ACTA ICHTHYOLOGICA ET PISCATORIA (2018) 48 (3): 315–318 DOI: 10.3750/AIEP/02307

LENGTH–WEIGHT RELATIONS OF 46 FISH SPECIES (ACTINOPTERYGII) FROM LOWER SECTIONS OF THE JIALING RIVER, SOUTH-WESTERN CHINA

Long REN[1, 2], Jinming WU[2], Meng HAO[1], and Jiabo ZHANG[1*]

[1] *College of Fisheries, Huazhong Agricultural University, Wuhan, Hubei, China*

[2] *Key Laboratory of Freshwater Biodiversity Conservation, Ministry of Agriculture of China, Yangtze River Fisheries Research Institute, Chinese Academy of Fishery Sciences, Wuhan, China*

Ren L., Wu J., Hao M., Zhang J. 2018. Length–weight relations of 46 fish species (Actinopterygii) from lower sections of the Jialing River, south-western China. Acta Ichthyol. Piscat. 48 (3): 315–318.

Abstract. Length–weight relations (LWRs) were estimated for 46 fish species representing 8 families and 29 genera from the lower sections of Jialing River, a tributary of Yangtze River basin, south-western China: *Opsariichthys bidens* Günther, 1873; *Squaliobarbus curriculus* (Richardson, 1846); *Ancherythroculter kurematsui* (Kimura, 1934); *Chanodichthys mongolicus* (Basilewsky, 1855); *Hemiculter tchangi* Fang, 1942; *Pseudolaubuca sinensis* Bleeker, 1864; *Pseudolaubuca engraulis* (Nichols, 1925); *Parabramis pekinensis* (Basilewsky, 1855); *Xenocypris davidi* Bleeker, 1871; *Xenocypris fangi* Tchang, 1930; *Hypophthalmichthys nobilis* (Richardson, 1845); *Hypophthalmichthys molitrix* (Valenciennes, 1844); *Sarcocheilichthys nigripinnis* (Günther, 1873); *Sarcocheilichthys sinensis* Bleeker, 1871; *Squalidus argentatus* (Sauvage et Dabry de Thiersant, 1874); *Coreius heterodon* (Bleeker, 1864); *Coreius guichenoti* (Sauvage et Dabry de Thiersant, 1874); *Rhinogobio typus* Bleeker, 1871; *Rhinogobio cylindricus* Günther, 1888; *Saurogobio dabryi* Bleeker, 1871; *Saurogobio gymnocheilus* Lo, Yao et Chen, 1998; *Gobiobotia filifer* (Garman, 1912); *Xenophysogobio boulengeri* (Tchang, 1929); *Onychostoma simum* (Sauvage et Dabry de Thiersant, 1874); *Spinibarbus sinensis* (Bleeker, 1871); *Procypris rabaudi* (Tchang, 1930); *Parabotia fasciata* Dabry de Thiersant, 1872; *Parabotia bimaculata* Chen, 1980; *Leptobotia elongata* (Bleeker, 1870); *Leptobotia taeniops* (Sauvage, 1878); *Leptobotia rubrilabris* (Dabry de Thiersant, 1872); *Leptobotia microphthalma* Fu et Ye, 1983; *Jinshaia sinensis* (Sauvage et Dabry de Thiersant, 1874); *Pseudobagrus vachellii* (Richardson, 1846); *Pseudobagrus pratti* (Günther, 1892); *Tachysurus nitidus* (Sauvage et Dabry de Thiersant, 1874); *Tachysurus dumerili* (Bleeker, 1864); *Hemibagrus macropterus* Bleeker, 1870; *Liobagrus nigricauda* Regan, 1904; *Liobagrus marginatus* (Günther, 1892); *Silurus asotus* Linnaeus, 1758; *Silurus meridionalis* Chen, 1977; *Glyptothorax fokiensis* (Rendahl, 1925); *Glyptothorax sinensis* (Regan, 1908); *Siniperca chuatsi* (Basilewsky, 1855); *Siniperca knerii* Garman, 1912. Data were monthly collected from May 2013 to October 2016. The values of coefficient *a* ranged from 0.0046 to 0.0237, and the values of exponent *b* ranged from 2.66 to 3.26. The length–weight relations of two species have not been previously reported.

