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Selectivity estimates for *Sphyraena jello* (Sphyraenidae) in the gill net fishery along Thoothukudi Coast, Southeast coast of India

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Abstract

Length frequency of barracudas, *Sphyraena jello* (Sphyraenidae) caught in gillnet with mesh size of 28, 50 and 52 mm operated in the Thoothukudi coast, Tamilnadu was recorded using this the selectivity parameters of the nets of these mesh sizes were assured. The size range of *S. jello* caught was 13-82 cm. The estimated selection factor ranged as 8.27 and the selection length ranged from 48 to 50 cm. Gillnets with mesh size less than 28 mm did not facilitate the escapement of *S. jello* which had not attained the stage of first maturity.

Keywords: gillnet selectivity, mesh size, *Sphyraena jello*, Thoothukudi coast

Introduction

Selectivity of fishing gear is an important tool for effective management of fisheries. The importance of selecting the optimum mesh size from the stand point of conservation of resources has been stressed by several investigators. Havinga & Deedler, (1948) [7]; Nomura, (1961) [13]. The selectivity of fishing gear has a direct influence on the exploited stock Hamley & Regier (1973) [5]; Hamley (1975) [6]. Studies on optimum mesh size were carried out in India for some commercially important species (Joseph & Sebastian, (1964) [8]; Sree Krishna *et al* (1972) [19]; Sulochanan *et al* (1968) [20] Dananjanie *et al* (2009) [2].

Gillnets with small and big mesh are widely used in Thoothukudi coastal waters to capture of anchovies, sardines, carangids and barracuda. Of these gillnets for barracuda with mesh size in the range of 28 mm to 128 mm are operated throughout the year.

Sphyraena jello is a common species in the Thoothukudi coast. The selectivity estimates for this important species has not been done so far. The main objective of this study was to determine the optimum mesh size, selection factor and commercial significant length group of *Sphyraena jello*.

Materials and Methods

The study was carried out for one year from April 2012 to March 2013 at Threspuram, Inigonagar and Tharuvaikulam landing centers for traditional crafts of Thoothukudi Coast (Tamil Nadu, Southeast Coast, India). Nets with the mesh size of 28 mm, 50 mm and 52 mm were sampled from the gillnets operated from the commercial fishing boats of Thoothukudi origin, (Popularly called "Vallam"). The nets with the mesh size of 28, 50 and 52 mm were named as net 'A', 'B', and 'C' respectively. The features of the net A, B and C are given in Table 1.

The webbings were maintained to head rope, maintaining a uniform horizontal hanging coefficient of 0.5. The total length of individual fish was measured to the nearest cm. The mesh size determined by measuring the stretched meshes with a centimeter scale (FAO, 1978) [4]. The selectivity was estimated by using the indirect method of Sparrae and Venema (1992) [18]. According to him, for gilling and wedging, the selection curves are bell shaped and can be described by the following relation $S(L) = \exp[-(L-L_c)^2 / 2S^2]$ where $S(L)$ is the length based gear selectivity, L is the mid length of the size/length group, L_c is the mean selection length per being caught and S is the standard deviation of the normal distribution.

The procedure for estimation of selection curve involved the following steps:

- i) CB = Number of fish caught in net with larger mesh size (m2)
CA = number if fish caught in A net with smaller mesh size (m1).
- ii) Calculations for log ratios for successive fish lengths

$$Y = \ln(CB/CA)$$

Linear Regression analysis was made against the mid value of each of the length group as follows

$$\ln(CB/CA) = a_1 + b_1L$$

Where, a₁=Intercept for BA combination
b₁= slope value for BA combination

$$\ln(CC/CB) = a_2 + b_2L$$

Where, a₂=Intercept for CB combination
b₂= slope value for CB combination
L= mid length of a length group
CA, CB and CC refers to catch in number in net with the mesh size A, B and C corresponding to the mid value of length group, L.

