

Length-weight relationship of eleven species of marine catfishes from the northern Arabian Sea coast of Pakistan

Noureen FAROOQ, Nazia QAMAR, Shahnaz RASHID, Sher Khan PANHWAR*

Center of Excellence in Marine Biology, University of Karachi, Sindh, Pakistan

Received Apr. 14, 2016; accepted in principle May 30, 2016; accepted for publication Aug. 23, 2016

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Abstract This study records length-weight relationships (LWRs) for eleven commercially important marine catfish species of the family Ariidae (sea catfishes) and Plotosidae (eel catfishes) from the northern Arabian Sea coast of Pakistan. The specimens were sampled from December 2014 to November 2015, using bottom trawls with various mesh sizes by commercial vessels. The species were *Nemapteryx caelatus*, *Sciades sona*, *Arius gagora*, *Batrachocephalus mino*, *Netuma thalassina*, *N. bilineata*, *Osteogeneiosus militaris*, *Plicofollis dussumieri*, *P. tenuispinis*, *Plotosus limbatus*, and *P. lineatus*. Of the eleven species, two species *A. gagora* and *N. bilineata* were recorded for the first time and LWRs for four species *A. gagora*, *N. bilineata*, *S. sona*, and *B. mino* still have no data in the FishBase database. In addition, new maximum length for each of the three species *N. bilineata*, *O. militaris* and *B. mino* was also found.

Keyword: marine catfishes; Arridae; Plotosidae; northern Arabian Sea

1 INTRODUCTION

The mathematical relationship between length and weight of fishes is a practical index suitable for understanding the survival, growth, maturity, reproduction and general well-being, and is often used to characterize life history and make morphological comparisons between different fish species or populations (Jennings et al., 2001; Xue et al., 2011). Since the last few years the landing records of marine catfishes has steadily declined in Pakistan, based on regular monitoring of local exporters and suppliers (authors' personal communication). The length-weight relationships (LWRs) of marine catfish species reported by various authors from different regions are summarized in Table 1. In this study, LWRs have been established for eleven marine catfish species captured from the northern Arabian Sea coast Pakistan.

2 MATERIAL AND METHOD

Specimens were sampled by commercial vessels from December 2014 to November 2015, using bottom trawls with various mesh sizes. The data from 995 specimens were used to calculate LWRs.

Measurement of large specimens was made on the spot and for further biological studies specimens were transported in ice boxes to the fisheries laboratory at the Centre for Excellence in Marine Biology (CEMB). All the species were identified using FAO species catalogues (Fischer and Bianchi, 1984; Kailola, 1999) or FishBase. Each individual was measured for total, fork and standard lengths in centimeters (cm) and weighed in grams. Pooled data were used to calculate LWRs, using the parabolic equation $W=aL^b$, where L is length (cm), W is the weight (g) of fish. The intercept ' a ' and growth coefficient ' b ' were analyzed after transforming data on natural log (ln) equation: $W=L_n a + b L_n$ and calculating 95% confidence limits (Le Cren, 1951; Froese, 2006).

3 RESULT

Data from 995 specimens were used to calculate length-weight relationships. The regression parameters (a , b , R^2 and confidence limits) are summarized in Table 2. It is interpretable from the R^2 value 0.8 to 0.9 that there is strong linearity between

* Corresponding author: sk.panhwar@uok.edu.pk

Table 1 The exponent (*b*), length range and sex calculated for different marine catfish species, reported from different waters

Species	Reference	Location	Length type	Sex	Length (cm)	(Slope) <i>b</i>
<i>Plicofollis dussumieri</i>	Dutta and Hazra, 2013	West Bengal	TL	Mixed	51.8–81.7	2.984
<i>Nemapteryx caelatus</i>	Sawant et al., 2013	Mumbai water	TL	Mixed	-	3.265
<i>Netuma thalassina</i>	Daliri et al., 2012	Persian Gulf	FL	Mixed	18–64	3.015
<i>Plicofollis tenuispinis</i>	Taherimirghaed et al., 2013	Persian Gulf	FL	Mixed	12.1–47	3.08
<i>Osteogeneiosus militaris</i>	Dutta et al., 2012	West Bengal	TL	Mixed	-	2.945
<i>Plotosus limbatus</i>	Torres, 1999	South Africa	TL	Mixed	-	2.940
<i>Plotosus lineatus</i>	Govindarao et al., 2015	Visakapatnam	TL	Mixed	11–17	3.457

–: no data available.

