ON THE SELECTIVE ACTION OF THE COD END MESHES OF A SHRIMP TRAWL

P. Appukutta Panicker* & T. M. Sivan**

Central Institute of Fisheries Technology (Craft & Gear Wing), Cochin - 5

[Selectivity studies using cod end and cover to determine the optimum cod end mesh size for commerical size groups of shrimps was carried out at Cochin during 1963—64 fishing season. The normality of the result was checked by trouser cod end method. Although the present investigation was mainly aimed to find out suitable cod end mesh size for commercial varieties of shrimps, five commonly occurring species of fishes were also taken.

The fifty percent escape level, co-efficient of selectivity and selection factor for all the species were worked out. From the findings the authors stress the necessity of increasing the cod end mesh size from the present condition (25.4 to 31.70 mm.) to 41.65 mm. fabricated mesh size to avoid depletion of the natural population.]

Introduction

Ever since the introduction of trawling for shrimps, the sizes of meshes, particularly those of the cod end of the trawl net had been receiving attention of the gear designers and operators to eusure an optimal catch consisting mainly of shrimps of marketable size. Such selective fishing with regulated mesh size would not only prevent depletion of population of the bed but also ensure filtering more water thereby increasing the efficiency of the gear. There is very little information on the relation between the size of cod end meshes and the srhimps caught and the authors in the following experiment have endeavoured to throw some light on the above relationship.

Materials and methods

Different workers elsewhere have studied the selective action of cod end meshes with particular reference to fish. Davis (1929 and 1934), Jenson (1949), Molunder (1949), Aoyama (1961), Treshev (1962) and Kitajima *et. al.*, (1962) in their respective studies have adopted the principle of 'cod end and cover' method. A similar approach has been followed in the present experiment as well. The normality of the experiment was checked with 'trouser cod end' method suggested by Russel and Edsor (1926) and Jenson (1948).

Gear

The net used throughout the experiment was a 27.5 ft. four seam cotton shrimp trawal

Present address

* Central Institute of Fisheries Technology Unit, Goa.

** Central Institute of Fisheries Technology Sub station, Veraval.

(Satyanarayana *et. al.*, p. 229) with 35″ otter boards (Satyanarayana *et. al.*, *op. cit.* p. 238). The details of the eight cod end and cover are indicated in Table -I. The size of the cod end meshes, following the stretched measure, were noted both in the dry and wet conditions and after every five hauls.

The gear was towed at an average speed of two knots from Fishtech No. 5 (30′-0 boat fitted with a 30 H. P. Diesel engine). The grounds operated were within the depth range of 9 m. laying between Narakkal and Chellanam. 20 and 15 effective hauls, each of one hour duration, were made for all the eight series of 'cod end and cover' and the 'trouser cod end' part of the experiment respectively. The catch in the cod end and the escape collected in the cover were separately measured for different species of shrimps and fishes and grouped into different length groups within a range of 5 mm.

Three species of shrimps and five species of fish were taken for the present investigation. Table No. II gives the details of species and their length frequencies. The length of shrimps were from the tip of the rostrum to the tip of the telson while that of the fishes were from the tip of the snout to the caudal fork or to the junction of the caudal fin rays and posterior end of the tail. All the species that are retained in the cod end, escaped and collected in the cover and the catch in the legs of the trouser cod ends were analysed separately.

Fig. Nos. 2—9 show the catch and the escape in number while Fig. Nos. 10&11 give the percentage of escape. The selection rate of different species with respect to the mesh size are shown in Table Nos. 3 and 4. Table Nos. 5 and 6 give the co-efficient of selectivity with respect to the average actual value of mesh size. Fig Nos. 15–19 show the 50% selection level plotted on probability paper for different groups of all the species with respect to the mesh size.

Fig. Nos. 12 & 13 show the catch of different species with respect to the legs of trouser cod ends series. Fig. No. 14 gives the percentage catch of different species caught in the larger meshed leg (b) with respect to the smaller meshed legs (a) of the trouser cod ends. The normality of the experiments is checked by grouping the cod end catches of the eight cod ends of the 'cod end and cover' series into four pairs similar to those of the 'trouser' series and calculated the percentage of catch of the larger meshed cod end (b) with that of the smaller meshed cod end (a) of the above four pairs. $\frac{b}{a}$ thus calculated for both the series with respect to the different length groups of all the species were represented in probability paper (Fig. No. 14).

Discussion

The general strategy of the cod end mesh selection of a shrimp trawl covers a broad subject concerned with how to obtain a sustained optimum yield from the present trawling grounds exposed to heavy trawling without affecting the natural population. Based on the collected materials the authors strive to arrive at a suitable mesh size to have such a judical exploitation on a commercial basis.

In the present investigation by employing cod ends of different mesh size changed the catch composition. The effect of change in the mesh size indicated a considerable shift in the selection rate. The co-efficient of selectivity with respect to the average actual value of mesh size (Fig. 1) for all the species, though seems to be identical, is characteristic to the species (Table Nos. 6 and 7). Among shrimps apparently the selection rate and the co-efficient of selectivity

seems to be similar in case of species Nos. 1 & 2; for all the length groups there is a subtle change in case of species No. 3. When species No. 2 shows a sharpest selection, species No. 3 the least and species No. 1 the intermediate selection ranges, which can be attributed to the active swimming nature of species No. 2 over species Nos. 1 & 3.

In case of fishes species No. 6 while showing the sharpest selection, species Nos. 4, 5, 8 and 7 shows their order in the selection range (Table Nos. 3 and 4).

The 50% selection level for different species of shrimps and fishes calculated from the probability curve are:-

(i) for 90–95 mm. length group of species Nos. 1, 2 and 3 found to be at 40.38, 37.34 and 45.72 mm. average actual value of mesh size respectively. (Fig. Nos. 15 & 16).

(ii) 50 - 55 mm. length group of species Nos. 4, 5 and 7 found to be at 28.19, 29.20 and 37.09 mm. average actual value of mesh size respectively.

(iii) 60-65 mm. length group of species Nos. 4, 5, 6 and 7 found to be at 30.73, 30.98, 28.70 and 40.38 mm. average actual value of mesh size respectively.

(iv) 80-85 mm. length group of species Nos. 6, 7 and 8 found to be at 32.00, 45.97 and 37.59 mm. average actual value of mesh size respectively. (Fig. Nos. 16-19).

From the above results, it has become clear that there is a relation between the length at 50% escape and the mesh size i. e, $m = L \times K$, where m is the average actual value of mesh size, L is the length at 50% escape and K the selection factor. K is found to be 0.51 for species No. 1; 0.48 for species No. 2; 0.47 for species No. 3; 0.52 for species No. 4; 0.56 for species No. 5; 0.38 for species No. 6; 0.60 for species No. 7 and 0.45 for species No. 8 (Table No. 7).

The above results of the cod end and cover experiment found in agreement with that of the trouser cod end series within the limits of the masking effect (2 - 5%) of the cover (Fig. No. 14).

Conclusion

From the above findings the authors are of opinion that the reduction of mesh size has gone too far, and that the use of larger mesh would not only obviate much of the useless destruction now taking place but also allowing a better flow of water through the net would actually increase its efficiency.

A survey of the existing shrimp trawls reveals that at present the maximum size of mesh employed by various agencies ranges from 25.4 to 31.70 mm fabricated mesh size i. e. 20.63 to 26.99 mm. average actual value of mesh size where the selection rate is only 0.18 to 0.25 and 0.15 to 0.34 for species Nos. 1 and 2 respectively among shrimps of 50 - 55 mm. length group (Fig. No. 10). In case of fishes it is only 0·17 to 0.39; 0.05 to 0.35 and 0.14 of the 50 - 55 mm. length groups of species Nos. 4, 5 and 7 and 0.08 to 0.24; 0.22 to 0.26; 0.18 to 0.41 and 0.09 of 60 - 65 mm. length groups of species No. 4, 5, 6 and 7 respectivcly (Fig. No. 11). Even the fifty percent escape level of species Nos. 1 and 2 of the 50 - 55 mm. length group comes at 32.25 mm. and 30.73 mm. average actual value of mesh size respectively, which is equivalent to 38.35 and 36.32 mm. or 1.51 and 1.43 inches fabricated mesh size. However, in the commerical catch of shrimps all the

groups below 80 - 85 mm. length are generally discarded from the catch along with the unwanted waste, which forms nearly 35-45% of the total catch in numbers. The fifty percent selection level for 80 - 85 mm. groups of shrimps is at 36.58 mm. (1.44") and 35.30 mm. (1.39") actual average value of mesh size i. e. 43.03 mm. (1.71") and 41.65 mm. (1.64") fabricated mesh size for species Nos. 1 & 2 respectively.

From the foregoing the authors stress that by employing 41.65 mm.(1.64") fabricated mesh size for the shrimp trawl cod ends one could avoid the useless destruction of the large quantities of undersized and unmarketable shrimps which are daily destroyed in course of trawling which stands to reason for the depletion of the natural population. Moreover by increasing the mesh size of the cod end a proportionate increase in the mesh size at the different parts of the trawl can be made which reduces much of the towing resistance thus increasing the optimum size and area of water filtered. Regarding our trawlers however, it is clearly impossible to enlarge the nominal mesh size by regulation to 35.30 mm. (1.39") average actual value of mesh size i. e. 41.65 mm. (1.64") fabricated mesh size in one jump from 25.34 to 31.75 mm. (1.06 to 1.25") fabricated mesh size. Therefore a better way will be to enlarge the mesh size step by step eliminating one after another the size groups below 80-85 mm. length group by employing the respective mesh sizes one after another thus reaching the mesh size for a fifty percent escape for 80 - 85 mm. length group.

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TABLE - I. DESIGN DETAILS OF COD END AND COVER

Sl. No.	Particulars	Fabricated mesh size in		Number of meshes in		Twine size	Average actual value of mesh size in	
		Inches	mm.	Length	Cricum-ference		Inches	mm.
1.	Cover	0.50	12.6993	240	280	20s/5/3	..	..
2.	Cod end No. 1	0.75	19.0493	133	112	20s/8/3	0.625	15.8748
3.	,, ,, No. 2	1.00	25.3997	100	84	,,	0.8125	20.6373
4.	,, ,, No. 3	1.25	31.7496	80	67	20s/10/3	1.0625	26.9871
5.	,, ,, No. 4	1.50	38.0995	66	56	,,	1.3125	33.6870
6.	,, ,, No. 5	1.75	44.4495	57	48	20s/12/3	1.5625	39.6870
7.	,, ,, No. 6	2.00	50.7994	50	42	,,	1.750	44.4495
8.	,, ,, No. 7	2.25	57.1493	45	37	,,	1.9375	49.2119
9.	,, ,, No. 8	2.50	63.4992	40	34	,,	2.0625	52.3816

N. B. The same cod ends are converted into four trouser cod ends. (Ist with cod end Nos. 1 & 2; 2nd with 3 & 4; 3rd with 5 & 6 and 4th with 7 & 8)

TABLE - II. DETAILS OF DIFFERENT SPECIES OF SHRIMPS AND FISHES

Sl. No.	Name of species	Species No.	Lengtn frequency in mm.
1.	Parapeneaopsis stylifera - Karikadi (Mal)	1	50-120
2.	Metapenaeus dobsoni - Poovalan (Mal)	2	50-125
3.	Metapenaeus affinis- Kazhunthan (Mal)	3	90-170
4.	Anchovis — Kozhuva (Mal)	4	50-75
5.	Ambasis — Nandan (Mal)	5	45-75
6.	Sole — Manthal (Mal)	6	60-135
7.	Sciaenids — Kuttan (Mal)	7	50-140
8.	Engraulis — Thada (Mal)	8	80-150