Keywords: length–weight relations, ichthyofauna, Jialing River, Yangtze River basin

INTRODUCTION

The Jialing River, with the largest river area (160 000 km^2) within the Yangtze River basin, is the first tributary on the northern banks of the upper Yangtze River. There are approximately 156 fish species inhabiting the upper Yangtze River basin, including 54 endemic and 12 endangered species (Jiang et al. 2016). The aquatic environment of the Yangtze River basin was gradually damaged by construction of the cascade hydropower stations and excessive dredging, which led to decreasing aquatic biodiversity and fishery resources (Wu et al. 2011). Accurate length–weight relations (LWRs) data are widely used to better understand the species conservation and population dynamics (Ruiz-Campos et al. 2006, Froese et al. 2011), however, the growth data for the endemic fish species are lacking in this key fishery regions. The present study describes the LWRs for 46 common fish species in Jialing River.

MATERIAL AND METHODS

The study was conducted in the lower sections of Jialing River (29°34′–29°59′N, 106°17′–106°35′E), from Hechuan to Chongqing reach, during May 2013–October 2016 except the closure period for fishing (between February and April annually). Fish specimens were sampled monthly by drift gillnets (mesh size of 25 mm, knot to knot), stationary gillnets (mesh size of 25 mm, knot to knot), and trawl (mesh size of 30 mm, knot

* Correspondence: Prof. Jiabo Zhang, 华中农业大学水产学院，湖北省武汉市洪山区狮子山街1号，430070, China, phone: +86 13307156660, e–mail: (ZJ) *zjb@mail.hzau.edu.cn*, (RL) *renlong21@163.com*, (WJ) *jinming@yfi.ac.cn*, (HM) *605114451@qq.com*.

Table 1

Descriptive statistics and estimated parameters of length–weight relations for 46 fish species, Jialing River, China

