
INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN BIOLOGY AND MEDICINE

ISSN: 2455-944X

www.darshanpublishers.com

DOI:10.22192/ijcrbm

Volume 1, Issue 9 - 2016

Original Research ArticleDOI: <http://dx.doi.org/10.22192/ijcrbm.2016.01.09.001>

Length Weight Relationship of Pelagic Marine Fishes in East Coastal Region, Chennai, Tamil Nadu, India

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Abstract

In this study length weight relationship was carried out for 19 marine fish species which belongs to pelagic, epipelagic and neritic habitat of Chennai Coastal Region. The entire samples were collected early in the morning by using gill net, hook and line. Length and weight parameters were measured to all fishes. The b value ranged between 1.99 and 4. In some of the fishes from Clupeidae and Engraulidae family, length weight relationship values are as $b > 3$ which shows positive allometric growth. In other fishes belong to Belonidae and Lutjanidae families b values were close to 3 as isometric growth. Hence morphometric studies are essential to determine the growth form and growth rate of the fishes which is very much important for proper exploitation and management of the population of fishes.

Keywords: Length Weight Relationship, Pelagic, Clupeidae and Engraulidae

1. Introduction

Length-Weight Relationship (LWR) has important role in fishery resource management and also useful for comparing life history and morphological aspects of populations inhabiting in different regions (Ferhat *et al.*, 2007; Goncalves *et al.*, 1997). Condition factor studies were taken into consideration for the health and general well-being of a fish as related to its environment; hence it represents how fairly deep-bodied or robust fishes (Reynold, 1968). The relationship indicates the taxonomic differences and events in the life history, such as metamorphosis and the onset of maturity. It also denotes the fatness and general well-being of a fish or groups of fishes. Obtaining the relationship between total length and other body weight are also very much essential for stabilizing the taxonomic characters of the species.

Length-Weight Relationship is important in fishery science, notably to raise length frequency samples to total catch, to estimate biomass from underwater

length observations, to evaluate fish growth and body condition etc. The length-weight relationship of fish is important in population assessments (Ricker, 1968). Length-weight relationship (LWR) is a very important parameter to understand the growth dynamics of the fish population. Length and weight data are useful to standard results of any fish sampling program (Morato *et al.*, 2001). LWR of fishes are important in fishery biology because they allow the estimation of average weight of fish at given length group by establishing mathematical relation between the two parameters (Beyer, 1987). LWR is particularly important in parameterizing yield equations and in estimations of stock size (Abdurahiman *et al.*, 2004). The exact relationship between length and weight differs among species of fish according to their inherited body shape, and within a species according to the condition (robustness) of individual fish (Schneider *et al.*, 2000). The study of morphometric characters in fishes is important because they can be used for the

differentiation of taxonomic units (Ambily and Nandan 2010). No attempt has been made on the morphometric study on edible fishes in East Coastal Regions. Hence the present study aimed to study the length weight relationship of the chosen edible marine fishes in ECR at Chennai, Tamil Nadu.

2. Materials and Methods

2.1 Sample collection

Fishes were collected early in the morning from East Coastal Region, Chennai, Tamil Nadu. Fishing vessels with gill nets, hook and line were used to catch marine fishes. Fishing vessels were equipped with icing systems and fish were kept at lower temperature to keep fresh. In this experiment, all fish samples were collected before sorting to avoid biasness on size. After collection, they were immediately preserved with ice in the ice box and transported to the laboratory. Samples were collected during the year 2015.

2.2. Sample measurement

After its arrival to the Zoological Research Laboratory, Government Arts College, Nandanam, Chennai-35, total length (L) and standard length (SL) of fishes were measured using a special measuring board with a meter rule calibrated in centimeters. Fish length was measured to the nearest centimeter. Body weight (W) was measured by using Infra Digital (model IN 600) monopan electronic balance after bolt drying with a piece of clean tissue correct to two decimal places. The length-weight relationship was calculated using the equation (Le Cren, 1951; Pauly, 1983;) $W = aL^b$ where W is the weight of fish in grams, Coefficient 'a' is the intercept in the y-axis, regression Coefficient 'b' is the exponent and L is the total length of fish in cm. The value of 'b' indicates isometric growth when close to 3. The growth is positive allometric when the value of 'b' is more than 3 and negative allometric when 'b' is less than 3. The statistical significance level of r^2 was estimated and

the parameters 'a' and 'b' were estimated by linear regression analysis based on the natural logarithms:

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

Additionally the coefficient of determination r^2 was estimated. The Fulton's condition factor (K) for each experimental fish has been calculated using the formula:

$$K = (W/L^3) \times 100$$

Where K is the condition factor

W is the weight of fish (g)

L is the length of fish (cm).

