

**A Comparison of the Selectivity in Codends
used by the Soviet and Norwegian Trawler Fleet
in the Barents Sea**

By

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ABSTRACT

In August/September 1989, joint Soviet-Norwegian selectivity experiments were performed east of Rybackya Bank (Østbanken) in the Barents Sea. The main aim of the experiments was to compare the selectivity in codends used by the Soviet and Norwegian trawler fleet. Of the two methods used to establish the selectivity parameters, bag type cover and trouser trawl, the last method were used to compare the results, indicating slightly better selectivity properties of the Soviet codend, roughly a 0.2 higher selection factor, and a selection range that was 3-4 cm narrower than for the Norwegian codend. This difference is explained by the different kind of codend material used by the Soviet and Norwegian trawler fleet.

INTRODUCTION

Since ICES recommended how to conduct selectivity experiments (ICES 1964) with small meshed covers, either top or whole cover, numerous experiments have been performed using these methods, either for establishing selection factors and intervals, or for elucidating circumstances that affect size selection in trawl and Danish seine.

When using the top cover method, an internal small meshed webbing is mounted at the lower section of the codend to prevent fish escaping through this part, and an external net mounted on the upper part of the codend serves to retain small fish that have escaped from the main codend. This net is made 1.5 times wider than the upper part of the codend, and about 1.2 times longer than the codend itself.

With the whole cover method, a totally enclosing cover, 1.5 times wider than the codend, and about 1.2 times longer, is used. Despite the fact that ICES did recommend to use the whole cover method, very much selectivity work has been conducted using the top cover method, mainly because this cover is more convenient to use and is much less vulnerable than a whole cover.

The attractiveness of the cover methods lies in the fact that results are obtainable from single hauls, but the method has often given lower selection factors than the alternate haul method, this may indicate a masking effect. However, during the early 80-ies, experiments with other types of cover than those specified by ICES have been conducted. Sakhno & Sadokhin (1982) used a whole cover (bag type), with a width of at least 2.5 times that of the codend, to make the masking effect insignificant. This bag type cover was furthermore 4-5 m longer than the codend, and was attached to the extension piece 3-4 m ahead of the codend/extension piece joining.

In accordance with the Protocol from the 16th Session of the Mixed SovietNorwegian Fishery Commission, joint selectivity experiments with different codend covers were undertaken in June 1988 with the two trawlers "Anny Kræmer" (Norway) and "Gremyachinsk" (USSR) (Anon 1988, Engås et al. 1988). Due to differences in the gear and rigging applied onboard the two boats, the results were not readily comparable, and both sides agreed that the main sources of discrepancies could be differences in the cover's width/bag width ratio, width of bags, twine thickness and structure of the twine. Both sides came, however, to the conclusion that the ICES top cover produces considerable effect on the gear selectivity (Anon 1989).

During a joint meeting in Murmansk 24 - 25 April 1989, detailed plans for further experiments were worked out. Selectivity of trawl bags should be estimated by using the USSR-specified bag type cover (whole cover) and the modified trouser trawl specified by Norway. The 135 mm trawl bags used should be representative for the national fisheries. If possible there should be an exchange of specialists during the cruise.

MATERIAL AND METHODS

The main characteristics of ships and gear used are as follows:

	R/V "Persey III" (USSR)	M/Tr "Anny Kræmer" (Norway)
<i>Vessel data</i>		
Gross tonnage		
Brt	1047	477
Nrt	556	176
Length	84 m	51 m
Width	14 m	10.3 m
Depth	5.5 m	4.7 m
HP	1700	2400
<i>Gear and rigging</i>		
Trawl	41.7/39.6 bottom trawl	"Alfredo-3"
Material	Polyamid (Kapron)	Polyethylen
Vertical opening	6.5 m	4 m
Horizontal opening	24 m	27 m
Otterboards	Oval-plain	V-shaped rectangular
Area	5.5 m ²	7.4 m ²
Weight	1500 kg	1750 kg
Total sweep/bridle length	120 m	150 m
<i>Extension piece</i>		
Material	Polyamid	Polyamid
Constr./thickness	Twisted 2x3.1mm	Plaited 2x5mm
<i>Codend</i>		
Material	Polyamid	Polyamid
Constr./thickness	Twisted 2x3.1mm	Plaited 2x7mm
<i>Covers</i>		
Bagtype		
Material	Polyamid	Polyethylen
Constr./thickness	Single twisted 2.4mm/3.1mm	Plaited 3.5mm
<i>Trouser trawl</i>		
Material	Polyamid	Polyethylen
Constr./thickness	Single twisted 2.2mm	Plaited 2.5mm

Before the two boats started joint work, underwater observation of the gear used onboard "Anny Kræmer" were carried out at the east coast of Finnmark. At the same time "Persey III" was searching for suitable areas for selectivity experiments.

On 28 August the vessels met east of Rybachya Bank (Østbanken), and in the following week more than 50 hauls were done in this area in water depths of 130 to 270 m. Except for a few hauls, the tows were done as parallel haulings, with a duration of approx. 2 hours and at a speed of 3.5 knots. Before the experiments started, there was an exchange of specialists between the vessels, as well as a short discussion of the practical details of the joint work.

The trawl codends used onboard "Persey III" and "Anny Kræmer" were similar to those used in commercial fishery. The bagtype covers were 2.5 times wider than the codends used, while the inside blinders used in the trouser trawl method were 10% wider and about 1-1.5 m longer than the codend. For further details of the gear used, see Figur 1-4.

Measurements of mesh size were done with wedge shaped ICNAF-type gauges, with a 5 kg weight attached to its lower part.

Whenever possible, a sample of 400 specimen of cod and haddock from both the cover and codend were measured, the rest of the fish were counted, and the different length-frequency distributions were raised by their respective numbers.

In the data analysis, all hauls containing less than 100 kg of mixed fish in the main codend were excluded. The fish measurements were grouped in 2 cm intervals, and the method of 3-point-moving averages (Pope et al. 1975) were used to establish the different selection curves.

RESULTS

Underwater observations - "Anny Kræmer"

During this part of the experiments, codends and covers were observed with different catch rate. When the codend was empty or contained very little fish (100-200 kg), it stayed close to or on the bottom of the 4-panels bag type cover, providing ample space for escaped fish to pass back into the cover. As the codend filled up and more fish went back into the cover, the space between

codend and cover was reduced. When the codend catch was roughly 700-800 kg, there was hardly space left for fish to pass back into the cover. In one haul of 1.3 tons in the main codend and about 1.6 tons in the cover, the cover was squeezing the main codend, and a lot of fish escaped from the main codend were gathered just in front of the codend catch, thus most probably causing a masking effect in the important "escape zone".

Another notable observation was the erratic "behaviour" of the codend inside the cover. It stayed almost stationary inside on the bottom of the cover, and was not making undulating movements as the codend normally does.

Observations of the trouser trawl confirmed that the vertical split net in front of the two codends divided the extension piece in two apparently equal halves. The small meshed blinder inserted in one of the trouser legs did not affect that codend or the trouser trawl system as a whole. Unfortunately no observations of big hauls with the trouser trawl were made.

Comparative fishing experiments - "Persey III" - "Anny Kræmer"

The parallel fishing started with the use of trouser trawls followed by a series with bag type cover. At the second half of the period this scheme was repeated, but some of the hauls with bag type covers were done individually by each vessel.

Quite soon after the parallel fishing started, it became evident that "Anny Kræmer" had a better fishing power than "Persey III". For cod the relative fishing power (in weight) was roughly 2.5:1, and for haddock 2:1. However, a comparison of the length distribution (cover and codend pooled) of fish taken during the first period with bag type cover, clearly demonstrates that the two vessels were sampling the same fish (Fig. 5).

Because of the difference in fishing power and catches, and the fact that selectivity can be affected by catch size (ICES 1964), for the analysis it was necessary to split the catches into weight groups.

The pooled catches are given in Table 3 and 4, and shown separately for cod and haddock in Figure 6 and 7. With a mesh size of 141 mm for "Persey III" and 137 mm for "Anny Kræmer", the 50% retention length - L_{50} , selection range - s.r., and selection factor - S.F., are given in Table 1.

During the preliminary analysis of the first series with trouser trawl (made onboard), it became evident that the two legs of the trouser trawl system did not fish equally. The difference was most obvious in the data from "Anny Kræmer". Therefore, before the second series of experiments with this method, the two legs, the ordinary one and the "blinded" one, were exchanged, and the data from the two series were treated separately (Table 5). The data from "Persey III"'s two series were pooled (Table 6). With an adjustment procedure as outlined by Pope et al (1975) for alternate hauls, the main parameters for catches less (I) or more (II) than 1.0 ton were calculated and shown in Figures 8 and 9 ("Persey III": meshsize 143 mm, "Anny Kræmer": 138 mm).

