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Research Note

Length-Weight Relationship of Three Species of Groupers (Pisces: Serranidae) off Visakhapatnam, Middle East Coast of India

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Obtaining accurate length-weight relationship (LWR) is an important factor in the assessment of fish stocks (Moutopoulos & Stergiou, 2002; Frota et al., 2004; Demirhan & Can, 2007). Information on the length groups represented in the catches during various months is also crucial for the sustenance of the fishery. Studies on LWR of *Epinephelus coioides, E. malabaricus* and *E. latifasciatus* include Mathew & Samuel (1987), Letourneur et al. (1998), Kulbicki et al. (2005) and Tharwat (2005). In Indian waters, studies on these aspects were carried out by Premalatha (1989), Ameer & Kasim (1992), Rangaswamy et al. (1999), Shanmugam et al. (2000), Murthy (2002), Sujatha et al. (2010) and Badhul et al. (2011).

Three species of genus *Epinephelus viz., E. coioides* (Hamilton, 1822) orange spotted grouper, *E. malabaricus* (Bloch & Schneider, 1801) Malabar grouper and *E. latifasciatus* (Temminck & Schlegel, 1802) striped grouper are common along the coasts of India and Andamans. As there is very little information on the length frequency distribution of grouper species from different types of gear operated in a particular locality, it is necessary to study this aspect of commercial fishery of groupers. The present study was carried out on length frequency distribution and length-weight relationship of these three species.

The present study was based on the specimens collected from traditional fish landing centres and fisheries harbour of Visakhapatnam (16°57'N; 82°11'E; 18°18'N; 83°54'E) and from FSI research vessel during September 2009 to August 2011. The total length (TL) of the fish was measured to the nearest millimetre from tip of mouth to the tip of caudal fin ray and weight measured to the nearest gram. For length frequency distribution and LWR studies, a total of 1656 specimens of these three species were collected. The specimens were grouped to the next 20 mm intervals. The data from each month was pooled and percentage length frequency and LWR was calculated by the method of least square employing the equation of Le Cren (1951), $W=aL^b$, where W = body weight (g); L = total length (mm); '*a*' is a coefficient related to body form and '*b*' is an exponent indicating isometric growth when equal to 3 (Beverton & Holt, 1996). The Bailey's t-test (Snedecor & Cochran, 1967) was employed to find out the variation of 'b' from isometric value 3. For *E. coioides* and *E. malabaricus*, the catch composed mostly of females and availability of males was very less. For *E. latifasciatus,* LWR was estimated separately for male, female and pooled specimens.

The *E. coioides* and *E. malabaricus* were represented in trawl and hand line while *E. latifasciatus* was represented only in trawl catches throughout the year. Largest recorded size of *E. coioides* in the present study was 107 cm (TL) in the month of July 2009, *E. malabaricus* was 153 cm TL in March 2011 and *E. latifasciatus* was 97.8 cm (TL) in February 2011. Of the small number of serranid species represented in the trawl catches, *E. latifasciatus* is the most common species. *E. coioides* and *E. malabaricus* of TL 14-36 cm and 17-33 cm respectively were caught from shallow waters (up to 20 m depth) using non motorized boats. The specimens of *E. coioides, E. malabaricus and E. latifasciatus* of TL 37-69 cm, 38-64 cm and 34-69 cm were caught from 20-

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100 m depth region using trawlers and specimens with TL 73-102 cm, 73-153 cm and 73-97 cm respectively from deep waters (80-120 m) using motorized boats.

From the length frequency distribution of *E. coioides*, *E. malabaricus* and *E. latifasciatus* (Fig. 1), it was observed that the modes were invariably around TL 18-99 cm indicating that specimens at all stages of maturity were captured during most of the months in Visakhapatnam. The common size in catches for *E. coioides* was 30-65 cm, *E. malabaricus* 21-64 cm and *E. latifasciatus* 15-40 cm. Based on the length at first maturity for *E. coioides* (53 cm TL), *E. malabaricus* (64 cm TL) and *E. latifasciatus* (61cm TL), it was observed that most of the catches contained juvenile specimens which did not reach maturity stage and did not reproduce.

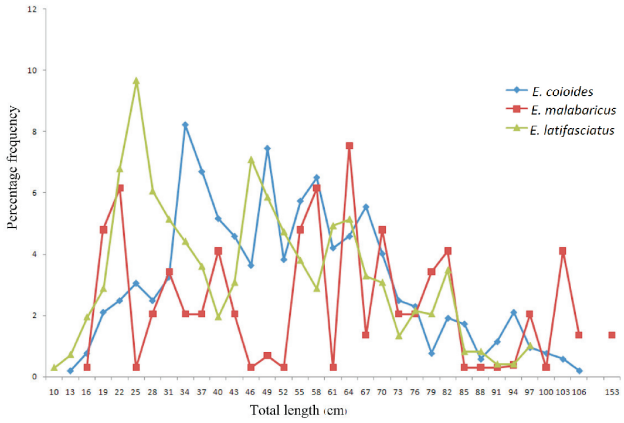

Fig. 1. Pooled length frequency distribution of three *Epinephelus* spp. off Visakhapatnam

