

Guppy (*Poecilia reticulata*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, March 2011
Revised, July 2015



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1 Native Range, and Status in the United States

Native Range

From Froese and Pauly (2015):

“South America: Venezuela, Barbados, Trinidad, northern Brazil and the Guyanas.”

Status in the United States

From Nico et al. (2015):

“Locally established in warmwater sites in Hawaii (Devick 1991), Idaho (Courtenay et al. 1987), New Mexico (Sublette et al. 1990), Nevada (Courtenay and Deacon 1983), Texas (Hubbs et al.

1991), and Wyoming (Courtenay et al. 1987); reported from California (Shapovalov et al. 1981), Colorado (Zuckerman and Behnke 1986), Connecticut (Whitworth 1996), Missouri (Keevin 1978), Montana (Moyle 1976), and Wisconsin (Becker 1983). Considered established in Arizona by Minckley (1973); however, according to Courtenay and Meffe (1989), populations in Arizona and Florida do not appear to be self-sustaining. Although introduced widely in Texas, the only established population is found in the San Antonio River near Brackenridge Park (Hubbs et al. 1991).”

Means of Introductions in the United States

From Nico et al. (2015):

“Most introductions probably are fish farm or aquarium releases (e.g., Zuckerman and Behnke 1986; Courtenay and Meffe 1989; Howells 1992; Dill and Cordone 1997). Some California introductions were made intentionally for mosquito control (Shapovalov et al. 1981; Dill and Cordone 1997).”

Remarks

From Nico et al. (2015):

“This species is widely studied as a model species ecology and evolutionary biology, and has had a long and popular history as an ornamental fish. A wide variety of strains differing in color and fin shape have been developed by aquarists (Axelrod et al. 1985; Sakurai et al. 1993; Wischnath 1993). Some fish reported from the United States as *P. reticulata* actually may represent other species in the genus. In 1989, M. Rauchenberger (personal communication) examined the *P. reticulata* voucher specimens (UF 91918) taken from Kelly Warm Springs, Wyoming, in 1984 by Courtenay et al. (1987), but she could not confirm that identification and labeled them as *Poecilia* species. In light of the enormous numbers of guppies produced in aquaculture each year and its prevalence in pet stores and the aquarium hobby, it is surprising that so few established populations exist. The guppy is known to require warm water to thrive, which may explain its inability to establish throughout most of the continental U.S. but other factors, presently unknown, must limit its distribution in suitable locations such as southern Florida.”

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2015):

“Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Osteichthyes
Class Actinopterygii

Subclass Neopterygii
Infraclass Teleostei
Superorder Acanthopterygii
Order Cyprinodontiformes
Suborder Cyprinodontoidei
Family Poeciliidae
Subfamily Poeciliinae
Genus *Poecilia*
Species *Poecilia reticulata* Peters, 1859 – gupi, guppy, millions

fish, rainbowfish”

Taxonomic Status: valid”

Size, Weight, and Age Range

From Froese and Pauly (2015):

“Max length : 5.0 cm SL male/unsexed; [Kottelat and Freyhof 2007]; 6.0 cm SL (female);
common length : 2.8 cm TL male/unsexed; [Hugg 1996]”

“Males mature at 2 months and females at 3 months of age [Riehl and Baensch 1991].”

Environment

From Froese and Pauly (2015):

“Freshwater; brackish; benthopelagic; pH range: 7.0 - 8.0; dH range: 9 - 19; non-migratory.”

Climate/Range

From Froese and Pauly (2015):

“Tropical; 18°C - 28°C [Riehl and Baensch 1991]; 14°N - 2°N, 67°W - 52°W”

Distribution Outside the United States

Native

From Froese and Pauly (2015):

“South America: Venezuela, Barbados, Trinidad, northern Brazil and the Guyanas.”

