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## Scientific Note

# Fish diversity loss in an urban stream of Uruguay throughout the last century

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**Abstract**. The urban and industrial expansion of the twentieth century had great impact on the Miguelete stream (Montevideo, Uruguay). In this paper we document the loss of fish species using the national scientific collections as a source of information.

**Keywords:** fish, richness, Miguelete, Montevideo-Uruguay, scientific collections

**Resumen. Pérdida de diversidad de peces en un arroyo urbano de Uruguay durante el último siglo.** El arroyo Miguelete (Montevideo, Uruguay), sufrió un gran impacto sobre su cuenca en la expansión urbana e industrial del siglo XX. En este trabajo documentamos la pérdida de especies de peces usando las colecciones científicas nacionales como fuente de información.

**Palabras clave:** peces, riqueza, Miguelete, Montevideo-Uruguay, colecciones científicas

The Miguelete stream is located in southern Uruguay. It runs from north to south, from Cuchilla Pereira to the Montevideo Bay in the Río de la Plata, crossing Montevideo, the capital city and the most densely populated area of the country. Its watershed has an area of 113 km$^2$, comprising important urban, rural and industrial areas (Figure 1). The basin has been affected by the urban development of Montevideo for more than a century. For this reason, this water course has suffered substantial modifications in most of its riparian zone, the stream channel, and the associated fauna and flora. The first historical factor that modified the banks of the basin was deforestation for firewood, which begun in the early times of the Spanish colony (Intendencia Municipal de Montevideo 2004, Gautreau 2006). Since the decade of 1930, the basin has been used as a development center of industry; primarily for the meat industry until the 1970's, and later for the tannery industry, among others. This industrialization and the rapid expansion of urbanization are the factors that caused the heavy environmental degradation reflected on the low quality of waters occurring at the present time due to the effluents of untreated wastewaters and multiple industrial discharges (Muniz *et al*. 2002, Intendencia Municipal de Montevideo 2004, Muniz *et al*. 2004). Furthermore, in the 1940's, the lower section of the stream suffered the canalization of the main channel which included the construction of a dam close to the mouth of the stream to prevent water from the estuary to go upstream in storm events (Intendencia Municipal de Montevideo 2004, Gautreau 2006). These perturbations had a clear impact on communities of fishes and other taxa by modifying water quality and habitat diversity, factors that are of substantial relevance in species distribution and organization on fluvial systems (Dyer *et al*. 1998,

Karr & Chu 2000). In the present work, we document a shift in the fish community trophic structure and richness loss throughout the last century, based on collections records.

