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LENGTH-WEIGHT STUDIES OF *EPINEPHELUS CHLOROSTIGMA* AND *E. AREOLATUS* FROM ARABIAN GULF

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ABSTRACT

Regression coefficient value (b) of the length-weight relation of *Epinephelus chlorostigma* was registered as 2.6383, which is significantly ($p<0.01$) less than the hypothetical value (3). This coefficient of *E. areolatus* was registered as 2.9500, a value close to 3. The correlation coefficients (r) were registered as 0.9725 and 0.9837 for *E. chlorostigma* and *E. areolatus*, respectively, which show a good relationship between the two parameters.

Keywords: Length-weight, *Epinephelus chlorostigma*, *E. areolatus*, Arabian Gulf

INTRODUCTION

The mathematical relationship of length with the weight of fish is considered as an important tool for interconversion (Lagler, 1956) and to deduce an inference regarding the suitability of the environment for any particular species (Maceina and Murphy, 1988). Hence, this type of study occupies an important place in most of the fishery biological investigations (Ezzat *et al.*, 1982). This relationship also provides some additional information related to spawning, growth, feeding, gonadal development and maturity time of the fish (Dawe, 1988; Maceina and Murphy, 1988). Similarly, the value of ponderal index (k) also gives the degree of well-being of the fish and when compared, the mean values of one species with another, show the suitability of environment to species with higher values (Ezzat *et al.*, 1982).

Fish are the main and cheapest source of animal protein for human being and groupers form a large part of it. Researches related to the food and feeding habits of groupers and qualities of their food canal have been started since early 1947 by a team headed by Husainy (Abu-Hakima *et al.*, 1986). *Epinephelus chlorostigma* and *E. areolatus* are supposed to be important species because of their feeding habits and other biological activities among the 65 species of groupers found in Saudi Arabia (Wray, 1979; Kuronuma and Yoshitaka, 1986). The reproductive biology, development of ovum and spawning, and fecundity of these two species were studied by Mathews and Samuel (1987). Studies on length-weight relationship (Baddr and Morgan, 1983) and age determination

(Ezzat *et al.*, 1981) of *E. chlorostigma* and *E. areolatus* were also made in the past. The only information on the length-weight relationship of *E. chlorostigma* from elsewhere is the result of investigations by Sanders *et al.* (1988) and Mees (1992). Similar studies were made by Mathews and Samuel (1987), and Letourneur *et al.* (1998) on *E. areolatus*. Ghorab *et al.* (1986) have studied the reproductive biology of *E. chlorostigma* from Red Sea.

In the present study, an attempt was made to establish a relation between the total length of the fish and its gutted weight sampled from the Arabian Gulf.

MATERIAL AND METHODS

For each species, 480 specimens were alaysed for the length-weight relationship. Samples of *E. chlorostigma* and *E. areolatus* were collected from the fish market twice in a month at an interval of 15 days. The length and weight of the fishes ranged from 19.9 to 63.8 cm and from 104.1 to 2980.0 g for *E. chlorostigma,* and from 21.4 to 44.7 cm and from 112.4 to 1133.8 g for *E. areolatus*. As the variations in the weight of gonads and guts affect this relationship, the gutted weight (weight without visceral organs) of the fish was used to deduce the relationship. The determination of the relationship between length and weight was based on the combined data regardless of time of capture, sex and stage of maturity for both the species. The length-weight relationship was derived in the logarithmic form following the formula given by Lagler (1956):

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

where,

W = Gutted weight of the fish in grammes

L = Total length of fish in centimetres

Log a and b are constants, and can be calculated by the following formula presented by Lagler (1956):

$$\text{Log } a = \frac{\Sigma \text{Log } W \times \Sigma(\text{Log } L)^2 - \Sigma \text{Log } L \times \Sigma(\text{Log } L \times \text{Log } W)}{N \times \Sigma (\text{Log } L)^2 - (\Sigma \text{ Log } L)^2}$$

$$b = \frac{\Sigma \text{ Log } W - (N \times \text{Log } a)}{\Sigma \text{ Log } L}$$

where, N = Number of groups in group data.

The recorded values of 'b' for *E. chlorostigma* and *E. areolatus* were tested using the 'T' test to see whether the differences between the 'b' values and the hypothetical value (3) are significant or insignificant.