3. Results and Discussion

3.1. Length –weight relationship

Length weight relationship was carried out for 19 marine fishes belonging to different family from pelagic, epipelagic, neritic and oceanic zone during the year 2015. Totally 1,110 fishes were collected and each fish species existed at the average number 58. The relationship between length and weight was significant one to analyse marine fishes because this relationship determines the fish growth and productivity of marine water. The b values for all fishes ranged from 1.99 to 4. In some fishes length weight ratio was greater than 3 and some other fishes it was less than 3. In epipelagic fishes b value was greater than 3 whereas in *Sardinella gibbosa* $b=3.42$, in *Stolephorus commersonni* $b=3.2$, in *Stolephorus indicus* $b=4$, in *Sarda chiliensis* $b=3.06$, and in *Saurida tumbil* $b=3.2$. In pelagic region fishes b value was close to 3, value in *Lutjanus fulvus* $b=2.91$, in *Tylosurus crocodiles* $b=2.92$ and in *Silage sihama* $b=2.9$. In other fishes b value was less than or close to 3 viz. *Rastrelliger brachisoma*, *Gerres filamentosus*, *Parastromateus niger* etc. The r^2 value was greater than 0.8 in all fishes of *Sardinella fimbriata* $r^2=0.92$, *Thryssa mystax* $r^2=0.92$, *Mugil cephalus* $r^2=0.91$ etc. The comparative study on LWR of marine fishes in east coastal region of Chennai are presented in the table 1 and figures 1 and 2. The feeding habit, feeding ground, spawning period and the seasonal availability of chosen marine fishes were also quoted in the table 1.