Introduced

From Froese and Pauly (2015):

“Albania; probably established”

“Australia; established”

“Colombia; established”

“Comoros; established”

“Cook Islands; established”
“Costa Rica; established”
“Cuba; established”
“Czech Republic; probably established”
“East Timor; established”
“Fiji; established”
“French Polynesia; established”
“Guam; established”
“Haiti; unknown”
“Hong Kong; established”
“Hungary; established”
“India; established”
“Indonesia; established”
“central Italy; established”
“Jamaica; established”
“Japan; established”
“Kenya; established”
“Madagascar; established”
“Malaysia; established”
“Martinique; established”
“Mauritius; unknown”
“Mexico; established”
“Namibia; established”
“Netherlands; established”
“New Caledonia; probably established”
“New Zealand; established”
“Palau; established”
“Papua New Guinea; established”
“Peru; established”
“Philippines; established”
“Reunion; established”
“Russia; established”
“Saudi Arabia; established”
“Seychelles; probably established”
“Singapore; established”
“Slovakia; probably established”
“South Africa; established”
“Spain; established”
“Sri Lanka; established”
“Tahiti; established”
“Taiwan; established”
“Thailand; established”
“Uganda; established”
“United Arab Emirates; established”
“Vanuatu; probably established”
“Western Samoa; established”

“Zambia; established”

Means of Introduction Outside the United States

From CABI (2015):

“Initial introductions of *P. reticulata* were conducted as a means of mosquito control in Asia, the Pacific, Africa, and Europe”

“It is likely that *P. reticulata* has been introduced into many countries via accidental or intentional release of aquarium fish into waterways and many introduced populations have become established.”

Short description

From Froese and Pauly (2015):

“Dorsal spines (total): 0; Dorsal soft rays (total): 7-8; Anal spines: 0; Anal soft rays: 8 - 10”

From CABI (2015):

“*P. reticulata* belongs to the poeciliids, a group of small freshwater fishes with internal fertilisation and viviparous reproduction. *P. reticulata* has clear sexual dimorphism. Males are 25-35 mm (SL) and have conspicuous polymorphic colour patterns consisting of combinations of black, white, red-orange, yellow, green, iridescent spots, lines and speckles. Males have a gonopodium; a slender, modified anal fin used as an intromittent organ, whereas the anal fin of females is rounded. Females are uniform silver grey, and are larger and deeper bodied than males (40-60 mm SL). Juvenile fish resemble females, and are independent from birth.”

Biology

From Froese and Pauly (2015):

“Inhabits warm springs and their effluents, weedy ditches and canals [Page and Burr 1991]. Found in various habitats, ranging from highly turbid water in ponds, canals and ditches at low elevations to pristine mountain streams at high elevations [Kenny 1995]. Occurs in wide variety of habitats with low predation pressure, usually in very small streams and densely vegetated lakes and springs [Kottelat and Freyhof 2007]. Has a wide salinity range but requires fairly warm temperatures (23-24 °C) and quiet vegetated water for survival [Skelton 1993, Allen et al. 2002, Louette 2004]. Feeds on zooplankton, small insects and detritus.”

From CABI (2015)

“*P. reticulata* is omnivorous; feeding on algae (approximately 50% of the wild diet), invertebrate larvae and benthic detritus (Dussault and Kramer, 1981). Within their natural range they may also prey on larvae of their own species and of *Rivulus hartii* (Houde, 1997). Experimental captive trials have found that the closely related *Gambusia holbrooki* preys on a wide range of

larvae of other fish species from areas into which *P. reticulata* has also been introduced (Howe et al., 1997), suggesting that *P. reticulata* may also prey on these species.”

Human uses

From Froese and Pauly (2015):

“Fisheries: of no interest; aquarium: commercial”

Diseases

From Froese and Pauly (2015):

“Aonthea Infestation, Parasitic infestations (protozoa, worms, etc.)”

“Camallanus Infection 12, Parasitic infestations (protozoa, worms, etc.)”

“Columnaris Disease (e.), Bacterial diseases”

“Columnaris Disease (l.), Bacterial diseases”

“Cryptobia Infestation, Parasitic infestations (protozoa, worms, etc.)”

“Eustrongylides Infestation 2 (Larvae), Parasitic infestations (protozoa, worms, etc.)”

“Fin Rot (early stage), Bacterial diseases”

“Fin-rot Disease (late stage), Bacterial diseases”

“Fish tuberculosis (FishMB), Bacterial diseases”

“Ichthyobodo Infection, Parasitic infestations (protozoa, worms, etc.)”

“Lernaea Infestation, Parasitic infestations (protozoa, worms, etc.)”

“Nematode Infestation, Parasitic infestations (protozoa, worms, etc.)”

