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# Larval fish assemblage in the Baía River (Mato Grosso do Sul State, Brazil): temporal and spatial patterns

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## Synopsis

We sampled the Baía River (Mato Grosso do Sul State, Brazil) monthly, to survey taxonomic composition and temporal and spatial distribution of fish larvae. The ichthyoplankton was mainly composed by larvae of small and medium sized sedentary species and it was numerically dominated by six taxa: *Plagioscion squamosissimus*, *Hypophthalmus edentatus*, *Hoplias* aff. *malabaricus*, *Bryconamericus stramineus*, *Serrasalmus* spp. and *Catathyridium jenynsii*. These taxa present distinct temporal and spatial occurrence patterns: *H. edentatus, B. stramineus* and *C. jenynsii* are abundant between September and March in lentic areas; *H.* aff. *malabaricus* and *Serrasalmus* spp. were caught between October and February in lotic areas; whereas *P. squamosissimus* occurs in all sampled areas, with peak of capture in January. *Hypophthalmus edentatus*, *H.* aff. *malabaricus, Serrasalmus* spp. and *B. stramineus* were the taxa that most contributed to structure the assemblages temporally and spatially, and their abundances were influenced by the interaction of several environmental variables.

## Introduction

Interest in the study of early life stages of fishes has increased considerably in recent years, as a tool to identify spawning grounds and natural nurseries (Nakatani et al. 1997, Baumgartner et al. 1997). In addition, such studies have contributed for the understanding of the ecological relations among communities based on the analysis of species composition and its spatial and temporal variability (Franco-Gordo et al. 2003).

Research on ichthyoplankton assemblages has shown that they possess temporal and spatial structure in both temperate (Holland 1986, Rakocinski et al. 1996, Gray & Miskiewicz 2000) and tropical (Araujo-Lima & Oliveira 1998, Harris et al. 1999, Baumgartner et al. 2004) waters. That research attempted to explain why they occur in a certain area and period, and how spatial and temporal distributions influence recruitment process. Assemblage structure is directly influenced by the mode, site, period, duration and intensity of reproduction. In addition, aspects of larval biology such as duration of the larval interval, growth rates and transport mechanisms are factors that should be considered (Richardson et al. 1980, Frank & Leggett 1983).

Fish larvae surveys in upper Paraná River floodplain found a relationship between high larvae densities and hydrological characteristics and vegetation cover of the environments (Baumgartner et al. 1997). Also, Castro et al. (2002) reported the great importance of lentic habitats for development of sedentary species. Both studies found a direct relationship between distribution of larvae and water temperature, pH, increase of the river stage and rain. However, studies that consider spatial and temporal structure of larvae assemblages have not yet been done. Such studies are important for understanding the use of the different floodplain habitats for spawning of the local ichthyofauna. Therefore, this study describes the results of a larval fish survey in the Baía River (upper Paraná River floodplain). The specific objectives of this work were: (i) to characterize the taxonomic composition, (ii) determine the spatial and temporal distribution of the most abundant taxa and (iii) analyze the assemblage structure of the larvae.

## Material and methods

### *Study area*

The Baía River is located in the west margin of the Paraná River (Mato Grosso do Sul State) and is about 70 km long (22°25′16″ and 22°45′20″ S and 53°01′15″ and 53°19′55″ W). The Baía River bed was interrupted by the dam of the Porto Primavera Hydroelectric Power Station and its flow is maintained mainly by groundwaters and the Samambaia River. Depending on the level of the Paraná River, its flow can change direction.

The sampling area consisted of the entire extent of the Baía River (Figure 1). We grouped 16 sampling stations into four areas based on water velocity (sites with mean velocity less than 0.10 m $s^{-1}$ were considered lentic) and position on the longitudinal axis: Area A (Rodrigo Lagoon) – Stations A1 to A3, all lentic; Area B (Channel) – Stations B1 to B6, all lotic; Area C (Baía Lagoon) – Stations C1 to C5, all lentic; and Area D (‘Exits’) – Stations D1 (lotic) and D2 (lentic).

### *Sampling and data analysis*

We carried out ichthyoplankton collections from February 1999 to April 2000 in the subsurface waters (approximately 20 cm deep) of the stations using a conical–cylindrical plankton net (500 μm mesh) equipped with a General Oceanics$^{TM}$ flowmeter which was used to measure water velocity. Trawling (one trawl per station per month) was horizontal, lasting 10 min and always at night (from 19:00 to 01:00 h). We fixed collected material in 4% formaldehyde and later preserved it in 80% ethanol, both buffered with $CaCO_3$. We sorted collections in the laboratory and separated larvae (yolk-sac through postflexion stage inclusive; sensu Ahlstrom & Moser 1976) from the rest of the plankton.