Table.1: Length weight relationship for pelagic sea fishes

Species name	Family	No	r ²	b	a	k	Feeding habit	Feeding ground	Spawning	Distribution	Season
<i>Tylosurus crocodiles</i>	Belonidae	45	0.73	2.92	2.00E-06	0.14	Carnivorous	Pelagic	Aug and Feb-Marc	South east coast of India and Indo Pacific region	Year round
<i>Atule mate</i>	Carangidae	12	0.79	2.7	4.00E-05	0.9	Carnivorous	Pelagic	Summer	Indo-Pacific: Red Sea and the East Coast of Africa	Year round
<i>Parastromateus niger</i>	Carangidae	7	0.69	1.99	0.005	1.93	Carnivorous	Epipelagic	June to August	West and East Coast of India	Aug to Dec
<i>Trichiurus lepturus</i>	Chirocentridae	24	0.62	2.02	0.0004	0.07	Carnivorous	Pelagic	April to Aug	West and east coast of India	July to April
<i>Sardinella gibbosa</i>	Clupeidae	383	0.58	3.42	9.00E+00	0.58	Zooplankton	Epipelagic	April to Oct	South-West Coasts of India	May to July
<i>Sardinella fimbriata</i>	Clupeidae	28	0.92	2.72	3.00E-05	0.7	Zooplankton	Epipelagic	Rainy	South-West Coasts of India	Aug to Dec
<i>Stolephorus commersonii</i>	Engraulidae	126	0.92	3.2	3.00E-06	0.8	Omnivorous	Epipelagic	Rainy	East and West Coast	Oct to April
<i>Stolephorus indicus</i>	Engraulidae	65	0.55	4	7.00E-08	0.69	Omnivorous	Coastal pelagic	Rainy	East and East Coast	Oct to April
<i>Thryssa mystax</i>	Engraulidae	32	0.92	2.6	5.00E-05	0.68	Carnivorous	Pelagic	June to July	Throughout Indian Ocean	April to June
<i>Gerres filamentosus</i>	Gerreidae	40	0.73	2.14	0.001	1.2	Omnivorous	Sub-littoral	Dec to April	India, China, Japan, Indonesia etc	Sep to January
<i>Secutor insidiator</i>	Leiognathidae	83	0.7	2.5	0.0001	1.2	Carnivorous	Demersal	Oct to Dec	Red Sea and the Gulf of Aden, along the Indian coasts	Mar to June
<i>Lutjanus fulvus</i>	Lutjanidae	19	0.83	2.91	2.00E-05	1.52	Carnivorous	Pelagic	Dec to April	South West and South East Coast of India	Sep to January
<i>Mugil cephalus</i>	Mugilidae	32	0.91	2.78	3.00E-05	1.02	Zooplankton	Benthopelagic	Oct to Dec	East and West Coast of India	Aug to Feb
<i>Nemipterus bipunctatus</i>	Nemipteridae	19	0.9	2.4	0.0003	1.2	Carnivorous	Epipelagic	April to Sep	East Coast of India	Aug to Feb
<i>Rastrelliger brachisoma</i>	Scombridae	28	0.77	2.45	0.0002	0.94	Carnivorous	Pelagic	March to September	South, middle-West and south East Coast of India	Aug to Nov
<i>Sarda chiliensis</i>	Scombridae	19	0.82	3.06	8.00E-06	1.07	Carnivorous	Epipelagic	Monsoon	East Coast of India	Oct to May
<i>Sillago sihama</i>	Sillaginidae	33	0.9	2.9	1.00E-05	0.74	Omnivorous	Neritic sone	Dec to April	East Coasts of India	May to Dec
<i>Saurida tumbil</i>	Synodontidae	56	0.94	3.2	2.00E-06	0.65	Carnivorous	Benthic	Oct-Mar	East Coast of India	Throughout the year
<i>Terapon puta</i>	Terapontidae	59	0.88	2.82	3.00E-05	1.2	Omnivorous	Benthopelagic	Dec to April	Indo West Pacific, Northern Indian Ocean and	Sep to Jan

