Pakistan J. Zool., vol. 54(6), pp 2985-2987, 2022 DOI: https://dx.doi.org/10.17582/journal.pjz/20210924030907

Short Communication

Length Weight Relationships of Commercial Fishes from the Mainstream of Yellow River, China

Jun Wang*, Xiaoming Jiang and Zhiwei Sun

State Key Laboratory of Eco-hydraulics in Northwest Arid Region of China, Xi'an University of Technology, Xi'an, 710048, China

Article Information
Received 14 August 2021
Revised 24 September 2021
Accepted 01 October 2021
Available online 02 March 2022 (early access)
Published 23 September 2022

Authors' Contribution
JW presented the concept of the study XJ, ZS and JW designed methodology and performed investigation. JW collected data. XJ and JW wrote and reviewed the manuscript.

Key words
Length-weight relationships, Ichthyofauna, Yellow river, Conservation biology

ABSTRACT

The present study estimates length-weight relationships (LWRs) of fish species from the mainstream of the Yellow River, which is the largest sediment-laden river in the world. A total of 1168 specimens belonging to 4 families and 18 species were analysed. The following fish species were covered: *Leuciscus chuanchicus* (Kessler, 1876); *Ctenopharyngodon idella* (Valenciennes, 1844); *Squaliobarbus curriculus* (Richardson, 1846); *Parabramis pekinensis* (Basilewsky, 1855); *Hemiculter leucisculus* (Basilewsky, 1855); *Culter alburnus* (Basilewsky, 1855); *Rhinogobio nasutus* (Kessler, 1876); *Hemibarbus maculatus* (Bleeker, 1871); *Cyprinus carpio* (Linnaeus, 1758); *Carassius auratus* (Linnaeus, 1758); *Hypophthalmichthys molitrix* (Valenciennes, 1844); *Hypophthalmichthys nobil* (Richardson, 1845); *Gymnocypris eckloni* (Herzenstein, 1891); *Schizopygopsis pylzovi* (Kessler, 1876); *Triplophysa siluroides* (Herzenstein, 1888); *Silurus lanzhouensis* (Chen, 1977); *Silurus asotus* (Linnaeus, 1758); *Channa argus* (Cantor, 1842). The b values of the LWRs ranged from 2.598 for *Ctenopharyngodon idella* to 3.271 for *Parabramis pekinensis.* This study represents the first report on LRWs of commercial fish species in the whole mainstream of the Yellow River.The LRWs of five species have not been previously record. These data can serve as important baseline for conservation and management in the Yellow River fishery resources, which is very useful for evaluation of the status of the river ecological health.

The Yellow River, which ranks the second longest river in China and the sixth longest river in the world, originates from Bayan Har Mountain in Qinghai province and meanders through nine provinces (about 5,464 km) and finally enters into Bohai Gulf (CTFRYR, 1986). As the China's mother river, the Yellow River are the key nourishing and cherish area of source of water, rich collecting zone of biodiversity and fragile district of ecology in China (Xu *et al*., 2009; Wang *et al*., 2018). Meanwhile, the river was characterized by a high degree of endemism and a large number of relic species, which played an important role in aquatic product supply and biodiversity conservation (Li *et al*., 2018; Xie *et al*., 2018). In addition to aquatic product supply aspects, this river was famous for its tourist economy i.e., Hukou Waterfall, Yellow River Delta wetland. However, despite the highly conservation value in this famous river in China, few basic biological data such as Length-weight relationships (LWRs) are available for fish species. Therefore, there is urgent need to study fisheries basic biology and provide useful information in the conservation of Yellow River fishes resources.

Length-weight relationships (LWRs) is of great significance in fisheries resources management, especially in the estimation of biomass from the length frequency distribution when the weight data cannot be taken (Petrakis and Stergiou, 1995; Froese, 2006; Siddik *et al*., 2016). Its data also can indirectly give some practical basic biological information such as growth rate, mortality, fecundity, age at maturity and life span (Le Cren, 1951; Gupta and Banerjee, 2015). In addition, it's also can provides valuable insights on the fish habitat while other scientist stressed the significance in modeling aquatic ecosystem (Gonçalves *et al*., 1997). However, little data have been reported regarding on the fish biology in the mainstream of the Yellow River. Therefore, the present study aims to fill this gap by estimating the LWRs of commercial fish species inhabiting the mainstream of the Yellow River, China.

