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Observations on Food and Feeding Habits of Lizardfish (*Saurida tumbil*) Landed along Veraval Coast

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Abstract: Lizardfish fishery in Veraval is mainly supported by *Saurida tumbil*. It is exploited by trawls and gillnets throughout the year. The length range of *S. tumbil* was found to be 15.20-39.90 cm. The food was mostly comprised of fishes, shrimps and squids. Food and feeding analysis confirmed the carnivorous feeding behavior of this species. Highest quantity of fish food (77.74%) in gut content was observed during April.

Key words: Food and feeding habit, *Saurida tumbil*, lizardfish, shrimps, squids, India

INTRODUCTION

Lizardfishes belong to the Family Synodontidae with size ranges from 25 (*S. longimanus*) to 67 cm (*S. tumbil*). They chiefly feed on teleost fishes, cephalopods and crustaceans. *Saurida tumbil* commonly known as Lizardfish is the most dominant among the four species of Saurida reported from India (Jaiswar *et al*., 2002).

Greater lizardfish (*S. tumbil*) is a demersal or reef-associated species that may perform migrations between freshwater and the sea (amphidromous) (Riede, 2004). It is widely distributed in tropical areas between 34°N and 28°S including the Indo-West Pacific, East to Southeast Asia and Australia (Russell and Houston, 1989). The maximum body size is approximate 60 cm (Shindo, 1972), corresponding to a t_{max} of 7 years. The important habitats of this species are muddy bottoms of the continental shelf down to about 100 m deep (FAO, 1974). It feeds on fishes, crustaceans and squid (Sommer *et al*., 1996). This species is mainly caught by bottom trawls (FAO, 1974; Nguyen, 2002) but it is known to perform dial migrations from bottom.

Lizardfishes constitute about 1% of the total trawl landings at Veraval from the present depth of operation (Manojkumar and Sivakami, 2005). The fishery of *S. tumbil* is confined to the depth zone shallower than 60 m. The resource is exploited by a variety of gears but the major contribution comes from multiday trawl nets (Manojkumar and Sivakami, 2005).

The lizardfish found in Veraval is locally named as Bhunger. However, the earlier reported research on the lizardfishes in Indian waters includes the studies by Kuthalingam (1959), Rao (1981, 1982, 1983a, b, 1984), Nair and Raghu (1990), Muthaih (1996) and Sivakami *et al*. (2003) were mostly qualitative and did not cover all the aspects dealt in this study. Hence, a detailed investigation was undertaken on the food and feeding of *S. tumbil* during the period January to December 2009 and the results are showed.

MATERIALS AND METHODS

Multi-stage stratified random sampling method was adopted for the collection of specimens. Every fortnight, a total of 25 specimens with minimum to maximum size ranges were collected from trawlers at Veraval harbor during January to December, 2009. Specimens were placed into insulated box with ice and brought to laboratory for biological analysis.

The feeding intensity was determined by eye estimation based on the degree of distension of the stomachs. The various stomach conditions based on degree of fullness expressed as Gorge, Full, ¾ full, ½ full, ¼ full, trace and empty were studied according to method given by Pillay (1952). In order to take into account both qualitative and quantitative estimations together, index of preponderance given by Natarajan and Jhingran (1961) was calculated month wise for each food items. The index of preponderance adopted here is expressed as:

$$IP = V_i \times O_i / \sum V_i \times O_i \times 100$$

where, V_i and O_i are the volume and occurrence index of food items in percentage.

RESULTS

Month wise food composition

Fish: As evident from high index of preponderance values, the bulk of food was constituted by fish in most of the months (Table 1). Fish was dominant food item in most of the months). Altogether, eight speciesof fishes

Table 1: Monthly percentage indices of food items in *S. tumbil*

Food items	Jan. (2009)	Feb. (2009)	Mar. (2009)	Apr. (2009)	May (2009)	Sept. (2009)	Oct. (2009)	Nov. (2009)	Dec. (2009)
Fish	27.41	31.51	65.98	77.74	57.89	64.73	75.15	77.71	58.17
Squid	20.39	6.70	1.15	5.31	11.63	5.51	0.00	0.00	6.37
Shrimps	38.99	22.48	24.23	13.81	0.00	0.00	0.00	0.00	16.48
Cuttlefish	8.03	11.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Digested matter	5.18	27.55	8.63	3.14	30.48	29.76	24.85	22.29	18.98

