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Observations on selected biological aspects of the spadenose shark (*Scoliodon laticaudus* Müller & Henle, 1838), landed along Saurashtra coast

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ABSTRACT

Spadenose shark, *Scoliodon laticaudus* (Family: Carcharhinide) locally known as "sandhi" is a common species inhabiting near shallow coastal waters along the Saurashtra coast. It is exploited by trawls and gillnets throughout the year in fair abundance. The dietary components of the species were studied and expressed as percentage of numerical composition (C_N), percentage of gravimetric composition (C_W) and percentage of frequency of occurrence (F). The major food item in the stomachs of the species was determined using an Index of relative importance (IRI). Food and feeding analyses confirmed the carnivorous feeding behavior of this species and the food mostly comprised fishes, shrimps and squids. There was no evidence of cannibalism. Overall sex ratio was 1.18 that showed the predominance of females over males. As there is limited information about the biological aspects of this species from Saurashtra coast, the results of the present investigation may play a vital role in the management of the resource as well as for the efficient exploitation of this species.

Keywords: Food and feeding habit, *Scoliodon laticaudus*, Spadenose shark

Introduction

Elasmobranchs are caught by trawls, gillnets, hooks and lines and dolnets along the Saurashtra coast. About 45% of the total elasmobranchs are landed by trawl net, 24.7% by gillnets operated from mechanised boats, 18.2% by nonmechanised gillnets, 9.6% by hooks and lines and 2.1% by dolnets. About 65% of batoid fishes and 33% of the sharks landings are from the trawlers. The catch and catch rate of sharks from trawlers have increased over the years, whereas the catch rate from mechanised gillnets declined over the years after registering a peak during 1985. The elasmobranchs, as a group have been found to be distributed all along the Indian coast constituting about 6% of the national marine fishery resources. The landings fluctuated from 26,710 t in 2008 to 29,126 t in 2009 (Anon, 2010). There was steady increase in the catches till the seventies. The introduction and expansion of mechanisation of fishing has resulted in substantial increase in the catches.

S. laticaudus, Muller & Henle (1838), one of the smallest tropical carcharhinid sharks is locally known as "*sandhi*" in coastal area of Saurashtra region. In recent years, elasmobranchs have attracted the attention of the fishing industry because of their fins and flesh which have high utility value in both export market as well as with in the country. Sharks are processed for meat which is sold frozen or dried, for shark fin soup, leather, liver oil and cartilage for export to different countries namely Singapore, Thailand, Malaysia, China and others. However, shark fins are most valuable fetching $60 per 0.5 kg (Cheung, 2003). *S. laticaudus* is not a fast swimmer and occupies the near shore region in shallow waters. It is mostly caught in trawl gear as a bycatch.

The earlier works on this species were mostly done on aspects of taxonomy and distribution. Literature available on the biology of this shark species is limited. A study on the description, bionomics and development of *S. sorrakowah*, which is now considered a synonym of *S. laticaudus* was carried out by Setna and Sarangdhar (1948). The age and growth of *S. laticaudus* were studied in Bombay waters by Nair (1976). Devadoss (1984) carried out a detailed study on the maturity, breeding and development of this shark off Calicut. Devadoss (1989) also studied the growth and population parameters of *S. laticaudus* from Calicut coast. Kasim (1991) reported on the shark fishery of Veraval coast with special reference to population dynamics of *S. laticaudus* and *Rhizoprionodon acutus*. Unfortunately, no work has been done on the other aspects of biology like length-weight relationship, food and feeding habits and sex ratio of this shark species from the Saurashtra region. Hence an attempt was made to fill up the gap which may be helpful for

devising policy guidelines for managing stock and fishery of this species along Saurashtra coast.

Materials and methods

Multi-stage stratified random sampling method was adopted for the collection of samples. Every fortnight, a total of 25 specimens of different size ranges, were collected randomly from the trawlers and gillnetters operating along Saurashtra coast during April 2009 to March 2010. Samples were placed into insulated boxes with ice and brought to the laboratory for the biological analyses.

The total length was measured from the tip of snout to the tip of upper caudal lobe to the nearest mm and weight to 0.5 g accuracy. The relationship between the measurements were worked out using 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

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

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 gorged, full, ¾ full, ½ full, ¼ full, trace and empty were studied according to the method given by Pillay (1952). The dietary components for each stomach studied were expressed as a percentage of numerical composition (C_N), percentage of gravimetric composition (C_W) and percentage of frequency of occurrence (F) (Hyslop, 1980). The most important food item was determined using the Index of Relative Importance (IRI %) of Pinkas *et al.* (1971) :

$IRI\ \% = (C_N + C_W) \times F$

The month-wise sex ratio was determined and Chi-square (χ^2) test was performed to test the homogeneity of male and female distribution (Sokal and Rohlf, 1998).

