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Length–weight relationships for 20 species collected in the Jurumirim reservoir (Paranapanema Basin, Brazil)

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Summary

Length–weight relationships were estimated for 20 species of the Jurumirim reservoir (southern Brazil): one Pimelodidae, one Callichthyidae, six Characidae, one Prochilodontidae, six Anastomidae, one Erythrinidae, two Curimatidae, one Parodontidae and one Cichlidae. The fishes were collected during 2001–2002 using three different types of fishing gear that allowed collection of both adult and juvenile specimens. The first reference of length–weight relationships for 12 species is provided.

Introduction

Length–weight relationships for 20 fish species collected from the Jurumirim reservoir (Sao Paulo, southern Brasil) in shallow and deep areas are reported, including the most common species as well as those of commercial interest. Little is know about the biology of most of the fishes captured in this study (Reis et al., 2003). The present work is part of a research project with the goal of describing diversity, distributional patterns and ecological attributes of the fish species from the oxbow lagoons of the Paranapanema River / Jurumirim reservoir complex.

Materials and methods

Study area

The Jurumirim is one of the largest reservoirs in the state of Sao Paulo (southern Brazil), with a hydrographic basin area of 17 800 km^2 located between latitudes 23°80′ and 23°35′S and longitudes 48°30′ and 49°13′W. It is the first reservoir of a reservoir-cascade system. The main feeder rivers are the Paranapanema and Taquari (Nogueira et al., 1999).

Sampling design and statistical analysis

All length–weight relationships presented here are the product of field studies conducted during the period 2001–2002 in different locations of the Jurumirim reservoir basin. The fish were caught using a fishing device that allowed collection of specimens without introducing a bias with respect to length or weight (Froese, 2006). This was composed of three different fishing gear: (i) a 0.5 mm mesh size sieve with an area of 0.89 m^2 was thrown in with the aquatic macrophytes of the shallow littoral areas; (ii) a 10 m-long bag seine net of 0.5 mm mesh size with which replicates were collected at each sampling site from the nearby 20 m reaches of shoreline (100–120 m^2 area per sampling unit) in shallow areas without or with low aquatic vegetation density; and (iii) monofilament nylon gillnets of different mesh sizes and heights (30, 40, 50, 60, 70 and 90 mm mesh size) placed in deep zones, and transversely from the edge of the reservoir in littoral areas.

Captured fish were labelled, preserved on dry ice (carbon dioxide) and transported to the laboratory. All individuals were identified as to species in the laboratory (Reis et al., 2003; Langeani et al., 2007) and measured for total length (TL) to the nearest 0.1 cm and weighed (total weight, TW) to the nearest 0.01 g. Individuals of each species are preserved in the ichthyological collection of the Department of Morphology (Institute of Biosciences, Botucatu).

The relationship was established using linear regresion analysis, TW vs TL (log-transformed): TW = log (a) + b log (TL), 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).

Results and discussion

Overall, 4361 specimens of 20 different species belonging to nine families were weighed and measured. During the course of the study, Characidae (1629 individuals; six species), Anatomidae (746 individuals; six species) and Curimatidae (670 individuals; two species) were the most abundant families. In terms of species richness, these families also dominate the Paranapanema River – Jurumirim reservoir transition zone (Carvalho et al., 1998).

Length–weight relationships are summarized in Table 1. According to fishbase data (http://www.fishbase.org, version 12 / 2007), we report new maximum total lengths for five species: 29.8 cm in *Galeocharax knerii*, 12.6 cm in *Astyanax altiparanae*, 11.0 cm in *Astyanax fasciatus*, 25.8 cm in *Schizodon nasutus* and 13.0 cm in *Steindachnerina insculpta*. Moreover, our research provides the first reference on length–weight relationships for 11 species (Table 1).

