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### **Fish Assemblage of the Una Biological Reserve, Bahia, Brazil**

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**Abstract:** The Biological Reserve of Una, located in the south of Bahia, is a region with very little information about the composition, diversity and spatial distribution of the species. The objective of the present study was to know the composition and structure of the fish assembly of the streams of Biological Reserve of Una – REBIO. Four samples were taken at seven points distributed in six streams, one being outside the reserve limits, between February 2011 and March 2012. The specimens were captured with trawls of the picaré and puçá type. In the field, the specimens were anesthetized, fixed in 10% formaldehyde and placed in 70% alcohol. The species were identified with specialized bibliography. The specimens that remained in doubt were sent to specialists from the Federal University of Rio Grande do Sul (UFRGS) and Pontifical Catholic University of Rio Grande do Sul (PUCRS) for identification. Then the material was deposited in the scientific collection of the State University of Santa Cruz (UESC). The occurrence constancy index, Shannon Diversity Index, Margalef Wealth and the Pielou Equity index were applied. In the ecological indexes, the ABC curves and the MDS ordering method were calculated. A similarity matrix was calculated from the Bray Curtis index. W statistic consisting of a numerical summary of the ABC curve was applied. The t - test was used to verify the level of significance at 95%. A total of 5549 individuals belonging to 4 orders, 9 families and 22 species were collected, of which 8 had indefinite taxonomic status, which confirms that the region is little explored from the point of view of the ichthyofauna. The results indicate the dominance of opportunistic species and demonstrate the influence of environmental conservation on the composition of the fish congregation. The lack of studies in the region and human occupation reflect the presence of undescribed species and the risk of extinction and the creation of a conservation strategy.

**Keywords:** Ecology, Ichthyofauna, Ecological indexes

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## Introduction

The conservation of terrestrial fauna and flora has been the main justification for the establishment of environmental protection areas in the last three decades in Brazil, and the extreme south of Bahia corresponds to a region of great importance for the conservation of biodiversity and where they are concentrated as the largest Atlantic Forest reserves in the Brazilian Northeast (Sarmiento-Soares *et al.*, 2007).

According to Cetra *et al.* (2010), defining the smallest area that can protect the greatest diversity is a complex challenge that has as a first step to know what species occur in a given region. In Southern Bahia, these authors point out that the information about natural fish populations is incomplete, lacking detailed knowledge about species richness, distribution patterns and population biology.

Recent surveys of freshwater fish in the region resulted in the description of new species, in the identification of endangered species, and the data revealed the presence of endemic species while others had their geographical distribution extended (Cetra and Petrere Jr., 2006; Cetra *et al.*, 2009; Martines-Pinheiro, 2006 a, b). Despite the growing knowledge of the region's richness, it contrasts with information on natural fish populations, such as species, their distribution patterns and their population biology (Cetra *et al.*, 2010). The results also demonstrate the presence of several species to be described (Sarmiento-Soares, 2007).

The region of southern Bahia is known as one that has very little information about the diversity of individuals, organization, composition and spatial distribution of species (Cetra *et al.*, 2009). The small

anthropic alteration on these areas still forested, according to these authors, suggests that their ichthyofaunistic composition is close to the original. According to Rosa and Menezes (1996), fish correspond to more than half of recent vertebrates, which are little considered in regional estimates of biodiversity and conservation.

Fish assemblages in most reservoirs include both native and introduced species in a non-naturally occurring habitat that is subject of fluctuation in depth or other human regulation (Araújo and Santos, 2001). The hydrological wealth in the extreme south of Bahia is contrasting in relation to the little-known fish fauna (Sarmiento-Soares *et al.*, 2007).

In a study carried out for the Una Biological Reserve management plan (MMA, 1997), several specimens of the fauna and flora were verified. No survey of the ichthyofauna of the region was carried out, probably because the species were rare or endemic, being constituted in exemplars of great importance in the elaboration of management plans. According to Thomas *et al.* (1998), the environments that demonstrated a biological richness, related to the significant levels of endemism of fauna and flora and to the high degree of fragmentation of the remaining forest ecosystems, were considered important.

However, it is important to note that in order to reduce the risk of extinction and to note that there is a high risk of extinction (Sarmiento-Soares *et al.*, 2007). Studies in regions that preserve natural features and which have suffered little human interference are important references for public conservation policies and understanding of

the composition and distribution of aquatic communities in intact environments is pressing given the accelerated environmental degradation observed in a number of limnic ecosystems (Duncan and Lockwood, 2001).

The objective of the present study was to characterize the fish assemblage in order to allow the knowledge, composition and structure of the ichthyofauna of REBIO – Una, Brazil.