DISCUSSION AND CONCLUSIONS

The underwater observations of the cover used onboard "Anny Kræmer" clearly showed that with a catch of about a ton or more in the codend, the cover would cause a masking effect and lower the selectivity of the codend. In addition, and perhaps more serious, the codend partly "stayed" on the bottom of the cover, and did not "work" as under normal fishing conditions. As recommended by ICES (1964), the cover was made of polyethylene, but it may be that a difference in material, and consequently bouyancy, of the cover and codend gives rise to a bias. Use of the same material in cover and codend as onboard "Persey III" is perhaps a better solution.

A comparison of the results from the bag type cover experiments and the trouser trawl experiments, further confirm a masking effect of the bag type cover used onboard "Anny Kræmer".

In contrast, the experiments carried out with "Persey III" did not indicate any kind of masking effect by the bag type cover. Both the selection factors and selection ranges are quite similar for the two methods.

Possible explanations of the discrepancies between the findings for the bag type cover for the two vessels may be:

1. The Norwegian codend does not "work" properly inside the cover, while the Soviet codend maintains the most of its characteristics inside the cover.
2. Difference in width of the two codends and covers. While a typical Norwegian codend has a circumference of 6.0-6.5 m, a Soviet codend has a circumference of 10.0-10.5 m. It is

reasonable to assume that in the Soviet codend an eventual masking effect by the cover will occur at a later stage during hauling, and mainly with big catches.

3. The Soviet extension piece is slightly more tapered than the Norwegian one, thus possibly giving a greater distance between the cover and codend.

Exact explanations of this discrepancy, however, can only be obtained by further comparative studies aided by underwater observation of both gears.

Comparisons of the selection ogives for cod and haddock established for the trouser trawl method, indicate slightly better selectivity properties of the Soviet codend, roughly a 0.2 higher selection factor, and a selection range that is 3-4 cm narrower than for the Norwegian codend. This is slightly different from the more equal results obtained during the joint Soviet-Norwegian selectivity experiments in 1977 (Ponomarenko et al 1978).

Factors that may affect size selection in trawl and Danish seine have during the last thirty years been elucidated by numerous selectivity experiments, and may be summarized as:

1. Conditions of fish.
2. Degree of stomach content.
3. Towing speed.
4. Duration of tow.
5. Size of catch.
6. Codend material and construction.

Regarding point 1 to 4, these factors should give equal selection since the vessels were doing parallel hauls, and were fishing on fish of the same size composition. Point 5 should not cause any difference since the catches are divided into weight groups before the comparisons were made. The main reason for the difference in selectivity has therefore to be explained by the different kind of codend material used by the Soviet and Norwegian trawler fleet.

The Soviet trawler fleet is presently using almost the same codend material as 10 years back, i.e. twisted, double 3.1 mm Kapron (polyamid A), with no bonding material added, a quite soft and pliable material. The most common codend material used by Norwegian trawlers is plaited, double, 7.0 mm polyamid, with a bonding material added. This material is much stiffer than the Soviet one, especially when new, and it may be classified as polyamid B.

These finding is similar to results obtained during the 50-ies (Boerema 1956, Lucas et al. 1954) where soft and light materials as cotton, hemp, or thin single manila gave higher selection factors than the more heavy and stiff double manila and sisal, a finding that was termed "the light trawl" problem.

Anyhow, the selection parameters obtained during the joint experiments this year should be regarded as representative for the codends used by the national trawler fleet today, and as long as the codend material and construction remains as it is. However, if any change in codend construction or material thickness and construction occurs, this will most probably lead to a change in selectivity as well.

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Table 1. Selection parameters for cod and haddock using the method with bag type cover.

Weigh groups (kg)	Selection parameters	COD		HADDOCK	
		Persey III	Anny Kræmer	Persey III	Anny Kræmer
I 100-500	l_{50} (cm)	58.5	52.2	55.4	46.8
	s.r. (cm)	8.4	17.7	10.8	-
	S.F.	4.1	3.8	3.9	3.4
II 500-1500	l_{50} (cm)	56.6	47.6	51.6	43.0
	s.r. (cm)	7.8	16.4	9.2	16.1
	S.F.	4.0	3.5	3.6	3.1
III 1500->	l_{50} (cm)	59.8	47.0	49.2	43.0
	s.r. (cm)	9.2	16.0	7.2	16.1
	S.F.	4.2	3.4	3.5	3.1

Table 2. Selection parameters for cod and haddock, when using the trouser trawl method.

Weigh group	Selection parameters	Persey III	Anny Kræmer
<i>COD</i>			
I		w=270 kg	w=450/475 kg
	l_{50}	61.0	56.2
	s.r.	7.6	11.8
II		w=1700 kg	w=1900 kg
	l_{50}	58.4	43.2
	s.r.	11.8	14.2
I		w=270 kg	w=450/475 kg
	l_{50}	56.0	51.5
	s.r.	8.6	11.1
II		w=1700 kg	w=1900 kg
	l_{50}	51.2	47.0
	s.r.	12.3	16.8
	S.F.	3.6	3.4

Table 3. Pooled selectivity data from M/Tr "Anny Kræmer"; bagtype cover (CD = Codend, CV = Cover).

Species	COD						HADDOCK					
	100-500		500-1500		1500-		100-500		500-1500		1500-	
Weight groups(kg)	3		5		8		3		5		8	
No. of hauls	3		5		8		3		5		8	
Fish length (cm)	CD	CV	CD	CV	CD	CV	CD	CV	CD	CV	CD	CV
>31	0.	0.	1.	3.	2.	12.	0.	26.	9.	179.	78.	1011.
31-32	0.	1.	0.	5.	8.	19.	0.	2.	1.	2.	23.	85.
33-34	0.	1.	0.	11.	5.	17.	0.	1.	1.	2.	21.	74.
35-36	1.	4.	3.	3.	4.	23.	0.	10.	4.	9.	42.	113.
37-38	0.	4.	3.	7.	3.	34.	1.	6.	5.	16.	79.	150.
39-40	1.	1.	6.	23.	20.	65.	2.	6.	11.	23.	125.	180.
41-42	2.	7.	12.	27.	70.	112.	2.	7.	16.	25.	170.	229.
43-44	3.	4.	21.	23.	119.	174.	1.	5.	21.	14.	326.	276.
45-46	3.	15.	25.	37.	280.	300.	4.	1.	43.	18.	524.	313.
47-48	8.	14.	37.	44.	350.	365.	4.	5.	49.	34.	751.	345.
49-50	21.	18.	78.	43.	639.	369.	4.	3.	86.	28.	1004.	317.
51-52	20.	21.	97.	49.	860.	320.	8.	9.	111.	32.	1221.	272.
53-54	28.	23.	86.	42.	802.	273.	4.	6.	71.	17.	901.	144.
55-56	16.	11.	121.	27.	781.	206.	5.	3.	59.	9.	714.	47.
57-58	21.	10.	128.	21.	882.	115.	1.	4.	45.	3.	349.	39.
59-60	27.	8.	160.	24.	964.	88.	0.	0.	26.	0.	164.	9.
60-61	26.	8.	160.	11.	941.	52.	0.	0.	10.	1.	39.	0.
63-64	27.	4.	184.	12.	908.	33.	1.	0.	2.	0.	29.	1.
65-66	27.	5.	172.	6.	795.	31.	0.	0.	2.	0.	5.	0.
67-68	23.	4.	202.	8.	613.	17.	0.	0.	0.	0.	0.	0.
69-70	27.	3.	159.	12.	552.	6.	0.	0.	0.	0.	2.	0.
71-72	13.	1.	120.	5.	429.	3.	0.	0.	0.	0.	0.	0.
73-74	13.	0.	76.	5.	238.	5.	0.	0.	0.	0.	0.	0.
≥75	21.	0.	184.	1.	500.	6.	0.	0.	0.	0.	0.	0.

Table 4. Pooled selectivity data from R/V "PerseyIII"; bagtype cover (CD = Codend, CV = Cover).