The length-weight relationship of *E. coioides* and *E. malabaricus* is presented graphically in Fig. 2 & 3, respectively. The calculated value of regression coefficient (b) for these two species was found as 2.9875 and 3.0632, which is very close to the hypothetical value 3 ($p > 0.05$). The relationship was established as $W = -4.8364\ L^{2.9875}$ and $W = -5.0212\ L^{3.0632}$. The correlation coefficient (r^2) was recorded as 0.9563 and 0.972, which indicated strong relationships between the two parameters. The regression coefficient for *E. latifasciatus* (Fig. 4) was found as 2.9234 and 3.0704, for pooled and males which are nearer and equal to the hypothetical growth. The relation between length and weight for pooled, female and male obtained as $W = -4.6471\ L^{2.9234}$, $W = -3.8128\ L^{2.6439}$ and $W = -5.0362\ L^{3.0704}$. The value of the correlation coefficient (r^2) showed a strong

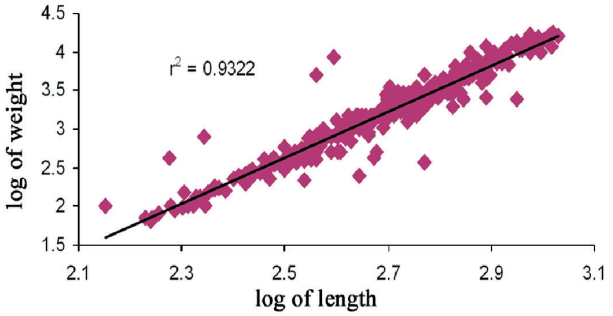

Fig. 2. Length-weight relationship of *Epinephelus coioides* off Visakapatnam

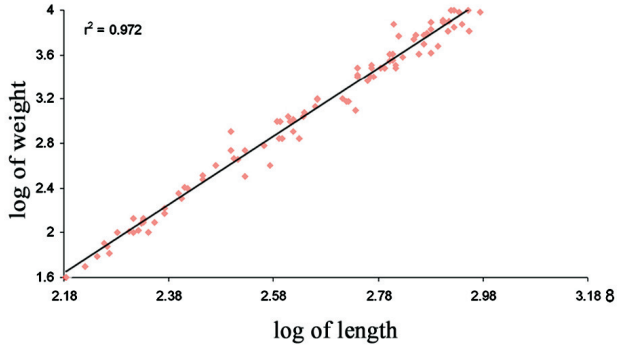

Fig. 3. Length-weight relationship of *Epinephelus malabaricus* off Visakapatnam

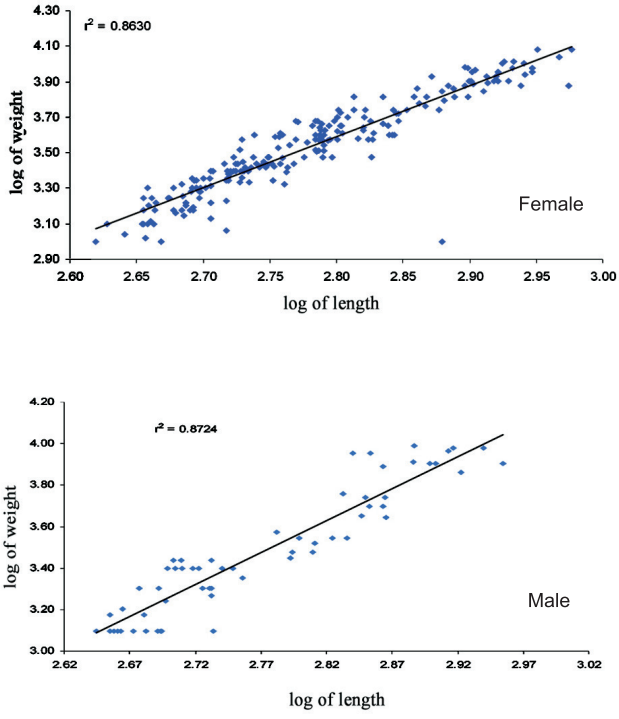

Fig. 4. Length-weight relationship of *Epinephelus latifasciatus* off Visakapatnam

relation between these two parameters for *E. latifasciatus.* According to Pauly & Gayanilo (1997), for fish, the 'b' values may range from 2.5 to 3.5 indicating that result of this study is valid. Isometric growth pattern has been reported in *E. latifasciatus* by Mathew & Samuel (1987) and Sujatha et al. (2010).

The results of Bailey's test revealed no significant departure of 'b' value from hypothetical value of '3' in male and female specimens of *E. latifasciatus.* The 't' test arrived at, 0.1 (df: 60) in males, 0.1 (df: 211) in females. For *E. coioides* 't' test revealed significant departure of 'b' value from the hypothetical value, the t test arrived at, 2.0 (df: 439) and for *E. malabaricus* 't' test arrived at 0.7 (df: 144) revealed no significant difference.

The earlier reports (Letourneur et al., 1998; Kulbicki et al., 2005; Al Janhi et al., 2002; Tharwat, 2005) are in compliance with the present finding on the LWR in pooled samples of *E. coioides* and *E. malabaricus* in which the 'b' value was very close to the isometric value of 3.

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