RESULTS

The length-weight relationship of *E. chlorostigma* and *E. areolatus* is presented graphically in Fig. 1 and 2, respectively. The calculated value of regression coefficient (b) for *E. chlorostigma* was found as 2.6383, which differs significantly ($p<0.01$) from the hypothetical value (3). The relation established is:

$$\text{Log } W = 1.3433 + 2.6383 \log L \text{ or } W = 0.0454\ L^{2.6383}$$

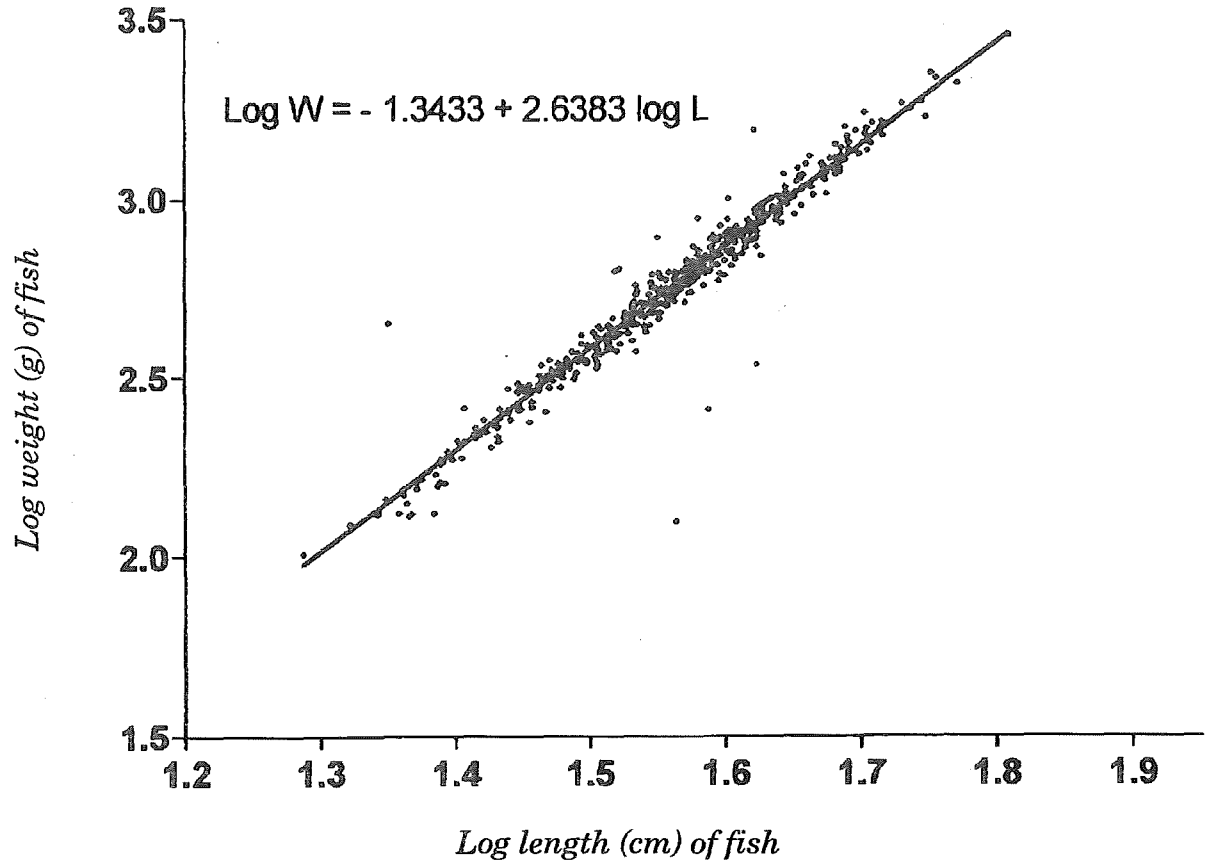

Fig. 1. Length-weight relationship of Epinephelus chlorostigma

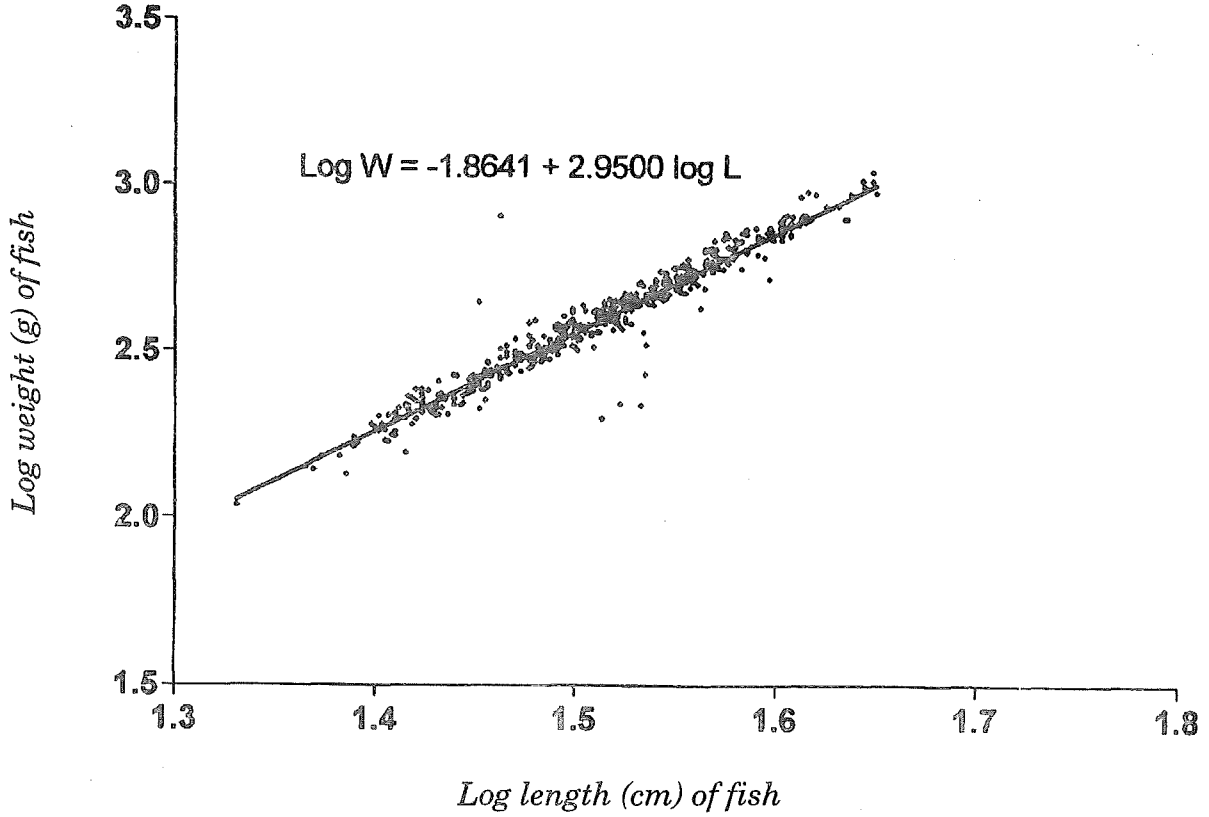

Fig. 2. Length-weight relationship of Epinephelus areolatus

The value of the correlation coefficient (r) was recorded as 0.9725, which indicates a strong relationship between the two parameters. The regression coefficient for *E. areolatus* was recorded as 2.9500, which is very close to the hypothetical value ($p>0.01$). The relation between length and weight for this species obtained is:

$\text{Log } W = -1.8641 + 2.9500 \log L$ or $W = 0.0137\ L^{2.9500}$

The value (0.9837) of the correlation coefficient (r) showed a strong relation between these two parameters of this species.

DISCUSSION

Generally, under the condition of isometric growth, the weight of the fish is considered as an exponential function to length and their relationship could be expressed by the cube-law, *i.e.*, weight = a x length^3. The exponent value 3 is being applied only to an ideal fish under favourable condition for growth. The value (2.6383) of regression coefficient (exponent) obtained in the present study for *E. chlorostigma*, is significantly ($p<0.01$) less than the hypothetical value. Hence, the cube-law is not applicable to this fish. The coefficient for *E. areolatus* was found as 2.9500, which is very near to the hypothetical value ($p>001$); hence, cube-law could be applicable.

A survey of literature reveals that the regression coefficient exhibits inter and intra-specific variations. The exponent value of 3 for any particular species indicates that the fish is growing isometrically and the environmental conditions are conducive for optimum growth. Apart from this, some fishes could not attain the coefficient 3 showing disproportional growth between length and weight, and can be attributed to environmental