Species	COD						HADDOCK					
	100-500		500-1500		1500-		100-500		500-1500		1500-	
Weight groups(kg)	3		5		8		3		5		8	
No. of hauls	3		5		8		3		5		8	
Fish length (cm)	CD	CV	CD	CV	CD	CV	CD	CV	CD	CV	CD	CV
< 31	0.	9.	0.	12.			0.	136.	0.	120.	0.	3.
31-32	0.	8.	0.	5.			0.	18.	0.	33.	0.	4.
33-34	0.	4.	0.	6.	0.	1.	0.	16.	1.	13.	0.	0.
35-36	0.	5.	1.	9.	0.	0.	1.	16.	4.	39.	0.	6.
37-38	0.	15.	1.	18.	0.	1.	2.	50.	6.	81.	2.	18.
39-40	0.	27.	3.	30.	0.	1.	1.	48.	3.	131.	2.	31.
41-42	1.	59.	5.	82.	0.	7.	1.	93.	22.	225.	5.	32.
43-44	4.	64.	5.	84.	0.	4.	7.	89.	24.	168.	6.	26.
45-46	5.	73.	8.	132.	0.	15.	12.	93.	47.	207.	8.	59.
47-48	8.	156.	27.	276.	1.	55.	21.	183.	158.	283.	91.	105.
49-50	14.	136.	31.	260.	9.	100.	54.	140.	133.	224.	121.	82.
51-52	44.	140.	108.	383.	7.	55.	68.	88.	268.	214.	113.	50.
53-54	48.	104.	146.	316.	17.	63.	59.	79.	198.	117.	116.	28.
55-56	28.	78.	134.	183.	18.	49.	38.	46.	116.	31.	68.	7.
57-58	49.	54.	215.	128.	25.	34.	24.	14.	65.	12.	46.	4.
59-60	75.	43.	248.	102.	47.	41.	10.	4.	53.	2.	25.	1.
61-62	68.	17.	347.	59.	12.	12.	3.	1.	12.	0.	6.	0.
63-64	86.	18.	431.	64.	45.	11.	1.	0.	5.	2.	2.	0.
65-66	83.	11.	298.	20.	38.	7.	0.	0.	3.	0.	0.	0.
67-68	78.	2.	371.	12.	40.	2.	0.	0.	2.	0.	0.	0.
69-70	50.	2.	292.	4.	42.	0.	0.	0.	0.	0.	0.	0.
71-72	36.	2.	181.	3.	15.	0.	0.	0.	0.	0.	0.	0.
73-74	26.	0.	96.	2.	13.	0.	0.	0.	0.	0.	0.	0.
> 75	72.	1.	255.	2.	22.	0.	0.	0.	0.	0.	0.	0.

Table 5. Pooled selectivity data from M/Tr "Anny Kræmer", trouser trawl method.
(CD = standard codend, CV = blinded codend)

Species	COD						HADDOCK					
	-1000		1000-		100-1000		-1000		1000-		100-1000	
Weight groups(kg)												
No. of hauls	3		5		8		3		5		8	
Series	1		1		2		1		1		2	
Fish length (cm)	CD	CV	CD	CV	CD	CV	CD	CV	CD	CV	CD	CV
<31	0.	3.			0.	8.	0.	12.	0.	16.	8.	852.
31-32	0.	3.	0.	1.	0.	12.	0.	1.	0.	1.	0.	98.
33-34	0.	2.	0.	0.	2.	60.	1.	2.	2.	8.	1.	115.
35-36	0.	3.	0.	3.	0.	33.	1.	8.	7.	8.	2.	177.
37-38	0.	8.	0.	12.	1.	54.	0.	12.	3.	26.	5.	157.
39-40	2.	10.	2.	19.	3.	68.	4.	31.	11.	45.	4.	182.
41-42	4.	20.	8.	25.	15.	106.	9.	40.	62.	109.	22.	253.
43-44	5.	27.	12.	30.	13.	161.	20.	78.	70.	145.	37.	309.
45-46	15.	32.	8.	55.	26.	206.	53.	112.	146.	226.	106.	411.
47-48	8.	49.	38.	101.	48.	320.	96.	128.	286.	310.	107.	540.
49-50	21.	58.	63.	127.	100.	466.	114.	166.	339.	398.	181.	612.
51-52	35.	78.	97.	170.	120.	484.	157.	152.	433.	434.	231.	613.
53-54	61.	83.	126.	122.	154.	510.	114.	94.	343.	323.	184.	399.
55-56	63.	88.	138.	164.	190.	414.	71.	65.	224.	217.	114.	239.
57-58	77.	90.	163.	175.	229.	452.	46.	24.	110.	97.	62.	122.
59-60	130.	114.	178.	178.	256.	424.	20.	17.	44.	30.	24.	79.
61-62	124.	105.	220.	194.	284.	424.	1.	6.	18.	18.	10.	22.
63-64	170.	102.	223.	145.	307.	408.	1.	1.	4.	3.	3.	2.
65-66	158.	112.	248.	189.	294.	392.	0.	1.	1.	2.	0.	6.
67-68	138.	79.	210.	147.	253.	327.	0.	2.	0.	0.	1.	2.
69-70	103.	74.	147.	103.	207.	270.	0.	0.	0.	0.	0.	1.
71-72	80.	54.	132.	69.	140.	178.	0.	0.	0.	0.	0.	0.
73-74	55.	29.	78.	45.	92.	112.	0.	0.	0.	0.	0.	0.
≥ 75	92.	93.	107.	99.	195.	233.	0.	0.	0.	0.	0.	0.

After Pope et al. 1975:

$$\text{First series, adjustment factor } F = \frac{\text{Cod above/equal 70 cm in CD (all hauls)}}{\text{Cod above/equal 70 cm in CV (all hauls)}} = \frac{1115}{721} = 1.54$$

$$\text{Second series, adjustment factor } F = \frac{634}{793} = 0.799$$

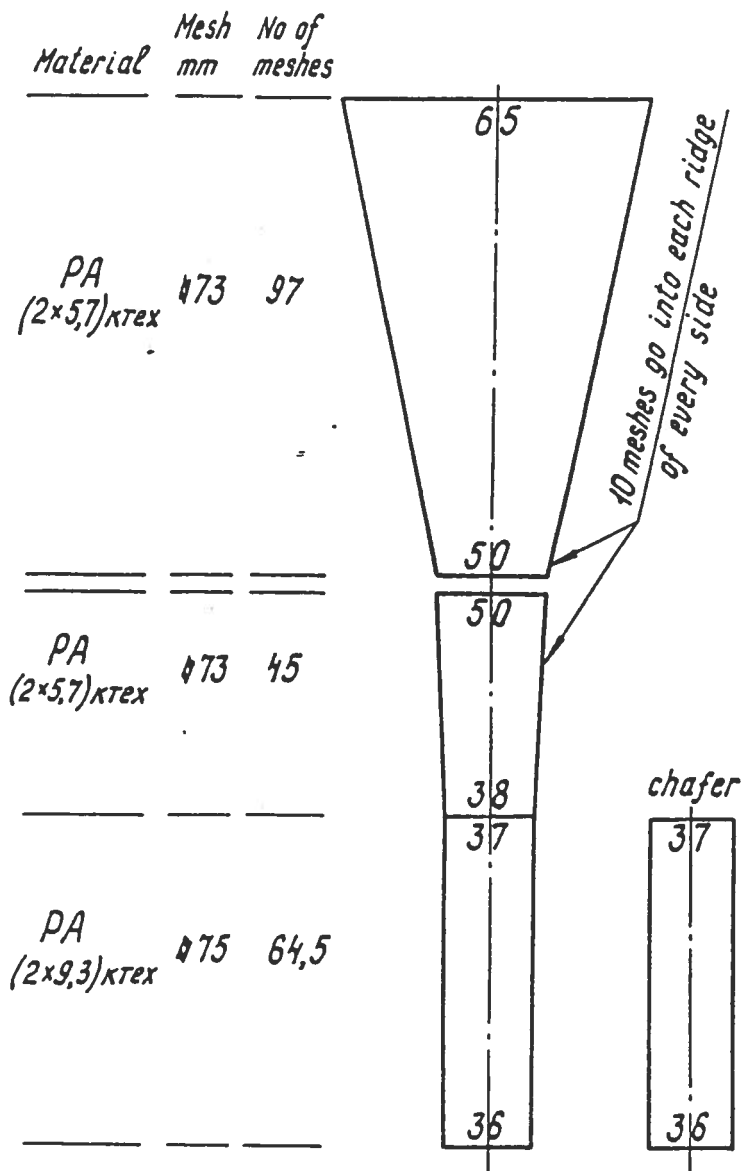
Table 6. Pooled selectivity data from R/V "Persey III", trouser trawl method.
(CD = standard codend, CV = blinded codend)

