Journal of Fisheries International 6 (3): 62-66, 2011
ISSN: 1817-3381

Investigations on Some Biological Aspects of Lizardfish (*Saurida tumbil*) Landed along Veraval Coast

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Abstract: Lizardfish fishery in Veraval is majorly 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 length-weight relationship is described as slope (b) 3.190±0.060 for male and 3.267±0.048 for female. It also confirms the growth is allometric growth of this species. The food was mostly comprised of fishes, shrimps and squids. Food and feeding analysis confirmed the carnivorous feeding behavior of this species. The overall sex ratio was 1.41. Absolute fecundity was 32,148-76,742 kg body weight.

Key words: Saurida tumbil, lizardfish, length-weight relationship, food and feeding habits, sex ratio, fecundity

INTRODUCTION

Lizardfishes belong to the family Synodontidae with size ranges from 25 cm (*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).

In Gujarat coast, the Lizardfishes constituted mainly by *S. tumbil* and *S. undosquamis* form an important constituent in the landings of multi-day trawlers operating from Veraval. These trawlers fish up to a depth of 80 m in the vast continental shelf area of Gujarat. *S. tumbil* is caught in fairly good numbers along the Veraval coast throughout the year. 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. Lizardfishes are reported as an important bycatch of shrimp trawler. This group has gained significance as it is used for food both in fresh and dried form (Nair *et al*., 1992; Sivakami *et al*., 2003a).

The fishes are usually sold in fresh condition and in ice when transported at long distances. Saurida is consumed mainly by the poorer sections of the society mainly in fresh condition. *S. tumbil* represents an important group of food fish in the waters along the Veraval coast and forms one of the major components of exploited marine fishery resources having good domestic and export demand. However, the earlier reported researches 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*. (2003a). Biological information of *S. tumbil* such as length-weight relationship, food and feeding habits, fecundity and sex ratio would unravel many unknown parameters for devising policy guidelines for managing this stock at Veraval coast.

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, 2009 to December, 2009.

Specimens were placed into insulated box with ice and brought to laboratory for biological analysis. The relationship between the measurements were worked out by the formula of linear regression (Y = a+bX) using regression module of SPSS software (SPSS 10.0, SPSS Inc., Chicago, USA). The length-weight relationships were estimated from the allometric formula proposed by Le Cren (1951), separately for both the sexes:

$$W = a L^b$$

or:

$$\log W = \log a + b \times \log L$$

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, ful, 3/4 ful, 1/2 ful,

1/4 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:

$$IP = Vi \times Oi/\Sigma Vi \times Oi \times 100$$

where, Vi and Oi are the volume and occurrence index of food items in percentage. The month wise sex ratio was determined and Chi-square (χ^2) test was performed to test the homogeneity of male and female distribution (Narasimham, 1994). Fecundity was calculated following gravimetric method by preserving ovaries in 5% formalin. The ripe ovary (V and VI) sub-samples were obtained from the anterior, middle and the posterior regions of the ovary (Rao, 1983a, b).

RESULTS

Length-weight relationship: A total of 450 (263 males and 187 female) specimens of *S. tumbil* in the length range of 15.20-39.90 cm were used for determining the length weight relationship separately for males (Fig. 1) and females (Fig. 2). The regression equation obtained was as follows as:

Male:

$$\log W = -2.406+3.190 \log L \ (r = 0.9562)$$

Female:

$$\log W = -2.516+3.267 \log L \ (r = 0.9809)$$

Since, there was no significant difference between the slopes at 5% level, a pooled relationship was obtained for males and females as:

Pooled:

$$\log W = -2.455+3.255 \log L \ (r = 0.9677)$$

The L-W relationship for male in form of Log W = Log a+b Log L is obtained as the average slope (b) value was found to be 3.190±0.060 and the average intercept (a) value was -2.406±0.083. The r^2 value was 0.9144 and Analysis of Variance (ANOVA) revealed significant difference ($p<0.0001$). The L-W relationship for females in form of Log W = Log a+b Log L is obtained as the average slope (b) value was found to be 3.267±0.048 and the average intercept (a) value was -2.516±0.065. The r^2 value was 0.9623 and Analysis of Variance (ANOVA) revealed significant difference ($p<0.0001$).