We carried out identification of the larvae to the lowest taxonomic level possible using mainly Nakatani et al. (2001). Some larvae that could not be identified to at least the order level (including damaged individuals) were included in the category ‘unidentified’. Larval abundance was standardized to 10 $m^3$ in accordance with Tanaka (1973), modified by Nakatani et al. (2001). Mean density per sampling station or per month (larvae 10 $m^{-3}$) was obtained dividing the sum of larval density for the number of stations or months sampled.

We obtained, during the collections, water samples to determine temperature (°C), dissolved oxygen (mg $l^{-1}$), pH and electrical conductivity (μS $cm^{-1}$). Rainfall and river level data, recorded at the Porto São José Climatological Station (Paraná State), were supplied by ANEEL (Agência Nacional de Energia Elétrica – National Agency of Electric Energy).

The protected Analysis of Variance (ANOVA) protocol was applied in order to evaluate temporal and spatial variations in the most abundant taxa [log (density + 1) to reach the assumptions] (Scheimer 1993, Johnson 1998). In this protocol, a Multivariate Analysis of Variance (MANOVA) (sampling areas and months as independent factors) is applied first. If it is significant, ANOVAs are then used; in this case two-way ANOVAs. Protected ANOVA is

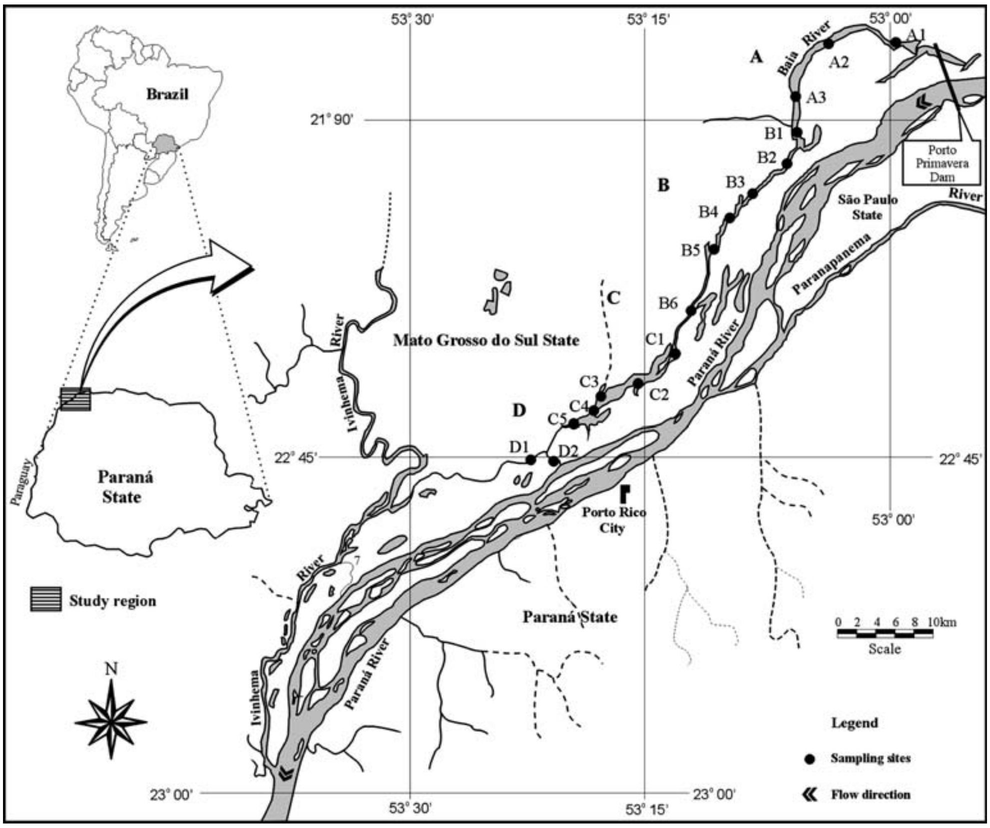

*Figure 1.* Location of the sampling areas and stations.

recommended because it is possible to find significant differences at random when many tests are used. When the ANOVA was significant the posteriori test of Tukey was applied in order to identify which means differed.

In order to identify patterns in the structure of larval assemblage in the various areas and months sampled, a Detrended Correspondence Analysis (DCA) was applied (Gauch 1986) to ordinate the data. Axes retained for interpretation were those that presented eigenvalues above 0.20, as suggested by Matthews (1998). Data matrix used in the DCA were densities of the most abundant taxa (mean density $\geq 0.03$ larva 10 $m^{-3}$), inasmuch as rare species may influence the results (Palmer 1990, ter Braak 1995). Later, to identify patterns in the structure of these taxa, a two-way ANOVA was carried out using the scores of the DCA axes retained for interpretation (sampling areas and months as factors). Significant ANOVAs indicate different positioning of the sampling areas and months in the ordination, which can be interpreted as different assemblage structure.

