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Summary

Mesh size selectivity experiments were conducted in 1979 and 1980 in order to assess the impact of an increase in mesh size to 9.0 cm on the sole fishery, as proposed by the E.E.C.
Experiments were carried out with three commercial beam trawlers (1015, 1235 and 1700 HP) in the North Sea and the Irish Sea, using the parallel haul technique and covered cod-end technique respectively.
The mean selection factor and standard deviation for all experiments was 3.3 ± 0.2. No significant influence of the engine power, mesh size and of the total catch weight in the wide cod-end on the selection factor could be established.

I Introduction

Since the extensive mesh size selection experiments on sole in the fifties using the otter trawl gear (Review in ICES, 1964), the fishery for sole changed considerably. In the early sixties the fleet of otter trawlers was gradually replaced by a fast growing fleet of predominantly Dutch beam trawlers.
In 1980 the average horse power (± 1100 HP) of the Dutch beam trawlers was about four times higher than in 1963 (± 250 HP). Nowadays the beam trawl fleet lands 95 % of the total catch of North Sea sole (ICES, 1980).

For 1982 the E.E.C. proposes to increase the mesh size from 8.0 to 9.0 cm. Data on the mesh selection of sole for beam trawlers are lacking. Therefore, experiments on mesh selectivity are urgently needed to assess the impact of a change in mesh size on the sole fishery.

BURD and VINCE (1979) and DE CLERCK and VANDEN BROUKE (1980) published preliminary results of the mesh selection experiments on sole on board of English and Belgian low powered beam trawlers respectively. In this paper the results of the Dutch experiments carried out in North Sea and Irish Sea in 1979 and 1980 with commercial vessels will be presented.

II Material and methods.

1. Introduction.

In order to obtain data which are representative for the present fleet of beam trawlers, three commercial vessels were chartered for the experiment.
The North Sea experiments were carried out with the old KW 34 (1235 HP) in 1979. The experiments in the Irish Sea were carried out with the WR 57 (1015 HP) and the new KW 34 (1700 HP).
The old KW 34 and WR 57 were fishing with two 10 m beam trawls with a speed of ± 5 knots over the bottom. The fishing gear of the old KW 34 was rigged with 12 tickler chains from the trawl heads and 12 smaller tickler chains from the ground rope. The WR 57 had 8 tickler chains from the trawl heads and 5 tickler chains from the ground rope.
The new KW 34 was fishing with 14 m beam trawls and a speed of 5.5 knots. The beam trawls were rigged with 10 tickler chains from the trawl heads and 6 smaller chains from the ground rope.

At regular intervals 25 meshes from the cod-end, cover or reference cod-end were measured, using a standard ICES spring loaded gauge with an operative pressure of 4 kg. In the first 6 experiments (22 October - 6 December 1979) an ICES gauge was used that did not block at 4 kg. Therefore, this gauge was calibrated and its measurements corrected. All technical data are summarized in Table I. In Table II details of the cod-ends used are given. Figure 1 presents a chart with the fishing positions.

2. Parallel haul technique.

This technique is a modification of the alternate haul method. Beam trawlers are particularly suited for this method because they can operate a gear with a small meshed cod-end (reference cod-end) and a gear with the wider cod-end simultaneously.
The length distribution of the population of fishes in the path of the trawl is sampled by the reference cod-end. The length distribution of the catch in the net with the wider meshes gives by substraction the escapement at each size class through the meshes.
With this technique differences in the efficiency of the fishing gears between port side and starboard may influence the number of fish entering the cod-ends before selection takes place. This difference will bias the results. Therefore, a correction factor was calculated to equalize the numbers of sole out of the range of the selection curve (sole > 30 cm). The correction factors for experiment 1 to 8 were respectively: 1.078, 1.081, 1.019, 0.915, 1.336, 1.294, 1.314 and 1.176.

3. Whole covered cod-end technique.

With this method the wide cod-end is covered with another cod-end of a smaller mesh size, as illustrated in figure 2. The fish escaping through the meshes of the wide cod-end are caught in the cover. On the top of the cover three series of three floats (4 litre) were fixed to separate the cover from the wide cod-end.

4. Fish measurements.

The catch of the wide cod-end and the reference cod-end (parallel haul technique) or cover (covered cod-end technique) were sorted seperately. Sub-samples were only taken in experiments 12 to 15. In a sub-sample at least 125 soles were measured to the centimetre below, whilst the remaining were counted. In the other experiments all soles were measured. Notes on the composition of the bycatch were made and the total weight of the catch in the cod-end and cover was estimated in baskets of 40 kg.

5. Selection curve.

For each experiment the data of the hauls were lumped in order to determine a selection ogive. For each length group the percentage of soles retained in the wide cod-end was calculated. To smooth the variation in these percentages the 3 point running mean was calculated for: the catch in the wide cod-end (Σ 3 w.c.), and the catch in the reference cod-end (parallel haul technique) or the catch in the wide cod-end + cover (covered cod-end technique) (Σ 3 total). From these running means the retention percentages are now calculated: (Σ 3 w.c./ Σ 3 total) * 100 %.
The rationale behind this procedure is to smooth the random variation in the retention percentages for those length groups for which just a few fishes were caught.
Following POPE et.al (1975) the selection curves were fitted by eye and 25 %, 50 % and 75 % retention lengths were read from the graphs.

III Results.

In Table III the results of the experiments are presented. The data base is given in Table VI. The selection ogives of each experiment are shown in figure 4.1 - 4.15.

Although the experimental method used in the North Sea differed from the one used in the Irish Sea, no significant difference between the selection factors was obtained, respectively 3.2 ± 0.1 and 3.3 ± 0.2. This year we hope to make two cruises in the North Sea with the covered cod-end technique to test this conclusion.

A first comparison of the selection factors in relation with the engine power did not reveal significant differences (Table IV), nor could we find a significant difference between the selection factors for different mesh sizes (figure 3).

With the data obtained in the Irish Sea in 1980 it was possible to analyse the influence of the total catch weight in the wide cod-end on the selection process. The total catch of the wide cod-end was divided in 5 weight classes of 4 baskets: 0.1 - 4.0, 4.1 - 8.0, 8.1 - 12.0, 12.1 - 16.0 and 16.1 - 20.0 baskets. The total catch in the wide cod-end consisted for 10 - 20 % of soles, 5 - 20 % of other fish and 75 % of rubbish. For each of these weight classes and for each experiment a selection curve was determined. The 50 % retention length was read from the selection curve in order to calculate the selection factor. In Table V the selection factors are given. A comparison between the selection factors of the different weight classes within each experiment does not show a consistent trend. Also when the results of experiments are lumped, the selection factors do not correlate with the catch weight ($r = 0.218$, $n = 17$, $P \gg 0.05$).

