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"MESH SELECTION IN THE ROUND FISH SEINE"

by

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Mesh Selection in the Round Fish Seine

Most of our knowledge of mesh selection is based on data derived from the trawl net. However, the Danish seine net has for many years been an important gear for capturing flat fish, and during the last thirty years a similar net has been modified progressively for catching round fish, particularly in the Scottish fishery. It has become increasingly necessary, therefore, to have an understanding of mesh selection, etc. in this net.

Not unnaturally, perhaps, the general tendency has been to assume that the selection principles and standards were similar to those of the trawl. There is very little reference to this subject in the literature, although Bowman (1928) drew attention to the apparent tendency for the seine to release more small fish than the trawl. He considered this to be a smaller factor in flat fish and more serious in the haddock. Jensen, in his review of mesh selection (1949), referred to the scanty evidence then available, whilst Margetts (1949) presented the first precise data for the seine and the trawl fishing side by side. In confirmation of the work outlined below, this published evidence has just been reviewed critically by Graham, Beverton, Gulland and Margetts (1953). In brief, they come to the conclusion that there is an over-all difference in the selective effect of the two gears, with the seine liberating relatively larger fish than does the trawl. Although the available data referred chiefly to plaice, there were indications that this generalisation would apply also to dabs and haddock.

Meanwhile, new data on the selectivity of seines of different meshes have been acquired since the end of the war, and particularly during 1953. This work was part of the programme of gear investigations being undertaken at Aberdeen. Preliminary results obtained during 1949-52 bore out in general the results obtained by Bowman (1928), both for flat fish and particularly for the round fish, haddock and whiting. A larger experiment in June of this year, in which two commercial seiners were chartered to fish seine nets with three different cod-end meshes, one against the other, on the same grounds, added substance to these preliminary results. A more extensive series of seine hauls was then taken, in August and September, with research and commercial trawlers working over the same grounds in order to provide comparative data. In a large proportion of the hauls the cod-ends were covered with small mesh to catch the escaping fish. The results have confirmed the earlier ones sufficiently to justify a report.

This deals mainly with seiner/seiner comparisons, using the 70 mm. trawl cod-end catches to provide the conventional idea of the fish population on the grounds in question. An associated paper (Graham, Margetts and Gulland, 1953) from the Lowestoft Laboratory, will be more particularly concerned with comparing seiner catches with trawler catches. For brevity, most of the information is confined to the haddock data, although whiting, hake and some flat fish were caught in useful numbers. The results are mainly confined to those obtained in August, 1953.

Various grounds have been sampled during these experiments, but most of the present material was obtained from the grounds some 10-20 miles N x W of Kinnaird Head, on the Scottish East Coast. Table 1 and Figure 1 give the over-all size distribution of haddock on the grounds as indicated by the 70 mm. cod-end catches of the trawl. There was no major change in the population during the month, but there was a tendency for the proportions of the larger haddock, as indicated by this gear, to increase. The haddock stock was evidently of two main size groups - a major one at 23-26 cm. and a minor one (as revealed by the trawl catches) at 29-33 cm.; the maximum size caught was 56 cm. The trawl cod-end catches suggest that there were roughly four times as many fish of the smaller size group as the larger.

In Table 2 and Figure 2 are shown the size composition of haddock in the corresponding 70 mm. cod-end catches from the seine nets, fished alongside the trawlers, together with the corresponding totals including the cover catches. Since this paper is not concerned with the comparative catching power of the

seine net and the trawl (discussed by the Lowestoft team), the seine graphs have been arranged for convenience so that their height roughly corresponds with that of the 70 mm. trawl graph. According to the seine cod-end catches, the fish stocks available would have been judged to consist chiefly of the larger size group of fish, with less than half as many of the smaller size group. However, the total catches (combined cod-end and cover catches) show quite clearly that the stock fished by the seiner really included a much larger proportion of the smaller fish (23-26 cm.) than was caught in the cod-end. There were approximately three times as many of the smaller size group in the cover as in the cod-end, thus showing that the stock of haddock fished by the seiners was of approximately the same size composition as that fished by the trawl. It is at once apparent that the 70 mm. seine net was permitting a much larger proportion of this smaller size group to escape through its cod-end meshes than did the trawl of the same mesh size.

