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A preliminary study on the length-weight relationship of Sacura boulengeri (Heemstra, 1973) from Indian waters

Kinattumkara BINEESH*, Sebastine MANJU, Kallivalappil AKHILESH, Gopalakrishna PILLAI
Central Marine Fisheries Research Institute, P. B. No. 1603, Ernakulam North P. O., Cochi - 682 018, Kerala - INDIA

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Abstract: Sacura boulengeri (Heemstra, 1973) is a rare serranid fish (Subfamily: Anthiinae) having very disjunct distribution in the western Indian Ocean. The rarity of the species is evident from earlier reports and, so far, no related studies on the species have been published except on taxonomy and distributional records. In the present investigation, the length-weight relationship of Sacura boulengeri was estimated to be W = 0.0777 × L2.690 (with 95% confidence intervals for b and r2). An analysis of the stomach contents revealed that sergestid shrimps and copepods were the major food items of the diet.

Key words: Length-weight relationship, Anthiinae, Sacura boulengeri, Indian waters

The subfamily Anthiinae of the family Serranidae (Perciformes) consists of about 21 genera with 170 species (Nelson, 2006). Anthiine fishes are beautifully colored fishes that inhabit coral and deep-reef habitats in tropical and warm temperate seas, and some of these species are taxonomically confusing. Many anthiine fishes are very few in collection because of their rarity. The genus *Sacura* is comprised of 4 species: *Sacura boulengeri*, *S. speciosa*, *S. parva*, and *S. margaritacea* (Heemstra and Randall, 1979). Thomas et al. (2008) reported *S. boulengeri* for the first time from Indian waters based on 2 specimens. Until 2008, fewer than 10 specimens had been collected and reported worldwide. During 2008 and early 2009, an occasional landing of *S. boulengeri* was observed in the trawler bycatch landings along the Keralan coast (CMFRI, 2008).

Knowledge of length-weight relationships (LWRs) is useful in fishery science for assessing length-based growth and the well-being of the population. In the present work, the LWR ($W = a \times L^b$) calculated for *S. boulengeri* specimens caught off the western coast of India forms the first reference for the species worldwide.

A total of 74 specimens (65 males and 9 unsexed) with standard lengths (SL) ranging from 13 to 17.8 cm were collected in stray numbers from the miscellaneous bycatch of trawler landings at Cochin Fisheries Harbor (09°56′N, 76°16′E) on the southwestern coast of India during the period of May 2008-March 2009. The LWR was calculated using least squares regression on log transformation of the following equation:

* E-mail: bineeshmarine@yahoo.com

$W = a \times L^b$,

where W = weight (g), L = length (SL, in cm), *a* = intercept (constant), and *b* = slope (regression coefficient) of the regression line; the values of *a* and *b* were estimated. A slope (*b*) value less than 3 indicates that the fish becomes more slender as it increases in length, and a slope value greater than 3 denotes stoutness, indicating positive allometric growth. Deviation from the cube law is observed in most species as they change their body shape during growth. The morphometric measurements of the specimens were taken with a Mitutoyo digital vernier caliper with an accuracy of 0.5 mm based on the method of Randall and Heemstra (2006). Morphometric characteristics were then compared with earlier reports.

The distribution of *S. boulengeri* is strictly confined to the Arabian Sea, and it has been previously recorded only off the coasts of Muscat, Oman (Heemstra and Randall, 1979; Randall, 1995); Sindh, Pakistan (Moazzam and Osmany, 2004); and western India (Thomas et al., 2008). It later occurred in the landings along the southwestern coast of India as an occasional bycatch (CMFRI, 2008).

Sacura boulengeri is identified based on the following characters: Dorsal fin rays X, 14; gill-rakers (14-16) + (30-33); lateral-line scales 30-33; head large; third anal fin ray prolonged; no scales on lower jaw. It is a beautiful fish with a brownish-green body featuring an olive-green shade and 4 prominent, irregular lavender-pink stripes. The head and preoperculum also have several lavender blotches, with the orbit encircled with lavender. In 1 of the specimens collected (175 mm in SL), a strikingly interesting feature was observed that has not been reported elsewhere and was not seen in any of the other specimens collected during the same time and from the same place. In earlier descriptions, only the third dorsal spine was elongated with a black pennant tip, but in this single specimen, both the second and third dorsal spines were found to be elongated with a black tip. The length of the second dorsal spine was recorded at 17.1% of the SL (compared to 7.5%-11% of the SL in earlier reports) and the third dorsal spine was 45.1% of the SL (Figure 1, Table).

Figure 1. *Sacura boulengeri* (Heemstra, 1973), male.

Length-weight relationship

A total of 74 fish were analyzed for LWRs. The length range of the SL of the fish varied from 13 to 17.8 cm. The LWR for *S. boulengeri* was estimated as:

$W = 0.0777 \times L^{2.690}$ ($r^2 = 0.840$).

The 95% confidence interval for the *b* value was between 2.41 and 2.96, indicating that *S. boulengeri* from Indian waters shows negative allometric growth.

Suzuki et al. (1974) estimated the LWR, using fork length, for *S. margaritacea* from Japan, a species closely related to *S. boulengeri*, as:

$W = 0.173 \times 10^{-4} L^{3.086}$ (n = 373).

The logarithmic equation for the relationship between standard length (L) and total weight (W) for *S. boulengeri* is:

$\log W = -2.5554 + 2.6899 \log L$.