IV Discussion.

The selection factors found in this study are in agreement with those obtained by DE CLERCK and VANDEN BROUKE (1980) for the North Sea (3.1 - 3.2). The factor reported by BURD and VINCE (1979) for the North Sea (3.3) differs from the one for the Irish Sea (2.9). Because this might be due to differences in the covers used, it is difficult to assess the validity of their estimates.

A comparison of the beam trawl and otter trawl experiments does not indicate a marked difference between the mean selection factors and standard deviations, despite the considerable difference in both gear and fishing method (bycatch, twine, fishing speed, and so on). The selection ranges in the present experiments, particularly those with the covered cod-end, are slightly wider than for the otter trawl experiments.

ROESSINGH (1960), BOHL (1964), BURD and VINCE (1979), RAUCK (1980) and VAN BEEK, RIJNSDORP and VAN LEEUWEN (1981) were able to show that for several flatfish species with increasing catch weight or -volume, the selectivity of the net decreased. In view of the variation in selection factors found in our results (Table V), it is not possible to decide if the slightly lower selection factors for high catch weights are directly caused by a decreased selectivity of the net, or are just a result of random variation.

A comparison of the selection factors for the experiments with the 1015 HP, 1235 HP and 1700 HP vessels indicates only slightly higher selection factors for the 1015 HP vessels. In the experiments of DE CLERCK and VANDEN BROUKE (1980) with a 285 HP vessel, the selection factors (3.1 and 3.2) lie in the same range as those for the 1235 and 1700 HP vessels. These results indicate that there is no direct relationship between engine power and selection factor.

However, there is a tendency for a wider selection range with increasing engine power. The mean of the selection ranges increases from 3.5 to 5.7 cm in the range from 1015 HP to 1700 HP. The mean selection range in the experiments of DE CLERCK and VANDEN BROUKE (1980) is 3.3 cm which is in agreement with this tendency. The selection ranges obtained in the low powered otter trawl experiments of BOEREMA, MARGETTS and ROESSINGH (in ICES 1964 : 1.9 - 3.1) are consistent, but those obtained by GILLIS (in ICES, 1964 : 4.2 - 8.3) are inconsistent with these results.

Figure 3 indicates that the selection factor is not correlated with the mesh size, so that the mean selection factor of 3.3 will be the best estimate for the present fleet of beam trawlers.

An increase in minimum legal mesh size to 9.0 cm as proposed by the E.E.C. can be expected to increase the 50 % retention length of soles to 29.7 cm. In the years 1975 - 1979 about 40 % of the international landings (60 % in numbers) in the North Sea, and 50 % (64 % in numbers in the Irish Sea, consisted of soles smaller than 30 cm. On the short term an increase in mesh size will result in a considerable loss of marketable soles. An assessment of the long term effect on the yield should be subjected to further research. At this moment the minimum landing size of sole is 24 cm. When mesh size will be increased this minimum landing size should be reconsidered.

V. Literature.

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Table I – Technical data for the mesh size selectivity experiments on sole with beam trawlers in 1979 and 1980.

experiment number	date	method	fishing ground	number of hauls	tow duration mean	tow duration range	mesh size ± S.D. (mm) cod-end	N	mesh size ± S.D. (mm) cover or reference cod-end	N	mean catch (baskets 40 kg) all species ± S.D. cod-end	mean catch (baskets 40 kg) all species ± S.D. cover/reference cod-end	schipcharacteristics engine power (h.p.)	BRT	code
1	22-23 Oct. 1979	parallel haul	North Sea	12	23	10-40	81.0 ± 3	100	34.0 ± 2.1	100	6.3 ± 2.1	9.7 ± 3.9	1235	206	KW 34
2	14-15 Nov. 1979	parallel haul	North Sea	26	52	20-90	80.1 ± 3.0	50	33.4 ± 1.7	52	1.8 ± 1.0	2.9 ± 1.4	1235	206	KW 34
3	20-23 Nov. 1979	parallel haul	North Sea	16	75	30-120	82.9 ± 2.2	20	35.2 ± 1.8	60	4.8 ± 3.9	8.1 ± 6.1	1235	206	KW 34
4	20-23 Nov. 1979	parallel haul	North Sea	15	74	30-120	101.3 ± 2.1	90	34.7 ± 1.5	20	4.4 ± 2.1	6.5 ± 2.8	1235	206	KW 34
5	28-30 Nov. 1979	parallel haul	North Sea	19	123	105-130	80.3	100	31.5	100	6.8 ± 2.2	8.4 ± 2.4	1235	206	KW 34
6	4-6 Dec. 1979	parallel haul	North Sea	17	113	60-120	86.5 ± 3.0	126	33.5 ± 1.8	116	7.2 ± 1.9	8.5 ± 2.2	1235	206	KW 34
7	12-23 Dec. 1979	parallel haul	North Sea	15	60	60	83.9 ± 3.1	75	32.5 ± 1.5	75	4.3 ± 2.0	5.3 ± 2.5	1235	206	KW 34
8	21 Aug.- 2 Sept. 1980	parallel haul	Irish Sea	6	111	60-125	82.0 ± 3.5	25	32.6 ± 1.5	25	3.5 ± 1.2	6.0 ± 2.3	1015	230	WR 57
9	21 Aug.- 2 Sept. 1980	whole cover	Irish Sea	12	124	120-135	85.1 ± 2.1	75	37.3 ± 2.4	50	5.3 ± 2.0	6.2 ± 1.3	1015	230	WR 57
10	21 Aug.- 2 Sept. 1980	whole cover	Irish Sea	20	125	110-170	80.4 ± 2.2	125	36.7 ± 1.5	125	8.4 ± 1.7	3.0 ± 0.7	1015	230	WR 57
11	21 Aug.- 2 Sept. 1980	whole cover	Irish Sea	23	132	110-170	72.0 ± 3.6	125	40.5 ± 1.6	125	7.0 ± 1.7	2.3 ± 0.6	1015	230	WR 57
12	20-28 Oct. 1980	whole cover	Irish Sea	12	108	60-140	84.6 ± 2.1	50	35.0 ± 1.1	50	8.5 ± 3.6	2.6 ± 1.7	1700	285	KW 34
13	20-28 Oct. 1980	whole cover	Irish Sea	16	124	120-130	76.0 ± 3.4	100	36.5 ± 1.8	75	12.7 ± 2.9	2.3 ± 1.3	1700	285	KW 34
14	20-28 Oct. 1980	whole cover	Irish Sea	2	120	120	85.3 ± 4.9	77	± 35.		10.1 ± 5.8	5.0 ± 3.9	1700	285	KW 34
15	20-28 Oct. 1980	whole cover	Irish Sea	8	107	60-140	65.3 ± 2.2	125	36.5 ± 1.3	25	10.9 ± 6.0	2.8 ± 1.6	1700	285	KW 34

Table II - Netmaterial and construction.

