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Short Communication

Length-weight relationships for five fish species from Gulf of Mannar, southeast coast of India

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The study documents length-weight relationships (LWRs) of five fish species *viz*. *Chaetodon collare* Bloch, 1787, *Chaetodon octofasciatus* Bloch, 1787, *Pempheris mangula* Cuvier, 1829, *Pseudotriacanthus strigilifer* (Cantor, 1849), and *Rogadius asper* (Cuvier, 1829) sampled from Gulf of Mannar, southeast coast of India. The fishes have been collected from bycatches of commercial trawlers from two landing centres of Gulf of Mannar during April, 2019 to March, 2020. The estimated co-efficient '*b*' values ranged from 2.878 (*Pseudotriacanthus strigilifer*) to 3.146 (*Chaetodon octofasciataus*) and r^2 values ranged from 0.953 (*Chaetodon collare*) to 0.989 (*Pseudotriacanthus strigilifer*). The results of LWR of five species show that these are highly significant ($p < 0.05$). Except *Pseudotriacanthus strigilifer*, the study is the first report of the LWRs of the four fish species which are not reported yet in FishBase.

[**Keywords**: Gulf of Mannar, Length-weight relationship, Southeast coast of India]

Introduction

The relationships between length and weight of fishes are used as important biological information for management of fishery[1]. LWR helps to determine the pattern of growth and biomass from its estimated length[2]. Initially, the LWR was used to get information on the condition of growth of the fish to estimate whether the growth is isometric or allometric[3,4]. Gulf of Mannar (08°47' to 09°15' N; 78°12' to 79°14' E), a marine biosphere reserve, situated between India and Sri Lanka consist of 21 islands surrounded by fringing coral reefs[5]. This ecosystem is known to be one of the richly endowed in terms of finfish diversity *i.e.*1182 species reported from the Gulf of Mannar[6]. Biological studies of fin fishes from the Gulf of Mannar are very scanty. The present study provides the LWR data for *Chaetodon collare* Bloch, 1787, *Chaetodon octofasciatus* Bloch, 1787, *Pempheris mangula* Cuvier, 1829, *Pseudotriacanthus strigilfer* (Cantor, 1849) and *Rogadius asper* (Cuvier, 1829) sampled from two landing centers of the marine national park of southeast coast of India. Except *Pseudotriacanthus strigilifer*, the established LWR data of the other four fish species has been reported for the first time as no records are available on LWR of these fishes in FishBase[7] (version 02/2022).

Materials and Methods

Fish specimens have been collected between April, 2019 to March, 2020 from the two major landing centers *viz*. Mandapam (09°16'37.99" N; 79°09'04" E) and Pamban (09°17′0.2″ N; 79°12′45.22″ E) of Gulf of Mannar, southeast coast of India. The fishes have been identified by following the standard literature[8] and Eschmeyer's Catalog of fishes[9] was referred for the scientific names. The digital caliper (Mitutoyo) was used for the measurement of total length nearest to 0.01 cm and a digital balance nearest to 0.01 g for body weight (BW). The length-weight relationship of each species was estimated using the formula, $W = a\ L^b$, where W: weight of the fish in grams (gm), L: Total length (TL) of the fish in centimeters (cm), '*a*' represents the intercept and '*b*' represents the slope[1,3,10]. The parameters of the LWR (*a* & *b*) were estimated by linear regression equation Log TW = log a + b log TL after logarithmic transformation of weight and length data respectively. The 95 % confidence limits of '*a*' and '*b*' and the coefficient of determination (r^2) were estimated. Microsoft Office Excel 2007 and SPSS 18.00 package programme has been used for analysis of the data. The outliers in the log-log plots have been identified and removed before the analysis of the linear regression[1].

Results and Discussion

385 specimens of five fish species have been measured. The analyzed LWR parameters including sample numbers, regression parameters '*a*' and '*b*' and their 95 % confidence limits and the coefficients of determination (r^2) have been summarized in Table 1. The study provides the first record of length-weight relationships of four fishes namely, *Chaetodon collare*, *Chaetodon octofasciatus*, *Pempheris mangula* and *Rogadius asper*. The '*a*' value ranged from 0.008 (*Pempheris mangula*) to 0.027 (*Chaetodon collare)* and the value of '*b*' ranged from 2.878

Table 1 — Descriptive statistics and estimated length-weight relationships (LWR) of five fish species from Gulf of Mannar, Southeast coast of India, sampled during April, 2019 to March, 2020

Family	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*	
Chaetodontidae	*Chaetodon collare* Bloch, 1787	72	4.97	13.42	7.8	112.9	0.027	2.913	0.0034 –0.0551	2.591 – 3.235	0.953
Chaetodontidae	*Chaetodon octofasciataus* Bloch, 1787	86	4.94	10.46	3.6	35.8	0.025	3.146	0.0126 –0.0505	2.787 – 3.503	0.965
Pempheridae	*Pempheris mangula* Cuvier, 1829	67	6.79	13.96	3.1	32.3	0.008	3.117	0.0036 –0.0189	2.754 – 3.481	0.966
Triacanthidae	*Pseudotriacanthus strigilifer* (Cantor, 1849)	78	8.16	22.25	6.4	116.3	0.015	2.878	0.0069 –0.0316	2.595 – 3.183	0.989
Platycephalidae	*Rogadius asper* (Cuvier, 1829)	82	8.58	18.56	5.8	50.2	0.009	2.973	0.0043 – 0.0218	2.647 – 3.297	0.970

