

Selectivity of Gill Nets for *Hilsa toli* and *Pampus argenteus*

P. A. PANICKER*, T. M. SIVAN*, H. N. MHALATHKAR** and P. GEORGE MATHAI*

Veraval Research Centre of Central Institute of Fisheries Technology,
Veraval-362 265, Gujarat

Fishing conducted off Saurashtra coast during 1971-'74 with 27 units of nylon gill nets using 210/2/3, 210/3/3 and 210/4/3 twines with 51, 57 and 63 mm bar mesh and 0.70, 0.60 and 0.50 hanging coefficients have helped in standardising an optimum gear for exploitation of commercial size group of *Hilsa toli* and *Pampus argenteus*. Gill nets of 210/2/3 with 51 mm bar mesh and 0.60 hanging coefficient for *Hilsa toli* and 210/2/3 with 63 mm bar and 0.60 hanging coefficient for *Pampus argenteus* are recommended for the commercial exploitation of these two species of fishes.

Mesh selectivity and mesh regulations are essential for the conservation and judicious exploitation of fisheries. Consequent on the introduction of mechanised fishing, the problem of indiscriminate fishing has become all the more important. Studies of Wallaston (1927), Hodgson (1927, 1933), Havinga & Deedler (1948), Baranov (1948), Holt (1957), Oslén (1959), Nomura (1961), Joseph & Sebastian (1964), Sulochanan *et al.* (1968, 1975), Sreekrishna *et al.* (1972), on gill nets and Russel & Edser (1926), Davis (1929, 1934), Jensen (1949), Molunder (1949), Aoyama (1961), Treshev (1962), Kitajima *et al.* (1962), Panicker & Sivan (1965) on trawl nets are all aimed at minimising indiscriminate fishing. Results of mesh selectivity studies conducted by the authors during 1971-'74 using hilsa and pomfret gill nets off Saurashtra coast are reported in this paper.

Materials and Methods

27 units of gill nets of machine made nylon webbings having three different twine sizes, mesh sizes and hanging coefficients (Table 1) were operated as surface, column and bottom drift nets from a 9.75 m overall length fish-

ing vessel fitted with 37.50 HP 3 YDAM Ruston engine, using all combinations to minimise the variables and to give maximum probability of chance selection for individual units. A total of 147 operations were conducted thereby landing 4943.94 kg fish consisting of 2010 hilsa of total weight 1834.16 kg, 755 pomfrets weighing 348.00 kg and 2761.78 kg of other fishes (Tables 2, 3 & 4). Morphometric data of fish such as length, weight, gill girth and maximum girth of hilsa and weight of pomfret and other fishes were collected and statistically analysed (Table 5).

Results and Discussion

Nylon 210/2/3 has shown better preference over 210/3/3 and 210/4/3 with 35.90 & 33.70 and 44.10 and 42.70% respectively for hilsa and pomfret in number and weight. 70% of this constitutes the better size group of 35 cm and above in length and 750 g and above in weight in case of hilsa and 24 cm and above in length and 500 g and above in weight in case of pomfret (Figs. 1 to 4). However, nylon 210/3/3 has indicated its maximum preference over others at 34.60% by weight for hilsa.

Mesh size 51 mm bar has shown maximum preference in case of hilsa over 57 and 63 mm mesh bars at 54.10 and 46.30% respectively in number and weight. In case of pomfret 63 mm bar mesh has shown its

