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Preliminary Results From Selectivity of "SORT-V" Sorting Grid System on the Basis of Single Grid Regarding the Greenland Halibut (Reinhardtius hippoglossoides) in the NAFO Regulatory Area (Div. 3L)

by

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ABSTRACT

Results from selectivity of "SORT-V" sorting grid system based on a single grid regarding Greenland halibut during fishery in the NAFO regulatory area (Div.3L) are presented. Grids of 1.2m long and of 1m width with 35-40mm bar distance were experimented. For the system with 35mm bar distance the fish length corresponding to 50% retention made up 33.1-33.8cm and selectivity range - 3.6-4.2cm. For the system with 40mm bar distance these parameters were 33.8 and 12.9cm, respectively. Specimens below 30cm long escaped completely. Thus, the "SORT-V" system with 35mm grid completely provides for a fulfilment of fisheries rules in regard to halibut minimum length allowable for catch.

INTRODUCTION

Fishery on Greenland halibut on the Grand Bank continental slope (Divs.3LNO) and on the Flemish Cap Bank western slope (Div.3M) in the NAFO regulatory area has been successfully developed since early 90s. By the estimate of experts the halibut catch taken by all the countries in this area reached 50-60 thou.t in some years. Such intensive fishing requires careful regulation of fishery. At present, to provide fisheries selectivity the minimum fishing size of halibut - 30cm (Anon, 1995a) and minimum allowable trawl mesh size equal to 130cm were set. Trawl bag selectivity is also regulated by specific requirements of its construction (Anon, 1995b). At the same time, mesh selectivity is known to be dependent on most factors, i.e. it decreases with an increase of catch per time unit (Pope et al.,1975), depends on increase in trawling speed, haul duration (Cardenas et al., 1995), catch size (Shestov, 1962), as well as on using heavier netting material (Isaksen et al., 1989). To eliminate impact of these factors a sorting grid system was suggested based on a single grid which has proved itself during cod fishery in the Barents Sea.

MATERIAL AND METHODS

Experiments were carried out by the Russian fishing trawler "Ozernitsa" from 23 February to 6 March 1996. Overall length of the vessel is 62.25m, width is 3.82m and 6.25m draught. The vessel deadweight capacity is 1895 BRT with the main engine capacity being 2400 h.p.. Bottom trawl (30.8/32.1m) with 20-24m distance of trawl wings and 5.5-5m opening height at trawling speed of 3.0-3.6 knots was used in the experiments (Fig.1). The trawl was rigged with a trawl bag made of kapron (5.7 kTex X 2), mesh size was 128mm. The bag conical part length was 17.7m and cylindrical - 19.4m. Perimeter of the conical part section made up 60 meshes. Sorting grid system consisting of a single grid, the lower edge of which was connected to a small-meshed guiding panel, was mounted between these parts of the trawl bag. In front of the grid a small-meshed lifting panel - "spring-board" for guiding fish to the grid was mounted. To release fish escaped from trawl through the grid a window was made in the sorting grid system upper panel. Fig.2 presents working principle of the sorting grid system.

Grids of 1m width and of 1.2m length made of usual steel were experimented. Bar distance used during the experiment was 35 and 40mm. Weight of grid (approximately 15 kg) was compensated by 6 floats with a buoyancy of 2.4 kg, which were adjusted to the grid frame.

To estimate efficiency of separating small-size fish a special cover (42mm mesh-size) was used for recapture of fish escaped through a grid. A blinder with the same mesh-size was inserted into a trawl bag. Scheme of installation of the "SORT-V" system in a trawl and its principle construction is given in Fig.2, mounting of cover - in Fig.3 and its pattern cutting in Fig.4.

3 versions of the sorting grid system were experimented.

1st version.
35mm grid was mounted across the sorting grid system at an angle of 30-35°, a top of " spring-board" was located along 5 meshes ahead of the grid front edge and a hight was 5 meshes (Fig.5).

2nd version.
40mm grid was mounted along the sorting grid system at an angle of 30-35°, the "spring-board" position remained the same as in the 1st version.

