Poeciliid Research

Ecological and biological perspectives on *Poecilia wingei*: an endangered freshwater fish endemic to South America

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Abstract. *Poecilia wingei*, commonly known as Endler's guppy, is a small viviparous freshwater fish species endemic to northern Venezuela, South America. It inhabits a complex system of freshwater coastal lagoons characterized by temperatures ranging from 27 to 30°C and by dark green waters, a feature associated with eutrophic conditions. The species exhibits predominantly insectivorous feeding behavior with a notable contribution of plant material to its diet. Males reach sexual maturity at 37.33± 8.08 days of age, and females produce an average of 17.33 offspring per brood following a gestation period of 26 to 30 days. Morphologically, *P. wingei* is distinguished by a gonopodial palp that extends conspicuously beyond the tip of the gonopodium and by the absence of a terminal hookon ray 3. Males display vivid metallic coloration, whereas females exhibit comparatively dull, beige tones. *P. wingei* is currently classified as endangered due to habitat degradation and its restricted geographic distribution. Conservation initiatives aimed at habitat protection have been constrained by the region's political context, thereby emphasizing the need for ex situ conservation strategies.
Key words: endler guppy, ornamental fish, Poeciliidae.

Origins and distribution. *Poecilia wingei*, commonly known as "Endler guppy" is a freshwater fish species belonging to the family Poeciliidae, subgenus *Acanthophacelus*, it is endemic to northern Venezuela within the Cumaná region, including Patos Lagoon, Malaguena Lagoon, and Buena Vista Lagoon (Poeser et al 2005; Arbuatti et al 2013).

Environment. The species' natural habitat is located in northern Venezuela, approximately three kilometers from the city of Cumaná. This area encompasses a complex system of coastal freshwater lagoons influenced by variable brackish infiltration, comprising two main water bodies: Laguna de Los Patos and Laguna La Malagueña, both of which are further subdivided into smaller sub-lagoons. These basins are primarily sustained by a freshwater aquifer originating in the nearby hills, whose discharge fluctuates seasonally, resulting in periodic variations in the physicochemical properties of the lagoon waters. The lagoons exhibit a dark green coloration attributed to eutrophication processes. Regarding water quality parameters, the average pH is 7.8, and water temperature ranges from 27 to 30°C. Ambient temperature also shows seasonal fluctuations, with daytime peaks reaching up to 46°C and nighttime minima of approximately 26°C, while relative humidity levels can rise to 98% (Arbuatti & Trentini 2007).

Biology. In their natural habitat, they usually move in small groups composed of individuals of the same sex, occupying all water strata from the surface to the deeper layers. The juveniles tend to remain near the surface, possibly in search of food. Their diet primarily consists of insect larvae, supplemented by plant material from algae and aquatic vegetation, as well as detritus, they can also feed on small invertebrates, contributing to nutrient cycling within its ecosystem (Arbuatti & Trentini 2007).

Ornamental use. Since its discovery, before its formal taxonomic classification, it has been a species that has attracted attention for its ornamental use, due to its bright metallic colors, and because they are commonly kept in conditions similar to common guppy *Poecilia reticulata*. Currently, its popularity has increased in the aquarium hobby with varieties of more intense and bright colors, in males (Figure 1) such as the popular "Japan blue" variety (Poeser et al 2005; Hernández-López & Luna-Vivaldo 2021; Csontos et al 2024).

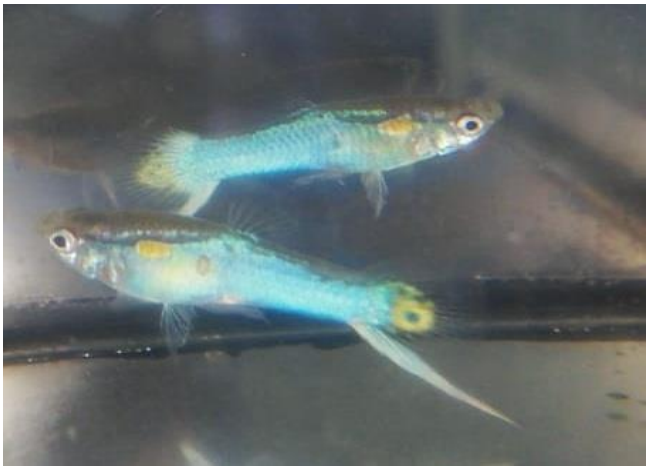

Figure 1. Males of *Poecilia wingei*, variety "Japan blue".

Reproduction. Similar to the common guppy, *P. wingei* is a social species that lives in groups and exhibits pronounced sexual dimorphism. Males are characterized by their vibrant metallic coloration, whereas females display a more subdued beige hue (Figure 2). Males devote a considerable portion of their time to courtship and mating behavior (Sommer & Olsén 2016).

Figure 2. Young female of *Poecilia wingei* displaying its typical muted coloration.

P. wingei exhibits an average fertility of 17.33 offspring per litter, with a mean total length at birth of 7.75±1.97 mm and a gestation period from 26 to 30 days. Males reach sexual maturity at 37.33±8.08 days of age, when they attain a mean total length of 18.44±3.51 mm and an average body weight of 1.67±0.21 g (Arbuatti & Trentini 2007; Hernández-López & Luna-Vivaldo 2021).