Fig. 1 Length weight relationship of marine fishes in ECR of chennai

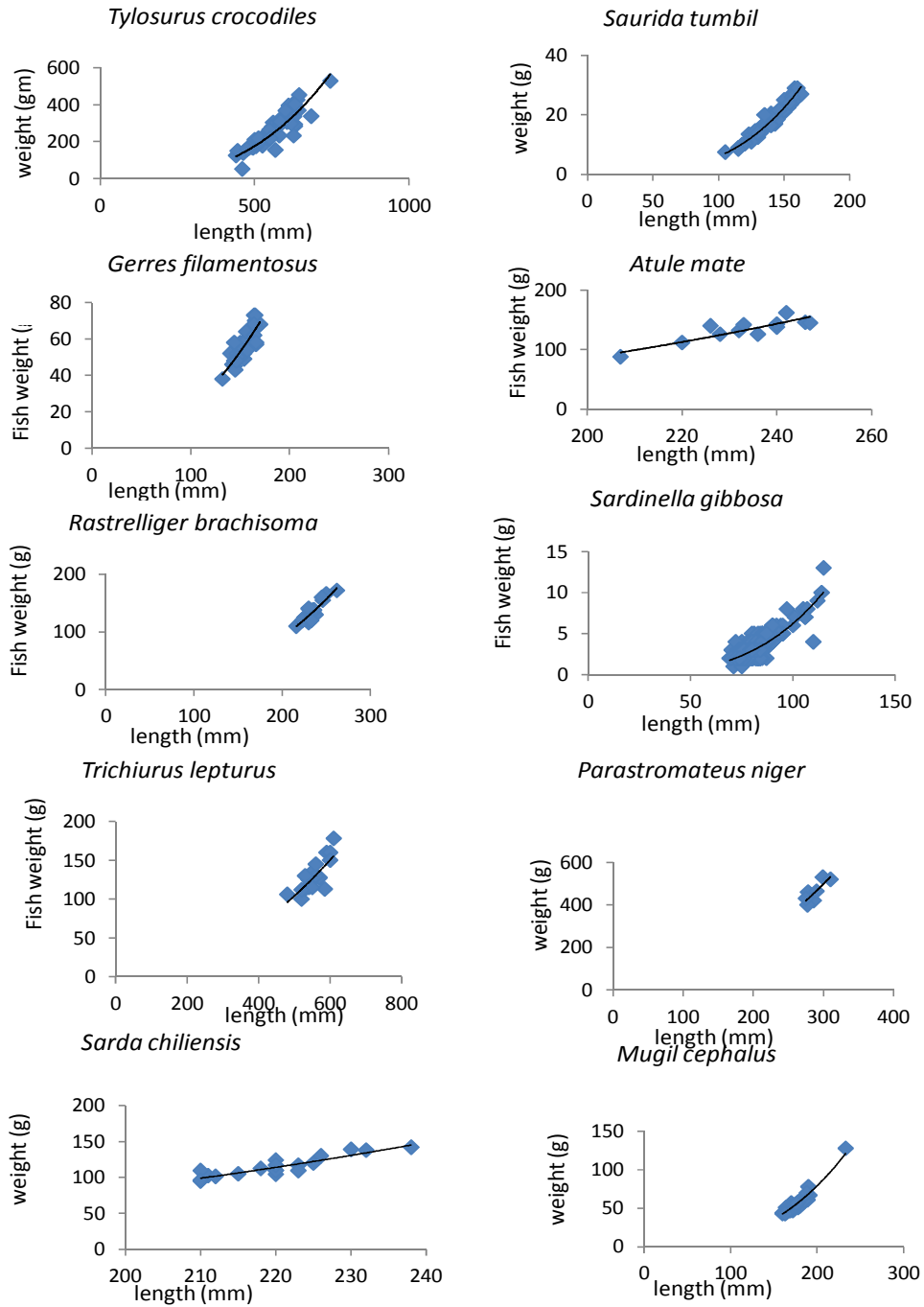
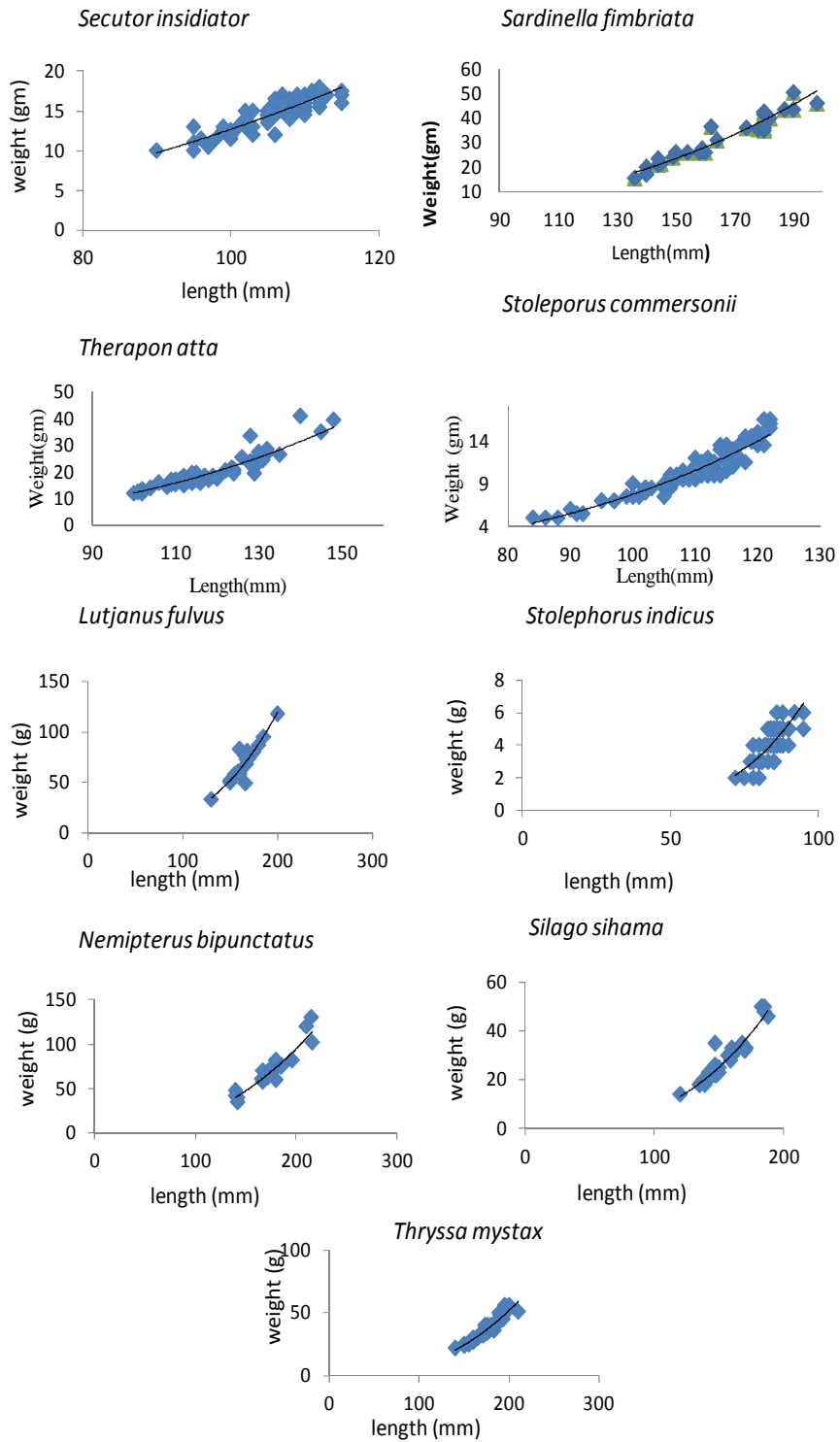