Table 2: Percentage of different food items of *S. tumbil*

Food items	Volume (V_i) (mL)	Occurrence (O_i)	V_i (%)	O_i (%)	V_iO_i	IP = $V_iO_i/\sum V_iO_i \times 100$
Fish	262.4	63	50.24	31.34	1575.00	58.47
Squid	58.3	31	11.16	15.42	172.20	6.39
Shrimps	124.0	54	23.74	26.86	637.90	23.68
Cuttlefish	12.5	4	2.39	1.99	4.76	0.17
Digested matter	65.0	49	12.44	24.37	303.40	11.26
Total	522.2	201			2693.00	

occurred in the gut where *Nemipterus* sp., was dominant. Size of food fishes encountered in stomachs varied from 37-88 mm in length. Largest fish (88 mm) encountered in the gut was *Cynoglossus* sp., in the March. Highest quantity of fish food in gut content was recorded during April (77.74%) followed by November (77.71%) and October (75.15%). The lowest percentage was recorded in January (29.41%).

Squid: Highest quantity of squid (*Loligo* sp.) in gut content was recorded during January (20.39%) and May (11.63%). The lowest percentage was recorded in March (01.15%).

Shrimp: Shrimp was the 2nd dominant species in the stomach content of *S. tumbil*. Shrimps were found to dominant in the food in January (38.99%) followed by March (24.23%) and February (22.48%). The lowest value recorded during April (13.81%).

Cuttlefish: Cuttlefish was poorly represented by *Sepia* sp., and was recorded only during January (8.03%) and February (11.76%), respectively.

Digested matter: During all the months, some part of the food which could not be identified due to its digestion condition was recorded as digested matter. Percentage of digested matter varied from lowest of 3.14% in April to the highest of 30.48% in May.

Composition of food items: During the present investigation, total 450 fish specimens were examined for studying the food and feeding habits of *S. tumbil*. Table 2 shows the food composition *S. tumbil* recorded during January to December, 2009. Food of *S. tumbil* was composed of fishes, molluscs and crustaceans. The fish component comprised of *Nemipterus japonicus*, *Pricanthus hamrur*, *Cynoglossus* sp., *Coilia dussumeiri*, Carangids, *Bregmaceros mackllandi*, *Rastrelliger kanagurta* and *Indian halibut*. The food analysis done by the method of index of preponderance (Natarajan and Jhingran, 1961) indicated that the fishes ranked 1st (58.47%) in the gut contents of *S. tumbil* which is followed by shrimps (23.68%). *S. tumbil* also fed on molluscs. Molluscs such as squid was represented by *Loligo* sp., contributing 6.39% and cuttlefish was represented by *Sepia* sp., contributing only 0.17% among the food items. The size of food fishes encountered in the guts varied from 37-88 mm. As some percentage of food material was digested beyond recognition, it could not be identified, also contributed in significant quantity (11.26%).

Feeding intensity in relation to length group: Analysis of degree of fullness of stomachs in relations to different sizes (length group) to study the feeding intensity with size (Fig.1) indicated a general pattern of increase in feeding intensity with size. There were no gorged stomachs in smaller length groups (140-159 to 200-219 mm). Maximum percentage of gorged stomachs (17.10%) was recorded in the 320-399 mm group while the lowest (4.95%) was seen in 380-399 mm group. The percentage of lowest feeding intensity (empty stomachs) varied from lowest of 16.60% in 320-339 mm length group to highest of 34.52% in 360-379 mm group. Percentage of low feeding (trace and ¼ full stomach) varied from lowest of 11.12% in 240-259 mm to highest of 51.25% in the smallest group of 180-199 mm. The percentage of moderate feeding intensity (½ full and ¾ full stomachs) varied from lowest of 6.44% in 140-159 mm length group to highest of 44.45% in 240-259 mm group. High feeding intensity (full stomach) did not show very wide variation ranged from 4.36% in 180-199 mm to highest of 16.66% in 240-259 mm group.