3rd version.
35mm grid was mounted along the sorting grid system at an angle of 40-45°, a top of "spring-board" was located at a distance of 2 meshes ahead of the grid front edge and its hight was 7 meshes (Fig.6).

Catch from a trawl bag and cover was measured in each haul. Measurements were done to an accuracy of 1cm. In the cases the specimens were large only a portion of fish (600-700 spec.) were measured, the rest portion from catch was counted. Further, files of actual number of fish from all length groups were formed. Catch weight was determined by a length-weight key.

Selectivity was determined by a relationship between the number of fish from each length group in a trawl bag and cover:

$$S_i = \frac{N_{1i}}{N_{1i} + N_{2i}},$$

where:

N_{1i} - number of fish from each length group in a trawl bag;
N_{2i} - number of fish from each length group in cover;

Smoothing of selectivity curve was done by 3-point moving average method.

RESULTS

Data on hauls and pooled data on selectivity are given in Tables 1-4. Length composition of fish from catch in a trawl bag and in cover when experimenting the sorting grid system each version are presented in Figs.7-9 and Fig.10 includes selectivity curves.

Greenland halibut 28-88cm long were fished off during the experiments. Specimens 38-44cm long were preponderant in the aggregations fished. Catches varied from 0.2 to 1.7 t per trawling (in a trawl bag).

Two hauls were done by the sorting grid system with 35mm grid mounted across a trawl bag (1st version). Fish from 28 to 48cm long escaped from this system. Specimens below 30cm long escaped comletely. Fish length corresponding to 50% retention made up 33cm and selectivity range (interval between fish length corresponding to 25% and 75% retention) was 3.6cm.

Halibut 28-58cm long escaped from the sorthing grid system with 40mm grid (2nd version). Specimens below 30cm long escaped completely. Fish length corresponding to 50% retention constituted 33.8cm and selectivity range was 12.9cm.

Halibut 28-52cm long escaped from the sorting grid system with 35mm grid (3rd version). Specimens below 30cm long escaped comletely. Fish length corresponding to 50% retention made up 33.8cm and selectivity range was 4.2cm.

DISCUSSION

Selectivity of trawl bag in a bottom trawl when fishing halibut and other flatfishes is known to be low and a mesh is less selective compared to for cod. Thus, the selection rate made up 4.0-4.2 and selectivity range varied from 7.8 to 9.2cm (Isaksen et al., 1989) in Russian trawls during fishery on cod. For halibut the selection rate constituted 3.0-3.1 and no selectivity range was estimated as far as a retention of fish at all length was above 30-50% (Nikeshin et al., 1981).

By other data (Cardenas, 1995) the selection rate for Greenland halibut made up 2.9-3.0 and selectivity range was 7.4-11.8cm. According to the data from Norwegian investigators (Huse, Nedreaas, 1995), who determined selectivity by method of alternating hauls, the selection rate for halibut constituted 2.7 at selectivity range being 0.8cm. In our opinion such narrow range of selectivity is due to insufficient number of comparative hauls performed during the experiments.

By our data selectivity range of the "SORT-V" sorting grid system with 35mm grid made up 3.6-4.2cm and 12.9cm - with 40mm grid. Such essential difference in our opinion results from a small quantity of hauls performed with 40mm grid.

Fish length corresponding to 50% retention made up 33.1-33.8cm for the system with 35mm grid and 31.3-31.8cm for that corresponding to 25% retention.

Halibut below 30cm long escape completely from such system, as well as much lesser fish of fishing size. In any case, the selectivity of the "SORT-V" system is higher than selectivity of mesh due to that small fish have a possibility to escape from a trawl immediately after a contact with a grid and not while accumulating as it occurs in a trawl bag (Zaferman and Serebrov, 1989). The "SORT-V" system in combination with 130mm mesh provides a high trawl selectivity which will give a positive effect for fishery in future due to prevention of fishing the small-size halibut having low qualities for a consumer.

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TABLE 1.