Species	COD				HADDOCK			
	100-1000		1000-		100-1000		1000-	
Weight groups (kg)	22		2		22		2	
No. of hauls	22		2		22		2	
Series	1+2				1+2			
Fish length (cm)	CD	CV	CD	CV	CD	CV	CD	CV
< 31	0.	21.	0.	0.	0.	998.	0.	1.
31-32	0.	18.	0.	0.	0.	61.	0.	2.
33-34	0.	7.	0.	0.	0.	41.	0.	0.
35-36	0.	8.	0.	0.	0.	62.	0.	0.
37-38	0.	23.	0.	0.	0.	133.	0.	3.
39-40	0.	37.	0.	2.	4.	121.	0.	15.
41-42	1.	73.	0.	5.	7.	234.	0.	42.
43-44	1.	56.	1.	7.	6.	205.	8.	24.
45-46	4.	102.	3.	10.	19.	310.	17.	40.
47-48	11.	273.	3.	38.	59.	608.	50.	165.
49-50	14.	244.	16.	36.	96.	617.	103.	181.
51-52	36.	345.	37.	151.	189.	492.	146.	209.
53-54	54.	316.	33.	142.	156.	395.	109.	138.
55-56	39.	241.	32.	85.	106.	212.	45.	80.
57-58	90.	327.	76.	131.	81.	138.	37.	34.
59-60	150.	330.	89.	140.	36.	44.	19.	24.
61-62	229.	290.	123.	142.	19.	11.	8.	3.
63-64	257.	362.	156.	215.	5.	7.	1.	0.
65-66	248.	229.	132.	161.	1.	0.		
67-68	249.	276.	157.	98.	0.	2.		
69-70	198.	179.	111.	78.	1.	0.		
71-72	163.	115.	75.	41.	0.	0.		
73-74	99.	83.	48.	50.	0.	0.		
≥ 75	215.	224.	92.	124.	0.	0.		

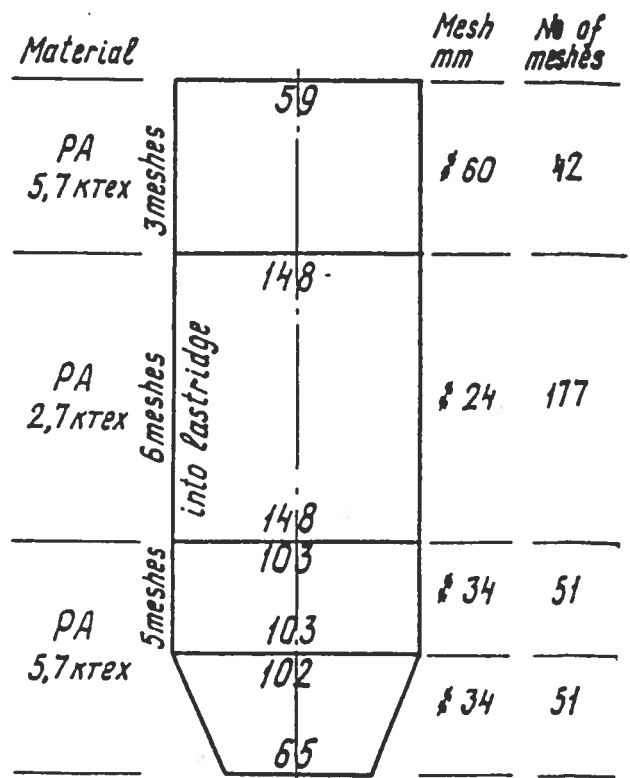
After Pope et al. 1975:

First + second series, adjustment factor $F = \frac{CD}{CV} = 1.11$

Codend (4 panel)



Bag-type cover (4 panel)



Codend with bag-type cover (USSR)

Figure 1. Drawings of codend and bag type cover used by R/V "Persey III".

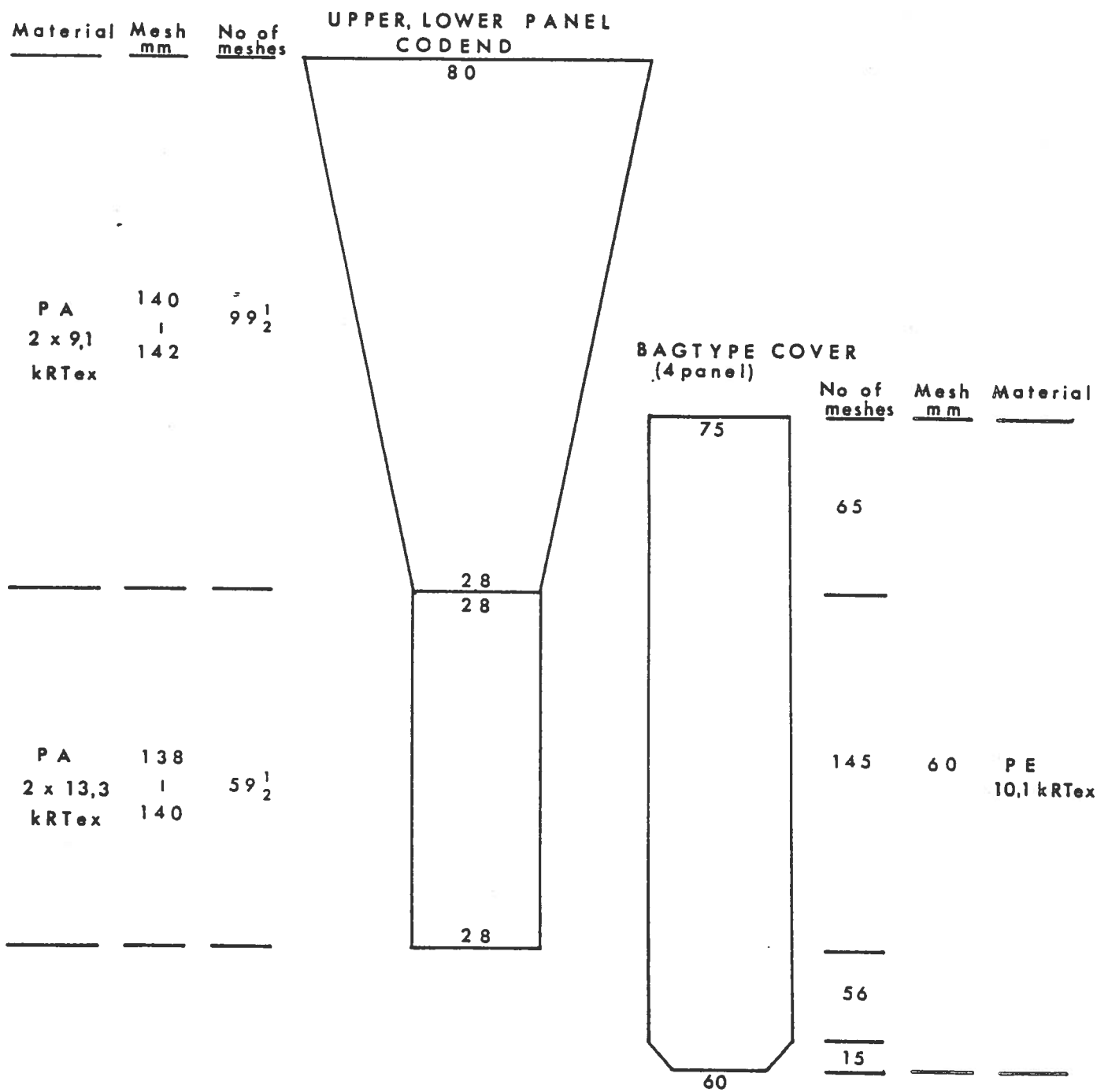


Figure 3. Drawings of the codend and bag type cover used by M/Tr "Anny Kræmer".