Description. In natural habitats, *P. wingei* is a small-sized species, with males reaching up to approximately 15 mm standard length (SL) and females up to 20 mm (SL). The species exhibits pronounced sexual dimorphism, characterized by polychromatic males and uniformly colored females. The gonopodium bears a retroverse hook on ray 5 but lacks one on ray 3. Moreover, the fleshy palp of ray 3 extends beyond the tip, rendering the gonopod terminally bulbous. *P. wingei* can be distinguished from most congeners by

the presence of a gonopodial palp that extends conspicuously beyond the gonopod tip, in combination with the absence of a terminal hook on ray 3. It also differs from the majority of species groups by possessing 14 scales around the caudal peduncle. Females are further recognized by a unique meristic pattern: nine anal-fin rays coupled with fewer than eight dorsal-fin rays. The closest relative of *P. wingei* is the common guppy, with which it shares identical merism counts but is distinguished by its pronounced metallic body pigmentation, which in *P. wingei* can be more variable and complex, presenting intricate patterns of lines and dots (Poeser et al 2005; Păpuc et al 2022).

Conservation. Populations of *P. wingei* have declined in the wild as a result of habitat degradation and environmental impacts such as urban sprawl, sewage discharges, open dumps, and the introduction of tilapia, as well as the removal of geographic barriers, which has led to extensive hybridization with *P. reticulata*. The species is currently listed as Endangered (EN) by the IUCN, owing to its restricted and vulnerable distribution range. Furthermore, since 2013, research permits to study these organisms in their natural habitat have been severely limited due to Venezuela's political regime, which has hindered the development and implementation of effective in situ conservation programs (Arbuatti & Trentini 2007; Tudor 2025). Therefore, attempts have been made to implement ex situ strategies for the conservation of pure lines in semi-controlled environments (Arbuatti & Trentini 2007).

Poecilia wingei in biological studies. *P. wingei* has been used as a model organism in various studies on animal development. Notably, it has been employed in research addressing heterochrony in the formation of pigment diversity among teleosts, as well as the effects of thyroid hormones on the regulation of pigmentation patterns (Prazdnikov 2020, 2024). More recently, this species has served as a pioneering model in the study of tumors (teratomas) and their influence on sexual activity in fish - an area that remains largely understudied (Prazdnikov & Kondakova 2024).

Additionally, *P. wingei* has been used as a model species in research focused on animal welfare in ornamental fish (Walster 2024), as well as in studies of the removal of compounds such as nitrates and phosphates applied to the ornamental fish industry (Csontos et al 2024).

Originally valued primarily for its vibrant coloration and popularity in the ornamental fish trade, *P. wingei* has gradually transcended its role as a decorative species to become an important biological model in scientific research. This transition stems from its wide availability, ease of maintenance, and well-documented life history under controlled conditions. Its use initially arose from human interest in its aesthetic appeal and production as an ornamental species, later expanding its utility beyond decoration to contribute to scientific and environmental applications. Consequently, *P. wingei* has been used as a model species in studies addressing animal welfare within the ornamental fish industry (Walster 2024), as well as in investigations on the removal and bioremediation of compounds such as nitrates and phosphates commonly associated with ornamental aquaculture systems (Csontos et al 2024).

Mexico and Latin America in the global market of *P. wingei*. In recent years, *P. wingei* has increased in popularity within the ornamental fish market (Hernández-López & Luna-Vivaldo 2021). In the Mexican market, the most frequently traded varieties include "Japan blue", Endler "Peacock", "Red Endler", and the common "Endler". These are typically sold as male specimens, and only rarely as pairs, since the sale of females is often avoided to maintain breeding exclusivity and ensure continued market demand. Prices range from approximately 2 USD per individual to 20 USD per pair, depending on the variety (Acuarex 2025; Aquaplantas 2025).

Although *P. wingei* was originally bred and traded as an ornamental species, it now represents a fish with multiple potential applications that extend beyond the aesthetic and commercial aspects traditionally associated with the aquarium trade, as the existence of numerous color morphs and phenotypic varieties further enhances its value among collectors and breeders, contributing to its continued economic and biological

relevance, particularly in Mexico, which is recognized as one of the main producers of poeciliid fish with most of its production destined for export to the United States (Hernández-López et al 2024).

Moreover, much of Latin America, including Mexico, offers favorable climatic conditions that make the region suitable for ornamental fish production. This geographic advantage highlights the potential for other Latin American countries to develop or expand *P. wingei* breeding as part of their aquaculture and ornamental fish industry.

Conclusions. *Poecilia wingei* is a small freshwater fish species endemic to northern Venezuela, South America. Although it was originally bred and traded as an ornamental species, it now represents a versatile biological model with multiple potential applications beyond the aesthetic and commercial aspects traditionally associated with the aquarium trade. The existence of numerous color morphs and phenotypic varieties has increased its value among collectors and breeders, reinforcing its economic and biological importance. In Mexico and other Latin American countries, favorable climatic conditions have positioned the region as a major producer of poeciliid fish, with a substantial portion of production destined for export to the United States. However, despite its growing popularity in the ornamental market, natural populations of *P. wingei* have undergone a marked decline and are currently considered endangered. For this reason, ex situ conservation strategies have been implemented to preserve the remaining wild populations, ensuring the long-term survival of this species while promoting its responsible use in both aquaculture and scientific research.

Conflict of interest. The authors declare that there is no conflict of interest.

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Received: 25 August 2025. Accepted: 05 October 2025. Published online: 10 December 2025.
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How to cite this article:
Luna-Vivaldo I., Hernández-López M., 2025 Ecological and biological perspectives on *Poecilia wingei*: an endangered freshwater fish endemic to South America. Poec Res 15(1):8-12.