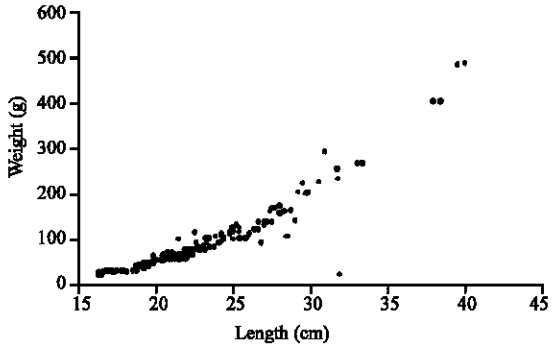

Fig. 1: Length weight relation of males of *S. tumbil* caught along Veraval coast

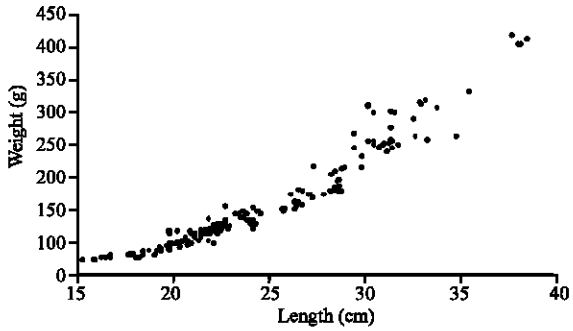

Fig. 2: Length weight relation of females of *S. tumbil* caught along Veraval coast

Food and feeding habit

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 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 1/4 full stomachs) 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 (1/2 full and 3/4 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 stomachs) did not show very wide variation ranged from 4.36% in 180-199 mm to highest of 16.66% in 240-259 mm group (Fig. 3).

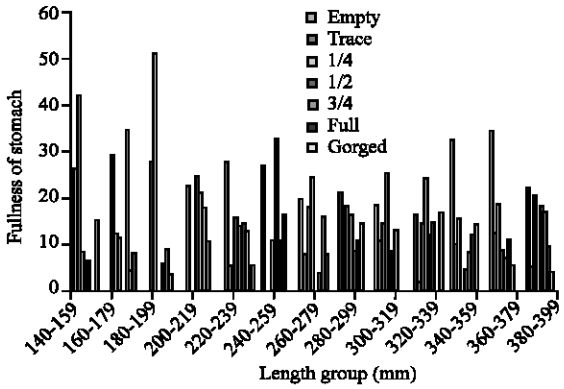

Fig. 3: Percentage composition of fullness of stomach according to length group of *S. tumbil*

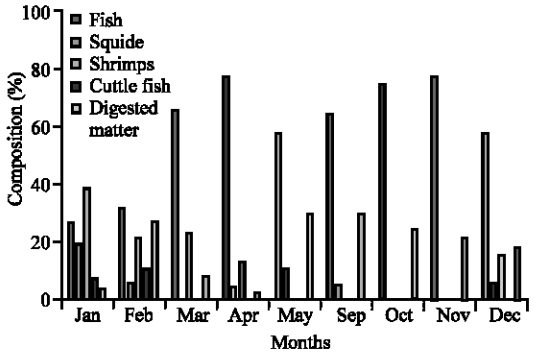

Fig. 4: Monthly percentage indices of food items in *S. tumbil*

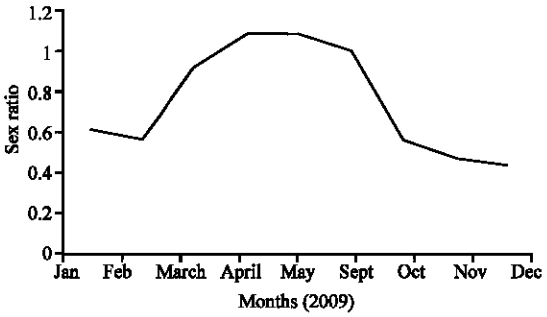

Fig. 5: Month wise sex ratio of *S. tumbil*

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. Fish was dominant food item in most of the months (Fig. 4). Altogether, 8 species of fishes 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 month of 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 month of 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 month of March (01.15%).