## **Materials and Methods**

### *Study area*

The Una Biological Reserve (REBIO Una) is an integral protection unit of the World Heritage Site, Atlantic Forest Reserve of the Discovery Coast, and is part of the Mata Atlântica Biosphere Reserve (Fig. 1). It is located to the south of the state of Bahia, distant about 13 km from the seat of the municipality of Una (15° 00' - 15° 15' S and 30° 00' - 30° 15' W) (MMA, 1997). The region presents a warm and humid climate, without a well defined dry season and has typical ecosystems of the Atlantic Forest biome of this stretch of the coast (MMA, 1998).

The hydrography of Rebio-Una is formed by several rivers and streams, the main one being the Serra river, whose headwaters are contained in the reserve, and can be cited as its main tributaries -- the São Caetano stream and the Rosario river. The Serra river is born in the western portion of Rebio-Una and flows into the Maruim river, the region's main watercourse and natural border northwest of the reserve (MMA, 1997).

In these watercourses the sampling points are located: Point 1 - São Caetano stream (39° 03' 36" W - 15° 12' 34" S); Point 2 – Rosário ribeira (39° 04' 24" W - 15° 13' 04" S); Point 3

– Serra river (39° 04' 32" W - 15° 13' 52" S); Point 4 – Maruim river (39° 05' 13" W - 15° 08' 22" S); Point 5 – Miriguim river (39° 08' 08" W - 15° 06' 41" S); Point 6 – Toninho stream (39° 10' 42" W - 15° 07' 17" S) and Point 7 – Maruim river (39° 09' 31" W - 15° 05' 38" S). Unlike the others, section 7 is located outside the reserve limits in a village called Vila Brasil (Fig. 2).

In spite of being considered "restricted", by the categorization of the Conservation Unit, despite the modification of the state of the landscape, which suggests the maintenance of an excellent state of conservation (Souza, 2009). A REBIO – Una suffers the acquisition of land (1976) and as a result the reflection of the invasion of farmers between the period of acquisition and that of the official decree. In this way, the sampling sections are marked by the presence of isolated dwellings, removal of the original vegetation converted to pasture and agricultural activities, and also by the construction of bridges at points 1, 3, 6 and 7. The point 6 has the narrowest channel as a function of the construction of a bridge and point 7 has the widest section.

### *Data Collect*

Our samplings were carried out between February 2011 and March 2012, in each of the seven points of six streams of the Una biological reserve, with trawls of the picaré type (5.5 m long, 1.5 m tall and mesh of 0.5 cm) (Malabarba and Reis, 1987). The specimens were anesthetized, still in the field, by substance MS222 (Ethyl 3-aminobenzoate methanesulfonate salt) at a concentration of 200 mg/L, fixed in 10% formaldehyde and then transferred to 70% alcohol. The species identification was performed with the aid of specialized bibliographical material (Melo et