TABLE — III. SELECTION RATE OF DIFFERENT SPECIES OF SHRIMPS WITH COD ENDS OF DIFFERENT MESH SIZE

Length frequency	Cod end Nos.															
	2		3		4			5			6		7	8		
	Species Nos.															
	1	2	1	2	1	2	3	1	2	3	1	2	3	3	3	
50-55	0.18	0.15	0.25	0.34	0.48	0.53	..	0.76	0.81	..	0.89	0.92	..			
55-60	0.12	0.10	0.27	0.27	0.46	0.50	..	0.73	0 77	..	0.86	0.94	..			
60-65	0.08	0.08	0.17	0.18	0.43	0.47	..	0.70	0.77	..	0 81	0.88	..			
65-70	0.04	0.06	0 15	0.19	0.36	0.45	..	0.65	0.71	..	0.76	0.85	..			
70 - 75	0.03	0.05	0.12	0.14	0.30	0.41	..	0.62	0.69	..	0.72	0.80	..			
75 - 80	0.02	0.04	0.10	0.14	0.29	0.39	..	0.60	0.65	..	0.70	0.76	..			
80 - 85	..	0.04	0.04	0.06	0.23	0.29	..	0.56	0.61	..	0.68	0.75	..			
85 -90	..	..	0.04	0.06	0.21	0.26	..	0.52	0.59	..	0.63	0.69	..			
90 - 95	..	..	0.03	0.05	0.16	0.20	0.07	0.40	0.53	0.20	0.56	0.64	0.39	0.60	0.80	..
95 - 100	..	..	0.02	0.03	0.10	0.17	0.06	0.32	0.46	0.18	0.52	0.61	0.35	0.56	0.76	..
100 - 105	..	..	0.01	0.04	0.08	0.12	0.06	0.26	0.34	0.13	0.43	0.57	0.28	0.50	0.71	..
105 - 110	..	..	..	..	0.03	0.12	0.03	0.19	0.26	0.12	0.38	0.46	0.23	0.46	0.66	..
110 - 115	..	..	..	..	0.01	0.07	0.02	0.08	0,17	0.09	0.27	0.35	0.18	0.43	0.60	..
115 - 120	..	..	..	..	..	0.06	0,01	0.04	0.09	0.03	0.21	0.30	0.14	0.39	0.54	..
120 - 125	..	..	..	..	..	..	..	..	0.06	0.02	..	0.24	0.08	0.33	0.50	..
125 - 130	..	..	..	..	..	..	..	..	..	0.02	..	..	0.06	0.26	0.45	..
130 - 135	..	..	..	..	..	..	..	..	..	0.01	..	..	0.03	0.21	0.41	..
135 - 140	..	..	..	..	..	..	..	..	..	..	..	..	0.02	0.19	0.34	..
140 - 145	..	..	..	..	..	..	..	..	..	..	..	..	0.03	0.17	0.30	..
145 - 150	..	..	..	..	..	..	..	..	..	..	..	..	0.01	0.16	0.20	
150 - 155	..	..	..	..	..	..	..	..	..	..	..	..	..	0.10	0.19	
155 - 160	..	..	..	..	..	..	..	..	..	..	..	..	..	0.08	0.17	
160 - 165	..	..	..	..	..	..	..	..	..	..	..	..	..	0.09	0.13	
165 - 170	..	..	..	..	..	..	..	..	..	..	..	..	..	0.05	0.12	

Cod end Nos. 2= 1.00″; 3 = 1.25″; 4 = 1.50″; 5 = 1.75″; 6 = 2.00″; 7 = 2.25″ and 8 = 2.50″ mesh size.

TABLE – IV. SELECTION RATE OF DIFFERENT SPECIES OF FISHES WITH COD ENDS OF DIFFERENT MESH SIZE

Length frequency	Cod end Nos.																		
	2			3					4					5			6		7
	Species Nos.																		
	4	5	6	4	5	6	7	8	4	5	6	7	8	6	7	8	7	8	7	8
45 - 50		0.07			0.48					0.81										
50 - 55	0.17	0.05		0.39	0.35		0.14		0.77	0.74		0.27			0 53		0.68		0.79	
55 - 60	0.10	0.03		0.36	0.35		0.10		0.75	0.71		0.22			0.50		0.65		0.75	
60 - 65	0·08	0.02	0.18	0.24	0.26	0.41	0.09		0.64	0.62	0.68	0.17		0.91	0 48		0.59		0·74	
65 - 70	0.07		0.12	0.20	0.25	0.38	0.05		0 59	0.55	0.65	0.07		0.93	0.36		0.43		0.75	
70 - 75	0·08		0.12	0.17	0.21	0.33	0.03		0.43	0.40	0.63	0·09		0.90	0.29		0.45		0.69	
75 - 80			0.06			0.23					0.59	0.06		0.87	0.23	0.46	0.41		0.67	
80 - 85			0.05			0.21		0.15			0.53	0.05	0.28	0.84	0 23	0.43	0.40	0.65	0·64	0.77
85 - 90			0 04			0.18		0.11			0.50	0.03	0.21	0.80	0.21	0.42	0 38	0.63	0.58	0.73
90 - 95			0.03			0.13		0.10			0.34	0.03	0.18	0.73	0.20	0 36	0.36	0 63	0.56	0.69
95 - 100			0 03			0.10		0.08			0.36	0.01	0.15	0.70	0 16	0.29	0.25	0.60	0.56	0 62
100 - 105						0.11					0.40		0.10	0.71	0.12	0.16	0.23	0.56	0.53	0.54
105 - 110						0.08					0.28		0 08	0.68	0.10	0.12	0.16	0.45	0 50	0.49
110 - 115						0.05					0.26		0.05	0.65	0.08	0.08	0.15	0.34	0.60	0.42
115 - 120						0.05					0.21		0.02	0 61	0.06	0.07	0.13	0.29	0.45	0.38
120 - 125						0·04					0.18		0.01	0.61	0 03	0.05	0.10	0 24	0.41	0.39
125 - 130											0.11			0.61	0.03	0.02	0.08	0.23	0·36	0.36
130 - 135											0.06			0·50	0 03	0.02	0.05	0.20	0.31	0.30
135 - 140											0.04			0 50	0.02	0.01	0 06	0.16	0.25	0.24
140 - 145														0 41		0.01		0 10	0.22	0.21
145 - 150																		0.08		0 23

N. B. Cod End No. 2 = 1.00″; 3 = 1.25″; 4 = 1.50″; 5=1·75″; 6 = 2.00″ and 7 = 2.25″ mesh size.

TABLE - V CO-EFFICIENT OF SELECTIVITY OF DIFFERENT SPECIES OF SHRIMPS OF DIIFFERENT LENGTH GROUPS ($C = \frac{l}{M}$)

Length frequency (l)	Species No. 1				Species No. 2				Species No. 3			
	Fabricated mesh size Inches	Average actual value of mesh size (M)		Co-efficient of selectivity - C								
		Inches	mm									
	1	2	3	4	1	2	3	4	1	2	3	4
50 - 55	1.51	1.27	32.25	1.55	1.43	1.21	30.73	1.63	..	..	..	..
55 - 60	1.52	1.28	32.51	1.69	1.48	1.25	31.75	1.73	..	..	..	..
60 - 65	1.55	1.31	33.01	1.82	1.54	1.30	33.01	1.82	..	..	..	..
65 - 70	1.60	1.35	34.29	1.90	1.55	1.31	33.28	1.95	..	..	..	..
70 - 75	1.64	1.39	34.57	2.02	1.56	1.32	33.53	2.09	..	..	..	..
75 - 80	1.65	1.40	35.55	2.11	1.60	1.35	34.29	2.19	..	..	..	..
80 - 85	1.71	1.44	36.58	2.19	1.64	1.39	35.30	2.27	..	..	..	..
85 - 90	1.75	1.48	37.59	2.26	1.69	1.42	36.07	2.36	..	..	..	..
90 - 95	1.89	1.59	40.38	2.23	1.74	1.47	37.34	2.41	2.14	1.80	45.72	1.97
95 - 100	1.96	1.65	41.91	2.27	1.81	1.52	38.60	2.46	2.19	1.84	46.73	2.03
100 - 105	..	..	..	..	1.91	1.61	40.89	2.44	2.25	1.89	48.00	2.08
105 - 110	..	..	..	..	..	..	..	..	2.30	1.93	49.03	2.14
110 - 115	..	..	..	..	..	..	..	..	2.35	1.97	50.03	2.20
115 - 120	..	..	..	..	..	..	..	..	2.43	2.04	51.81	2.32
120 - 125	..	..	..	..	..	..	..	..	2.48	2.08	52.83	2.37

TABLE – VI. CO-EFFICIENT OF SELECTIVITY OF DIFFERENT SPECIES OF FISHES OF DIFFERENT LENGTH GROUPS ($C = \frac{1}{M}$)

Length frequency	Species No. 4				Species No. 5				Species No. 6				Species No. 7				Species No. 8			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
45 - 50					1.28	1.08	27.43	1.65												
50 - 55	1.32	1.11	28.19	1.77	1.36	1.15	29.20	1.72					1.75	1.46	37.09	1.35				
55 - 60	1.34	1.13	28.70	1.92	1.37	1.16	29.46	1.87					1.83	1.53	38.86	1.42				
60 - 65	1.43	1.21	30.73	1.95	14.1	1.22	30.98	1.94	1.34	1.13	28.70	2.09	1.89	1.59	40.38	1.49				
65 - 70	1.46	1.23	31.24	2.08	..	..	..	..	1.37	1.16	29.47	2.26	1.86	1.56	39.63	1.64				
70 - 75	..	..	..	..	..	..	..	..	1.40	1.20	30.48	2.30	1.98	1.67	42.41	1.65				
75 - 80	..	..	..	..	..	..	..	..	1.45	1.23	31.24	2.40	2.13	1.79	45.46	1.65				
80 - 85	..	..	..	..	..	..	..	..	1.49	1.26	32.00	2.50	2.15	1.81	45.97	1.71	1.76	1.48	37.59	2.13
85 - 90	..	..	..	..	..	..	..	..	1.52	1.28	32.51	2.61	2.17	1.83	46.48	1.83	1.83	1.53	38.86	2.19
90 - 95	..	..	..	..	..	..	..	..	1.60	1.35	34.29	2.63	2.21	1.86	47.24	1.90	1.84	1.53	38.86	2.21
95 - 100	..	..	..	..	..	..	..	..	1.59	1.34	34.06	2.78	2.25	1.89	48.00	1.98	1.89	1.59	40.38	2.35
100 - 105	..	..	..	..	..	..	..	..	1.57	1.33	33.78	2.96	2.25	1.89	48.00	1.98	1.89	1.59	40.38	2.34
105 - 110	..	..	..	..	..	..	..	..	1.62	1.37	34.78	3.02	..	..	..	..	..	..	..	..
110 - 115	..	..	..	..	..	..	..	..	1.66	1.41	34.99	3.14	..	..	..	..	..	..	..	..
115 - 120	..	..	..	..	..	..	..	..	1.68	1.42	36.07	3.33	..	..	..	..	..	..	..	..
120 - 125	..	..	..	..	..	..	..	..	1.71	1.45	36.58	3.42	..	.	..	..	..	..	..	..

