U.S. Fish & Wildlife Service

# Shortfin Molly (*Poecilia mexicana*)
## Ecological Risk Screening Summary

**U.S. Fish and Wildlife Service, February 2011**
**Revised, August 2014, December 2017**
**Web Version, 8/29/2018**

Photo: JGB. Licensed under CC BY-NC. Available:
https://www.inaturalist.org/observations/7024871. (December 2017).

# 1 Native Range and Status in the United States

## Native Range

From Nico and Schofield (2017):

"Atlantic Slope from Rio San Juan, Mexico, to Guatemala, possibly south to Nicaragua (Miller 1983; Page and Burr 1991)."

## Status in the United States
From Nico and Schofield (2017):

"This species has been recorded from Phoenix canals, Arizona (Minckley and Deacon 1968; Minckley 1973; W. Silvey, personal communication); southern California (St. Amant 1966; Mearns 1975; Moyle 1976a; Hubbs et al. 1979; Shapovalov et al. 1981; Courtenay et al. 1984, 1991; Swift et al. 1993); Conejos and Sagauche counties, Colorado (Hahn 1966; Woodling 1985; Zuckerman and Behnke 1986); the Brunneau River at Brunneau Hot Springs, Idaho (Courtenay et al. 1987); three locations in Madison County, Montana (Brown 1971; Holton 1990; Courtenay, personal communication); the Moapa River (U.S. Fish and Wildlife Service 1983) and the Moapa River and several springs in Nevada (Deacon et al. 1964; Hubbs and Deacon 1964; Bradley and Deacon 1967; Deacon and Bradley 1972; Cross 1976; Courtenay and Deacon 1983; Deacon and Williams 1984; Scoppottone et al. 1998; Vinyard 2001; USFWS 2005); and an unspecified area in Texas (Courtenay et al. 1984, 1991; Howells [1992]).

Although previously reported from Oahu, Hawaii (Maciolek 1984; Devick [1991]); those fish have recently been identified as a hybrid (Mundy 2005; see *Poecilia* sp. records)."

According to Froese and Pauly (2017), *P. mexicana* is established in American Samoa.

This species is in trade in the United States. For example:

From Goliad Farms (2017):

"*Poecilia mexicana*, Campeche […] $2.00–$10.00"

## Means of Introductions in the United States
From Nico and Schofield (2017):

"Most introductions presumably were due to fish farm escapes or aquarium releases."

## Remarks
From Nico and Schofield (2017):

"There is considerable confusion surrounding U.S. records of this and other members of the *P. sphenops* complex. For instance, Howells [1992] expressed doubt as to the authenticity of the report of this species in Texas because of the common difficulty in distinguishing it from other members of the species complex, as well as from various molly hybrids. Maciolek (1984) and Devick [1991] reported this species from Oahu, Hawaii; however, a recent report by Mundy (2005) indicates these fish are in fact a hybrid including both *P. mexicana* and *P. sphenops* (see account for *Poecilia* sp.). There is a file report indicating that this species was collected in July 1984 in Kelly Warm Springs, Teton County, Wyoming; however, that record is apparently in error (Courtenay, personal communication). There is no mention of this species being found in Kelly Warm Springs by Courtenay et al. (1988) although another introduced poeciliid, *P.*

*reticulata,* was reported from the site. Wischnath (1993) reported that natural hybrids with *P. latipinna* are known from the Rio Mante Canal in Mexico."

From Bailly (2008):

"Synonymised names
*Poecilia cuneata* Garman, 1895
*Poecilia limantouri* Jordan & Snyder, 1899
*Poecilia mexicana mexicana* Steindachner, 1863"

# 2 Biology and Ecology

## Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2017):

"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 mexicana* Steindachner, 1863"

From Eschmeyer et al. (2017):

"Current status: Valid as *Poecilia mexicana* Steindachner 1863. Poeciliidae: Poeciliinae."

## Size, Weight, and Age Range

From Froese and Pauly (2017):

"Max length : 11.0 cm SL male/unsexed; [Greenfield and Thomerson 1997]; common length : 4.0 cm TL male/unsexed; [Hugg 1996]"

From Plath et al. (2003):

"In *Poecilia mexicana*, […] mature males can range from 18 mm to more than 70 mm (Menzel and Darnell 1973)."

