Journal of Animal Diversity

Online ISSN 2676-685X

Volume 3, Issue 4 (2021)

Short Communication

http://dx.doi.org/10.52547/JAD.2021.3.4.5

Length-weight relationship of four fish species of the genera *Pseudorhombus*, *Plicofollis* and *Scarus* (Actinopterygii: Paralichthyidae, Ariidae and Scaridae) from the Persian Gulf, Iran

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Received: 13 July 2021
Accepted: 23 September 2021
Published online: 31 December 2021

Abstract

In the present study, the length-weight relationships (LWRs) of 148 specimens representing four species, including 20 specimens of *Pseudorhombus javanicus*, 70 *Plicofollis dussumieri*, 28 *Scarus persicus* and 30 *S. fuscopurpureus* collected from the Persian Gulf were estimated. The LWRs equations were found as $W= 0.67\times L^{2.23}$ for *P. javanicus*, $W= 0.05\times L^{2.38}$ for *P. dussumieri*, $W= 0.62\times L^{2.15}$ for *S. persicus* and $W= 0.27\times L^{2.41}$ for *S. fuscopurpureus*. The values of *b* ranged from 2.15 (*S. persicus*) to 2.41 (*S. fuscopurpureus*), with the coefficient of determination (r^2) greater than 0.85. The present study presents the LWRs parameters for *P. javanicus* from the Persian Gulf, Iran for the first time and provides useful information for marine ecologists, fishery managers, the conservation of marine fishes, and the online database of FishBase.

Key words: *b* parameter, conservation, coefficient of determination, length-weight relationships, Persian Gulf

Length-weight relationship (LWRs) parameters of fish species are important for the estimation of the weight of a specimen from its length and vice versa, to use in stock assessment, in the estimation of biomass from length observations, ontogenetic changes, growth studies (Kumolu-Johnson and Ndimele, 2010; Mousavi-Sabet et al., 2015; Jafari-Patcan et al., 2018; Mouludi-Saleh and Eagderi, 2019; Abbasi et al., 2019; Eagderi et al., 2020), and to estimate the condition factor (Wootton, 1990; Pauly, 1993; Petrakis and Stergiou, 1995; Gonçalves et al., 1997; Yedier et al., 2019; Türker et al., 2020). The Persian Gulf is considered as a subtropical region and is located within the large, arid East Asian land mass (Sheppard, 1993). Its seawater temperatures can exceed 34 °C in summer and might be less than 15 °C in winter (Rezai et al., 2004). Based on the latest checklist, some 744 species representing 131 families, 445 genera and 27 orders were recorded from the Persian Gulf (Eagderi et al., 2019). This study was conducted to provide the LWRs parameters of four fish species viz. *Pseudorhombus javanicus* (Bleeker), *Plicofollis dussumieri* (Valenciennes), *Scarus persicus* Randall and Bruce, and *Scarus fuscopurpureus* (Klunzinger) from the Persian Gulf.

From July to August 2020, a total of 148 specimens including: 20 *P. javanicus*, 70 *P. dussumieri*, 28 *S. persicus* and 30 *S. fuscopurpureus* were collected using gill and pound nets from two sampling sites in the Persian Gulf, Iran (Table 1). After anesthesia, the specimens were fixed into 10% buffered formalin and transported to the laboratory at the University of Tehran for further study. In the lab, the total length (TL) and weight of all specimens were measured using a digital caliper (Insize Model) and scale to the nearest 0.1 cm and 0.1 g, respectively.

The equation $W= aL^b$ with 95% confidence limits of the constants ("*a*" and "*b*") and logarithmically transformed into $\text{Log}W= \text{Log}a + b\text{Log}L$ was used to estimate the length-weight relationship (Froese, 2006), where *W*= total weight (g), *L*= total length (cm), *a*= the intercept and *b*= the slope. Prior to

regression analyses, log-log plots of the length-weight pairs were performed to identify outliers (Froese et al., 2011). The student's t-test (ts) was used to estimate whether parameter *b* is significantly different from the expected or theoretical value of 3 (*i.e.* *b*= 3, P< 0.05). All statistical analyses were performed in PAST software version 2.17b (Hammer et al., 2001) and Excel 2016.

