Journal of Applied Ichthyology

J. Appl. Ichthyol. 30 (2014), 431–433

ISSN 0175–8659

*Received: December 14, 2012*
*Accepted: August 23, 2013*
doi: 10.1111/jai.12374

## Technical contribution

# Weight–length relationships of 22 fish species from Paraíba do Sul River in Rio de Janeiro State, southeastern Brazil

By R. J. Albieri[1,2], M. R. Costa[1,3], A. B. I. Santos[1], R. C. Albieri[2] and F. Gerson Araújo[1]

[1]*Laboratório de Ecologia de Peixes, Universidade Federal Rural do Rio de Janeiro, Seropédica, RJ, Brazil;* [2]*Colégio Técnico da Universidade Rural, Seropédica, RJ, Brazil;* [3]*Centro Universitário Módulo, Caraguatatuba, SP, Brazil*

**Summary**

The present study reports the weight–length relationships of 22 fish species from middle stretches of the Paraíba do Sul River, a riverine system located in the most important economic regions of Brazil and which is under great pressure due to damming and others ventures. Data were collected quarterly in 2010 and 2011 from three reservoirs and the adjoining downstream by using three different mesh sizes of gill nets. Of the 22 species, eight had no records in the FishBase WLR database; new maximum lengths are given for eight species.

### Introduction

Weight–length relationships (WRL) are used by researchers to estimate weights from a given length (Froese, 2006), and are useful in fisheries, estimations from partial data (length or weight) and literature and environmental monitoring programs. A riverine ecosystem located in the most important economic region of Brazil, the Paraíba do Sul River together with its ichthyofauna have been impacted by several ventures (dams, industries, cities) whereby basic ecological information (such as fish weight–length relationships) is scarce or nonexistent.

The objective of the present study was to establish weight–length relationships for 22 fish species from three stretches of the Paraíba do Sul River, southeastern Brazil, represented by three reservoirs and the adjoining downstream. WRL information from Paraíba do Sul fishes are important because species in the river are in a status of evaluation by the Brazilian government (ICMBio) and the IUCN organization.

### Materials and methods

The Paraíba do Sul River in southeastern Brazil is a 9th order river (length: 1080 km; watershed area 57 000 km$^2$) in the states of São Paulo, Minas Gerais, and Rio de Janeiro, draining one of the most important industrial regions in the country (Araújo et al., 2009). The river contains water of decreased quality due to indiscriminate land use (agricultural, industrial, and urban) (Pfeiffer et al., 1986) and receives large amounts of untreated sewage and industrial effluents (Araújo et al., 2009). Currently, seven impoundments are in operation in the main channel of the river, one is in final stages of construction, and another two are planned. This study was carried out in three river stretches (22°31′43.5″S, 43°34′05.7″W; 22°28′52.6″S, 43°50′20.2″W; 21°51′11.6″S, 42°36′24.6″W) located in the middle reaches of the Paraíba do Sul River.

Fish collections were carried out quarterly between January 2010 and August 2011, four times in the wet season and four times in the dry season. A standardized fishing effort was applied both in the reservoir and downstream, along a ca. 2 km stretch from the dam. Three gill nets of 25 × 2 m with different meshes (stretched mesh 25, 50 and 75 mm) encompassing 150 m$^2$ of netted area were used, thus defining the unit effort. A total of ten sample units were used at each reservoir and downstream during each fishing occasion. The nets were set up at sunset and retrieved the next morning, remaining in operation for approximately 15 h. Our sampling design thus had a total of 480 samples: 10 samples (i.e. 1500 m$^2$ of nets) × 3 locations × 2 habitats (reservoir and downstream) × 2 seasons (wet and dry) × 2 visits per season × 2 years.

Collected fishes were identified, measured (to the nearest millimeter) and weighed (to the nearest gram). The vouchers were then fixed in 10% formalin for 48 h and subsequently transferred to 70% ethanol and deposited in the reference collection of the Laboratório de Ecologia de Peixes of the Universidade Federal Rural do Rio de Janeiro.