Hauls made by "Ozernitsa" during the selectivity experiments in 1996

DATE	INITIAL POSITION OF TRAWLINGS		TIME OF START	DURATION OF HOULS	SPEED	CATCH		VERSION OF DESIGN
						CODEND	COVER	
	N	W		min	kn	no	no	
23.02.96	48°17'	46°07'	23-20	150	3.4	313	41	I
24.02.96	48°28'	46°07'	18-30	300	3.0	1716	37	I
25.02.96	48°24'	46°18'	07-30	330	3,2	1129	279	II
25.02.96	48°14'	46°55'	15-20	330	3.0	767	320	II
1.03.96	48°10'	47°18'	21-30	240	3.6	922	85	III
2.03.96	48°11'	47°18'	11-30	300	3.2	381	25	III
3.03.96	48°13'	46°58'	04-30	300	3.2	518	29	III
3.03.96	48°10'	46°56'	19-00	180	3.0	185	40	III
4.03.96	48°15'	46°48'	07-20	180	3.0	367	34	III
6.03.96	48°10'	47°02'	10-00	300	3.6	342	43	III
6.03.96	48°20'	46°32'	16-40	300	3.6	508	54	III
7.03.96	48°27'	46°11'	00-30	300	3.0	498	50	III

TABLE 2.
POOLED SELECTIVITY DATA FOR VERSION OF THE ' SORT - V ' SYSTEM DESIGN No.1

Length, cm	No.in codend	No.in cover	Selectivity for each group ,%	Selectivity calculated as 3-point moving average,%
28	0	4	0	0
30	0	2	0	3,1
32	2	11	18,2	34,4
34	101	18	84,9	65,1
36	291	25	92,1	90,8
38	536	25	95,5	94,2
40	622	32	95,1	95,3
42	504	25	95,3	95,9
44	378	10	97,4	96,7
46	263	7	97,4	98,1
48	178	1	99,4	98,9
50	82	0	100	99,8
52	50	0	100	100
54	23	0	100	100
56	16	0	100	100
58	29	0	100	100
60	16	0	100	100
62	2	0	100	100
64	2	0	100	100
SUM.:	3095	160		

TABLE 3.
POOLED SELECTIVITY DATA FOR VERSION OF THE ' SORT - V ' SYSTEM DESIGN No.2

Length,cm	No.in codend	No.in cover	Selectivity for each group ,%	Selectivity calculated as 3-point moving average,%
28	0	3	0	0
30	0	9	0	15,4
32	32	37	46,3	30,7
34	85	101	45,7	51,7
36	209	123	63	65,5
38	372	138	72,9	71,1
40	466	136	77,4	74,9
42	448	177	71,7	73
44	241	104	69,9	74,4
46	335	75	81,7	77,9
48	201	44	82	84
50	105	14	88,2	81,3
52	53	19	73,6	82,3
54	74	13	85,6	79,7
56	33	8	80,5	84,8
58	24	3	88,9	89,8
60	20	0	100	96,3
SUM.:	2698	1004		

TABLE 4.
POOLED SELECTIVITY DATA FOR VERSION OF THE ' SORT - V ' SYSTEM DESIGN No.3

Length,cm	No.in codend	No.in cover	Selectivity for each group ,%	Selectivity calculated as 3-point moving average,%
28	0	1	0	0
30	0	3	0	7,8
32	11	36	23,4	27,4
34	89	62	58,9	52,9
36	328	101	76,5	72,5
38	546	120	82	81
40	753	138	84,5	85,5
42	887	100	89,9	88,5
44	545	54	91	91,4
46	492	35	93,4	93,8
48	403	13	96,9	95,6
50	223	8	96,5	97,6
52	158	1	99,4	98,6
54	115	0	100	99,8
56	65	0	100	100
58	43	0	100	100
60	38	0	100	100
62	15	0	100	100
64	17	0	100	100
66	16	0	100	100
68	9	0	100	100
70	13	0	100	100
72	1	0	100	100
74	4	0	100	100
76	4	0	100	100
82	4	0	100	100
86	2	0	100	100
88	2	0	100	100
Sum:	4783	672		