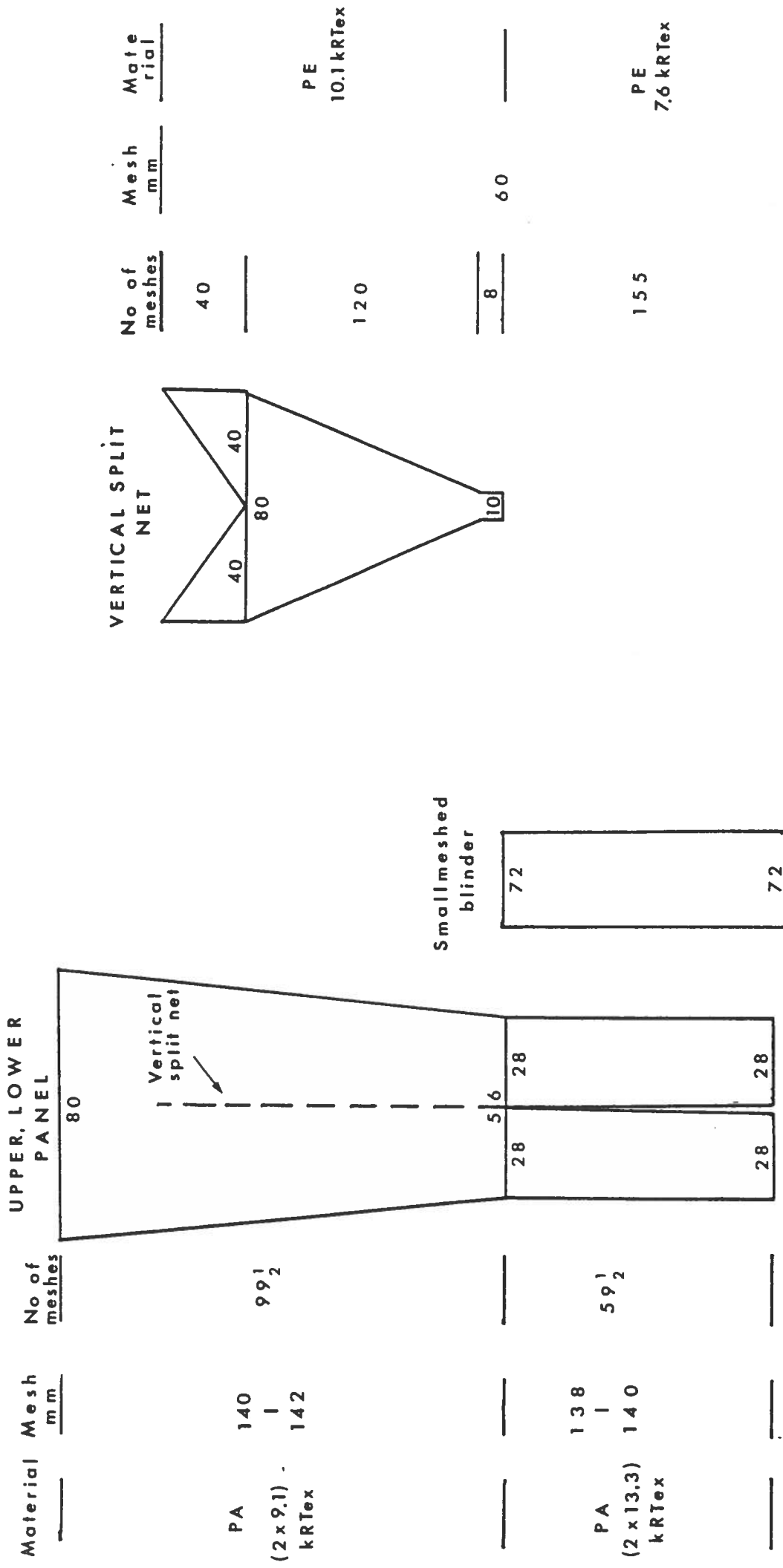
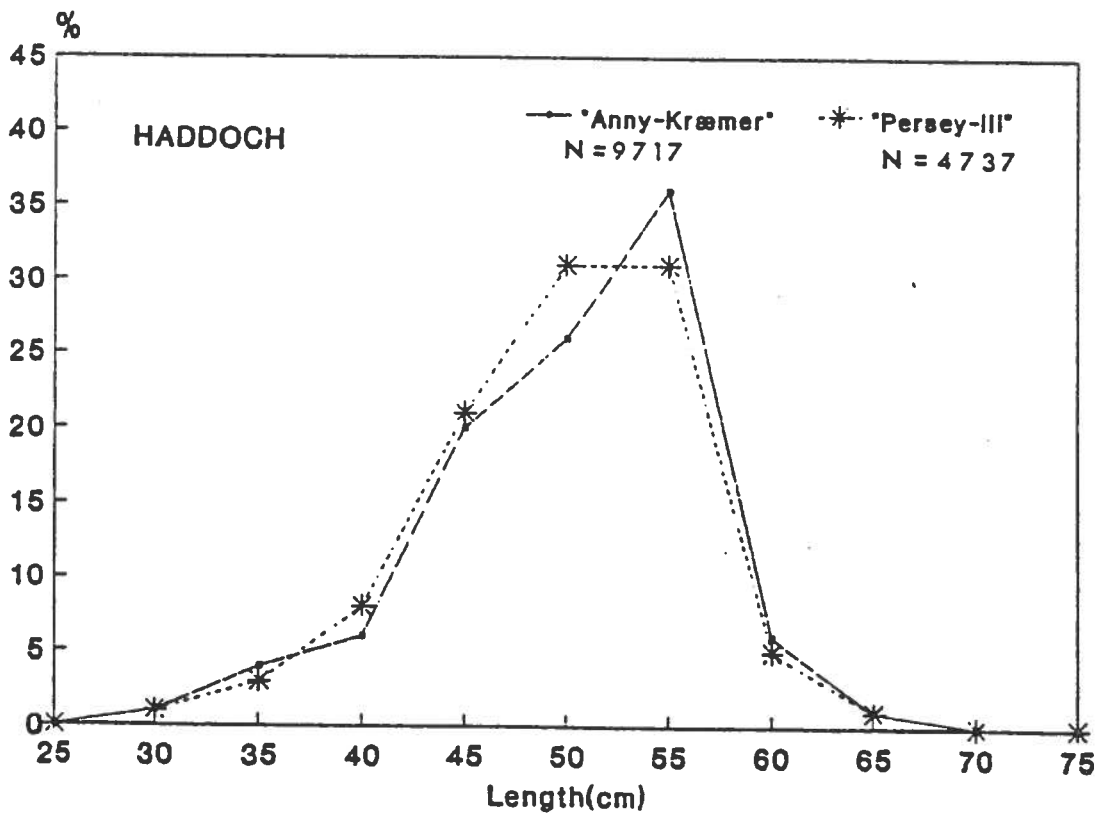
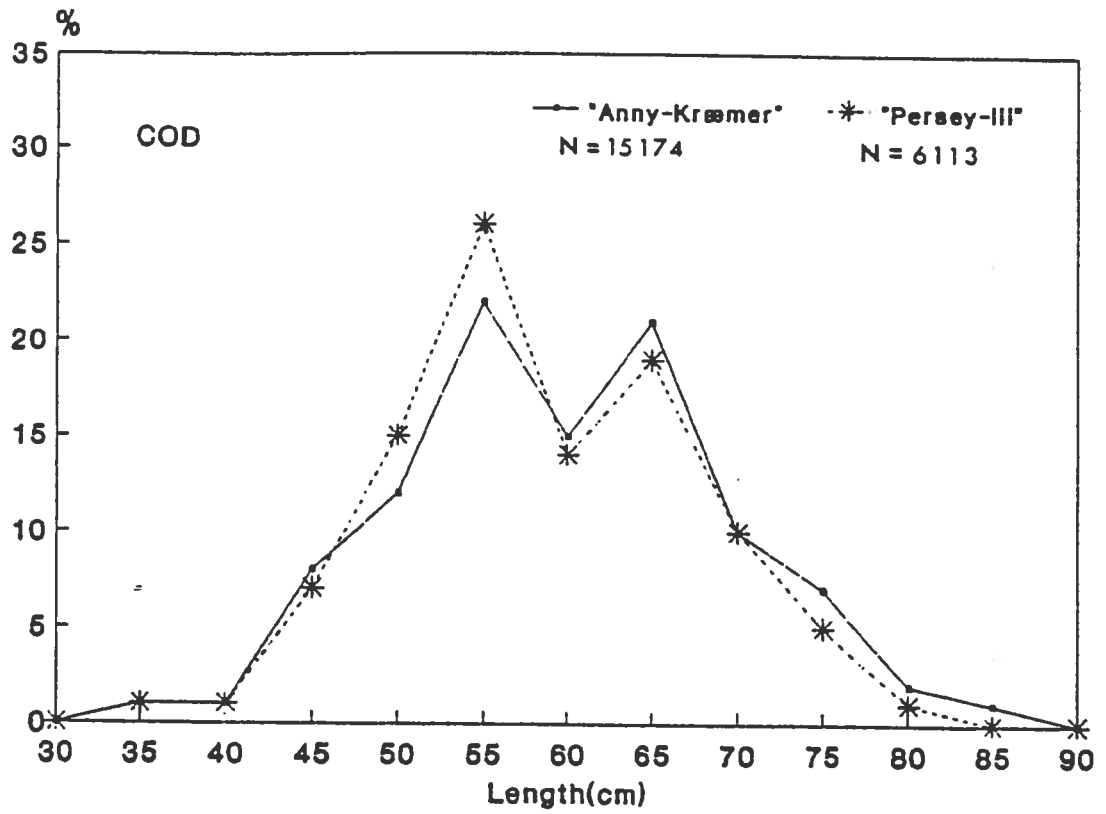