“Skin Flukes, Parasitic infestations (protozoa, worms, etc.)”

“Skin Fungi (Saprolegnia sp.), Fungal diseases”

“Tetrahymena Disease, Parasitic infestations (protozoa, worms, etc.)”

“White spot Disease, Parasitic infestations (protozoa, worms, etc.)”

There are no OIE-listed diseases reported for this species.

Threat to humans

From Froese and Pauly (2015):

“Potential pest”

3 Impacts of Introductions

From Nico et al. (2015):

“The guppy is considered a threat to native cyprinids and killifishes (Sigler and Sigler 1987). For instance, it has adversely affected the White River springfish, *Crenichthys baileyi*, in a Nevada spring (Deacon et al. 1964). Two subspecies of this springfish are now listed as federally endangered (U.S. Fish and Wildlife Service 1993), and three others are proposed for listing (U.S. Fish and Wildlife Service 1994). The guppy has also been implicated in the decline of the Utah sucker, *Catostomus ardens*, in a thermal spring in Wyoming (Courtenay et al. 1987). The guppy has become the dominant species in some warm water springs in the west (Courtenay, personal

communication). Courtenay and Meffe (1989) summarized the effect of this species on native fishes. This species also presents a threat because it is a known carrier of certain exotic trematode parasites (Leberg and Vrijenhoek 1994).”

“Guppies, and other introduced poeciliids, have been implicated in the decline of native damselflies on Oahu, Hawaii. The distributions of the damselflies and introduced fishes were often found to be mutually exclusive, probably resulting from predation by the fish on the insects (Englund 1999).”

From GISD (2006):

“It eats the eggs of native fish species and acts as a host for the parasitic nematode *Camallanus cotti*, and the Asian tapeworm *Bothriocephalus acheilognathi* in Hawaii (Eldredge, 2000).”

“Hybrids between *P. reticulata* and *P. mexicana* and between *P. reticulata* and *Xiphophorus helleri* are shown to threaten species of native fish in the western USA (Courtenay and Meffe, 1989 in Eldredge, 2000).”

From Froese and Pauly (2015):

“Probably introduced [to Hong Kong] by aquarists. Native minnow *Aphyocypris lini* (Weitzman & Chen) may be seriously threatened by introduced guppies. Only one specimen recently found in 1986, first for 20 years [FAO 1997].”

From Valero et al. (2008):

“Persistent courtship by male Trinidadian guppies (*Poecilia reticulata*) is costly for conspecific females. Since male guppies are known to attempt matings with other poeciliid females, we asked whether persistent courtship is also directed towards morphologically similar but phylogenetically distant females encountered following invasion. *Skiffia bilineata* is one of several endangered viviparous goodeids from Central México, whose remaining habitats are increasingly shared with invasive guppies. Experiments in which guppy sex ratios were manipulated to vary the proportion of heterospecific to conspecific females showed that male guppies courted and attempted forced copulations with *S. bilineata* females even when females of their own species were in excess. This behaviour places an additional, and previously unrecognized, burden on a group of endemic Mexican fishes already in risk of extinction.”

From Bambaradeniya (2002):

“The Guppy (*Poecilia reticulata*), which is a prolific breeder distributed in aquatic habitats throughout Sri Lanka, has been observed to feed on the eggs of native amphibians (de Silva, 1996).”

4 Global Distribution



Figure 1. Map of known global distribution of *Poecilia reticulata*. Map from GBIF (2015). Points in Ecuador, Cape Verde, Morocco, Algeria, Denmark, Congo, and the Democratic Republic of Congo were not included in climate matching (Sec. 6) because these points do not represent established populations of *P. reticulata*.

5 Distribution within the United States



Figure 2. Distribution of *Poecilia reticulata* in the U.S. Map from Nico et al. (2015).

6 Climate Match

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) is high across the western United States, including Texas. High match also occurs in Florida. Medium climate matches are seen in the western Great Lakes region, extending up the Atlantic Coast from Florida to North Carolina, and along the Gulf Coast in Alabama. Low match is found in western Oregon and Washington, as well as much of the eastern U.S. Climate 6 match indicates that the continental U.S. has a high climate match. The range for a high climate match is 0.103 and greater; Climate 6 score of *Poecilia reticulata* is 0.603.