Family	*Species*	FB	n	SL range [cm]	BW range [g]	Regression parameters				
						a	95% CI *a*	b	95% CI *b*	r^2
Cyprinidae	*Opsariichthys bidens*		883	6.1–17.3	2.6–97.2	0.0098	0.0084–0.0111	3.20	3.13–3.27	0.993
	Squaliobarbus curriculus		91	11.2–27.8	21.7–818.3	0.0121	0.0094–0.0148	3.12	2.89–3.35	0.990
	Ancherythroculter kurematsui	No	253	9.3–19.4	8.8–92.5	0.0148	0.0117–0.0179	3.01	2.85–3.17	0.980
	Chanodichthys mongolicus		209	10.2–40.7	22.3–890.0	0.0167	0.0136–0.0198	2.98	2.90–3.06	0.984
	Hemiculter tchangi		482	5.9–23.3	1.0–204.3	0.0046	0.0020–0.0072	3.03	2.93–3.13	0.987
	Pseudolaubuca sinensis		638	5.5–23.8	1.4–170.0	0.0079	0.0061–0.0097	3.05	2.99–3.11	0.993
	Pseudolaubuca engraulis		275	6.7–18.6	2.9–83.9	0.0083	0.0055–0.0111	3.11	3.01–3.21	0.979
	Parabramis pekinensis		146	13.0–32.7	40.0–710.3	0.0185	0.0157–0.0213	2.95	2.82–3.08	0.953
	Xenocypris davidi		549	6.1–32.3	4.5–461.7	0.0137	0.0113–0.0162	3.07	2.96–3.18	0.988
	Xenocypris fangi		261	5.1–29.5	4.2–356.6	0.0165	0.0126–0.0200	2.98	2.80–3.16	0.972
	Hypophthalmichthys nobilis		79	9.4–65.6	10.5–6250	0.0208	0.0163–0.0252	2.96	2.75–3.17	0.958
	Hypophthalmichthys molitrix		241	10.3–84.5	15.2–9500.0	0.0163	0.0139–0.0186	3.03	2.97–3.09	0.980
	Sarcocheilichthys nigripinnis		68	5.5–10.2	2.2–23.5	0.0089	0.0034–0.0144	3.23	2.97–3.49	0.952
	Sarcocheilichthys sinensis		170	6.3–13.9	5.2–64.1	0.0194	0.0159–0.0239	3.08	3.01–3.15	0.990
	Squalidus argentatus		2765	5.8–19.5	2.5–129.0	0.0089	0.0080–0.0098	3.24	3.21–3.27	0.998
	Coreius heterodon		192	7.6–50.4	6.8–1821.9	0.0104	0.0088–0.0120	3.08	3.03–3.13	0.986
	Coreius guichenoti		464	5.8–57.3	2.6–2750.0	0.0133	0.0120–0.0147	3.01	2.93–3.09	0.983
	Rhinogobio typus		1869	5.5–35.2	3.8–503.1	0.0095	0.0079–0.0111	3.06	3.01–3.11	0.987
	Rhinogobio cylindricus		268	8.2–26.6	7.2–230.6	0.0109	0.0083–0.0135	3.08	2.99–3.17	0.972
	Saurogobio dabryi		2568	6.6–23.2	3.1–136.5	0.0118	0.0111–0.0125	3.02	2.99–3.05	0.998
	Saurogobio gymnocheilus		27	6.8–16.3	4.4–63.8	0.0107	0.0045–0.0169	3.06	2.79–3.33	0.950
	Gobiobotia filifer		463	5.2–12.8	1.7–22.6	0.0112	0.0085–0.0139	2.97	2.82–3.12	0.985
	Xenophysogobio boulengeri		108	4.6–14.1	1.2–41.7	0.0108	0.0058–0.0158	3.09	2.92–3.28	0.965
	Onychostoma simum		275	6.7–36.5	5.0–1619.0	0.0123	0.0103–0.0124	3.22	3.12–3.32	0.981
	Spinibarbus sinensis		1170	9.5–43.2	16.8–3052.0	0.0154	0.0132–0.0176	3.18	3.11–3.25	0.987
	Procypris rabaudi		57	12.1–27.5	39.0–766.0	0.0168	0.0143–0.0193	3.14	3.06–3.22	0.986
Cobitidae	*Parabotia fasciata*		220	4.2–18.8	0.5–122.3	0.0055	0.0029–0.0081	3.26	3.07–3.47	0.980
	Parabotia bimaculata		41	6.0–13.5	2.9–48.6	0.0103	0.0051–0.0155	3.20	2.93–3.47	0.950
	Leptobotia elongata		124	7.8–35.0	4.2–605.0	0.0090	0.0051–0.0140	3.05	2.94–3.19	0.979
	Leptobotia taeniops		36	7.7–15.6	4.4–94.0	0.0096	0.0040–0.0152	3.11	2.86–3.36	0.963
	Leptobotia rubrilabris		158	6.5–21.0	3.0–105.6	0.0105	0.0044–0.0166	3.03	2.85–3.32	0.964
	Leptobotia microphthalma		93	4.4–10.0	0.8–13.7	0.0097	0.0062–0.0122	3.04	2.94–3.14	0.981
Balitoridae	*Jinshaia sinensis*		112	4.5–12.6	1.8–34.7	0.0212	0.0153–0.0272	2.92	2.73–3.11	0.962

Table continues on next page.

Table 1 cont.