N: number of individuals; Min: minimum; Max: maximum; '*a*': intercept; '*b*': slope; CL: Confidence limits; r^2: Coefficient of determination

(*Pseudotriacanthus strigilifer*) to 3.146 (*Chaetodon octofasciatus*). The analyses of LWR were statistically significant ($p < 0.05$). The estimated '*b*' values of five fishes have been recorded within the expected limits (2.5 – 3.5)[1,11]. The 95 % confidence limits are also found within the desirable range and at par with Bayesian confidence limits[12]. The analysis of growth value (*b*) found that three species shows negative allometric growth ($b < 3$) and two species are with positive allometric growth ($b > 3$). The value of '*b*' of *P. strigilifer* reported by Aghajanpour *et al*.[13] and Salahi *et al*.[14] ($b = 2.75$ and $b = 2.858$) from Persian Gulf, Iran was found to very close to the present findings ($b = 2.878$). The variations of '*b*' value can be occurred due to several factors such as sample size, length range covered, type of habitat, ontogenetic development, season, population, sex, gonad maturity, diet, health[15,16], etc. Here the length-weight relationship of four important fin fishes from Gulf of Mannar, India was estimated. The reported LWRs data could be beneficial to the fishery biologists for further research, management and conservation of these important fish species.

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Conflict of Interest

The authors have no competing interests.

Ethical Statement

The dead specimens were collected from the fish landing centre following scientific collection ethics.

Author Contributions

MKD, RRK, CS & PP: Sample collection and preservation, and MKD: Identification and manuscript preparation.

References

1 Froese R, Cube law, condition factor and weight–length relationships: history, meta-analysis and recommendations, *J Appl Ichthyol*, 22 (4) (2006) 241–253.
2 Giarrizzo T, de Sena Oliveira R R, Andrade M C, Gonçalves A P, Barbosa T A P, *et al*., Length-weight and length-length relationships for 135 fish species from the Xingu River (Amazon Basin, Brazil), *J Appl Ichthyol*, 31 (2) (2015) 415 – 424.
3 Le Cren E D, The length-weight relationship and seasonal cycle in gonad weight and condition in the perch *Perca fluviatilis*, *J Animal Ecol*, 20 (2) (1951) 201–219.
4 Ricker W E, Computation and interpretation of biological statistics of fish populations, *Bull Fish Res Board Can*, 191 (1975) 1 – 382.
5 Venkataraman K, Jeyabaskaran R, Satyanarayana C & Raghuram K P, Status of coral reefs in Gulf of Mannar Biosphere Reserve, *Rec Zool Surv India*, 103 (2004) 1–15.
6 Joshi K K, Sreeram M P, Zacharia P U, Abdussamad E M, Varghese M, *et al.*, Check list of fishes of the Gulf of Mannar ecosystem, Tamil Nadu, India, *J Mar Biol Assoc India*, 58 (1) (2016) 34 -54.
7 Froese R & Pauly D (eds), *FishBase*, World Wide Web electronic publication. http://www.fishbase.org version (02/2022).
8 Fischer W & Bianchi G, *FAO Species identification sheets for fishery purposes*, *Western Indian Ocean (Fishing Area 51)*, Vol II, (Food and Agricultural Organization of the United Nations, Rome), 1984.
9 Fricke R, Eschmeyer W N & Fong J D (eds), Eschmeyer's Catalog of Fishes: Genera/ Species by Family/ Subfamily.

Electronic version accessed 25th July, 2022. http://research-archive.calacademy.org/research/ichthyology/catalog/SpeciesByFamily.asp

10 Pauly D, *Some simple methods for the assessment of tropical fish stocks*, (FAO, Fisheries Technical Pap, FAO, Rome), 234 (1983) pp. 60.

11 Carlander K D, *Handbook of freshwater fishery biology*, Vol 1, (The Iowa State University Press, Ames), 1969, pp. 752.

12 Froese R, Thorson J T & Reyes Jr R B, A Bayesian approach for estimating length–weight relationships in fishes, *J Appl Ichthy*, 30 (1) (2014) 78-85.

13 Aghajanpour M, Raeisi H, Moradinasab A, Daliri M, Parsa M, *et al*., Length-weight relationships of six fishes from intertidal and coastal waters in the northern Persian Gulf, *J Appl Ichthyol*, 31 (2) (2015) 403-404.

14 Salahi M, Kamrani E, Daliri M & Momeni M, Length-Weight Relationships of Four Fish Species Associated to Shrimp Trawl Fishery as by-Catch in the Persian Gulf, Iran, *Thalassas*, 36 (1) (2020) 33–35.

15 Tesch F W, Age and growth, In: *Methods for assessment of fish production in fresh waters*, edited by Ricker W E, (Oxford: Blackwell Scientific Publications), 1971, pp. 98.

16 Chen S, Xie C, Li D, Yao N, Ding H, *et al.*, Length-weight relationships of five *Triplophysa* species from the northwest of China, *J Appl Ichthyol*, 33 (6) (2017) 1234-1236.