Results

Length-weight relationship

A total of 439 (201 males and 238 females) specimens of *S. laticaudus* in the length range of 22.30 – 68.50 cm were used for determining the length-weight relationship separately for males and females. The regression equations derived are as follows :

Male: log W = -2.3167 + 2.8174 log L (r = 0.9564)

Female: log W = -2.5407 + 2.9263 log L (r = 0.9907)

Since, there was no significant difference between the slopes at 5% level, a pooled relationship (Fig. 1) was obtained for males and females as:

Pooled: log W = -2.4331 + 2. 9465 log L (r = 0.9709)

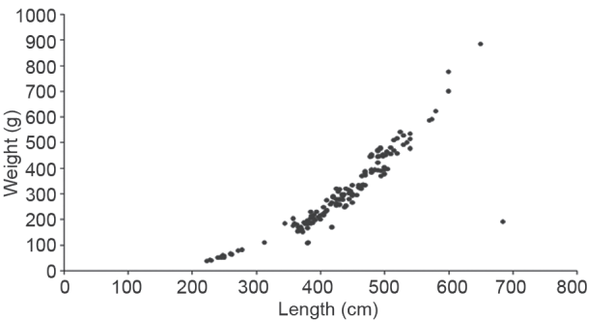

Fig. 1. Length-weight relationship of of *S. laticaudus* (pooled)

Food and feeding

Monthwise feeding intensity of S. laticaudus

Highest percentage of empty stomachs was recorded in October (78%) and the lowest in January (32%) in *S. laticaudus* (Fig. 2). Percentage of low feeding (trace and ¼ full) varied from 4% in April to 53% in November. In the month of October, there was no trace and ¼ full stomachs observed. Moderate feeding (½ full and ¾ full) was seen to fluctuate from 1% in August to highest of 49% in December. Percentage of high feeding (full stomachs) also varied considerably from 4% in January to 12% in August and there was no gorged stomach observed during the entire study period.

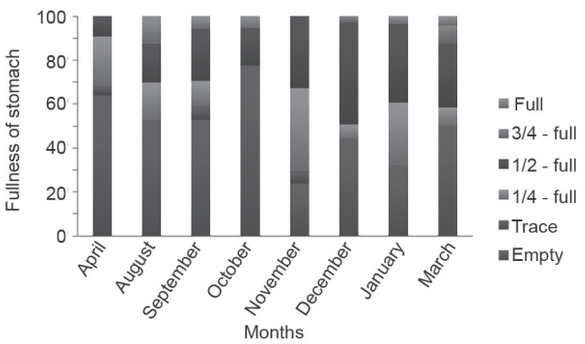

Fig. 2. Month-wise feeding intensity of *S. laticaudus*

Food patterns

Food and feeding analyses confirmed the carnivorous feeding behaviour of the species. The diet of *S. laticaudus* comprised *Coilia dussumieri*, *Trypauchen vagina, Harpodon nehereus, Lepturacanthus savala, Thryssa* spp., *Cynoglossus* spp., *Loligo* spp., *Solenocera* spp., *Sardinella* spp., Sciaenids, *Sepia* spp., *Squilla* spp., *Acetes indicus,*

Metapenaeus monoceros, Metapenaeopsis stridulans and *Parapenaeopsis stylifera.*

Frequency of occurrence

The most frequent food item found in the *S. laticaudus* diet was digested fish, shrimp and molluscs which were encountered during almost all the months. During January to September, shrimps were frequent food item, while after October, fish species was observed in much of the stomach contents (Fig. 3).

Shrimp was the most dominant group in the stomach content of *S. laticaudus*. Shrimps were found to be dominant among the food items in the month of January (83.56%) followed by August (65.69%) (Fig. 3). The lowest value was recorded during October (2.06%). The shrimp species recorded includes *Acetes indicus, Metapenaeus monoceros, Metapenaeopsis stridulans* and *Parapenaeopsis stylifera*.

As evident from the Index of relative importance values, the bulk of food was constituted by fish during October to December. Fish was the second dominant food item in most of the months. Altogether five species of fishes occurred in the gut and *C. dussumieri* was the most dominant species encountered. Highest quantity of fish food in gut content was recorded during November (84.71%) and lowest percentage was recorded in the month of August (2.02%). The fish species recorded in the gut contents comprised *Trypauchen vagina, Sciaenid* spp., *Harpodon nehereus, Lepturacanthus savala* and *Thryssa* spp.

Molluscs encountered in the stomach contents of *S. laticaudus* include squid and cuttlefish. Highest quantity of squid (*Loligo* spp.) was recorded during October (16.76%) and December (0.90%). *Sepia* spp. was recorded in the month of August (4.03%).

Crustaceans were chiefly represented by *Squilla* spp. and was recorded only during August (28.24%) and March (3.74%).

