

Seasonality and life history traits in *Priapichthys annectens* (Regan, 1907): Recent insights into reproductive strategies and ecological adaptation

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Abstract. *Priapichthys annectens* (Regan, 1907), commonly known as the orange-finned toothcarp, is a freshwater poeciliid fish endemic to Costa Rica. It inhabits streams and brooks across elevations of 25–1,270 meters, thriving in tropical climates with temperatures ranging from 17°C to 35°C. The species exhibits distinct morphological traits, including black-bordered scales, orange anal fin rays, and silvery-green reflections on the cheeks and eyes. Ecologically, *P. annectens* occupies diverse depths over rocky or sandy substrates, forming small groups and feeding on terrestrial and aquatic insects, particularly ants and termites. A recent study explored the influence of seasonality on its life history traits, revealing significant variation in reproductive investment and offspring size between wet and dry seasons. This research underscores the importance of environmental factors in driving phenotypic plasticity, contributing to evolutionary biology, biodiversity conservation, and tropical ecosystem management.

Key Words: *Priapichthys annectens*, Poeciliidae, seasonality, phenotypic plasticity, Costa Rica, tropical fish, evolutionary ecology.

Priapichthys annectens (Regan, 1907), commonly known as the orange-finned toothcarp (Figure 1), is a freshwater fish species within the Poeciliidae family (Wischnath 1993). Endemic to Costa Rica, it inhabits brooks and streams with varying current velocities, ranging from low to high, at elevations between 25 and 1,270 meters. The species thrives in tropical climates, tolerating temperatures from 17°C to 35°C (Froese & Pauly 2024). This species largely exhibits the characteristic traits of the Poeciliidae fish family (Oroian & Kovacs 2022; Petrescu-Mag 2007, 2008; Petrescu-Mag et al 2019).

Morphologically, *P. annectens* exhibits scales bordered in black, creating a cross-hatch pattern along its body. This pattern intensifies along the midline and may resemble a series of X's. The sides display 6 to 12 vertical bars, more pronounced on the urosome, with intensity varying by geographical region (Bussing 1998; Froese & Pauly 2024). Notably, black elongate blotches are present on the membranes at the base of the dorsal fin. The first anal fin rays are orange, while other fins are colorless. The eyes and cheeks reflect silvery green highlights. In terms of size, males reach a maximum total length of approximately 4.0 cm, whereas females can grow up to 6.5 cm in standard length (Bussing 1998; Froese & Pauly 2024). The species is harmless to humans and is currently classified as "Least Concern" on the IUCN Red List, indicating a stable population without significant threats (Lyons 2020).

Ecologically, *P. annectens* forms small groups and occupies various depths over rocky or sandy substrates (Froese & Pauly 2024). It reproduces year-round, feeding primarily on terrestrial and aquatic insects, with a particular preference for ants and termites (Bussing 1998; Froese & Pauly 2024). The species was first described by Regan in 1907. Its genus name, *Priapichthys*, is derived from Priapus, the Greek and Roman god of procreation, combined with the Greek word "ichthys," meaning fish (Froese & Pauly 2024).



Figure 1. *Priapichthys annectens* (Regan, 1907) observed in Costa Rica by Abraham Hernández Bacca (licensed under <http://creativecommons.org/licenses/by-nc/4.0/>). Creator Abraham Hernández Bacca; Publisher: iNaturalist. <https://www.gbif.org/species/2350416>

A research approach, conducted by Erik S. Johnson, Michael Tobler, and Jerald B. Johnson, explores the impact of seasonal environmental changes on the life history traits of the livebearing fish *P. annectens*. The researchers are affiliated with the University of Missouri–St. Louis, Kansas State University, and Brigham Young University, institutions recognized for their contributions to evolutionary ecology and life history research. This research aimed to investigate how seasonal variation, specifically between the wet and dry seasons in Costa Rica, influences reproductive investment, fecundity, and offspring size in this species (Johnson et al 2024). The findings revealed that seasonality plays a significant role in shaping certain life history traits of *P. annectens*. During the wet season, females were in better physical condition and produced fewer but larger offspring, likely due to increased resource availability (Johnson et al 2024). In contrast, during the dry season, females allocated more energy to reproduction, resulting in higher fecundity and reproductive allotment, but offspring were smaller (Johnson et al 2024). Interestingly, the study found that traits such as male and female size at maturity were not affected by seasonal changes (Johnson et al 2024). The researchers also observed that *P. annectens* employs a lecithotrophic reproductive strategy, provisioning nutrients to eggs before fertilization, and does not exhibit superfetation, meaning females do not carry multiple developing broods simultaneously (Johnson et al 2024).

The previously presented research is significant as it highlights the role of environmental factors in driving phenotypic plasticity in life history traits. By providing insights into how organisms respond to fluctuating resource availability and environmental conditions, the study contributes to a deeper understanding of evolutionary biology and ecological adaptation. Furthermore, these findings have practical applications for biodiversity conservation and the management of tropical ecosystems, emphasizing the importance of considering seasonality in ecological and evolutionary studies.

Conflict of interest. The author declares no conflict of interest.

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