod-ends used on either side were mostly identical, but the other parts of the trawls differed in their mesh sizes. The hauls were done with three different trawl combinations as per diagrams in Fig. 1. In each combination the starboard trawl the cod-end excepted was of the type normally used by the German shrimp fishermen. On the port side a larger-meshed trawl was towed.

During the experiments 19 hauls were made altogether. Each of the 38 single catches was separated by means of a riddling machine into edible shrimps (at least 50 mm in length), small shrimps (less than 50 mm in length) and by-catch (fishes, other crustaceans). The weights of these three catch components were determined by means of a decimal balance with an accuracy of $\pm$ 100 g *).

Results

The effect of the different mesh sizes on the efficiency of the shrimp trawl becomes obvious by comparing the weights of the three catch components obtained on starboard and port side (Table 1).

In the case of the trawl combination I it was found that the starboard catches only contained some more amounts of edible shrimps and by-catches, but considerably more small shrimps than the port side catches. Since on starboard a trawl with meshes of 11.4, 9.6, 8.4 mm, with a 7.0 mm cod-end, on the port side, however, a trawl with meshes of 15.0, 12.6 mm, with a 10.6 mm cod-end was towed, the differences of the weights caught are due to the "net mesh selection" as well as to the "cod-end mesh selection".

In the trawl combination II the 7.0 mm cod-end has been substituted by a 10.4 cod-end. Because in this combination the cod-ends are practically identical, the differences in the catch-weights must be

*) The length compositions of the catches, which are based on 30,413 shrimp measurements, are published elsewhere (BOHL, 1963).

caused only by the "net mesh selection". The small-meshed starboard trawl again caught larger quantities of each catch component. From this result it must be concluded that the large-sized anterior meshes of the port side trawl (15.0 and 12.6 mm) are responsible for the lower efficiency of this trawl.

Further conclusions can be drawn from a comparison between the weight compositions obtained from the trawl combinations I and II. Since the port side gear was identical in both combinations, the average weights of each catch component of this trawl, can be taken as a unit (= 100) and those of the starboard trawl expressed in percentages (Table 2). It can be seen that the starboard gear of the combination II (10.4 mm cod-end) caught more edible shrimps than that of the combination I (7.0 mm cod-end). This confirms the result found during the first investigations (BOHL and KOURA, 1962), that with relatively large-meshed cod-ends used in the commercial fishery the yield of edible shrimps can be increased. In order to catch small shrimps, however, the starboard trawl of the combination II is less suitable than that of the combination I. The average proportions of the catch-weights confirm that an increase of the landings of edible shrimps achieved by a mesh regulation is combined with a decrease in the small shrimp yield.

In order to diminish the catch losses resulting from the large meshes of the port side trawl the posterior 155 meshes of the 12.6 mm net section were substituted by 190 meshes of a 10.6 mm webbing. In this manner the combination III was developed. In this combination, too, the starboard trawl was more efficient. As shown in Table 2, however, the differences between the compared catch-weights were smaller than those of the combination II. (This time the average catch-weights of the starboard trawl must be taken as a unit and those of the port side trawl expressed in percentages, because the starboard trawls of both combinations were identical.)

Discussion

The results prove that the efficiency of the shrimp trawls depends on a composition of appropriate sizes of the cod-end meshes and of the meshes of the anterior net parts. If a maximum yield of edible shrimps is desired, it is most important to use 10-11 mm cod-ends. The optimum mesh sizes for the other parts of the trawl could not yet be determined exactly. But it is quite clear that the meshes must not be too large,

in order to avoid catch losses caused by the "net mesh selection". According to the data found during the experiments even the port side trawl of the combination III (15.0, 12.6, 10.6 mm, cod-end 10.6mm) has a bit too large meshes in its anterior parts. Yet it must be considered, that a trawl with large meshes can be towed with a higher speed because of its lower towing resistance than a small-meshed trawl. This advantage of large-sized meshes is masked to a high degree by the technique employed. Therefore, in evaluating the results it must be taken in consideration that during the experiments the large-meshed trawls could not be towed with their adequate speed; they were always combined with small-meshed trawls, which slackened the towing speed. That means that the large-meshed beam trawls would no doubt catch more shrimps under commercial conditions than during these experiments.