Experiment number	mesh size	construction	number of meshes in Ø	number of meshes in length	material
Wide cod-end					
1	8	Double	100	50	nylon
2	8	D	100	50	nylon
3	8	D	100	50	nylon
4	10	Single	no data		
5	8	D	100	50	nylon
6	8.5	D	100	50	nylon
7	8	D	100	50	nylon
8	8	D	100	50	nylon
9	8.5	Single	100	50	nylon
10	8	D	100	50	nylon
11	7.5	D	100	50	nylon
12	8.5	D	100	50	nylon
13	7.5	D	100	50	nylon
14	8.5	D	) no data		
15	6.5	D	)		
covers: 9 - 15	3½	S	400	150	nylon

Table III - Results of the mesh size selectivity experiments on sole with beam trawlers.

Experiment number	Date	Method	mesh size (mm)	50% retention length (cm)	Selection factor	Selection/range 25% - 75% in cm	Number of soles in selection/range	Total catch of soles (numbers)
1	22-23 Oct. 1979	parallel hauls	81.0	25.6	3.2	23.1 - 28.1	115	346
2	14-15 Nov. 1979	parallel hauls	80.1	25.4	3.2	24.2 - 26.9	61	644
3	20-23 Nov. 1979	parallel hauls	82.9	24.9	3.0	22.6 - 26.8	57	593
4	20-23 Nov. 1979	parallel hauls	101.3	30.1	3.0	27.5 - 31.6	184	557
5	28-30 Nov. 1979	parallel hauls	80.3	26.0	3.2	23.1 - 27.7	149	772
6	4-6 Dec. 1979	parallel hauls	86.5	29.1	3.4	26.5 - 30.8	585	1458
7	12-13 Dec. 1979	parallel hauls	83.9	27.9	3.3	25.9 - 29.5	86	350
8	21 Aug. - 2 Sept. 1980	parallel hauls	82.0	29.4	3.6	27.9 - 30.9	193	992
9	21 Aug. - 2 Sept. 1980	whole cover	85.1	29.3	3.4	27.6 - 30.8	326	1832
10	21 Aug. - 2 Sept. 1980	whole cover	80.4	27.2	3.4	25.3 - 28.9	1411	3118
11	21 Aug. - 2 Sept. 1980	whole cover	72.0	23.4	3.3	21.2 - 25.5	1335	3180
12	20-28 Oct. 1980	whole cover	84.6	26.2	3.1	22.5 - 28.6	6557	9459
13	20-28 Oct. 1980	whole cover	76.0	24.2	3.2	20.4? - 26.7	10457	14480
14	20-28 Oct. 1980	whole cover	85.3	27.9	3.3	24.6 - 29.5	816	2017
15	20-28 Oct. 1980	whole cover	65.3	22.4	3.4	24.9		5476

Table IV - Summary of the results of mesh selection experiments on sole with beam and otter trawls.

Date	Method	Selection factors	Selection range (cm)	Number of experiments	Engine power
BEAM TRAWL					
This study:					
experiment: 1- 7	parallel haul	3.2 ± 0.1	4.1 ± 0.7	7	1235
experiment: 9-11	whole cover	3.4 ± 0.1	3.7 ± 0.6	3	1015
experiment: 8	parallel haul	3.6	3.0	1	
experiment: 12-15	whole cover	3.3 ± 0.1	5.8 ± 0.8	4	1700
TOTAL:		3.3 ± 0.2	4.3 ± 1.1	15	
Author:					
De Clerck and vanden Brouke	whole cover	3.14± 0.05	3.3 ± 0.8	4	285
OTTER TRAWL					
Authors:					
Boerema	full cover	3.3 ± 0.1	2.8 ± 0.4	7	
Furnestein	cover	3.4 ± 0.2	-	4	
Gillis	top cover and whole cover	3.3 ± 0.2	6.0 ± 1.3	8	
Margetts	top cover	3.3 ± 0.2	2.7 ± 0.2	3	
Roessingh	full cover	3.5 ± 0.1	2.0 ± 0.1	2	
TOTAL:		3.3 ± 0.2	4.0 ± 1.9	24	

Table V - Relation between weight of total catch (fish + rubbish) in wide cod-end and selection factor. Between brackets is the number of hauls over which the data were lumped.

Ship	experiment	mesh size	weight cod-end (baskets of 40 kg)				
			0.1 - 4.0	4.1 - 8.0	8.1 - 12.0	12.1 - 16.0	16.1 - 20.0
WR 57	11	7		3.2 (21)	3.3 (1)	3.4 (1)	
WR 57	10	8	3.3 (9)	3.4 (8)	3.4 (12)		
WR 57	9	8.5	3.5 (4)	3.4 (8)	3.5 (1)		
KW 34	12	8.5	3.0 (3)	3.2 (3)	3.1 (4)	3.0 (2)	
KW 34	13	7.5		3.2 (1)	3.2 (6)	3.2 (6)	3.1 (3)

Table VI - Length distribution of soles in cod-end and reference cod-end (experiment 1 - 8) or cover (experiment 9 - 15). All hauls combined.

