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## Technical contribution

# Length–weight relationships for five endemic fish species in the upper Yangtze River basin, China

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### Summary

Length–weight relationships were estimated for five endemic fish species in the upper Yangtze River: *Platysmacheilus nudiventris* Luo, Le & Chen, 1977, *Xenophysogobio nudicorpa* (Huang & Zhang, 1986), *Homatula potanini* (Günther, 1896), *Leptobotia rubrilabris* (Dabry de Thiersant, 1872), and *Euchiloglanis kishinouyei* Kimura, 1934. The *a* values ranged from 0.0079 to 0.0134, and *b* values from 2.833 to 3.081. These five endemic species are rare, small and difficult to find and capture. Thus the sampling period was lengthy, from May 2010 to May 2014. A total of 718 specimens were available for analysis, and the length–weight relationships are the first reports for these five endemic fish species.

### Introduction

The upper Yangtze River basin includes 124 endemic fish species (He et al., 2011). Because of overfishing and the building of dams, many endemic fishes have become rare and endangered (Le and Chen, 1998). Length–weight relationships (LWRs) are used in fisheries science (Mendes et al., 2004; Froese, 2006; Ismen et al., 2009), and are lacking in particular for some rare and endemic Yangtze River fishes such as *Platysmacheilus nudiventris* Luo, Le & Chen, 1977, *Xenophysogobio nudicorpa* (Huang & Zhang, 1986), *Homatula potanini* (Günther, 1896), *Leptobotia rubrilabris* (Dabry de Thiersant, 1872), and *Euchiloglanis kishinouyei* Kimura, 1934. The LWRs of these five endemic species were analyzed and are presented in this study.

### Materials and methods

The LWRs were calculated for these five endemic fish species collected from the upper Yangtze River and its tributaries, the Jinshajiang, Minjiang, Nanguanghe and Changninghe rivers. The sampling area is located within 29°33′–27°25′N and 103°08′–105°2′E. Periodic sampling was conducted using different sizes of drift gill nets (120 m long, 1.5 m high, 1.0 cm × 2.0 cm × 3.0 cm mesh size), set nets (60 m long, 1.5 m × 2.0 cm) and fish cages (30 m long, 1 m diameter, 0.5 cm mesh) from May 2010 to May 2014. However, February, March and April are under a fishing moratorium in the upper Yangtze River basin, thus sampling was halted at these times. The fish were caught and measured (total length, TL) immediately with a digital caliper (±0.1 mm precision) and weighed with an Electronic Balance (±0.01 g precision); the fish were covered with wet towels prior to being measured in order to prevent any deaths before they were returned to the river.

The relationship between total length and weight ($W = aL^b$) was described by logarithmic transformation (Tesch, 1971; Cone, 1989), $\log^W = \log^a + b\log^{TL}$, where $W$ is the weight (g), $TL$ total length (cm), $a$ the intercept and $b$ the slope. The parameters $a$ and $b$ were estimated by ordin-

Table 1
Length–weight relationships for five endemic fishes, upper Yangtze River basin, China, May 2010 to May 2014

| Species | Family | Stage | n | Length range (cm) | Weight range (g) | Parameters of LWR | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *a* | 95% CI of *a* | *b* | 95% CI of *b* | $r^2$ |
| *Platysmacheilus nudiventris*[a,b] | Cyprinidae | J–A | 97 | 4.9–12.7 | 1.1–17.8 | 0.0082 | 0.0073–0.0093 | 3.007 | 2.953–3.061 | 0.992 |
| *Xenophysogobio nudicorp*[a,b] | Cyprinidae | J–A | 149 | 3.9–13.1 | 0.6–17.7 | 0.0093 | 0.0084–0.0103 | 2.930 | 2.885–2.976 | 0.991 |
| *Homatula potanini*[a,b] | Cobitidae | J–A | 168 | 4.5–13.2 | 1.1–21.9 | 0.0134 | 0.0126–0.0143 | 2.833 | 2.804–2.861 | 0.996 |
| *Leptobotia rubrilabris*[a,b] | Cobitidae | J–A | 171 | 5.6–16.4 | 2.1–37.1 | 0.0125 | 0.0116–0.0134 | 2.856 | 2.825–2.886 | 0.995 |
| *Euchiloglanis kishinouyei*[a] | Sisoridae | J–A | 133 | 4.3–16.2 | 0.8–42.6 | 0.0079 | 0.0075–0.0084 | 3.081 | 3.057–3.106 | 0.998 |

J, juvenile; A, adult; n, sample size; *a*, intercept, *b*, slope; $r^2$, coefficient of determination; CI, confidence interval.
[a]No LWR reference in FishBase.
[b]New maximum length record in FishBase.

ary least squares regression, and the 95% confidence limits of *a* and *b* were calculated. A log–log plot of the length-weight pairs was performed to identify and remove outliners (Froese et al., 2011).

## Results

A total of 718 specimens covering three families, five genera, and five species were caught in the upper Yangtze River basin. The species studied were: *Platysmacheilus nudiventris*, *Xenophysogobio nudicorpa*, *Homatula potanini*, *Leptobotia rubrilabris*, and *Euchiloglanis kishinouyei*. Sample size ranged from 97 individuals for *Platysmacheilus nudiventris* to 171 for *Leptobotia rubrilabris*. Overall, relationships were highly significant (for all $r^2 > 0.991$, $P < 0.01$), and the values for *a* remained within the range of 0.0079–0.0134. The values of *b* rose from 2.833 in *Homatula potanini* to 3.081 in *Euchiloglanis kishinouyei*. For all species, the sample size (n), length and weight range, parameters of LWR (*a* and *b*), coefficient of determination ($r^2$) and 95% confidence interval of *b* are summarized in Table 1.

## Discussion

These are the first LWRs reported for these five endemic fish species in the upper Yangtze River. The length–weight relationships of fishes are influenced by such factors as sex, gonad maturity, season, growth phase, and stomach fullness (Tesch, 1971); these factors were not taken into account for the five species. Because of the sample size, the gear selection and narrow length range might also have influenced the parameter values of the LWRs (Froese et al., 2011). In the present study, the sample size for four of the species was above 100; only one species (*Platysmacheilus nudiventris*) was below 100. The span of juveniles to adult individuals was taken into account; thus, the data is credible and can serve as baseline data.

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