TABLE — VII SELECTION FACTOR (K) FOR DIFFERENT SPECIES OF FISHES AND PRAWNS OF DIFFERENT LENGTH GROUPS

Length frequencies	Species Nos.							
	1	2	3	4	5	6	7	8
45-50	..	..	..	..	0.61	..	..	..
50-55	0.65	0.62	..	0.56	0.58	..	0.74	..
55-60	0.60	0.56	..	0.52	0.54	..	0.71	..
60-65	0.55	0.55	..	0.51	0.52	0.47	0.67	..
65-70	0.52	0.51	..	0.48	..	0.45	0.61	..
70 - 75	0.49	0.48	..	..	..	0.44	0.61	..
75 - 80	0.47	0.46	..	..	..	0.42	0.66	..
80 - 85	0.45	0.44	..	..	..	0.40	0.58	0.47
85 - 90	0.44	0.42	..	..	..	0.38	0.55	0.46
90 - 95	0.45	0.42	0.51	..	..	0.38	0.53	0.43
95 - 100	0.44	0.41	0.49	..	..	0.36	0.51	0.43
100 - 105	..	0.41	0.48	..	..	0.34	0.48	0·43
105 - 110	..	— —	0.47	..	..	0.33	..	..
110 - 115	..	..	0.46	..	..	0.32	..	..
115 - 120	..	..	0.45	..	..	0.31	..	..
120 - 125	..	..	0.44	..	..	0.31	..	..
Average	0.51	0.48	0.47	0.52	0.56	0.38	0.60	0.45

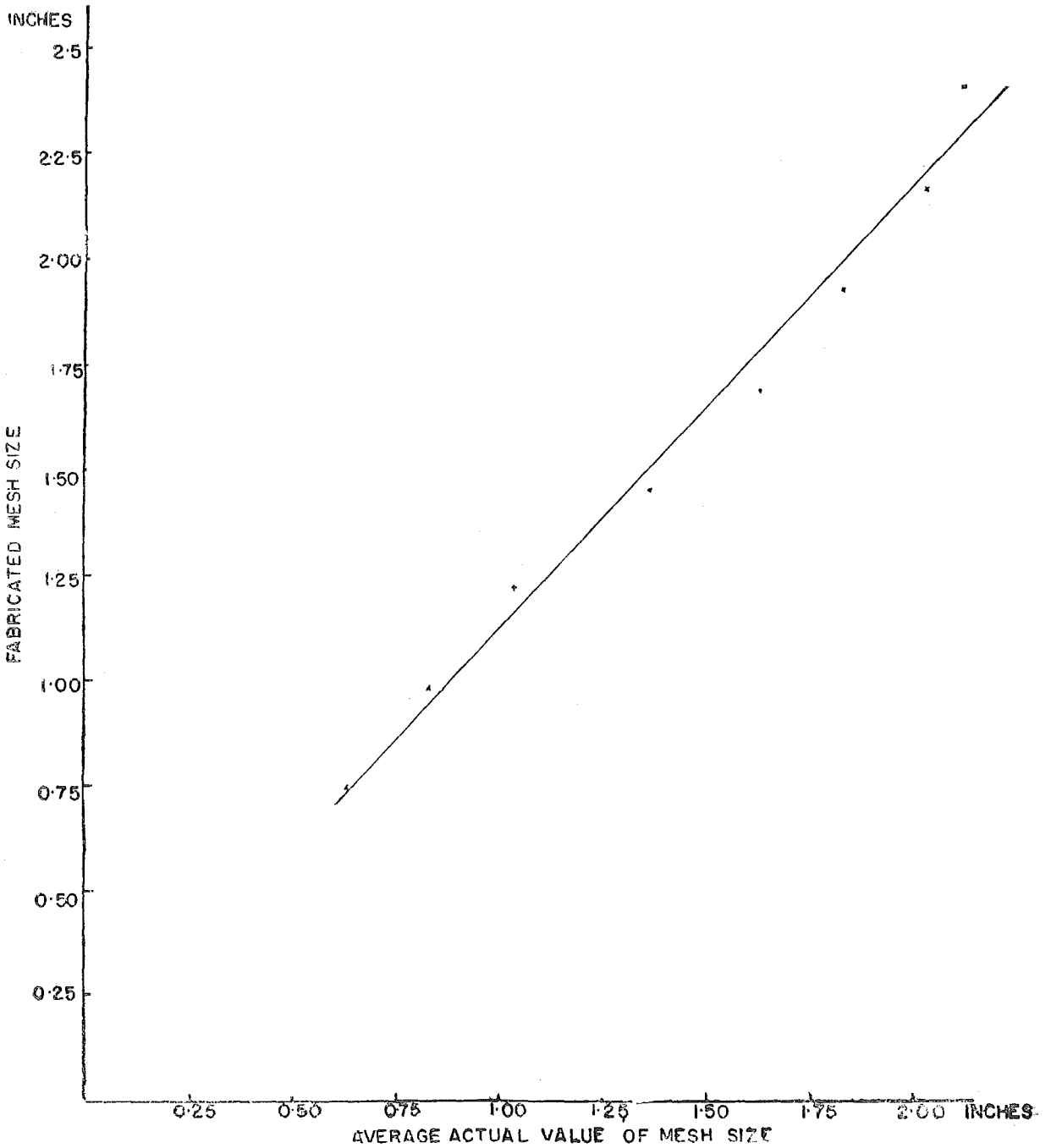

Fig. No. 1 : Relation between fabricated mesh size and average actuai of value of mesh size.

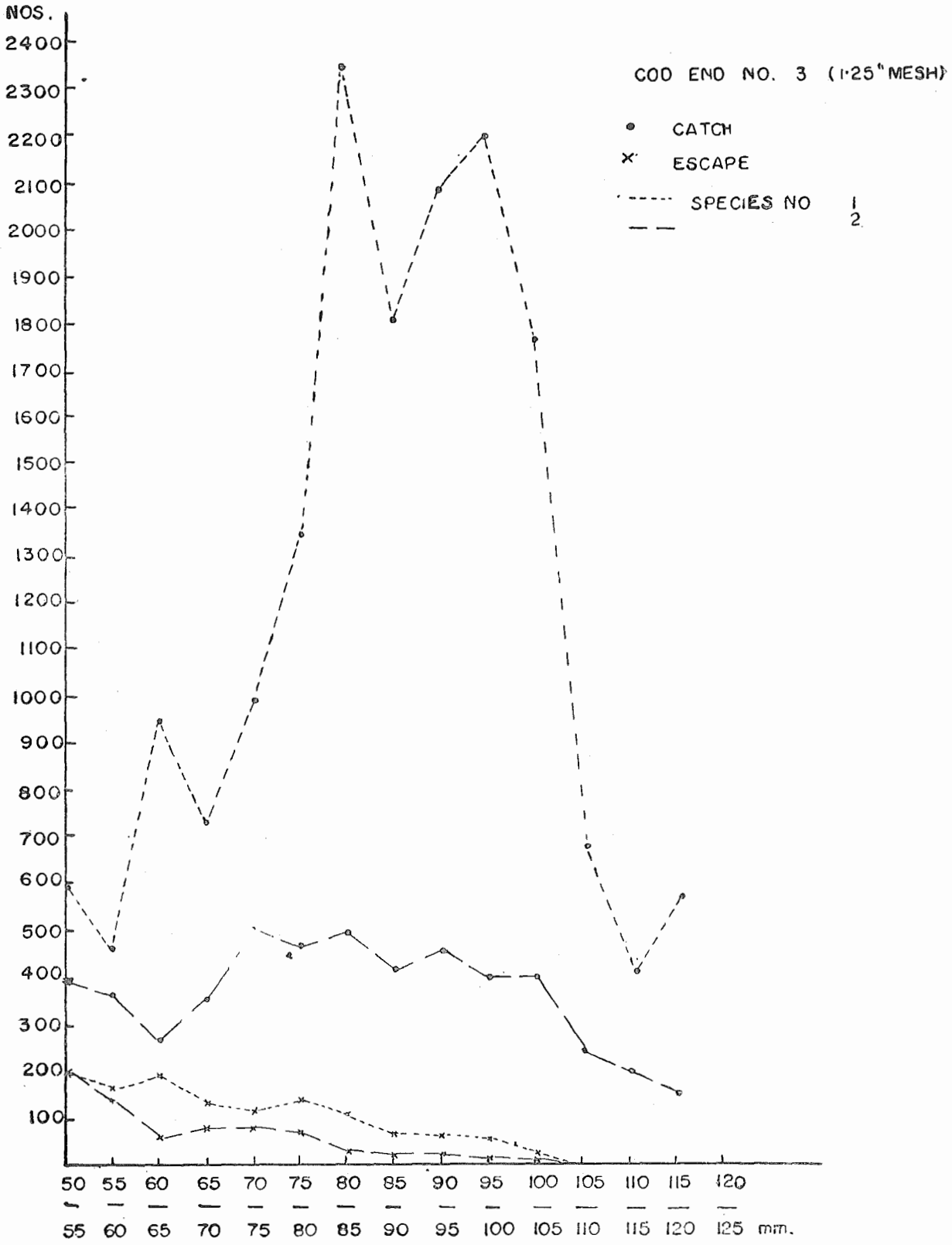

Fig. No. 2 : Catch and escape of species No. 1 and 2 from cod end of 1.25" fabricated mesh size.

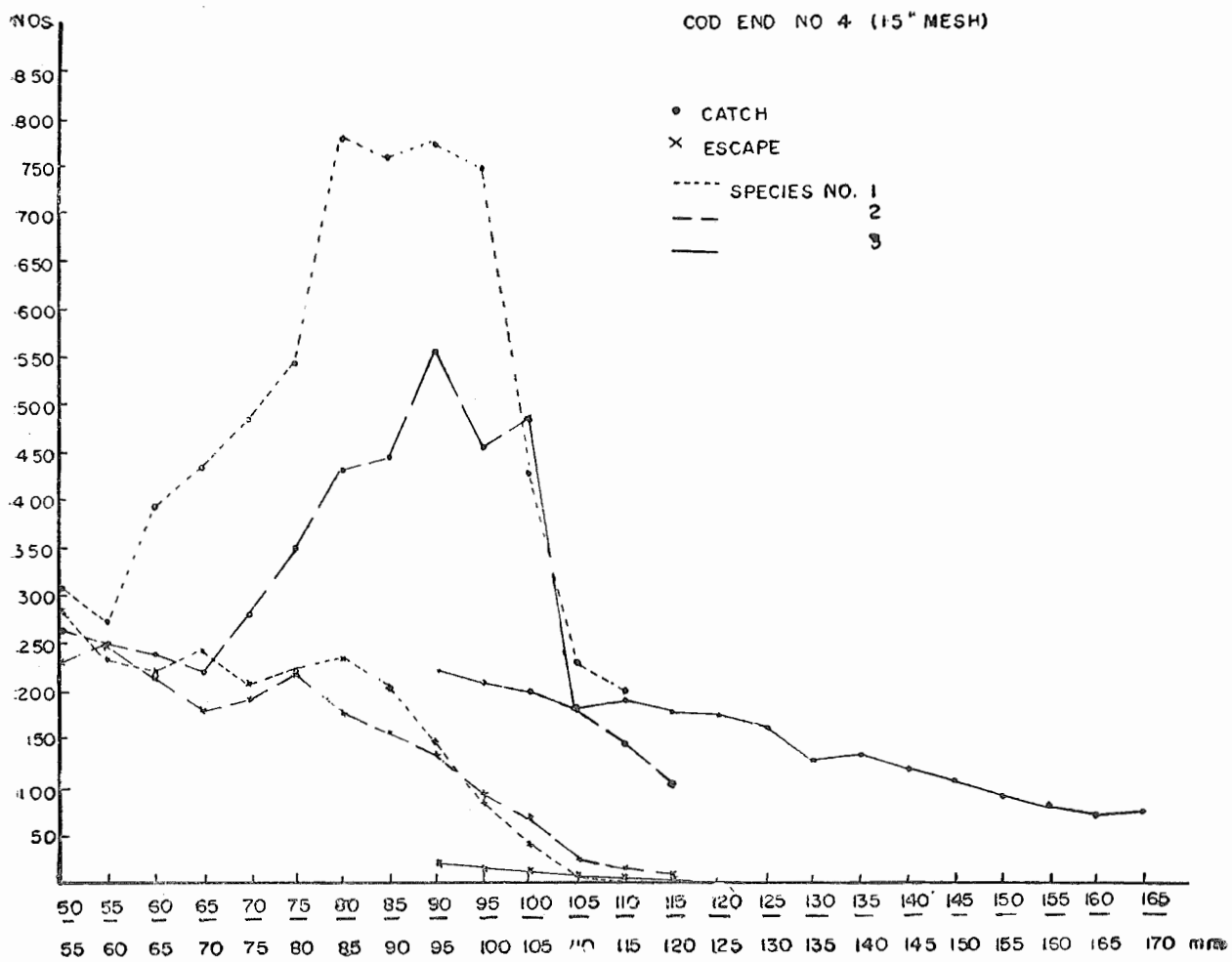

Fig. No. 3 : Catch and escape of species Nos. 1, 2 and 3 from cod end of 1.5" fabricated mesh size.

