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Preliminary results of German mesh selection experiments on cod and redfish off Iceland and Newfoundland

by

Hansjürgen Bohl*)

1. Introduction

During the 30th cruise of FRV "Walther Herwig" (July 17th - September 1st, 1969) rather extensive trawl mesh selection experiments were carried out off the north, west and southwest coasts of Iceland as well as off the east and south coasts of Newfoundland. Although the final results of these experiments are not yet available, it was thought worth-while to give a brief account of th provisional findings without delay. A final version of this paper - including relevant details such as length frequency distributions of cod and redfish catches, selection curves and plots of girth against length - will be submitted to the 1970 Annual Meeting of ICNAF.

2. Material and methods

FRV "Walther Herwig" - a diesel-electric stern trawler of 83.23 m total length, 1,987 gross tons, capable of developing 2,000 h.p.e. at 190 r.p.m. - employed the German standard roundfish bottom trawl (140 ft. groundrope). During the course of the experiments four double-braided cod-ends were used; one of them was made of polyethylene monofilament and the other three were made of polyamide multifilament. Some information about the physical properties of the cod-end netting yarns is given in Table 1.

Table 1: Properties of the cod-end netting yarns

Cod-end material	Polyamide multifilament	Polyamide multifilament	Polyamide multifilament	Polyethylene monofilament
Rtex (g/1000 m)	6,484	18,000	5,000	6,516
Runnage (m/kg)	154	56	200	153
Yarn construction	Twisted	Plaited	Twisted	Plaited
Wet knot breaking load(kp)	299	777	103	120
Diameter (mm)	2.9	7.0	2.8	4.5
Elongation at half the wet knot breaking load(%)	23.8	22		

The polyamide cod-end R6,484tex is made from that netting yarn which - according to a recommendation of the Joint ICES/ICNAF Working Group on Selectivity Analysis - should be introduced as a new standard for selectivity purposes. Although the report of the above-mentioned Working Group (comp. ICES, C.M.1969/B: 13) still needs the approval of the relevant committees of ICES and ICNAF, the Institut für Fangtechnik ordered this netting yarn as early as in the month of May. Thus, it was possible to collect the first selectivity data for the propose new standard material already during this summer.

The polyamide cod-end R18,000tex is also a new purchase of the Institut für Fangtechnik. This type of an extremely robust cod-end which belongs to the

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standard equipment of most of the large German stern trawlers for the last three or four months, was chosen for the experiments because little is known about the selectivity of extra strong netting yarns.

The remaining two cod-ends have already been used several times on former cruises of German research vessels.

The selectivity was investigated by the covered cod-end technique. The topside covers were in accordance with ICES specifications. They were made of single braided polyamide netting (23tex x16x3, twisted) with a mesh opening of about 60 mm. The inner underside of the cod-ends was always lined with small-meshed netting similar to that of the cover.

The length composition of the catches was ascertained by measuring the total length of fish to the centimetre below. The mesh measurements were taken immediately after each haul using an ICES gauge with an operating pressure of 4 kg.

Whenever redfish were meshed in the cod-end, these fish were measured separately. However, when calculating the selectivity data, the meshed specimens were treated as part of the cod-end catch.

To study the girth/length relationships of cod and redfish, the unconstricted maximum body girth was measured to the nearest millimetre.

3. Selectivity results for cod

Selection experiments on cod were carried out on the southern Horn Bank (North Iceland, ICES Div. Va), on the eastern edge of the Grand Bank of Newfoundland (ICNAF Div. 3L) and on the St.Pierre Bank (ICNAF Div. 3Ps). The results obtained are shown in Table 2.

Comparisons between the selectivity of the polyamide cod-ends R6,484tex (standard) and R18,000tex (extra strong) were made in ICES Div. Va as well as in ICNAF Div. 3L. In the latter division the selection factor for the cod-end R18,000tex was found to be 4.1 per cent lower than that for the cod-end R6,484tex, whilst in the former division the corresponding difference was only 1.5 per cent.

From Table 2 it can be seen that the selection factors abtained from the Horn Bank were lower than those obtained from the Grand Bank. This would lead to the assumption that the fish off Iceland have been thicker than those off Newfoundland. However, the reverse is true: The relationships between maximum body girth (G) and total length (L) (which were derived from fish caught with the cod-end R18,000tex) are described by the regression equations

$G = 0.521L - 0.87$ cm for the Horn Bank cod (634 measurements), and
$G = 0.555L - 2.89$ cm for the Grand Bank cod (757 measurements).

