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Optimization of Mesh Size of Gill Nets for *Sardinella gibbosa* (Bleeker)

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Fishing conducted in inshore waters off Thoothukkudi (Tamil Nadu) during 1997-98 using 16 units of nylon gill nets with 26, 28, 30 and 32 mm mesh size made up of 210D/1/2 twine revealed that the proportionality co-efficient (k) of the gill net selectivity equation for *Sardinella gibbosa* was 0.104. Gill net with mesh size 29.6 mm was found to be ideal for the commercial exploitation of *S. gibbosa* which contributes considerably to the lesser sardine fishery of Thoothukkudi coast. The details of enmeshing pattern of different length groups of *S. gibbosa* in gill nets of different mesh sizes are presented.

Key words: Mesh size, gill nets, *Sardinella gibbosa*, selectivity

Attempts have been made in India to optimize the mesh sizes for commercial exploitation of different inland and marine fishes (Joseph & Sebastian, 1964; Sulochanan *et al.*, 1968; Sreekrishna *et al.*,1972; Sulochanan *et al.*, 1975; Khan *et al.*, 1989; Kartha & Rao, 1991; Neethiselvan *et al.*, 2000). Luther *et al.*, (1994) studied the role of gill nets in the exploitation of lesser sardines at Visakhapatnam inshore area and concluded that the operation of gear having mesh size less than 28 mm must be discouraged for ensuring sustained lesser sardine fishery in the region.

In Thoothukkudi inshore waters, *Sardinella gibbosa* is captured using both shore seines and gill nets. However, gill nets are largely employed for capturing this species. Fishermen of this coast use gill nets of various mesh sizes ranging from 25 to 36 mm, leading to indiscriminate capture of this species. In this study, an attempt was made to determine the optimum mesh size for the commercial exploitation of *S. gibbosa*, which forms a notable fishery from June to August along this coast.

Materials and Methods

Gill nets of mesh size 26, 28, 30 and 32 mm each, in quadruplicate, were made from machine-made nylon webbing, fabricated using 210D/1/2 twine. The nets with mesh size 26, 28, 30 and 32 mm used in this study were designated as A, B, C and D, respectively. During the operation, all the sixteen nets were connected serially and a total of 50 fishing operations were carried out, off the ship anchorage of Thoothukkudi Port from 4 am to 7 am. The fishing operations were carried out from January to August 1997 using a 20 footer plank-built boat powered with a 10 hp inboard engine. After every operation, the fish caught in each net were segregated and morphometric measurements such as total length, gilled girth and maximum girth were recorded. According to Baranov (1948), mesh size of gill nets is proportional to modal length of fish caught by it. Proportionality coefficient, k, was determined as per the method described by Baranov (1948).

Results and Discussion

The details of average fish catch per operation of the nets A, B, C and D are given in Table 1. Details such as number of fishes examined, length range, and mean length of *S. gibbosa* captured in different nets are given in Table 2. The length frequency distribution expressed as percentage of the fish caught in

Table 1. Average fish catch per operation of experimental gill nets

Gear	Catch per unit (nos.)	Total catch (nos.)
A	378	1512
B	406	1624
C	224	986
D	84	336

Table 2. Details of fish caught in experimental gear

	Nets			
	A	B	C	D
No. of fish examined	235	250	180	175
Length range (mm)	10.50-14.20	12.00-14.50	14.10-15.70	14.40-17.00
Mean length (mm)	12.26±2.03	13.43±1.11	14.81±1.80	15.52±1.50

Table 3. Length frequency distribution as percentage of *Sardinella gibbosa* caught in nets A, B, C & D

	Nets			
	A	B	C	D
111-115	10.1	0	0	0
116-120	15.1	8.7	0	0
121-125	27.6	13.0	0	0
126-130	24.5	16.3	12.5	0
131-135	13.0	22.4	12.7	0
136-140	6.0	29.0	18.5	0
141-145	3.7	10.6	31.3	32.3
146-150	0	0	14.5	43.3
151-155	0	0	10.5	18.7
156-160	0	0	0	5.7

different nets is given in Table 3. Enmeshing pattern of *S. gibbosa* in different experimental nets is given in Tables 4, 5, 6 and 7.

