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Length-weight relationships of 11 fish species from the Min River Estuary and its adjacent waters, Fujian Province, China

Qing Xu | Lan-lan Zhang | Qing-qiang Ren | Yan Jiang | Min Liu

College of Ocean and Earth Sciences, Xiamen University, Xiamen, China

Correspondence
Min Liu, College of Ocean and Earth Sciences, Xiamen University, Xiamen, Fujian, China.
Email: minliuxm@xmu.edu.cn

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Abstract

Length-weight relationships (LWRs) were estimated for 11 fish species from the Min River Estuary and its adjacent waters, Fujian Province, China. All samples were collected using gillnets (mesh size 45 mm) and bottom trawls (mesh sizes 45 mm at the main webbing and 25 mm at the cod end) seasonally in 2017 and 2018. The parameters for the LWRs were estimated, along with the basic Statistical analyses for total length and weight ranges as well as the 95% confidence intervals for the intercept (a) and the slope (b) of the regression lines. Further, the coefficient of correlation indicated that the LWRs were highly significant (all $r^2 > .95$, $p < .001$). This study provides the new maximum total lengths (TL_{max}) for *Coilia grayii* (33.0 cm), *Johnius taiwanensis* (20.9 cm), *Johnius trewavasae* (22.0 cm) and *Cynoglossus sibogae* (22.0 cm).

KEYWORDS

China, fish, LWRs, Min River Estuary, nearshore fishery

1 | INTRODUCTION

Length-weight relationships (LWRs) are species-specific which represent the natural process of the population growth and biological condition, and are influenced by various factors including temperature, food availability and sex (Froese, 2006; Pauly, 1984). The Min River is the largest river in Fujian Province, southern China, in terms of the total length, the basin area and the annual average runoff (Fujian Province Atlas, 2001). The Min River Estuary and its adjacent waters, connecting to the East China Sea, are important fishing ground, spawning ground and nursery ground for many nekton species (Kang et al., 2018). Fishery resource surveys in the region were conducted seasonally in 2017 and 2018, and about 240 nekton species including fishes, crustaceans and cephalopods were measured for length and weight. This study documented the LWRs of 11 fish species generated from the seasonal fishery survey data operated in the Min River Estuary and its adjacent waters.

2 | MATERIALS AND METHODS

All samples were collected in the Min River Estuary and its adjacent waters (25°51′–26°18′N, 119°31′–119°52′E), Fujian Province, China, using gillnets (mesh size 45 mm) and bottom trawlers (mesh sizes 45 mm at the main webbing and 25 mm at the cod end). The fishery operation was conducted seasonally in February, May, August and November, both 2017 and 2018. For bottom trawling, the operating time of each net was around 30 min, and the vessel speed was 2–4.2 kn. For gillnetting, the operating time of each net was around 30 min. The fishing areas have a depth range of 8–26 m and salinity range of 10–31, increasing from nearshore to offshore.

After harvest, the samples were stored on ice and transferred to laboratory for measurement within 48 hr. Species identification were confirmed against the FISHBASE (Froese & Pauly, 2020), the World Register of Marine Species (WORMS, 2020) and Chao et al. (2019). For the 11 fish species, the total length (TL) was measured to the nearest 0.1 cm, and the body weight (W) to the nearest 0.01 g for

TABLE 1 Descriptive statistics and estimated length-weight relationship parameters for 11 fish species from the Min River Estuary and its adjacent waters, Fujian Province, China, collected seasonally from February 2017 to November 2018