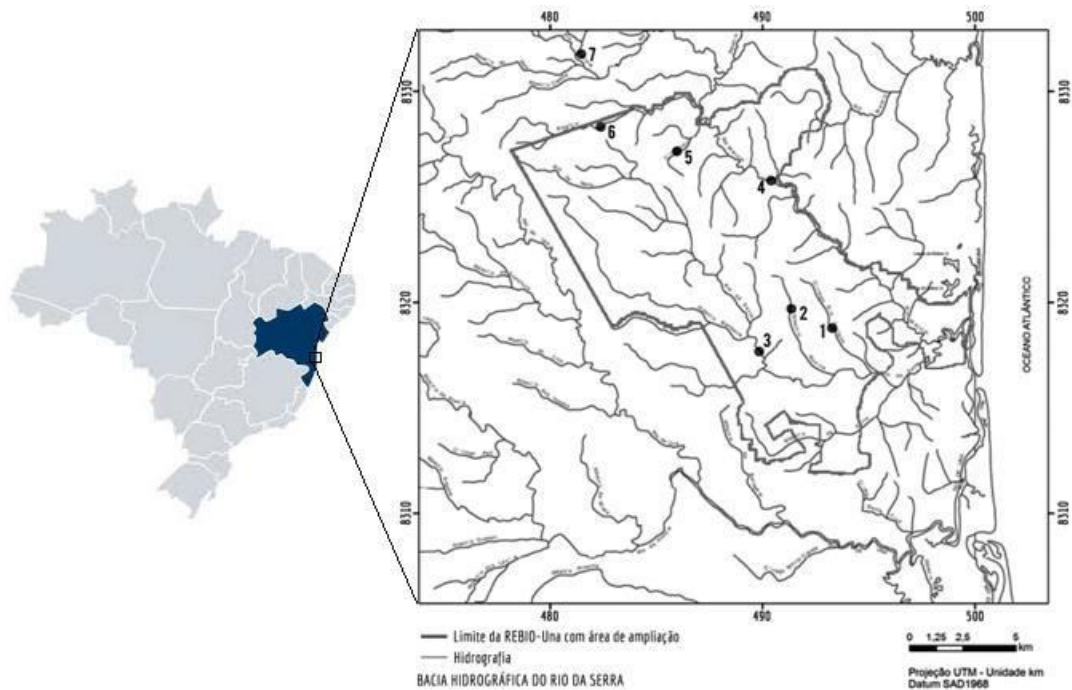


Fig. 1: Map of Brazil, Bahia and UNA Biological Reserve with the location of sampling points. 1 - São Caetano Stream, 2 - Rosario Stream, 3 - Serra river, 4 Maruim river, 5 - Miriguim river, 6 - Toninho Stream and 7 - Maruim river.

*al.*, 2005; Oyakawa *et al.*, 2006; Menezes *et al.*, 2007). The specimens that remained in doubt were sent to specialists from the Federal University of Rio Grande do Sul (UFRGS) and Pontifical Catholic University of Rio Grande do Sul (PUCRS) for identification. Subsequently the specimens were deposited in the scientific collection of the State University of Santa Cruz (UESC).

#### Data analysis

In order to characterize the ichthyofauna, the Constancy index of occurrence was calculated where a species is considered constant when present in more than 50% of the samples, ancillary when present in 25 to 50% of samples and accidental species when present in less than 25% of samples (Dajoz, 1983). Measurements of weight (g) and standard length (cm) were taken individually, by means of analytical balance and digital caliper respectively.

The Shannon Diversity Indexes ( $H' = - \sum p_i \ln p_i$ , where:  $p_i$  = proportion of species to the captured total and  $\ln$  = neperian logarithm), the Margalef Wealth ( $D = (S-1)/\ln S$ ,  $S$  = number of species,  $1 =$  number of individuals and  $\ln =$  neperian logarithm) and the index of Pielou Equability ( $E' = H'/H_{max}$ , where:  $H_{max} = \log S$  and  $S =$  number of species). The t-test was used to verify the level of significance at 95%. These analyses were calculated using the Past 1.11 program.

The ABC (Abundance-Biomass-Curve) curves were calculated in order to verify the relationship between relative abundance in body mass and number of individuals in the different points sampled, along with the W statistic consisting of a numerical summary of the ABC curve. The Multi-Dimensional Scaling (MDS) was applied to identify the groupings between the points. The similarity matrix was calculated from the Bray Curtis index



Fig. 2: Photos of the sampling points in the REBIO – UNA. Point 1 – São Caetano, Point 2 – Rosário ribeira, Point 3 – Serra river, Point 4 – Maruim river, Point 5 – Miriguim river; Point 6 – Toninho stream and Point 7 – Maruim river.

considering the transformation by square root. These tests were performed using Primer 6.0 software.

## Results

### *Composition of the Ichthyofauna*

5549 individuals were captured, distributed in 4 orders, 9 families and 22 species, 8 of them with indefinite taxonomic status (Table 1). The most representative order was Characiformes (83%), followed by Cyprinodontiformes (9%), Perciformes (6%) and Siluriformes (2%). The families that

presented the highest percentage were Characidae (82%), Poeciliidae (9%) and Cichlidae (6%), with 6 remaining families totaling 3%.

The order Characiformes occurs in almost all samples, with 6 genera and 11 species distributed in at least two sampling points, except for *Hoplerythrinus unitaeniatus* (Agassiz, 1829) and *Astyanax* sp., which occurred only at points 4 and 7, respectively.

The specimens of the order Cyprinodontiformes were verified in the 4

Table 1: List of species and numbers of individuals sampled at REBIO – UNA, Bahia, Brazil

