INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Serial No. 800
(D. c. 8)

Document No. 7.

ANNUAL MEETING - JUNE 1961

Results of a Trip to Subarea 1 for the Study of the Selectivity of Different Cod-Ends for Redfish.

by Prof. Dr. v. Brandt

The following summarizes the results from a trip to Subarea 1 in April-May 1960 for the study of the selectivity of various cod-ends used in fishing for redfish.

Ship: "Anton Dohrn", 62 m, 850 HP

Gear: German bottom trawl usual type, 140 feet.

Date: April, 20th - May 18th, 1960

Locality: Subarea I.

Cod-end Material:	Manila No. 3	Perlon No. 6	Trevira No. 20
runnage:	165	210	205 m/kg
braiding:	double twisted	double plaited	double twisted
preparation:	no	no	no
age:	1956	1956	1960
Mesh Size: mean:	129	132	133 mm

Scotch gauge, WESTHOFF type

Experimental Method: covered cod-end, cotton Nm 20/36, 35-40 mm.
Species: Sebastes marinus

50% retention length:	31	41	37 cm
Selection Factor:	2.4	3.1	2.8
Total number of fish:	6,424	3,806	5,123
25-75% Selection Range:			
cod-end	995	1,158	1,085
cover	557	1,026	717

	Manila No. 3	Perlon No. 6	Trevira No. 20
Number of hauls:	5	7	5
Average tow duration:	1	1	1 h
Towing speed: ca.	4	4	4 knots

Method of measuring fish: Nearest cm from the mouth closed to the tip of the caudal fin.

Much more important as the summarized results may be the investigation of the individual in connection with the number of fishes retained in the cod-end.

cod-end material	Manila	Perlon	Trevira
average mesh size	129	132	133 mm
number of fish in the cod-end			
100	-	3.33	-
200	-	3.36	3.08
300	-	-	-

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(cod-end material average mesh size number of fish in the cod-end	Manila	Perlon	Trevira)
400	2.77	-	-
500	-	3.02	3.00
800	-	-	2.78
900	2.62	2.71	-
1400	2.56	-	-
2300	2.40	-	-
2500	-	-	<2.2

For further details a copy of my paper 10 for the ICES meeting 1960 is appended.

APPENDIX

Selection of Redfish.

by A. v. Brandt

At Meeting of ,ICES,ICNAF and FAO in Lisbon, 1957, J. Clark, McCr ken, Templeman and Sætersdal reported in several papers on the selection or redfish in trawls. The investigations were made by the first-mentioned authors in the American fishing areas and by Sætersdal in Finmark and west Norway.

At the Annual Meeting of ICNAF - June 1958 - J. Clark, McCracken and Templeman summarized the afore-mentioned investigations. These were exclusively made with trawl with double Manila cod-ends, mainly using the covered cod-end method.

Three facts were specially mentioned in that summary:

(1) "The selection factor decreases with the mesh size, ranging from 2.56 at a mesh size of 140 mm to 2.30 at a mesh size of 70mm".

(2) "It is possible that, if heavier twine had also been used at sma- ler mesh sizes, the selection factor would have declined even more rapidly".

(3) "In the covered cod-end experiments the selection factor is lower with larger catches and higher with smaller catches".

At the Annual Meeting of ICNAF, 1959, a working group concluded in a review of redfish selection, amongst others, that

"future selectivity work should be carried out, when possible, under conditions of heavy abundance, where large catches may be expected" and that

"future selectivity work should include testing of synthetic cod-ends, since these have been shown to permit relatively higher selection than those of natural fibres for many species".

Moreover, the following facts are also important for the investiga tion into the selection of redfish in the cod-ends of trawlnets. With red- fish, at least 2 forms are concerned: Sebastes marinus mentella (Travin) and Sebastes marinus marinus (L.). The first mentioned species is provided with a hook which is, however, missing in larger forms. Greatest height d circumference of body, however, are also differing between the two forms the various fishing grounds (Kotthaus, 1950). This could be of influence

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on the selection.

According to the investigations on Sebastes marinus mentella made by Templeman (1957) there exists a difference in the selection of males and females. The 50 per cent-retention length of males is 2 cm above that of females.

Particularly with redfish, meshed (gilled) fish are very frequent. The occurrence of meshed fish could influence the selection. The same might also refer to the portion of other fishes caught with the same net. Mixed catches should therefore be treated separately.

German investigation on the selection of redfish off West Greenland.

