Journal of Applied Ichthyology

J. Appl. Ichthyol. 31 (2015), 242–243

ISSN 0175–8659

Received: August 3, 2013
Accepted: June 20, 2014
doi: 10.1111/jai.12622

Technical contribution

Length–weight relationships of 11 fish species from the Yibin reach of the Yangtze River, southwest China

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Summary

Length-weight relationships (LWRs) were evaluated for 11 fish species from the Yibin reach of the upper Yangtze River, southwest China. Samples were collected from April 2012 to January 2013. Length-weight relationships for 11 species were unknown to FishBase, and new maximum lengths are recorded for five species. Results indicate that parameter b ranged from 2.586 (*Sinibotia superciliaris*) to 3.164 (*Rhinogobio ventralis*), and r^2 values ranged from 0.931 (*Sinibotia superciliaris*) to 0.996 (*Silurus meridionalis*).

Introduction

The Yangtze River is the third largest river in the world and the longest river in China. The upper reaches of the Yangtze River have an exceptional aquatic ecosystem, with unique geology, topography, and climate, and particularly abundant fish fauna of some 286 species. The upper reaches of the Yangtze are also the habitat for China's internationally known rare fish, *Psephurus gladius* (Martens, 1862), as well as many other endemic fish species (Ding, 1994; Wei, 2012). Our study was conducted in the Yibin reach in the upper reaches of the Yangtze River, southwest China. Although fish diversity is high in these upper reaches, data on length-weight relationships (LWRs) are scarce (Pu et al., 2013; Pan et al., 2014; Waryani et al., 2014).

Length-weight relationships of fish species not only have important implications for the assessments of fisheries (Ricker, 1975), biomass (Martin-Smith, 1996), and yield (Garcia et al., 1998), but also provide data for ecosystem modeling in fishery management (Christensen and Walters, 2004). In addition, LWRs can be used for life-history and morphological comparisons among species and populations (Petrakis and Stergiou, 1995; Goncalves et al., 1997). In our study the LWRs for *Rhinogobio ventralis*, *Leptobotia elongata*, *Pseudobagrus crassilabris*, *Tachysurus nitidus*, *Silurus meridionalis*, *Coreius heterodon*, *Pseudobagrus vachellii*, *Coreius guichenoti*, *Sinibotia superciliari*, *Leptobotia taeniops*, *Rhinogobio typus* were determined in order to provide biological data from the upper reaches of the Yangtze.

Materials and methods

The investigation was carried out in the Yibin reaches (28°45′–28°51′N; 104°38′–105°01′E) in the upper reaches of the Yangtze River. Fish specimens were collected between April 2012 and January 2013, using various fishing gear (drift gillnets, stationary gillnets, and shrimp cages). Species were identified in the field, measured to the nearest 1 mm (total length, TL), and weighed to the nearest 0.1 g (weight, *W*).

The length-weight relationship is expressed by the equation $W = aL^b$, where W = body weight (g), and L = total length (cm), (Ricker, 1973). Parameters a and b are estimated by the logarithmic expression: $\log^W = \log^a + b\log^L$, with 95% confidence interval, and log-log plots of total length and weight were used to detect outliers (Froese, 2006).

Results

A total of 1835 specimens from 11 fish species were used in this study. The most abundant species were *Leptobotia elongata* and *Sinibotia superciliaris*, with 699 and 365 individuals, respectively. Table 1 shows the LWRs, where parameter b ranged from 2.586 for *Sinibotia superciliaris* to 3.164 for *Rhinogobio ventralis*, and r^2 values ranged from 0.931 for *Sinibotia superciliaris* to 0.996 for *Silurus meridionalis*. The species of concern are: *Rhinogobio ventralis*, *Leptobotia elongata*, *Pseudobagrus crassilabris*, *Tachysurus nitidus*, *Silurus meridionalis*, *Coreius heterodon*, *Pseudobagrus vachellii*, *Coreius guichenoti*, *Sinibotia superciliari*, *Leptobotia taeniops*, and *Rhinogobio typus* (Table 1).

Discussion

Length-weight relationships of 11 species were not yet recorded in FishBase and new maximum lengths are recorded for five species. The b values remain within the range of 2.5–3.2, which is consistent with the expected range of Tesch (1971). Differences in LWRs of fishes may be attributed to several factors, such as the number and length range of the sampled specimens, gonad maturity, sex, diet, stomach

Table 1
Length–weight relationships for 11 fish species, Yibin reach in the upper reaches of the Yangtze River, southwest China

Species	n	Length range (cm)	Weight range (g)	*a*	*b*	r^2	*a* CL95%	*b* CL95%
Rhinogobio ventralis[a,b]	89	8.7–28.5	6.1–205.7	0.0056	3.164	0.988	0.0045–0.0069	3.090–3.238
Leptobotia elongata[a]	699	7.7–45.5	3.7–877.2	0.0065	3.021	0.969	0.0058–0.0073	2.980–3.061
Pseudobagrus crassilabris[a,b]	35	4.8–23.4	2.6–83.8	0.0219	2.646	0.961	0.0133–0.0361	2.457–2.834
Tachysurus nitidus[a,b]	83	5.2–23.5	1.1–105.2	0.0062	3.101	0.971	0.0047–0.0082	2.982–3.220
Silurus meridionalis[a]	54	8.3–61.5	5–1408.4	0.0077	2.943	0.996	0.0066–0.0091	2.894– 2.992
Coreius heterodon[a,b]	60	25.9–37	145.7–422.5	0.0164	2.816	0.954	0.0095–0.0286	2.654–2.978
Pseudobagrus vachellii[a]	152	5–32.3	1.1–245.1	0.0083	3.035	0.984	0.0070–0.0097	2.973–3.096
Coreius guichenoti[a]	159	11.2–34.1	13.3–419.2	0.0078	3.075	0.980	0.0064–0.0096	3.006–3.145
Sinibotia superciliaris[a,b]	365	7.9–16.4	4–43.1	0.0238	2.586	0.931	0.0199–0.0285	2.513–2.658
Leptobotia taeniops[a]	50	11.5–18.2	12.7–48	0.0160	2.757	0.966	0.0107–0.0239	2.606–2.908
Rhinogobio typus[a]	89	7.2–28	2–159.3	0.0053	3.080	0.988	0.0040–0.0069	2.987–3.173

n, number of individuals; *a* and *b*, LWR parameters; r^2, coefficient of determination; CL, confidence limits.
[a]No LWR reference in FishBase.
[b]New maximum length record in FishBase.

fullness, and growth phase (Bagenal and Tesch, 1978; Wootton, 1990; Froese, 2006); however, these factors were not considered in the present study. In conclusion, the results could provide valuable information for the FishBase database and contribute to fishery research, management and conservation in the upper reaches of the Yangtze River.

Acknowledgements

We wish to thank the many other members of the Conservation of Endangered Fish Group, Yangtze River Fisheries Research Institute, and Chinese Academy of Fisheries Science, for their assistance collecting the sampling data for this study. This work was supported by the Special Fund for Agro-Scientific Research in the Public Interest (200903048-02), and scientific projects of China Three Gorges Corporation (0701979).

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