Table ³ 2 and Figure 3 show the size compositions in comparable seine-net catches with 70 and 80 mm. cod-ends taken in a systematic series during the course of this experiment, together with the catches from a smaller number of 60 mm. hauls interspersed rather irregularly with those of the 70 and 80 nets. These results show that by changing from 60 to 70 mm. seines, in this population, the total catch was greatly reduced due mainly to a large reduction in the catch of unmarketable haddock, although some marketable haddock were also lost. Comparable shots with the 80 mm. mesh provided a further reduction in the catch of both groups. Simply for comparison, Table 4 and Figure 4 show another set of such catches (this time from 64 and 80 mm. seine nets), over different areas, in June. The differences happen to be even more striking, presumably because these catches sampled a different population and because of the greater mesh difference.

It is important to consider just what these graphs signify. They indicate that the seine net at any given mesh is selecting fish differently from the trawl net. This is shown particularly by comparing Figures 1 and 2. The seine net tends to release more haddock of the smaller sizes than the trawl and, indeed, to release haddock of a larger size than does the trawl. This effect increases progressively as one changes from 60 mm. to 70 mm. and then to 80 mm. cod-end meshes.

There are other ways in which this difference can be examined. In most of the August fishing the seine net cod-ends were covered with loose bags of fine netting in order to investigate the cod-end mesh selection properties of the seine.

Now, whatever the nets we are using, one measure of this is given by that length in the size-range of fish available at which a fish has approximately a 50 per cent. chance of being released or retained. Figure 5 presents the information we have obtained on this subject. First, it shows the ranges of haddock lengths within which the 50 per cent. release points are considered to lie for haddock being fished by seine nets of 60, 70 and 80 mm. cod-ends. They are, of course, increasing and the range for each is quite separate from those of the others. The next important thing is that these ranges are each quite different from the corresponding ranges within which the 50 per cent. escape lengths lie for haddock caught by trawl cod-ends of corresponding meshes. These are also indicated in Figure 5 and the differences are quite distinct.

Looking at this from another point of view, we are really discussing how easy it is for a fish to slip through the mesh of the net, and here we are concerned with the girth of the fish. One can think of the girth of the body, which is both variable and compressible, and the girth of the head which is much less so. Measurements of various dimensions, both of haddock and whiting, made on northern North Sea fish during May 1953, suggest that probably the latter is the better measure to use. This is quite simply related to the length of the fish, and Figure 6 shows this relationship, on the average, for haddock of lengths between 20 and 42 cm. Roughly, the length is rather more than twice the head-girth (Pope, 1953, in preparation for publication).

We know that meshes in the trawl are stiff. Not only is the twine relatively stiff, but the Lowestoft film of the trawl shows the cod-end meshes as

being rigidly diamond-shaped. In contrast, it is obvious from the Aberdeen film of the seine net that its cod-end meshes are much more limp than those of the trawl, and we all know that the twine is much finer. Now, if the meshes were simply free loops, then the maximum girth values which the 50 per cent. release points could have would be approximately equal to the circumferences of the appropriate mesh squares. So it is easy to assess these for each of the 60, 70 and 80 mm. meshes. They are approximately as follows:- 120, 140 and 160 mm. The head-girth/length relationship shows that the fish length corresponding to each of these is appreciably greater (by about 20 mm.) than the experimentally determined 50 per cent. lengths for the seine net (Figure 5) and, of course, much greater than those for the corresponding trawls. This seems to be a sensible result, for it is hardly to be expected that the seine net meshes would be perfectly limp, except during the early stages of fishing. Later the water pressure makes them loosely diamond-shaped, and the tension must increase as the bag fills with fish (again shown by the film). Evidently the shape of the seine mesh is less rigidly fixed during fishing than is that of the trawl, and thus permits the escape of fish with girths nearer the maximum value than does the trawl mesh of the same size.

For the haddock, the seine net results seem to be quite clear, both in the catch and selection differences between seines of different mesh sizes, and in their selection differences from the corresponding trawl selections. The data for other fish caught during these experiments are still being examined. At present it can only be said that the tendency in a number of them is similar, particularly in the whiting. It is intended to present detailed results for the other fishes, together with many other aspects of the work, in another paper.

Meanwhile, it may be concluded that for the haddock there are marked differences in selectivity between the seine net and the trawl. The data illustrated in Figure 5 suggest that for equivalence in haddock selectivity the trawl cod-end mesh should be at least 10 mm. greater than that of the seine.