ORDER / FAMILY	SPECIES	No. IND.
<b>Characiformes</b>		
Characidae	<i>Astyanax bimaculatus</i> (Linnaeus, 1758)	82
	<i>Astyanax burgerai</i> Zanata & Camelier, 2009	3896
	<i>Astyanax aff fasciatus</i> (Curvier, 1819)	481
	<i>Astyanax</i> sp (Bird e Girard, 1854)	4
	<i>Hyphessobrycon luetkenii</i> (Boulenger, 1887)	84
	<i>Oligossarcus macrocephus</i> (Steindachner, 1877)	16
	<i>Oligosarcus</i> sp (Cuvier, 1829)	9
Crenuchidae	<i>Characidium</i> sp (Reinhardt, 1867)	35
Erythrinidae	<i>Hoplerythrinus unitaeniatus</i> (Agassiz, 1829)	1
	<i>Hoplias malabaricus</i> (Bloch, 1794)	9
	<i>Hoplias</i> sp (Bloch, 1794)	3
<b>Cyprinodontiformes</b>		
Poeciliidae	<i>Poecilia reticulata</i> Peters, 1859	141
	<i>Poecilia vivipara</i> Block & Schneider, 1801	339
<b>Perciformes</b>		
Cichilidae	<i>Geophagus brasiliensis</i> ( Quoy & Gaimard, 1824)	344
	<i>Geophagus</i> sp (Heckel, 1840)	10
Gobiidae	<i>Awaous tayasica</i> Lichtenstein, 1822	3
<b>Siluriformes</b>		
Callichthidae	<i>Scleromystax lacerdai</i> (Hieronimus, 1995 )	3
	<i>Callichthys callichthys</i> (Linnaeus, 1758)	1
Loricaridae	<i>Aspidoras</i> sp ( Nijssen & Isbrücker, 1976)	8
	<i>Pareiorhaphis bahianus</i> (Gosline, 1947)	76
	<i>Rineloricaria</i> sp (Kner, 1853)	1
Pimelodidae	<i>Rhamdia</i> sp (Humboldt, 1821)	3

samplings, represented by only one genus and two species, *Poecilia vivipara* (Block and Schneider, 1801) and *Poecilia reticulata* (Peters, 1859), both exotic. No records of individuals of these species were found for points 1, 2 and 3.

The order Perciformes was represented by only 2 genera and 3 species: *Awaous tajasica* (Lichtenstein, 1822), *Geophagus* sp (Heckel, 1840) and *Geophagus brasiliensis* (Quoy and Gaimard, 1824), the latter being recorded at all sampling points.

The order Siluriformes represented 6 genera and 6 species, generally found in environments with rocky bottom and little current. Most of the individuals were verified at point 7, where the *Pareiorhaphis bahianus* (Gosline, 1947) species presented 95% of the records at this place, with no records of individuals of this order at points 3 and 4.

*Astyanax burgerai* (Zanata and Camelier, 2009) was the most abundant, accounting for 70% of the total number of individuals followed by the *Astyanax* aff. *fasciatus* (Curvier, 1819), with 9%, *Geophagus brasiliensis* (Quoy and Gaimard, 1824) (6%), *Poecilia vivipara* (Bloch and Schneider, 1801) (6%) and *Poecilia reticulata* (Peters, 1859) (3%), while the other species had values lower than 3% each. The species *Poecilia vivipara* and *Poecilia reticulata*, considered exotic, represented 8.6% of the individuals collected.

Only species *G. brasiliensis* and *A. burgerai* were considered constant, both dominant at most points, while 6 species were considered as accessory: *A. bimaculatus*, *A. aff. fasciatus*, *Oligosarcus macrocephalus* (Steindachner, 1877), *P. reticulata*, *P. vivipara* and *Characidium* sp. The remaining 13 species were considered to

be accidental, such as *Astyanax* sp., *H. unitaeniatus*, *Scleromystax lacerdai* (Hieronimus, 1995), *Callichthys callichthys* (Linnaeus, 1758) and *Rineloricaria* sp., each occurring in only one stream.

The total biomass collected was 6.3 kg, with *A. burgerai* accounting for 52.7% of this value. The highest weights were of the species *Rhamdia* sp. (82.8 g), *Hoplias* sp. (53.4 g) and *H. malabaricus* (46.49 g) and the lowest weights were *Aspidoras* sp. (0.13 g) and *Characidium* sp. (0.15 g). The species with the highest standard length *Rhamdia* sp (18 cm) and the lowest in the species *Poecilia reticulata*, (1 cm).

#### *Ecological indices*

The diversity ranged from 0.05 at point 2 in the second collection to 1.58 at point 7 of the third collection. Point 7 was the one that maintained the highest values of diversity throughout the sampling period, and only at this point were the species *Astyanax* sp and *Rineloricaria* sp. Of the total sampled species, 43% of the individuals observed were collected at point 2 during the second sampling, and 99.2% of them were represented by a single species (*A. burgerai*).

The highest value of richness index was verified at point 7 (1,84) in the third sample, where 97 individuals were observed from 7 species. The lowest value was verified at point 6 (0.36) in the first collection, where 276 individuals were distributed in 3 species: *G. brasiliensis*, *A. burgerai* and *P. reticulata*.

The equability was lower at point 2 (0.07) during the third collection, where *A. burgerai* represented 98% of individuals and higher at point 3 (0.95) during the first collection, where *Characidium* sp. (n=1), *Geophagus* sp.