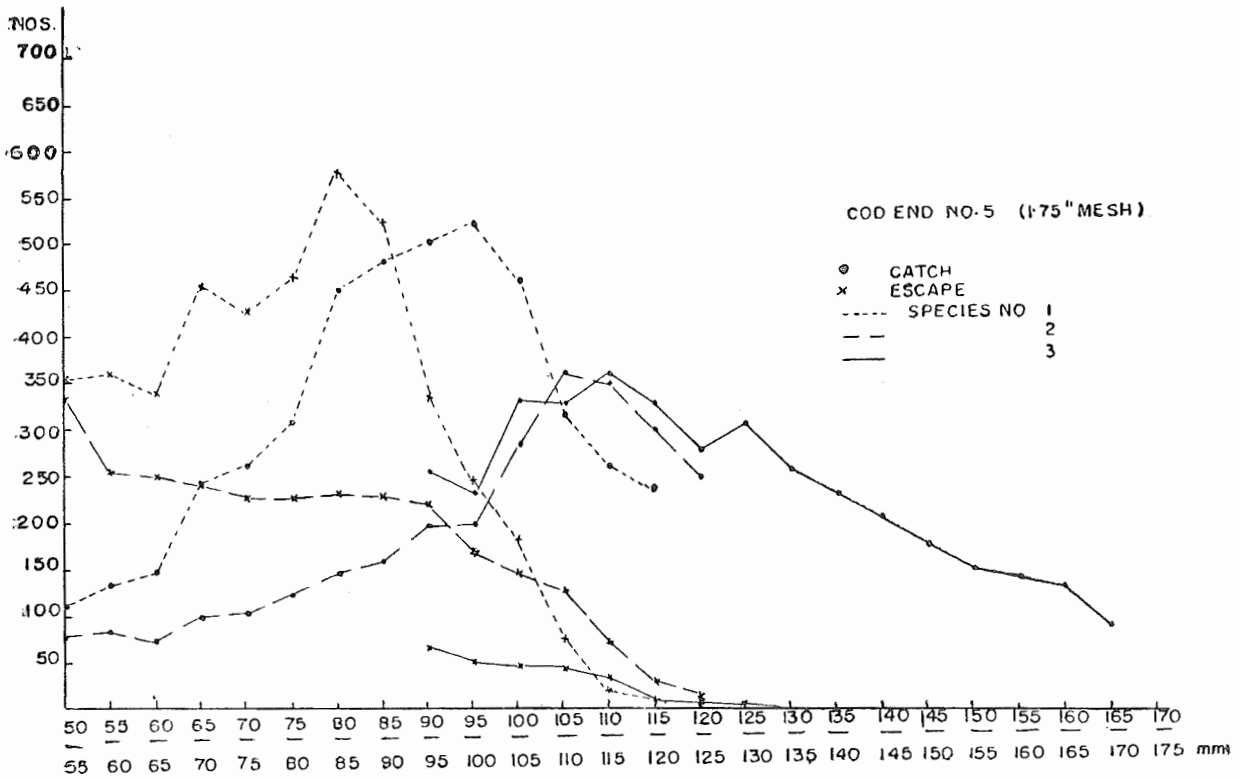

Fig. No. 4 : Catch and escape of species Nos. 1, 2 and 3 for cod end of 1.75″ fabricated mesh size.

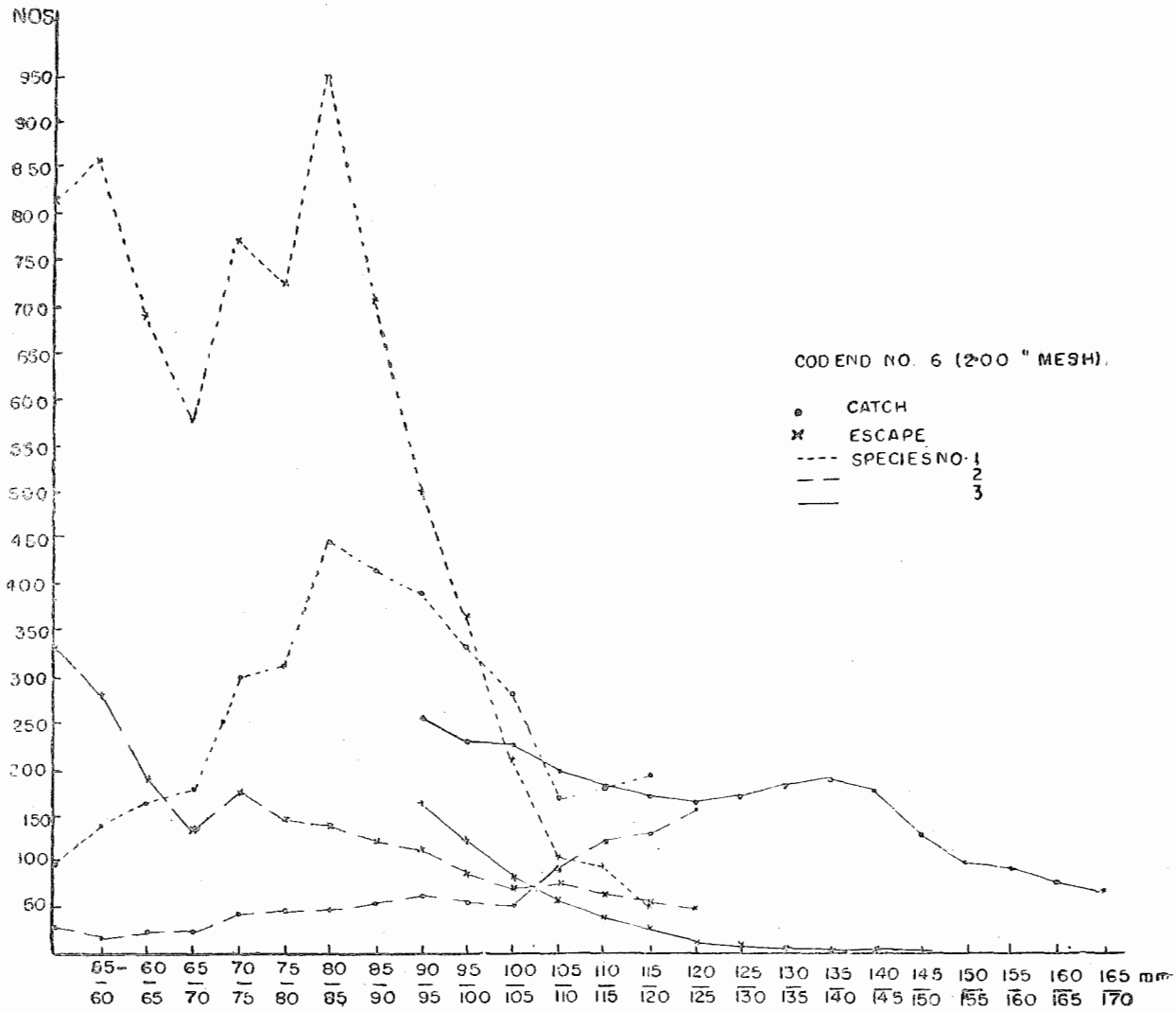

Fig. No. 5 : Catch and escape of species Nos. 1, 2 and 3 from cod end of 2" fabricated mesh size.

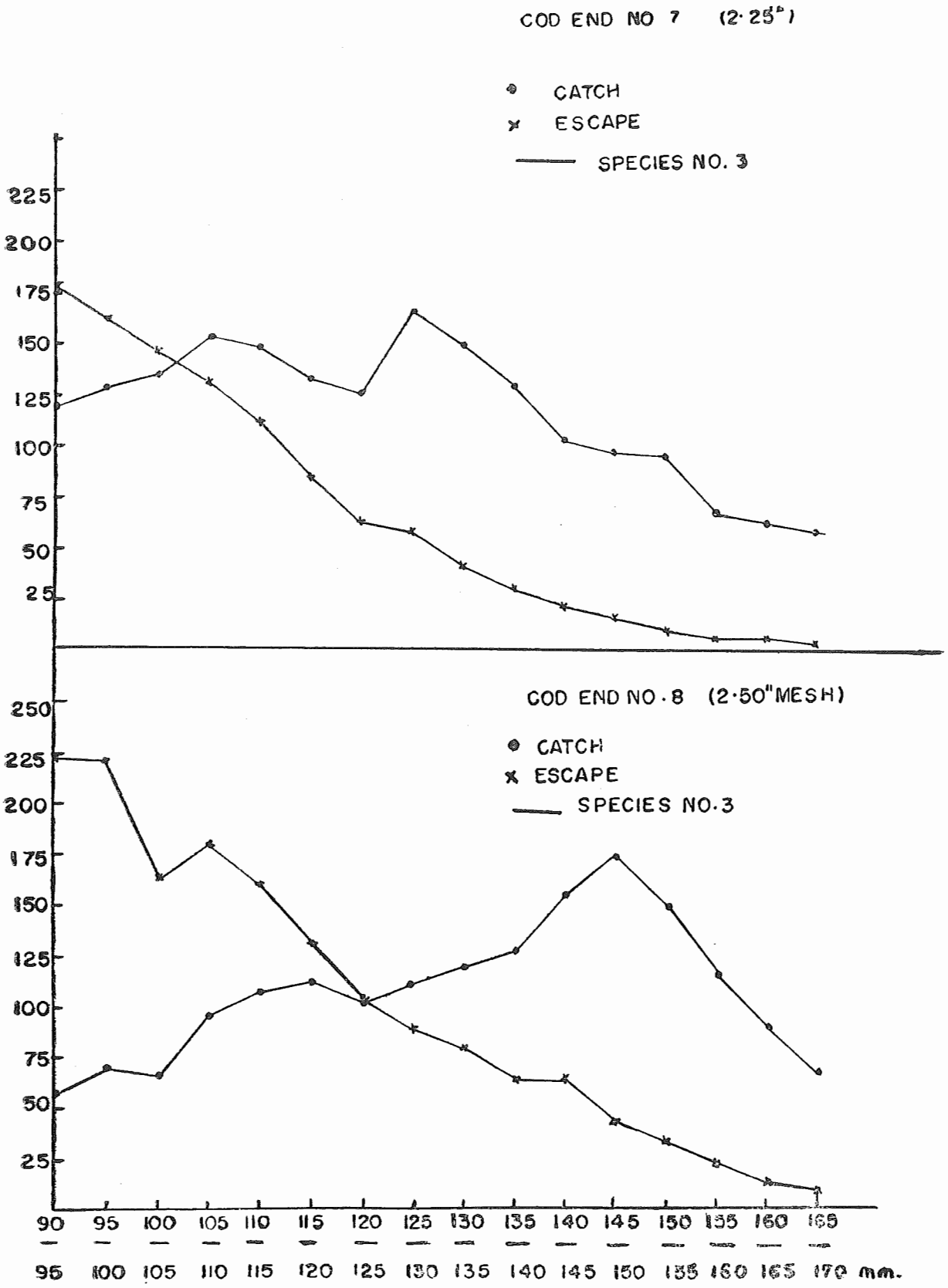

Fig. No. 6 : Catch and escape of species No. 3 from cod ends 2.25" and 2.5" fabricated mesh size.