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TABLE 1

F.P.S. "EXPLORER"

Length Composition of Haddock Caught by Trawl with 70 mm. Cod-EndMORAY FIRTH, August, 1953(12 hauls = 15 hours' fishing)

Length (cm).	Total Numbers caught.	Number per 10 Hours. (Slide rule accuracy)	Frequencies smoothed in 3's.
20	8	5	11
21	41	27	36
22	115	77	95
23	273	182	179
24	419	279	243
25	400	267	240
26	260	173	175
27	126	84	103
28	80	53	60
29	65	43	49
30	78	52	47
31	67	45	49
32	73	49	42
33	50	83	36
34	41	27	26
35	26	17	19
36	18	12	13
37	14	9	10
38	12	8	6
39	2	1	3
40	3	1	1
41	2	1	1
42	2	1	1
43	3	1	1
44	3	1	1
45	2	1	1
46	2	1	1
47			
48			
49			
50	1	-	
> 50	5	3	
TOTAL	2191	1503	

TABLE 2

COMMERCIAL SEINERS, MARGARET HERD AND HELEN HERD

Length Composition of Haddock Caught by Seine With 70 mm. Cod-End

MORAY FIRTH: August, 1953

(Number of hauls = 37)

LENGTH (cm.)	TOTAL Numbers caught in cod-end	TOTAL Numbers in cod-end plus cover	Numbers in cod-end per 6 Hauls (Slide rule accuracy)	Frequencies smoothed in 3's	Numbers in cod-end plus cover per 6 Hauls (Slide rule accuracy)	Frequencies smoothed in 3's
18		7			2	2
19	2	30			5	8
20	12	110		3	18	27
21	48	358	2	11	58	68
22	135	788	8	19	128	131
23	234	1278	22	39	207	200
24	358	1629	38	51	264	221
25	355	1185	58	54	192	194
26	276	772	45	45	126	130
27	194	445	31	39	72	87
28	247	396	40	44	64	73
29	383	514	62	62	83	84
30	516	644	83	80	104	102
31	590	696	95	86	118	104
32	498	563	81	80	91	93
33	397	435	64	63	71	69
34	268	281	43	45	46	49
35	178	182	29	28	29	29
36	75	76	13	18	13	18
37	65	65	11	10	11	10
38	34	34	5	7	5	7
39	25	25	4	4	4	4
40	18	18	3	3	3	3
41	13	13	2	2	2	2
42	5	5	1	1	1	1
43	1	1	1	1	1	1
44	2	2				
45	1	1				
46						
47						
48						
49						
50						
> 50						
TOTAL	4930	10553	799		1718	

TABLE 3

COMMERCIAL SEINERS: "MARGARET HERD" and "HELEN HERD"

Length Composition of Haddock in 60, 70 and 80 mm. seine cod-end catches

MORAY FIRTH: AUGUST 1953

Length (cm.)	Total Numbers caught	Total Numbers caught	Total Numbers caught	Numbers per 25 hauls	Numbers per 25 hauls	Numbers per 25 hauls	Frequencies smoothed in 3's.		
	60 mm. (8 hauls)	70 mm. (37 hauls)	80 mm. (27 hauls)	60 mm. Slide	70 mm. Rule	80 mm. Accuracy	60 mm.	70 mm.	80 mm.
19		2			1			3	
20	17	12	1	53	8	1	53	14	3
21	34	48	7	106	32	7	106	44	15
22	51	135	40	158	91	37	192	94	33
23	100	234	60	312	158	56	402	163	55
24	234	358	80	735	241	74	686	213	71
25	324	355	90	1010	240	83	885	222	74
26	290	276	70	909	186	65	807	186	76
27	161	194	38	501	131	81	582	161	76
28	108	247	89	337	167	82	416	135	94
29	131	383	130	410	258	120	407	258	127
30	152	516	195	475	350	180	489	336	143
31	186	590	183	582	400	128	554	362	138
32	193	498	156	604	336	105	539	334	114
33	138	397	116	432	266	108	467	261	100
34	117	268	105	366	182	97	346	189	93
35	75	178	79	241	120	73	255	118	70
36	51	75	43	159	51	40	162	72	49
37	27	65	36	85	44	33	94	39	28
38	12	34	12	37	23	11	47	28	18
39	6	25	10	18	17	9	24	17	10
40	6	18	11	18	12	10	13	13	8
41	1	13	6	3	9	6	8	8	6
42	1	5	2	3	3	2	5	4	3
43	3	1	2	9	-	2	7	1	1
44	3	2	-	9	1	-	7	-	1
45	1	1	2	3	-	2	4	-	1
46			2			2	1		1
47									
48									
49									
50			1			1			
>50									
TOTAL	2422	4930	1621	7575	3327	1414			

TABLE 4

COMMERCIAL SEINERS: "MARGARET HERD" and "HELEN HERD"