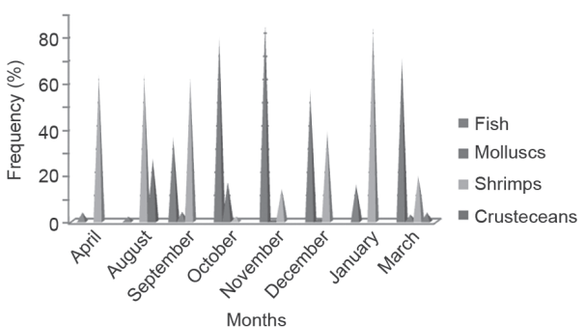

Fig. 3. Percentage of frequency of occurrence of food items in *S. laticaudus*

Index of relative importance (IRI)

The IRI percentage revealed that digested shrimps (46.36%) and fishes (40.15%) contributed more than other food items. *C. dussumieri* (34.62%), ribbonfish (13.57%), Bombayduck (11.79%) and *Thryssa* spp. (2.64%) were the dominant food items. *Squilla* spp. (15.99%), *Acetes* spp. (14.65%), *Loligo* spp. (8.83%) and *Sepia* spp. (2.50%) stand next to the above list of food items of *S. laticaudus* (Fig. 4).

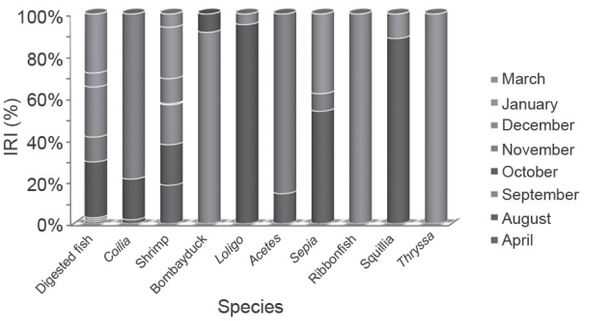

Fig. 4. Month-wise percentage index of relative importance of food items in *S. laticaudus*

Sex ratio

Sex ratio was calculated monthly for males and females (Table 1). The overall sex ratio was 1.18. *Chi* square values indicated significant dominance by females in the months of August 2009, September 2009, November 2009, December 2009 and March 2010 and there was a preponderance of catch of males in the months of April 2009, October 2009, and January 2010.

Table 1. Month-wise sex ratio of *S. laticaudus.*

Month	Sex ratio
April, 2009	0.85
August	1.27
September	2.4
October	0.67
November	2.58
December	4.56
January, 2010	0.75
March	1.1
Average	1.18

Discussion

In the present study, highest 'b' value was arrived at for females of *S. laticaudus* followed by males. The exponential value of 2.926 in females implies that the females gain weight at a faster rate in relation to its length whereas the low exponential value compared to female (2.817) observed in males reveals the reverse condition. It may be concluded that during early stages of life, growth rate is allometric. The b value estimated for the sexes

combined was 2.946. The results indicated allometric growth (b<3) in both sexes. The maximum length of *S. laticaudus* recorded in the present study was 68.50 cm for female specimen. However, Mathew (1997) and Nair (1976) recorded maximum length of 66 cm for female and 60 cm for male respectively.

S. laticaudus has a carnivorous feeding nature and mainly feeds on fishes, shrimps and molluscs (squid and cuttlefish). It is seen that the overall percentage of fish species in the stomach of *S. laticaudus* is high as compared to shrimps. This indicates that fish is the main component of their diet and considered to be their preferred food. During the 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. laticaudus*. The food items recorded in the present study were fishes (*C. dussumieri*, *T. vagina, H. neherus, L. savala, Thryssa* spp., *Cynoglossus* spp., *Sardinella* spp., Sciaenids), shrimps (*Solenocera* spp., *A. indicus, Squilla* spp., *M. monoceros, M. stridulans* and *P. stylifera*) and molluscs (*Loligo* spp. and *Sepia* spp.). Similar food items were also reported by Devadoss (1989).

As food items like bottom living fishes namely *Cynoglossus* spp., Sciaenids and crustaceans like shrimps and *Squilla* spp., observed in the stomach contents of smaller specimens, indicate that *S. laticaudus* in their early growing years when they are unable to move fast, seek and prey such bottom living fishes. As they grow and become fast swimmers, they migrate to the pelagic zone and start actively preying on pelagic fishes like *C. dussumieri*, *H. nehereus* and fast moving molluscs like squids and cuttlefish. Cannibalism was not encountered during the entire study period. In the present study, the overall sex ratio observed was 1.18 and females were larger in number than males.

S. laticaudus occupies a position high in the marine foodweb, far from the primary producers and this has its significance in the low productivity of its fishery unlike *Coilia,* sardines or mackerel.

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