Experiment number	1			2			3			4			5			6		
Mesh size (mm)	81.0			80.1			82.9			101.3			80.3			86.5		
Length (cm below)	8 cm cod-end	4 cm cod-end	Ret. % (Σ3)	8 cm cod-end	4 cm cod-end	Ret. % (Σ3)	8 cm cod-end	4 cm cod-end	Ret. % (Σ3)	10 cm cod-end	4 cm cod-end	Ret. % (Σ3)	8 cm cod-end	4 cm cod-end	Ret. % (Σ3)	8½ cm cod-end	4 cm cod-end	Ret. % (Σ3)
≤9		5	0								1	0						
10		32	0											1	0			
11		9	0								3	0						
12		7	0								3	0						
13		6	0								1	0		1	0			
14					2	0					1	0		3	0			
15								1	0					1	0			
16					2	0					1	0		1	0			
17		1	0		1	0					1	0		8	6			
18		1	19		7	0		3	0		1	0	1	4	5			
19	1	3	9		10	0		1	11		5	0		4	8			
20		6	9		7	0	1	5	16		2	0	1	12	11		2	4
21		1	10		12	0	1	6	20		6	0	4	19	11	1	16	10
22	1	2	21		14	6	3	13	28		9	4	1	12	22	2	6	16
23	1	6	39	2	6	12	3	6	28	1	13	4	6	6	31	7	28	16
24	6	11	41	2	10	45	1	6	45		5	12	5	11	37	11	61	16
25	11	24	41	11	15	41	8	14	62	2	10	20	14	34	43	11	53	15
26	15	38	53	17	42	75	24	32	72	3	13	23	39	56	58	22	112	21
27	28	33	76	49	38	80	41	53	82	8	40	21	63	61	71	48	140	28
28	41	32	98	60	65	85	54	57	82	8	44	28	91	87	87	70	132	46
29	31	30	106	62	84	80	67	83	102	17	46	41	106	76	91	123	132	58
30	24	22	97	76	81	91	76	50	102	26	47	53	107	86	100	122	156	74
31	13	13	111	79	55	99	60	62	111	24	45	79	80	58	98	165	139	82
32	23	15	115	36	43	106	41	44	92	45	40	94	63	47	102	190	155	101
33	10	9	119	38	35	93	30	33	96	39	40	113	43	31	92	149	91	104
34	8	8	93	34	29	101	36	33	110	40	40	105	45	50	97	109	88	112
35	7	8	85	25	25	101	39	28	119	39	43	109	58	32	91	72	48	106
36	8	9	93	22	20	88	33	28	115	40	36	94	35	32	113	50	33	96
37	9	7	93	13	18	81	10	14	109	18	34	95	23	13	99	24	36	90
38	3	4	93	6	9	83	9	5	103	13	12	78	12	8	132	17	9	74
39		1	93	6	1	100	4	3	147	6	6	132	9	4	112	4	2	138
40	2		93	1	2	100	2	2	74	4	1	132	6	6	112	13	8	96
≥41		3	46	7	10	62	3	7	55	11	8	182	12	8	96	9	11	89

Table VI (continued)

Experiment number	7			8			9			10			11			12		
Mesh size (mm)	83.9			82.0			85.1			80.4			72.0			84.6		
Length (cm below)	8 cm cod-end	4 cm	Ret. % (Σ3)	8 cm cod-end	4 cm	Ret. % (Σ3)	8½ cm cod-end	cover	Ret. % (Σ3)	8 cm cod-end	cover	Ret. % (Σ3)	7 cm cod-end	cover	Ret. % (Σ3)	8½ cm cod-end	cover	Ret. % (Σ3)
<9																		
10																		
11																		
12		2	0															
13		2	0															
14																		
15																4	8	33
16		1	25											1	0	4	8	29
17	1	2	38											1	0	12	32	27
18	1	1	29					1	0					1	20	26	71	23
19	1	5	14		1	0		1	14		2	0	1	2	14	26	116	22
20		5	8		9	3	2	12	4		20	5	1	9	17	76	277	22
21	1	8	8	1	30	3	2	73	3	4	61	8	14	70	32	177	597	23
22	1	7	18	2	77	3	2	149	4	16	162	10	88	138	40	294	909	25
23	3	6	21	4	127	3	12	214	4	41	307	13	156	180	51	366	1064	29
24	3	13	13	6	166	4	12	276	6	70	393	17	268	176	64	523	941	34
25	2	28	18	12	180	9	27	257	9	115	390	26	413	110	75	483	637	43
26	7	11	23	32	164	13	34	217	15	203	289	39	394	71	85	477	399	54
27	11	26	45	21	101	22	50	160	24	214	140	55	353	29	90	526	247	64
28	23	34	58	29	53	32	59	67	37	175	60	71	236	6	95	356	131	73
29	30	25	79	21	33	54	43	37	55	129	11	84	149	6	97	224	31	82
30	46	38	86	15	17	69	35	10	69	103	4	96	118	4	97	173		94
31	27	28	97	16	14	88	29	1	89	85		98	82	1	97	96		100
32	38	21	108	10	9	94	25		99	60		100	45	2	98	59		100
33	27	16	117	4	4	71	13		100	33		100	28		98	41		100
34	15	15	103	2	6	77	6		100	19		100	14		100	11		100
35	24	18	93	3		100	3		100	4		100	7		100	17		100
36	15	11	105	2		595	1		100	4		100	3		100	11		100
37	12	8	105	2	1	350	1		100	1		100	2		100	3		100
38	9	8	91			255	1		100	1		100	1		100	3		100
39	4	5	81	1						1		100				3		100
40	5	4	82							1		100						
>41	4	3	98															

Table VI (continued)

Experiment number	13			14			15		
Mesh size (mm)	76.0			85.3			65.3		
Length (cm below)	7½ cm cod-end	cover	Ret. % (Σ3)	8½ cm cod-end	cover	Ret. % (Σ3)	6½ cm cod-end	cover	Ret. % (Σ3)
≤9									
10									
11									
12									
13		4	0						
14									
15								1	21
16		4	8				3	10	19
17	3	32	6		4	0	3	15	38
18	2	22	19		9	17	16	11	32
19	21	55	27	6	17	15	15	45	45
20	60	147	31	9	58	17	75	75	41
21	254	547	34	27	133	17	139	205	45
22	581	1025	38	54	235	19	338	389	49
23	989	1315	45	72	287	21	475	396	59
24	1301	1187	54	91	281	24	653	225	70
25	1420	685	63	63	154	31	676	145	81
26	1092	377	74	84	89	37	507	56	88
27	1175	208	83	60	114	48	395	24	92
28	752	44	90	63	17	52	221	21	94
29	573	20	96	33	12	81	156	4	94
30	249	1	97	24		86	99	4	97
31	129	4	99	15		100	44		98
32	90	2	97	3		100	16		100
33	42	3	93	3		100	7		100
34	11	5	99				7		100
35	10		86				4		100
36	17	1	97						
37	7		97						
38	5		100						
39	9		100						
40									
≥41							1		100

Figure 2 - Diagram of rigging the cod-end cover with floats.