Length Composition of Haddock in 64 and 80 mm. seine cod-end catches

MORAY FIRTH: JUNE 1953

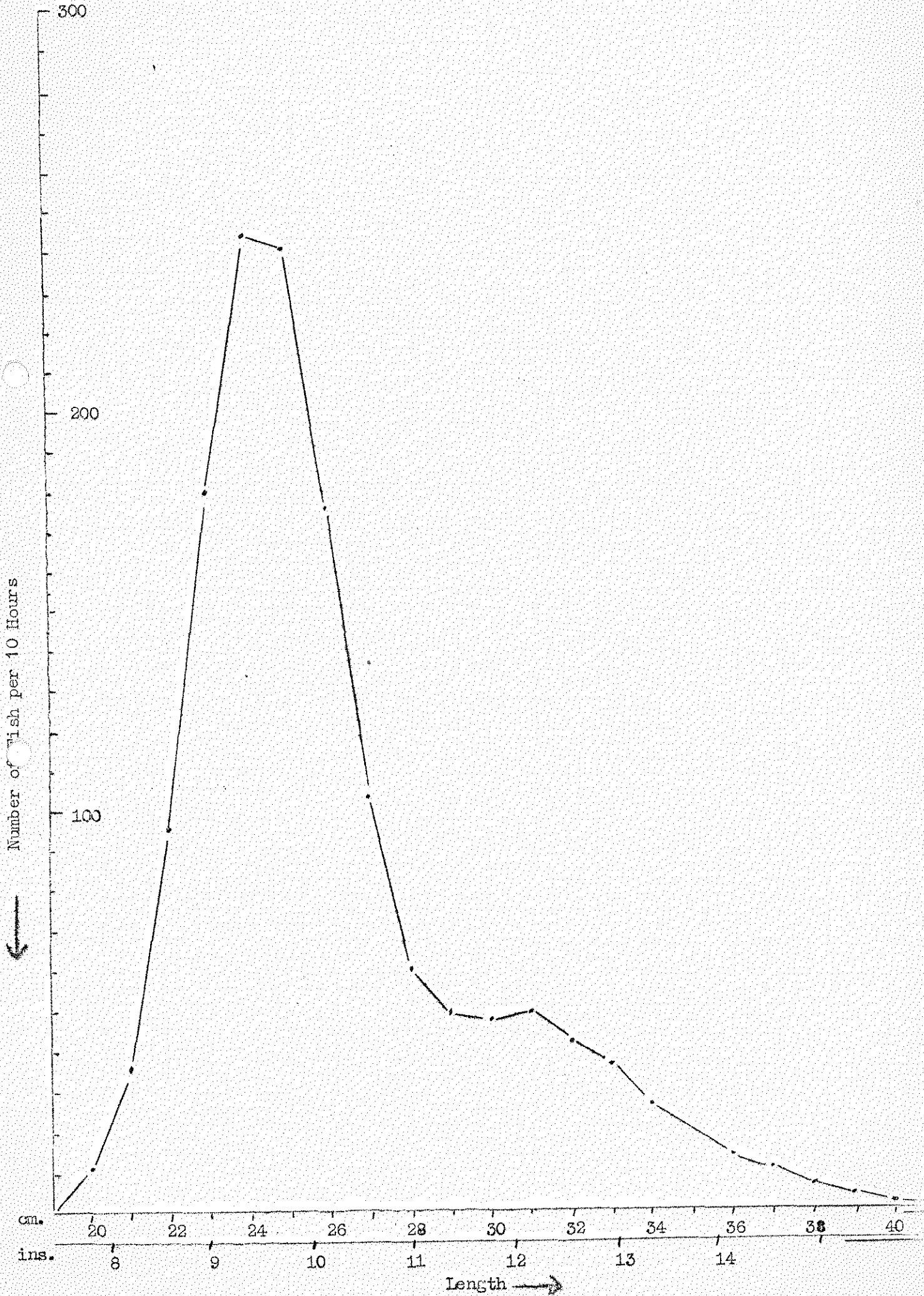
(32 hauls with each mesh size)