Environmental variables (water temperature, dissolved oxygen, pH, electrical conductivity, river level and rainfall) were summarised by a Principal Components Analysis (PCA). PCA axes retained for interpretation were those that presented eigenvalues higher than 1.0 (criterion of Kaiser–Guttman; Jackson 1993). Environmental variables that presented structure coefficients (correlations) greater than 0.4 were considered biologically important (Hair et al. 1984).

Procrustean Randomization test (Jackson 1995) was used to evaluate the association of the environmental variables matrix (summarized in the PCA axes retained for interpretation) with the patterns of assemblage structure (summarized in the axes of the DCA retained for interpretation).

The ordinations (DCA and PCA) were carried out using PCORD 2.0 (McCune & Mefford 1995);

whereas STATISTICA v. 5.0 (Statsoft 1999) was employed for the parametrical tests ANOVA and MANOVA. Significant differences implies in $p < 0.05$.

## Results

### *Environmental variables*

Environmental variables showed a clear seasonal variation. Water temperature had high values in February 1999 and January 2000 (Figure 2a). High concentrations of dissolved oxygen were recorded during the winter and low concentrations during the summer (Figure 2b), while pH and conductivity showed large fluctuations over the period (Figure 2c–d). River level was high in February 1999 (Figure 2e). After this month, large river level values were not recorded, while rainfall showed the highest value in February 2000 (Figure 2f).

Principal Components Analysis (PCA) axis 1 (PC1) and 2 (PC2) showed eigenvalues higher than