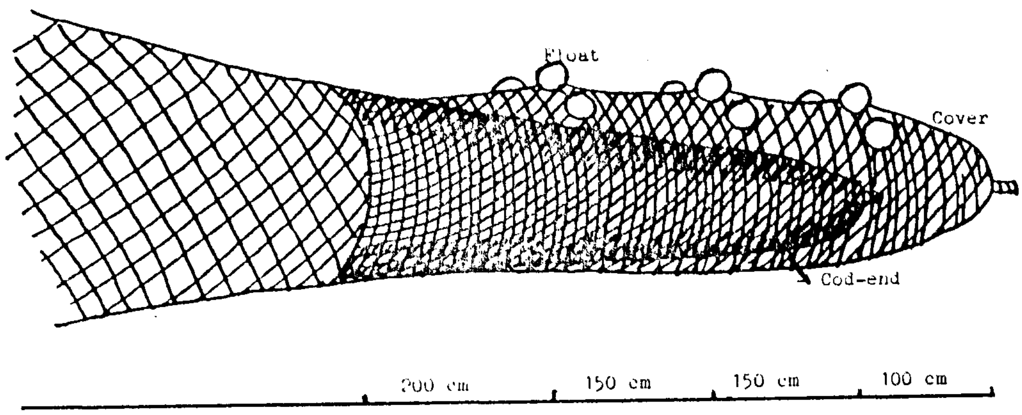


Figure 1 - Position of experiments on mesh size selectivity in 1979 (North Sea) and 1980 (Irish Sea).

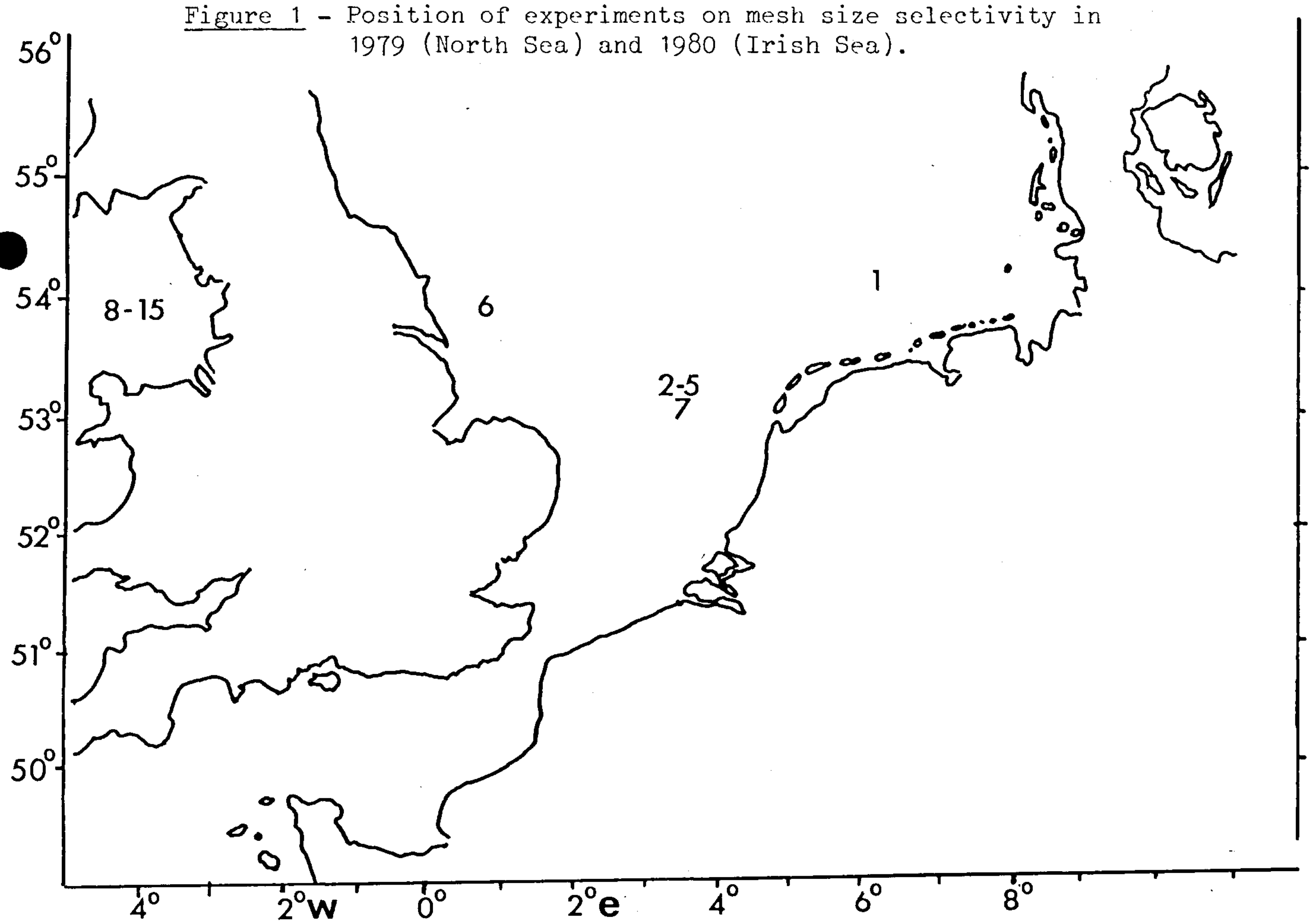


Figure 3 - Relation between selection factor and mesh size.