* Corresponding author: wangjunwj.2006@163.com
0030-9923/2022/0006-2985 $ 9.00/0

Materials and methods

The fish specimens were collected from July to November in 2018 from 34 sampling points on the mainstream of Yellow River (33°47′-37°23′N, 99°41′-118°12′E). The specimens were collected by gill nets (mesh size: 3-5 cm, length: 80-100 m, height:1.5-2 m), fish cages (mesh size: 0.5 cm, length: 2-3 m) through everyday independent sampling (fishing nets were put in river water body at dusk about 16:00-18:00 o'clock and collected in the following early morning about 7:00-9:00o'clock) and electrofishing technique (CWB-2000 P, 12V, 250 Hz). All fish specimens were identified immediately to the species level according to Li (2017) and rechecked based on FishBase (Froese and Pauly, 2018). Standard length (SL, nearest to 0.1 mm) and body weight (W, nearest to 0.1 g) were measured for each sample. LWRs were estimated using the equation: $W = aL^b$, where a and b are the equation parameters calculated by the least squares method using the logarithmic form of the equation: Log W= Log a + b Log L, where W is the body weight (g), L is the standard length (cm). The log-log plots of length and weight data were performed for visual inspection of outliers and obvious outliers were removed according to the plot of the log W over log L (Froese, 2006). The statistical significance level of the coefficient of determination (r^2) and 95% confidence intervals (95%CI) of a and b were also estimated.

Result and discussion

In the present study, the LWRs of 1168 individuals from 18 species representing 4 families and 17 genera were determined. The following species were covered: *Leuciscus chuanchicus* (Kessler, 1876); *Ctenopharyngodon idella* (Valenciennes, 1844); *Squaliobarbus curriculus* (Richardson, 1846); *Parabramis pekinensis* (Basilewsky, 1855); *Hemiculter leucisculus* (Basilewsky, 1855); *Culter alburnus* (Basilewsky, 1855); *Rhinogobio nasutus*

Table I. Descriptive statistics and estimated parameters of length-weight relationships for commercial fish species from the mainstream of the Yellow River, China.

Family and species	n	SL range (cm)	W range (g)	a	b	95% CI of a	95% CI of b	R^2
Cyprinidae								
Leuciscus chuanchicus+	19	12.8-20.6	24.5-157.7	0.0075	3.240	0.0026-0.0217	2.862-3.609	0.952
Ctenopharyngodon idella	27	24.0-60.5	309.2-3640.0	0.0824	2.598	0.0392-0.1734	2.393-2.804	0.964
Squaliobarbus curriculus	38	13.5-37.0	38.5-672.5	0.0097	3.131	0.0379-0.1694	2.399-2.812	0.989
Parabramis pekinensis	56	13.5-34.8	37.0-777.9	0.0068	3.271	0.0044-0.0107	3.126-3.416	0.974
Hemiculter leucisculus	19	5.1-17.8	1.7-65.4	0.0120	3.016	0.0073-0.0199	3.126-3.416	0.982
Culter alburnus	30	7.8-55.0	2.1-1482.5	0.0066	3.102	0.0044-0.0097	2.979-3.225	0.989
Rhinogobio nasutus+	9	14.5-24.3	36.1-177.5	0.0130	2.975	0.0027-0.0638	2.463-3.487	0.964
Hemibarbus maculatus	32	7.7-28.0	6.5-255.5	0.0260	2.821	0.0129-0.0525	2.573-3.069	0.947
Carassius auratus	361	6.1-25.8	8.1-445.2	0.0371	2.913	0.0317-0.0435	2.854-2.973	0.962
Cyprinus carpio	237	6.9-62.0	9.1-5250.0	0.0325	2.903	0.0281-0.0378	2.856-2.951	0.984
Hypophthalmichthys molitrix	40	10.5-52.0	18.5-2020.0	0.0112	3.127	0.0085-0.0149	3.042-3.212	0.993
Hypophthalmichthys nobil	16	13.0-71.0	30.0-5971.0	0.0153	3.065	0.0069-0.0338	2.838-3.293	0.984
Gymnocypris eckloni	63	4.0-25.8	1.1-209.2	0.0164	2.949	0.0137-0.0196	2.880-3.018	0.992
Schizopygopsis pylzovi+	23	3.8-34.9	0.7-506.9	0.0155	2.912	0.0124-0.0195	2.825-2.999	0.996
Cobitidae								
Triplophysa siluroides+	17	2.4-29.2	0.2-261.4	0.0175	2.802	0.0014-0.0021	2.693-2.910	0.995
Siluridae								
Silurus lanzhouensis+	30	20.0-61.5	41.9-1973.7	0.0042	3.145	0.0022-0.0082	2.962-3.328	0.978
Silurus asotus	137	14.5-64.2	31.0-1960.0	0.0122	2.864	0.0079-0.0188	2.734-2.994	0.934
Channidae								
Channa argus	14	15.5-41.5	52.0-1099.0	0.0147	2.970	0.0071-0.0304	2.746-3.193	0.986

n denote number of analysed specimens, SL denote standard length, W denote body weight, a coefficient of proportionality, b denote allometric coefficient, CI denote confidence limit, R^2 denote coefficient of determination, + denote no data about LWRs in FishBase (Froese and Pauly, 2018).