Month wise feeding intensity in females of *S. tumbil*: Highest percentage of empty stomachs was recorded in September (60%) and the lowest in March (5%) in females of *S. tumbil* (Table 3). About 60% females

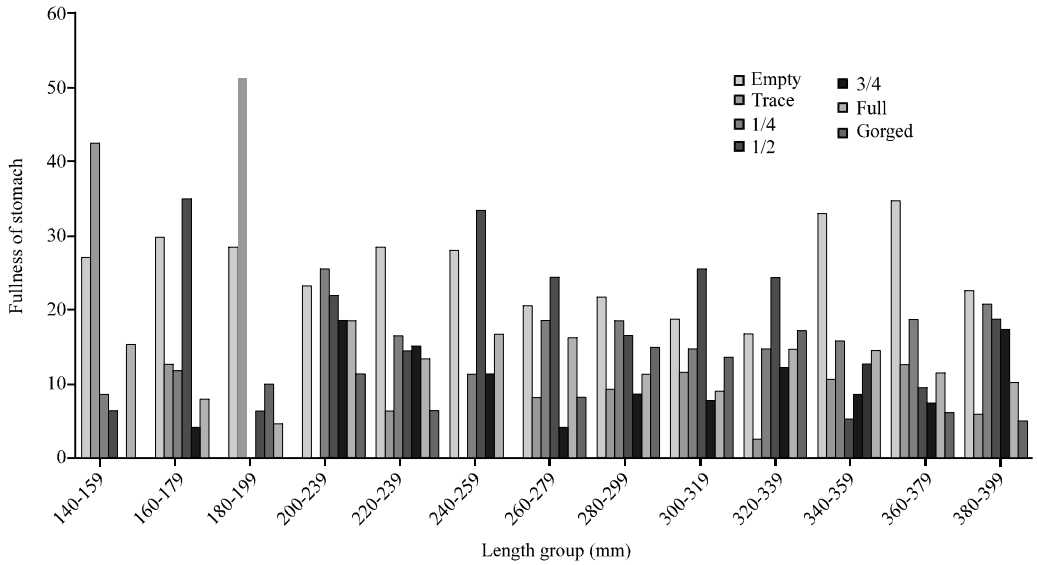

Fig. 1: Percentage composition of fullness of stomach according to length group of *S. tumbil*

Table 3: Month wise feeding intensity in females of *S. tumbil*

Fullness of stomach	Jan. (2009)	Feb. (2009)	Mar. (2009)	Apr. (2009)	May (2009)	Sept. (2009)	Oct. (2009)	Nov. (2009)	Dec. (2009)
Empty	10.15	7.41	5.0	27.27	16.03	60	36.84	21.42	14.28
Trace	8.62	4.53	0.0	0.00	30.00	0	5.27	7.15	0.00
¼	21.00	10.07	20.0	13.64	14.58	0	5.26	21.42	14.27
½	10.00	23.57	37.5	27.27	12.41	20	5.27	14.29	21.43
¾	15.00	25.62	0.0	13.64	8.40	10	10.52	21.42	7.15
Full	20.18	18.45	30.5	9.09	8.25	0	26.31	7.15	0.00
Gorged	15.05	10.35	7.0	9.09	16.03	10	10.52	7.15	42.86

Table 4: Month wise feeding intensity in males of *S. tumbil*

Fullness of stomach	Jan. (2009)	Feb. (2009)	Mar. (2009)	Apr. (2009)	May (2009)	Sep. (2009)	Oct. (2009)	Nov. (2009)	Dec. (2009)
Empty	0	16.66	9.09	20	36.36	14.34	71.42	25.85	42.85
Trace	0	16.66	0.00	20	18.18	12.41	0.00	42.62	0.00
¼	0	25.01	27.28	10	9.09	8.40	14.29	11.25	28.57
½	40	0.00	18.18	20	27.27	27.00	0.00	11.63	0.00
¾	20	16.66	9.09	10	0.00	11.35	14.29	8.65	14.29
Full	20	25.01	36.36	20	9.09	8.25	0.00	0.00	0.00
Gorged	20	0.00	0.00	0	0.00	18.25	0.00	0.00	14.29

appeared to have not fed during September followed by 36.84% in October and 27.27% in April. Cessation of feeding probably coincides with breeding season. Percentage of low feeding (trace and ¼ full) varied from 10.53% in October to 44.58% in May while in September, there was no trace and ¼ full stomachs observed. Moderate feeding was seen to fluctuate from 15.79% in October to highest of 49.19% in February. Percentage of high feeding (full stomach) also varied considerably from 7.15% in November to 30.50% in March and no full stomachs recorded in September and December. Similarly, highest feeding (gorged stomach) was seen in December (42.86%).

