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Research Letters

Implications of using a variety of fishing strategies and sampling techniques across different biotopes to determine fish species composition and diversity

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ABSTRACT

The objective of this study was to evaluate the combination of some sampling gears operated in different biotopes on fish species richness and species composition. Fish were collected from five different types of biotopes in the Upper Parana River floodplain, according to the most suitable sampling gear for the characteristics of each biotope. A total of 116 fish species were identified in the samples and the highest species richness (68 species) was recorded in streams sampled with boat electrofishing. Rivers and open lakes sampled with gillnets showed the greater similarity between the biotopes, while creeks sampled with electrofishing and open lakes sampled with gillnets showed the least. There were significant differences in species composition among the combinations of biotopes/fishing gears. The results of this study demonstrate the importance of using a variety of fishing methods to sample the different biotopes within a region. We emphasize the importance of well-conducted inventories that take into account the particularities of individual environments.

Introduction

Initiatives for the conservation of fishery resources implemented by the electrical power companies in Brazil have been largely ineffective. This is mainly due to a lack of information about the species assemblages in the areas targeted by conservation initiatives, once the mitigation is used in areas already flooded. Moreover, the management measures are used opportunistically by having great popular acceptance, as

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the stocking and the building of fishways, both *a posteriori* of the reservoir (Agostinho et al., 2010).

In the 1990s, the Resolution 001/86 of the National Environmental Council (Conselho Nacional do Meio Ambiente (CONAMA)) established the need for an Environmental Impact Assessment (EIA) for projects involving the exploitation of or interference with water resources. However, in many cases, the assessment of impacts on aquatic communities and the decision making on measures to mitigate these impacts are still hampered by inadequate sampling procedures (Agostinho et al., 2007; Silveira et al., 2010).

With regard to methodological procedures, the selection of sampling techniques and equipments for inventories aiming to determine which and how many species are present at specific biotope should be based on a well-planned sampling design that takes into consideration the research questions, the habitats to be studied, the species, and the sampling period (Portt et al., 2006). In relation to fishing gears for sampling [*e.g.*, gillnets (the most used, sometimes the only one), hooks, seines, fish-traps, cast nets, sieves, and electrofishing, among others], it is essential to consider the different biotopes to be sampled. Fishing devices select for different species, just as species select different habitats (Olin and Malinen, 2003). Fishing gear can be *active* or *passive*. Active gear is moved to capture fish. Passive gear is stationary and fish swim into it. Gears can vary in selectivity, according to the fish species and environment (Lapointe et al., 2006; Portt et al., 2006). Thus, the use of several fishing gears is fundamental to obtain high quality surveys and the use of a limited number of these gears is a key limitation in EIA sampling designs (Silveira et al., 2010).

The components of biodiversity (*e.g.*, α, β and γ) are strongly underestimated when only a single fishing strategy or a limited number of strategies are used and when the sampled environments are all relatively similar to each other. Therefore, the objective of this study was to estimate α and γ diversity using combinations of fishing methods operated in different biotopes in the Upper Paraná River floodplain. It is expected that the methods are complementary to estimated γ diversity and the use of a single method or combinations of some methods underestimated it substantially.

Materials and methods

Study area

This study was conducted in the floodplain of the Upper Paraná River, downstream Engenheiro Sérgio Motta Dam (locally known as Porto Primavera) and upstream Itaipu Reservoir. This 230-km reach represents the last significant dam-free stretch of the Paraná River within Brazil and plays a key role in maintaining aquatic biodiversity and fisheries of the region (Agostinho et al., 2000; Hoinghauss et al., 2009). The floodplain in the study reach is characterized by a high

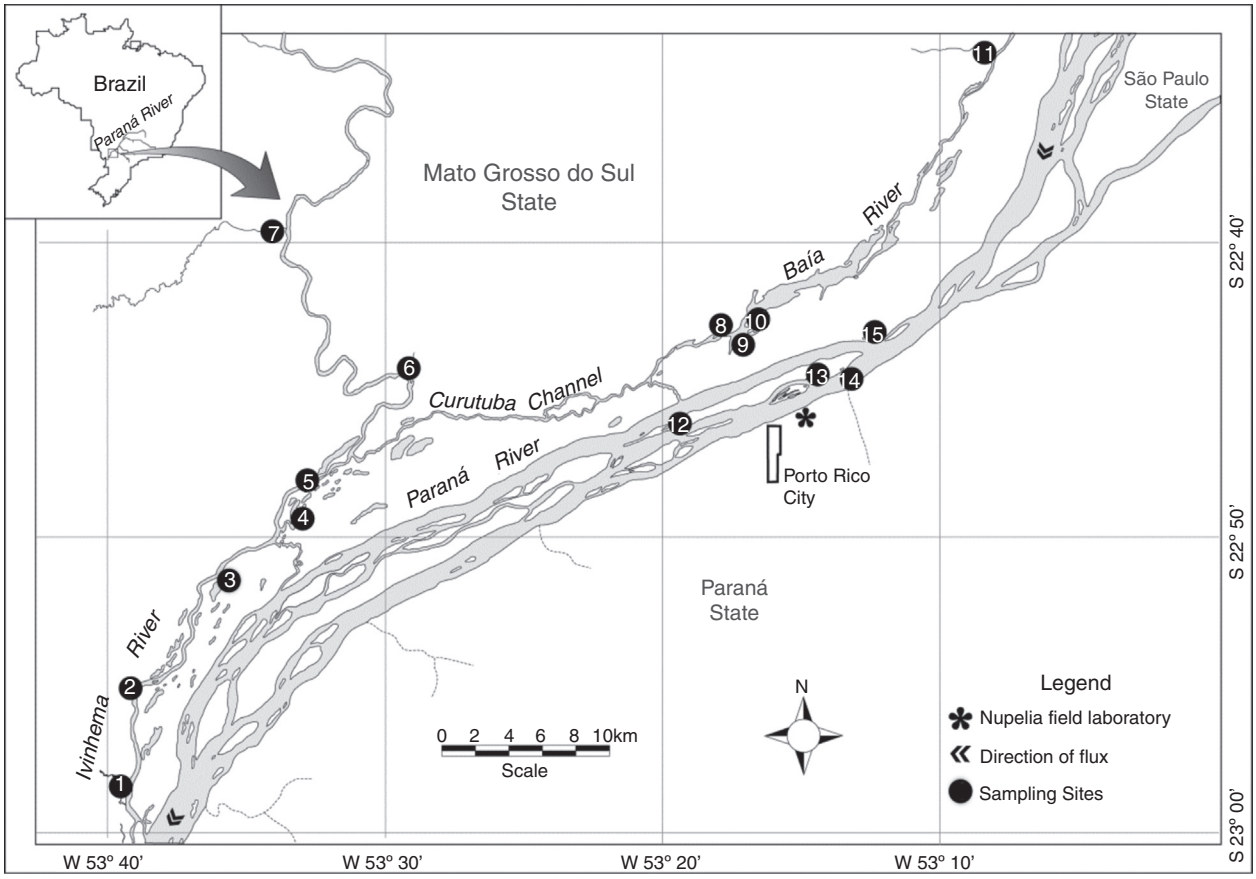

Fig. 1 – Study area with the 15 sampling sites. (1) Curupaí Stream; (2) Peroba Creek; (3) Ventura Lake; (4) Patos Lake; (5) Ivinhema River; (6) Lambaci Creek; (7) Guiraí Stream; (8) Guaraná Lake; (9) Baía River; (10) Fechada Lake; (11) Perdiz Stream; (12) Osmar Lake; (13) Pau Veio Lake; (14) Paraná River; (15) Garças Lake.