Family	Species	FB	n	SL range [cm]	BW range [g]	Regression parameters				
						a	95% CI *a*	b	95% CI *b*	r^2
Bagridae	*Pseudobagrus vachellii*		2968	4.4–39.3	1.3–873.5	0.0159	0.0155–0.0163	2.97	2.95–2.99	0.993
	Pseudobagrus pratti		339	5.2–23.7	1.4–136.0	0.0176	0.0133–0.0219	2.78	2.71–2.85	0.970
	Tachysurus nitidus		474	4.7–22.6	1.4–155.3	0.0237	0.0204–0.0270	2.76	2.62–2.88	0.969
	Tachysurus dumerili		18	15.3–53.2	58.2–2019.6	0.0094	0.0026–0.0162	3.03	2.67–3.39	0.948
	Hemibagrus macropterus		1325	4.0–31.0	0.8–265.0	0.0221	0.0196–0.0246	2.66	2.62–2.70	0.998
Amblycipitidae	*Liobagrus nigricauda*		61	4.8–7.7	1.8–8.0	0.0183	0.0132–0.0214	2.89	2.74–3.04	0.962
	Liobagrus marginatus		26	5.1–8.4	1.6–8.2	0.0229	0.0133–0.0325	2.77	2.59–2.95	0.967
Siluridae	*Silurus asotus*		138	8.9–52.7	5.4–2450.0	0.0141	0.0098–0.0184	2.83	2.66–3.00	0.975
	Silurus meridionalis		247	11.3–97.0	8.9–10800.0	0.0126	0.0071–0.0172	2.94	2.77–3.11	0.966
Sisoridae	*Glyptothorax fokiensis*	No	285	4.8–12.5	2.0–31.1	0.0142	0.0086–0.0198	3.20	2.99–3.41	0.970
	Glyptothorax sinensis		143	4.4–13.4	1.7–36.9	0.0115	0.0053–0.0177	3.06	2.91–3.20	0.966
Percichthyidae	*Siniperca chuatsi*		202	7.5–30.6	8.3–652.8	0.0188	0.0166–0.0210	3.06	3.02–3.10	0.985
	Siniperca knerii		340	6.3–30.1	6.1–700.0	0.0182	0.0158–0.0206	3.16	3.08–3.24	0.981

FB = records available in FishBase, SL = standard length, BW = body weight, *n* = number of individuals, *a* = intercept, *b* = regression coefficient, CI = confidence interval, r^2, coefficient of determination (adjusted *R*-squared), No = no LWRs reference available in FishBase database.

to knot). Fishes were identified to species level based on morphology in the field (Ding 1994), measured for the standard length (SL) and body weight (BW) to the nearest 0.1 cm and 0.1 g, respectively.

The relations between SL and BW were calculated using the (Ricker 1975) equation

$$\log W = \log a + b \log L$$

where W is the body weight (BW, g), L is the standard length (SL, cm), a is the intercept and b is the regression parameters. Prior to regression, log-log plots of the length–weight pairs were performed to detect outliers (Froese 2006). The 95% confidence interval (CI) for the parameters (a and b) and the statistical significance level of r^2 were estimated. Overall statistical analyses were considered significant at 5% ($P < 0.05$).

