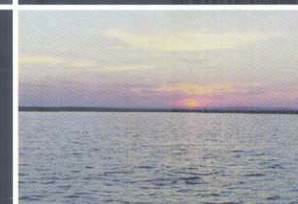
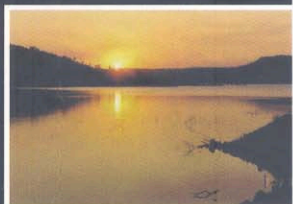
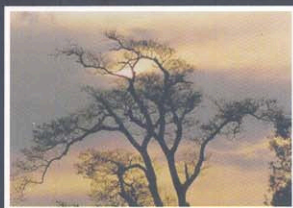


Structure and functioning of the Paran River and its floodplain

**LTER - site 6
(PELD stio 6)**



**Angelo Antonio Agostinho
Liliana Rodrigues
Luiz Carlos Gomes
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Reproductive Strategies of the Fish Community of the Upper Paraná River Floodplain

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Elaine Antoniassi Luiz
João Dirço Latini
Angelo Antonio Agostinho

Abstract

The ichthyofauna of the Upper Paraná River floodplain is formed by species that have a large variety of reproductive strategies. Collections made from 1986 to 2001, using gillnetting and seining in the different environments of the system, revealed that the representation of reproductive strategies in the community changed over the years. The shortage of young migratory species on the floodplain indicates recruitment failure, associated mainly with the regulation of the flood regime imposed by the closing and operation of the Porto Primavera Dam.

Key words: Fish. Reproductive strategy. Floodplain.

Resumo

A ictiofauna da planície de inundação do alto rio Paraná é formada por espécies que apresentam uma grande variedade de estratégias reprodutivas. Coletas efetuadas no período de 1986 a 2001 com redes de espera e arrasto nos diferentes ambientes do sistema revelaram que a proporção das estratégias na comunidade mudou ao longo dos anos. A escassez de jovens migradores na planície indica falhas no recrutamento, associada principalmente à regulação do regime de cheias, imposta pelo fechamento e operação da Usina Hidrelétrica de Porto Primavera.

Palavras-chave: Peixes. Estratégia reprodutiva. Planície de inundação.

Introduction

The large variety of reproductive strategies found in fishes of the Upper Paraná River floodplain (AGOSTINHO; VAZZOLER; THOMAZ, 1995; VAZZOLER, 1996) reflects the environmental diversity that forms this system. This diversity is influenced by river-floodplain dynamics and the flood pulse (JUNK; BAYLEY; SPARKS, 1989; NEIFF, 1990). Considering previous

studies (AGOSTINHO; VAZZOLER; THOMAZ, 1995; AGOSTINHO; JÚLIO JÚNIOR; GOMES; BINI; AGOSTINHO, 1997) and current surveys, the Upper Paraná River floodplain includes 117 fish species. In general these species may be classified as large migratory with external fertilization and without parental care, non-migratory with external fertilization and with/without parental care, and non-migratory with internal fertilization and parental care (AGOSTINHO; JÚLIO JÚNIOR, 1999). Various factors are responsible for the reproductive process, e.g. gonadal development stimulated by the rise in temperature and photoperiod, and the beginning of synchronized spawning with the start of the floods (VAZZOLER, 1996). The objective of this work was to describe the reproductive strategies of the fishes in this system, and to discuss the changes induced by the control of the floods.

Results and Discussion

Most of the species (83.8%) have a sedentary habit or migrate short distances to reproduce, fulfilling their life cycle in the environments of the floodplain itself (Figure 1). The rest (16.2%) carry out upstream reproductive migrations of variable distances in the Paraná River channel and its tributaries, using the floodplain mainly as an area of growth for juveniles.

To evaluate the abundance of species with different reproductive strategies, samplings were carried out at quarterly intervals from February 2000 to October 2001, using gillnets with a diversity of mesh sizes (2.4 to 16.0 cm mesh) fished for 24 hours (rivers, channels, and lagoons) and seine (lagoons).