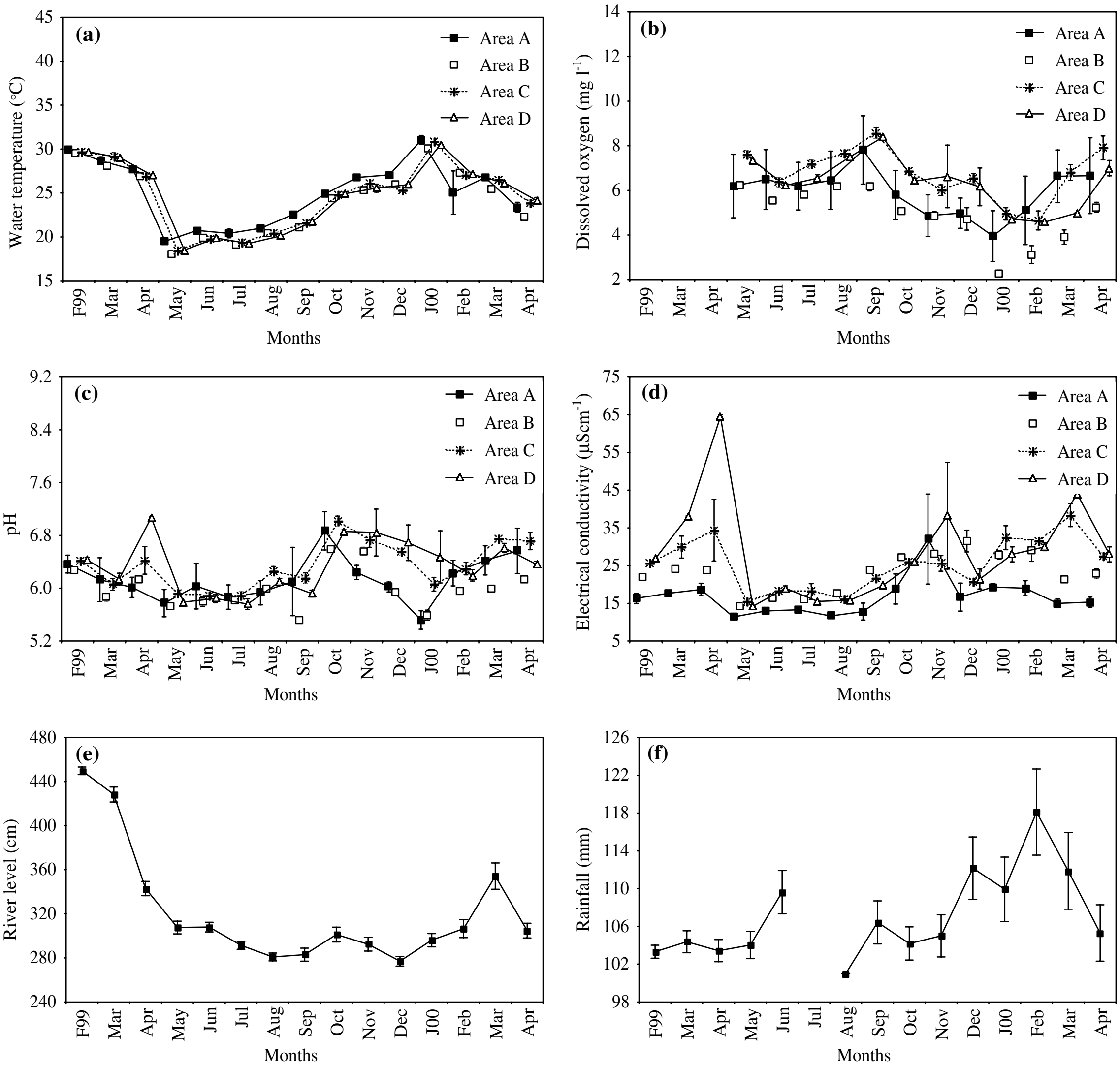

*Figure 2.* Average monthly values (markers) and standard error (bars) of the environmental variables obtained in the Baía River – upper Paraná River (Mato Grosso do Sul State) from February 1999 to April 2000.

1.0, so they were retained for interpretation. These two axes together explained 63.33% of these data variability. PC1 had an eigenvalue of 2.96 and explained 42.26% of the variability. Variables that contributed most positively to the formation of this axis were water temperature, river level and rainfall, while the variable that contributed most negatively was dissolved oxygen. The second axis (PC2) had an eigenvalue of 1.48 and explained 21.07% of the data variability. The variable water velocity contributed positively whereas pH contributed negatively to the formation of this axis (Table 1).

### *Taxonomic composition*

Over the studied period we collected a total of 12 152 fish larvae belonging to 14 families, 21 genera, and 23 species (Table 2). Characiformes constituted the greater number of taxa (13) whereas Perciformes and Siluriformes were more numerous and, together, contributed 92% of the individuals caught. Despite the great difficulty in identifying the ichthyoplankton, only a few larvae (242) were not identified to the generic level. The six most abundant taxa were *Plagioscion squamosissimus* (Perciformes), *Hypophthalmus edentatus* (Siluriformes), *Hoplias* aff. *malabaricus* (Characiformes), *Bryconamericus stramineus* (Characiformes), *Serrasalmus* spp. (Characiformes), and *Catathyridium jenynsii* (Pleuronectiformes).

### *Spatial and temporal distribution*

MANOVA applied to the densities of the six most abundant taxa (sampling areas and months as factors) was significant (Wilks' Lambda: sampling areas = 0.49; months = 0.12; sampling areas $*$ months = 0.06; all at $p < 0.001$), indicating the relevance of applying ANOVAs for each taxon.

ANOVAs were significant for every taxon considered. The densities of *P. squamosissimus* varied mainly between months ($F = 10.41$; $p < 0.01$) with highest densities in January 2000 (Figure 3). For the other taxa, interactions between areas and months were significant ($F > 1.86$; $p < 0.01$) (Figure 3), indicating that the variations in the density depended on the areas and months sampled. The highest densities of *H. edentatus* were recorded in October in area A and December in area C. As regards *H.* aff. *malabaricus* and *Serrasalmus* spp., the highest densities were in October in area B. *Bryconamericus stramineus* presented high densities in areas C in January and D in March; whereas the highest densities of *C. jenynsii* were in March and November in areas D and A, respectively.

### *Larval assemblage structure and influence of environmental variables*

Axis 1 of the DCA had an eigenvalue of 0.73, while axis 2 had an eigenvalue of 0.26 (axis retained for interpretation). To a large degree no differences were detected in community structure among the four habitat types in the fall of 1999 and 2000 with the exception of area D in March 2000 in axis 2 (Figure 4a, b). This area had slightly more *H. edentatus* and *B. stramineus* and fewer *H.* aff. *malabaricus* and *Serrasalmus* spp. at that time than the other areas. During the late winter and spring community structure differed amongst the four areas. Area A and C were characterized mainly by *H. edentatus* (DC1) whereas area B a combination of *H. edentatus, H.* aff. *malabaricus* and *Serrasalmus* spp. (DC1 and DC2).