RESULTS AND DISCUSSION

The LWRs of 21 921 individuals from 46 species representing 8 families and 29 genera were determined. The following species were studied: *Opsariichthys bidens* Günther, 1873; *Squaliobarbus curriculus* (Richardson, 1846); *Ancherythroculter kurematsui* (Kimura, 1934); *Chanodichthys mongolicus* (Basilewsky, 1855); *Hemiculter tchangi* Fang, 1942; *Pseudolaubuca sinensis* Bleeker, 1864; *Pseudolaubuca engraulis* (Nichols, 1925); *Parabramis pekinensis* (Basilewsky, 1855); *Xenocypris davidi* Bleeker, 1871; *Xenocypris fangi* Tchang, 1930; *Hypophthalmichthys nobilis* (Richardson, 1845); *Hypophthalmichthys molitrix* (Valenciennes, 1844); *Sarcocheilichthys nigripinnis* (Günther, 1873); *Sarcocheilichthys sinensis* Bleeker, 1871; *Squalidus argentatus* (Sauvage et Dabry de Thiersant, 1874); *Coreius heterodon* (Bleeker, 1864); *Coreius guichenoti* (Sauvage et Dabry de Thiersant, 1874); *Rhinogobio typus* Bleeker, 1871; *Rhinogobio cylindricus* Günther, 1888; *Saurogobio dabryi* Bleeker, 1871; *Saurogobio gymnocheilus* Lo, Yao et Chen, 1998; *Gobiobotia filifer* (Garman, 1912); *Xenophysogobio boulengeri* (Tchang, 1929); *Onychostoma simum* (Sauvage et Dabry de Thiersant, 1874); *Spinibarbus sinensis* (Bleeker, 1871); *Procypris rabaudi* (Tchang, 1930); *Parabotia fasciata* Dabry de Thiersant, 1872; *Parabotia bimaculata* Chen, 1980; *Leptobotia elongata* (Bleeker, 1870); *Leptobotia taeniops* (Sauvage, 1878); *Leptobotia rubrilabris* (Dabry de Thiersant, 1872); *Leptobotia microphthalma* Fu et Ye, 1983; *Jinshaia sinensis* (Sauvage et Dabry de Thiersant, 1874); *Pseudobagrus vachellii* (Richardson, 1846); *Pseudobagrus pratti* (Günther, 1892); *Tachysurus nitidus* (Sauvage et Dabry de Thiersant, 1874); *Tachysurus dumerili* (Bleeker, 1864); *Hemibagrus macropterus* Bleeker, 1870; *Liobagrus nigricauda* Regan, 1904; *Liobagrus marginatus* (Günther, 1892); *Silurus asotus* Linnaeus, 1758; *Silurus meridionalis* Chen, 1977; *Glyptothorax fokiensis* (Rendahl, 1925); *Glyptothorax sinensis* (Regan, 1908); *Siniperca chuatsi* (Basilewsky, 1855); *Siniperca knerii* Garman, 1912. The most abundant species included *Pseudobagrus vachellii*, *Squalidus* *argentatus*, and *Saurogobio dabryi*. The values of coefficient *a* ranged from 0.0046 (*Hemiculter tchangi*) to 0.0237 (*Tachysurus nitidus*), and the values of exponent *b* ranged from 2.66 (*Hemibagrus macropterus*) to 3.26 (*Parabotia fasciata*). The coefficient of determination values (r^2) in the majority of LWRs were high ($r^2 > 0.938$). The *b* values represented the range expected for teleost species between 2.5 and 3.5 (Froese 2006). Additionally, the LWRs for two species were determined for the first time (indicated in Table 1): *Ancherythroculter kurematsui* and *Glyptothorax fokiensis* according to FishBase (Froese and Pauly 2018).

In conclusion, it is the first time to study the LWRs for the species in Jialing River. The results in this study provide significant information in this area for scientists and managers which can help them monitor growth conditions and estimate species population dynamics for management and conservation purposes.

ACKNOWLEDGEMENTS

The authors wish to thank the colleagues: Shalong Zhang, Wei Wang, Lei Li, Huanchao Yang, Zhihua Hu, and Wen Song for their assistance in the fieldwork.

REFERENCES

Ding R.H. 1994. [The fishes of Sichuan Province.] Sichuan Publishing House of Science and Technology, Chengdu, China. [In Chinese.]

Froese R. 2006. Cube law, condition factor and weight–length relationships: History, meta-analysis and recommendations. Journal of Applied Ichthyology **22** (4): 241–253. DOI: 10.1111/j.1439-0426.2006.00805.x

Froese R., Pauly D. (eds.) 2018. FishBase. [Version 06/2018] www.fishbase.org

Froese R., Tsikliras A.C., Stergiou K.I. 2011. Editorial note on weight–length relations of fishes. Acta Ichthyologica et Piscatoria **41** (4): 261–263. DOI: 10.3750/AIP2011.41.4.01

Jiang Z.G., Jiang J.P., Wang Y.Z., Zhang E., Zhang Y.Y. 2016. [Red List of China's Vertebrates.] Biodiversity Science **24**: 500–551. [In Chinese.]

Ricker W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada No. 191.

Ruiz-Campos G., González Acosta A.F., De La Cruz Agüero J. 2006. Length–weight and length–length relationships for some continental fishes of northwestern Baja California. Mexico. Journal of Applied Ichthyology **22** (4): 314–315. DOI: 10.1111/j.1439-0426.2006.00780.x

Wu J., Wang J., He Y., Cao W. 2011. Fish assemblage structure in the Chishui River, a protected tributary of the Yangtze River. Knowledge and management of aquatic ecosystems **400**: e11. DOI: 10.1051/kmae/2011023

Received: 19 September 2017
Accepted: 3 August 2018
Published electronically: 30 September 2018