- iii) Regression analysis of the log ratios against the interval midpoint and expressed as,

$$Y = a + bL$$

Where, Y is the natural logarithm of ratio of catches, L is the midpoint of the length class and a and b are constants. The common selection factors (SF) for three mesh combination viz. A, B and C was derived using the equation.

$$SF = \frac{-2x [(A+B) \times a_1/b_1] + [(B+C) \times a_2/b_2]}{(A+B)^2 + (B+C)^2}$$

- iv) The common standard deviation(s) for three combinations A, B and C was derived using the equation

$$S = \sqrt{\frac{1}{3-1} \left[\frac{-2xa_1 \times (B-A)}{b_1^2 \times (A+B)} \right]^2 + \left[\frac{-2xa_2 \times (C-B)}{b_2^2 \times (B+C)} \right]^2}$$

- v) The mean selection length (L_c) of each net was estimated from the common selection factor (SF) as follow

$$L_{ci} = SF \times mi$$

Where, 'L_{ci}' refers to mean selection length of different nets 'mi' refers to different mesh size

- vi) The optimum mesh size for the commercial exploitation of each species of barracuda were worked out based on the following formula,

$$m = \frac{L_{opt}}{SF}$$

Where 'm' is the stretched measure of mesh in cm and 'L_{opt}' is either the mid-length of the commercially significant length group or mean length at first maturity of the respective species in cm. SF is the mean value of selection factors derived based on different mesh combinations.

- vii) Monthly Average catch and effect of barracudas are calculated as, the mean daily catch for a month was worked out by taking the mean total catch estimated during different sampling days of months. The average daily catch was multiplied by the number of fishing days of the month for estimated the monthly catch. The effort was expressed in terms of boat days and the catch was expressed in terms of kilograms and also in tonnes.

Table 1: Description of the gillnets operated for fishing barracuda along Thoothukudi coast

S. No	Parameters	Types of gillnets		
		A	B	C
1	Webbing material	Polyethylene	Polyethylene	Polyethylene
2	Mesh size	28mm	50mm	52mm
3	No. of meshes in length	1,500	2,640	2,640
4	No. of meshes in depth	400	110	110
5	Twine Specification	1.0mm φ	0.5mm φ	0.5mm φ
6	Horizontal hanging co-efficient	0.5	0.5	0.5
7	Type of float	HDPE	PVC	HDPE
8	No. of floats/Net	10	20	20
9	No. of Sinkers/Net	5	10	10
10	Type of sinkers	Stone	Stone	Stone
11	Head rope material	PP	PP	PP
12	Thickness of head rope			
13	Length of head rope	25.2m	20.5m	22.8m
14	Foot Rope material	PE	-	-
15	Size of foot rope	3mm φ	-	-
16	Thickness of foot rope	2.4 m	-	-

Results and Discussion

Fishing season of barracuda was found to be from November to June as reported by Mohammed and Balasubramanian, (1990) [12] and Premalatha and Manojkumar (1990) [11]. However, a slight deviation in peak season from that reported by Mohammad and Balasubramanian (1990) [12]. Among the two peaks of fishing season of barracuda in the gillnet fishery, one was found to fall on the months of November and May against the November and March as observed by Mohammed and Balasubramanian (1990) [12]. The reason may be attributed to the gear selected for the study. As 15th April to 30th May being closed season for trawl net along the coast of Tamil Nadu, One of the peak seasons has been recorded as March instead of May. The comprehensive study involving catches from all fishing gear such as gillnets, long lines and trawl nets is required to find out the exact fishing of barracuda along Thoothukudi coast. The peak fishing season found to be from November Premalatha and Manojkumar, (1990) [15] who study was based on the catches from commercial trawl nets. The reason may be attributed the fact that the fisherman of Thoothukudi used to switch over to long lining from July to September due to rough weather conditions, though barracudas are reported to migrate and available for fishing in shallow water during south-west monsoon (June to August). Catch and effort particulars of *Sphyræna obstustata* is given in Table (2).

Table 2: Monthly Catch and effort particulars of *Sphyraena jello* in gillnets for the period from April 2012 to March 2013 in Thoothukudi Coast

S. No	Month	Average No of crafts operated/day	Boat Days	Number of barracuda landed/boat	Total weight of barracudas landed/boat (in kg)	Total no. of barracudas landed	Tot. wt. of barracuda landed (in kg)	CPUE
1	Apr.'12	200	24	100	150	2400	3600	6.25
2	May.'12	180	24	120	180	2880	4320	7.50
3	Jun.'12	180	26	80	80	2080	2,080	3.08
4	Jul.'12	180	24	50	50	1200	1,200	2.08
5	Aug.'12	190	22	50	50	1100	1,100	2.27
6	Sep.'12	180	22	40	40	880	880	1.82
7	Oct.'12	180	24	50	50	1200	1,200	2.08
8	Nov.'12	180	24	50	50	1200	1,200	2.08
9	Dec.'12	180	24	55	55	1320	1320	2.29
10	Jan.'13	180	23	60	60	1380	1380	2.61
11	Feb.'13	150	23	70	105	1610	2415	4.57
12	Mar.'13	150	23	100	150	2300	3450	6.52
	Total		283			19550	24145	3.596