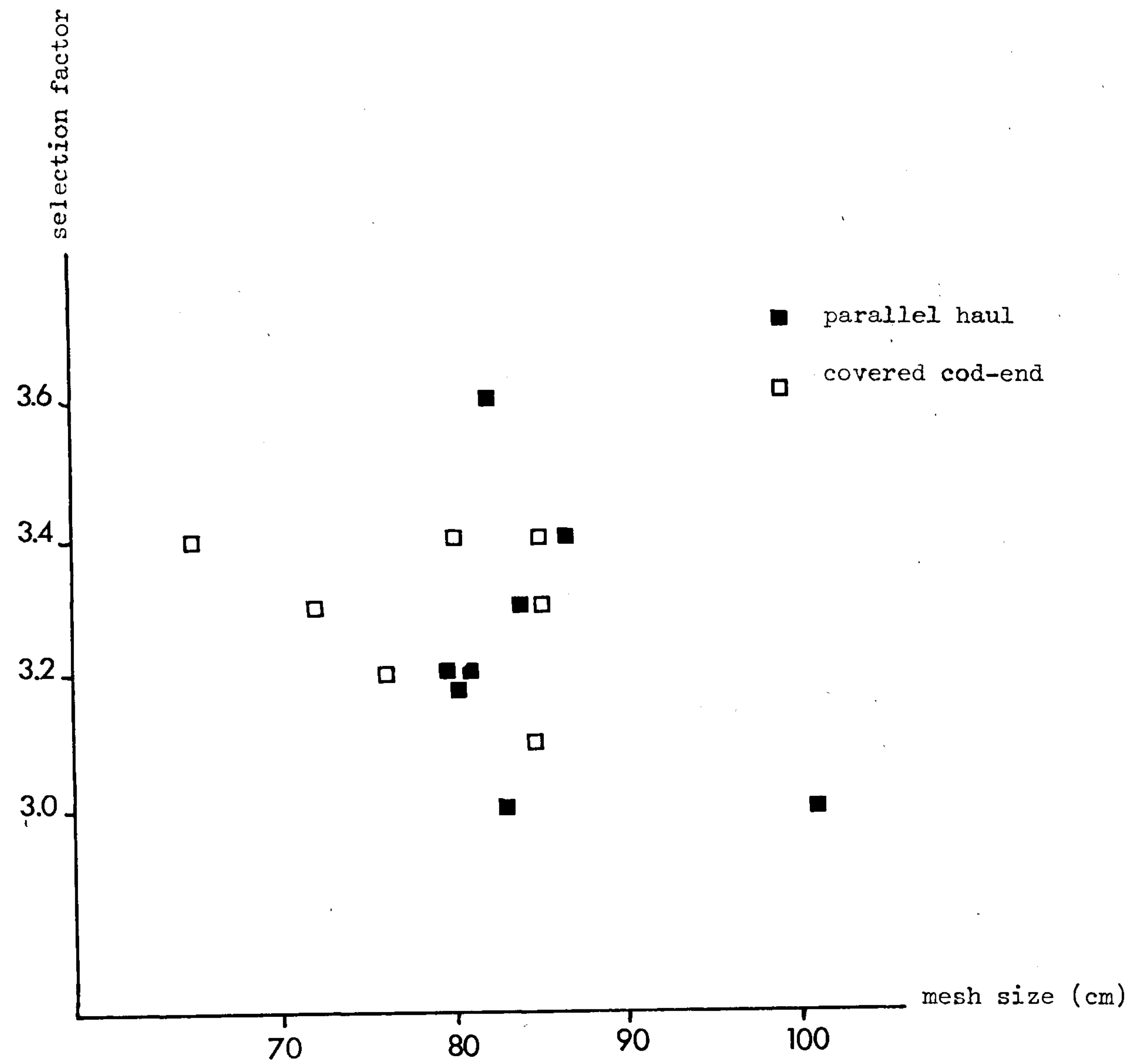
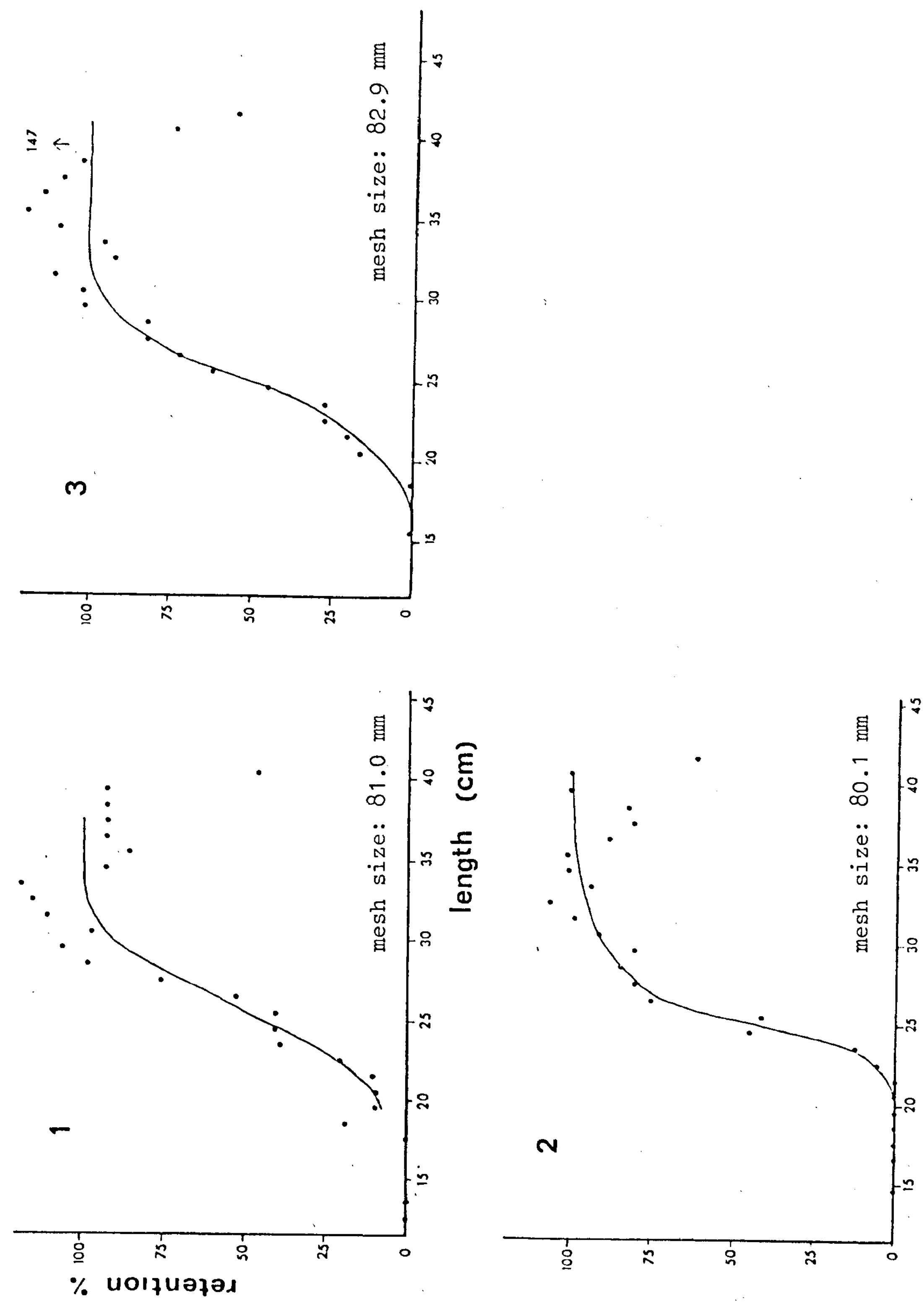