The weight–length relationship was calculated using the equation $W = aL^b$ (Pauly, 1984), and logarithmically transformed into: $\log W = \log a + b \log L$, where $W$ is the weight of the fish in grams and $L$ is the total length of the fish in cm, where $a$ is the intercept of the regression curve (coefficient related to body form) and $b$ the regression coefficient (exponent indicating isometric growth) (Froese, 2006). Additionally, the 95% confidence limits (CL) of $a$ and $b$ were estimated. Fit of the model to the data was measured by the coefficient of Pearson r-squared ($r^2$). Outliers observed in the log–log curves of all species were excluded from the regression.

### Results and discussion

A total of 1280 fish distributed in three orders, 13 families and 22 species were used for length–weight analyses in

Table 1
Weight–length data of 22 species collected in three stretches of the Paraíba do Sul River, Rio de Janeiro State, Southeastern Brazil

| Species | *N* | TL Min – Max (cm) | | *a* | 95% TL | | *b* | (95% TL) | | $r^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Characiformes | | | | | | | | | | |
| Curimatidae | | | | | | | | | | |
| *Cyphocarax gilbert* (Quoy & Gaimard, 1824) | 49 | 10 | 21 | 0.007 | 0.005 | 0.012 | 3.1 | 2.90 | 3.27 | 0.96 |
| Prochilodontidae | | | | | | | | | | |
| *Prochilodus lineatus* (Valenciennes, 1837) | 54 | 13.5 | 45.5 | 0.008 | 0.005 | 0.013 | 3.05 | 2.92 | 3.18 | 0.98 |
| Anostomidae | | | | | | | | | | |
| *Leporinus copelandii* (Steindachner, 1875) | 65 | 12 | 43 | 0.003 | 0.002 | 0.007 | 3.31 | 3.11 | 3.50 | 0.95 |
| *Leporinus conirostris* (Steindachner, 1875)* | 11 | 25 | **36.5** | 0.005 | 0.001 | 0.028 | 3.20 | 2.70 | 3.70 | 0.95 |
| Characidae | | | | | | | | | | |
| *Astyanax parahybae* (Eigenmann, 1908) | 162 | 8 | 14.4 | 0.007 | 0.006 | 0.009 | 3.14 | 3.02 | 3.25 | 0.95 |
| *Oligosarcus hepsetus* (Cuvier, 1829) | 148 | 12 | **27.3** | 0.012 | 0.009 | 0.016 | 2.80 | 2.71 | 2.90 | 0.96 |
| Erythrinidae | | | | | | | | | | |
| *Hoplias malabaricus* (Bloch, 1794) | 39 | 13.2 | 35.5 | 0.021 | 0.014 | 0.033 | 2.72 | 2.59 | 2.86 | 0.98 |
| Serrasalmidae | | | | | | | | | | |
| *Metynnis maculatus* (Kner 1858)* | 14 | 7 | 15 | 0.014 | 0.005 | 0.039 | 3.10 | 2.68 | 3.52 | 0.95 |
| Siluriformes | | | | | | | | | | |
| Callichthyidae | | | | | | | | | | |
| *Hoplosternum littorale* (Hancock, 1828) | 133 | 9 | 23.5 | 0.013 | 0.010 | 0.016 | 3.03 | 2.96 | 3.11 | 0.98 |
| Loricariidae | | | | | | | | | | |
| *Hypostomus affinis* (Steindachner, 1877) | 17 | 13 | 31 | 0.013 | 0.005 | 0.035 | 2.80 | 2.48 | 3.11 | 0.96 |
| *Hypostomus auroguttatus* (Kner, 1854)* | 17 | 14 | **34** | 0.015 | 0.006 | 0.034 | 2.84 | 2.57 | 3.11 | 0.97 |
| *Rhinelepis aspera* (Spix & Agassiz, 1829)[a] | 19 | 24 | 34.2 | 0.022 | 0.007 | 0.077 | 2.90 | 2.54 | 3.26 | 0.95 |
| Heptapteridae | | | | | | | | | | |
| *Rhamdia quelen* (Quoy & Gaimard, 1824) | 62 | 16 | 34 | 0.014 | 0.008 | 0.023 | 2.79 | 2.64 | 2.95 | 0.96 |
| *Pimelodella eigenmanni* (Boulenger, 1891)* | 24 | 14.5 | **24.5** | 0.004 | 0.001 | 0.010 | 3.11 | 2.78 | 3.44 | 0.95 |
| Auchenipteridae | | | | | | | | | | |
| *Trachelyopterus striatulus* (Steindachner, 1877) | 14 | 14 | 27.7 | 0.008 | 0.002 | 0.031 | 3.17 | 2.72 | 3.62 | 0.95 |
| Pimelodidae | | | | | | | | | | |
| *Pimelodus fur* (Lütken, 1874)* | 158 | 11 | **23** | 0.016 | 0.012 | 0.021 | 2.67 | 2.60 | 2.80 | 0.95 |
| *Pimelodus maculatus* (Lacépède, 1803) | 77 | 11.5 | 33.5 | 0.004 | 0.002 | 0.005 | 3.20 | 3.08 | 3.31 | 0.97 |
| Perciformes | | | | | | | | | | |
| Sciaenidae | | | | | | | | | | |
| *Pachyurus adspersus* (Steindachner, 1879)* | 36 | 12.5 | **27.5** | 0.003 | 0.002 | 0.004 | 3.31 | 3.15 | 3.47 | 0.98 |
| *Plagioscion squamosissimus* (Heckel, 1840)[a] | 119 | 10.5 | 32 | 0.004 | 0.003 | 0.004 | 3.24 | 3.19 | 3.30 | 0.99 |
| Cichlidae | | | | | | | | | | |
| *Australoheros* cf. *paraibae* (Ottoni & Costa, 2008)* | 14 | 8.2 | **18.5** | 0.021 | 0.007 | 0.070 | 3.0 | 2.54 | 3.45 | 0.95 |
| *Cichla kelberi* (Kullander & Ferreira, 2006)[a] | 26 | 10 | 19.5 | 0.011 | 0.007 | 0.017 | 2.91 | 2.72 | 3.11 | 0.97 |
| *Crenicichla lacustris* (Castelnau, 1855)* | 22 | 12 | **30.5** | 0.005 | 0.002 | 0.012 | 3.20 | 2.88 | 3.53 | 0.96 |