Length (cm.)	Total Numbers Caught 64 mm.	Total Numbers Caught 80 mm.	Numbers Caught per 25 hauls		Frequencies Smoothed in 3's	
			64 mm.	80 mm.	64 mm.	80 mm.
			Slide Rule Accuracy			
16	1		1		1	
17	4		3		4	
18	11		9		9	
19	21	1	16	1	15	1
20	25	1	20	1	16	1
21	16	1	13	1	20	3
22	33	7	26	6	38	4
23	97	7	76	6	63	5
24	113	4	88	3	83	6
25	107	13	84	10	97	11
26	152	24	120	19	150	23
27	288	50	227	39	247	35
28	501	59	393	46	374	54
29	643	98	502	77	440	69
30	544	109	425	85	410	84
31	387	114	303	89	321	85
32	301	103	236	80	228	84
33	187	107	146	84	166	79
34	150	93	117	73	122	72
35	132	74	103	58	102	59
36	112	60	87	47	82	49
37	73	55	57	43	66	42
38	70	45	55	35	48	32
39	40	23	31	18	37	25
40	31	27	24	21	24	14
41	22	4	17	3	20	11
42	23	13	18	10	17	7
43	20	10	15	8	13	9
44	9	11	7	9	10	8
45	9	7	7	6	6	6
46	4	5	3	4	5	4
47	6	2	5	2	4	3
48	4	4	3	3	3	2
>48	15	7	12	6		
TOTAL	4151	1138	3249	893		

FIGURE I

LENGTH FREQUENCY DISTRIBUTION OF HADDOCK
 CAUGHT BY F.R.S. "EXPLORER"
 USING OTTER TRAWL WITH 70 mm. CODEND

Frequencies expressed as numbers per 10 hours' fishing (smoothed in 3's)