		TL (cm)		W (g)				Regression parameters		
Species	*n*	Min	Max	Min	Max	*a*	95% CI of *a*	*b*	95% CI of *b*	r^2
Scoliodon macrorhynchos (Bleeker, 1852)	23	22.3	37.0	50.47	220.88	0.0083	0.0031–0.0220	2.781	2.501–3.061	.953
Setipinna tenuifilis (Valenciennes, 1848)	290	8.8	18.5	4.02	44.25	0.0053	0.0044–0.0064	3.090	3.019–3.161	.962
Coilia grayii Richardson, 1845	361	5.5	33.0[a]	0.42	127.32	0.0012	0.0010–0.0015	3.267	3.193–3.341	.955
Johnius taiwanensis Chao et al. (2019)	63	9.2	20.9[a]	6.66	116.52	0.0043	0.0032–0.0059	3.366	3.249–3.482	.982
Johnius trewavasae Sasaki, 1992	409	2.8	22.0[a]	0.10	135.27	0.0061	0.0054–0.0069	3.227	3.179–3.276	.977
Cynoglossus oligolepis (Bleeker, 1855)	68	7.6	32.6	3.20	179.54	0.0027	0.0017–0.0044	3.167	3.002–3.331	.957
Cynoglossus sibogae Weber, 1913	235	7.7	22.0[a]	2.06	53.41	0.0026	0.0020–0.0033	3.237	3.145–3.329	.954
Cynoglossus sinicus Wu, 1932	20	9.0	28.5	2.66	127.77	0.0015	0.0008–0.0027	3.372	3.166–3.577	.985
Paraplagusia japonica (Tmminck & Schlegel, 1846)	13	11.4	21.5	6.41	55.61	0.0032	0.0011–0.0091	3.147	2.752–3.542	.966
Stephanolepis cirrhifer (Temminck & Schlegel, 1850)	13	3.4	16.0	0.94	77.70	0.0402	0.0285–0.0565	2.682	2.497–2.867	.989
Takifugu xanthopterus (Temminck & Schlegel, 1850)	15	10.5	21.0	19.92	208.69	0.0257	0.0116–0.0568	2.908	2.610–3.205	.972

Note: a and *b*, parameters of LWRs; CI, confidence interval; TL, total length; *n*, sample size; r^2, coefficient of determination; W, weight.
[a]New maximum total length record.

each individual. After removing a couple of outlier values, the LWRs was estimated using the equation without considering the sexes, $W = a\ TL^b$, which is estimated through logarithmic transformation, $\log W = \log a + b \log TL$, *a* the intercept and *b* the slope of the linear regression (Froese, 2006). The degree of relation between the variables was computed by the coefficient of determination (r^2). The 95% confidence interval (CI) was determined for parameters *a* and *b* using the regression analysis. All analyses were performed using the SPSS 25.0 software and Excel Microsoft Office.

3 | RESULTS

Descriptive statistics of each species on sample size, total length range, body weight range, parameters *a* and *b* of the LWRs, and their 95% CI and r^2 are summarized in Table 1. All LWRs are highly significant (all $r^2 > .95$, $p < .001$).

4 | DISCUSSION

The parameter *a* for all 11 fish species lied within the expected range of 0.001 to 0.05 and the *b* lied within the expected range of 2.5 to 3.5 (Table 1) (Froese, 2006). For *C. grayii*, although the *b* value is not available in FISHBASE, it was reported with $b = 3.48$ ($n = 129$) in the Pearl River Estuary, China (Zhou et al., 2016). The two Estuaries have a distance of approximate 900 km along the coastline. The fishing gears used in the two studies were the same, gill net and trawler, however, with different mesh sizes. The results indicate that not only the factors such as seasonality, location, habitat, population, diet and maturity, but also the fishing gear and mesh size, may cause the difference in the *b* value for the same species.

In this study, the new maximum total lengths (TL_{max}) were updated in 4 species, comparing to the records in FISHBASE (Froese & Pauly, 2020) (Table 1). For *C. grayii*, the maximum standard length (SL_{max}) is 25 cm in FISHBASE, while this study provided the new maximum lengths on 33.0 cm TL_{max} and 30.4 cm SL_{max}. For *C. sibogae*, the TL_{max} is 22.0 cm in this study, exceeding the record in FISHBASE. For *J. trewavasae*, the SL_{max} is 15.0 cm in FISHBASE, while this study provided the new maximum lengths on 22.0 cm TL_{max} and 18.5 cm SL_{max}. For *J. taiwanensis*, a newly described species in the family Sciaenidae (Chao et al., 2019), the new maximum total length is 20.9 cm. This study provides basic biological data of fishery species in the Min River Estuary and its adjacent waters which can be used for further fishery and biology studies.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Some data used during the study are available from the corresponding author by request. (Author's email: minliuxm@xmu.edu.cn).

ORCID

Qing Xu https://orcid.org/0000-0003-3768-674X
Min Liu https://orcid.org/0000-0002-6768-6794

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