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DEVELOPMENT OF A MATHEMATICAL MODEL FOR LENGTH - WEIGHT OF L.lentjan AND L.nebulosus

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Abstract: In this paper we have developed a mathematical model applied to fisheries science and predict the specific data. Based on selected fish data (length - weight) of L.lentjan and L.nebulosus a mathematical model was elaborated by use of anonlinear polynomial equation to demonstrate between length- weight relationship of L. lentjan and L. nebulosus in Thoothukudi coast. The value of L.lentjan (99.5 %) and L.nebulosus (97.9%) confidence fitting were analyzed by using polynomial equations.
Keywords: Length-Weight relationship, Lethrinus nebulous, Lethrinus lentjan, Polynomial equation.

INTRODUCTION

Length-weight data are widely used to gather documents on natural science of fishes. Indian coast is decorated with the East, West coasts, the coasts of Lakshadweep, Andaman and Nicobar Islands, within the bounds of the tropics. The Indian coastal length measures about 8,129 km and the Exclusive Economic Zone extends up to about 2.0 million km^2 (Ramani et al., 2010). In South East Asia, the Gulf of Mannar was declared as the first Marine Biosphere Reserve. In the world marine biodiversity perspective, the Gulf of Mannar is the richest region of marine fisheries resources. The area of Gulf of Mannar has an area of about 10,500 km^2. In this region, approximately 3600 species of fauna and flora have been identified. With an aim to conserve the valuable fauna and flora living in this region, the Gulf of Mannar Indian coast is ornamented with the East coast, West coast and the coasts of Lakshadweep and Andaman and Nicobar islands, within the bounds of the tropics. The family Lethrinidae, otherwise known as emperor fishes, contains some of the most common and economically important commercial and artisanal tropical demersal fish species. Emperor fishes are demersal carnivorous feeders. In general, monarch fishes consume a wide range of prey including polychaetes, molluscs (gastropods, bivalves, squids and octopus), echinoderms (sea urchins, sand dollars, star fish and brittle stars), crustaceans (crabs, shrimps) and small fishes. Lethrinid fishes are carnivorous bottom feeders and it actively works on feeding in day time

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and not active in late evening hours (Toor, 1964). Early studies on reproduction of lethrinids have identified several species as protogynous hermaphrodites (sex change from female to male) (Motlagh, 2010). The lethrinid fishes are utilized as good food resources from the areas of western Pacific Ocean to the Indian Ocean because of their dominance in fish catch (Ebisawa, 2009). The lethrinid fishes form year around fishery along the Thoothukudi coast. Much studies were made on the length-weight relationship by using parabolic and logarithmic equation for lethrinind in Indian water. Hence, in this paper an attempt has been made to fit the polynomial equation for the length-weight relationship of *L.lentjan* and *L.nebulosus*.

MATERILAS AND METHODS

The current study was carried out based on for a period of 12 months from July, 2011 to June 2012. The profusion of *lethrinid* fish species in the Thoothukudi coast triggered this study on its fishery management aspects. The major *lethrinids* species available along Thoothukudi coast were *Lethrinuslentjan, L.nebulosus, L.ornatus, L.elongatus, L.microdon, L.mahsena, L.harak, L.ramak. L.conchyliatus,L.rubiroperculatus, Gymnocraniusrobinsonii and G.griseus.* Among these twelve lethrinids species, L.lentjan and L.nebulosus have been selected for this study. Since sexual dimorphism was not found among these two species, sexes were treated as common to calculate the above parameters. A total of 232 specimens of *L.lentjan* and *L.nebulosus* were collected during the study period. The specimens were collected from Thoothukudi fishing harbour located along the Thoothukudi coast.