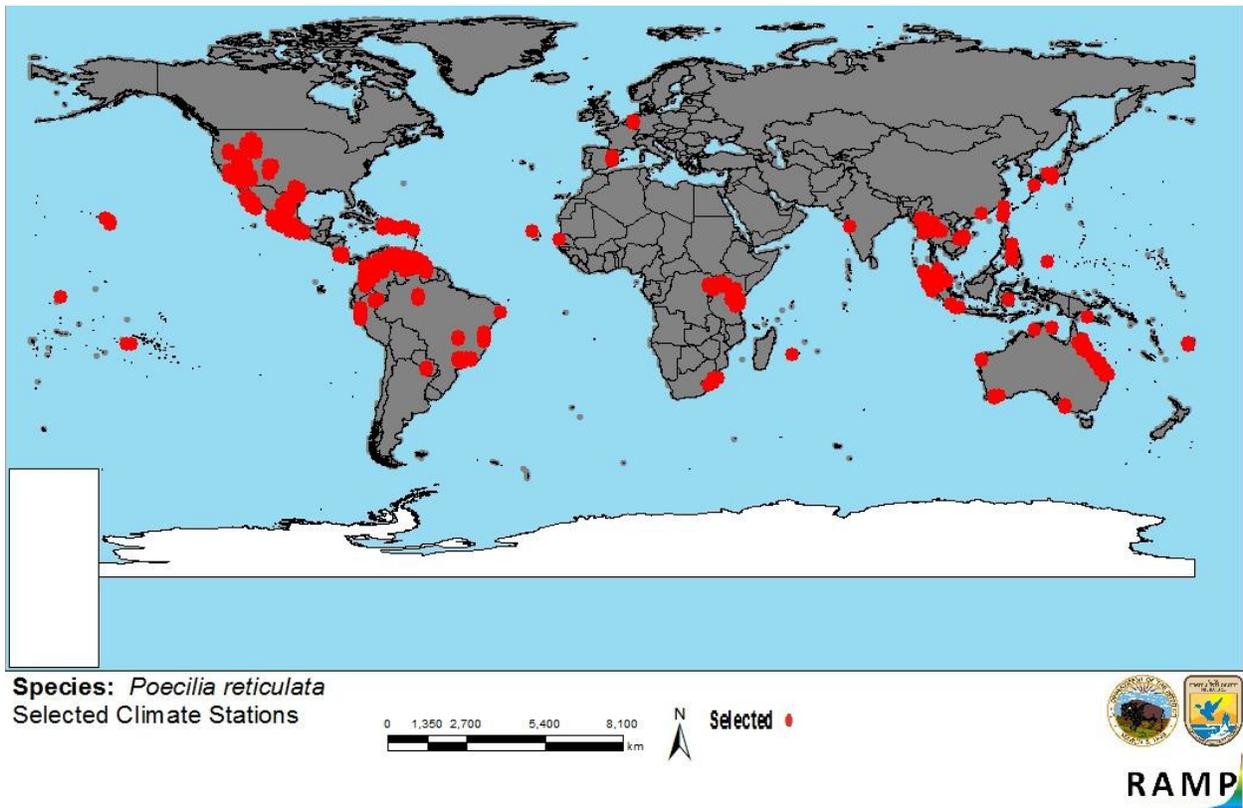


Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *Poecilia reticulata* climate matching. Source locations from CABI (2015), Froese and Pauly (2015), GBIF (2015), and Nico et al. (2015).