On analyzing the growth stages of the fish caught in the nets A, B, C and D, it was evident that most of the fish caught in the net A were either juvenile or maturing animals. The catch from the nets B, C and D were mostly constituted by mature and spent fishes. Since the net D could capture only a few fishes, the fishes caught from this net were excluded for the estimation of 'k'. The estimated k value based on the l_o (130 mm) derived from the length frequency data of the nets A and B was 0.1037 and the value

Table 4. Enmeshing pattern of various size groups of *Sardinella gibbosa* in gill net 'A'

Size range in cm	Percentage of enmeshing		
	Before opercular margin	At opercular margin	Between opercular margin and maximum girth
111-115	–	65	35
116-120	–	68	32
121-125	–	70	30
126-130	–	86	14
131-135	2	98	–
136-140	8	92	–
141-145	14	86	–
146-150	8	82	–
151-155	25	75	–
156-160	30	70	–

Table 5. Enmeshing pattern of various size groups of *Sardinella gibbosa* in gill net 'B'

Size range in cm	Percentage of enmeshing		
	Before opercular margin	At opercular margin	Between opercular margin and maximum girth
111-115	–	–	–
116-120	–	82	18
121-125	–	94	6
126-130	–	100	–
131-135	–	100	–
136-140	–	100	–
141-145	7	93	–
146-150	–	–	–
151-155	–	–	–
156-160	–	–	–

of l_o and k derived from the length frequency data of the nets B and C were 139 mm and 0.1042, respectively. The average value of k was worked out to be 0.104. Taking this value of k, the mesh size required for the exploitation of commercially significant size group (141–145 mm) was 29.6 mm (i.e., 142.5 x 0.104 = 14.8 mm; 2 x 14.8 = 29.6 mm).

The length group 141-145 mm formed 17% of the commercial landings (Table 8) and this length group comprised of mainly spawning and spent animals. The commercially important size group of 141-156 mm

Table 6. Enmeshing pattern of various size groups of *Sardinella gibbosa* in gill net 'C'

Size range in cm	Percentage of enmeshing		
	Before opercular margin	At opercular margin	Between opercular margin and maximum girth
111-115	–	–	–
116-120	–	–	–
121-125	–	–	–
126-130	–	–	–
131-135	–	–	–
136-140	–	92	8
141-145	15	79	6
146-150	24	72	4
151-155	30	70	–
156-160	32	68	–

Table 7. Enmeshing pattern of various size groups of *Sardinella gibbosa* in gill net 'D'

Size range in cm	Percentage of enmeshing		
	Before opercular margin	At opercular margin	Between opercular margin and maximum girth
111-115	–	–	–
116-120	–	–	–
121-125	–	–	–
126-130	–	–	–
131-135	–	–	–
136-140	–	–	–
141-145	–	–	–
146-150	–	92	8
151-155	–	95	5
156-160	–	98	2

was properly enmeshed at opercular margin in the nets B and C to the extent of 93% and 79%, respectively (Tables 5 & 6) and the proposed mesh size of 29.6 mm falls between the mesh size of the nets B and C. Further, it is suggested that the use of nets with mesh size 26 mm and less should be discouraged so as to avoid capturing juveniles in order to prevent 'growth over-fishing' of *S. gibbosa* off Thoothukkudi coast.

Table 8. Composition of landings of *Sardinella gibbosa*

Length range (mm)	Percentage composition
111-115	2.0
116-120	5.0
121-125	10.0
126-130	15.0
131-135	15.0
136-140	16.0
141-145	17.0
146-150	12.0
151-155	5.0
156-160	2.0

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