Indian J. Fish., **51**(2) : 199-207, Apr.-Jun., 2004

Observations on the lizard fish fishery and some aspects of biology of *Saurida tumbil* (Bloch) off Mumbai

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ABSTRACT

The average annual landing of lizard fishes by the commercial trawlers at New Ferry Wharf during 1991 to 1995 was 1,591 tonnes (54.19 kg/unit) contributing to 2.28% of total marine fish landing at Mumbai. The landing was maximum in March-May and September-October periods with *Saurida tumbil* as the dominant species, which occurred in all the months. In *S. tumbil* empty stomachs occurred in high percentage (56.91 %). This fish is a piscivore, feeding mainly on teleosts (IP 52.54), followed by molluscs (IP 39.64) and crustaceans (IP 1.05). The male to female ratio was 1:1.02. The size at first maturity was 288 mm and it spawns from August to December with peak during October-November. Fecundity ranged between 33,305 and 79,202 in the length range of 276 mm to 334 mm. The relationship between length and weight is significantly different in the sexes.

Introduction

Lizard fishes constitute an important component of the demersal resources of India contributing to 4.5 % of the total demersal landing in 1997. At Mumbai they are mainly caught by shrimp trawlers almost throughout the year.

Annigeri (1963) studied the spawning periodicity of *S. tumbil,* while Dighe (1977) described some aspects of its biology from Mumbai. Nair *et al.* (1992) and Gulati *et al.* (1994) worked on the status of exploitation of the resource. There is no published information on the fishery and biology of *S. tumbil* from Mumbai waters, hence the present investigations were carried out on the fishery of lizard fishes with some biological aspects of *S. tumbil*.

Material and methods

The data for the present study were collected from commercial trawlers operating from New Ferry Wharf during1991-1995. *S. tumbil* being the dominant species was considered for biological studies. The data on length, weight, sex, stages of maturity in females, food and feeding conditions were taken from fresh specimens. The feeding intensity was assessed by visual estimation based on distension of gut and the quantity of food contained in it. The volume and frequency of occurrence of each food item were noted. The index of preponderance (IP) method of Natarajan and Jhingran (1961) was employed for the quantification of the food items. The stages of gonadial maturity were classified following Rao (1983).

TABLE 1. *Estimated effort, catch, catch rate and percentage of Lizard fishes in total fish catch in trawl net at New Ferry Wharf, Mumbai during 1991-1995.*

Years	Effort (Units)	Catch (Tonnes)	Catch Rate (Kg./unit)	% in total catch
1991	27,387	990	36.2	1.7
1992	31,020	2,400	77.4	3.1
1993	28,828	1,238	42.9	1.6
1994	29,006	1,837	63.4	2.3
1995	30,577	1,489	40.7	2.4
Average	29,364	1,591	54.2	2.3

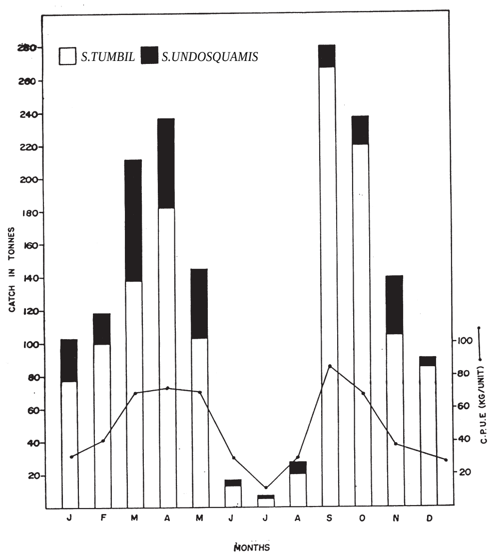

Fig.1. Monthy average catch (Tonnes), catch per unit effort (kg) and species composition of lizardfishes in trawl catches at New Ferry Wharf during 1991 - 95. (*Synodus* sp. and *Trachinocephalus myops* also occurred, but in very small quantities and therefore ignored in this graph).