Conclusions and recommendations

The purpose of the trials carried out in 1961 and 1962 was to result in concrete recommendations to the German shrimp fishermen with the view to improve their gear. The experience gathered during these investigations lead to the conclusion that a trawl of the following construction would be most suitable for the commercial fishery:

Part of the trawl	Mesh bar (mm)	Number of meshes(depth)
Anterior	14	ca. 125
Medium	12	ca. 145
Posterior	10-11	ca. 155- 175
Cod-end	10-11	

The whole trawl can be made of Nylon or "Perlon" Td 210x15. But it is more profitable, though more expensive, to use stronger net twines (Td 210x18) for the anterior and medium net sections.

The trawl recommended has the following advantages:

1) Compared with the trawl commonly used a larger quantity of edible shrimps is caught. The increase of the yield is neither combined with more expenditure of work nor with additional costs.

2) The catches of the gear used at present contain generally much more cheap small shrimps than edible ones. During hauling big catches it is inevitable that a good deal of the expensive edible shrimps becomes pressed and crushed. That means, of course, a considerable depreciation of the landings. By means of the large-sized meshes the share of the small shrimps is reduced and, there-

fore, the quality of the edible shrimps is improved.

3) As derived from the investigations made in 1961, the 10-11 mm cod-end mesh has a protective effect on the shrimp stock. Contrary to the small meshes rigorously fishing the recommended mesh size allows an immense number of juvenile specimens to escape. ~~A long-standing protection should result in a remarkably increased density of the edible shrimp stock.~~ However, it cannot be said now if a long-standing protection will result in a remarkably increased density of the edible shrimp stock.

References

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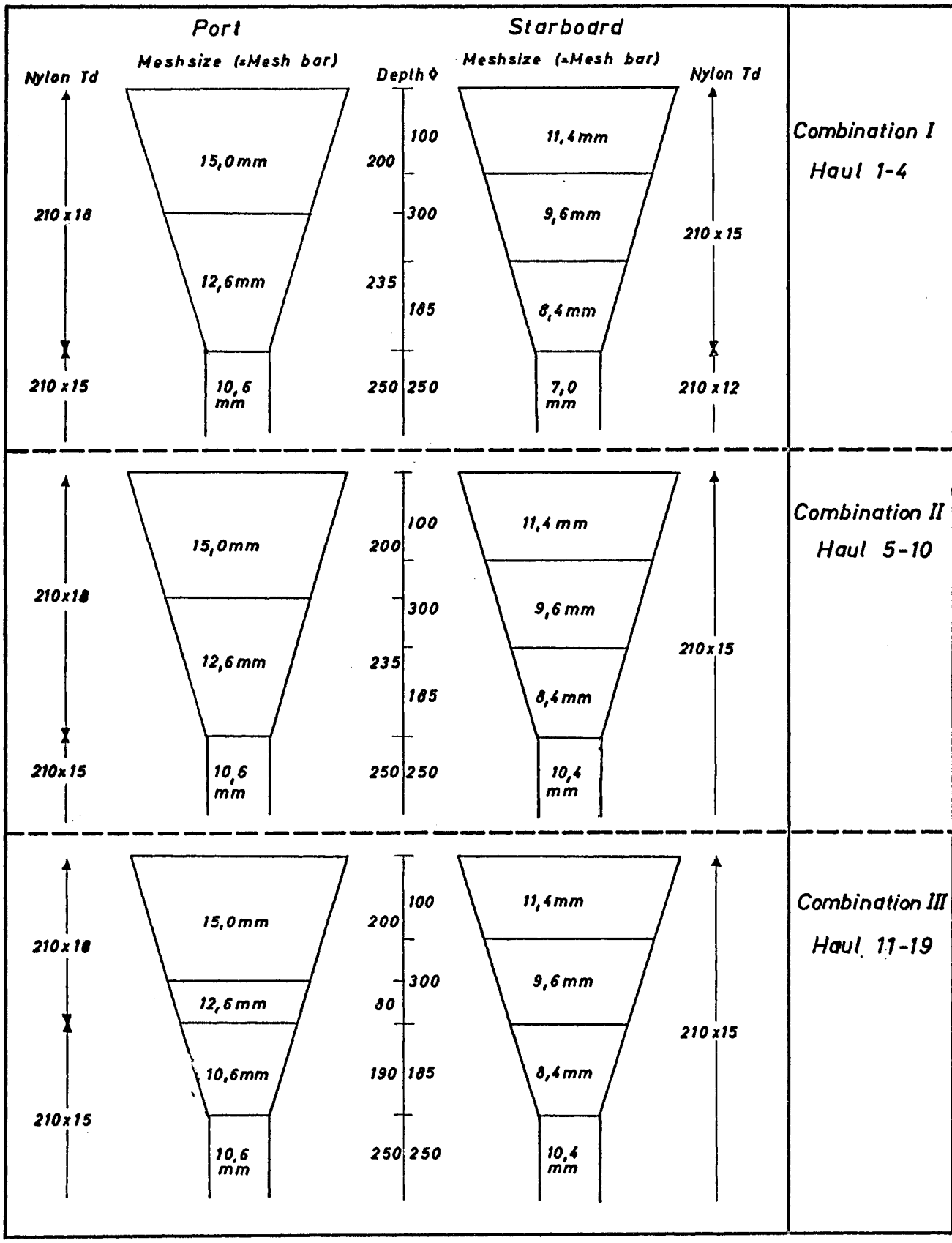