(n= 2) and *O. macrocephis* (n= 1) were recorded. There was no statistically significant difference between the points sampled ( $P < 0.05$ ) for any of the indices during the study period.

The W statistic for the relation between biomass and abundance indicated that species dominance is higher in number of individuals than in body mass. The curves showed two configurations, one for points 1, 2, 3, 4, 5 and 7, where the abundance was above the biomass ( $w < 0$ ) and another for the point 6 ( $w > 0$ ) where the biomass curve above the abundance curve. At this point the biomass is dominated by a small number of individuals that present greater body weight as is the case of *H. malabaricus* and *Hoplias* sp. (Fig. 3).

It was verified through the MDS analysis a greater abundance at points 1, 2 and 3 and at point 6 a greater biomass check. At points 4, 6 and 7 there was a certain equivalence between the two items. It was possible to verify that at point 7 this equivalence was more intense. MDS analysis also showed a greater proximity between points 5 and 7 and greater spatial distance between points 2 and 7, but the formation of clusters was not evidenced. The circles projected in the graph demonstrate that the species *A. burgerai* presented the lowest occurrence at points 5 and 7 and higher occurrence at point 2 (Fig. 4).

## Discussion

The neotropical region contains the largest diversity of freshwater fish in the world (Malabarba, 1998). In this area, the most representative orders and most of the specimens of this group can be observed. In southern Bahia, according to Menezes (1997), there is a marked endemism in the coastal

drainage region from Rio de Janeiro to southern Bahia, which can be exemplified by the species with exclusive distribution and the possibility of affirming that the area has a distinct faunal composition. Sarmiento-Soares *et al.* (2006) pointed out that the species *Trichomycterus pradensis* and *Microglanis patoxo* presented endemism in the basins of the extreme south of Bahia.

Despite the increase in the number of works carried out in the region, it is evident that species description studies are needed, since many have not yet been cataloged. Most of the species initially recorded are classified as indefinite taxonomic status. When collecting different species, Cetra *et al.* (2009, 2010) observed a large number of species with indefinite taxonomic status, due to the fact that they are insufficiently known in the studied areas, but are of probable biological importance and that they may represent new species, which reveals the need for new surveys in the region. According to Menezes *et al.* (2007), the small size of specimens of the species refer to the occupation of microenvironments by these small organisms and the possibility of them completing the life cycle in restricted geographical areas, suggesting endemism.

Situations such as this demonstrate the necessity of carrying out more detailed taxonomic studies on these specimens, so that they are precisely identified or described as new species. The results agree with the proposition that there is a lack of information about the region's ichthyofauna (Sarmiento-Soares *et al.*, 2007; Cetra *et al.*, 2010) and indicates the importance of conservation of this environment due to the risk of some species being extinct before being described.

