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Discovery of the Critically Endangered annual killifish *Austrolebias wolterstorffi* (Ahl, 1924) (Cyprinodontiformes: Rivulidae) in Lagoa do Peixe National Park, Rio Grande do Sul, southern Brazil

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Abstract: This paper documents the discovery of the rare and Critically Endangered annual killifish *Austrolebias wolterstorffi* in temporary wetland of Lagoa do Peixe National Park, an important conservation unit of southern Brazil protected under the Ramsar Convention and recognized Biosphere Reserve.

Keywords: Annual fish, Cynolebiasinae, endemic, freshwater, Neotropics, protected areas, Ramsar sites, restricted-range fishes, threatened species, wetlands.

The neotropical aplocheiloid genus *Austrolebias* Costa comprises 40 small annual killifishes endemic to South America, distributed in southern Brazil, southern Bolivia, Paraguay, Uruguay and northeastern Argentina (Costa 2010). Their highest diversity occurs in Uruguay and southern Brazil, where several distinct species may be found sympatric or syntopic. *Austrolebias* populations live in shallow temporary wetlands formed close to rivers, streams and lagoons during the rainy season, and die off when the pools dry (Costa 2003, 2006). Their eggs survive the dry season and hatch after the next rainy season begins.

The genus *Austrolebias* has recently been redefined phylogenetically by Costa (2006), including the species previously referred to the genus *Megalebias* Costa. Subsequently the genus *Austrolebias* was divided into subgenera (Costa 2008), according to clades defined in Costa (2006). Accordingly the subgenus *Megalebias* which has the same general geographic range as *Austrolebias*, comprises five valid species: *Austrolebias cheradophilus* (Vaz-Ferreira, Sierra de Soriano & Scaglia-de-Paulete, 1964), *Austrolebias elongatus* (Steindachner, 1881), *Austrolebias monstrosus* (Huber, 1995), *Austrolebias prognathus* (Amato, 1986), and *Austrolebias wolterstorffi* (Ahl, 1922). They can reach a large size (about 70-120 mm SL), making some the largest among the family Rivulidae (Costa 1998, 2001). These large species are generally rarer than smaller species that are often abundant in their habitats (Costa 2009), probably due to increased energy demand as a function of larger body size (Laufer et al. 2009; Arim et al. 2010).

Austrolebias wolterstorffi (Image 1) the type-species of the *Megalebias* subgenus is a medium size species (compared with other species of rivulid fishes) reaching about 78mm, endemic to the Laguna dos Patos hydrographic system and adjacent coastal drainages in southern Brazil and eastern Uruguay. The species feeds mainly on mollusks and is the most specialized of the moluscivorous *Austrolebias* (Costa 2009). *Austrolebias wolterstorffi* is considered Critically Endangered by the red books of threatened fauna of Rio Grande do Sul State (Reis et al. 2003) and Brazil (Rosa & Lima 2008), due to the extensive alteration and loss of wetlands in that region, through anthropogenic activities, especially agriculture. The species is considered vulnerable to developments of forestation with exotic species (e.g. *Eucalyptus*, *Acacia* and *Pinus*) (ZAS 2007).

According to previous studies the record of *A. wolterstorffi* closest to the Lagoa do Peixe National Park

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Image 1. *Austrolebias wolterstorffi* (46.35 SL; MCP 44520) collected from Lagoa do Peixe National Park (LPNP).

was for the São Caetano locality, more than 100km of protected area (see the map in Costa 2006). This paper documents the discovery of the species in Lagoa do Peixe National Park and presents recommendations for its conservation in southern Brazil.

Material examined: A female (46.35 SL) was captured on 28 June 2008 in shallow (33.17 ± 5.16 cm depth) palustrine temporary wetland, 31^{0}06'55"S & 50^{0}50'57"W (Image 2), during a field trip of a research project conducted by the Laboratory of Ecology and Conservation of Aquatic Ecosystems, University of Vale do Rio dos Sinos (UNISINOS). The purpose of the project was to establish the diversity and distribution of annual fishes in Lagoa do Peixe National Park (Fig. 1). Water samples revealed the following parameters: pH: 6.52 ± 0.1; dissolved oxygen: 9.36 ± 0.91 mg/l; conductivity: 41.17 ± 10.83 mS; and water temperature: 15.69 ± 0.38 ^{0}C. The specimen collected by hand net (D-shaped, 30cm width) was euthanized with a lethal dose of phenoxyethanol, fixed in situ with 10% formalin and later transferred to 70% ethanol. Measurements were made with an electronic digital caliper reading to the nearest 0.01mm, and material was vouchered in collections of fishes of Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP 44520). The material was identified based on Costa (2006).

Diagnosis: According to Costa (2006), *A. wolterstorffi* is distinguished from the remaining species of the *Megalebias* subgenus by having fewer scales in longitudinal (31-35 vs. 50-75), minute contact organs on uppermost pectoral-fin ray in males (prominent contact organs on most pectoral-fin rays), and a greater number of branchiostegal rays (7 vs. 6).