Small-sized and sedentary species (S) or those that migrate short distances to reproduce (CM) predominated in the seine catches in lagoons (89.6%, mainly small characids), followed by representatives of species with some type of parental care (PC - 10.2%, some cichlids, *L. platymetopon*, and *H. malabaricus*) (Figure 2A). This results may be related to the fact that most of the species of these groups completed their life cycle in these environments, independent of the flood cycle. The high abundance of species of this groups may also be due to these species presenting multiple spawning over a single season and rapid recruitment via rapid maturation (WINEMILLER, 1989).

Despite lagoons being recognized as nurseries for migratory species (AGOSTINHO; VAZZOLER; THOMAZ, 1995; AGOSTINHO; GOMES; SUZUKI; JÚLIO JÚNIOR, c2003), a low catch of juveniles of migratory species was observed (0.1%, represented mainly by *P. lineatus*, *P. maculatus* and *L. obtusidens*) when compared to years with regular floods before the formation of Porto Primavera Reservoir (VERÍSSIMO; AGOSTINHO; OKADA; GOMES, in press).

The gillnet catches (Figure 2B) indicated a predominance of species with parental care (PC) in the channel and lagoon biotopes, with *L. platymetopon* and *S. marginatus* dominating the catches, followed by sedentary/short migration species represented by mainly by *S. borellii*, *L. lacustris*, and *M. intermedia*. In the river biotope, the species with sedentary or short migration strategies prevailed

Biotic Component

in the catches. The migratory species had low frequencies in the catches in the three biotopes analyzed.

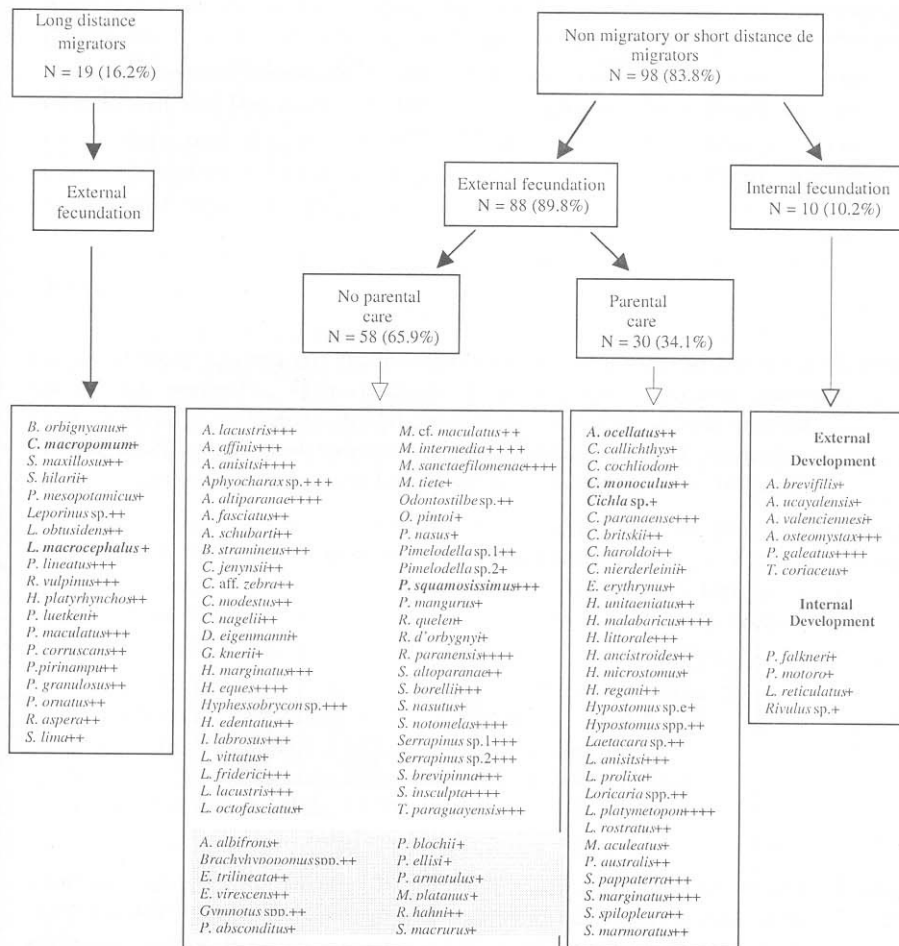


Figure 1 - Reproductive strategy of the 117 species collected in the Upper Paraná River floodplain, 1986-2001 (see appendix for complete name of the species). Shaded: species with little information about the reproductive strategy; Bold: exotic species; + indicates the relative abundance in the catches.