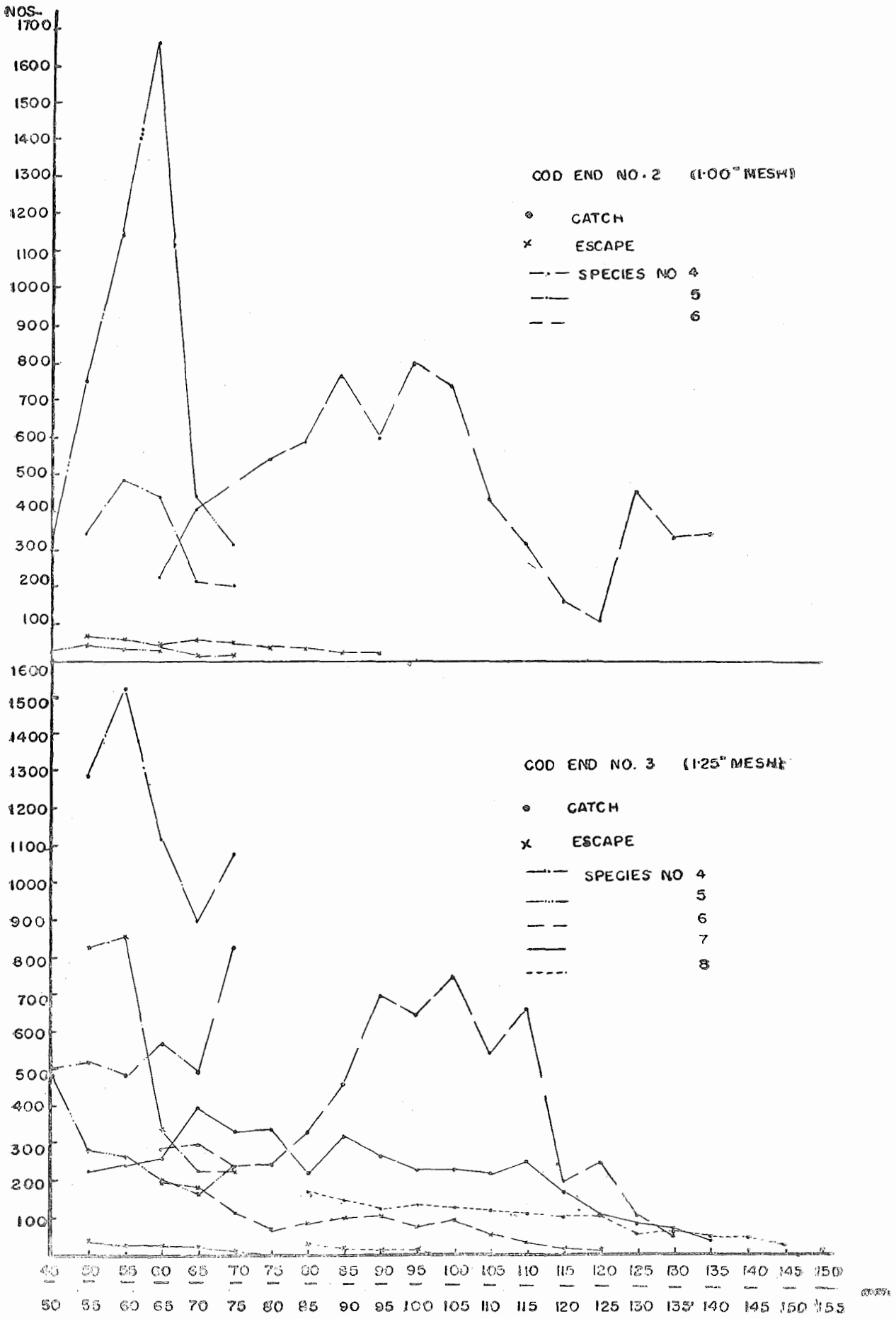

Fig. No. 7 : Catch and escape of species Nos. 4 to 8 from cod end of 1 and 1.25" fabricated mesh size.

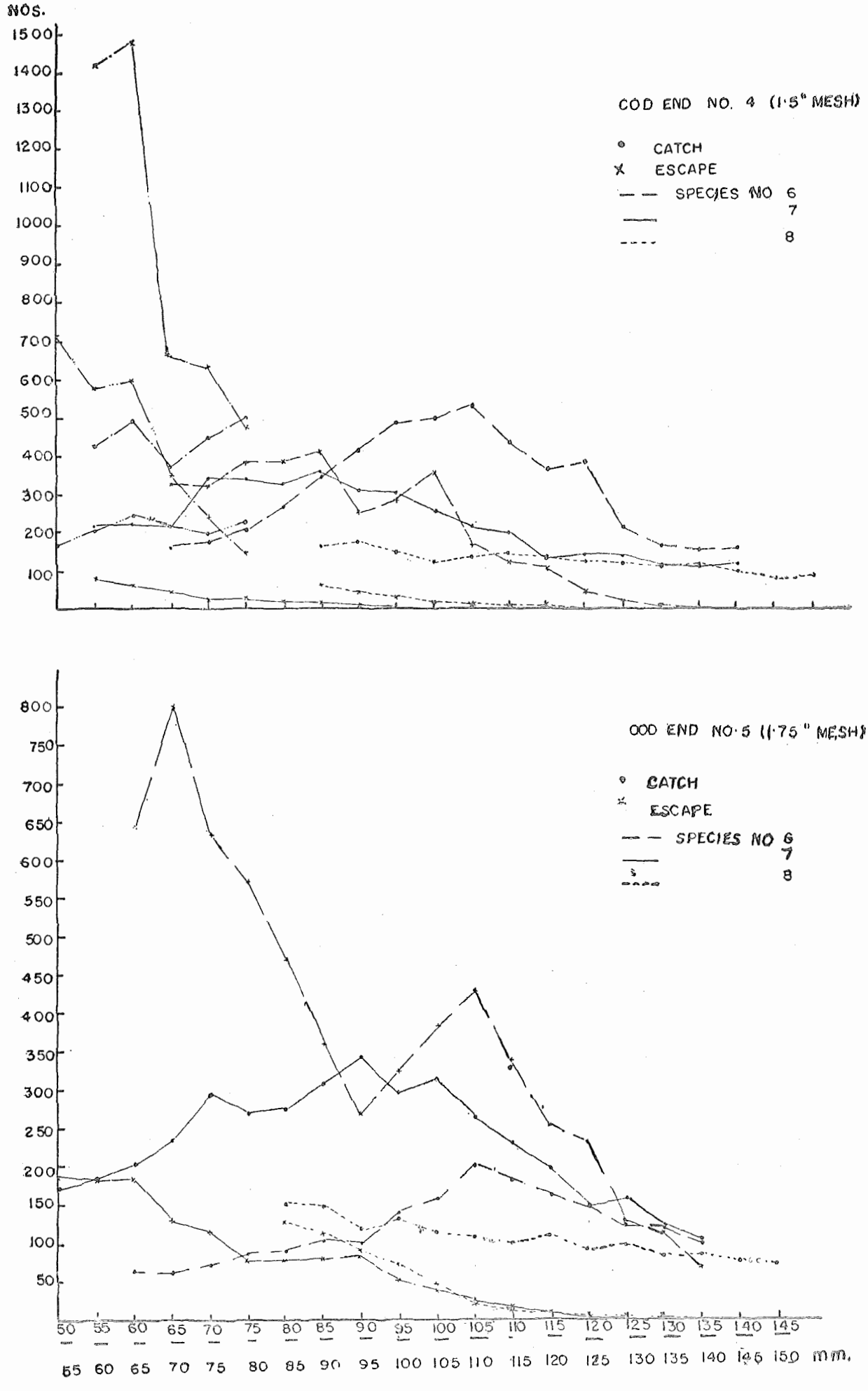

Fig. No. 8 : Catch and escape of species Nos. 6, 7 and 8 from cod end of 1.5 and 1.75" fabricated mesh size.

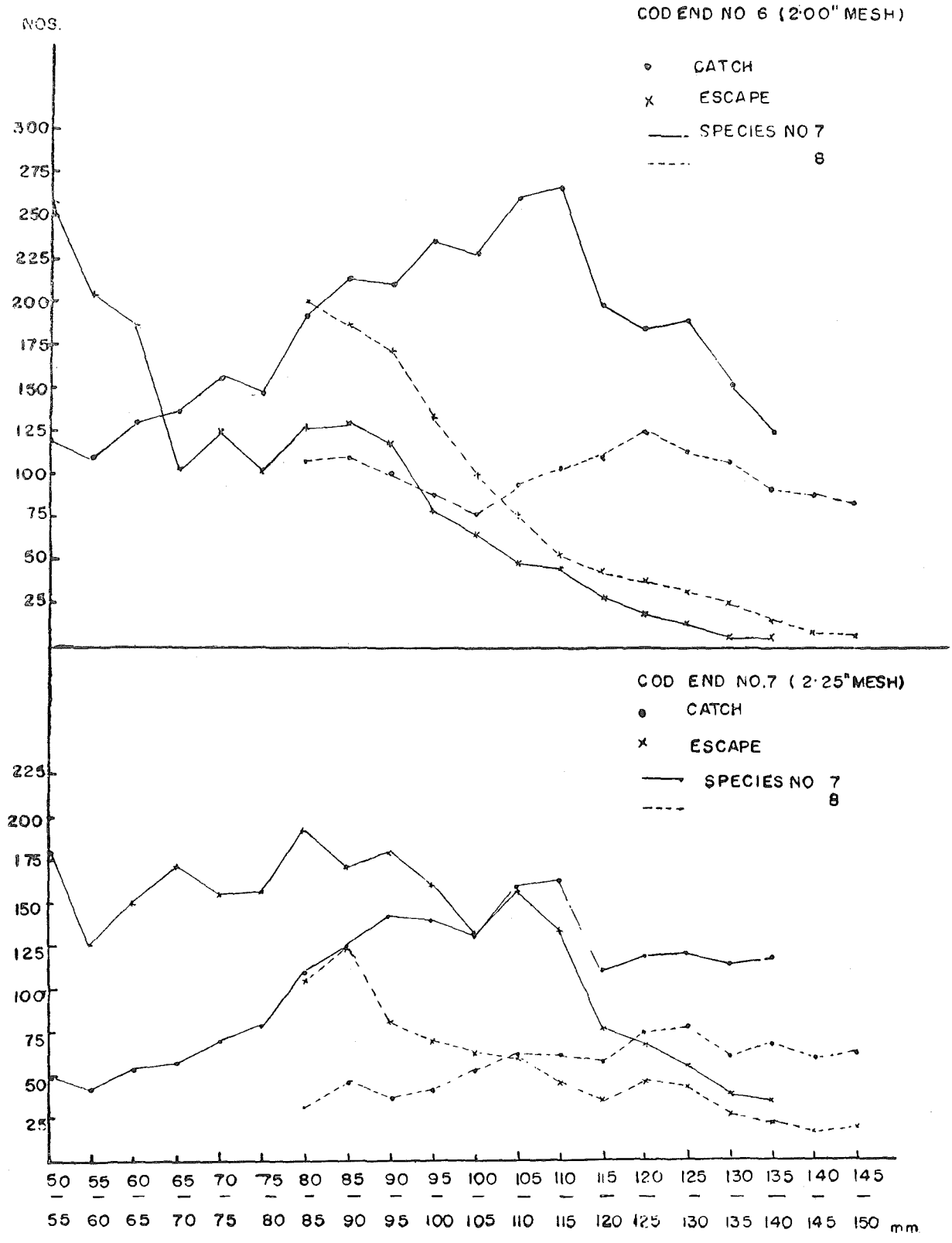

Fig. No. 9 : Catch and escape of species Nos. 7 and 8 from cod end of 2 and 2.25" fabricated mesh size.

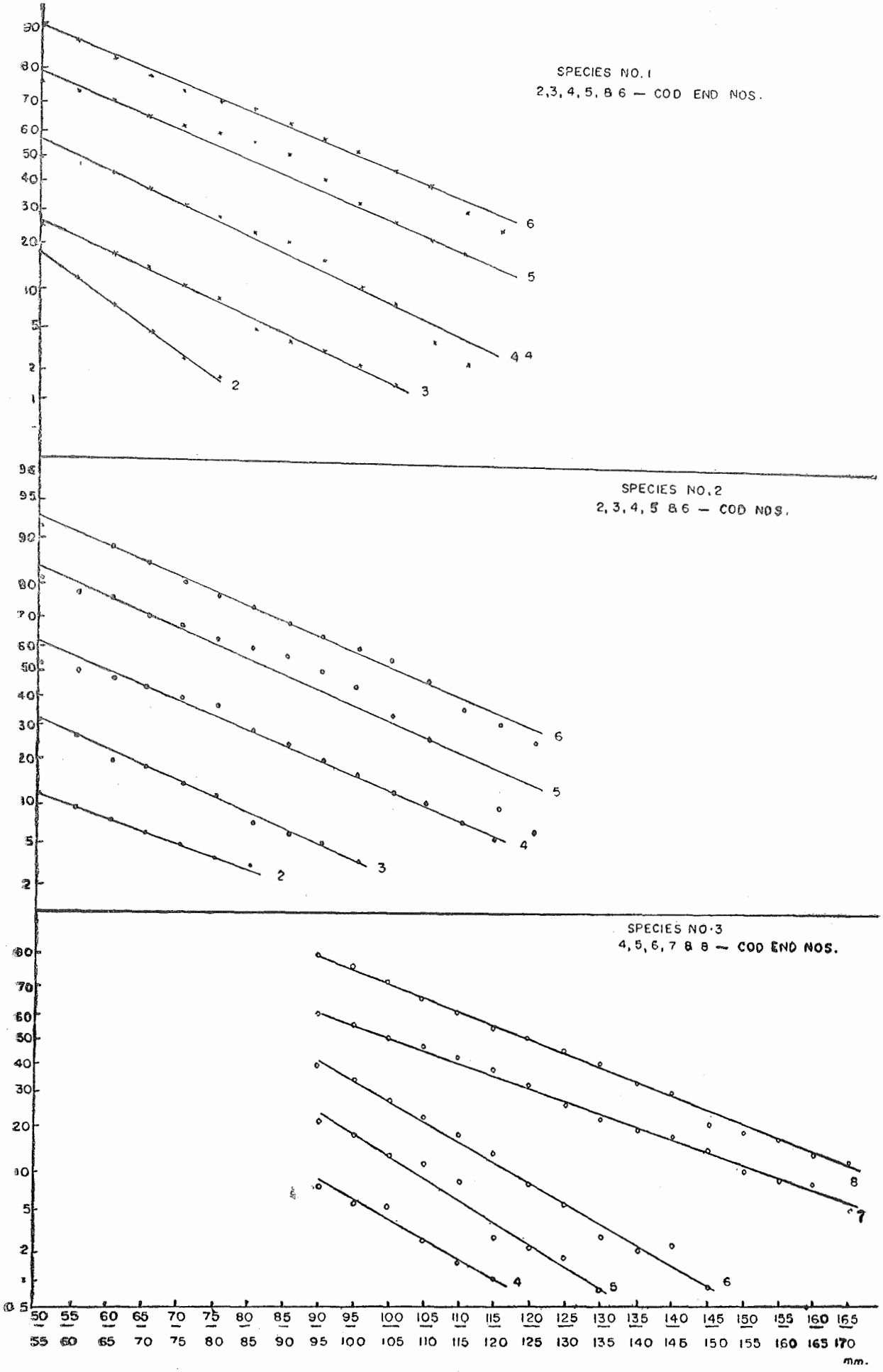

Fig. No. 10 : "Percentage of escape of species Nos. 1, 2 and 3 from cod end Nos. 2 to 8 (from 1" to 2.5").