Figure 4.1 - 4.15: Selection curves of the experiments 1 - 15.
Parallel haul : 1 - 8
Covered cod-end : 9 - 15



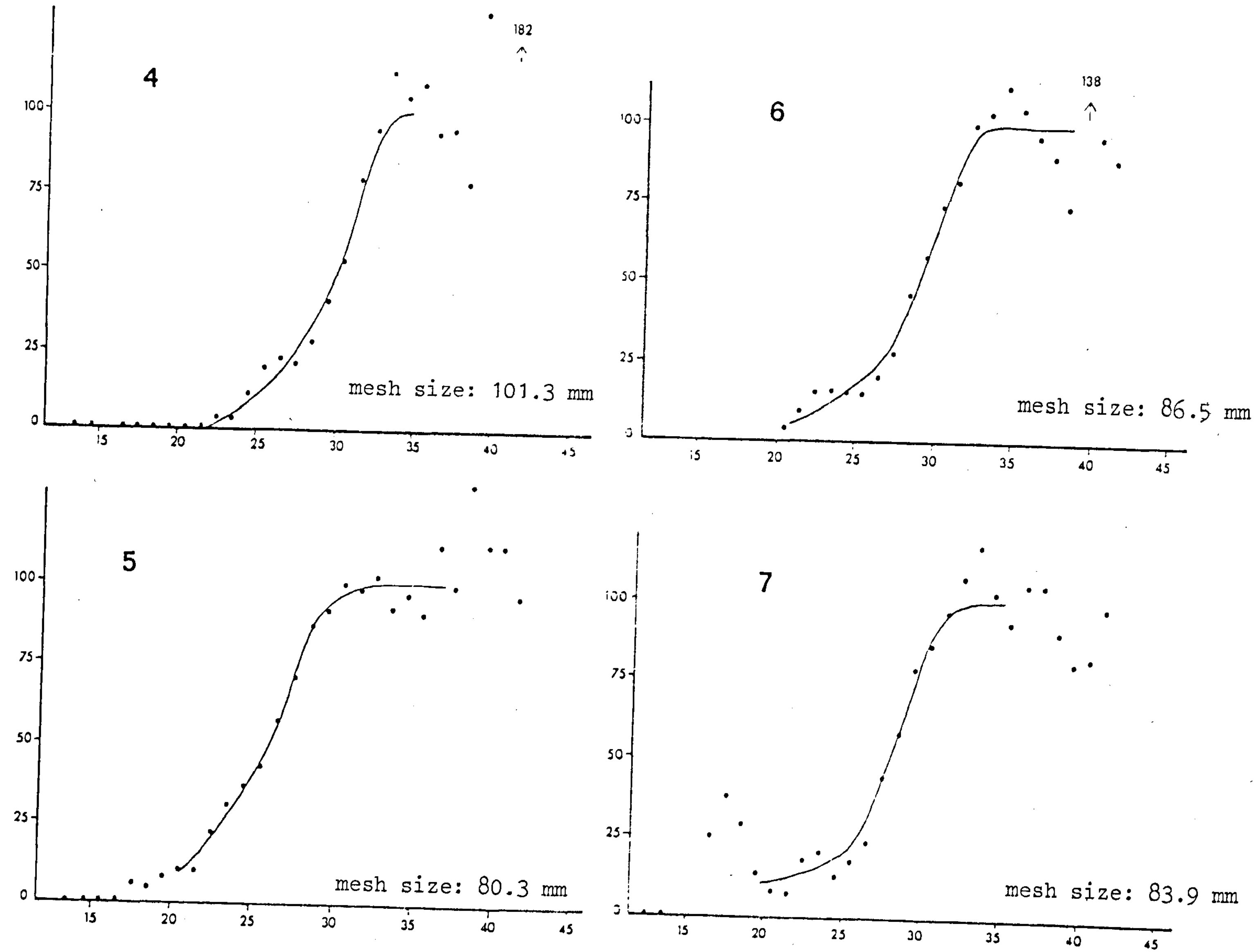


Figure 4.1 – 4.15: continued.

