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A note on length-weight relationship and relative condition factor of freshwater fish species inhabiting Thamirabarani River, Eastern Slope of Western Ghats, Southern Tamil Nadu, India

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Abstract

The length-weight relationship (LWR) and relative condition factor for the two freshwater fish species, malabar sprat, *Ehirava fluviatilis* and quoy's garfish, *Hyporhamphus quoyi* were estimated from the potamon zone of Thamirabarani river, Eastern Slope of Western Ghats, Southern Tamil Nadu, India. Fish samples were caught fortnightly using various fishing gears viz., cast net and seine net between November 2020 and October 2021. The total length of the fish was measured to the nearest 0.1 cm and total weight to the nearest 0.001 g. The LWR and relative condition factor were calculated and the slope *b* value lies within the acceptable range of 2.5 – 4.0 for the two studied species. This study also reports a specimen with a maximum length of 5.37 cm (TL) for *E. fluviatilis* which is marginally higher compared to previously observed length of 5 cm in FishBase and a new record of *H. quoyi* for the first time in Thamirabarani River.

Keywords: Length-weight relationships, Relative condition factor, *E. fluviatilis*, *H. quoyi*, Thamirabarani River, Western Ghats

Introduction

LWR and relative condition factor are the most important studies to assess the growth, maturity and well-being of fish population and for scientific fisheries management and further stock assessment studies (Arup Kumar *et al.*, 2018) [2]. Fish growth is considered to be an isometric (i.e. a constant specific gravity), when the slope value is 3 and observed to be an allometric (i.e. growth with changing specific gravity), when the slope value is greater (Positive allometric) or less (Negative allometric) than 3 (Froese and Pauly, 2022). In general, the value of the slope *b* in the parabolic equation usually lies between 2.5 and 4.0 (Martin *et al.*, 1949) [20]. Of these two fish species, *H. quoyi* (Hemiramphidae) has been categorized as Not Evaluated (NE) and *E. fluviatilis* (Clupeidae) as Data deficient (DD) by IUCN (2021) [14]. There is no original description available for two studied fish species in WoRMS (2022) and also no previous study on LWR particularly in India for these two species. In Indian waters, the order beloniformes which comprises of 50 species belonging to 17 genera with three families that includes species, *H. quoyi* (Thomas *et al.*, 2022) [28].

Materials and methods

Fish specimens were collected fortnightly along the potamon zone of Thamirabarani River (8° 37'56.2" N, 77° 52'29.9" E (Puliyangulam, Thoothukudi district) and 8° 38'45.2" N, 77° 52' 29.9" E (Karungulam, Thoothukudi district) between November 20 and October 21. This present work was carried out in Fisheries College and Research Institute, Thoothukudi. The fish specimens were caught by cast netting and seine netting during day time. The specimens were collected, kept in an insulated container with ice and brought to the laboratory. The specimens were examined for their morphological characteristics and identification of fish species was confirmed using the standard keys from Talwar and Jhingran (1991) [27], Jayaram (1994) [15], Jhingran (1999), Menon (1999) [21] and updated with FishBase (Froese and Pauly, 2020).

A digital vernier caliper was used to measure the total length (TL) to the nearest 0.1 cm and analytical digital balance was used to record total body weight to the nearest 0.001 g. The relationship between length and weight was calculated by using the cube law $W = a * L^b$ (Le Cren, 1951; Froese, 2006) [19, 7]. In this above equation, W is the total body weight (g), L is the total length (cm), *a* is the intercept and *b* is the slope. The relative condition factor (Kn= w/W) is the ratio of observed weight (w) of a fish at a given length to the expected weight (W) of a fish of the same length as calculated from the length weight regression (Le Cren, 1951) [19]. The parameters *a*, *b* and coefficient of determination (r^2) were estimated using the linear regression analysis after converting the length and weight values into logarithmic ones using the natural

logarithm function 'ln'. Outliers in the log – log plots were recognized and removed from the data before doing linear regression analysis (Froese, 2006) [7].

Results

The results of length-weight relationship and relative condition factor values inclusive of sample size, Bayesian estimates and regression statistics are provided in Table 1. This study also reports a specimen with a maximum length of 5.37 cm (TL) for *E. fluviatilis* which is marginally higher compared to previously observed length of 5 cm in FishBase and a new record *H. quoyi* for the first time in the potamon zone of Thamirabarani River, Eastern slope of Western Ghats.