Historical data series of catches with the effort standardized revealed large changes in abundance of migratory species, with minor changes on species that dispense some parental care to their offsprings (Figure 3). These results suggest a high degree of dependence between the reproductive success of the migratory species and the duration and intensity of the floods. In 1992-1994 large floods occurred; whereas in 2000-2001, the floods were insufficient, intermittent and late (VERISSIMO, 1994). The low catch of young individuals of migratory species in the lagoons in the last few years (Figure 2A) may reflect

recruitment failures resulting from the regulated hydrological regime (GOMES; AGOSTINHO, 1997).

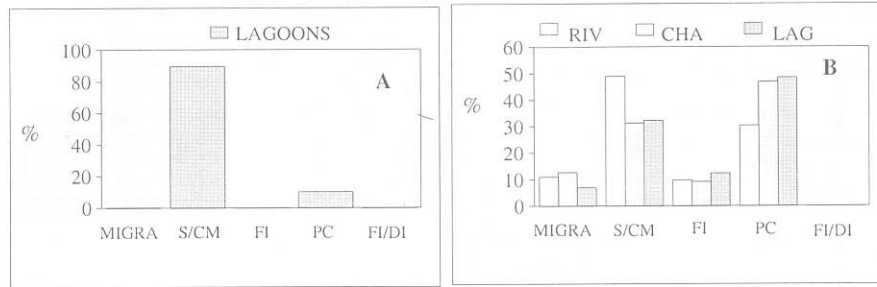


Figure 2 - Relative frequency of the various reproductive strategies of species collected using seines (A) and gillnets (B) in rivers (RIV), channels (CHA), and lagoons (LAG). MIGRA - migratory, S/SM - sedentary or short-distance migratory, without parental care, IF - internal fertilization, PC - parental care, and IF/ID - internal fertilization and internal development.

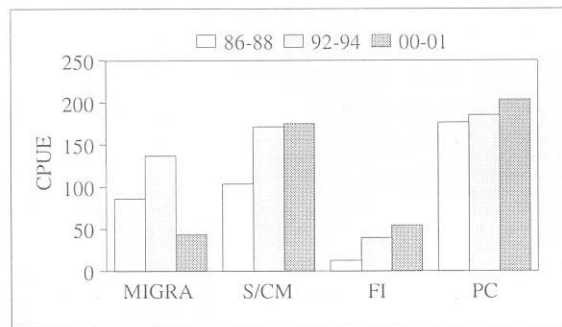


Figure 3 - Catch per unit of effort (CPUE) of species grouped in the main reproductive strategies from collections in 1986-1988, 1992-1994 and 2000-2001. MIGRA - migratory, S/SM - sedentary or short-distance migratory without parental care, IF - internal fertilization, PC - parental care.

The reduction in the catch of large migratory species with commercial value shows that the impacts caused by the regulation imposed by the hydroelectric power stations on the flood regime of the Paraná River can reach levels that go beyond the environmental scope or biodiversity protection. However, other factors resulting from anthropogenic activities may be negatively influencing the migratory species stocks in the region (e.g., riparian vegetation degradation, frequent fires, and the incorporation of the floodplain in the farming system (AGOSTINHO; ZALEWSKI, 1996). The establishment of allochthonous species from stocking programs developed by some hydroelectric companies is certainly an important additional factor in the impacts (e.g., *Astronotus ocellatus*, *Cichla* spp., and *Plagioscion*

squamossissimus). However, the control of the floods resulting from the operation of the upstream dams is undoubtedly the most important source of impact inasmuch as they limit the floodplain, favoring the anthropogenic occupation of the floodplain and the occurrence of fires in addition to intercepting the migratory routes of fishes. This unfavorable picture of the integrity of the Paraná River floodplain reinforces the necessity for continued monitoring and the execution of actions that make the operation of the reservoir upstream compatible with the need for floods in this important segment of the Paraná River.

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