LENGTH – WEIGHT RELATIONSHIP

Two hundred and thirty-two specimens covering different length groups were used to study the length -weight relationship of *L. lentjan* and *L. nebulosus*. The total length of the above species was measured nearest to the centimetre and the whole body weight was recorded nearest to gram. To study the length - weight relationship of *L.lentjan* and *L.nebulosus*, both the sexes were combined and the relationship was worked out by fitting polynomial equation method by the following equation,

$$W = aL^3 + bL^2 + cL + d \qquad (1)$$

where W - Weight L- Length and a, b, c, d - coefficient of constant

RESULTS AND DISCUSSION

Fig. 1 shows the length-weight relationship of *L.lentjan*. Here initially length is increased upto 30 cm range, same time weight also increased slowly upto 140 g. Then, next range of length 30 cm to 60 cm weight is increased in the range of 1500 g weight. Finally

length is increased upto 75 cm, this range of length weight is doubly (3000 g) increased compared to 60 cm range of length.

For *L. lentjan* fitting values used in equation (1) is

$$W = 0.0085L^3 + 0.0895L^2 - 12.78L + 183.33 \quad (2)$$

The polynomial equation (1) represents the length-weight relationship of *L. lentjan*. The raw data of *L.lentjan* is fitted in polynomial equation. This curve fitting is clearly shows the difference between minimum and maximum range of length-weight relationship. The analysis of polynomial curve fitting values of R^2 is 99.5 % confidence fitting. Table 1 shows the polynomial equation, coefficient of constant and R^2 value.

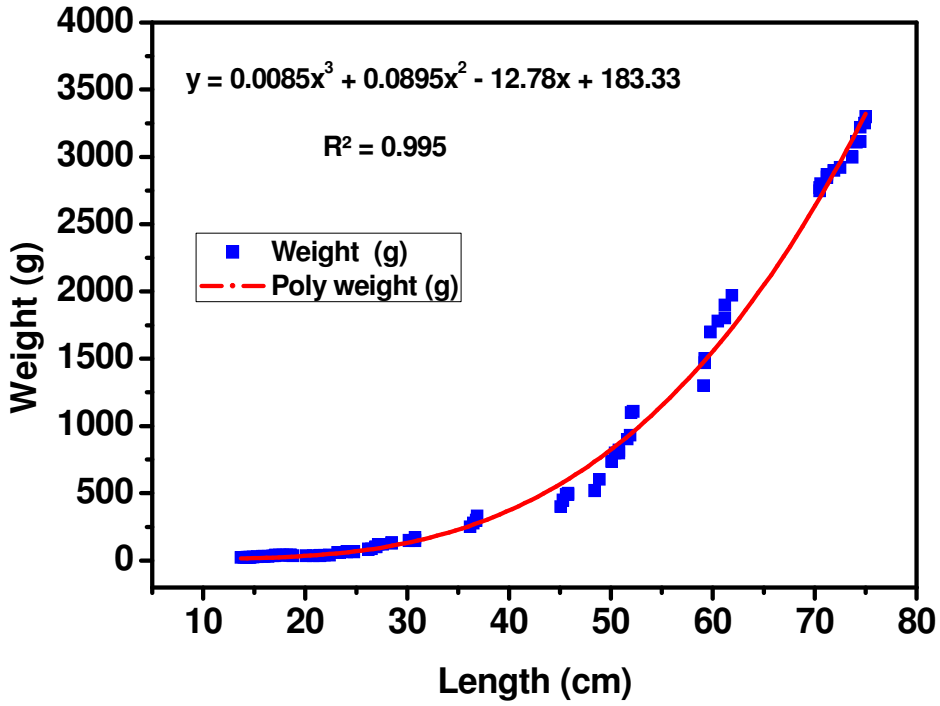

Fig. 1 Length-weight relationship of *L. lentjan*

Table 1. Length-weight relationship of *L. lentjan*

Polynomial equation	Constant Coefficient	R-squared value
$W = aL^3 + bL^2 + cL + d$	$a = 0.0085, b = 0.0895,$ $c = -12.78, d = 183.33$	0.995

Fig. 2 shows the length-weight relationship of *L. nebulosus*. Here initially length is increased upto 30 cm range, same time weight also increased slowly upto 200 g. Then, next range of length 30 cm to 60 cm weight is increased in the range of 2000 g weight. Finally length is

increased upto 75 cm, this range of weight is more than doubly (3500 g) increased compared to 60-75 cm range of length.