(Kessler, 1876); *Hemibarbus maculatus* (Bleeker, 1871); *Cyprinus carpio* (Linnaeus, 1758); *Carassius auratus* (Linnaeus, 1758); *Hypophthalmichthys molitrix* (Valenciennes, 1844); *Hypophthalmichthys nobil* (Richardson, 1845); *Gymnocypris eckloni* (Herzenstein, 1891); *Schizopygopsis pylzovi* (Kessler, 1876); *Triplophysa siluroides* (Herzenstein, 1888); *Silurus lanzhouensis* (Chen, 1977); *Silurus asotus* (Linnaeus, 1758); *Channa argus* (Cantor, 1842). The most abundant species included *Cyprinus carpio*, *Carassius auratus*, and *Silurus asotus*. The values of coefficient *a* ranged from 0.0066 (*Culter alburnus*) to 0.0824 (*Ctenopharyngodon idella*), and the values of exponent *b* ranged from 2.598 (*Ctenopharyngodon idella*) to 3.271 (*Parabramis pekinensis*). The coefficient of determination values (r^2) in the majority of LWRs were high ($r^2 > 0.934$). Moreover, the LWRs for five species were determined for the first time (denoted in Table I). *Leuciscus chuanchicus*, *Rhinogobio nasutus*, *Schizopygopsis pylzovi*, *Triplophysa siluroides*, and *Silurus lanzhouensis* according to FishBase (Froese and Pauly, 2018).

In the present study, all the estimated *b* values remained within the excepted range of 2.5-3.5 (Froese 2006). Multitude of factors, such as number of specimens, fish habitat, degree of stomach fullness, sex, stage of gonadal maturity, and length range of the specimens, are known to cause variation in *b* value of fishes (Froese 2006; Borah *et al*., 2018). The present study reports the *b* value of *Schizopygopsis pylzovi* as 2.912, which was different from congeneric species *Schizopygopsis malacanthus* derived from the upper Jinsha River (*b* as 3.060) (Lin *et al*., 2015). The reason may be attributed to (a) different fish habitat environment scenarios and (b) to different length range of the specimens compared to our method, and individual biological differentiation. In conclusion, it is the first time to study the LWRs for the species in the whole mainstream of the Yellow River. The results will be meaningful for further research about sustainable development and scientific management of fishery resources of the Yellow River.

Acknowledgements

This research was supported by National Natural Science Foundation of China (No.51709225), Shaanxi Natural Science Foundation (No.2018JQ5121) and Startup Foundation for Doctor of Xi'an University of Technology (No.104-451118020).

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

CTFRYR (The cooperative team of fishery resource research on the Yellow River system). 1986. *Fishery resource in the Yellow River system*. Liaoning Science and Technology Publishing House, Dalian, China (In Chinese).

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., 2018. *FishBase.* (Version 12/2018) www.fishbase.org

Gonçalves, J., Bentes, L., Lino, P., Ribeiro, J., Canario, A., and Erzini, K., 1997. *Fish. Res*., **30**: 253-256. https://doi.org/10.1016/S0165-7836(96)00569-3

Gupta, S., and Banerjee, S., 2015. *Zool. Ecol*., **25**: 54-58.

Le Cren, E.D., 1951. *J. Anim. Ecol*., **20**: 201-219. https://doi.org/10.2307/1540

Li, S.Z., 2017. *Fishes of the Yellow River*. China Ocean University Press, Qingdao, China (In Chinese).

Li, T., Huang, X., Jiang, X., and Wang, X., 2018. *Hydrobiologia*, **814**: 31-43. https://doi.org/10.1007/s10750-015-2541-5

Lin, P., Miao, Z., Gao, X., and Liu, H., 2015. *J. appl. Ichthyol*., **31**: 223-224. https://doi.org/10.1111/jai.12466

Petrakis, G., and Stergiou, K., 1995. *Fish. Res*., **21**: 465-469. https://doi.org/10.1016/0165-7836(94)00294-7

Siddik, M., Chaklader, M., Hanif, M., Islam, M., and Fotedar, R., 2016. *J. appl. Ichthyol*., **32**: 1300-1302. https://doi.org/10.1111/jai.13181

Wang, X., Yang, T., Yong, B., Krysanova, V., Shi, P., Li, Z., and Zhou, X., 2018. *Environ. Earth Sci*., **77**: 465. https://doi.org/10.1007/s12665-018-7628-7

Xie, J., Tang, W., and Yang, Y., 2018. *Ecol. Evolut*., **8**: 4173-4182. https://doi.org/10.1002/ece3.3890

Xu, Z., Zhao, F., and Li, J., 2009. *Quat. Int*., **208**: 62-75. https://doi.org/10.1016/j.quaint.2008.09.001