Table 1: Length-weight estimates of two freshwater fish species, *E. fluviatilis* & *H. quoyi* of the River Thamirabarani in the potamon zone

Family	Species	N	TL range (cm)		TW range (g)		Kn	Regression parameters				
			Min	Max	Min	Max		<i>a</i>	95% CI of <i>a</i>	<i>b</i>	95% CI of <i>b</i>	r^2
Clupeidae	<i>E. fluviatilis</i>	109	1.2	5.37	0.030	0.962	1.0299	0.0171	0.0144 - 0.02017	2.5645	2.4232 - 2.7057	0.9244
Hemiramphidae	<i>H. quoyi</i>	68	1.3	16.00	0.001	6.220	1.1320	0.00631	0.0034 - 0.01167	2.6018	2.3344 - 2.8692	0.8531

Abbreviations: N, sample; TL, total length; TW, total weight, *a*, intercept; *b*, slope; CI, confidence limits; r^2 , coefficient of determination

Discussion

The length-weight relationship and relative condition factor values are used for studying mathematical relationship between two variables, length and weight and is of immense useful in catch statistics and stock assessment studies, growth, maturity, reproduction and general well-being of fish (Haniffa *et al.*, 2006) [12]. In this present study, the values of the calculated parameter *b* for two species lie within the acceptable range of 2.5 – 4.0 (Hile, 1936 & Martin *et al.*, 1949) [13, 20] and between 2.5 and 3.5 (Carlander 1969 & Froese 1998) [4, 6]. The coefficient of determination (r^2) value for fish exhibiting optimum growth falls within the range of 0.90 – 1.0 (Hanif *et al.*, 2017) [11]. In this present study, r^2 value for *E. fluviatilis* was 0.9244 and r^2 value of 0.8531 was obtained for *H. quoyi* showing a high degree of correlation. Aqmal-naser *et al.*, (2021) [1] reported *b* value of 2.94 for the closely related species river sprat, *Clupeichthys* sp. from Tasik Kenyir, in Peninsular Malaysia. The slope value observed by the author was higher than that of the reported *b* value obtained for *E. fluviatilis* (2.5645) in this present study. Similarly, Shakir *et al.*, (2008) [25] reported the slope *b* value of 3.57 indicating allometric growth for *Sperata sarwari* from Mangla Lake in Pakistan. Karna *et al.*, (2017) [17] studied length-weight relationship of *H. limbatus* from Chilika Lake, India and reported *b* value of 2.945 showing negative allometric growth. As far as length-weight relationship parameters available for *H. quoyi* in Fish Base and the slope value of 3.199 indicating positive allometric growth collected from Mathabhanga River, Bangladesh (FishBase 2022). On comparing with the above earlier studies, the reported *b* value was 2.6018 for *H. quoyi* indicating negative allometric growth. Mogalekar *et al.*, (2017) [22] reported that *H. quoyi* species was not found in Punnaikayal estuary, where Thamirabarani River discharges its water into Gulf of Mannar, a world heritage site through fishing hamlet in Thoothukudi district. Though there were reports available of this species in Coleroon – Pichavaram – Vellar – Parangipettai estuarine complex in Cuddalore district (Mogalekar *et al.*, 2017) [22]. However, the availability of these species not reported in Kodayar River, Kanaykumari district, Tamil Nadu (Canciya *et al.*, 2020) [3] and also in Cauvery Wildlife Sanctuary, Western Ghats of Karnataka

(Srinivasan *et al.*, 2021) [26] and also in the Inland water of Southeast Asia (Kottelat, 2013) [18]. From this study, a maximum TL of 5.37 cm was recorded for *E. fluviatilis* in Thamirabarani riverine system which is marginally higher compared to previously observed length of 5 cm in FishBase (Whitehead 1985 and Talwar *et al.*, 1991) [29, 27]. Hence, in the present study, a negative allometric growth was observed for *E. fluviatilis* and *H. quoyi*. Though there are reports with scanty availability of *H. quoyi* in northern parts of Tamil Nadu, India, but recorded for the first time in Thamirabarani River, southern parts of freshwater riverine system of Tamil Nadu.

Conclusion

Thamirabarani is the perennial river that becomes a part of the Eastern Slope of Western Ghats. It has rich fish biodiversity and cultural heritage of the people those who lived along the river bank in Tirunelveli and Thoothukudi districts. Of late it is found that there are issues are water pollution, water is being drawn for various usage particularly industrial purpose, discriminated fishing practices and discharge of house hold solid waste into the river resulted in diversity of fishes are at peril. The river is usually enjoys both SW monsoon and NE monsoon but often floods during NE monsoon that brings more fishes into the potamon zone of Thamirabarani River, which drains into the Bay of Bengal at Gulf of Mannar, Punnaikayal village, Thoothukudi district. The present study also reports a new record of *H. quoyi* in the river Thamirabarani. The slope value for the studied fish species showed negative allometric growth. However, the relative condition factor value showed 1 indicated well-being of the studied fishes is quite satisfactory. Nevertheless, the basic biological studies on small sized fishes (minor fishery) in this region would be helpful for scientists, research scholars, biologist, taxonomist and conservationist to undertake further study on stock of these fishes towards conservation and management in this region.

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Conflict of interest

The authors declare that they do not have any conflict of interest.

Data availability statement

The prime data that supports the findings of this study are available from the corresponding author upon reasonable request.

Author's contribution

RD carried out research work and drafted the manuscript. PJ narrated the work and executed the experiment, NJ critically reviewed the manuscript and condensed the matter and CS analysed the data. All authors interpreted the data and critically reviewed the manuscript and approved the final version.

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