*Pakistan J. Zool., pp 1-3, 2024.* **DOI**: https://dx.doi.org/10.17582/journal.pjz/20231015030433

## Short Communication

# Length–Weight and Length–Length Relationship of Four Native Fish Species from the Middle and Lower Jinsha River, China

**Jie Chen[1], Baoshan Ma[2], Xin Yang[3], Bin Xu[2] and Xianqin Hu[1]***

[1]*School of Animal Science and Nutritional Engineering, Wuhan Polytechnic University, Wuhan 430023, China*
[2]*Yangtze River Fisheries Research Institute, Chinese Academy of Fishery Sciences, Wuhan 430223, China*
[3]*Hunan Fisheries Science Institute, Changsha 410153, China*

**Article Information**
**Received 15 October 2023**
**Revised 10 December 2023**
**Accepted 26 December 2023**
**Available online 15 April 2024**
**(early access)**

**Authors' Contribution**
**CJ analyzed the data and wrote the first draft. MB collected and identified fish species, and performed laboratory work. YX provided technical help, analysed the data and reviewed the draft. XB helped in field work. HX critically reviewed the manuscript, and approved the final version.**

**Key words**
**Length-weight relationship, Length-Length relationship, Native fish, Jinsha River, China**

## ABSTRACT

Length-weight (LW) and length-length (LL) relationships are reported for four fish species (*Anabarilius brevianalis*, *Beaufortia szechuanensis*, *Yunnanilus sichuanensis*, *Triplophysa xichangensis*) from the Shenyu River, Xining River and Anning River, tributaries of the Jinsha River, located in Sichuan, southwestern China. Totally, 409 specimens collected from April to May 2019, November 2020 and April 2021. The *b* values of the LW relationship ranged 2.733-3.064 for the studied species. It is worth mentioning that all four species of fish are first described in FishBase and this article also provides new maximum standard length recording for *A. brevianalis* (16.2 cm), *Y. sichuanensis* (6.9 cm) and *T. xichangensis* (14.4 cm) in FishBase.



Investigating the relationships between length and weight (LWRs) growth of fish in the growth process and the correlation coefficient is important for the basic theoretical research of fish ecology, the expression of fish growth and the development of fishery production (Wang *et al*., 2016). Moreover, the length-length relationships (LLRs) also play a significant role in fish growth research (Hossain *et al*., 2006).

The Shenyu River, Xining River and Anning River are tributaries of the middle and lower reaches of the Jinsha River, located in Sichuan Province. *Anabarilius brevianalis*, *Beaufortia szechuanensis*, *Yunnanilus sichuanensis*, *Triplophysa xichangensis* were the native fishes in the Jinsha River, which very little research has been done on them. Furthermore, there is also a lack of studies and availability of length and weight, especially the LWRs of some fish species that have not been recorded in FishBase. Therefore, the study of the LWRs and LLRs of these four kinds of fish will provide reference for the diversity and the reasonable utilization, protection and proliferation of the fish resources in the Jinsha River basin (Yang *et al*., 2010).

### *Materials and methods*

The fish specimens were collected from the Shenyu River, Xining River and Anning River (Fig. 1) by trap nets (mesh size 1.5 mm), and backpack electro-fishing during April and May 2019, November 2020 and April 2021 in Sichuan province, China (Table I). After sampling, for each individual, standard length (SL) and total length (TL) were measured with digital calipers to 0.1 cm, total weight (W) were measured with digital balance to 0.1 g (Duan *et al*., 2016). All scientific names were aligned to FishBase (Zhang *et al*., 2018).

LWR was estimated as: $W = aSL^b$, where $W$ is the total weight ($W$, g), $SL$ is the standard length ($SL$, cm), $a$ is the intercept, and $b$ is the slope (Froese, 2006). Graphing this equation in logarithmic form gives a straight-line relationship: $\log W = \log a + b \log SL$. Their 95% confidence limit (CL) and statistical significance of the correlation coefficient ($r^2$) were also determined. Furthermore, the relationship between $TL$ and $SL$ was analyzed by linear

* Corresponding author: huxiangin@163.com
0030-9923/2024/0001-0001 $ 9.00/0

regression for the $TL = p + qSL$ (Xiong *et al.*, 2017). Statistical analyses were performed in SPSS 26.0 and Excel 2016.

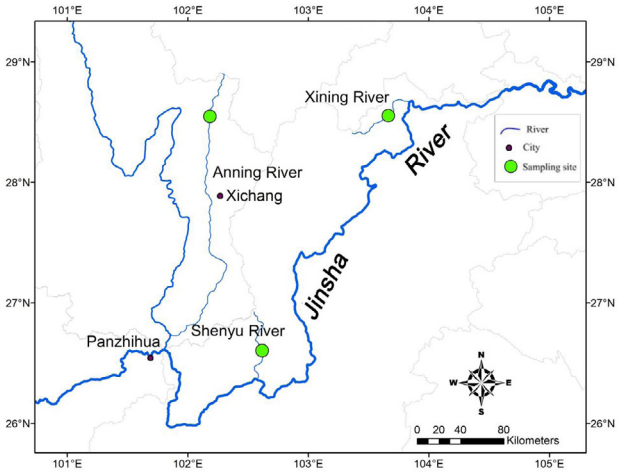


Fig. 1. Sampling locations of four species fish from the middle and lower Jinsha River.