The calculated curve for the LWR is presented in Figure 2. From the nature of the graph, it appears that there exists a linear relationship between standard length and weight. There can be variations in LWRs as a result of different factors, including geography, habitat, season, stomach condition, maturity, sex, and age (Tesch, 1971).

Food and feeding

Studies on the diet and feeding habits of these fish were carried out in order to better understand the trophic relationship in the marine ecosystem. Most of the specimens collected had empty stomachs. Some of the fish, however, fed heavily on sergestid shrimp and *Acetes* sp.; in one fish, *Acetes* sp. was

Table. The comparative morphometric data of *S. boulengeri* (SL = standard length, HL = head length).

Location	Muscat[1]	Sindh[1]	Neendakara[2]	Manglore[2]	Cochin[3]
	1979	2004	2005	2006	2008
Sex	Male	Male	Female	Male	Male
No. examined	3	1	1	1	1
Standard length (mm)	101-139	170	103.82	134.74	175
Greatest body depth (% SL)	41-43	41.7	39.1	41.8	39.4
Head length (% SL)	42-43	39.2	38.1	44	38.8
Pectoral fin length (% SL)	29-32	29.2	29.7	29.2	29.1
Pelvic fin length (% SL)	25-29	28.3	30.2	29.2	27.6
Caudal peduncle length (% SL)	20-22	20.8	21	20.3	18.8
Caudal peduncle depth (% SL)	12-14	12.5	14.6	12.3	13.1
First dorsal spine length (% SL)	6.4-7.3	5.8	6.5	6	6.3
Second dorsal spine length (% SL)	9.7-11	7.5	9.2	9.9	17.1*
Third dorsal spine length (% SL)	52-66	55	40.9	50.8	45.1
Fourth dorsal spine length (% SL)	13-15	14.2	13	13.6	13.1
Third dorsal soft ray length (%SL)	50-52	47.5	48.4	50.8	39
Anal fin length (% SL)	33-36	32.5	31	31.8	32
First anal spine length (% SL)	7.6-8	7.5	7	7.3	6.6
Second anal spine length (% SL)	14-17	15	12.6	14.6	12.6
Second anal soft ray length (% SL)	26-29	25	27.9	27.8	26.3
Pelvic fin spine length (% SL)	15-18	15	14	15.2	14.3
Snout length (% HL)	20-21	21.3	21	20.4	19.1
Orbit length (% HL)	26-28	27.7	27.5	27.6	23.5
Interorbital width (% HL)	20-22	23.4	22	22	23.5
Postorbital distance (% HL)	53-56	53.5	53	57.2	55.9
Upper jaw length (% HL)	43-44	42.6	42	42.3	42.6
Gill rakers (upper)	14-16	N.S.*	12	12	14
Gill rakers (lower)	30-33	N.S.*	27	27	29-30

Sources: [1]Moazzam and Osmany, 2004; [2]Thomas et al., 2008; and [3]Cochin: present study.

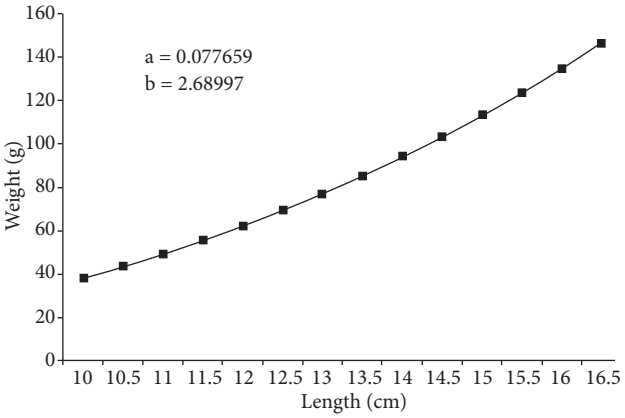

Figure 2. The length-weight relationship of *Sacura boulengeri* from Indian waters.

found along with a few copepods. Suzuki et al. (1974) reported that *S. margaritacea* feeds on plankton and, primarily, on calanoid copepods.

Sacura boulengeri was found mostly in demersal trawl bycatch landings along with species such as *Priacanthus hamrur*, *Chelidoperca investigatoris*, *Pristigenys niphonia*, *Odontanthias rhodopeplus*, *Aphareus rutilans*, *Epinephelus diacanthus*, *Liopropoma* cf. *lunulatum*, *Nemipterus* spp., *Pseudanthias* sp., *Scolopsis* sp., *Sargocentron* spp., and *Cookeoulus* spp., but it most commonly occurred along with *O. rhodopeplus* and *P. hamrur.* The occurrence of *S. boulengeri* in demersal trawl catches indicates a greater range of depth of occurrence (up to 200 m) than the range of 49-90 m that was reported previously (Heemstra and Randall, 1979; Moazzam and Osmany, 2004; Thomas et al., 2008).

The wide range of areas requiring more in-depth exploration underscores the importance of this fish and creates opportunities for researchers to provide or expand the knowledge of a population or community of the species (Lopez et al., 2009). Although a large area of the Indian Exclusive Economic Zone (EEZ) remains unexplored, the expansion of fishing to new waters and depths is bringing several new fishes to commercial landings. This, in turn, may enable researchers to gain a better understanding of various aspects of the demersal ecosystem of the Indian EEZ.

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