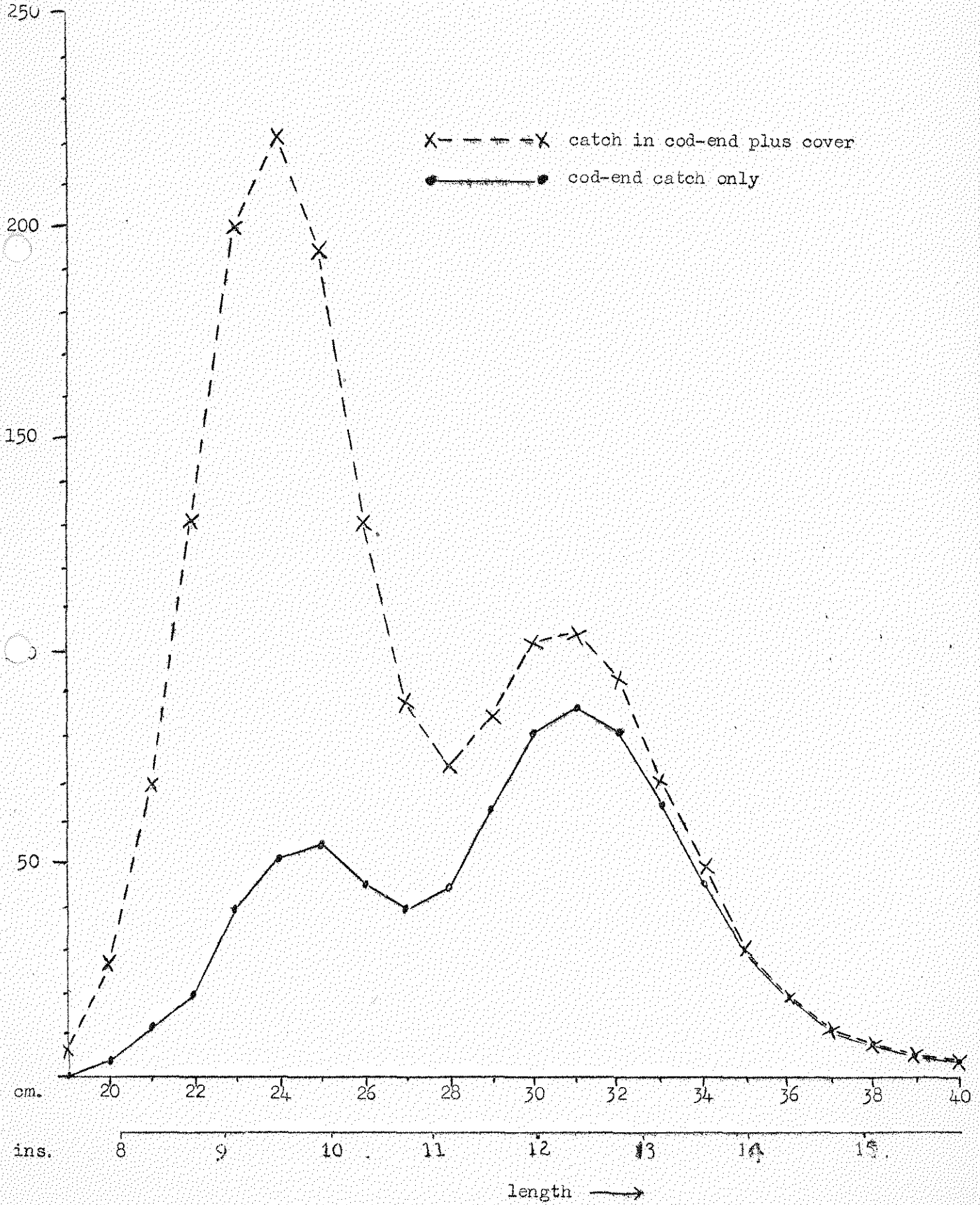


SEINE MESH INVESTIGATIONS

FIGURE 2

LENGTH FREQUENCY DISTRIBUTION OF HADDOCK
CAUGHT BY 70 m.m. SEINE COD-END AND COVER

Frequencies expressed as number per 6 hauls (smoothed in 3's)

