

First record of the non-native fish *Poecilia reticulata* (Cyprinodontiformes: Poeciliidae), in Chiapas, southern Mexico

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ABSTRACT. Introduction: Due to its colors, shape, size, and simplicity of care, the neotropical fish *Poecilia reticulata* (guppy) is popular in the aquarium trade. It is also valued as mosquito control and is now found in most of the world. **Objective:** To report its presence in southern Mexico. **Methods:** Fish were captured with seine nets in a tributary of the Grijalva River, Chiapas, in August 2019, and March 2020. **Results:** Two hundred and fifty individuals of *P. reticulata* were captured. **Conclusion:** The species, found in México in 1971, has extended its range to the Grijalva Usumacinta river system.

Keywords: Introduced species, exotic species, livebearer fishes.

RESUMEN. “Primer registro del pez introducido *Poecilia reticulata* (Cyprinodontiformes: Poeciliidae), en Chiapas, sur de México”. **Introducción:** Debido a sus colores, forma, tamaño y simplicidad de cuidado, el pez neotropical *Poecilia reticulata* (guppy) es popular en el comercio de acuarios. También se valora como control de mosquitos y ahora se encuentra en la mayor parte del mundo. **Objetivo:** Informar su presencia en el sur de México. **Métodos:** Se capturaron peces con redes de cerco en un afluente del río Grijalva, Chiapas, en agosto de 2019 y marzo de 2020. **Resultados:** Se capturaron 250 individuos de *P. reticulata*. **Conclusiones:** La especie, hallada en México en 1971, ha extendido su ámbito geográfico al sistema fluvial Grijalva Usumacinta.

Palabras clave: Especies introducidas, especies exóticas, peces portadores.

Live-bearing fishes of the family *Poeciliidae* (Garman, 1895) are a New World family with a widespread natural distributional range that includes South, Middle, North America, and the West Indies (Reznick et al., 2017). Poecilids are small fishes that are recognized by the presence in males of a gonopodium, which is an anal-fin transformed into an intromittent organ used for transferring sperm to the females (Jones et al., 2016). In Central America and southern Mexico, they are the most common and speciose fishes in freshwater systems (Matamoros et al., 2012; Matamoros et al., 2015). The family comprises 29 genera with ~ 275 valid species (Huber, 2019; Fricke et al., 2020), of which *Poecilia* (Bloch & Schneider, 1801) is the most speciose genus (Huber, 2019; Fricke et al., 2020). Recent molecular phylogenies placed almost all Middle American *Poecilia* within the subgenus *Mollienesia*, (Garman, 1895) except for *Poecilia caucana* (Steindachner, 1880) that is placed in the subgenus *Allopoecilia* (Steindachner, 1880) (Ho et al., 2016). South American *Poecilia* such as *P. reticulata* (Peters, 1859), the species herein treated, was assigned to the subgenus *Acanthophaelus* (Günther, 1866) (Ho et al., 2016).

Poecilia reticulata is commonly known as guppy and it is one of the most popular aquarium fish in the world (Lucinda & Van Der Sleen, 2018). It is a small-bodied fish whose males reach up to 50mm in standard length whereas females can reach up to 60mm in standard length (Froese & Pauly, 2020). The species naturally occurs in coastal regions of Venezuela, Guyana and Trinidad and Tobago (Magurran, 2005; Deacon et al., 2011). However, due to intentional and nonintentional introductions, its popularity in the aquarium trade and its use for mosquito control (Warbanski et al., 2017), *P. reticulata* now has a global distribution and it is found in all continents except the Antarctica (Fig. 1) (Deacon et al., 2011; Lucinda & Van Der Sleen, 2018).