Table 1: Sampling sites of the four species from the Persian Gulf.

Species	Station	Geographical coordinate
Pseudorhombus javanicus	Qeshm Island	27°06'26"N, 56°06'14"E
Plicofollis dussumieri	Qeshm Island	27°06'26"N, 56°06'14"E
Scarus persicus	Coral reef near the Kish Island	26°34'28"N, 54°01'45"E
Scarus fuscopurpureus	Coral reef near the Kish Island	26°34'28"N, 54°01'45"E

The total length and weight of the four studied species ranged from 11.7–33.9 cm and 16.6–1291.3 g, respectively. The ranges of the total length and weight parameters, estimated LWRs parameters including *α*, *b*, and the coefficient of determination (r^2) are presented in Table 2. Based on the results, the *b* parameter ranges from 2.15–2.41 with r^2 0.86 to 0.98. The *b* parameter was 2.23 for *P. javanicus*, 2.38 for *P. dussumieri*, 2.15 for *S. persicus* and 2.41 for *S. fuscopurpureus*.

Based on the results, the negative allometric growth pattern was recorded in the studied species ($P< 0.05$).

In the LWRs, the *b* value was expected to be in the range of 2.5–3.5 (Froese, 2006) or 2–4 (Tesch, 1971) as was found in the present study. Dutta and Hazra (2013), Cheraghi et al. (2013), Aghajanpour et al. (2015), Farooq et al. (2017) and Mohseni et al. (2019) in their studies reported the *b* parameter 2.984, 2.979, 2.777, 2.968, and 2.95 for *P. dussumieri*, respectively, whereas in our study the value was 2.38, showing a negative allometric growth pattern. The parameter *b*-value of *S. fuscopurpureus* was reported to be 3.17 (versus 2.41 in the present study) (Javadzadeh et al., 2016). Also, a value of 3.071 was reported for *S. persicus* from Bushehr Province, Persian Gulf by Pouladi et al. (2020). Generally, some factors such as habitat, diet, sex, gonad maturity, stomach fullness, and health can be affected by the *b* value (Tesch, 1971; Bagenal and Tesch, 1978; Kamal et al., 2009). Also, the length-weight relationship and its related parameters can change daily and seasonally (De Giosa et al., 2014). The present study presents the LWRs parameters for *P. javanicus* from the Persian Gulf, Iran for the first time and further data for other species which can be used for their stock assessment.

Acknowledgments

The authors would like to thank the University of Tehran for its financial support and two anonymous reviewers for their valuable comments to improve our manuscript.

Conflict of interest

All authors declare that there are no conflicting issues related to this short communication.

Table 2: Descriptive statistics and length-weight relationship parameters for four species from the Persian Gulf.

Species	N	TL (cm)		W (g)		*a*	95% Cl *a*	*b*	95% Cl *b*	r^2	Growth pattern
		Min	Max	Min	Max						
Pseudorhombus javanicus	20	11.7	24.8	16.6	83.6	0.067	0.051–0.089	2.23	2.14–2.34	0.98	A^-
Plicofollis dussumieri	70	12.3	32.1	17.3	187.4	0.05	0.021–0.11	2.38	2.13–2.68	0.88	A^-
Scarus persicus	28	16	33.9	232.6	1291.3	0.62	0.36–0.98	2.15	2.02–2.32	0.95	A^-
Scarus fuscopurpureus	30	13.2	29.8	155.3	962.1	0.27	0.091–0.81	2.41	2.08–2.75	0.86	A^-

N: number of individuals; TL: total length; W: weight; Min= minimum; Max= maximum; a= intercept; b= slope; CL= confidence limits; r^2, coefficient of determination, A^-= negative allometric.

[DOR: 20.1001.1.2676685.2021.3.4.7.6]
[DOI: 10.52547/JAD.2021.3.4.5]

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[DOI: 10.52547/JAD.2021.3.4.5]