Austrolebias wolterstorffi is considered a restricted-range fish (Nogueira et al. 2010), and there are only two previous records of the occurrence of the species in protected areas of Brazil, both in Rio Grande do Sul state: Delta do Jacuí State Park (Reis et al. 2003) and Private Natural Heritage Reserve of Pontal da Barra (Volcan et al. 2009). Although these populations are theoretically protected, these areas have many conflicts of land use, and growing urbanization threatens the habitats of vulnerable species. Despite presenting a relatively wide area of distribution along the Coastal Plain of Laguna dos Patos hydrographic system (Costa 2006), records of *A. wolterstorffi* in the northern portion of the system, where the species has more representation in ichthyological collections are increasingly rare (Reis et al. 2003). In the south of the Laguna dos Patos, Lanés et al. (2005) documented the occurrence of *A. wolterstorffi* in a private area of municipality of Pelotas, near to Pontal da Barra swamp, and Porciúncula et al. (2006) and Quintela et al. (2007) recorded the species in coastal adjacent drainage to this hydrographic system in Rio Grande municipality, an important wetland located in the industrial district of this city.

The Lagoa do Peixe National Park (LPNP) is the only conservation unit in southern Brazil protected under the Ramsar Convention. The LPNP presents a variety of continental, estuarine and marine wetlands, ensuring the survival of a wide variety of species of several groups

Image 2. Occurence site of *Austrolebias wolterstorffi* in Lagoa do Peixe National Park.

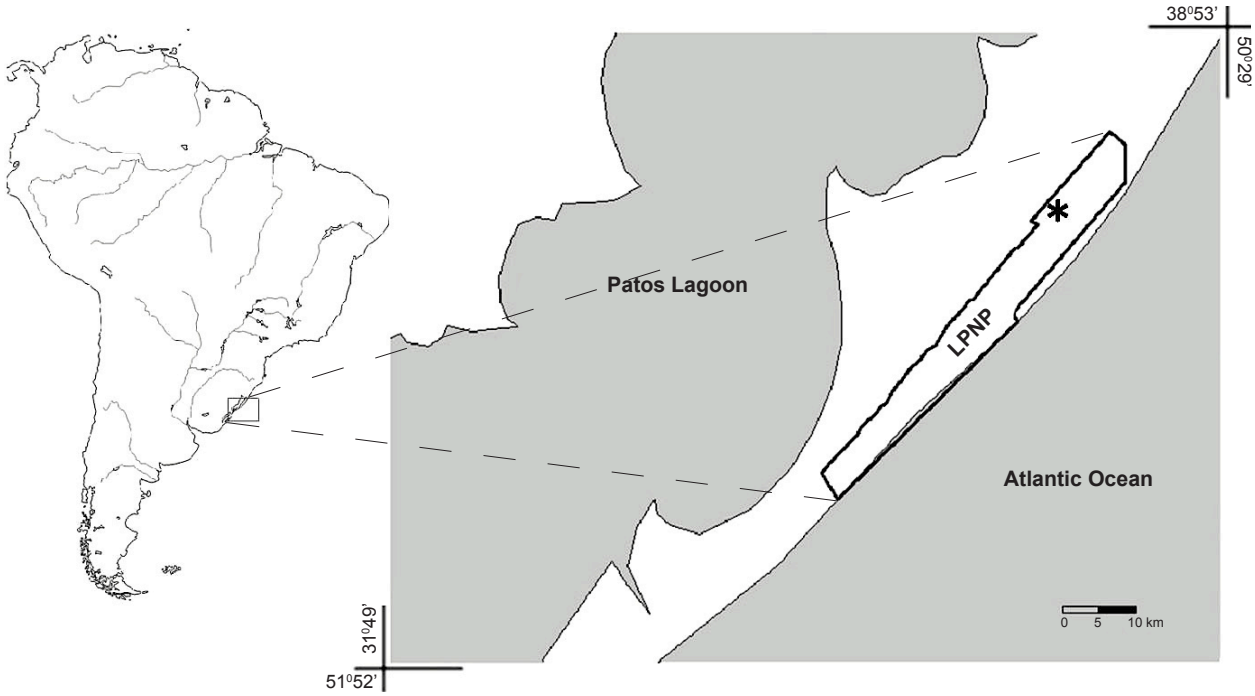

Figure 1. Map showing the present record of *Austrolebias wolterstorffi* in Lagoa do Peixe National Park, Rio Grande do Sul, southern Brazil.

of organisms. Is recognized Biosphere Reserve and integrates various networks for the protection of waterfowl in the world, such as the Western Hemisphere Shorebird Network. Although several surveys of fish fauna in the area of the park have been made, only recently has killifish diversity has been revealed. Costa & Lanés (2009) describe *Rivulus riograndensis* a freshwater non-annual killifish whose type-locality is Pai João swamp in Lagoa do Peixe National Park, and Correa et al. (2009) documented the occurrence of *Austrolebias minuano* Costa & Cheffe, 2001 in park area, a species endemic to southern Brazil and threatened in the category "endangered" (Reis et al. 2003; Rosa & Lima 2008).

Based on the recent records of endangered killifishes, Lagoa do Peixe National Park, traditionally recognized for its biodiversity related to marine and estuarine ecosystems, is recognized now for its importance in the conservation of these endangered species that present restricted distribution and are exclusive of continental wetlands. These are the most threatened ecosystems in southern Brazil, and studies suggest that over 90% of natural wetlands have been lost (Rolon et al. 2008; Maltchik 2010), especially due to drainage for irrigated rice production (Fontana el al. 2003).

Although the record of *A. wolterstorffi* for LPNP is important, it is required for their conservation and that wetlands of southern Brazil be preserved from agriculture and exotic forestry expansion, since these are the most threatened ecosystems in this region and are habitat to several endemic and endangered species. In addition, studies are needed to assess the population status of *A. wolterstorffi* in protected areas, establish priority areas for conservation, perform bio-ecological research and establish the inclusion of species in the IUCN Red List of Threatened Species. These recommendations apply also for other *Austrolebias* species endangered and endemic to southern Brazil.

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