Fecundity was estimated by raising the number of ova in a sample of the ovary to its total weight. Month-wise biological data collected from 1987 to 1997 for corresponding months in different years were pooled for this study.

Results and discussion

Fishery

The annual average catch of lizard fishes during 1991 to 1995 was 1,591 t (54 kg/unit) constituting to 2.3% of the total marine landing off Mumbai (Table 1). The annual catch and the catch rate were found to be the lowest during 1991 (990 t at 36 kg/unit) and the highest during 1992 (2,400 t at of 77 kg/unit). The lizardfish catch comprised of four species viz. *Saurida tumbil*, S. *undosquamis*, *Synodus indicus* and *Trachinocephalus myops*. *S. tumbil* was the most dominant species (Fig.1) forming 1,319 t (82.9 %) of the average annual catch, its monthly percentage ranging from 65 % in March to 95.4 % in September.

The monthly average catch of lizard fish (Fig.1) varied from to 6.07 t (10.7 kg/unit) in July, 280 t (85.5 kg/unit) in September with the peak landing during March-May and September-October.

Feeding intensity

Of the total 1,534 stomachs examined, 56.9% were empty. The percentage of empty stomachs (Table 2) were higher in all the months, which

TABLE 2. *Percentage frequency of feeding intensity of* S.tumbil (data pooled 1987-1997)

Months	No. of fish	Gorged	Full	3/4 Full	1/2 Full	1/4 Full	Trace	Empty
Jan.	79	2.5	1.3	5.1	7.6	17.7	5.1	60.8
Feb.	143	1.4	7	3.5	8.4	14.7	7.7	57.3
Mar.	176	0.6	6.8	6.3	10.2	17.6	9.7	48.8
Apr.	132	2.3	3.8	1.5	9.9	9.9	8.3	64.3
May	168	0	4.8	3.6	10.7	10.1	10.1	60.7
Jun.	46	0	2.2	6.5	10.9	15.2	8.7	56.5
Jul.	48	0	6.3	10.4	14.6	14.6	2.1	52
Aug.	127	1.8	8.7	4.7	9.5	21.3	5.5	49.6
Sep.	160	2.5	4.4	6.3	12.5	16.3	5	53
Oct.	194	2.1	5.2	3.6	7.2	15.5	5.2	61.2
Nov.	130	1.5	3.1	2.3	9.2	16.2	3.9	63.8
Dec.	131	0.8	11.5	9.2	8.4	11.5	6.9	51.9
Pooled	1534	1.3	5.7	4.8	9.7	14.9	6.8	56.8

ranged between 48.8% in March to 64.3% in April.

Food composition

Different food items were identified upto generic or species level depending on their state of digestion. The index of preponderance (IP) of the various food items (Table 3) showed that fishes (IP 56.23) formed the major constituent followed by molluscs (IP 36.49) and crustaceans (IP 1.07).

Teleost fishes were the dominant food item in almost all the months except during February and December. *Decapterus* spp. was the predominant item (IP 16.10) followed by *Nemipterus* spp. (IP 7.79), *Saurida tumbil* (IP 2.74) and *Apogon* spp. (IP 0.54). The fishes like *Rasrelliger kanagurta* (2.0), *Ariomma indica* (1.75), sciaenids (1.48), *Pricanthus hamrur* (1.19), *Harpadon nehereus* (1.11), *Cynoglossus* spp. (0.68), *Coilia dussumieri* (0.57), *Trichiurus* spp. (0.43), *Saurida undosquamis* (0.40), *Upeneus* spp. (0.36), *Tripauchen vagina* (0.32), *Lactarius lactarius* (0.32), eels (0.24), *Carangids* (0.24), *Platycephalus* spp. (0.24), *Stolephorus* spp. (0.19), *Bregmaceros macclellandi* (0.13), *Leiognathus* spp.(0.11), *Psettodes erumei* (0.11) and Myctophids (0.08) also occurred infrequently in the diet. *Loligo* spp. (IP 36.34) contributed to a significant part of the diet followed by *Sepia* spp. Crustaceans were represented by *Parapenaeopsis hardwickii*, (IP 0.15), *P. stylifera* (IP 0.11), *P. sculptilis* (0.04), *Solenocera* spp. (0.14), *Nematopalaemon tenuipes*, crabs and squilla (0.08). The occurrence of juveniles of *S. tumbil* in the stomach of adults suggests the cannibalistic nature of the species. Similar observations were made by Rao (1981) for *S. tumbil* and *S. undosquamis*.