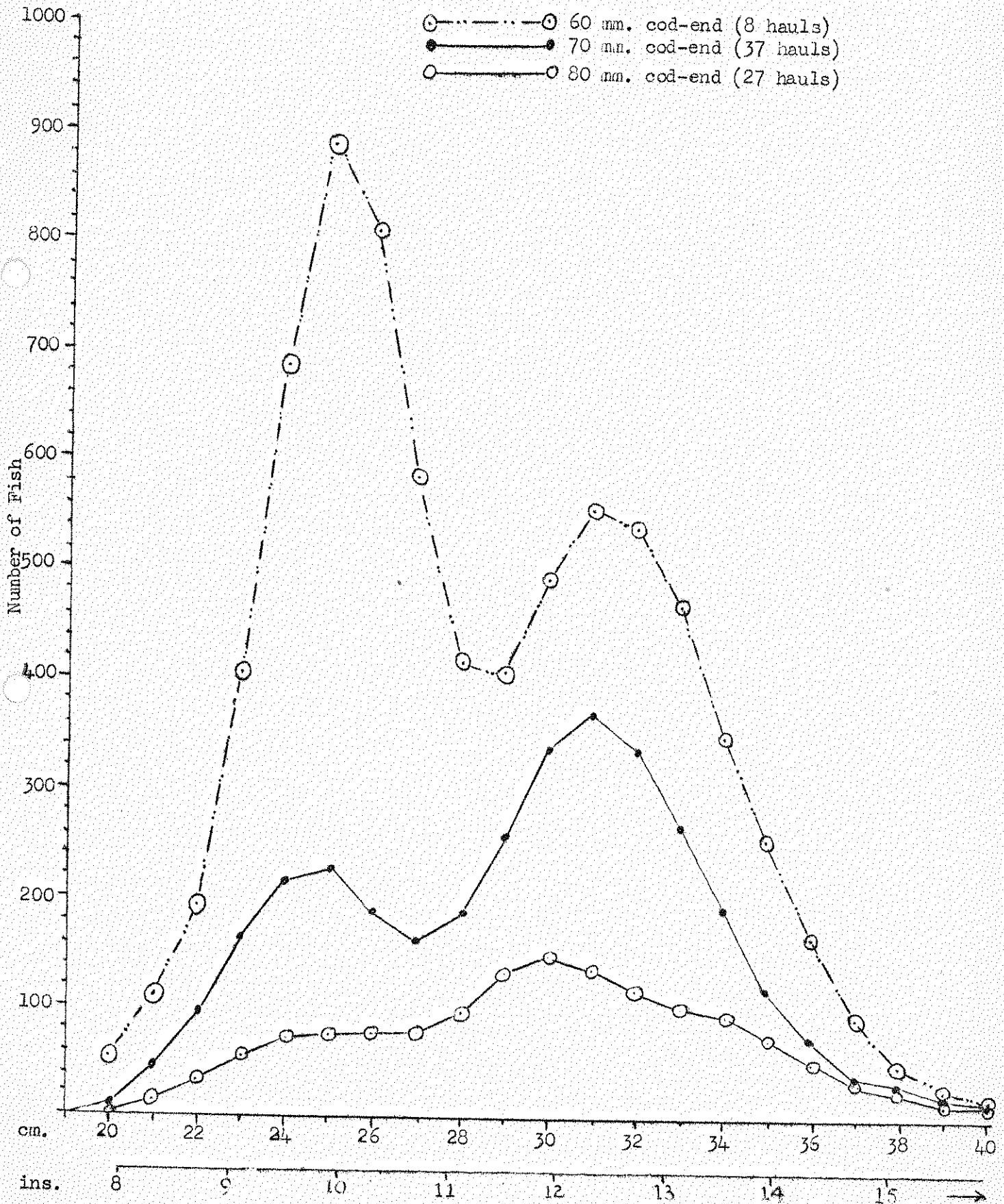


SEINE MESH INVESTIGATIONS

FIGURE 3

LENGTH FREQUENCY DISTRIBUTION OF HADDOCK
 IN SEINE CATCHES WITH 60 mm., 70 mm. and 80 mm. COD-ENDS
 AUGUST 1953

Frequencies expressed as number per 25 hauls (smoothed in 3's)