*N*, number of fish; TL, total length; *a*, angular coefficient and 95% confidence limit; *b*, allometric coefficient and 95% confidence limit; $r^2$, coefficient of determination. Families and species in alphabetical order; NS, non-significant.
New maximum size data in bold.
[a]Introduced species.
*Data represent first reporting of weight–length relationship for the species.

three Paraiba do Sul stretches. Values of *a* and *b* and their associated statistical information are provided in Table 1. As the samples included individuals collected over the two most contrasting seasons in Neotropical regions, parameters *a* and *b* were treated as mean annual values. All 22 species presented highly significant ($P < 0.01$) WLRs with a coefficient regression greater than 0.95.

Eight of the 22 analyzed species had no weight–length data recorded in FishBase (Froese and Pauly, 2012), and eight new maximum size data were noted (Table 1). This information is important because the status of these species, in addition to other freshwater fish in the Paraíba do Sul, are in the process of evaluation by the Brazilian government (ICMBio) and IUCN organization.

**Acknowledgements**

We thank the team of the Laboratory of Fish Ecology, Universidade Federal Rural do Rio de Janeiro. The Carlos Chagas Filho Research Support Foundation of the Rio de Janeiro State, FAPERJ gave a sponsorship to RJA. FGA was the recipient of CNPq and FAPERJ fellowships.

**References**

Araújo, F. G.; Pinto, B. C. T.; Teixeira, T. P., 2009: Longitudinal patterns of fish assemblages in a large tropical river in southeastern Brazil: evaluating environmental influences and some concepts in river ecology. Hydrobiologia **618**, 89–107.

Froese, R., 2006: Cube law, condition factor and weight–length relationships: history, meta-analysis and recommendations. J. Appl. Ichthyol. **22**, 241–253.

Froese, R.; Pauly, D., 2012: FishBase. World Wide Web Electronic Publication. Available at: http://www.fishbase.org (accessed on 25 August 2012).

Pauly, D., 1984: Fish population dynamics in tropical waters: a manual for use with programmable calculators. ICLARM Stud Rev **8**, 325.

Pfeiffer, W. C.; Fiszman, M.; Malm, O.; Azcue, J. M., 1986: Heavy metal pollution in the Paraíba do Sul River. Brazil. Sci. Total. Environ. **58**, 73–79.

**Author's address:** Rafael J. Albieri, Laboratório de Ecologia de Peixes, Universidade Federal Rural do Rio de Janeiro, BR 465, km 7, Seropédica, RJ, Brazil. E-mail: albieri.rafael@gmail.com