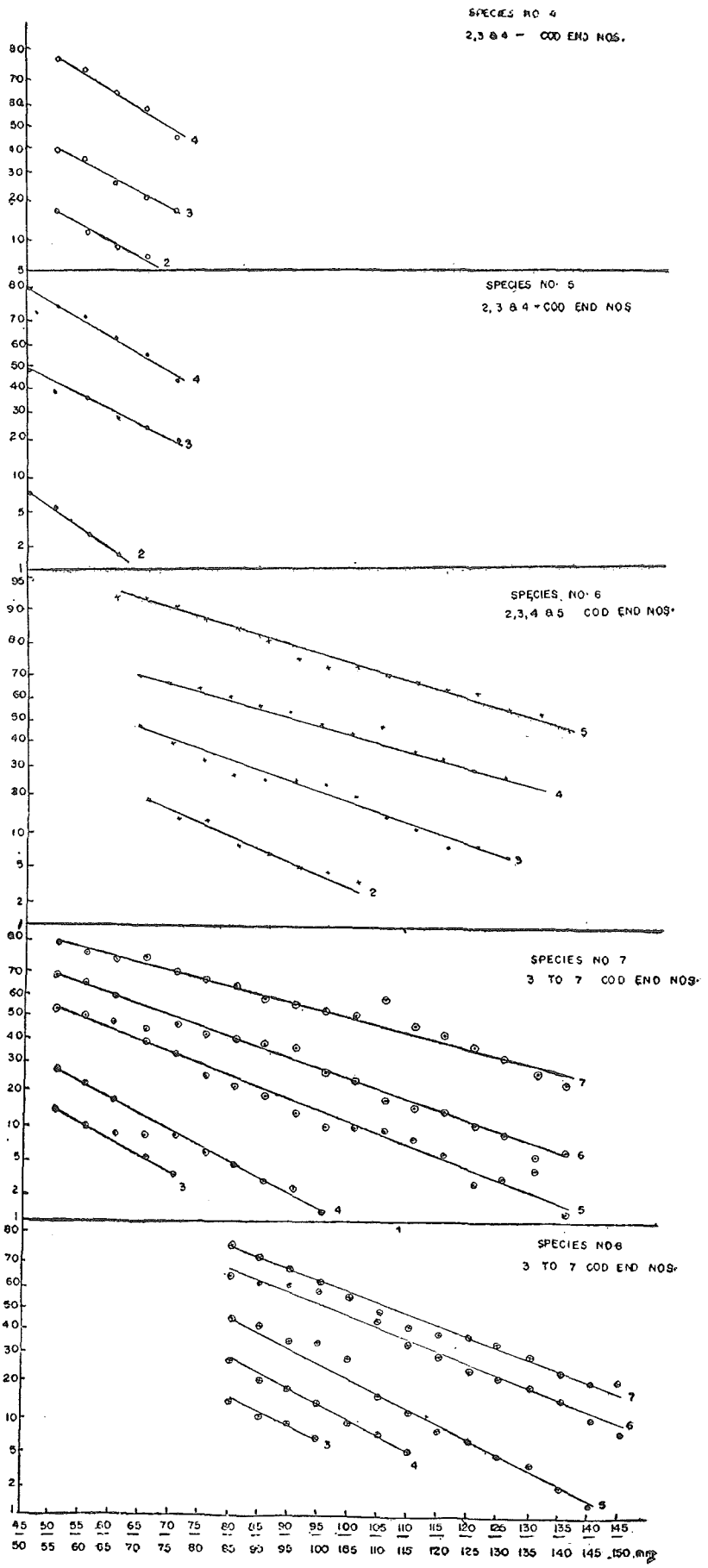

Fig. No. 11 : Percentage of escape of species Nos. 4 to 8 from cod end Nos. 2 to 7 (1" to 2.5").

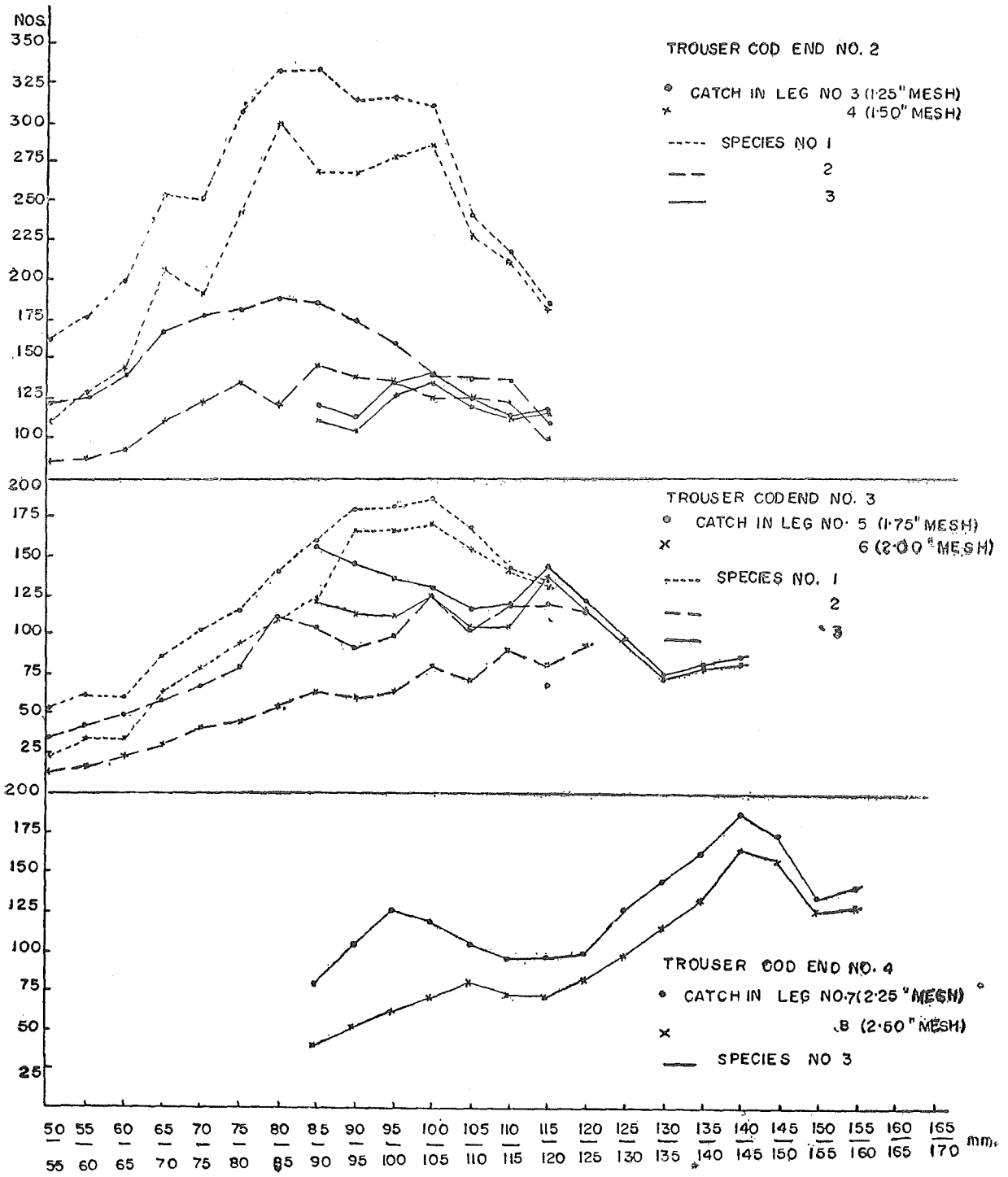

Fig. No. 12 : Catch of species Nos. 1, 2 and 3 in the small and larger meshed legs of trouser cod end Series Nos. 2, 3 and 4.

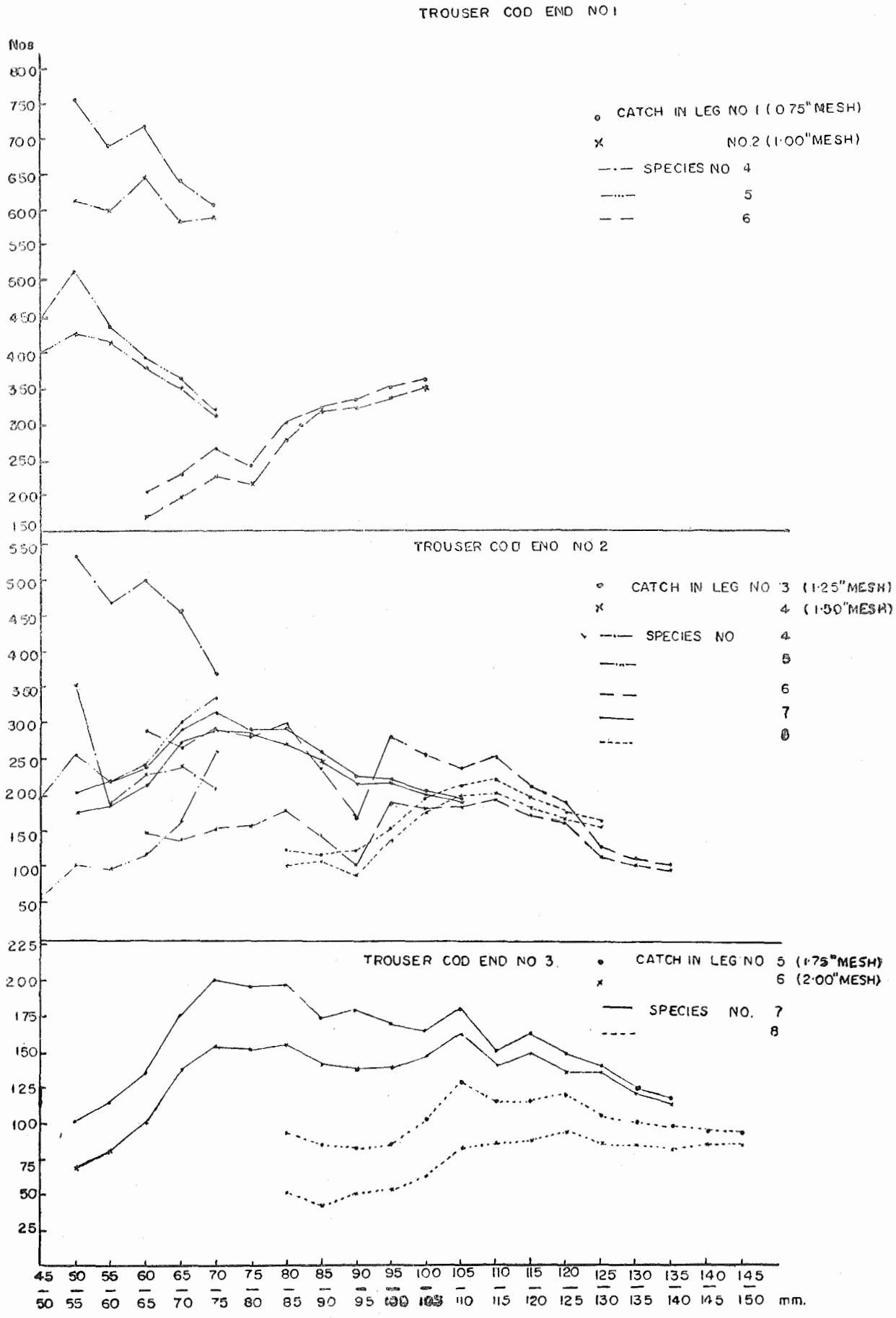

Fig. No. 13 : Catch of species Nos. 4 to 8 in the small and larger meshed legs of trouser cod end series Nos. 4 to 8