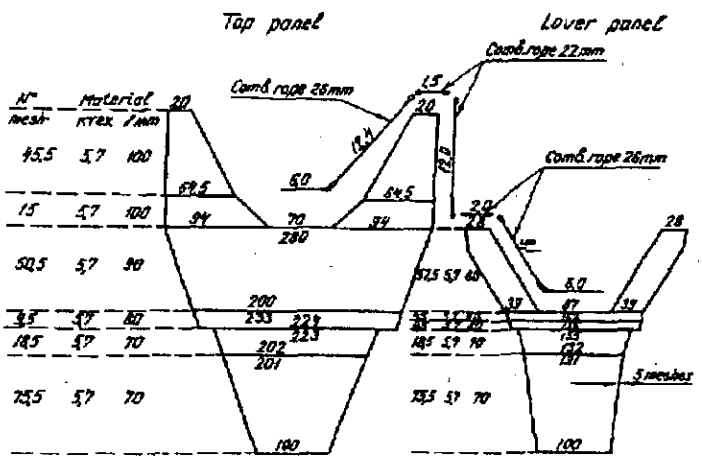

Figure 1. 30,8/32,1 m bottom trawl used in experiments on selectivity

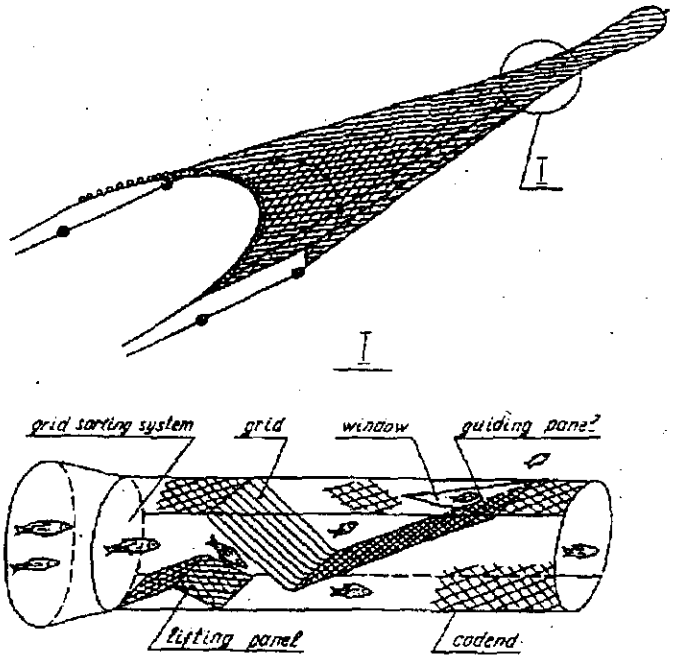

Figure 2. Illustration of the working principle of the one grid system („Sort-V")

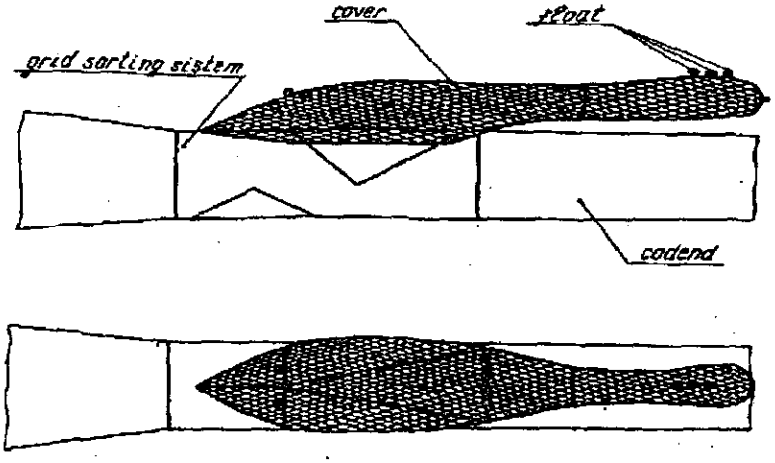

Figure 3. Illustration of cover used to collect fish that have escaped through the „Sort-V"