*Results and discussion*

In this study, 409 samples were analyzed, belonging to three families, four genera and four species. Descriptive statistics and estimated LWRs and LLRs parameters for each fish species are listed in Table II and III. The LWRs of the four species were extremely significant ($p$ <0.001) and $r^2$> 0.888. The intercept value ($a$) ranged between 0.011 for *A. brevianalis* and 0.019 for *B. szechuanensis*, and the $b$ value ranged from 2.773 (*B. szechuanensis*) to 3.064 (*A. brevianalis*). The $t$-test indicated that except for *B. szechuanensis* for which the $b$ value was significantly different from 3 ($t$ = 22.009, $p$<0.05), the $b$ values of the other three fish including *A. brevianalis* ($t$ = 0.702), *Y. sichuanensis* ($t$ = 0.397) and *T. xichangensis* ($t$ = 0.133) showed not significantly different from 3 ($p$>0.05). Besides, all LLRs were extremely remarkable ($p$ <0.001) and all decision coefficients ($r^2$) were> 0.975. The study identified the *A. brevianalis* (16.2cm), *Y. sichuanensis* (6.9cm) and *T. xichangensis* (14.4 cm) new maximum standard-length value (marked with asterisks in the Table II).



**Table I. Information of fish species from the tributaries of middle and lower Jinsha River.**

| Species | Sampling sites | Sampling time | Fishing gear | Latitude | Longitude |
|---|---|---|---|---|---|
| *A. brevianalis* | Shenyu River | 2019.04 | Electro-fishing, Trap nets | 26°22′-26°41′ N | 102°32′-102°38′ E |
| *B. szechuanensis* | Shenyu River | 2019.04 | Trap nets | 26°22′-26°41′ N | 102°32′-102°38′ E |
| | Xining River | 2019.05 | | 28°25′-28°36′ N | 103°29′-103°42′E |
| *Y. sichuanensis* | Shenyu River | 2019.04 | Trap nets | 26°22′-26°41′ N | 102°32′-102°38′ E |
| *T. xichangensis* | Anning River | 2020.11, 2021.04 | Trap nets | 28°23′-28°34′ N | 102°18′-102°52′ E |

**Table II. Descriptive statistics and parameters of length–weight relationship (LWR) for fish species from the tributaries of middle and lower Jinsha River.**

| Family | Species | *n* | Standard length (cm) | Weight (g) | Parameters | | | | $r^2$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min.-Max. | Min.-Max. | *a* | *b* | 95% CL (*a*) | 95% CL (*b*) | |
| Cyprinidae | *A. brevianalis* * | 145 | 7.9-16.2 | 3.2-34.5 | 0.011 | 3.064 | 0.007-0.015 | 2.884-3.244 | 0.888 |
| Balitoridae | *B. szechuanensis* | 53 | 3.0-7.2 | 0.1-3.0 | 0.019 | 2.773 | 0.013-0.025 | 2.566-2.978 | 0.936 |
| Cobitidae | *Y. sichuanensis** | 54 | 4.2-6.9 | 0.6-3.0 | 0.015 | 3.057 | 0.009-0.022 | 2.768-3.345 | 0.897 |
| Cobitidae | *T. xichangensis** | 149 | 6.6-14.4 | 1.9-22.3 | 0.013 | 2.992 | 0.013-0.017 | 2.805-3.040 | 0.942 |

*N*, number of individuals; Min., minimum; Max., maximum; *a*, intercept; *b*, slope; CL, Confidence limit; $r^2$, coefficient of determination.
Species with new maximum size records are marked with an asterisk (*).

**Table III. Descriptive statistics and estimated length–length relationship (LLR) for fish species from the tributaries of middle and lower Jinsha River.**

| Species | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | *n* | *p* | *q* | 95% CL of *p* | 95% CL of *q* | $r^2$ |
| *A. brevianalis* | 145 | 0.616 | 1.120 | 0.379-0.852 | 1.095-1.144 | 0.983 |
| *B. szechuanensis* | 53 | 0.133 | 1.164 | 0.015-0.251 | 1.138-1.190 | 0.993 |
| *Y. sichuanensis* | 54 | 0.096 | 1.164 | -0.100-0.293 | 1.120-1.209 | 0.981 |
| *T. xichangensis* | 149 | 0.905 | 0.970 | -0.194-0.329 | 1.146-1.207 | 0.975 |

n, number of samples; *a*, intercept; *b*, slope; $r^2$, coefficient of determination.