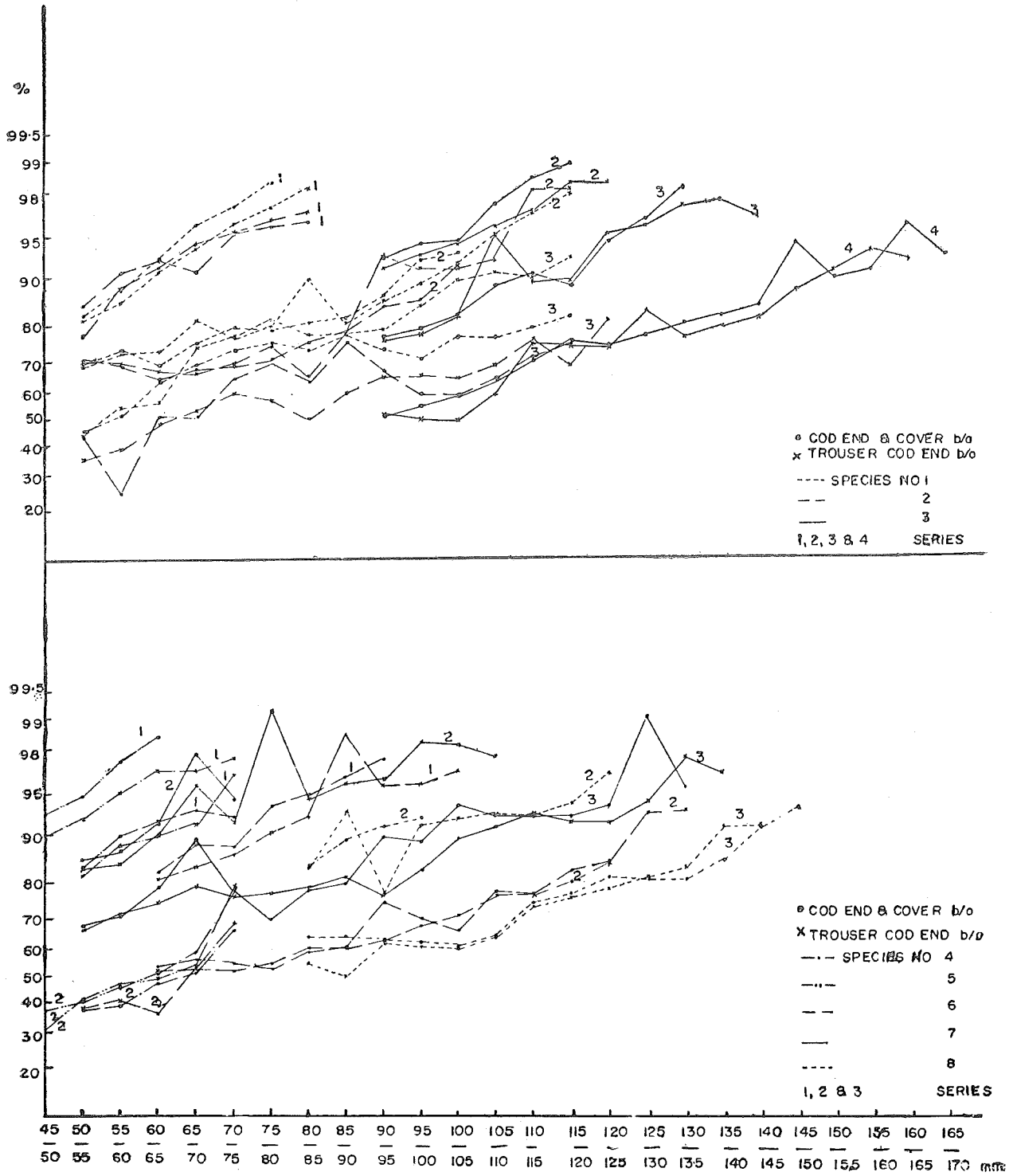

Fig. No. 14 : $\frac{b}{a}$ of cod end and cover and trouser series from species Nos. 1 to 8.

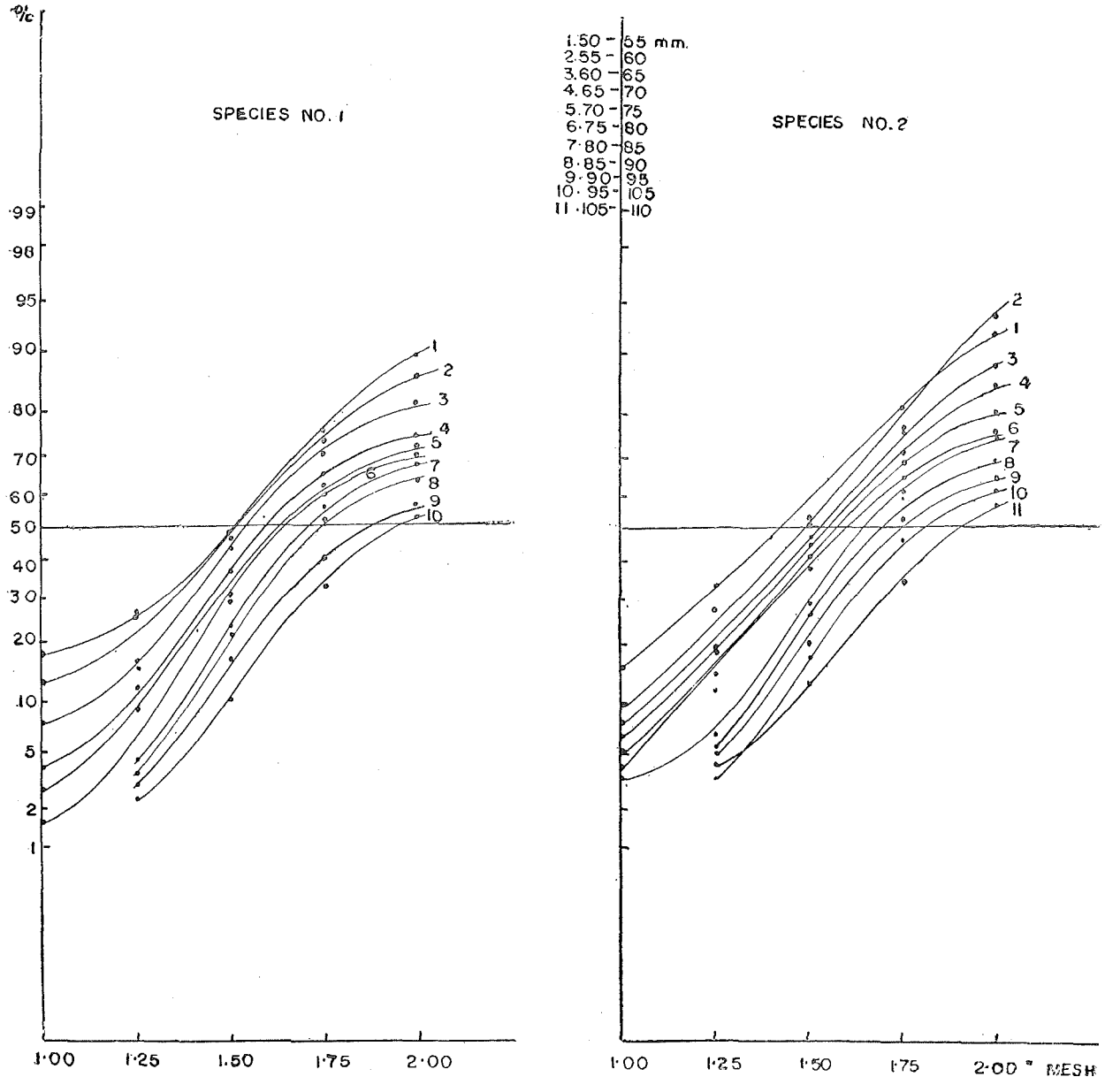

Fig. No. 15 : Probability curve showing 50% selection level of different length group of species Nos. 1 & 2.

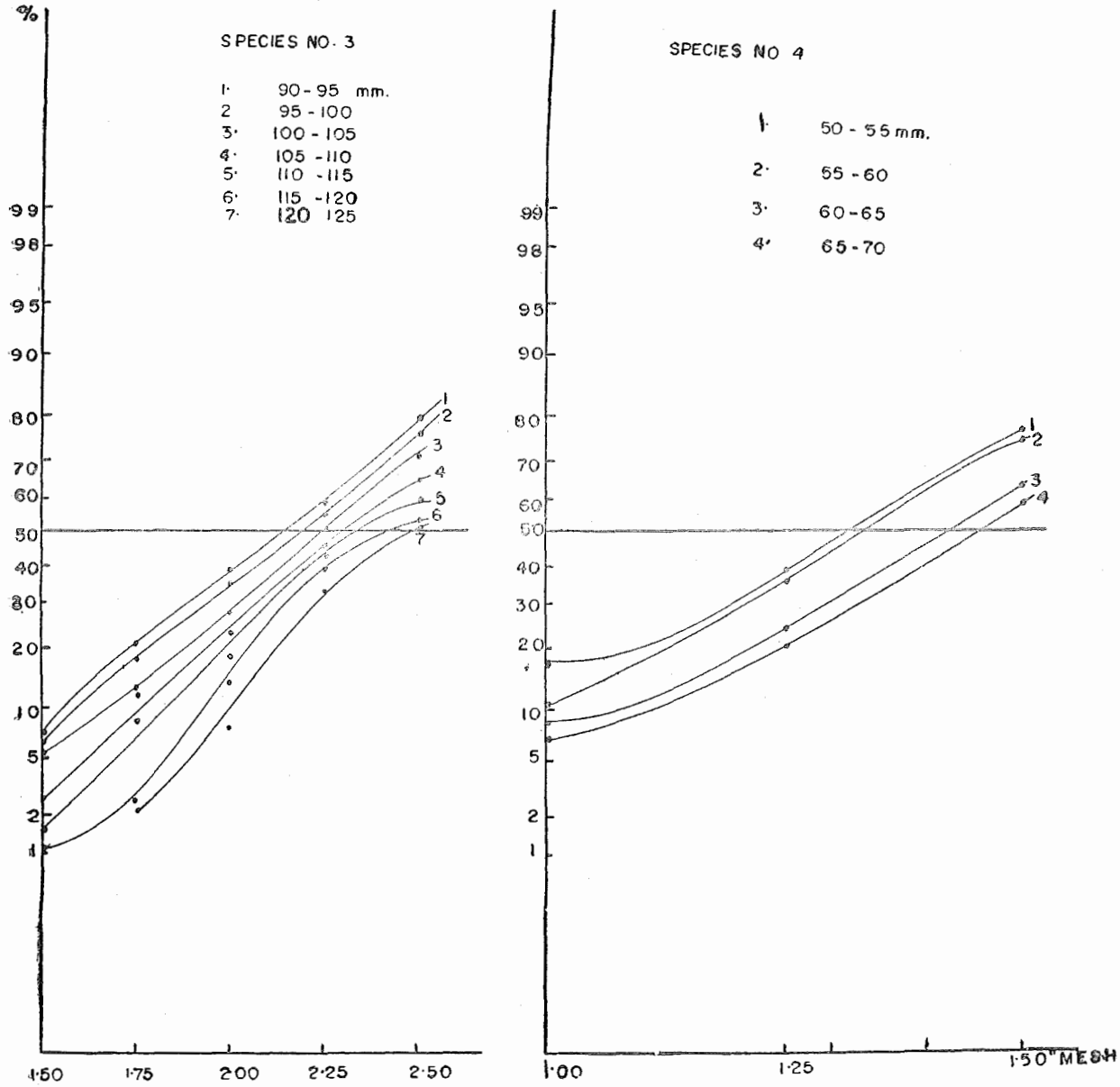

Fig. No. 16 : Probability curve showing 50% selection level of different length group of species Nos. 3 and 4.