Present address: * Central Institute of Fisheries Technology, Cochin-682 029

** Goa Research Centre of Central Institute of Fisheries Technology, Goa-403 001

Table 1. Design details of nets

Twine size	Mesh size mm	Number of meshes in length	Number of meshes in depth	Coefficient of hanging	Specification of head rope	Specification of floats	Number of floats	Specification of sinkers	Number of sinkers
210/2/3	51.00	720	72	0.70			26		7
210/2/3	57.00	640	64	0.70			26		7
210/2/3	63.00	576	57	0.70			26		7
210/3/3	51.00	720	72	0.70			26		7
210/3/3	57.00	640	64	0.70			26		7
210/3/3	63.00	576	57	0.70			26		7
210/4/3	51.00	720	72	0.70			26		7
210/4/3	57.00	640	64	0.70			26		7
210/4/3	63.00	576	57	0.70			26		7
210/2/3	51.00	720	72	0.60			22		6
210/2/3	57.00	640	64	0.60			22		6
210/2/3	63.00	576	57	0.60			22		6
210/3/3	51.00	720	72	0.60			22		6
210/3/3	57.00	640	64	0.60			22		6
210/3/3	63.00	576	57	0.60			22		6
210/4/3	51.00	720	72	0.60			22		6
210/4/3	57.00	640	64	0.60			22		6
210/4/3	63.00	576	57	0.60			22		6
210/2/3	51.00	720	72	0.50			18		5
210/2/3	57.00	640	64	0.50			18		5
210/2/3	63.00	576	57	0.50			18		5
210/3/3	51.00	720	72	0.50			18		5
210/3/3	57.00	640	64	0.50			18		5
210/3/3	63.00	576	57	0.50			18		5
210/4/3	51.00	720	72	0.50			18		5
210/4/3	57.00	640	64	0.50			18		5
210/4/3	63.00	576	57	0.50			18		5

6 mm Ø 3 ply Garfil

13.5 x 13.5 x 1.25 cm wooden of extra buoyancy 100 g each

11 cm Ø x 3 cm thick cement sinkers of 500 g each

Table 2. *Number and weight of hilsa, pomfret and other fishes caught in nets of different mesh and twine sizes*

Twine size	Mesh size mm bar	Hilsa		Pomfret		Other fishes kg	Total kg
		Number	Weight kg	Number	Weight kg		
210/2/3	51.00	408	297.37	94	44.81	345.62	687.80
	57.00	216	211.63	118	488.09	254.53	514.25
	63.00	97	108.67	122	55.82	212.04	376.53
Total		721	617.67	334	148.72	812.19	1578.58
210/3/3	51.00	379	289.92	46	18.05	348.97	656.94
	57.00	192	207.25	72	34.04	330.28	571.57
	63.00	117	138.22	81	41.10	296.00	475.32
Total		688	635.39	199	93.19	975.25	1703.83
210/4/3	51.00	300	261.82	61	26.81	349.42	638.05
	57.00	209	216.03	72	33.29	333.57	582.89
	63.00	92	103.25	89	45.99	291.35	440.59
Total		601	581.10	222	106.09	974.34	1661.53

Table 3. *Number and weight of hilsa, pomfret and other fishes caught by nets of different meshes and hanging coefficients*

Mesh size	Hanging coefficient	Hilsa		Pomfret		Other fishes kg	Total kg
		Number	Weight kg	Number	Weight kg		
51.00	0.70	282	216.16	62	25.69	334.38	576.23
	0.60	420	309.99	69	32.40	327.57	669.96
	0.50	385	322.96	70	31.58	382.06	736.60
Total		1087	849.11	201	89.67	1044.01	1982.79
57.00	0.70	167	153.71	84	39.43	248.99	442.13
	0.60	218	226.31	86	42.77	319.91	588.99
	0.50	232	254.89	92	33.22	349.48	637.59
Total		617	634.91	262	115.42	918.38	1668.71
63.00	0.70	80	85.24	91	45.97	242.32	373.53
	0.60	111	130.89	109	54.89	287.12	472.90
	0.50	115	134.01	92	42.05	269.95	446.01
Total		306	350.14	292	142.91	799.39	1292.44

Table 4. Number and weight of hilsa, pomfret and other fishes caught in nets of different twine sizes and hanging coefficients

Hanging coefficient	Twine size	Hilsa		Pomfret		Other fishes kg	Total kg
		Number	Weight kg	Number	Weight kg		
0.70	210/2/3	192	146.60	94	42.39	235.91	424.90
	210/3/3	165	150.62	71	32.75	289.92	473.29
	210/4/3	172	157.89	72	35.95	299.86	493.70
Total		529	455.11	237	111.09	825.69	1391.89
0.60	210/2/3	272	230.65	110	52.54	307.04	500.23
	210/3/3	253	230.91	71	35.04	287.73	553.68
	210/4/3	224	205.63	83	42.48	339.83	587.04
Total		749	667.19	264	130.06	934.60	1731.85
0.50	210/2/3	257	240.42	130	53.79	269.24	563.45
	210/3/3	270	253.86	57	25.40	397.60	676.86
	210/4/3	205	217.58	67	27.66	334.65	579.89
Total		732	711.86	254	106.85	1001.49	1820.20