For *L.nebulosus*fitting values used in equation (1) is

$$W = -0.0299L^3 + 4.752L^2 - 161L + 1566.8 \quad (3)$$

The polynomial equation (1) represents the length-weight relationship of *L.nebulosus*. The raw data of *L.nebulosus*is fitted in polynomial equation. This curve fitting is clearly shows the difference between minimum and maximum range of length-weight relationship. The analysis of polynomial curve fitting values of R^2 is 97.9 % confidence fitting. Table 2 shows the polynomial equation, coefficient of constant and R^2 value.

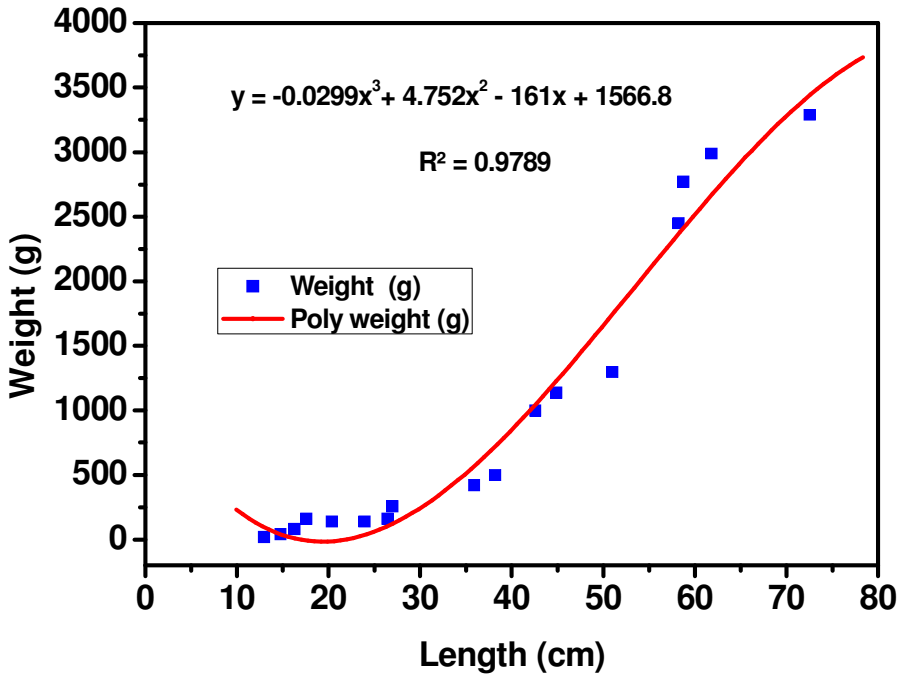

Fig. 2 Length-weight relationship of *L. nebulosus*

Table 2. Length-weight relationship of *L. nebulosus*

Polynomial equation	Constant Coefficient	R-squared value
$W=aL^3+bL^2+cL+d$	a=-0.0299,b=4.752, c=-161,d=1566.8	0.9789

This proposed parabolic model expresses not significantly about the length-weight relationship of *L. lentjan and L. nebulosus.*

Conclusion

It could be concluding that the length-weight relationship of *L.lentjan*. The analysis of polynomial curve fitting values of R^2 is 99.5 % confidence fitting. Length is increased up to 75 cm, this range of weight is more than doubly (3500 g) increased compared to 60-75 cm range of length.

Again, the length-weight relationship of *L.nebulosus*. The analysis of polynomial curve fitting values of R^2 is 97.9 % confidence fitting Finally length is increased up to 75 cm, this range of weight is more than doubly (3500 g) increased compared to 60-75 cm range of length. Through this model it was observed that the L.lentjan reaches the theoretical maximum weight approximately at the length of 60-75.cm and the L.nebulosusat the length of 60-75.cm in a natural environment. Moreover, it is clearly shown that L.lentjan and L.nebulosus have a different growth up to 60-75.cm of life in natural environment.

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