Spawning season

Mature and ripe females (stage V and VI) were present during August-December period with a peak in October. Females with partly spent ovaries (stage VIIa and VIIb) occurred from August to January with their percentage reaching maximum in October and November (Table 4). Hence, it may be inferred that the species spawns from August to December with peak in October and November. The recruitment of juveniles to the fishery from 70 mm was observed from February onwards.

TABLE 3. *Month-wise index of preponderence of different food items of* S.tumbil *during 1987-1997.*

Months	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Pooled for 1987-1997
Teleost:													
Decapterus spp.	7.75	4.47	20.4	9.02	1.55	0	0	9.64	59.1	24.1	17.2	1.3	16.41
Nemipterus spp.	41.3	2.61	19.1	34.3	0.62	0	0	0.07	0.32	4.61	55.7	1.53	7.79
Saurida tumbil	2.12	5.54	0.55	6.38	6.52	0.85	0	1.61	0.15	1.75	6.33	1.7	2.74
Apogon spp.	0	1.22	1.13	0	5.38	0	0.98	0.1	0.26	0	1.65	0	0.54
Identified fishes	1.37	1.23	8.86	10.7	0.61	0	0	33.7	15.3	35.4	4.62	0.58	11.95
Fish remains	15.6	2.69	6.43	22	39	57.54	61.59	15	9.33	23.6	13.5	0.16	17.11
Pooled	68.2	17.76	56.5	82.4	53.6	58.39	62.57	60.1	84.5	89.4	99	5.27	56.23
Molluscs:													
Loligo spp.	16.4	79.09	22.1	12.2	31	34.52	6.2	29.5	8.86	4.53	0	94.3	36.34
Sepia spp.	0	0	0	0.26	5.26	0	0	0	0.03	0	0	0	0.08
Cephalopod remains	0	0.09	0	0	0	4.69	0	1.12	0	0	0	0.05	0.07
Pooled	16.4	79.18	22.1	12.4	36.3	39.21	6.2	30.6	8.89	4.53	0	94.4	36.49
Crustaceans:													
Parapenaeopsis spp.	0	0.12	0	0.26	0	0	0	4.96	0.28	0	0	0	0.15
Solenocera spp.	0	0	0	0.88	0	1.49	0.98	1.66	0	0	0.02	0.01	0.14
Prawn remains	0	0.25	0.04	0	2.12	0.85	29.64	0.02	0.39	2.36	0	0	0.7
Other crustaceans	0	0	0.09	0.66	0.75	0	0.3	0.07	0.01	0.07	0	0	0.08
Pooled	0	0.37	0.13	1.8	2.87	2.34	30.92	6.71	0.68	2.43	0.02	0.01	1.07
Digested matter	15.4	2.69	21.3	3.38	7.22	0.06	0.31	2.53	5.95	3.67	0.94	0.33	6.24

TABLE 4. *Monthly percentage occurrence of females of* S. tumbil *in different stages of maturity,based on pooled data from 1987 to 1997.*