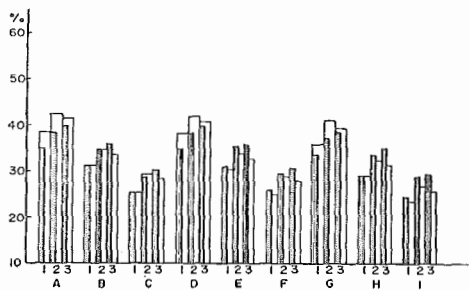


Fig. 1. Catch in per cent by weight and number for hilsa

□ Number ▨ Weight (Kg.)

1-0.7, 2-0.6, 3-0.5 hanging coefficients

A-210/2/3, 51 mm bar mesh; B-210/2/3, 57 mm bar mesh; C-210/2/3, 63 mm bar mesh; D-210/3/3, 51 mm bar mesh; E-210/3/3, 57 mm bar mesh; F-210/3/3, 63 mm bar mesh; G-210/4/3, 51 mm bar mesh; H-210/4/3, 57 mm bar mesh; I-210/4/3, 63 mm bar mesh.

preference over 51 and 57 mm bar mesh at 38.70 and 41.10% respectively in number and weight. 84 and 75% of this constitutes respectively the better commercial size group of hilsa and pomfret (Figs. 1 to 4).

Hanging coefficient 0.60 has shown better preference over 0.70 and 0.50 in case of hilsa by number at 37.30% and pomfret by number and weight at 35 and 37.40% respectively. 79.50 and 76.00% of this constitute respectively the better commercial size group of hilsa and pomfret. However, hanging coefficient 0.50 has shown better preference in case of hilsa by weight without much difference at 38.80% (Fig. 1 to 4).

Statistical analysis has shown significance at 1% level for hilsa in both number and weight with respect to mesh size and hanging coefficient. In the case of pomfret it is found significant at 1% level for twine size and mesh size with respect to weight and at 1 and 5% levels respectively for twine

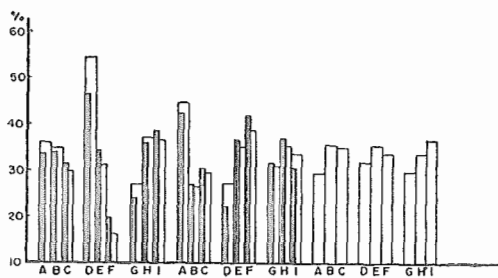


Fig. 2. Total catch in per cent by weight and number for different species

□ Number ▨ Weight (kg.)

A-Nylon 210/2/3, B-Nylon 210/3/3, C-Nylon 210/4/3, D-51 mm bar mesh, E-57 mm bar mesh, F-63 mm bar mesh, G-0.7 hanging coefficient, H-0.6 hanging coefficient, I-0.5 hanging coefficient.

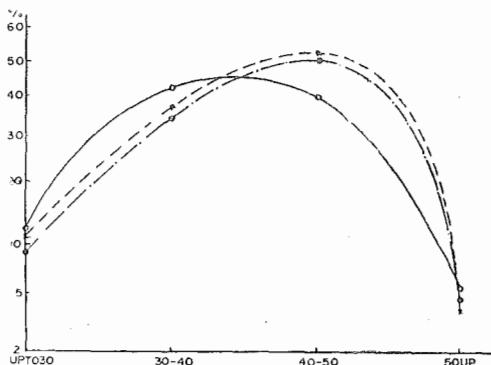


Fig. 3 b Probability curve of length frequency for hilsa with reference to mesh size

○—○ 51 mm bar mesh,
X—X 57 mm bar mesh,
●—● 63 mm bar mesh

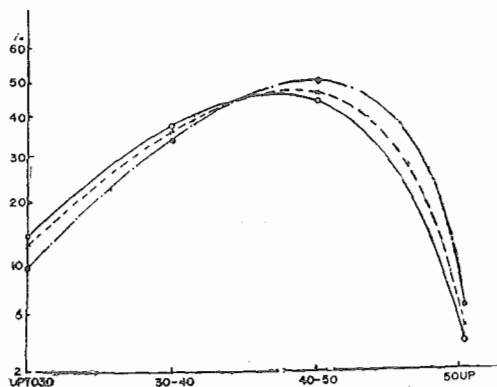


Fig. 3 a. Probability curve of length frequency for hilsa with reference to twine size