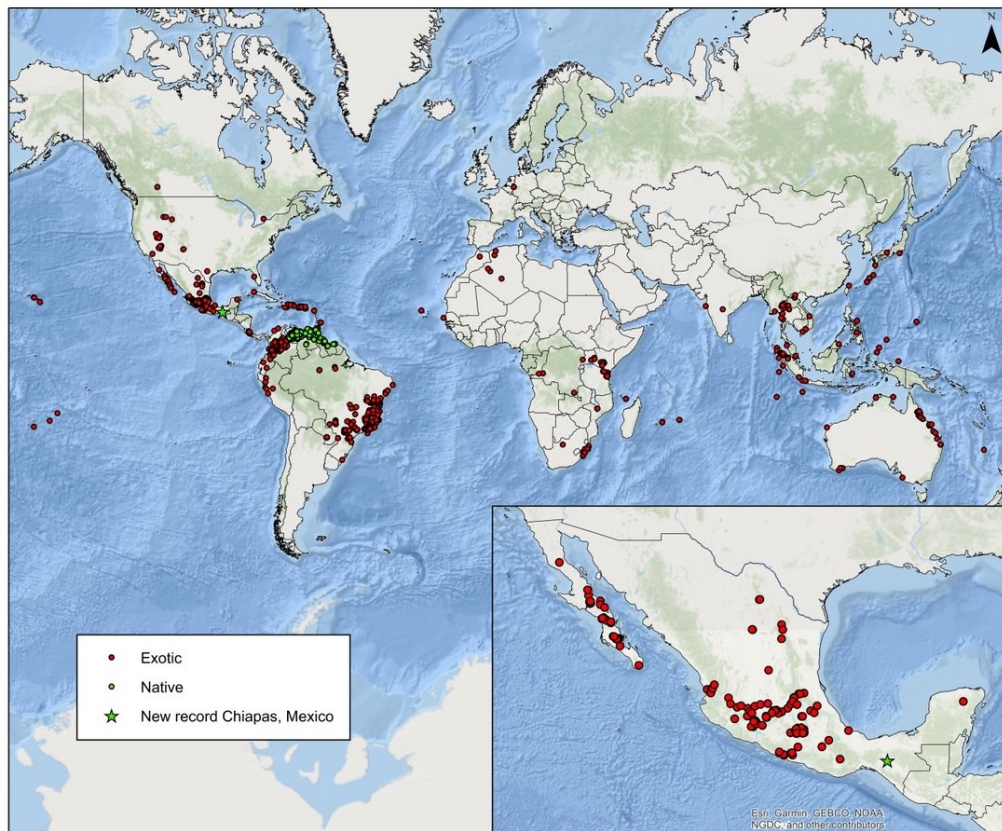


Fig. 1. Distribution localities of *Poecilia reticulata* worldwide. Right lower corner, collection points in Mexico only.

Poecilia reticulata is currently considered as a highly invasive species (Deacon et al., 2011), capable of modifying native fish communities and ecosystem processes (Fraser & Lamphere, 2013; Holitzki et al., 2013). Its invasive history suggests, that, once the species arrives at a new environment, life history and biological adaptations such as early reproductive maturity, sperm storage (Meffe & Snelson, 1989), superfetation (Courtenay & Meffe, 1989), and air-breathing capacity (Kramer & Mehegan, 1981; Boschetto et al., 2011), help the species to become well established and sometimes even dominant (Casatti et al., 2009). Although this species is not a top predator capable of directly preying upon native species, its capability of forming large populations may increase the likelihood of out-competing native fishes for food resources and changing rates of nutrient and/or organic-matter cycling, as it has been documented with other invasive species (e.g. Capps & Flecker, 2013a; 2013b).

In Mexico, *P. reticulata* was first introduced in 1971 for mosquito control purposes (Salgado-Maldonado & Rubio-Godoy, 2014). It was registered for the first time in Baja California, currently it

is reported in streams in Baja California Norte, Baja California Sur and in the Gulf of Mexico (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad [CONABIO], 2017). Although *P. reticulata* is considered a high-risk invasive species at the same level as tilapia (*Oreochromis niloticus*) (Linnaeus, 1758) (Golubov et al., 2014), the species is still commonly found in the Mexican aquarium trade and several rearing facilities that operate in the country (Devezé-Murillo et al., 2004). In the wild *P. reticulata* has been collected in at least 109 localities (González et al., 2014) and it has been documented that the river drainages of northwestern Mexico, the species has shown a rapid and successful expansion (Ruiz-Campos et al., 2014). In this paper, we report the occurrence of *P. reticulata* for the first time in a tributary of the Grijalva River in the state of Chiapas, southern Mexico.