## Environment

From Froese and Pauly (2017):

"Freshwater; brackish; benthopelagic; pH range: 7.0 - 7.5; dH range: 20 - 30; […]"

"[…] 22°C - 28°C [Baensch and Riehl 1995; assumed to be recommended aquarium temperatures];

From Englund (1999):

"*P. mexican*a inhabits waters with a wide range of salinities, from 0 ppt to 40 ppt (ocean water in Hawaii has a salinity of 36–37 ppt). Because of this salinity tolerance, the fish were found in every coastal estuary and low-elevation wetland."

From Passow et al. (2017):

"Our study focused on the *Poecilia mexicana* species complex (Poeciliidae), in which multiple lineages have independently colonized toxic, hydrogen sulphide ($H_2S$) rich springs across four river drainages in southern Mexico [Tobler et al. 2011, Palacios et al. 2011]. Sulphide springs in this region exhibit average $H_2S$ concentrations between 20 and 200 µM (with peak concentrations reaching over 1000 µM) [Tobler et al. 2011], which are all well above the toxicity threshold for most metazoans [Riesch et al. 2014]. In addition, sulphide springs are characterized by hypoxia, reduced pH, and increased levels of conductivity as compared to adjacent non-sulphidic habitats [Tobler et al. 2011]."

## Climate/Range

From Froese and Pauly (2017):

"Tropical; […] 19°N - 14°N"

## Distribution Outside the United States

### Native

From Froese and Pauly (2017):

"North and Central America: Rio San Juan, Mexico to Guatemala."

### Introduced

According to Froese and Pauly (2017), *P. mexicana* is established in American Samoa, Fiji, Tahiti, and French Polynesia.

From Matsunuma and Motomura (2009):

"The Shortfin Molly, *Poecilia mexicana*, is herein reported for the first time from Japan on the basis of specimens collected from the Nitanda River (hot spring water) in Ibusuki City, Kagoshima Prefecture. The fish from Ibusuki City, previously misidentified as *P. sphenops*, is believed to represent an introduced population from the west coast of Central America (original locality of the species) or other places."

## Means of Introduction Outside the United States

From Welcomme (1988):

"The species has [...] been disseminated among the Pacific Islands mainly for Mosquito control."

## Short Description

From Menzel and Darnell (1973):

"Important counts include: dorsal rays 8-11 (9 modally); anal rays in females 8-10 (9); principal caudal rays 17-22 (20); pectoral rays 14-16 (15); pelvic rays in- variably 6; scales in lateral series 26-29 (27); scales around caudal peduncle 16-19 (18); predorsal scales 12-15 (13). Proportional measurements in standard length: body depth 3.1 to 3.6 (females); caudal peduncle depth 4.0 to 5.0 (males) and 4.6 to 5.6 (females); head length 3.2 to 4.0; depressed dorsal fin length 2.3 to 3.8 (males) and 3.6 to 4.3 (females). Body size is moderate to large, males to 70 mm, females to 85 mm in SL. […] The body is deep, particularly in the caudal peduncle region. Adult males are considerably deeper than females and much compressed. Large males are decidedly slabsided. The pre-dorsal profile in smaller specimens may be slightly convex, but in adults it is straight."

From Bierbach et al. (2013):

"Body colouration in the female sex is reported as a cryptic beige while colouration in the male sex is highly variable, with dominant *P. mexicana* males being more conspicuous in body colouration, showing black vertical bars on the body along with yellowish to orange colour patterns on the margins of the dorsal and anal fins. Subordinate (mostly smaller-bodied) males, however, are more cryptically coloured, with only faint or no vertical bars and little to no orange fin margins."

## Biology

From NatureServe (2017):

"Reaches sexual maturity at about 1.5 to 2" in length. Under suitable conditions may produce several broods a year (Brown 1971). Fertilization internal; young born alive."

"Habitat Comments: Warm springs and their effluents, canals, weedy ditches, and stream pools (Page and Burr 1991). In Nevada, found in warm springs. In California, has been collected in freshwater ditches around Salton Sea."

“Food Comments: Diet varied. Feeds on both plant and animal matter; vascular plants and mosquito larvae are important items in the diet (Brown 1971).”

From Riesch et al. (2010):

“The Atlantic molly, *Poecilia mexicana*, is a widespread freshwater fish, living along the Atlantic coastal drainages of Mexico, and it exhibits wide habitat tolerances. It can be found in first-order through third order streams, creeks, brooks, lakes, springs, and coastal lagoons, as well as in fresh to brackish waters (Miller 2005).”

