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Length-weight relationship of five finfish species from Chennai coast, India

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Abstract

Length-weight relationships for five finfish species belonging to five different families were estimated collected from Chennai coast, Tamil Nadu, India. The estimated allometric parameter 'b' values ranged from 2.78 (*Nemipterus randalli* Russel, 1986) to 3.32 (*Trachinocephalus myops* (Forster, 1801) which is within the normal range and r^2 values ranged from 0.952 (*Nemipterus randalli*) to 0.980 (*Trachinocephalus myops*). All the LWRs were highly significant, with $p < .005$. There were no prior LWRs data in Fish Base from India regarding three of these species (*Stolephorus indicus*, *Trachinocephalus myops* and *Upeneus tragula*).

Keywords: Allometric growth, Length-weight relationships, Chennai coast, Tamil Nadu

1. Introduction

Length-weight relationships (LWRs) are commonly used as a fundamental tool for estimation of weight and biomass of the species under studies, where weighing of fish in the field is often not possible to provide sufficient precision for LWR estimates ^[1]. The mathematical relationship between length and weight of fishes is a practical index suitable for understanding their survival, growth, maturity, reproduction and general well-being ^[2]. The relationship is also useful in differentiating small taxonomic units, as variations occur within populations of different localities ^[2]. The studies on length-weight relationships of important fishes are highly significant for management and conservation of fish populations in natural water bodies. The present study provides LWR data for five species of fishes belonging to five different families Nemipteridae (*Nemipterus randalli*, Russell, 1986), Engraulidae (*Stolephorus indicus* (van Hasselt, 1823), Carangidae (*Atule mate* (Cuvier, 1833), Synodontidae (*Trachinocephalus myops* (Forster, 1801) and Mullidae (*Upeneus tragula*, Richardson, 1846) collected from trawl landing centre at Kasimedu fishing harbour, Chennai coast, Tamil Nadu. Except, *Nemipterus randalli* and *Atule mate*, the other three species had no LWRs data available from India in Fish Base ^[3]. Hence the present study aimed to provide the first LWR data for *S.indicus*, *T. myops* and *U.tragula* from India water along the Chennai coast, Tamil Nadu, India.

2. Materials and methods

2.1 Study area

The samples were collected every month in day time from February, 2019 to January, 2020. A total of 336 fish specimens of five species (*Nemipterus randalli* = 72, *Stolephorus indicus* = 76, *Atule mate* = 58, *Trachinocephalus myops* = 68 and *Upeneus tragula* = 62) were collected from Kasimedu trawl fishing landing centre (Lat. 13°7'36.84" N, Long. 80°17'51.72"E).

2.2 Treatment

The collected fish specimens were transported to the laboratory in a well preserved condition using ice, washed thoroughly using tap water and wiped off before study. The specimens were preserved in 6% formaldehyde solution after recording the total length and body weights. The total length (TL) was measured in centimeters (to the nearest 0.01 cm) with the help of digital caliper (Mitutoyo) and body weight was recorded in grams (to the nearest 0.01g) with a digital balance.

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2.3 Identification

The specimens were identified following Fischer and Bianchi (1984) [4] and Talwar and Kacker (1984) [5].

2.4 Data analysis

The parameters of length-weight relationships were calculated by using the following equation:

$$W = a L^b \text{ (Le Cren, 1951; Pauly, 1983 and Froese, 2006) [2, 1, 6]}$$

Where, W: weight of the fish in grams (gm),

L: Total length (TL) of the fish in centimetres (cm)

a: Constant (intercept)

b: the length exponent (slope)

Regression parameters 'a' and 'b' of the length-weight relationships were estimated by linear regression equation $\text{Log TW} = \log a + b \log \text{TL}$ after logarithmic transformation of weight and length data respectively. The statistical significance, 95% confidence limits of 'a' and 'b' and the coefficient of determination (r^2) were estimated. Data were statistically analyzed by using Microsoft Office Excel 2007 and SPSS 18.00 package programmes. Prior to linear regression analysis, outliers in the log-log plots were identified and removed from the data [1].

3. Results and discussion

Statistical analyses of length and weight relationship parameters including sample sizes, regression parameters 'a' and 'b' and their 95% confidence limits (CI) and the coefficients of determination (r^2) are given in Table 1. All the LWRs showed highly significance levels ($r^2 > 0.95$, $p < 0.005$). The allometric co-efficient b values ranged from 2.78 for *Nemipterus randalli* to 3.32 for *Trachinocephalus myops*, whereas the coefficient of determination (r^2) ranged from 0.952 for *Nemipterus randalli* to 0.980 for *Trachinocephalus myops*.