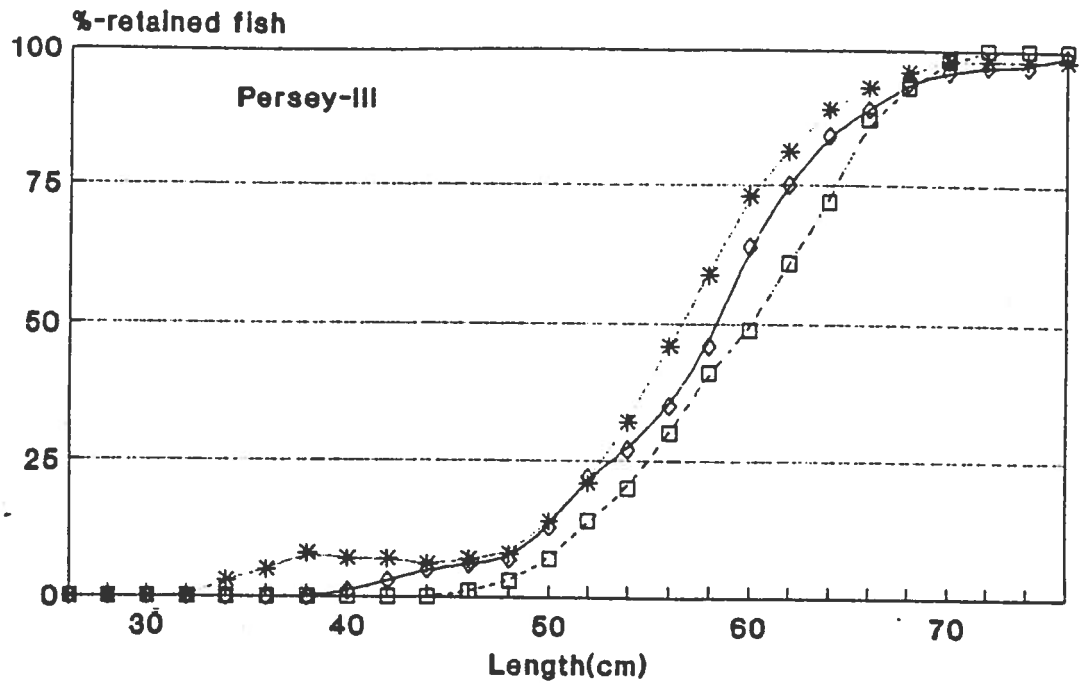
Figure 4. Drawings of the trouser trawl system used by M/Tr "Anny Kræmer".



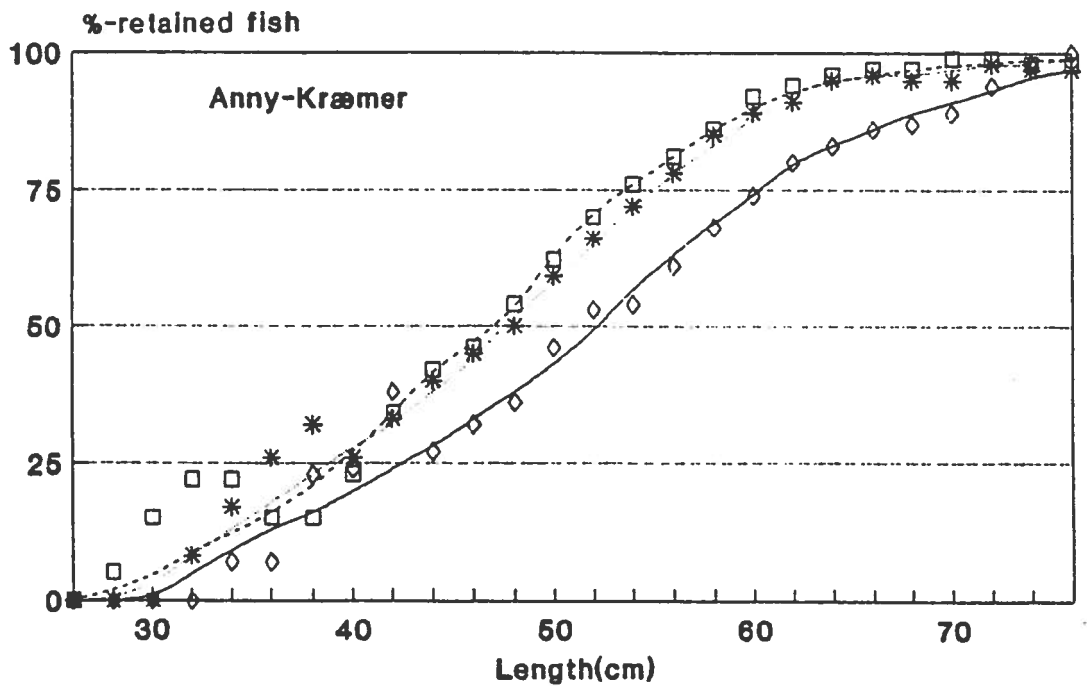
1111b1

Figure 5. Length distribution of cod and haddock caught by R/V "Persey III" and M/Tr "Anny Krømer" during the joint selectivity experiment in August/September 1989 (first series with bag type cover).

Selection oogives for cod, bagtype cover



	—◇— Catch 100-500kg	-*- Catch 500-1500kg	-□- Catch 1500- kg
l_{50} (cm)	58.5	56.6	59.8
s.r. (cm)	8.4	7.8	9.2
S.F.	4.1	4.0	4.2



	—◇— Catch 100-500kg	-*- Catch 500-1500kg	-□- Catch 1500- kg
l_{50} (cm)	52.2	47.6	47.0
s.r. (cm)	17.7	16.4	16.0
S.F.	3.8	3.5	3.4

Figure 6. Selection oogives for cod, bag type cover.

(R/V "Persey III": 141 mm, M/Tr "Anny Kræmer": 137 mm)