Length frequently distribution of *S. jello* in gillnets of mesh sizes 28, 50 and 52 cm is given in Table (3). The total length of *S. jello* caught ranged from 13 to 82 cm. The net 'A' capture more number of immature and maturing animals than net B and C. So, the net A with 28mm meshsize is not suitable for capture *S. jello* in Thoothukudi coast.

Table 3: Length frequency distribution and the ratios of natural logarithms of number caught under different length group of *Sphyraena jello* in different gillnet combinations

Midlength	Net A	Net B	Net C
	50mm	52mm	128mm
13	4		
16	7		
19	10		
22	15	7	
25	20	10	
28	24	16	
31	35	20	5
34	28	15	5
37	20	9	6
40	14	17	7
43	10	18	10
46	6	26	13
49	4	28	33
52	3	22	24
55		27	18
58		23	16
61		14	12
64		12	10
67		8	9
70		6	7
73		4	5
76		2	3
79			2
82			1

Selectivity parameters viz, L_b , L_c and L_d increased with the increase in mesh size irrespective of species, indicating clear cut selectivity by the gillnets (Ag). This is an accordance with the findings of Reis and Pawson (1992) [17] who reported the gillnets are rather than species specific. Increase in L_c and SF of *Amblygaster sirm* with the increase in mesh size have also been documented by many workers Dayartane (1988) [3]; Jude (2000) [9]; Ravikumar (2003) [16]; Manojkumar (2006) [11] and Parivallal (2008) [14]. L_b , L_c and L_d values for *S. obtustata*

were given in Table (4 and Fig-1). Selection factor for this species is 8.27 this is accordance with the findings of Andreev (1962) [1] who reported that the selection factors generally ranges between 5 and 10. Optimum mesh size for the *S.jello* is 5.92 cm. It is understood that the net A with the mesh size of 2.8 cm need to be discouraged to capture *S. jello*. Further the mesh size of net B may be decreased to 4.21 cm from 5.0 cm. Through fishing with net C with higher mesh size (5.2cm) was found to better and would considerably reduce the recruitment over fishing of *S.jello* considering the profitability of fishing operation. Luther *et al.*, (1994) [10] has recommended to discourage the use of nets with mesh size less than 28mm to avoid fishing of juveniles of lesser sardines of Vishakapatnam Coast.

Table 4: Selectivity parameters of *Sphyraena jello* with respect to different gillnets

Net	Selectivity Parameters (in cm)		
	L_b	L_c	L_d
A	13	28.5	33.5
B	25.5	40	58
C	35	54	60

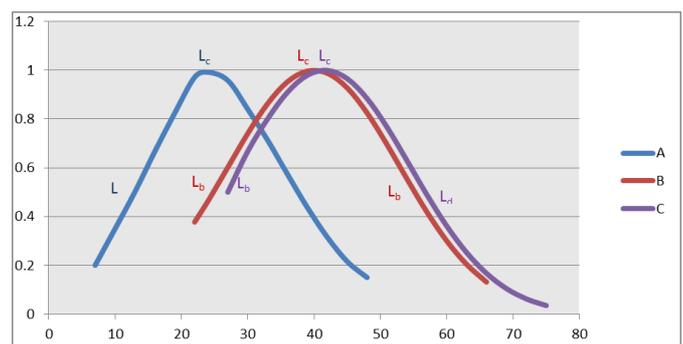


Fig 1: Selection curves of *Sphyraena jello* for gill net types A, B and C

Conclusion

The present investigation recommended to discouraged the gillnet with 28mm mesh may lead to growth over fishing of barracuda species along Thoothukudi Coast. Further, the maximum landings (19,550 no) were observed for the species of *S. jello*. The selectivity parameters viz., L_b , L_c and L_d increased with increase in mesh size irrespective of species, indicating clear cut selectivity by gillnets

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