Months	No.of females examined	Percentage of maturation stages			
		I & II	III & IV	VI & V	VII a & VIIb
Jan.	36	72.2	13.9	0	13.9
Feb.	93	88.2	11.8	0	0
Mar.	89	97.8	2.2	0	0
Apr.	57	100	0	0	0
May	75	100	0	0	0
Jun.	20	100	0	0	0
Jul.	17	100	0	0	0
Aug.	59	45.8	27.1	10.2	16.9
Sep.	71	45.1	26.8	11.3	16.8
Oct.	118	36.4	19.5	20.4	23.7
Nov.	68	22.1	42.6	14.7	20.6
Dec.	73	67.1	17.8	4.1	11.0

Annigeri (1963) reported that spawning period of this fish commences from October and ends in December off Mangalore coast. Rao (1983) noted that the spawning period along the northwestern part of Bay of Bengal extends from October to March, with a peak in November-December.

Length at first maturity

The females in stages III-VII of maturation were grouped into 10-mm length groups and their frequencies were scaled to percentages (Fig.2). The females in mature condition were observed first at 220 mm in total length. The size at which 50 % of the fish mature was 288 mm and this may be considered as the length at first sexual maturity of the population of *S. tumbil* off Mumbai waters.

Dighe (1977) found length at first maturity of female *S.tumbil* as 218 mm from Bombay, while Rao (1983) reported that the minimum size at first maturity was 260 mm and the size at 50% maturity was 300 mm along the Northwestern part of Bay of Bengal.

Sex ratio

A total of 1,534 fishes were examined of which 758 were males and 776 females. M:F ratio was 1:1.02 showing no significant departure from the normal expected value.

Monthwise sex ratio (Table 5) showed significant difference in February and October with

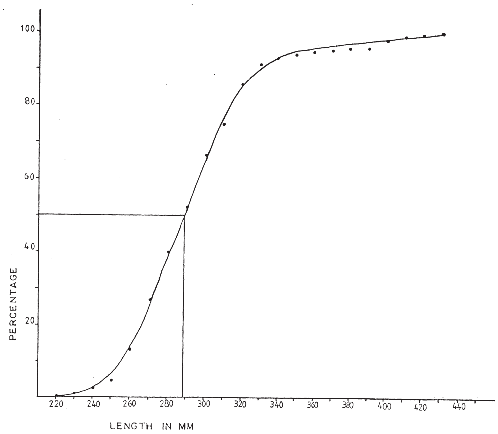

Fig. 2. Size at first maturity in *S. tumbil.*

TABLE 5. *Sex ratio of* S. tumbil *in different months for the period 1987 to 1997 (pooled).*

Months	No. of specimens examined	No. of males	No. of females	Chi -square
Jan.	79	43	36	0.62
Feb.	143	50	93	12.93 *
Mar.	176	87	89	0.02
Apr.	132	75	57	2.45
May	168	93	75	1.93
Jun.	46	26	20	1.78
Jul.	48	31	17	4.08
Aug.	127	68	59	0.64
Sep.	160	89	71	2.03
Oct.	194	76	118	9.09 **
Nov.	130	62	68	0.28
Dec.	131	58	73	1.72
Pooled	1534	758	776	0.21

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

preponderance of females. The sex ratio in different size groups (Table 6) indicated that in the size groups 210-219 mm and 230-239 mm, males were significantly dominant and the females in the size groups 280-329 and 340-349 mm outnumbered the males. The predominance of females was seen from 289 mm onward, which incidentally happened to be the size of 50 % maturity in this fish.