The length-weight relationship is the most important aspect in biological studies of fishes. The 'b' value less than 3 shows that fish become lighter (negative allometric) for a particular length. The fishes may not remain the same shape or body outline throughout their life span. The value of 'b' gives

information about the growth and wellbeing of fish [2].

The estimated 'b' values of the regression for all the species remained within the expected range for teleosts between 2.5 and 3.5 as per Carlander (1969) [7], (Froese, 2006) [1]. Out of five species analysed herein, three species (*S.indicus*, *T.myops* and *U.tragula*) have no LWR data estimated from India water in Fish Base [3]. The LWR for *Atule mate* in the present study showing positive allometric growth ($b = 3.08$) which is similar with the findings in Kerala water (Ruben *et al.*, 1992) [8]. Mohd Azim *et al.*, (2017) [9] also reported positive allometric growth of *Atule mate* ($b = 3.148$) from mangrove estuarine waters of Malaysia. Positive allometric growth generally indicates good overall health for most of the fish and the obtained value can be used to provide information regarding the suitability of the environment for a particular species [1].

In the present study, 'b' value of *N.randalli* ($b = 2.78$) differed from that of Murty (1982) [10] from Kakinada, Andhra Pradesh ($b = 2.877$). The 'b' value of *Nemipterus japonicus* (Bloch, 1791) was recorded almost 3 referred to symmetrical or isometric growth by Vivekanandan and James (1986) [11] for Madras waters in India, Mathews and Samuel (1991) [12] for Kuwait waters and Manojkumar (2004) [13] for North West coast of India. The differences in length weight relationships by sexes and regions were reported among the previous study for *N. japonicus* for Karnataka region in India (Zacharia, 1998) [14], Kizhakudan *et al.* (2008) [15] and SureshKumar *et al.* (2011) [16] in India.

The 'b' value of *Stolephorus indicus* ($b = 3.14$) in the present study, differed from Martin *et al.*, 2016 [17] ($b = 4$) who reported the length weight relationship of pelagic marine fishes in east coastal region, Chennai, Tamil Nadu. A number of factors are known to influence length-weight relationships in fishes, including growth phase, season effect, size range, general fish condition and size selectivity of the sampling gear [18]. Multitude of factors, either singly or in combination, such as number of specimens examined; fish habitat; degree of stomach fullness; sex; stage of gonadal maturity; and differences in the observed length range of the specimens are known to cause variations in b value of fishes [1].

Table 1: Descriptive statistics and estimated parameters of length-weight relationships of five fish species from Chennai coast, Tamil Nadu, India

Family	Fish species	n	Total Length (cm)		Body weight (g)		Regression Parameters		Confidence Limits		r^2
			Min.	Max.	Min.	Max.	a	b	95% CL of a	95% CL of b	
Nemipteridae	<i>Nemipterus randalli</i> Russel,1986	72	9.66	22.16	13.7	102.3	0.028	2.78	0.0174 – 0.0454	2.499 – 2.872	0.952
Engraulidae	<i>Stolephorus indicus</i> (vanHasselt,1823)	76	7.62	15.42	2.4	26.3	0.003	3.14	0.0019 – 0.0053	3.024 – 3.467	0.957
Carangidae	<i>Atule mate</i> (Cuvier, 1833)	58	8.43	24.41	7.13	49.9	0.135	3.08	0.0931 – 0.1976	1.713 – 2.014	0.971
Synodontidae	<i>Trachinocephalus myops</i> (Forster,1801)	68	14.21	31.74	22.3	127.3	0.057	3.32	0.0161 – 0.1499	1.987 – 2.756	0.980
Mullidae	<i>Upeneus tragula</i> Richardson,1846	62	10.82	23.56	15.4	89.6	0.059	2.84	0.0401 – 0.0874	2.193 – 2.495	0.978

n, number of individuals; Min, minimum; Max, maximum; a, intercept; b, slope; CL, confidence limits; r^2 , coefficient of determination

4. Conclusion

The present studies provides baseline information of the length weight relationships for five commercially important species of fishes from Chennai coast, India which will be useful for assessment of population parameters and management of these resources and it will add to the biology and ecology of the species for further research.

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