The results described before are shown in the two-way ANOVA applied on the sampling stations scores of axes 1 and 2 of the DCA (areas and months as factors), which revealed that these taxa inhabit different areas according to months. This is confirmed by the significant interaction between the two factors considered ($F = 2.28$; $p = 0.01$ to axis 1; $F = 4.49$; $p = 0.00$ to axis 2). Thus, we can say that, on average, the overlap of the larvae of

*Table 1.* Results of the Principal Components Analysis applied to summarize environmental variables obtained in the Baía River – upper Paraná River (Mato Grosso do Sul State) from February 1999 to April 2000.

| Variables | PC 1 | PC 2 |
|---|---|---|
| Water temperature | 0.52 | −0.14 |
| Dissolved oxygen | −0.44 | −0.38 |
| Electrical conductivity | 0.35 | −0.24 |
| pH | 0.11 | −0.71 |
| River level | 0.42 | 0.09 |
| Rainfall | 0.47 | 0.02 |
| Water velocity | 0.04 | 0.52 |
| Eigenvalues | 2.96 | 1.48 |
| % de explanation | 42.26 | 21.07 |

*Table 2.* List of identified taxa with respective number caught (NC), frequency of occurrence (%C), mean density (larvae $10m^{-3}$) ± standard error (M ± SE), months and areas of capture (A, B, C and D) of fish larvae collected in the Baía River – upper Paraná River (Mato Grosso do Sul State) between February 1999 and April 2000. Bold signs indicated those months with greater abundances.

| Taxa | NC | %C | M ± SE | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | A | B | C | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Characiformes (unidentified) | 187 | 1.54 | 0.14(±0.04) | +* | + | + | + |  |  |  | + | + | + | + | + | + | + | + | + | + | + | + |
| Characidae unidentified | 17 | 0.14 | 0.01 (±0.01) | +* |  | + |  |  |  |  |  |  |  |  |  |  | + |  | + | + | + |  |
| *Astyanax* spp. | 1 | 0.01 | <0.01 | +* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  |
| *Bryconamericus stramineus* | 153 | 1.26 | 0.08 (±0.02) | + | +* | + |  |  |  |  | + | + | + | + | + | + | + | + | + | + | + | + |
| *Hyphessobrycon eques* | 4 | 0.03 | <0.01 | +* |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  | + |  |  |
| *Moenkhausia intermedia* | 2 | 0.02 | <0.01 | +* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | + |
| *Moenkhausia sanctae-filomenae* | 26 | 0.21 | 0.02 (±0.01) | + |  |  |  |  |  |  |  |  |  |  | + |  | + | +* | + | + | + | + |
| *Aphyocharax* cf. *anisitsi* | 4 | 0.03 | <0.01 | + |  |  |  |  |  |  |  |  |  |  |  | + |  | +* |  |  | + | + |
| *Serrapinus notomelas* | 8 | 0.07 | <0.01 | +* |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  | + | + | + |
| *Serrapinus* spp. | 4 | 0.03 | <0.01 | +* | + |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  | + | + |
| *Roeboides paranensis* | 4 | 0.03 | <0.01 | +* |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  | + | + |
| *Serrasalmus* spp. | 59 | 0.49 | 0.04 (±0.02) | + |  |  |  |  |  |  |  | +* |  | + |  |  |  |  | + | + | + | + |
| Anostomidae (unidentified) | 13 | 0.11 | <0.01 |  |  |  |  |  |  |  |  |  |  | + |  | + | +* |  | + | + | + | + |
| Erythrinidae |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *Hoplias* aff. *malabaricus* | 253 | 2.08 | 0.22 (±0.08) |  |  |  |  |  |  |  |  | +* | + | + | + |  |  |  | + | + | + | + |
| Gymnotiformes (unidentified) | 12 | 0.10 | <0.01 | + |  | + |  |  |  |  | + | +* |  |  |  | + | + |  |  | + |  |  |
| Gymnotidae |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *Gymnotus* cf. *carapo* | 4 | 0.03 | <0.01 | + |  | + |  |  |  |  |  |  | +* |  | +* |  |  |  |  | + |  |  |
| Sternopygidae |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *Eigenmannia* spp. | 1 | 0.01 | <0.01 |  | +* |  |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  |
| Siluriformes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Auchenipteridae |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *Parauchenipterus galeatus* | 5 | 0.04 | <0.01 | + |  |  |  |  |  |  |  |  |  | + |  | +* |  |  | + |  | + |  |
| *Tatia neivai* | 7 | 0.01 | <0.01 | + |  |  |  |  |  |  |  |  | + | +* | +* | + |  |  | + | + |  |  |
| Hepapteridae |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *Rhamdia quelen* | 21 | 0.17 | <0.01 |  | + |  |  |  |  |  |  |  |  |  |  |  | +* |  |  |  | + | + |
| Pimelodidae |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *Pimelodus maculatus* | 1 | 0.01 | <0.01 |  |  |  |  |  |  |  |  |  |  |  |  |  | +* |  |  |  | + |  |
| *Hypophthalmus edentatus* | 5521 | 45.43 | 2.92 (±0.90) | + |  |  |  |  |  |  | + | + | + | + | + | + | + |  | + | + | + | + |
| Callichthyidae |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *Hoplosternum littorale* | 1 | 0.01 | <0.01 | + |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | + |  |  |
| Loricariidae |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *Loricariichtys platymetopon* | 4 | 0.03 | <0.01 |  |  |  |  |  |  |  |  | +* | +* | +* |  |  | +* |  | + | + | + | + |
| Cyprinodontiformes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Rivulidae |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *Rivulus* spp. | 1 | 0.01 | <0.01 |  |  |  |  |  |  |  |  |  |  |  | +* |  |  |  |  | + |  |  |
| Perciformes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sciaenidae |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Plagioscion squamosissimus* | 5670 | 46.66 | 3.78 (±0.63) | + | + | + | + | | | | | + | + | + | +* | + | + | + | + | + | + | + |
| Cichlidae (unidentified) | 13 | 0.11 | 0.01 (±0.01) | | | | | | | | | | | | | | | | + | | | |
| Pleuronectiformes | | | | | | | | | | | | | | | | | | | | | | |
| Achiridae | | | | | | | | | | | | | | | | | | | | | | |
| *Catathyridium jenynsii* | 54 | 0.44 | 0.03 (±0.01) | | + | + | | | | | | | +* | | + | + | + | | + | + | + | + |
| Unidentified | 102 | 0.84 | 0.04 (±0.01) | + | + | + | + | | | | + | + | + | +* | + | + | + | | | | | |