Shrimp: Shrimp was the second dominant species in the stomach content of *S. tumbil*. Shrimps were found to dominant in the food in the month of 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 (Fig. 4).

Composition of food items: Total 450 fish specimens were examined for studying the food and feeding habits of *S. tumbil*. 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 first (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 %).

Sex ratio: Sex ratio was calculated monthly for males and females of *S. tumbil* (Fig. 5). The overall sex ratio was 1.41. Chi-square (χ^2) values indicated significant dominance by males in the months of October, November, December, January, February, 2009 and March, 2009 and there was a prevalence of catch of females in the months of April, May and September, 2009.

Fecundity: Absolute fecundity of *S. tumbil* varied from 32,148 during September to 76,742 in November. The 205. The average fecundity for a period of 1 year was observed

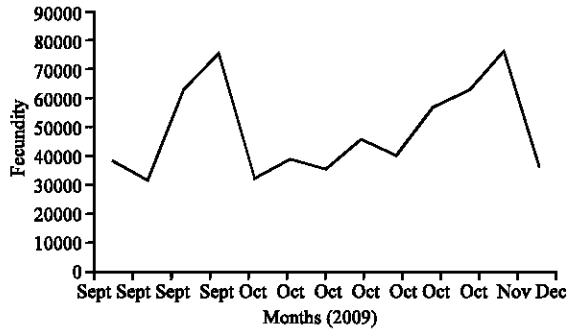

Fig. 6: Month wise absolute fecundity of *S. tumbil*

to be 49,167. There were two peaks in the average fecundity per gram body weight was estimated as fecundity observed during September and November (Fig. 6). The relationships between fish length, weight of fish and weight of ovary with fecundity were as follows:

For fish length:

$$\text{Log } F = 1.4388+2.2122 \text{ Log } L \ (r^2 = 0.4770)$$

For fish weight:

$$\text{Log } F = 2.8180+0.8085 \text{ Log } L \ (r^2 = 0.6937)$$

For ovary weight:

$$\text{Log } F = 4.0731+0.6488 \text{ Log } L \ (r^2 = 0.6533)$$

DISCUSSION

In the present study, the highest b value was arrived at in female of *S. tumbil* followed by males. The exponential value of 3.267 in females implies that the females gain weight at a faster rate in relaion to its length whereas the low exponential value compare to female (3.190) observed in males reveals the reverse condition. It may be concluded that during early stages of life, *S. tumbil* grows allometric.

The b-value ranged for male is 3.190, in female 3.267 and combined 3.255. Thus, the results showed allometric growth (b<3) in both type of sexes. Similar results on length-weight relationship were reported by Rao (1983b) who observed that the power term was >3 for female (3.20) and males (3.29) from Indian waters. Mathews and Samuel (1989) reported that b-value for *S. tumbil* was 3.08 in Kuwait waters. *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*.

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* sp. and *Solenocera* sp.) and molluscs (*Loligo* sp. and *Sepia* sp.). Similar food items were reported by Euzen (1989), Sivakami *et al.* (2003b) and Raje *et al.* (2004).

In present study, overall sex ratio was 1.41 and males were larger in number than females. Sex ratio was not steady throughout the year. While, Budnichenko and Nor (1978) and Budnichenko and Dimitrova (1980) reported that in Arabian sea, overall the males predominate over females; the young males of *S. tumbil* were larger in number than females. Bakhsh (1994) reported that the ratio of males to females of *S. tumbil* was 1:1.79. Raje *et al.* (2004) reported that M:F ratio of *S. tumbil* was 1:1.02 showing no significant departure from the normal expected value.

CONCLUSION

In present study, absolute fecundity of *S. tumbil* varied from 32,148 during September to 76,742 in November and the average fecundity for a period of 1 year was observed to be 49,167. There were two peaks in the fecundity that was observed during September and November.

Bakhsh (1994) reported that the spawning of males and females of *S. tumbil* extended throughout the year and greatest amount of spawning was observed during winter in Red sea.

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