Month wise feeding intensity in males of *S. tumbil*: Male fishes of *S. tumbil* appeared to be showing low feeding intensity in various months since high percentage of empty stomach were recorded viz. 71.42% in October, 42.85% in December and 36.36% in May and so on (Table 4). Percentage of low feeding (trace and ¼ full stomach) was nil in January while it varied from 14.29% in October to 53.87% in November. Percentage of moderate feeding (½ and ¾ full stomach) varied from 14.29% in October and December to 60% in January. Percentage of high feeding was highest in 36.36% in March and lowest in October, November and December with no full stomach. Percentage of gorged stomachs (highest feeding intensity) was recorded highest in January (20%) followed by 18.25% in September and 14.29% in December. Out of 9 months of study, 6 months were observed with nil percentage of gorged stomachs.

DISCUSSION

S. tumbil has a carnivore feeding nature. It mainly feed on fishes, shrimps and molluscs (squid and

cuttlefish). It is seen that the overall percentage of fish species in the stomach of *S. tumbil* is high as compared to shrimps. This indicates that fish is main component of their diet and considered to be their preferred food. During study period, digested matter which includes fish scales, fish bones and eyeballs often encountered in the diet are evidently the remnants of the fish normally eaten by *S. tumbil*.

Euzen (1987) studied the food content of two species of *S. tumbil* and *S. undosquamis*. He found that they eat Theraponidae (*Helotes sexlineatus*), Cynoglossidae (*Cynoglossus macrolepidotus*), Nemipteridae (*Nemipterus japonicus* and *N. tolu*), *Leiognathidae* sp., Clupeidae (*Ilisha indica*), Carangidae (*Caranx leptolepis*). Bakhash (1994) reported most prey item in stomach of *S. tumbil* were *Nemipterus japonicus*, *Carangidae*, *Scombroidae*, *S. undosquamis*, Squid and Shrimps (*Penaeus semisulcatus* and *Metapenaeus monoceros*).

Rajkumar *et al.* (2003) reported that *S. undosquamis* off Visakhapatnam was a carnivore, feeding predominantly on fishes (*Sardinella* sp., *Stolephorus* sp., *Pentaprion* sp., *Rastrelliger kanagurta*, *Upeneus* sp., *Leiognathus* sp., Nemipterus japonicus and *Apogon* sp.), crustaceans (*Acetes*, *Metapenaeus*, *Solenocera* sp., and juvenile crabs) and squid (*Loligo duvacelli*). Raje *et al.* (2004) reported that *Decapterus* sp., was the predominant item followed by *Nemipterus* sp., *Saurida tumbil* and *Apogon* sp. The fishes like *Rastrelliger kanagurta*, *Ariomma indica*, *sciaenids*, *Pricanthus hamrur*, *Harpadon nehereus*, *Cynoglossus* sp., *Coilia dussumieri*, *Trichiurus* sp., *Saurida undosquamis*, *Upeneus* sp., *Tripauchen vagina*, *Lactarius lactarius*, eels, Carangids, *Platycephalus* sp., *Stolephorus* sp., *Bregmaceros mackllandi* also recorded in stomach of *S. tumbil* off Mumbai. The food items that were seen in the present study were fishes (*Nemipterus japonicus*, *Pricanthus hamrur*, *Cynoglossus* sp., *Coilia dussumeiri*, Carangids, *Bregmaceros mackllandi*, *Rastrelliger kanagurta* and Indian halibut), shrimps (*Acetes*, *Metapenaeus* and *Solenocera* sp.) and molluscs (*Loligo* and *Sepia* sp.).

Bakhash (1994) reported the principal food item of lizardfish is fish; particularly lizardfish and sardine occurrence were 70 and 22%, respectively. Raje *et al.* (2004) reported that teleost fishes were the dominant food item in almost all the months except during February and December. Soofiani found the gut content consisted mostly of fish, suggesting a carnivorous feeding habit of *S. tumbil* from the Persian gulf. In present study, the fishes were dominant food items of *S. tumbil.* The highest quantity of fish food in gut content was recorded during April (77.74%) followed by November (77.71%) and October (75.15%) while the lowest percentage was recorded in January (29.41%). In present investigation, 60% females appeared to have not fed during September followed by 36.84% in October and 27.27% in April. High percentages of empty stomach of males were recorded viz. 71.42% in October, 42.85% in December and 36.36% in May.

CONCLUSION

In all specimens, there were no plant material (phytoplankton or algae) observed, suggesting that the fish is strictly a carnivores in nature. However, fish is not a voracious feeder and most of them sustain themselves on low feeding intensities particularly during the period September to December which would be the spawning season.

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