Table 2 Summary of parameters estimated for eleven marine catfishes from the northern Arabian Sea coast of Pakistan

Species	<i>n</i>	Min & Max TL (cm)	<i>a</i>	CL ₉₅ <i>a</i>	<i>b</i>	CL ₉₅ <i>b</i>	<i>R</i> ²
<i>Netuma bilineata</i> ^{1,2}	361	3.0–90.0	0.033	-3.830–3.00	3.367	2.499–2.737	0.839
<i>Plicofollis dussumieri</i>	302	13.4–85.0	0.011	-4.668–4.209	2.968	2.902–3.034	0.964
<i>Arius gagora</i> ¹	95	15.0–38.0	0.009	-5.663–3.709	3.013	2.709–3.318	0.806
<i>Nemapteryx caelatus</i>	29	22.0–47.0	0.001	-7.516–5.247	3.527	3.192–3.863	0.945
<i>Sciades sona</i> ¹	23	24.0–63.0	0.035	-5.217–1.471	2.671	2.146–3.196	0.841
<i>Plicofollis tenuispinis</i>	41	7.0–45.0	0.005	-5.459–4.976	3.194	3.113–3.275	0.994
<i>Netuma thalassina</i>	30	16.0–106	0.011	-5.657–3.288	2.892	2.570–3.215	0.923
<i>Batrachcephalus mino</i> ^{1,2}	8	25.0–33.0	0.089	-4.741–0.089	3.411	1.672–3.063	0.938
<i>Osteogeneiosus militaris</i> ²	46	19.0–42.0	0.003	-6.474–5.143	3.350	3.147–3.553	0.962
<i>Plotosus limbatus</i>	28	28.0–50.0	0.006	-2.584–1.823	3.00	2.764–3.241	0.962
<i>Plotosus lineatus</i>	28	10.5–27.2	0.0007	-8.008–6.780	3.742	3.527–3.958	0.980

n is number of individuals; parameter *a* and *b*: intercept and slope; CL: confidence limit; *R*²: coefficient of determination. ¹ species as first published LWR; ² species with record of new maximum length.

the parameters. The values of slope *b* indicated that five species' growth was positive allometric (*b*>3) and rest of the six species' growth was negative allometric (*b*<3). The length-weight relationship of four species is reported for the first time and maximum length for three species should also be added to FishBase.org.

4 DISCUSSION

In this study, calculated *b* values were within the proposed range of 2.5–3.5 (Froese, 2006). The *b* values of *A. gagora*, *N. caelatus*, *P. tenuispinis*, *O. militaris*, *P. lineatus* were >3, and indicated positive allometry. In *N. bilineata*, *P. dussumieri*, *S. sona*, *N. thalassina*, *B. mino* and *P. limbatus*, on the other hand, values were <3, indicating negative allometry. The *b* values above 3 are the result of large specimens that increase in girth or width (Froese, 2006). The *b*-values for *P. dussumieri* and *N. caelatus* were close to those in the same species reported from West Bengal (Dutta and Hazra, 2013). The parameter *b* varied significantly

among the species and this variation within a similar habitat may be ascribed to differences in the physiology of the fishes (Le Cren, 1951).

It is concluded that, this study has contributed to the knowledge of catfish species from the northern Arabian Sea coast of Pakistan and that the data should be utilized for better management and conservation of these important fisheries.

5 ACKNOWLEDGEMENT

The assistance of the Director, Center of Excellence in Marine Biology, University of Karachi is greatly acknowledged.

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