factors which inhibit growth (Swain, 1993), immature individuals' frequency in the population and food availability (Andrian and Barbeiri, 1992). The variations in the regression coefficient may also be related to sex, size and season (Dasgupta, 1988). A previous study (Mathews and Samuel, 1987) indicated that the two species show an isometric growth in Kuwaiti waters and thus, follow the cube-law. The regression coefficients for some species of fish like *Oreochromis niloticus* (Pratap and Mkamba, 1987; Quddus and Dewan, 1988; Alkahem *et al.*, 1997), *Megalapsis cordyla* (Jaiswar and Acharya, 1991), *Leiognathus brevirostris* (Batcha and Badruddin, 1992), *Puntius sophore* (Reddy and Rao, 1992), major carps (Zofair and Mustafa, 1992; Salam and Mahmood, 1993) and *Salmo truta* (Milewski and Brown, 1994) are found to be more than the hypothetical value. These high values of regression coefficient for the above-mentioned species indicate that the physical, chemical and biological conditions of the environment are conducive for the better growth of fishes.

Published reports related to the length-weight relationship show that the values of exponent for certain fishes are low when compared to the hypothetical value. The recent and notable contributions among them are those of Ezzat *et al.* (1982), Gowda *et al.* (1987), Sinha (1987), Sivakami (1987) and Swain (1993). This discrepancy in the

values of regression coefficient may be related to factors such as physical and chemical conditions of the environments, food availability, competition with indigenous species, immature individuals in the samples, etc. The difference in the exponent value of *E. chlorostigma* and *E. areolatus* recorded in the present study shows that environmental conditions are more suitable to *E. areolatus* compared to *E. chlorostigma* and the latter species may be facing more competition for food, space and other factors necessary for an isometric growth. The value of exponent (b) for *E. chlorostigma* reported by Mees (1992) from a different locality was high when compared with the value registered in the present study. This variation may be because of the difference in the ecological conditions of the habitats.

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