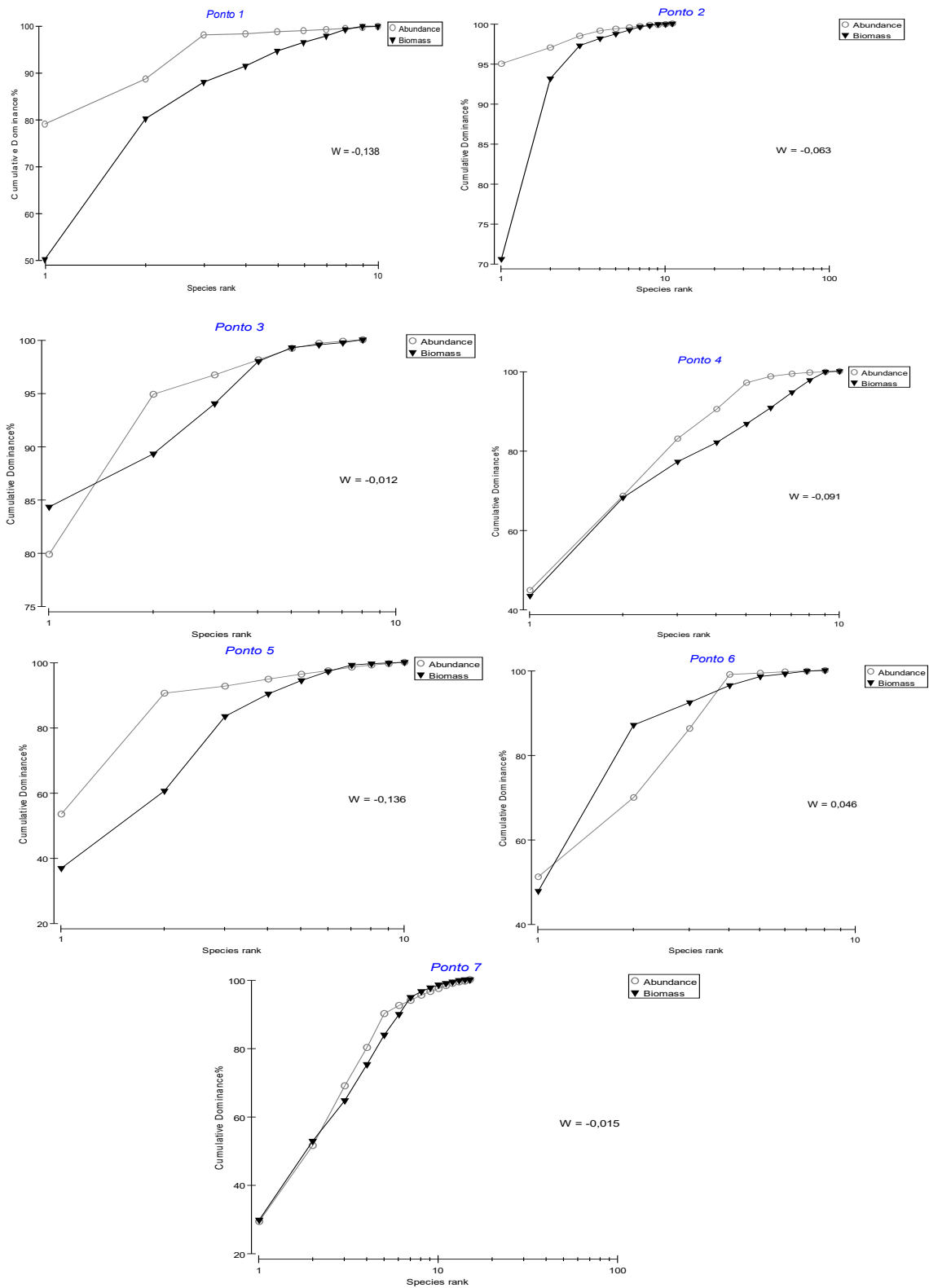


Fig. 3: ABC curves for each of the sample points. Abundance and Biomass. Point 1 – São Caetano, Point 2 – Rosário ribeira, Point 3 – Serra river, Point 4 – Maruim river, Point 5 – Mirigum river; Point 6 – Toninho stream and Point 7 – Maruim river.