these taxa in the study area is low, with the exception of *P. squamosissimus*, which constituted high catches in every area and in most of the months sampled.

To evaluate the degree of congruence between the configurations of the two ordinations applied to summarize environmental variables (PCA) and patterns of the larval assemblage (DCA), we applied the Procrustean Randomization test. After 4999 randomizations, the values of m$^2$ obtained was 0.8945 ($p = 0.0001$), indicating significant congruence, that is, sampling stations on the PCA and DCA occupied similar position on space, generating similar clouds of dots in the ordination. Then, we can assume that larval assemblage structure is influenced by environmental variables, especially the ones that contributed to the formation of the PCA axes retained for interpretation.

## Discussion

The number of species found in the ichthyoplankton of the Baía River corresponds to 15% of the total number recorded for the upper Paraná (Agostinho et al. 2004). The larval assemblage was composed mainly of species of small- or medium-sized species that do not migrate or only perform short migrations for spawning. All of them are somehow related to low water velocity (Figure 5).

This dominance of sedentary species was also reported by Baumgartner et al. (1997) and Nakatani et al. (1997). The sampled area is considered feeding and growth grounds for migratory species (Nakatani et al. 1997). These species do not reproduce in the Baía River, probably because the low tolerance of fertilized eggs in relation to the water quality of this river (low pH and dissolved oxygen due to the great quantities of humic compounds).

The main taxonomic groups found represent different reproductive strategies. *Plagioscion squamosissimus*, *C. jenynsii*, *H. edentatus* (Suzuki 1992, Nakatani 1994, Nakatani et al. 2001) and *B. stramineus* (David A. Reynalte-Tataje, personal communication) are opportunistic species that reproduce in the pelagic zone and also possess pelagic eggs and larvae. The first two species lay floating eggs (with a drop of oil; Suzuki 1992). *Hoplias* aff. *malabaricus* and *Serrasalmus* spp. are seasonal strategists, with adhesive eggs, and