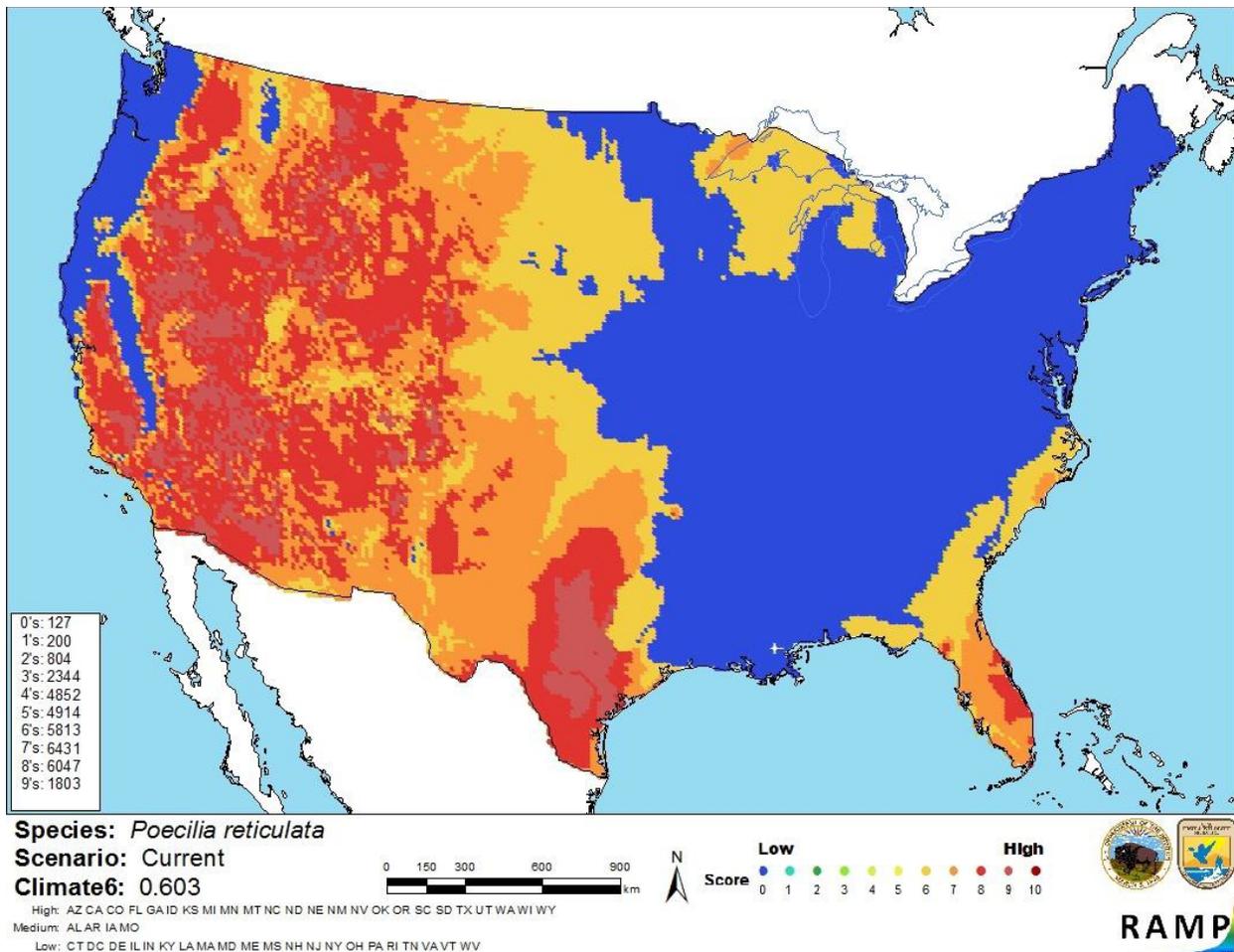


Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *Poecilia reticulata* in the continental United States based on source locations reported by CABI (2015), Froese and Pauly (2015), GBIF (2015), and Nico et al. (2015). 0= Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

7 Certainty of Assessment

P. reticulata is a well-studied species. Negative impacts from introductions of this species are adequately documented in the scientific literature. No further information is needed to evaluate the negative impacts the species is having where introduced. Certainty of this assessment is high.

8 Risk Assessment

Summary of Risk to the Continental United States

Poecilia reticulata is a popular fish for aquaria and for research, and was originally introduced to many countries as a method of mosquito control. Where introduced, *P. reticulata* has been documented to have adverse impacts on native fishes and invertebrates through competition, predation, and disease. *P. reticulata* is currently established in the western U.S., where it has been implicated in the decline of White River springfish (*Crenichthys baileyi*) and Utah sucker

(*Catostomus ardens*). Climate match to the continental U.S. is high, with highest matches in Florida and the West. Overall risk posed by this species is high.

Assessment Elements

- History of Invasiveness (Sec. 3): High**
- Climate Match (Sec.6): High**
- Certainty of Assessment (Sec. 7): High**
- Overall Risk Assessment Category: High**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

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10 References Quoted But Not Accessed

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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