○—○ Nylon 210/2/3,
X—X Nylon 210/3/3,
●—● Nylon 210/4/3

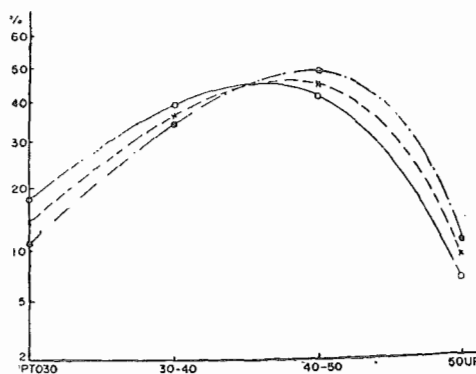


Fig. 3 c. Probability curve of length frequency for hilsa with reference to hanging coefficient

○—○ 0.7 hanging coefficient,
X—X 0.6 hanging coefficient,
●—● 0.5 hanging coefficient

size and mesh size for number (Table 5). When the overall performance of the gear is considered it is significant at 1% level for mesh size and hanging coefficient in relation to the total catch by weight.

The above results have shown a sharp selection in the case of mesh size and hanging coefficient. Out of 2010 hilsa of total weight 1834.16 kg 721 numbers weighing 617.67 kg were taken by nets of nylon 210/2/3; 1087 hilsa weighing 849.11 kg were taken by nets of 51 mm bar mesh and 749 hilsa

weighing 667.19 kg were taken by nets of 0.60 hanging coefficient. Again out of 721 hilsa weighing 617.67 kg caught by nets on nylon 210/2/3, 408 hilsa weighing 297.37 kg came from 51 mm bar mesh and 272 hilsa weighing 230.65 kg from 0.60 hanging coefficient. This trend of selection in respect to hilsa catch has made it possible to recommend a gill net of nylon 210/2/3 with 51 mm bar mesh and 0.60 hanging coefficient as the optimum gear for the judicial exploitation.

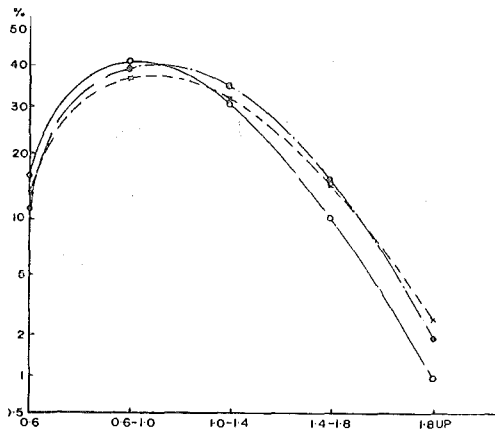


Fig. 4 a Probability curve of weight frequency for hilsa with reference to twine size

- Nylon 210/2/3,
- ×—× Nylon 210/3/3,
- Nylon 210/4/3

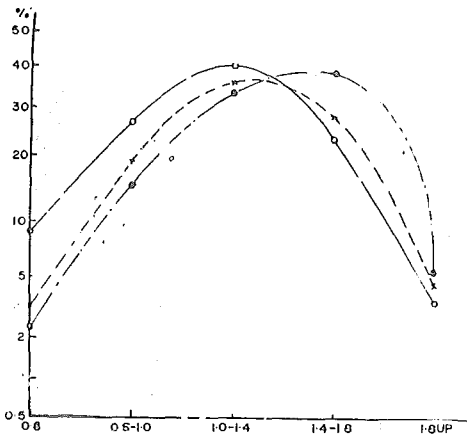


Fig. 4 b. Probability curve of weight frequency for hilsa with reference to mesh size.