This implies that, at the 50% retention lengths (41-43 cm), the Horn Bank cod was thinner than the Grand Bank cod by 5.3 per cent.

In this connection it may be mentioned that the cod girth measurements taken hitherto off N. & NW.Iceland yielded rather similar results, viz.

$G = 0.511L - 1.5$ cm; "A.T.Cameron"; N.Iceland; VII 1962; (ICES, 1965)
$G = 0.564L - 2.0$ cm; "Maria Julia"; N.& NW.Iceland;VII 1962; (ICES,1965)
$G = 0.515L - 1.46$ cm; "Anton Dohrn"; NW.Iceland; VI 1964; (Bohl, 1967)
$G = 0.521L - 0.87$ cm; "Walther Herwig"; N.Iceland; VII 1969; (this paper).

The unweighted averages of all the covered cod-end selection factors reported previously for N. & NW. Iceland are as follows (experiments with topside chafers not included): Double manila = 3.21 (ICES, 1964 and 1965), d.polypropylene multifilament = 3.48 (Bohl, 1967) and d.polyamide multifilament = 3.55 (ICES, 1965). From 1962 to 1969 no selectivity data for cod in ICNAF Div. 3L have been submitted, but in this period some selection factors for other divisions were reported. The unweighted averages of these factors are for d.manila

Table 2: Compilation of cod selection data for grouped hauls

Working area	S.Horn Bank (N.Iceland)		Grand Bank of Newfoundland		St.Pierre Bank
Division	ICES Div. Va		ICNAF Div. 3L		ICNAF Div. 3Ps
Position	66°43'N;21°17'W		47°25'N; 47°21'W		45°35'N;55°39'W
Cod-end	PA R6,484tex	PA R18,000tex	PA R6,484tex	PA R18,000tex	PE R6,516 tex
Date 1969	28.-29.7.	29.-31.7.	14.-16.8.	13.-14.8.	22.8.
Number of hauls	3	6	6	7	3
Av.duration of haul (minutes)	70	90	111	120	87
Av.towing speed through water (kn)	4.8	4.4	4.9	4.4	4.2
Depth range (m)	110-130	110-180	260-320	295-350	50-60
25-75% selection range (cm)	13.1	10.6	12.6	8.1	6.0
No.of cod in selection range					
cod-end	5,456	3,448	448	1,434	1,170
cover	4,847	2,675	834	1,596	1,094
Total no. of cod					
cod-end	7,678	6,729	1,582	3,433	2,794
cover	5,999	3,406	3,241	3,230	2,862
Av.quantity of cod (baskets[1])					
cod-end	42 1/4	16 3/4	6 1/2	8 3/4	8 1/2
cover	22	5 3/4	4 1/2	4	4 1/4
Av.quantity of by-catch (baskets)					
cod-end	6 1/2[2]	3 1/2[2]	7 3/4[3]	6 [3]	10 2/3[4]
cover	1	1/2[2]	8 3/4[3]	4 [3]	2 3/4[4]
Range of total catch/tow (baskets)					
cod-end	24 1/3-82	7 1/4-43 1/2	7 1/2-31 1/4	7 2/3-24 1/2	15 1/4-23
cover	8 2/3-38	2 3/4-12	3 1/3-26 1/4	4 1/2-14	2 1/4-11
Cod-end mesh size, mean (mm)	136.3	126.5	134.1	124.2	114.3
Range (mm)	129-149	112-140	128-147	112-135	104-128
No.of measurements	135 (=3x45)	270 (=6x45)	270 (=6x45)	315 (=7x45)	174 (=3x58)
50% retention length (mm)	449	410	485	430	369
Selection factor	3.29	3.24	3.62	3.47	3.23

[1]) The average net weight of one basket filled with cod was 68.5 kg.

[2]) Mainly Melanogrammus aeglefinus, redfish (type marinus), Pollachius virens and small quantities of Anarhichas lupus, A.minor, A.denticulatus, Brosme brosme, Molva molva, Pleuronectes platessa, Microstomus kitt, Hippoglossoides platessoides, Hippoglossus hippoglossus, skates and rays and Clupea harengus.