In April/May, 1960, investigations on the selection of redfish in bottom-trawls were carried out with the fishery research vessel "Anton Dohrn" off West Greenland. Already in 1957, selection experiments have been made in the same area. The previous investigations, however, referred in the first line to cod and, beside redfish, all hauls included a more or less great percentage of cod.

The covered cod-end method was used. These cod-ends were made of Manila, "Perlon" and Trevira, always double-strand. (Trevira is a polyester fibre like Terylene). The mesh-measurement was made by means of the Scottish longitudinal gauge along a row of mesh in the longitudinal axis of the cod-end. The length of fish was determined up to the nearest cm. i.e. from the mouth closed, possibly also including the hook of Sebastes marinus mentella, to the tip of the caudal fin. (All the measurements of the North American data were from the chin, with the mouth closed, to the end of the medium ray of the caudal fin!)

Summarized Results on Redfish Selection

Generally speaking, the investigations on the selection with trawl-nets base on hauls of 1 hour's duration. As the quantities are often insufficient for calculating the selection factor for each haul, one remedies this by adding several hauls and calculating the 50 per cent retention length or the selection factor respectively from the result. As will be shown below, it is doubtful, whether such a summarizing is admissible.

By using this method the data for redfish off West Greenland given in Table (1) resulted from the experiments made in 1957 and 1960. No difference was made between the various forms of redfish and between males and females. The fishes occurred more or less heavily mixed and a clear distinction by forms and sexes by exterior characteristics was not possible. The separation of the larger fishes was particularly doubtful.

TABLE 1

Year	1960	1957	1957	1960	1960
Material	Manila	"Perlon"			Trevira
Cod-end No.	3	6	9	6	20
Av. mesh size mm	129	129	129	132	133
No. of hauls	5	12	11	7	5
Total no. of fishes	6424	691	681	3806	5123
No. of fish in the selection range +) cod-end	995	68	95	1158	1085
cover	557	121	165	1026	717
50% retention length	31	45	42	41	37
Selection factor	2.4	3.5	3.3	3.1	2.8

+) number of fish between about 25 and 75 per cent retention length

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According to this table the selection factor for Manila was 2.4 at 129 mm. As mentioned above, the data compiled by Clark, McCracken-Templeman show a selection factor of 2.6 at 140 mm and, at 70 mm, a selection factor of 2.3, so that the found value ranges within the same category of size.

In 1957 and 1960, greater differences resulted from the individual experiments made with "Perlon"cod-ends with the same mesh size (sf. 3.1-3.5), which may be explained by the small number of fish in the selection range of 1957 and by the fact, that the experiments in 1957 only exceptionally dealt with pure redfish catches. But as found with other species of fish, the 50 per cent retention length and thus the selection factor for redfish, is substantially higher in cod-ends made of "Perlon" than in those made of Manila.

For Trevira the selection values for cod-ends are between Manila and "Perlon". This, too, corresponds to the expected result, as also with other species of fish the selection with cod-ends made of that polyester fibre takes an inter-mediate position.

As, however, the possibility exists that, by summarizing the results from various hauls, the results may differ, it might be desirable to analyze the individual hauls, as far as this can be done.

Catch Size and Selection

For redfish, Clark, McCracken and Templeman (1958) had found, that in the covered cod-end experiments the selection factors are lower with large catches and vice versa.

This is also known from other species of fish. For haddock data were presented (by Clark, 1957), and McCracken, 1957) which indicated that cod-end escapement was reduced with large hauls (Parrish and Beverton, 1957). For herring Lishev (1957) stated, if big catches are taken the selectivity effect is considerably lowered. Finally, the Mesh Selection Working Group of 1959 stated for cod, basing on the common investigations in the Barents Sea, that most of the lower selection factors were obtained in hauls with high catches.

The individual hauls obtained off Greenland in 1960 were then investigated, as far as possible, with reference to the relation of the caught quantity and the 50 per cent retention length and/or the selection factor. Owing to the small number of fish, an analysis of each haul was not possib. in 1957.

These were hauls of 1 hour each. The number of fishes retained in tl cod-end were taken as a basis. The number was always rounded off to hundred. The results can be seen from Table 2.

Table 2

Material	Manila	"Perlon"	Trevira
Cod-end No.	3	6	20
Mesh size	129	132	133
100	-	3.33	-
200	-	3.36	3.08
300		-	-
400	2.77	-	
500	-	3.02	3.00
800	-	-	2.78
900	2.62	2.71	-
1400	2.56	-	-
2300	2.40	-	-
2500	-	-	<2.2

Table 2 indicates an almost linear relation between the quantity caught and the selection factor. The bigger the redfish catches, the smaller the 50 per cent retention length and thus the selection factor with the same size mesh.