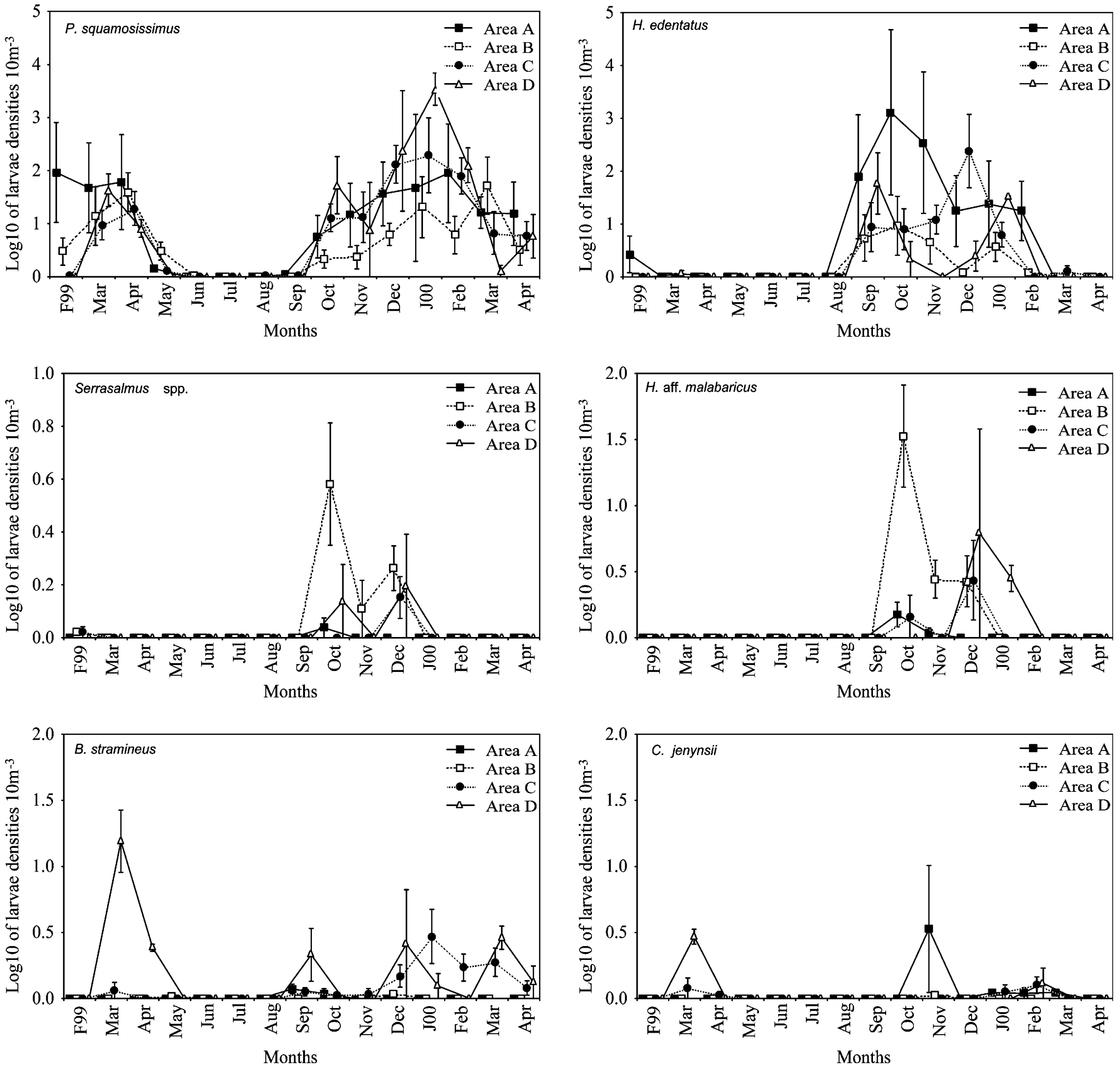

*Figure 3.* Temporal and spatial distribution of the six main taxa of fish larvae caught in the Baía River – upper Paraná River (Mato Grosso do Sul State) from February 1999 to April 2000 (markers, mean values; bars, standard error).

construct nests in the marginal aquatic vegetation where the larvae live (Machado-Allison 1990, Vazzoler 1996, Nakatani et al. 2001).

The great abundance of Perciformes and Siluriformes larvae, represented by *P. squamosissimus* and *H. edentatus*, may be related to their high fecundity, large adult populations, low rate of larval mortality (Araujo-Lima & Oliveira 1998), and the type of initial development (pelagic eggs and larvae; Nakatani et al. 2001) that favors surface dispersal (Holland 1986). Another aspect that should be considered is the type of sampling gear that favors the capture of pelagic eggs and larvae.

There is high seasonality in the occurrence of larvae in the Baía River, with highest densities registered between spring and summer. However, a succession seems to exist in the dominance of the taxa. This succession of the groups may reflect the partitioning of resources in the habitat or may be related to temperature differences and spawning, incubation and growth requirements, which vary from species to species (Post et al.

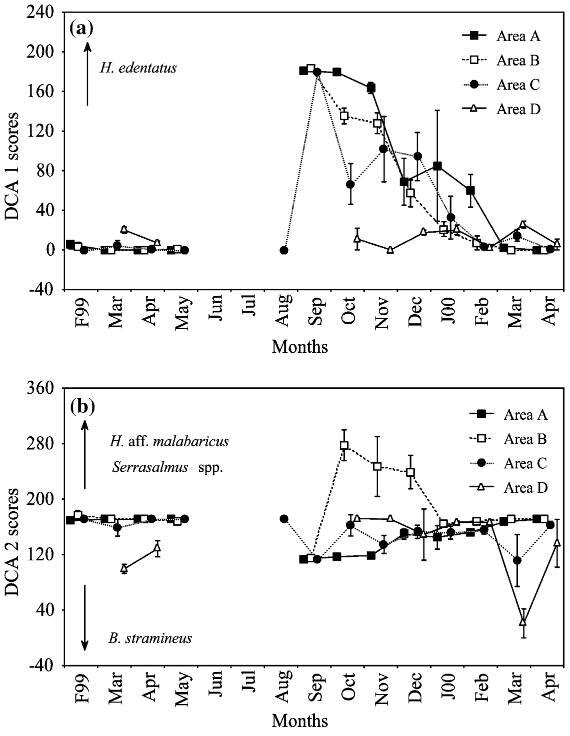

*Figure 4.* Average values and standard error of the sampling station (grouped by areas) scores of axes 1 (DCA1; a) and 2 (DCA2; b), which summarized the abundance matrix of the main taxa for the different months sampled in the Baía River – upper Paraná River (Mato Grosso do Sul State). Arrows indicate the most important species to the formation of a given axis.