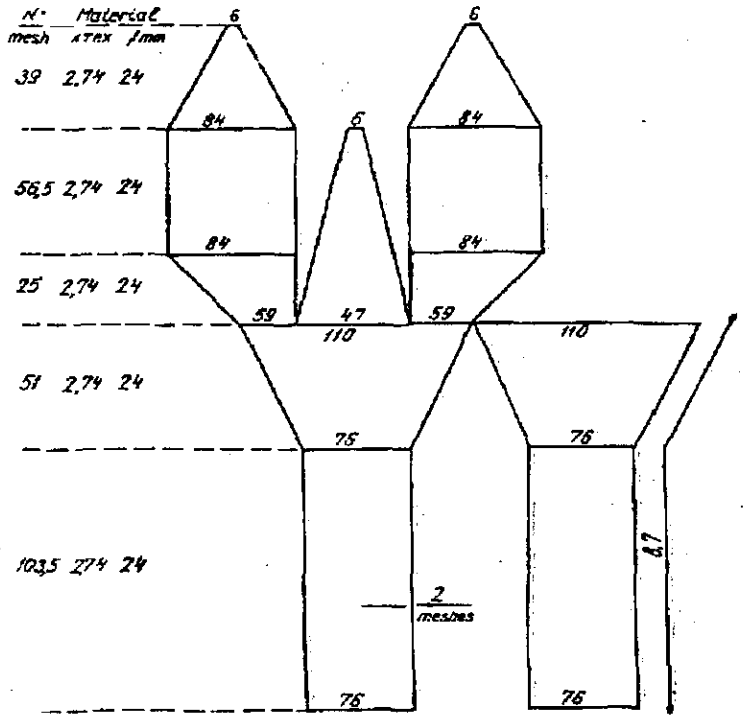

Figure 4. The construction of the cover used during selectivity experiments with sorting grid

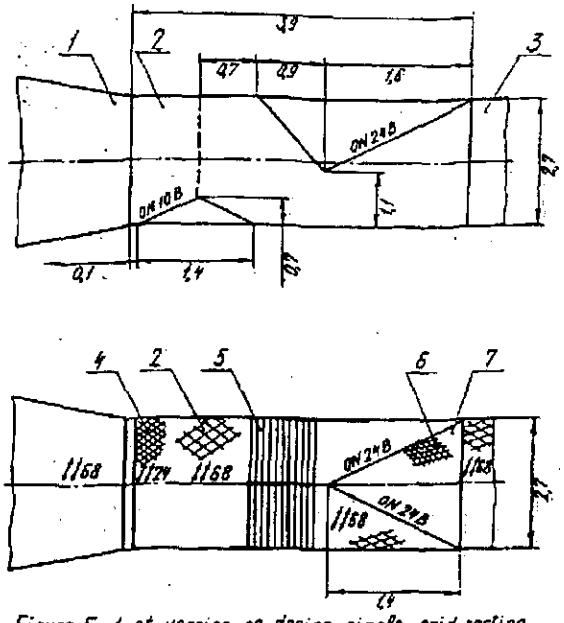

Figura 5. 1-st version of design single grid sorting system used in experiments on selectivity: 1-extension; 2-grid sorting system; 3-codend; 4-lifting panel; 5-35 mm grid sorting; 6-guiding panel; 7-window