In the case under discussion 1 basket contained 36 redfishes on the average (between 23 and 56!) Considering that redfish is a bulkfish and that 100 baskets and more are not seldom, it becomes quite clear, that at the tested mesh-sizes and, even less, at the usual meshes of 110 mm a selection is no longer to be expected. Even with a haul of 2500 fishes, in that case 70 baskets, practically no selection took place. A conservation of redfish stocks by the regulation of meshes is not possible.

As mentioned at the beginning, hauls of 1 hour each were compared. It must be said, that in a single haul with the "Perlon" cod-end, which had to be interrupted after 35 minutes because the net got hooked, the selection factor was lower than it was to be expected according to Table 2 :

Number of fishes in the cod-end: 253, selection factor 2.73. It is supposed, that the shorter towing period reduced the 50% retention length. That would mean that, even with equal quantity caught, the selection factor is variable, depending on how much time is available for the selection. Clark (1957) had pointed out, that the effect of the towing period is greater with large meshes than with small ones.

Redfish Meshing Problem.

In redfish catches numerous fishes get ensnarled in the meshes. This refers to the cod-end as well as to the wing. As already stated by Templeman, when fishing is carried out over starboard, more gilled fishes occur in the outer wing of the net (from the forward gallow) than in the inner wing. From this fact may be concluded, that the fishes before the net evade from the vessel.

In the cod-end, gilled fishes only occur in the rear part. Depending on the caught quantity, gilled fishes are either in the last third, in the rear half or, with larger catches, even more forward. As already found by Clark (1957), this indicates that most of the fish escape through the end of the cod-end.

For catches under discussion the number of gilled fish can be seen from Table (3). This table also gives the number of fishes in the cod-end and cover. Moreover, the percentage of the gilled fishes has been computed. Only hauls of 1 hour duration have been used for this comparison.

TABLE 3

Cod-end	mm	haul	cod-end	cover	gilled fish	% cod-end	% cover
Manila	129	5	1157	495	22	0.9	4.4
		9	1349	361	21	1.5	5.8
		7	867	404	44	5.0	10.8
		6	444	223	26	5.6	11.6
"Perlon"	132	13	860	389	84	9.8	22.1
		20	510	280	85	16.6	30.3
		10	253	183	38	15.0	21.9
		16	105	361	51	48.5	14.1
		14	83	226	17	20.4	7.5
		21	53	131	29	54.7	22.1
		19	52	284	25	48.0	8.8
Trevira	133	38	2460	347	52	2.1	14.9
		40	791	326	82	10.3	25.1
		36	113	100	45	38.8	45.0

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The table does not indicate a uniform relation between the caught quantity and the number of gilled fishes. This is mainly due to the fact, that the contents of the individual hauls were not uniformly composed. When catches of approximately equal composition are compared (for instance cod-end/cover - 2/1), the number of gilled fishes will increase with the increasing number of fishes in the cover.

At an about equal size of mesh, however, the number of gilled fishes is substantially smaller with Manila than with "Perlon" and Trevira. If it is already to be feared that too many gilled fishes occur with Manila, the danger is even greater in cod-ends made of the investigated synthetic fibres. Probably, this is also related to the fact, that cod-ends made of these synthetic fibres, even with equal size of mesh, practically have larger meshes during fishing than the Manila meshes theoretically of the same size. In a cod-end made of knotless "Perlon" at a mesh size of 101 mm only and tested at the same time, no gilled fishes occurred.

The mean size of the gilled fishes is indicated by the following Table 4.

TABLE 4

Material	Mesh size	Length mm	Circumf. mm.
Manila	129	430	308
Trevira	133	440	309
Perlon	132	442	313

Templeman (1957) found, that the highest percentage of meshed fish is at the same redfish size asthe 95-100% retention point; in the case in question the mean value corresponds to the 75-90% retention length. It is thus confirmed, that the greatest percentage meshed is not at the 50% selection point, but close or nearer to the 100% retention point.

Considering the number of meshed fishes in relation to the catch in the cod-end, it can be seen that the portion of meshed fishes is less than 10 per cent already with quantities of over 20 baskets, quite apart from the fact, that during the experiments under discussion the fishes have not been shaken from the net, so that the real number of meshed fishes would be less by 1/4. It also appears, that with bigger catches the share of meshed fishes declines, owing to the necessity to divide the catch (with side-trawlers).

Thus it follows, although meshed fishes may be expected at a mesh size of 130 mm, they will not be so numerous to make operations too difficult, that this mesh size, suggested for Arctic waters, may prove unsuitable.

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