[3]) Mainly redfish (type marinus), Macrouridae, skates and rays and small quantities of Glyptocephalus cynoglossus, Hippoglossoides platessoides, Hippoglossus hippoglossus, Reinhardtius hippoglossoides, A.lupus, A.minor, Lycodes spec. and Melanogrammus aeglefinus.

[4]) Mainly holothurians, Limanda ferruginea, skates and rays, Hippoglossoides platessoides, Glyptocephalus cynoglossus and sporadically M. aeglefinus, Urophycis spec., Merluccius bilinearis, Scomber scombrus, Lophius americanus and scallops.

in ICNAF Div. 2J: 3.64, for d. polyamide multifilament in ICNAF Div. 3M: 3.97 and for the same material in ICNAF Div. 3M - 4W: 3.66 (ICNAF, 1967). In the light of this evidence the selection factors found for polyamide at Iceland and Newfoundland during this summer appear to be unusually low.

Finally, it has to be mentioned that on the St.Pierre Bank (ICNAF Div. 3Ps), where very small cod (most abundant length 38.5 cm) were caught in 1969, only the relatively small-meshed polyethylene cod-end R6,516tex could be used. So it was not possible to establish directly a mesh differential for this net material. However, compared to the selection factor found for the polyamide cod-end R6,484tex (standard) in ICNAF Div. 3L, the corresponding factor for the polyethylene cod-end was lower by 10.8 per cent. This finding is in agreement with the mesh differential prescribed at present for polyethylene in the ICNAF area and in the Arctic regions of NEAFC.

4. Selectivity results for redfish (type marinus)

Selection experiments on redfish were carried out off NW. & SW. Iceland (ICES Div. Va) and on the eastern edge of the Grand Bank of Newfoundland (ICNAF Div. 3L). The results obtained are shown in Table 3.

During the course of the redfish experiments only polyamide cod-ends were used. The catches were relatively small and heterogeneously composed. Redfish were not always predominant; especially on the Grand Bank the bulk of the catches frequently consisted of species other than redfish.

The selectivity of the cod-end R18,000tex was compared (a) with that of the cod-end R5,000tex at SW-Iceland and (b) with that of the cod-end R6,484tex on the Grand Bank. In the first case the selection factor for the extra strong cod-end was found to be 8.9 per cent lower than that for the cod-end R5,000tex, whilst in the second case the factor for the extra strong cod-end was found to be 6.6 per cent higher than that for the cod-end R6,484tex. These results make it impossible to elucidate the effect of the netting yarn properties on the selectivity. If there should have been such an effect, then it was probably masked by the influence, which the catch size is known to excert on the selection of redfish: Table 3 shows that, in both working areas, the cod-end with the smaller average redfish catch gave the higher selection factor and vice versa.

In this context, attention should be drawn to the fact that, independently of the cod-end used and the area fished, very similar selection factors were calculated for average catches of the same size range, viz. 2.84, 2.88 and 2.88 for average redfish cod-end catches ranging from 8 1/2 to 11 1/3 baskets (= 456 - 606 kg), and 3.07 and 3.16 for average catches of 2 1/4 baskets (= 121 kg) and 5 1/2 baskets (= 295 kg), respectively.

No attempt was made to draw a parallel between the redfish data reported previously and those reported in this paper. The reason for this is that only those selection factors would be directly comparable which are derived from catches of equal size.

Girth measurements were made on redfish caught with the cod-end R5,000tex off SW.Iceland as well as on redfish caught with the cod-end R6,484tex on the Grand Bank. The relationships between the maximum body girth (G) and total length (L) are described by the following regression equations:

SW.Iceland redfish : G = 0.728 L - 1.33 cm (355 measurements)
Grand Bank redfish : G = 0.810 L - 2.07 cm (267 measurements).

These equations imply that, at the 50% retention lengths (39-43 cm), the SW.Iceland redfish were thinner than the Grand Bank redfish by 8.3-8.5 per cent. This difference in girth corresponds to the difference in the selectivity of the two cod-ends used. However, it must be left undecided whether the discrepancy between the selection factors obtained is attributable either to differences in girth or to differences in catch size or to both.