The Grijalva River is located in southern Mexico and is part of the Grijalva-Usumacinta River Basin. On August 14th, 2019, and March 12th, 2020, fieldwork was performed in two localities in a small tributary of the Grijalva River near the city of Tuxtla Gutierrez, Chiapas, Mexico. In the two sampling points, we performed a pass with a backpack electro-shocker (DC backpack electrofishing SAMUS RICH P-2000) in a section of river of about 100 m, followed by a pass with a seine in the same river section. After capture, fish were euthanized with an overdose of tricaine methanesulfonate (MS-222), after that, they were placed in a solution of 10% formaldehyde and transported to the lab. At the laboratory, fish were counted and identified to species, and deposited in the fish collection of the Universidad de Ciencias y Artes de Chiapas.

The two sampled localities are small creeks of 5-7m width, with a water depth of 20-30cm, with riffles, pools and runs. The substrate is dominated by mud, but there were also, rocks, gravel and sand. There is riparian vegetation, but not submerged vegetation or emergent vegetation, canopy cover of 70-80%.

A total of 454 fish were recorded, belonging to five species: *Profundulus punctatus* (Günther 1866) (10 individuals), *Poeciliopsis pleurospilus* (Günther 1866) (153 individuals), *Poecilia sphenops* (Valenciennes 1846) (34 individuals), *Astyanax aeneus* (Günther 1860) (seven individuals) and *Poecilia reticulata* (250 individuals). This being the first record of *P. reticulata* in the Grijalva River drainage. UNICACH-MZ-P-7850; August 14, 2019; latitude 16.765813, longitude 93.235263; 120 individuals and UNICACH-MZ-P-7850; March 12, 2020; latitude 16.765897, longitude 93.233472; 130 individuals.

The presence of enlarged and swollen pelvic fins and a fleshy extension of the gonopodium place our specimens in the genus *Poecilia* (Fig. 2) (Froese & Pauly, 2020). In order to identify and to distinguished *P. reticulata* from other *Poecilia* we used a series of meristic and colouration characters as presented by Poeser et al. (2005): (1) polychromatic and polymorphic colouration pattern in males; (2) gonopodial palp extended beyond gonopodium tip; (3) absence of retrorse hook on tip of the gonopodial ray 3a; (4) presence of retrorse hook on tip of gonopodial ray 5; (5) gonopodial ray 3 with series of ventral serrae; (6) scales around caudal peduncle 14; and (7) females with 9 anal-fin rays and 6-7 dorsal fin rays. *P. reticulata* shows a conspicuous reticulate pattern along the females flank and lack of a humeral blotch are also useful characters to distinguish the *P. reticulata* from other *Poecilia* species (Bragança et al., 2020).

Records of *P. reticulata* in Mexico date back to 1971 (Salgado-Maldonado & Rubio-Godoy, 2014), however, recent checklist from the state of Chiapas did not report *P. reticulata* in freshwater systems (Gómez-González et al., 2015; Velázquez-Velázquez et al., 2016; Soria-Barreto et al., 2018). Herein we report the first record of *P. reticulata* in the Grijalva River Basin. The two localities registered in this study were probably the result of deliberate releases of ornamental fish. The introduction of exotic species is the second greatest threat to biodiversity, after habitat loss (Capdevila-Argüelles et al., 2013). This practice has occurred historically, but it is until recent times that this practice has exploded due to the promotion of trade and the lack of control of it. The

mitigation and eradication of this practice, which would represent an instrument for the conservation of biodiversity. Therefore, it is essential to establish national strategies that integrate prevention, detection, rapid response, control and eradication of the release of invasive species (National Advisory Committee on Invasive Species, 2010.) One of the crucial activities is the monitoring and the capture of invasive species (Ramírez & Ramírez, 2017).