Fig. 2 Length weight relationship of marine fishes in ECR of Chennai



The length weight relationship of marine fishes in East Coastal regions of Chennai was supported by many authors. Jaikumar *et al.*, (2011) has reported that the length –weight relationship in *Lambis lambis* is in allometric growth ($b=2.3765$). Maria Yankova (2014) has reported the co-efficient of determination (r^2) of different samples showed high degree of correlation between length and weight of horse mackerel for female ,male and both sexes is 0.8571,0.9716 and 0.994 respectively.

Subodha Kumar and Sudarsan (2012) has reported parameters of ‘a’ and ‘b’ of the LWR of 20 fish species .The calculated ‘b’ value of all the species ranged between 2.5 and 3.5. Kurma Rao and Ramesh Babu (2013) has reported the regression values of juveniles (2.16), adults (2.81), males (2.66) and females (2.74) of *Mugil cephalus*. Alex Nehemia *et al.*(2012) has reported that the value of exponent ‘b’ and the condition factors (K) for *Tilapia zillii* in fresh water (FW) and full strength sea water (FSSW) (in the bracket) were found to be 2.94 (3.3)and 2.07 (0.74) respectively. On the other hand the value of exponent ‘b’ and condition factor (K) for *Oreochromis urolepis* in FW and FSSW (in the bracket) were found to be 2.81 (3.46) and 0.86 (0.53) respectively.

Conclusion

Overall length weight relationship varied between families because all fishes having different behaviour and different feeding habit. The range also varied among the carnivore and herbivore fish. In carnivores, value had ups and down whereas omnivore and herbivore fish value was in linear range the carnivore fish utilized the food when food availability was more in open sea, whereas in herbivorous and omnivorous fishes can get the food where the plankton productivity was more. The length weight relationship was determined by factor such as availability of food, water quality or productivity

Acknowledgments

The authors are thankful to the Principal and Head of the department of Zoology, Government Arts College, Nandanam Chennai-35 for providing necessary facilities to carry out the work.

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How to cite this article:

Martin. P, Kuppan. A and Kalaichelvi. N. (2016). Length Weight Relationship for Pelagic Marine Fishes in East Coastal Region, Chennai, Tamil Nadu. *Int. J. Curr. Res. Biol. Med.* 1(9): 1-7.

DOI: <http://dx.doi.org/10.22192/ijrbm.2016.01.09.001>