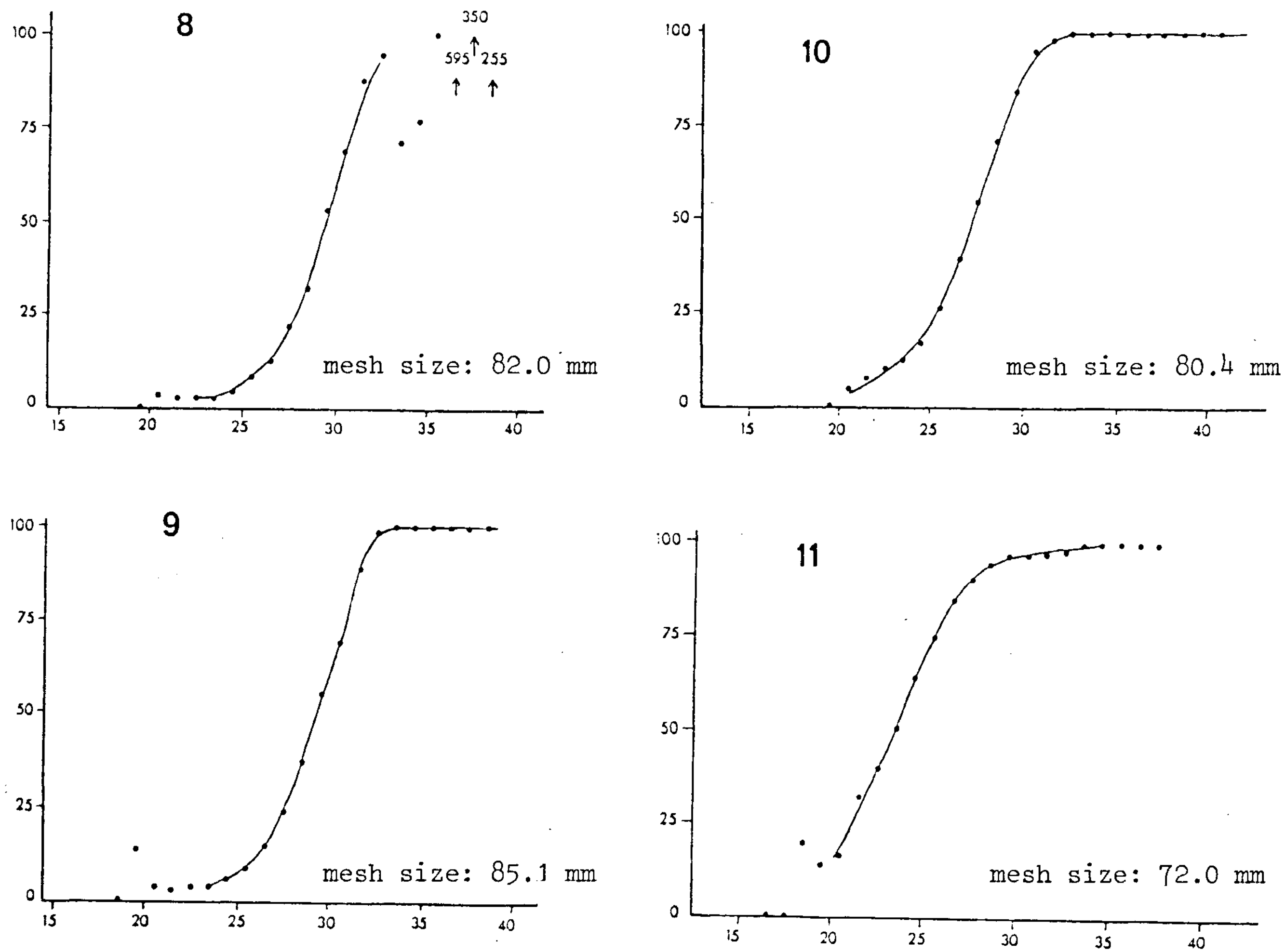


Figure 4.1 - 4.15: continued.

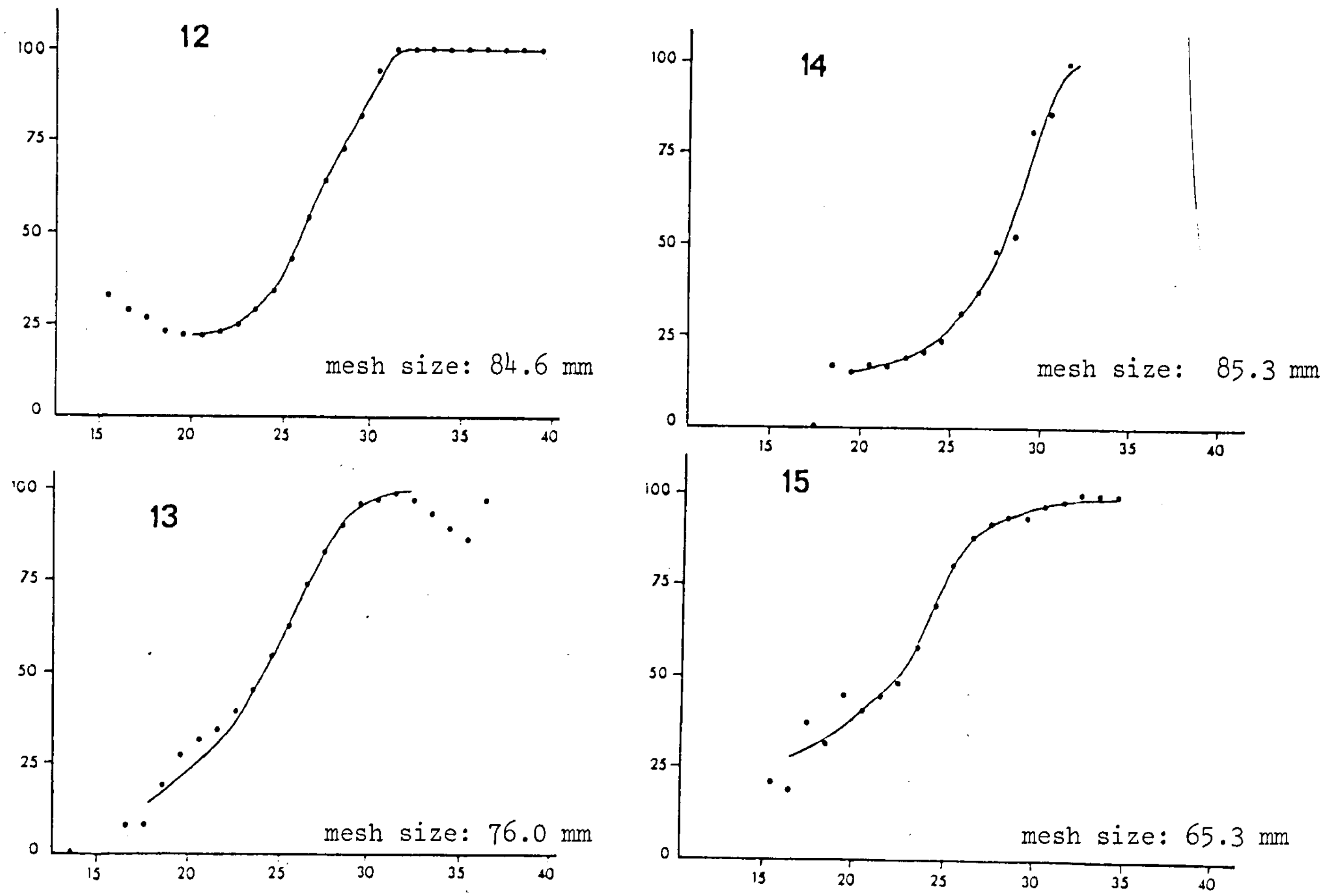


Figure 4.1 - 4.15: continued.