Table 3: Compilation of redfish (type marinus) selection data for grouped hauls

Working area Division Position	NW.Iceland ICES Div. Va 65°23'N;26°54'W	SW.Iceland ICES Div. Va 63°22'N;24°39'W		Grand Bank of Newfoundland ICNAF Div. 3L 47°25'N;47°21'W	
Cod-end	PA R18,000tex	PA R18,000tex	PA R5,000tex	PA R18,000tex	PA R6,484tex
Date 1969	31.7.	6.8.	7.8.	13.-14.8.	15.-16.8.
Number of hauls	3	4	5	5	4
Av.duration of haul (minutes)	60	120	132	120	113
Av.towing speed through water (kn)	4.7	4.6	4.6	4.5	4.9
Depth range (m)	220-250	250-270	260-295	300-350	290-320
25-75% selection range (cm)	9.7	?	9.8	5.5	6.8
No.of redfish in selection range					
cod-end	262	?	214	280	1,039
cover	311	?	382	419	1,346
Total no. of redfish					
cod-end	1,217	1,807	925	764	2,250
cover	800	1,999	1,867	2,564	6,620
Av.quantity of redfish (baskets[1])					
cod-end	10	11 1/3	5 1/2	2 1/4	8 1/2
cover	2 1/3	2 1/2	2 3/4	4 1/2	14 1/3
Av.quantity of by-catch (baskets)					
cod-end	5 [2]	4 [3]	3 1/2[3]	13 3/4[4]	8 1/2[4]
cover	3 [2]	1 1/4[3]	4 3/4[3]	4 3/4[4]	2 1/4[4]
Range of total catch/tow (baskets)					
cod-end	5 1/4-22 1/2	12 2/3-17 3/4	5 3/4-11 1/4	7 2/3-24 1/2	7 - 31 1/4
cover	2 3/4- 9 1/4	2 1/4- 6	5 1/2-10	3 3/4-14	5 1/4-26 1/4
Cod-end mesh size; mean (mm)	126.6	125.0	142.1	124.1	133.8
Range (mm)	114-140	113-136	134-151	112-135	128-147
No.of measurements	135 (=3x45)	180 (=4x45)	190 (=5x38)	225 (=5x45)	180 (=4x45)
50% retention length (mm)	360	360	449	381	387
Selection factor	2.84	2.88	3.16	3.07	2.88

[1]) The average net weight of one basket filled with redfish was 55.6 kg.

[2]) Mainly Argentina spec. and sponges, but also Molva molva, M.byrkelange, Pollachius virens, Brosme brosme, Gadus morhua, Anarhichas minor and some flatfish.

[3]) Mainly Argentina spec. and Pollachius virens, small quantities of Molva molva, Brosme brosme, Anarhichas lupus, Micromesistius poutassou, Gadus morhua, Chimaera monstrosa and very few flatfish.

[4]) Mainly Gadus morhua; for the other by-catch see foot-note [3]) of Table 2.

Although the data collected for redfish meshed in the cod-ends are not yet analysed, it can already be pointed out that the number of meshed fish increased with increasing mesh size. The meshed proportions of the total numbers of redfish held by the cod-end R18,000tex (mesh size 125 mm) were 2.3% at NW.Iceland, 4.1% at SW.Iceland and 7.1% on the Grand Bank. The corresponding proportions for the cod-ends R6,484tex (mesh size 134 mm; used on the Grand Bank) and R5,000tex (mesh size 142 mm; used at SW.Iceland) were 10.0 and 13.7% respectively. Appreciable meshing (i.e. more than 4% meshed at any centimetre length) was confined to length ranges extending over 4-12 cm (R18,000tex), 14 cm (R6,484tex) and 24 cm (R5,000tex).

5. Conclusions and Summary

(i) There is no significant difference between the selectivity of the extra strong polyamide cod-end (R18,000tex) and that of "normal" polyamide cod-ends (R5,000tex and R6,484 tex). It is much to be hoped that only the extra strong cod-end will be used on German stern trawlers in the future, because this would help to obviate the need for topside chafers.

(ii) The selection factors found for N-Iceland cod were lower than those found for Grand Bank cod. This is in contradiction to the results of girth measurements.

(iii) Compared to the cod selection factors obtained previously on both sides of the Atlantic, the factors obtained this year appear to be relatively low.

(iV) A comparison between the selectivity of St.Pierre Bank cod caught with the polyethylene cod-end R6,516tex and Grand Bank cod caught with the polyamide cod-end R6,484tex shows the present mesh differential for polyethylene to be justified.

(V) The regional difference found in the maximum body girth of redfish at Iceland and Newfoundland is in agreement with the selection results obtained.

Vi) The number of redfish meshed in the cod-end increases with increasing cod-end mesh size.

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