- 51 mm bar mesh,
- ×—× 57 mm bar mesh,
- 63 mm bar mesh

Nets of nylon 210/3/3 with 0.50 hanging coefficient has indicated a slight increase in catch with respect to weight, but considering the increase which is less than 3 and 6% respectively for nylon 210/3/3 and 0.50 hanging coefficient over nylon 210/2/3 and 0.60 hanging coefficient, the use of a higher twine number and lower hanging coefficient

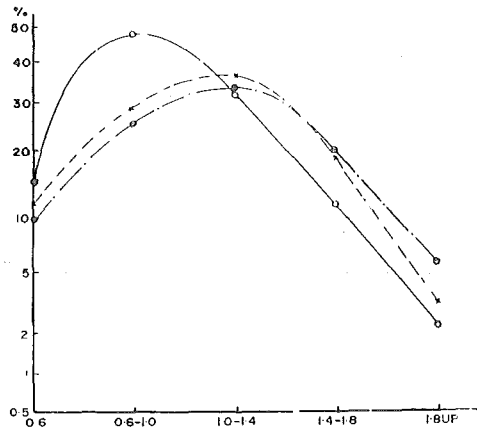


Fig. 4 c Probability curve of weight frequency for hilsa with reference to hanging coefficient

- 0.7 hanging coefficient,
- ×—× 0.6 hanging coefficient,
- 0.5 hanging coefficient

can be ruled out. Again the high percentage of better commercial size group of hilsa namely 70, 85 and 79% respectively for nylon 210/2/3, 51 mm bar mesh and 0.60 hanging coefficient justifies the above selection.

In the case of pomfret there is a sharp selection with respect to twine size, mesh size and hanging coefficient. According to Solanki *et al.* (1976) pomfrets caught in the local gill net varies from 16 to 28 cm in length and 150 to 775 g in weight. The average weight of a pomfret taken by the experimental gear is 500 g and its corresponding length is 24 cm. This size group is taken for the commercial exploitation. This is represented by 70, 75 and 76% respectively for nylon 210/2/3, 63 mm bar mesh and 0.60 hanging coefficient (Fig. 2). Out of 755 pomfrets weighing 348 kg, 334 pomfrets weighing 148.72 kg were taken by nets of nylon 210/2/3; 292 pomfrets weighing 142.91 kg were taken by nets of 63 mm bar mesh and 264 pomfrets weighing 130.06 kg taken by nets of 0.60 hanging coefficient. Again out of 334 pomfrets weighing 148.72 kg taken by nets of nylon 210/2/3, 122 weighing 55.82 kg came from 63 mm bar mesh, 110 weighing 52.54 kg is from 0.60 hanging coefficient. The percentage catch of 41.10, 38.70, 35.00 respectively for nylon 210/2/3, 63 mm bar mesh and 0.60 hanging coefficient in number

Table 5. *Analysis of variance*

Source	D. F.	S. S.	M. S.
		Hilsa numbers	
Twine size	2	854.00	427.00
Mesh size	2	34,354.90	17,177.45**
Hanging coefficient	2	3,329.56	1,664.28**
Error	20	3,382.22	169.11
Total	26	41,920.68	
		Hilsa weight	
Twine size	2	170.32	85.16
Mesh size	2	13,923.96	6,961.98**
Hanging coefficient	2	4,181.26	2,090.63**
Error	20	1,354.58	67.73
Total	26	19,630.12	
		Pomfret numbers	
Twine size	2	1,159.18	579.59**
Mesh size	2	477.86	238.93*
Hanging coefficient	2	41.40	20.70
Error	20	1,118.52	55.92
Total	26	2,796.96	
		Pomfret weight	
Twine size	2	187.68	93.84**
Mesh size	2	157.52	78.76**
Hanging coefficient	2	33.94	16.97
Error	20	186.20	9.31
Total	26	565.34	
		Total fish by weight	
Twine size	2	902.14	451.07
Mesh size	2	26,548.46	13,274.23**
Hanging coefficient	2	11,364.00	5,682.00**
Error	20	17,554.24	877.71
Total	26	56,368.84	

**Significant at 1% level *Significant at 5% level

and 42.70, 41.70, and 37.40% by weight indicated a clear and sharp selection to recommend gill nets of 210/2/3 with 63 mm bar mesh and 0.60 hanging coefficient as the optimum gear for pomfrets.

Any chance of indiscriminate exploitation leading to depletion of stock can thus be avoided by fixing the commercial size as 36 cm and above in length and 750g and above by weight for hilsa and 24 cm and above in length and 500 g and above by weight for pomfret. Excluding the lower size groups of these fishes, will not in any way upset the economy but will help to a great extent to avoid depletion of stock by intensive and extensive fishing.

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