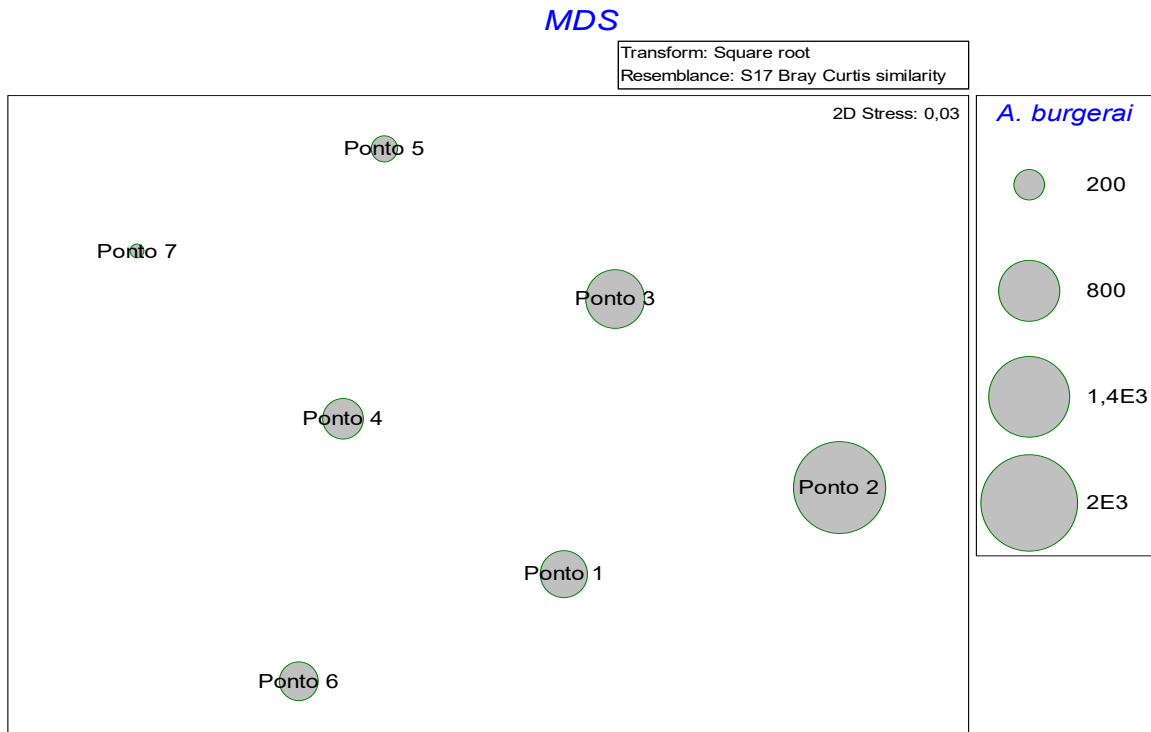


Fig. 4: MDS cluster analysis, gray the projection of the numerically dominant taxon. Point 1 – São Caetano, Point 2 – Rosário ribeira, Point 3 – Serra river, Point 4 – Maruim river, Point 5 – Miriguim river; Point 6 – Toninho stream and Point 7 – Maruim river.

Still few works were done in the region, and the articles by Cotes *et al.* (2007), Amorim *et al.* (2009), Cotes and Morel (2011), Aguiar *et al.* (2012) and Sollberg *et al.* (2014) have not used Ichthyofauna as an object of study in order to evaluate its composition and structure. In this context, few studies exist in which aquatic environments and organisms have been taken into account in the delimitation of these protected areas (Cetra *et al.*, 2010). No ichthyological study was carried out for Biological Reserve of Una, even though it has been more than thirty years since its creation (Teodosio, 2012).

In the Una Ecological Reserve, REBIO - Una, 4 of the 18 orders of freshwater fish occurring in Brazil were registered, with the highest percentage of individuals represented by Characiformes, which corroborates the

pattern described by Lowe-McConnell (1999), for non-estuarine rivers and streams of the neotropical region. In this work, the largest number of species of the Characidae family was observed, and the species that presented the most frequent sampling was *Astyanax burgerai* (Zanata and Camelier, 2009). The result observed in this study is in agreement with Reis *et al.* (2003), who analyzed similar samples from the South and Central America.

The species *A. burgerai* with *G. brasiliensis* stands out for its consistency in the samplings. The *Astyanax* genus, with about 100 species described, is one of the most common in the Neotropical basins and its high occurrence of individuals for the region has been portrayed in several studies (Sarmiento-Soares *et al.*, 2007; Cetra *et al.*, 2009). Garutti and Britski (2000) reported that the distribution of

*Astyanax* in the most diverse habitats in the Brazilian watersheds may be related to its trophic plasticity. Specimens of this genus can also perform larger displacements, overcoming obstacles and may occupy several stretches of the basin (Aquino, 2009).

This set of information can also apply to the occurrence of *G. brasiliensis* in all the stretches, since it is an opportunistic species that has its diet influenced by the availability of resources in the environment (Teixeira *et al.*, 2005). According to Aquino (2009), the small size of the streams and the irregularity of the stretches are factors that favor the occurrence of species characterized by plasticity and resistance to abiotic variations.

The substrate influences diversity by limiting the presence of species in a given habitat (Araújo, 2001). Thus, the absence of siluriformes at points 3 and 4 may be associated with the presence of the sandy substrate. Guimarães *et al.* (2010) observed an association between the decrease in the number of individuals of this order and the gradual reduction of the granulometry of the substrate. It was verified at point 7 having a greater abundance of the loricarídeos, rocky place and of strong current. The results were corroborated by the studies of Melo *et al.* (2005). The occurrence of similar data can be explained by the food strategy of these species, since they are based on rocks and feed on microorganisms adhered to the substrate (Casatti, 2002).

This point, being located outside the reserve area, is the most anthropized place, thus being subject to the presence of several environmental stressors. These types of factors compromise the survival of various organisms. Deforestation intensifies the

loading of light particles, making it difficult to establish structurally more complex substratum-dependent photosynthetic organisms and, consequently, affects allochthonous and autochthonous production (Ferreira and Cassati, 2006). The presence of these characteristics alters the diversity of both fish and food resources, directly or indirectly compromising the food chain (Gomiero and Braga, 2005). Harding *et al.* (1998) argue that the maintenance of aquatic diversity may require the conservation of most or all of the river basin. Thus, the preservation of its natural characteristics and the promotion of restoration of degraded riparian areas adjacent to the reserve is essential for the maintenance of the high diversity of species in its rivers.

On the other hand, some species favored the situation observed at the points. The fact that the species *H. unitaeniatus* is recorded only at point 4, a section of retention and with pasture, can be explained by its capacity of resistance to the abiotic variations, since, in this section, changes such as water level or temperature in a short period cause drastic changes, providing a new environment. This result may indicate that, in this environment, *H. unitaeniatus* finds favorable conditions for its survival. Similar results were reported by Polez *et al.* (2003) and Leal *et al.* (2010), who verified the establishment of the species in places with high temperatures and that this species presents morphological adaptations that guarantee the capacity to survive long periods of hypoxia. Teodosio (2012) observed that this is the most visibly modified point and that it presented the highest percentage of exotic species.