Fig. 1: The three trawl combinations used

Table 1

Catch weights in kg

Trawl combination	Haul	Edible shrimps		Small shrimps		By-catch	
		Port	Starb.	Port	Starb.	Port	Starb.
I	1	8.2	10.3	14.8	33.6	6.4	7.2
	2	6.8	8.5	13.9	30.3	7.3	9.4
	3	12.4	12.8	19.1	36.5	6.2	6.8
	4	12.2	13.8	14.6	44.5	9.6	11.8
	Total	39.6	45.4	62.4	144.9	29.5	35.2
	Average	9.9	11.4	15.6	36.2	7.4	8.8
II	5	37.7	43.5	46.5	85.8	10.5	15.2
	6	32.4	38.0	27.1	39.4	8.1	9.8
	7	9.0	15.1	17.1	37.0	7.8	13.1
	8	11.0	12.6	20.3	35.1	5.5	7.0
	9	2.8	7.2	11.1	20.9	5.1	6.9
	10	6.2	7.6	11.2	22.9	9.2	10.7
	Total	99.1	124.0	133.3	241.1	46.2	62.7
	Average	16.5	20.7	22.2	40.2	7.7	10.5
III	11	8.8	10.4	13.3	27.0	7.7	10.4
	12	6.2	8.1	17.3	26.1	11.7	12.0
	13	20.9	23.7	23.0	32.2	5.0	6.3
	14	18.5	19.2	35.6	37.1	6.7	8.8
	15	21.9	23.1	42.9	41.5	12.2	13.1
	16	12.5	14.1	13.9	16.1	1.3	1.8
	17	8.5	9.6	8.4	13.2	2.6	3.7
	18	18.4	20.9	24.5	36.6	8.0	9.6
	19	9.5	9.6	21.8	24.6	14.2	14.3
	Total	125.2	138.7	200.7	254.4	69.4	80.0
	Average	13.9	15.4	22.3	28.3	7.7	8.9

Table 2

Average proportions of the catch-weights

Trawl combination	Edible shrimps	Small shrimps	By-catch
	Port : Starb.	Port : Starb.	Port : Starb.
I	100 : 115	100 : 232	100 : 119
II	100 : 125	100 : 181	100 : 136
II	80 : 100	55 : 100	73 : 100
III	90 : 100	79 : 100	87 : 100

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CONSEIL INTERNATIONAL POUR L'EXPLORATION DE LA MER

To all Members of the Comparative Fishing Committee

RJHB/MEC/1.B. 9th September, 1963

Dear Colleague,

Report of the 1962 Icelandic Mesh Selection Experiment

You will doubtless remember that at our meeting last year we had a preliminary Report from Mr. Margetts on the Icelandic Mesh Selection Experiment carried out in the summer of 1962.

As the findings were needed for the meeting of the Permanent Commission in May of this year, it was arranged that the working group which met in December to work up the results should present their findings directly to the Liaison Committee. This they did, and the results were taken into account when the Liaison Committee reported on the effect of mesh regulations at Iceland. In point of fact the selectivity results obtained were similar to those adopted in the Northwestern Working Group Report, and no substantial revision of the assessments was required.

It now remains for the Report to be formally approved by the Comparative Fishing Committee and a decision taken on whether we should recommend it for publication by the Council. Many of you will already have seen a copy but I enclose a spare one in case you have not. The matter will be on the Agenda for our forthcoming meeting, so I hope you will have time to glance through this Report before then.

Looking forward to seeing you in Madrid.

Yours sincerely,

R. J. H. Beverton.
Chairman

Fisheries Laboratory,
Lowestoft.