According to Froese (2006), values of $b = 3$ indicate that the small specimens have the same form and probably same condition as large specimens. The exponent b varies between 2.56 ± 0.08 for *Astyanax altiparanae* and 3.20 ± 0.04 for *Serrasalmus maculatus* (Table 1). According to Carlender (in Froese and Pauly, 2007), the exponent b should normally fall between 2.5 and 3.5, thus we consider our results to be an adequate estimation of the length–weight relationships. The length–weight relationship in fishes can be affected by habitat, season, gonad maturity, sex, health, preservation techniques and differences in the observed length ranges of the specimen

Table 1
Length–weight relationships for 20 species captured in the Jurumirim reservoir (2001–2002), all lengths in TL. New maximum sizes data highlighted in bold

Family	Species		n	Min.	Max.	*a*	*b*	*b* $CL_{95\%}$	r^2	FishBase
Pimelodidae	*Pimelodus maculatus*		621	8.7	27.2	0.026	2.85	2.78–2.91	0.964	
Callichthyidae	*Hoplosternum littorale*		506	7.0	17.8	0.053	2.84	2.78–2.91	0.976	
Characidae	*Galeocharax knerii*		184	7.0	**29.8**	0.009	3.17	3.09–3.25	0.985	(FB)
	Astyanax altiparanae		469	5.4	**12.6**	0.060	2.64	2.57–2.71	0.975	(FB)
	Astyanax fasciatus		152	6.2	**11.0**	0.045	2.68	2.50–2.85	0.961	
	Serrasalmus maculatus		627	4.2	19.8	0.021	3.20	3.16–3.25	0.983	(FB)
	Salminus hilarii	(J)	25	9.9	26.0	0.010	3.17	3.01–3.33	0.987	(FB)
	Oligosarcus paranensis		157	8.3	15.9	0.018	3.06	2.87–3.14	0.961	(FB)
Prochilodontidae	*Prochilodus lineatus*	(J)	45	10.1	35.0	0.056	2.74	2.55–2.91	0.975	
Anastomidae	*Leporinus striatus*	(J)	17	8.9	12.0	0.017	3.07	2.48–3.67	0.936	(FB)
	Leporinus obtusidens	(J)	126	7.8	26.5	0.032	2.83	2.74–2.93	0.966	
	Leporinus friderici		116	8.0	25.3	0.028	2.89	2.80–2.98	0.973	
	Leporinus octofasciatus		19	8.8	16.0	0.018	3.08	2.87–3.30	0.982	
	Schizodon nasutus		280	9.2	**25.8**	0.031	2.99	2.93–3.04	0.988	(FB)
	Schizodon intermedius		188	8.6	25.5	0.019	3.08	2.99–3.17	0.979	(FB)
Erythrinidae	*Hoplias malabaricus*		132	11.2	32.0	0.014	3.06	2.99–3.14	0.980	
Curimatidae	*Steindachnerina insculpta*		260	6.9	**13.0**	0.037	2.81	2.68–2.93	0.942	(FB)
	Cyphocharax modestus		410	7.0	14.0	0.032	2.92	2.85–2.99	0.968	(FB)
Parodontidae	*Apareiodon affinis*		12	9.3	10.7	0.024	2.81	2.05–3.58	0.901	
Cichlidae	*Geophagus brasiliensis*	(J)	15	5.3	10.2	0.086	2.62	2.32–2.93	0.991	(FB)

n, sample size; Min. and Max., minimal and maximal total length (cm); *a* and *b,* relationship parameters; *b* $CL_{95\%}$, confidence limits of *b*; r^2, determination coefficient; (J), only juveniles; (FB): new data for FishBase.

caught, all of which were not accounted for in the present study. Therefore, although the fish samples were obtained during different seasons throughout the sampling period, these data could be used as mean annual values for each species and are not representative of a particular season and are close to the median values of *a* and *b* (Froese, 2006).

This study represents an additional contribution to the available weight–length relationship data in other geographical areas (Verdiell-Cubedo et al., 2006; Aguirre et al., 2008; Vaslet et al., 2008; among others) and can serve for comparison with similar data of the south Brazilian area (Benedito-Cecilio et al., 1997).

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