Fecundity

Fecundity study was based on 14 mature females (stage IV and VI) ranging in size between 276 and 334 mm in total length and 129 and 282 g in weight. The number of ova of *S. tumbil* ranged from 33,305 in a fish measuring from 334 mm to 79,202 in a fish of 301mm (Table 7). The regressions of fecundity and length, weight and ovary weight reveal exponential relationships. The relationships between fish length, weight of fish, weight of ovary and fecundity were as follows:

For fish length: Log F = - 1.21 + 2.38 LogL (r^2 = 0.241)

For fish weight: Log F = 3.42 + 0.55 Log L (r^2 = 0.115)

For ovary weight: Log F = 4.33 + 0.41 Log L (r^2 = 0.342)

It is possible that the fish being fractional spawner (Rao, 1983), the correlation coefficients obtained between fecundity and size and weight of the fish were poor. Dighe (1977) also observed that the fecundity in the species varied from 5,926 to 16,112 in the fish of 210-316 mm in total length at Bombay.

Length - weight relationship

A total of 1,441 specimens of *S.tumbil* comprising of 727 males (TL 130 to 446 mm; TW 18.0 to 651.0 g) and 714 females (TL 113 to 425 mm; TW 11.0 to 609.0 g) were used for the study. The relationships were calculated for the two

TABLE 6. *Size-wise sex ratio of* S . tumbil *based on pooled data from 1987 to 1997.*

Size- groups (mm)	No. of specimens examined	No. of males	No. of females	Chi - square
110-119	2	-	2	2.0
120-129	3	1	2	0.3
130-139	7	5	2	1.3
140-149	10	7	3	1.6
150-159	11	4	7	0.8
160-169	13	7	6	0.1
170-179	22	11	11	0
180-189	31	20	11	2.6
190-199	41	22	19	0.2
200-209	45	25	20	0.5
210-219	70	46	24	6.9 *
220-229	91	53	38	2.5
230-239	120	74	46	6.5 *
240-249	123	68	55	1.4
250-259	134	77	57	3
260-269	153	85	68	1.9
270-279	140	79	61	2.3
280-289	126	48	78	7.1 *
290-299	115	39	76	11.9 **
300-309	64	21	43	7.6
310-319	69	22	47	9.0 **
320-329	44	12	32	9.1 **
330-339	36	14	22	1.8
340-349	19	4	15	6.4 *
350-359	12	4	8	1.3
360-369	9	4	5	0.1
370-379	6	2	4	0.7
380-389	3	1	2	o.3
390-399	3	1	2	0.3
400-409	4	1	3	1
410-419	3	0	3	3
420-429	2	0	2	2
430-439	2	0	2	2
440-449	1	1	0	1

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

TABLE 7. *The fecundity in various size groups of* S.tumbil

Length of fish (mm)	Weight of fish (g)	Weight of ovary (g)	No. of ova
276	129	5.887	39106
278	155	5.309	32186
279	195	5.831	39359
282	154	7.211	36055
292	214	5.32	57190
295	179	15.902	42646
300	169	7.164	51683
301	207	13.331	79202
304	224	4.85	40186
305	184	13.828	67988
317	274	11.422	61263
328	270	14.297	76110
330	238	5.5	68962
334	282	4.037	33305

sexes by the method of least squares, using the expression Log W = Log a + b Log L. The regression equations are:

Male: Log W = - 4.81 + 2.86 Log L (r^2= 0.9231)

Female: Log W = - 5.05 + 2.97 Log L (r^2 = 0.9288)

The regression coefficients for both the sexes were compared by analysis of covariance and it was found that there was significant difference at 5 % level for the slope although there was no significant difference between the elevations. Therefore, length-weight relationships in respect of males and females were treated separately. However, Rao (1983) did not find any difference in length-weight relationship of males and females of the same species from Visakhapatanam.

Acknowledgements

The authors are thankful to Dr. M. Devaraj, former Director, Dr. V. Sriramchandra Murty, former Head of Demersal Fisheries Division, Dr. S. Sivakami, Project Leader, C.M.F.R.I. Cochin and Dr. Kuber Vidyasagar, Officer-in-Charge, M.R.C. of C. M.F.R.I., Mumbai for their encouragement. Sincere efforts of B.B.Chavan, J.D.Sarang and S.K.Sujit in data collection are acknowledged.

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