1995). Larvae of *H. edentatus, B. stramineus* and *C. jenynsii* appear in the Baía River mainly from September to March in lentic areas (Areas A, C, and D), suggesting that these species are spawning in the pelagic zones of these areas and larvae are then dispersed downriver. Larvae of *H.* aff. *malabaricus* and *Serrasalmus* spp. appeared between October and February, mainly in the lotic area (Area B), which, in addition to being a much narrower stretch of the river than the others, also has a large quantity of macrophyte stands, where these two species construct their nests and also disperse their larvae when small stands of these plants drift (Nico & Taphorn 1988, Bialetzki et al. 2002). Larvae of *P. squamosissimus* were found mainly between December and February (with a peak in January), along the entire extent of the river. But despite the fact that this species was also found

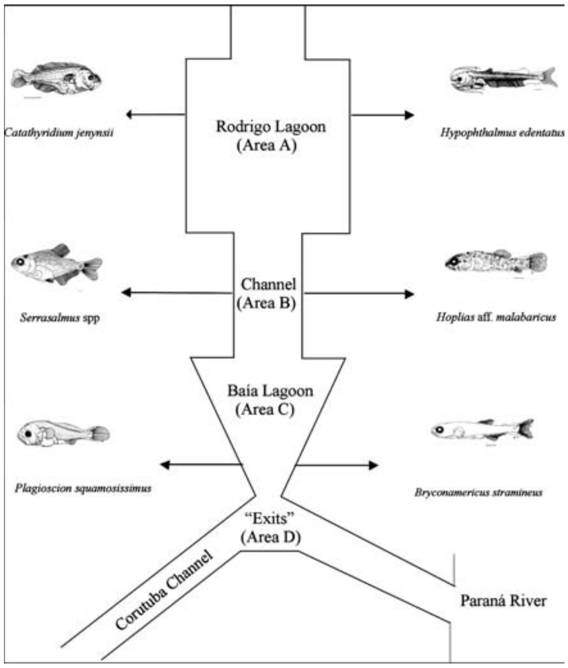

*Figure 5.* Conceptual model of the dominant patterns in spatial distribution of the main taxa larvae found in the Baía River – upper Paraná River (Mato Grosso do Sul State) from February 1999 to April 2000.

in areas B and D, spawning probably occur mainly in areas A and C (lentic ones). In these last areas, we collected large quantities of eggs and new hatched larvae (Bialetzki et al. 2004), and, from there, they are easily dispersed through passive (eggs and new hatched larvae) and active (more developed larvae) mechanisms to the other areas.

The structure of larval assemblages is a result of patterns in the spawning behavior of adults, which reproduce only when conditions are adequate, as an attempt to maximize their fitness and, consequently, guarantee a sufficient number of survivors. Miller (2002) suggested that fish larval assemblages are formed and maintained by a pool of abiotic and biotic factors operating spatially and temporally. In this study, *H. edentatus*, *H.* aff. *malabaricus, Serrasalmus* spp. and *B. stramineus* were the taxa that most influenced the structure, probably because of their reproductive strategy, and the fact that they inhabited a given area at a particular time of the year, associated with changes and preferences for some abiotic conditions.

Another factor that could be influencing the structuring of the larvae assemblage is the amount of zooplankton (preferential food for the larvae) in the area. According to the match–mismatch hypothesis (Cushing 1975), feeding, growth and survival of the larvae are better when there is a balance between the interval in which they begin exogenous feeding and the availability of appropriate food in the environment. Nakatani (1994), studying the ichthyoplankton of the Itaipu Reservoir, verified that the larvae of *H. edentatus* also appear in the environment before *P. squamosissimus*. This pattern could be associated with a high availability of preferred food for the larvae. Makrakis et al. (2004) studied the feeding of these two species and concluded that larvae of *H. edentatus* fed mainly on cladocera whereas *P. squamosissimus* fed on calanoid copepods. Lima et al. (1998) reported that these two zooplankton groups have a direct relationship with the Baía River water lever. Thus, cladocera are abundant during low river levels (June to October) and calanoid copepods during high river levels (November to February). However, the influence of zooplankton availability on larvae structuring in the Baía River is a speculative hypothesis and, therefore, need to be studied in the future.

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