All regression results are highly significant from the table, the $r^2$ value ranged between 0.888 and 0.993. Although the number of several fish specimens used in this study is small, the *b* values for four species were within the expected range of 2.5-3.5 recommended by Froese (2006), and therefore can still be used within a certain length range. Values of *b* are species-specific, and different *b* values can reflect the growth and diet condition of fish in different environments (Borah *et al*., 2018).

According to the information in FishBase (Froese and Pauly, 2012), this paper not only reports the LWRs and LLRs for four species of fish in the Jinsha River basin for the first time, but also records the new maximum standard length of the three species (*A. brevianalis*, *Y. sichuanensis*, *T. xichangensis*). But a sufficiently broad temporal and spatial scope was not included in this survey, making it unrepresentative. In addition, there is also the possibility that inconclusive LWRs may be related to growth stage, health, fecundity, and gut satiety (Froese and Pauly, 2012; Lin *et al*., 2018, 2021), these reasons were not considered for this study, but the preliminary estimated LWRs were useful but not fully representative of the populations of these four species. However, these data obtained provide the first information on the length-weight relationship of four endemic fish in Sichuan province, China. It can also provide some reference value for the subsequent research and management of these species.

*Acknowledgement*

The authors would like to thank Tianyi Zhao for his help with field investigation. The research was funded by the National Natural Science Foundation of China (Grant No. 51809280).

*Statement of conflict of interest*

The authors have declared no conflict of interest.

*References*

Borah, S., Gogoi, P., Bhattacharjya, B., Suresh, V., Yadav, A., Baitha, R. and Das, B., 2018. *J. appl. Ichthyol.*, **34**: 788-790. https://doi.org/10.1111/jai.13685

Duan, Y. J., Ma, B. S., Yang, X., Xie, C. X. and Huo, B., 2016. *J. appl. Ichthyol*., **32**: 1298-1299. https://doi.org/10.1111/jai.13180

Froese, R., 2006. *J. appl. Ichthyol*., **22**: 241-253. https://doi.org/10.1111/j.1439-0426.2006.00805.x

Froese, R. and Pauly, D., 2012. *FishBase World wide web electronic publication*. http://www.fishbase.org, version 4.

Hossain, M.Y., Ahmed, Z.F., Leunda, P.M., Jasmine, S., Oscoz, J., Miranda, R. and Ohtomi, J., 2006. *J. appl. Ichthyol.*, **22**: 304-307. https://doi:10.1111/j.1439-0426.2006.00801.x

Karna, S.K., 2017. *J. appl. Ichthyol*., **33:** 1284-1286. https://doi.org/10.1111/jai.13503

Lin, F., Wang, Z., Luo, Z., Sun, G. and Chen, X., 2021. *J. appl. Ichthyol*., **37:** 635–637. https://doi.org/10.1111/jai.14152

Lin, F., Zhou, Q.H., Yang, D.H., Lu, Z.L. and Zhang, J., 2018. . *J. appl. Ichthyol*., **34**: 203-205. https://doi.org/10.1111/jai.13534

Pan, L., Peng, Z.Y., Shao, D.G., Yang, T., Wang, Z.X., Zeng, Z.F. and Shi, X.T., 2018. *J. appl. Ichthyol*., **34:** 1094-1096. https://doi.org/10.1111/jai.13729

Salahi, M., Kamrani, E., Solaimani, A., Hajializadeh, P., Mandegari, M. and Sadeghi-Mazidi, S., 2018. *J. appl. Ichthyol*., **34:** 735-736. https://doi.org/10.1111/jai.13592

Wang, L. J., Wu, Z. H., Nie, M. M., Liu, M. X., Liu, W. and You, F., 2016. *J. appl. Ichthyol*., **32:** 737-739. https://doi.org/10.1111/jai.13058

Wang, T., Wang, H.S., Sun, G.W., Huang, D. and Shen, J.H., 2012. *J. appl. Ichthyol*., **28:** 660-662. https://doi.org/10.1111/j.1439-0426.2012.01971.x

Xu, H.L., Gu, D.X., Wang, R., Sun, J.H. and Bai, D.Q., 2017. *J. appl. Ichthyol*., **33:** 642–644. https://doi.org/10.1111/jai.13337

Xiong, F., Liu, H.Y., Duan, X.B., Liu, S.P. and Chen, D.Q., 2017. *J. appl. Ichthyol*., **33:** 835-838. https://doi.org/10.1111/jai.13358

Yang, C.Q., Chen, J.H., He, F., He, Y.P., Cai, X. H., Fan, H. and Long, T.L., 2010. *J. Sichuan Forest. Sci. Technol.,* **31**: 34-40. (in Chinese with English abstract). https://doi:10.16779/j.cnki.1003-5508

Yoğurtçuoğlu, B., Atalay, M.A. and Ekmekçi, F.G., 2016. *J. appl. Ichthyol*., **32:** 495–496. https://doi.org/10.1111/jai.12965

Zhang, Z., Wei, J., Chen, F., Fang, Y., Chang, X., Chen, J., Huang, D. and Lei, H., 2018. *J. appl. Ichthyol*., **34:** 999-1001. https://doi.org/10.1111/jai.13634