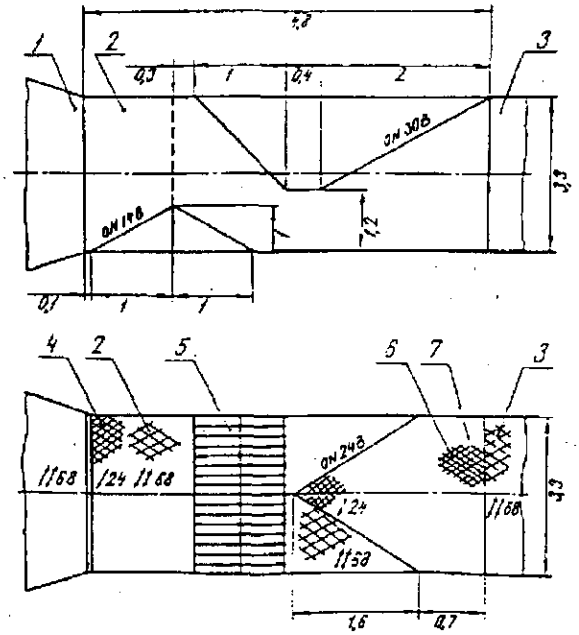

Figura 6. 3-d version of design single grid sorting system used in experiments on selectivity: 1-extension; 2-grid sorting system; 3-codend; 4-lifting panel; 5-35mm grid sorting; 6-guiding panel; 7-window

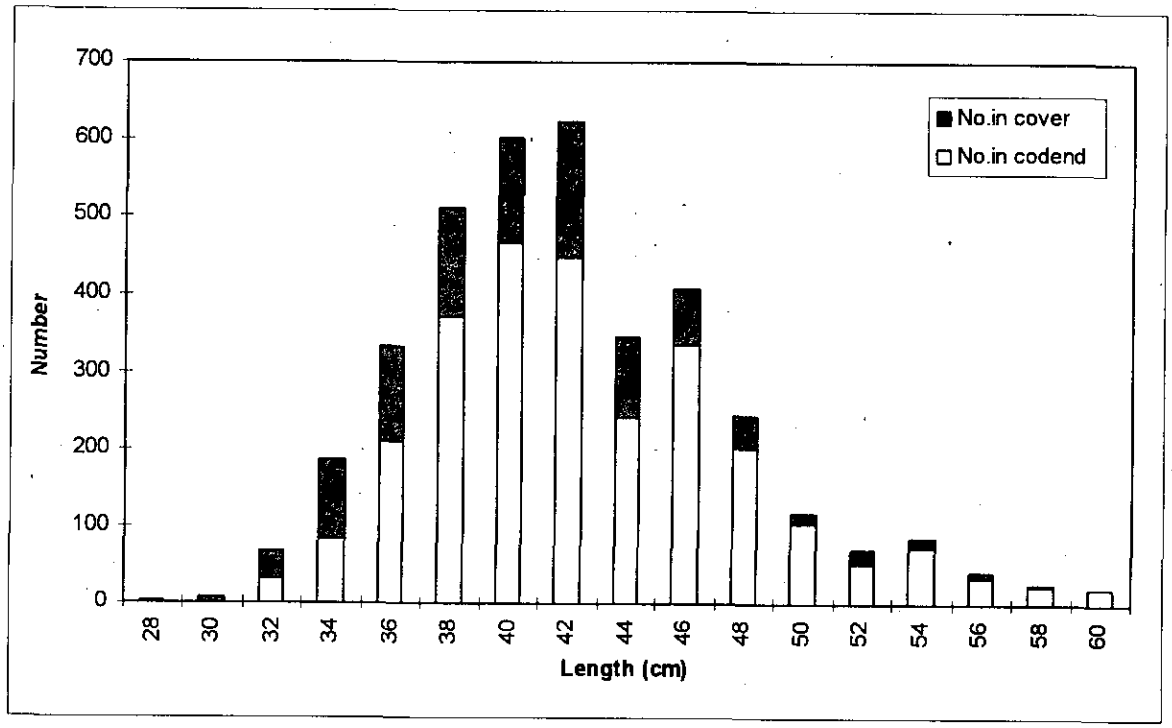

FIGURE 7. Length distribution greenland halibut caugth comparative fishing version of the 'Sort - V ' system design No.1.