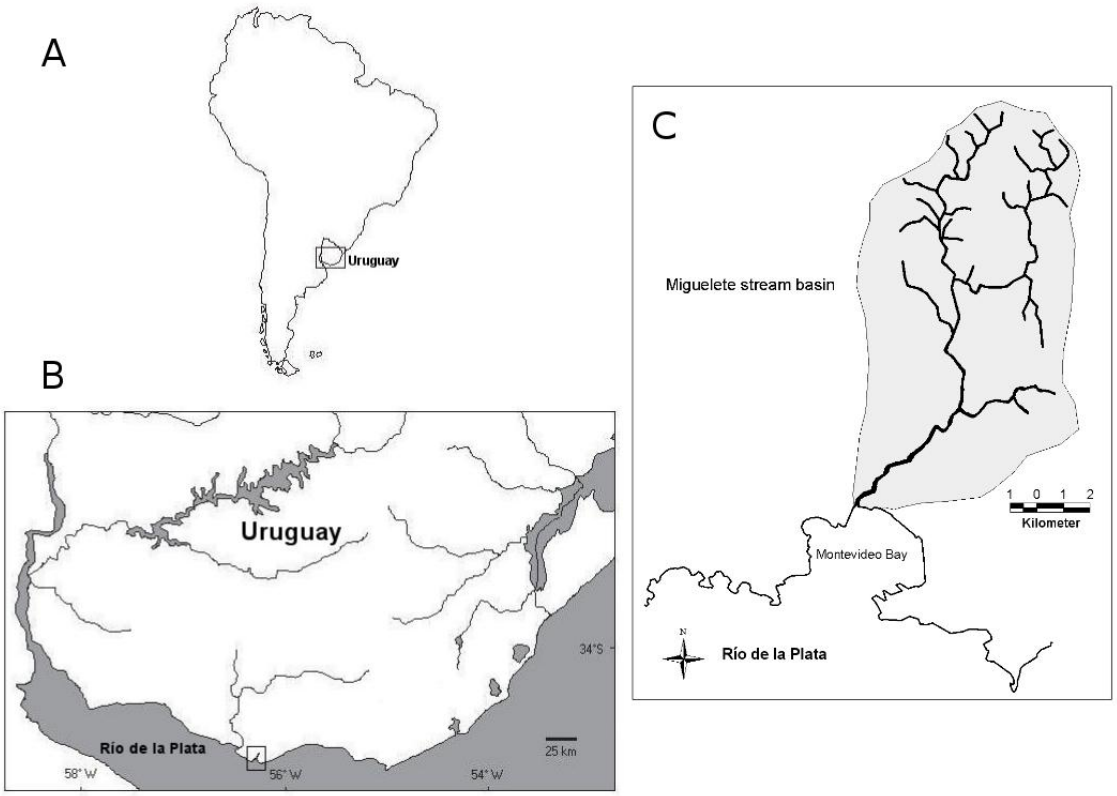


**Figure 1.** Map of studied site: A- South America; B- location of Uruguay and C- Coast of Uruguay and the location of Miguelete stream basin and the Montevideo Bay

This study is based on the records of the two collections of fishes in Uruguay: Museo Nacional de Historia Natural (MNHN) and the collection of Vertebrates of the Facultad de Ciencias (ZVCP), plus a bibliographic revision. The collection of the museum has records as old as 1890; these collects were made mainly by the Austrian naturalist Karl Berg who was hired to build the collection of fishes of the museum. We identified the species with updated taxonomic keys and classified according to the criteria of trophic groups from Teixeira-de Mello *et al*. (2009) and Ringuelet (1975); fishes were classified as omnivorous (i.e. feeding on both primary producers and animals), benthivorous (i.e. sediment dwellers and/or feeding on macroinvertebrates), herbivorous (i.e. feeding on plants, periphyton or phytoplankton), planktivorous (i.e. feeding on zooplankton) and piscivorous (i.e. feeding on fish), and identified also the potentially piscivorous species (i.e. those whose adults feed on fish regardless of the feeding habits of the juveniles).

Table I shows the species reported for the Miguelete basin and the functional groups assigned to them. Despite that museum records do not necessarily come from a single sample or an standardized sampling design, they show important information about the species present in the stream in the period previous to the 1930's. At this time period the basin had an important species diversity (11 species registered) and high diversity of functional groups (from omnivores to piscivores). All species found are those typical of tributaries of the Rio de la Plata estuary. Furthermore, the main taxonomic groups of the region are represented: Characiformes, Siluriformes, and Perciformes, including big-sized species like *Pimelodus maculatus* and *Luciopimelodus pati*. The species documented after the 1930's show a very different scenario. Recent records come from lots collected in a technical study developed in the stream where its basin was sampled exhaustively and systematically (Mazzeo *et al*. 1997). The information obtained

showed a drastic reduction in diversity when compared to data from the early decades of the twentieth century, with only tree species collected: *Cheirodon interruptus, Corydoras paleatus* (both only upstream), and *Cnesterodon decemmaculatus*. These species are omnivores of small size. Furthermore, *C. paleatus* and *C. decemmaculatus* have been classified as urban-industrial pollution tolerant species (Teixeira-de Mello, 2007). Given the fact that old museum records mostly do not come from systematic samplings, we expect that species richness before 1930 has been highly underestimated. In a recent study of an adjacent basin (Colorado stream) with similar land use (urbanization, industry and agriculture) and area, but with less years of industrial activities, Teixeira-de Mello (2007) found 28 fish species. This indicates that the richness loss in the Miguelete streams may be much stronger than here suggested.