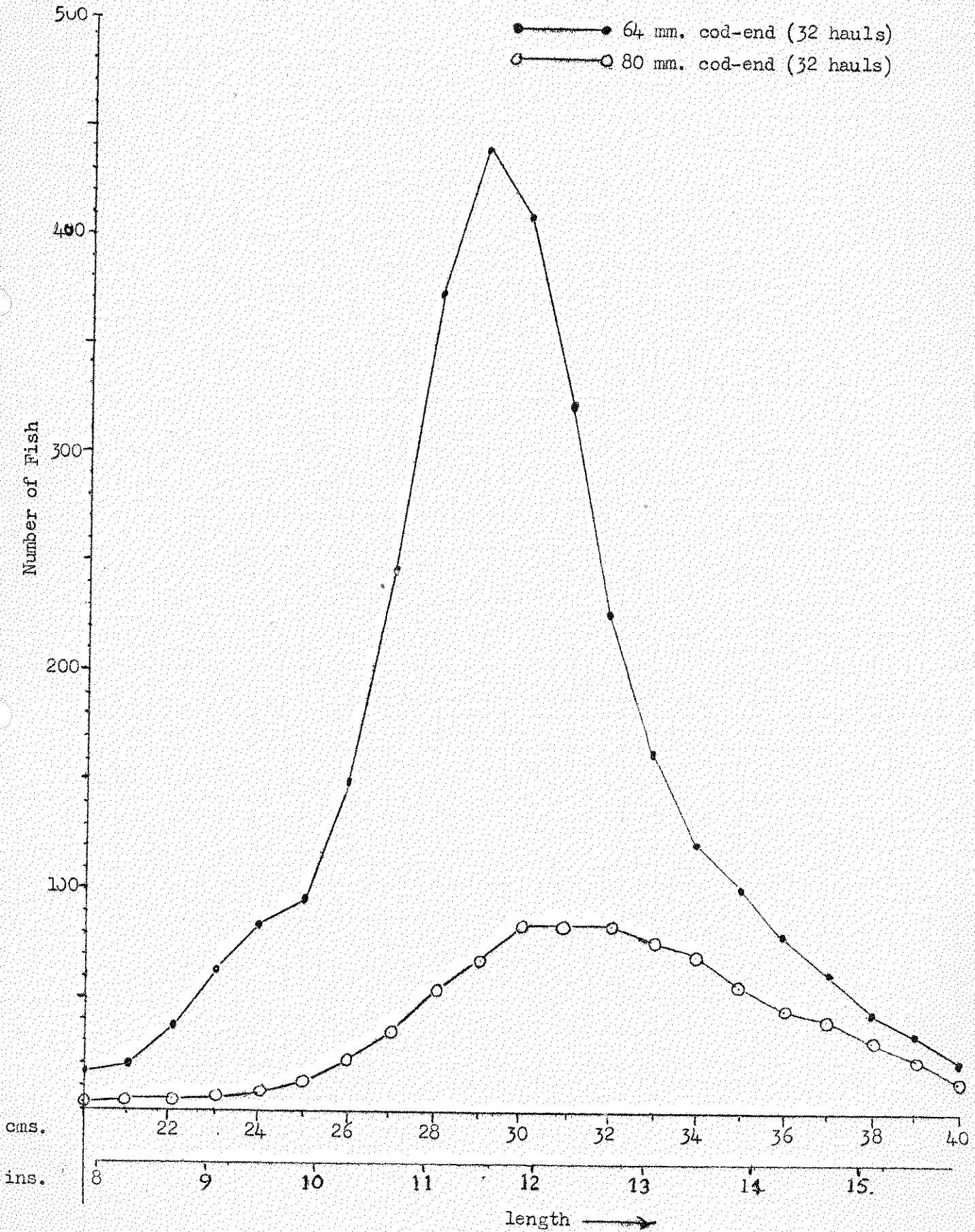


SEINE MESH INVESTIGATIONS

FIGURE 4

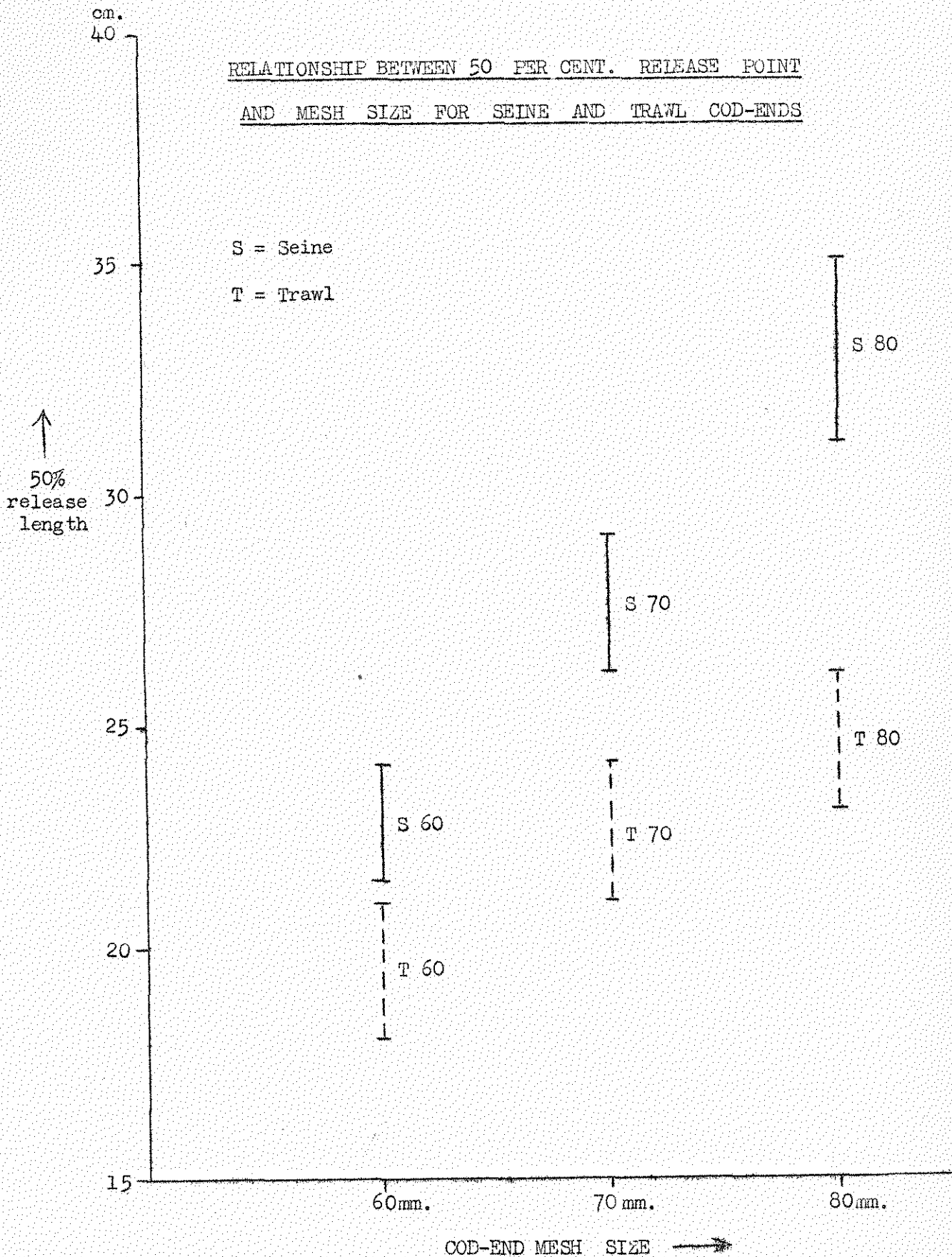
LENGTH FREQUENCY DISTRIBUTIONS OF HADDOCK
IN SEINE CATCHES WITH 64 mm. and 80 mm. COD-ENDS
JUNE 1953.

Frequencies expressed as numbers per 25 hauls (smoothed in 3's)



SEINE MESH INVESTIGATIONS

FIGURE 5



SEINE MESH INVESTIGATIONS

FIGURE 6