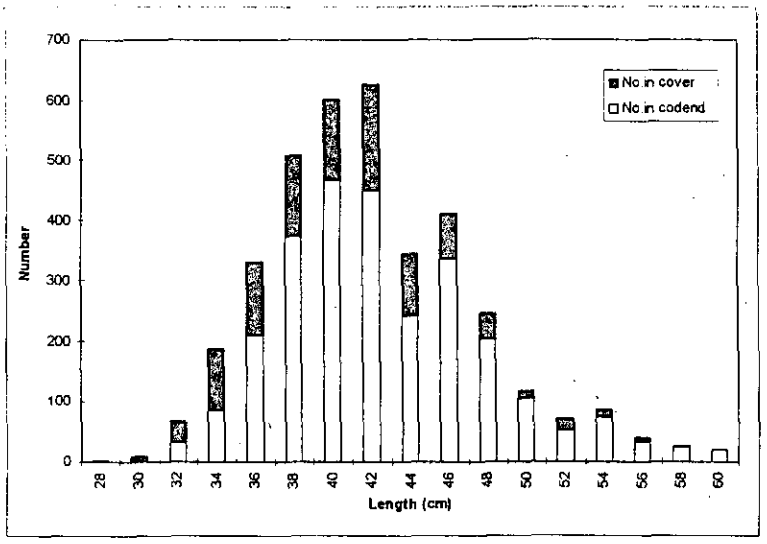

FIGURE 8. Length distribution greenland halibut caugth comparative fishing version of the 'Sort-V ' system design No.2.

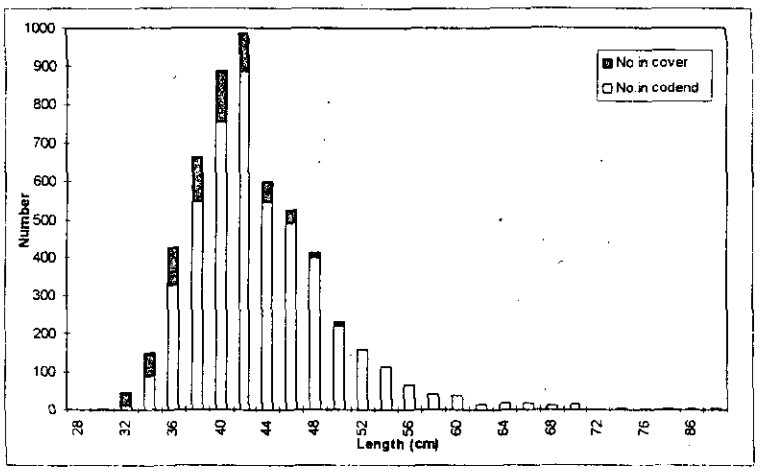

FIGURE 9. Length distribution greenland halibut caugth comparative fishing version of the 'Sort-V' system design No.3.

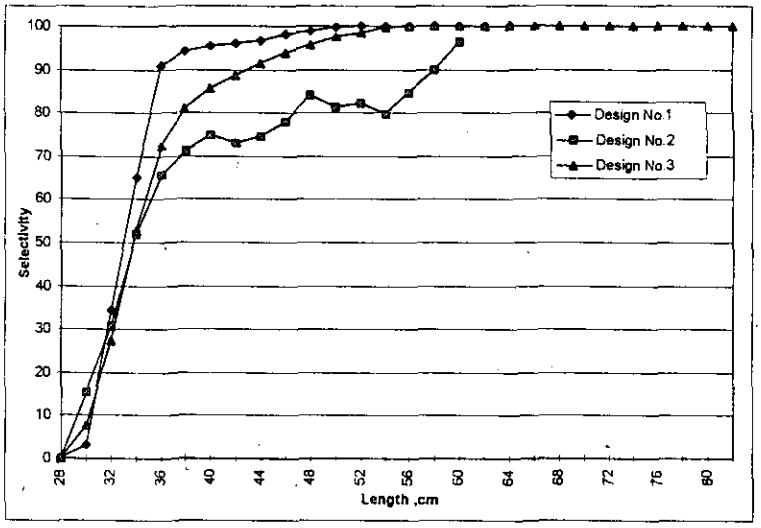

Figura No.10 Selectivity of different versions of the ' Sort-V ' system design relative to greenland halibut.