**Table I.** Species reported for the Miguelete stream, with the assignation of trophic group and habit. The data from before and after 1930 is shown separately. (*) Indicates potential piscivore.

| | Order | Species | Trophic group | Year |
|---|---|---|---|---|
| **Before 1930** | | | | |
| | Characiformes | *Oligosarcus jenynsii** | Omnivore–benthivorous | 1890 |
| | | *Oligosarcus oligolepis** | Omnivore–benthivorous | 1890 |
| | | *Pseudocorynopoma doriae* | Omnivore–benthi–planktivorous | 1890 |
| | | *Astyanax cf. fasciatus* | Omnivore–benthi–planktivorous | 1892 |
| | Siluriformes | *Corydoras paleatus* | Benthi–planktivorous | 1890 |
| | | *Pimelodella australis* | Benthi–herbivorous | 1890 |
| | | *Pimelodus maculatus* | Omnivore–benthivorous | 1890 |
| | | *Heptapterus mustelinus* | Omnivore–benthivorous | 1893 |
| | | *Luciopimelodus pati* | Omnivore–benthi–piscivorous | 1893 |
| | | *Rhamdia quelen** | Omnivore–benthivorous | 1890 |
| | Perciformes | *Crenicichla scottii* | Omnivore–benthi–piscivorous | 1923 |
| **Total** | 3 | 11 | 5 | |
| **After 1930** | | | | |
| | Characiformes | *Cheirodon interruptus* | Omnivore–benthi–planktivorous | 1997 |
| | Siluriformes | *Corydoras paleatus* | Benthi–planktivorous | 1997 |
| | Cyprinodontiformes | *Cnesterodon decemmaculatus* | Omnivore–benthi–planktivorous | 1997 |
| **Total** | 3 | 3 | 3 | |

This study evidences the rapid degradation suffered by a fluvial system subjected to anthropic activity. In the course of 50 years we have witnessed marked effects in the basin and have assisted to the loss of the majority of the species and functional groups that once occurred therein. In recent years, an environmental quality restoration plan for the Miguelete stream basin has begun by initiative of the local government (Intendencia Municipal de Montevideo, 2004). In this context, the dam located at the mouth of the stream is a relevant factor that hinders the recolonization of the basin by freshwater fishes. Additionally, if it is considered that the Montevideo bay is highly polluted (Danulat *et al*.

2002, Muniz *et al*. 2002, 2004), the chance of migration from adjacent basins is very scarce. In the present time there is an important interest of the local government of Montevideo to improve the quality of the basin and this study could be relevant for the development of a baseline for the system's management.

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## APPENDIX

Museum records species analyzed. ZVC-P: Fish Collection, Facultad de Ciencias, Universidad de la Republica, Montevideo, Uruguay and MNHN: Museo Nacional de Historia Natural, Montevideo, Uruguay.

***Oligosarcus oligolepis**:* MNHN 02, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. C. Berg, X/1890. ***Oligosarcus jenynsii**:* MNHN 15, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. C. Berg, IX/1890; MNHN 13, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. C. Berg, IX/1890. ***Cheirodon interruptus:*** ZVC-P 4201, Arroyo Miguelete, cruce con calle Osvaldo Rodriguez, Dpto. Montevideo, Uruguay, Col. M. Loureiro y F. Scasso, 21/IV/1997. ***Astyanax af fasciatus:*** MNHN 25, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. G.J. Devincenzi, XII/1890; ***Rhamdia quelem:*** MNHN 7, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. C. Berg, VII/1890. ***Pimelodella australis:*** MNHN 12, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. C. Berg, IX/1890. ***Corydoras paleatus:*** MNHN 14, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. G.J. Devincenzi, IX/1890; ZVC-P 4199, Arroyo Miguelete, cruce con calle Osvaldo Rodriguez, Dpto. Montevideo, Uruguay, Col. M. Loureiro y F. Scasso, 21/IV/1997. ***Pimelodus maculatus:*** MNHN 18, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. C. Berg , X/1890. ***Pseudocorynopoma doriae:*** MNHN 22, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. G.J. Devincenzi, XI/1890; MNHN 23, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. C. Berg, XI/1890. ***Heptapterus mustelinus:*** MNHN 37, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. C. Berg , 1893. ***Luciopimelodus pati:*** MNHN 3140, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. C. Berg , 1893. ***Cnesterodon decemmaculatus:*** ZVC-P 4200, Arroyo Miguelete, cruce con calle Osvaldo Rodriguez, Dpto. Montevideo, Uruguay, Col. M. Loureiro y F. Scasso, 21/IV/1997.***Crenicichla scotii:*** MNHN 250, Arroyo Miguelete, Dpto. Montevideo, Uruguay, Col. L.P. Barattini, 1923.