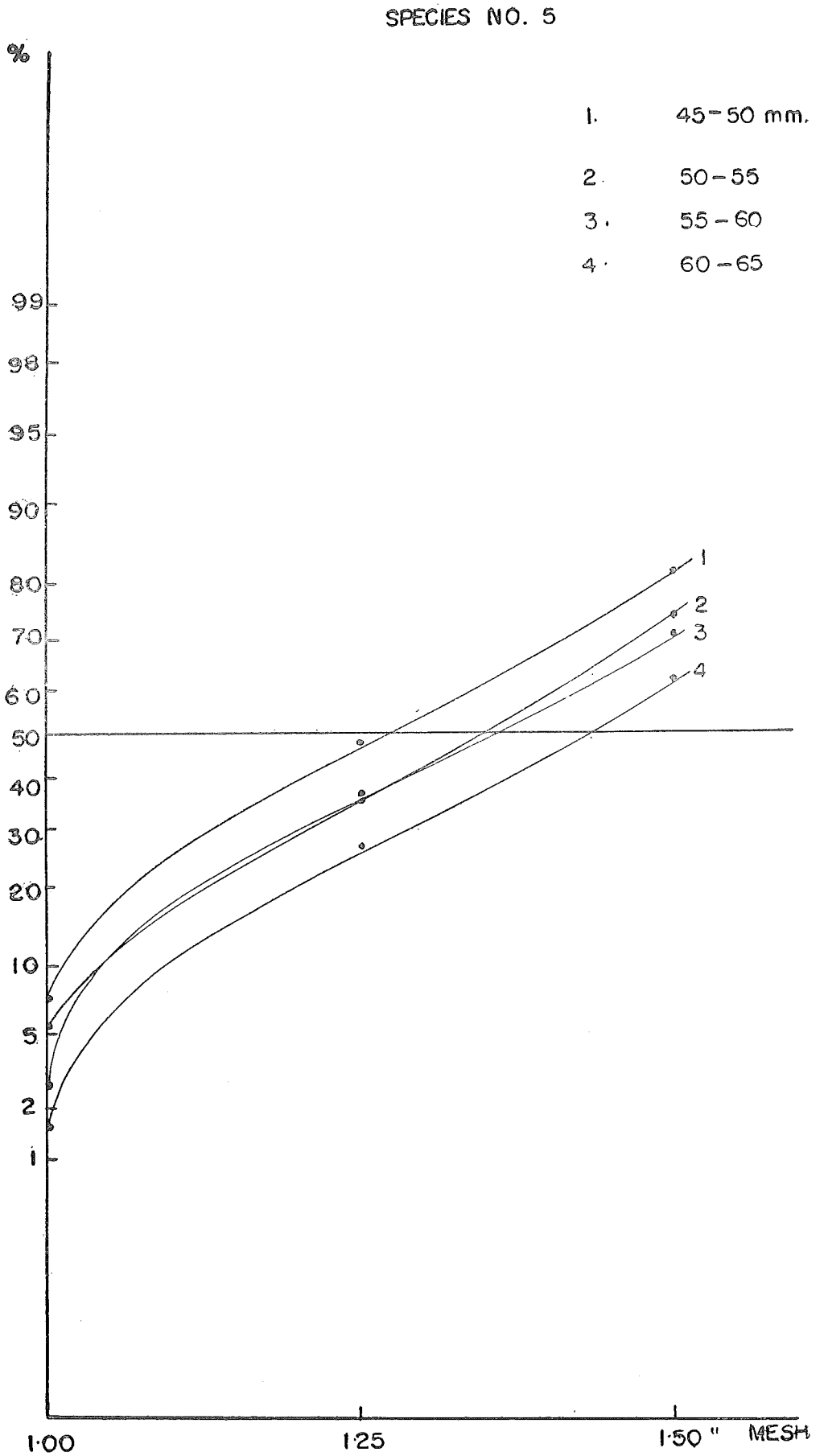

Fig. No. 17 : Probability curve showing 50% selection level of different length group of species No. 5.

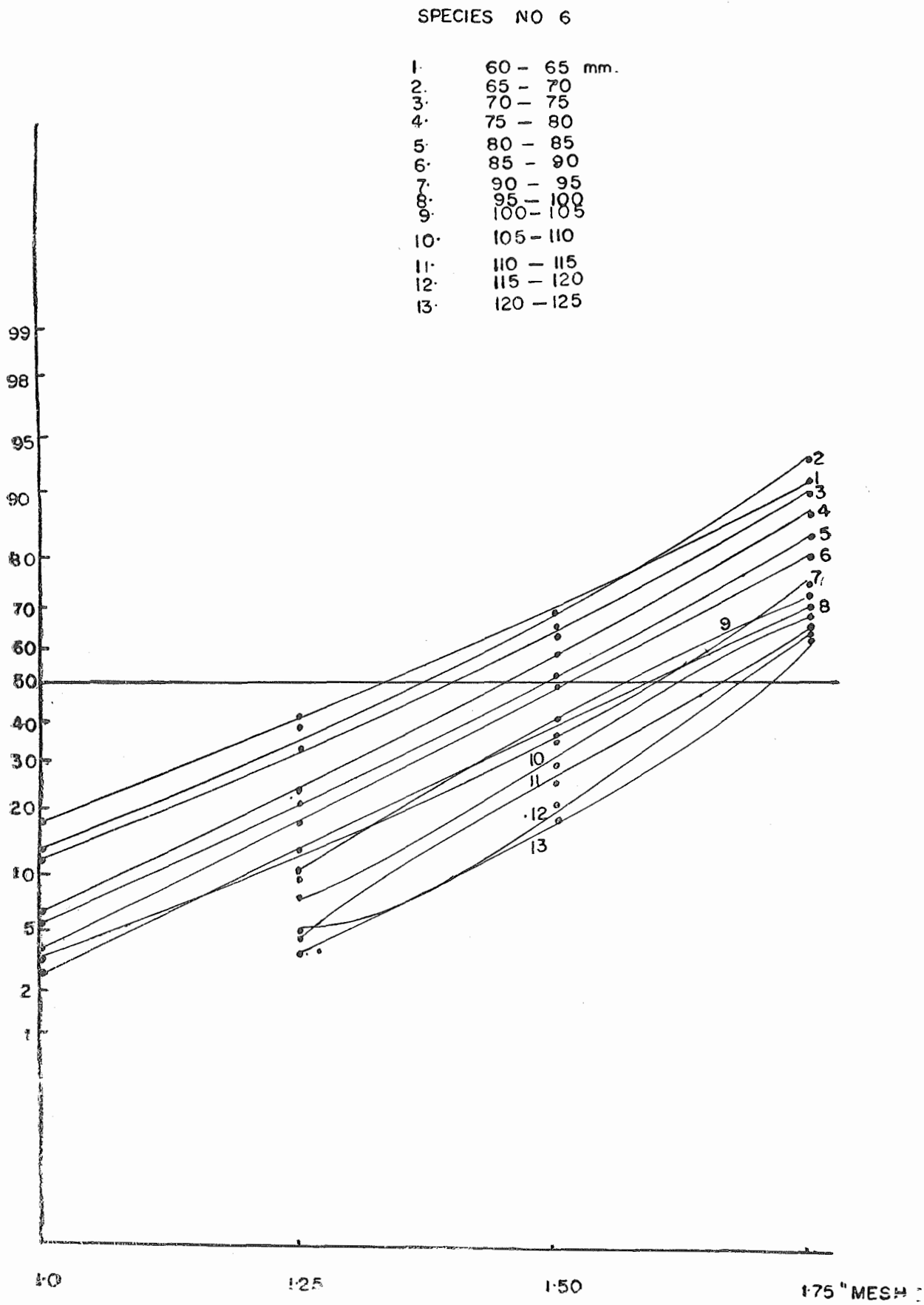

Fig. No. 18 : Probability curve showing 50% selection level of different length group of species No. 6.

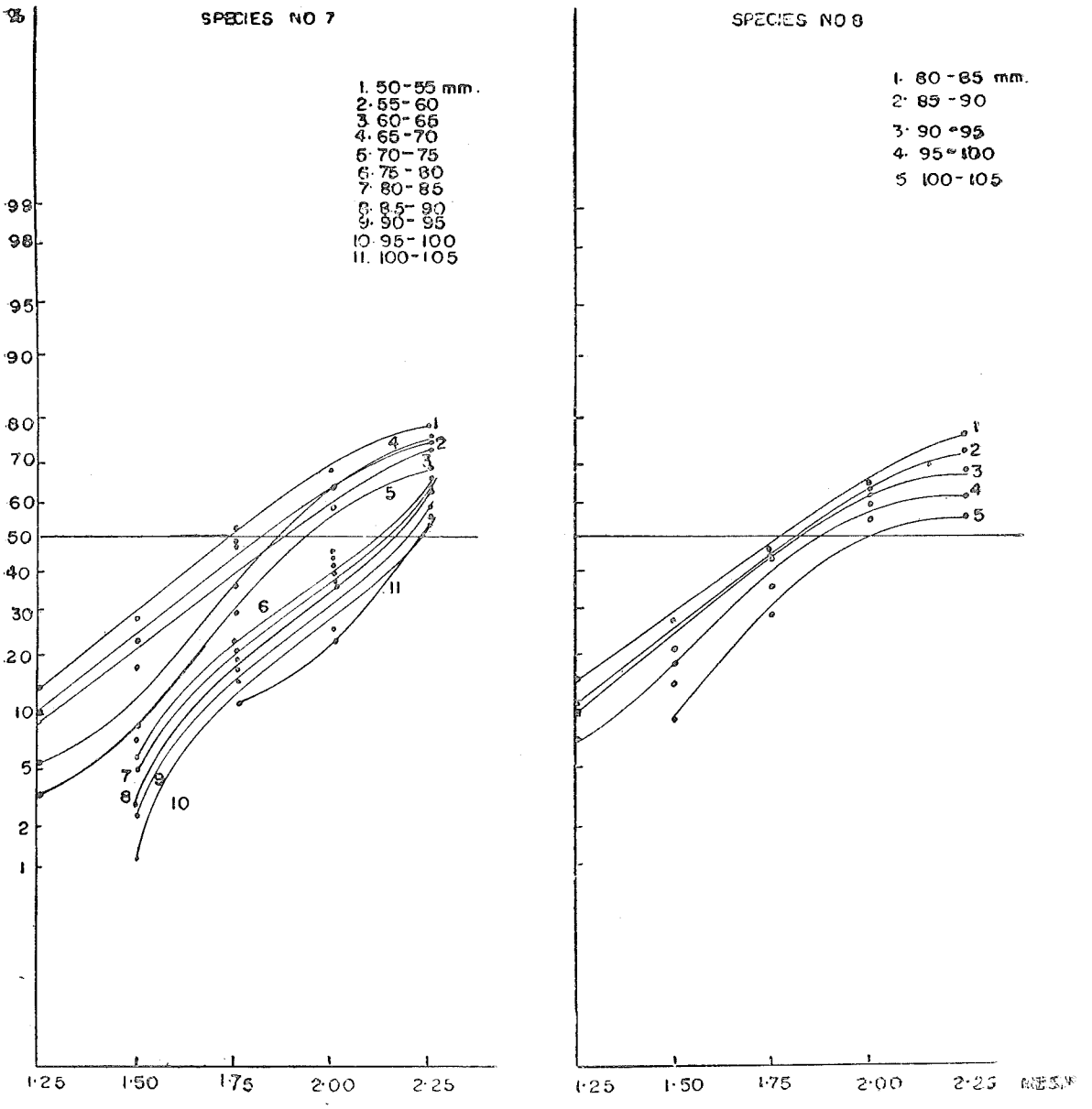

Fig. No. 19 : Probability curve showing 50% selection level of different lenght group of species Nos. 7 and 8.