The transformation of riparian forests into pastures influences the increase of the light

incidence, decreasing the oxygen of the water and may lead to the death of certain individuals and to benefit others such as the *Poecilia* genus (Vieira and Shibatta, 2007). The highest occurrence of these species in pasture stretches resembles the results found by Sarmiento-Soares (2007) who found dominance of these individuals in areas where marginal vegetation was replaced.

Species *P. vivipara* and *P. reticulata* were considered as exotic species. These species are widely known for their ability to tolerate altered environments, occurring in places where a large number of species have limited distribution and dominate the environment in relation to native species. This fact, together with its reproductive adaptations with relative independence of the environmental variations, can favor its high number (Aranha and Caramaschi, 1999; Araújo *et al.*, 2003; Teixeira *et al.*, 2005). The presence of these species may pose a threat to the conservation of native ichthyofauna.

It is possible to consider that the low diversity and equability at point 2 are related to the abundance of *A. burgerai*. Araújo *et al.* (2007) related the occurrence of low values of these indices with the changes caused by anthropic activities and the resistance of the species. According to Tereza and Casatti (2010), the presence of opportunistic species is favored by the absence of riparian forest.

At point 6, the presence of only 3 species in the first sampling contributed to the lower found richness and probably is related to the present environmental changes, that is to say, habitat characteristics such as narrowing of the channel and human activity that strongly influenced the total number of individuals and the number of species (Melo *et al.*, 2003).

On the other hand, the highest values of richness and diversity found at point 7 may be related to the fact that this part of the river had a larger area compared to other regions of the river itself and to other streams. Some authors associate the highest values of these indices to the width of the stretch, which may increase habitat heterogeneity and consequently greater shelter availability for different species (Castro *et al.*, 2003; Araújo *et al.*, 2007). These values are also favored by the presence of accidental species in the collections, as is the case of *Astyanax* sp. and *Rineloricaria* sp. The greater equability at point 3 may have been influenced by the absence of dominant species in this sampling, that is, the individuals distribute more homogeneously within the present species.

Although there was no statistically significant difference between the indices during the sampling, the results allowed to affirm that the presence of opportunistic species is probably associated with the lowest observed values, while the occurrence of accidental species was related to the verification of the highest values.

The relationship between abundance and biomass represented a slight numerical dominance of abundance and lower biomass for most points. At point 7, the result found in the ABC curve showed that there was a certain equilibrium between the two indexes, which shows that at this point a better environmental quality due to not having the advantage of one item in relation to the other.

This result was influenced by the high presence of smaller species, as is the case of the representatives of the genera *Astyanax* and *Poecilia*. The opportunistic character favors the dominance of these species with the

increase of disturbances, where species of slow growth can not follow (Gonçalves and Braga, 2008), that is, in disturbed environments the assembly is composed of few small species that dominate in terms of abundance. At point 6, the main reason for the positive result of the curves was the occurrence of species such as *H. malabaricus* and *Hoplias* sp. which represented little of the total abundance, but much in the body mass contribution, so when graphically represented the biomass curve overlaps with that of abundance. The low indexes verified, together with the negative values obtained by the W statistic in most of the sections, suggest a situation of environmental disturbance that can have as main stimulator the human occupation.

These results are complementary to those of the MDS statistics, whose absence of well defined groupings shows that there is no disparity in species composition between the points. Felipe and Suárez (2010) reported that homogenization occurs when there is a decline in environmental quality, since this condition increases the abundance of tolerant species. The result reflects an assemblage with high frequency of dominant species, being *A. burgerai* the species that contributes most to this effect.

One of the main problems of the Conservation Unit concerns land issues that have not yet been regularized, which explains the areas presenting vegetation in different stages of succession and the forms of land use and occupation (Casatti *et al.*, 2009). In addition, the use of bioenergetic techniques to reduce the number of native vegetation losses, or permanent preservation areas or legal reserves, may lead to reduced fish biomass,

loss of more sensitive species and higher chances of biotic homogenization.

Knowledge of ichthyofauna is the first step in the development of monitoring programs. This study suggests that REBIO - Una fish populations are influenced by the physical structure of the habitat, which is reflected in the composition of Ichthyofauna, structure in terms of abundance and biomass, and diversity. It also shows the need for more in-depth studies in view of the strength that anthropic activities exert on the diversity of species studied.

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