Selection oogives for haddock, bagtype cover

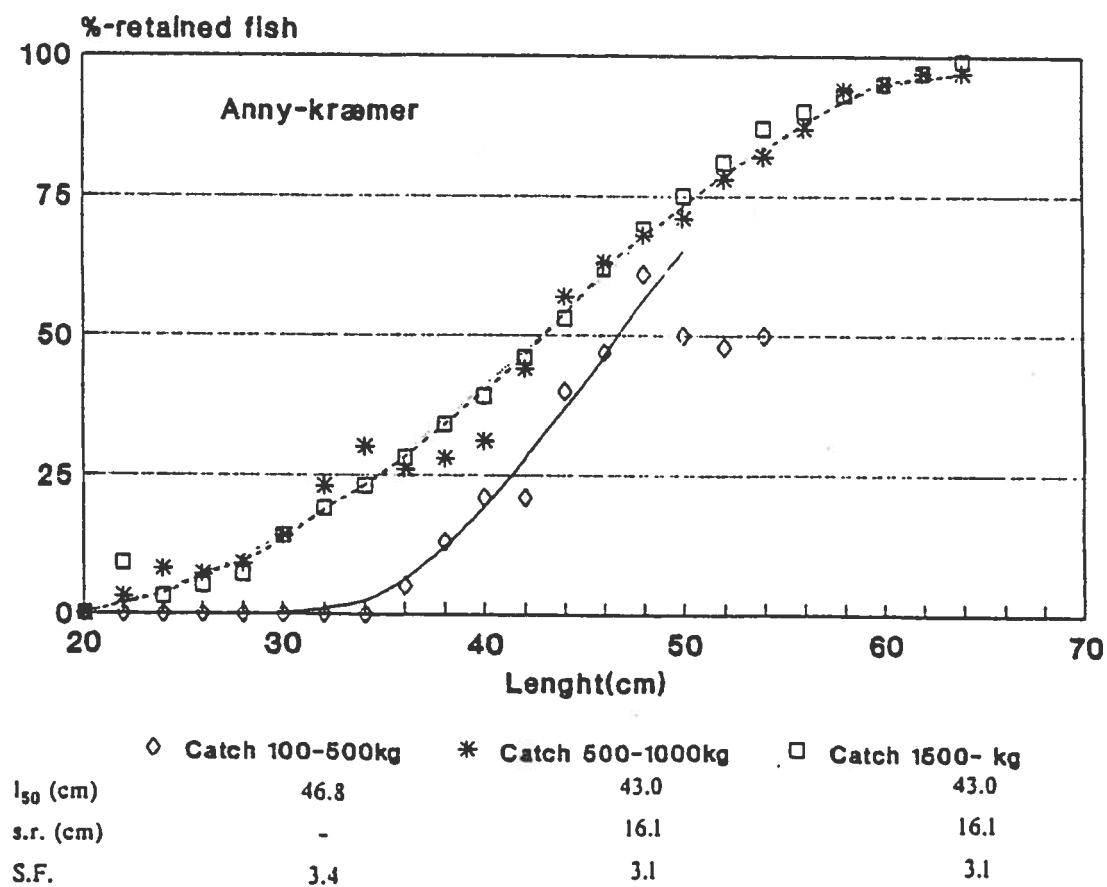
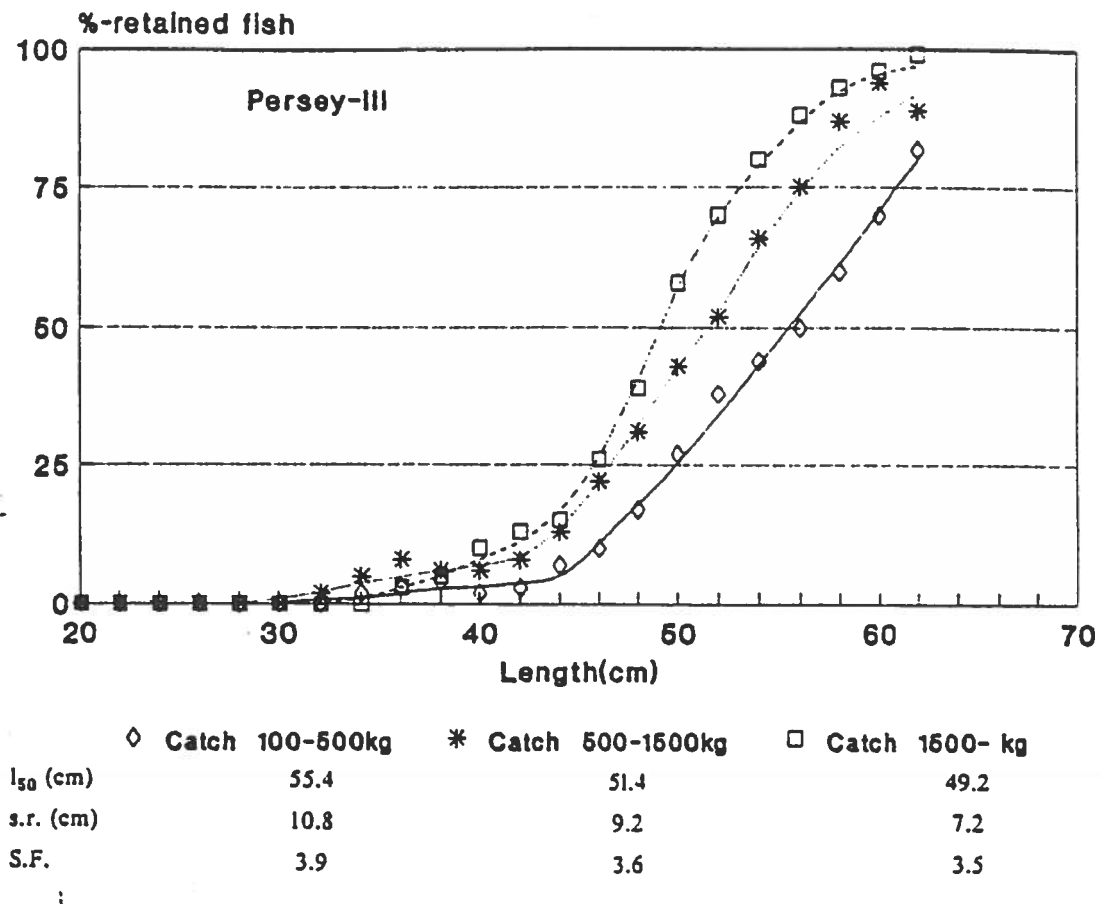


Figure 7. Selection oogives for haddock, bag type cover.

Selection oogives for cod, trouser trawl

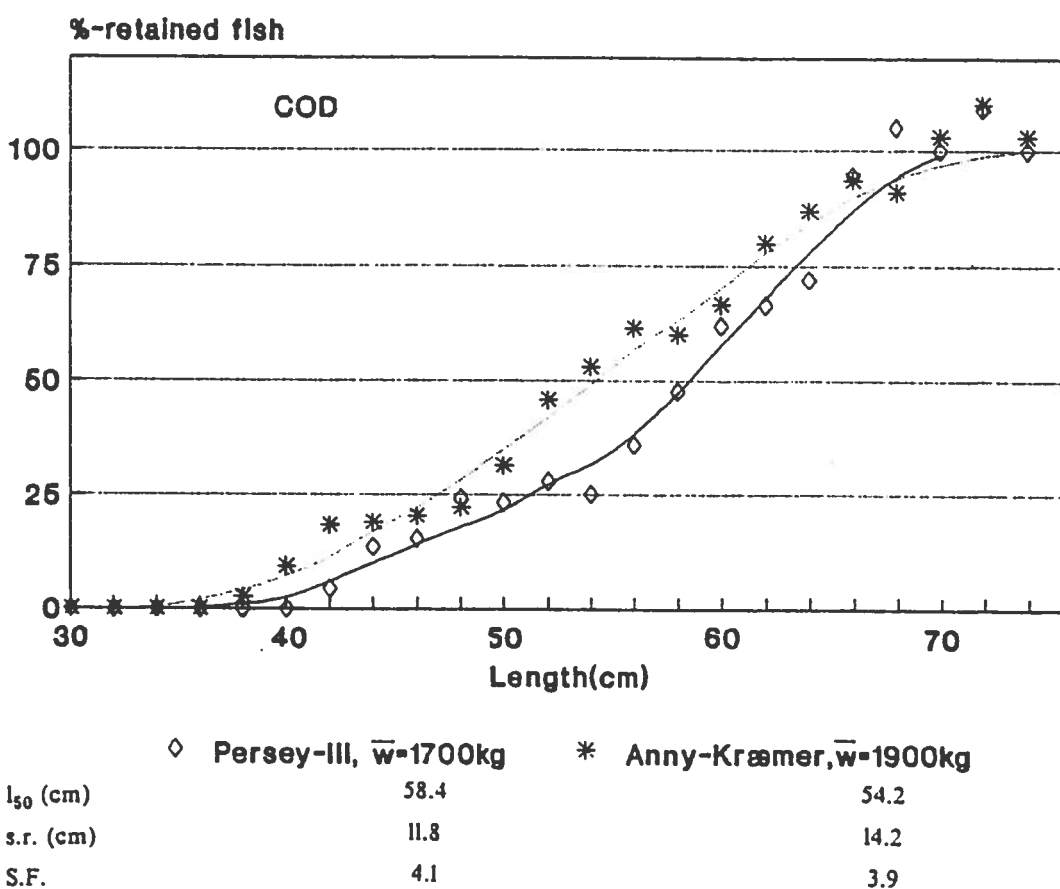
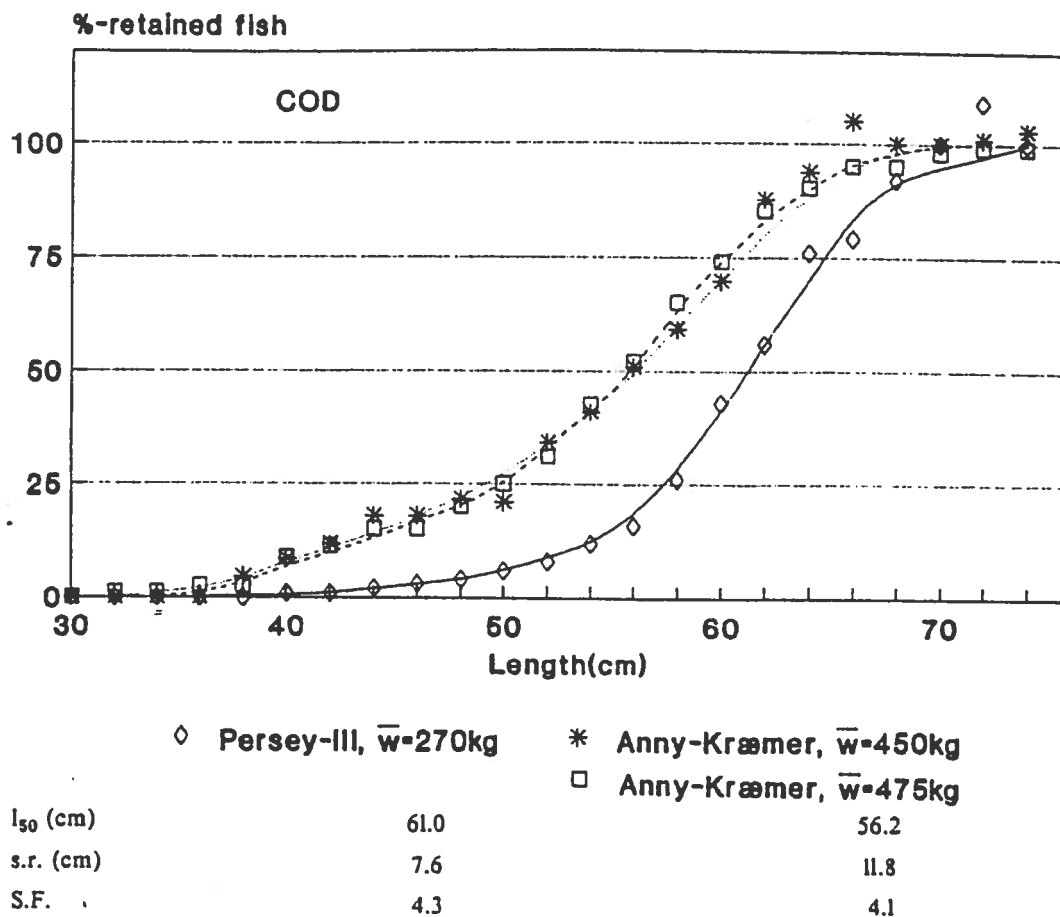