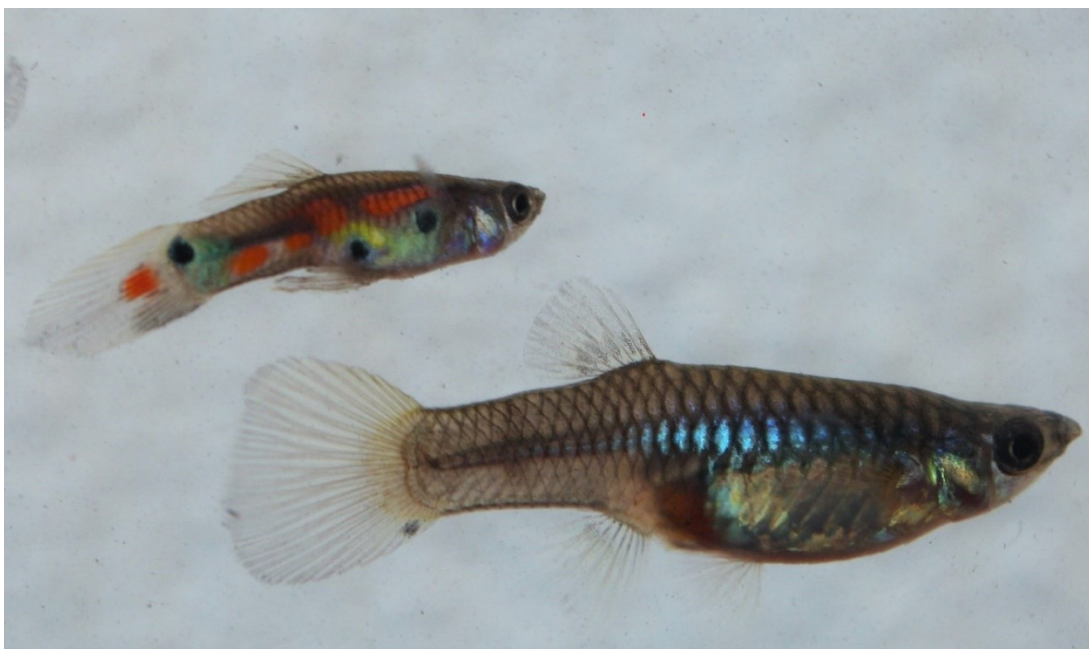


Fig. 2. Male (26,1 mm standard length) and female (49,6 mm standard length) *Poecilia reticulata* (UNICACH-MZ-P-7850) captured in a tributary of the Grijalva River, near the city of Tuxtla de Gutierrez.

It has been reported that *P. reticulata* can have established ecologically competitive populations in some regions of the country (Ruiz-Campos et al., 2014). Although, that this species is a major threat to native-fish assemblages (Golubov et al., 2014). *Poecilia reticulata* has still been commercialized in the aquarium trade in Mexico, augmenting this way the possibility of further incrementing the distributional range of the species in Mexican territory. *Poecilia reticulata* was positively identified because of its conspicuous coloration that does not match any other Chiapas native livebearer fishes. This report is the first record of *P. reticulata* in the state of Chiapas.

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ETHICAL, CONFLICT OF INTEREST AND FINANCIAL STATEMENTS

The authors declare that they have fully complied with all pertinent ethical and legal requirements, both during the study and in the production of the manuscript; that there are no conflicts of interest of any kind; that all financial sources are fully and clearly stated in the acknowledgments section; and that they fully agree with the final edited version of the article. A signed document has been filed in the journal archives

The statement of each author's contribution to the manuscript is as follows: C.P.L.F.: writing of the manuscript, field work and laboratory work. W.A.M., E.V.V. & M.A.C.: writing of the manuscript and field work.

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