Figure 8. Selection oogives for cod, trouser trawl.
(R/V "Persey III": 143 mm, M/Tr "Anny Kræmer": 138 mm)

Selection oogives for haddock, trouser trawl

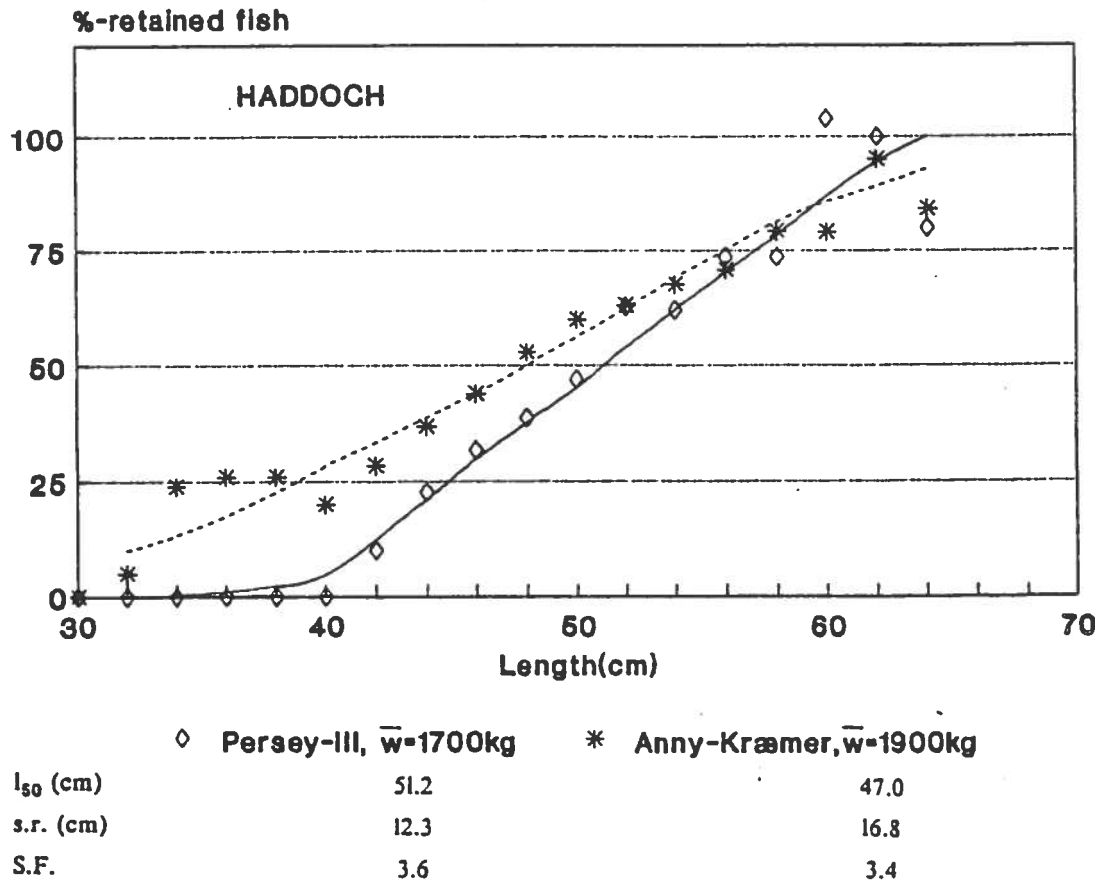
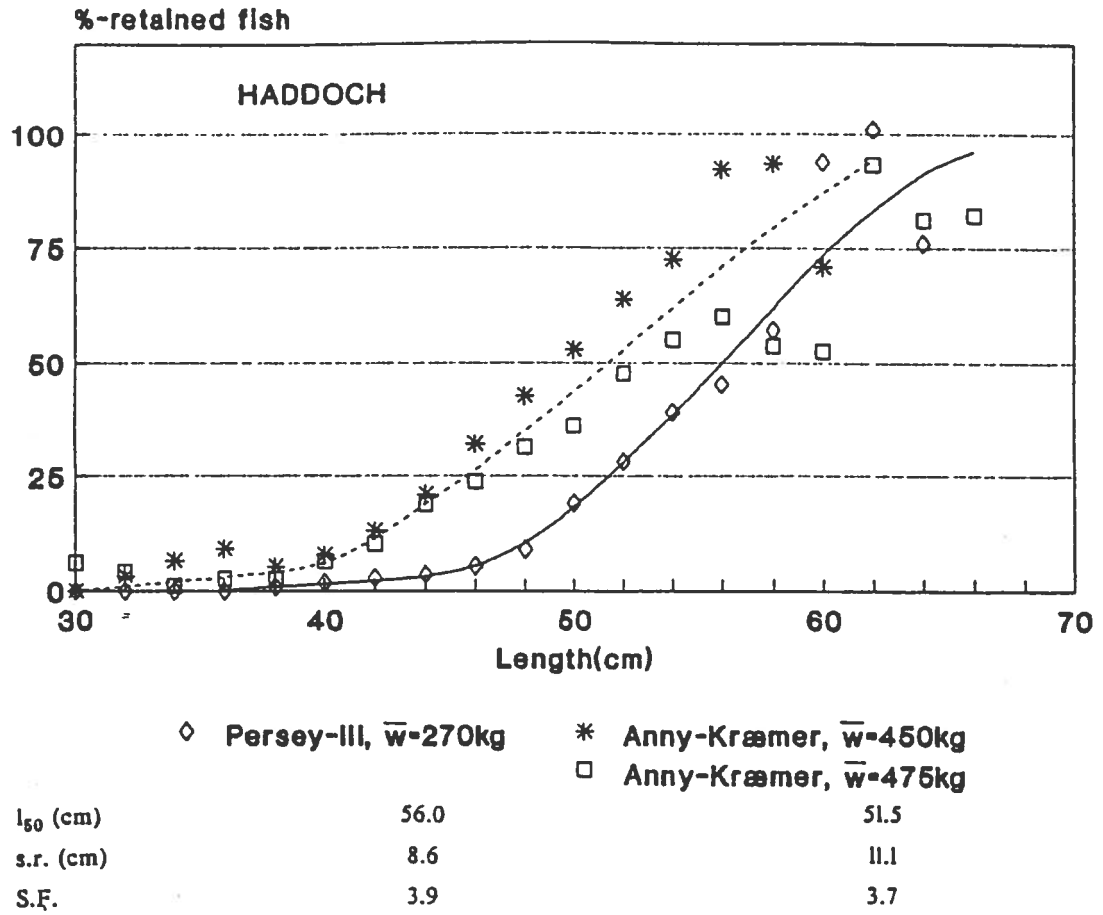


Figure 9. Selection oogives for haddock, trouser trawl.