“On a plateau in Tabasco (southern Mexico), two populations of the widespread Atlantic molly (*Poecilia mexicana*) have colonized subterranean watercourses, the Cueva del Azufre (Gordon and Rosen 1962) and the Cueva Luna Azufre (Pisarowicz 2005, Tobler et al. 2008[b]). These two limestone caves are unique, because they are the only known caves inhabited by poeciliids. Moreover the watercourses of the cave plateau are characterized by the presence or absence of another physiochemical stressor: naturally occurring hydrogen sulfide ($H_2S$), and all combinations of surface/cave and non-sulfidic/sulfidic habitat types are found (Gordon and Rosen 1962, Tobler et al. 2008[b]). Hydrogen sulfide is acutely toxic to metazoans (Grieshaber and Volkel 1998) and leads to extreme hypoxia in the water (Tobler et al. 2006, 2009b). *Poecilia mexicana* from toxic habitats (both cave and surface) perform aquatic surface respiration (ASR) to exploit the more oxygenated (and thus less sulfidic) topmost layer of the water column (Plath et al. 2007b, Tobler et al. 2009a). Hence, mollies from the cave plateau have to cope with the adverse effects of two strong selective forces: darkness and toxicity (Tobler et al. 2006, 2008a, Plath et al. 2007a).”

## Human Uses

From Froese and Pauly (2017):

“Fisheries: of no interest; aquarium: commercial; bait: occasionally”

This species is in trade in the United States. For example:

From Goliad Farms (2017):

“*Poecilia mexicana*, Campeche […] $2.00–$10.00”

## Diseases

Poelen et al. (2014) list the following parasites of *Poecilia mexicana*: *Bothriocephalus acheilognathi*, *Hepatocapillaria cyprinodonticola*, *Ascocotyle diminuta*, *Urocleidoides reticulatus*, *Pygidiopsis pindoramensis*, *Saccocoelioides sogandaresi*, *Ascocotyle mcintoshi*, *Glossocercus auritus*, *Ascocotyle tenuicollis*, *Ascocotyle megalocephala*, *Spinitectus mexicanus*, *Echinochasmus leopoldinae*, *Glossocercus aurita*, *Southwellina hispida*, *Clinostomum complanatum*, *Diplostomum compactum*, *Posthodiplostomum minimum*, *Uvulifer* sp., *Rhabdochona lichtenfelsi*, *Myxobolus nuevoleonensis*, *Ascocotyle mollienisicola*, *Centrocestus formosanus*, *Rhabdochona kidderi*, *Glossocercus auritus*, and *Camallanus cotti* (Strona et al. 2013, Benesh et al. 2017).

From García-Vásquez et al. (2017):

"The monogenean *Gyrodactylus cichlidarum* Paperna, 1968 is a common parasite of African cichlid fishes […]"

"On the Pacific Ocean watershed, we found *G. cichlidarum* infecting invasive shortfin molly, *Poecilia mexicana* […] in streams just outside an aquacultural facility in Araro, Michoacán, located on Lake Cuitzeo, on which shore several tilapia fish farms are installed."

From Baldwin and McGrenra (1979):

"Significant losses due to tail rot and red snout were recorded in American Samoa in 1975 following handling and transport of *P. mexicana* when water temperatures rose above 32$^{O}$C."

"In July 1977 an infestation of the parasitic copepod, *Pseudocaligus parvus* (Cressey, Dept. of Invertebrate Zoology, Smithsonian Institution, personal communication), followed by a secondary bacterial infection, caused a loss of approximately 500,000 bait-sized *P. mexicana* in American Samoa (Bryan, Office of Marine Resources, American Samoa, personal communication)."

"The monogenetic trematode, *Gyrodactylus* sp. (Hoffman, Fish Farming Experiment Station, Stuttgart, Arkansas, personal communication), was observed on the caudal, dorsal, and pectoral fins of some *P. vittata* and *P. mexicana* from American Samoa (Bryan, personal communication)."

No OIE-reportable diseases have been documented for this species.

## Threat to Humans

From Froese and Pauly (2017):

"Potential pest [Courtenay and Hensley 1980]"

# 3 Impacts of Introductions

From Scoppettone (1993):

"I investigated interactions between native and nonnative fishes in the upper Muddy River system to add insight into (1) the mechanism causing the decline of the Moapa dace *Moapa coriacea* after the introduction of the shortfin molly *Poecilia mexicana*, (2) the reason Moapa White River springfish *Crenichthys bailevi moapae* were less affected by the introduction, and (3) the reason interactions between natives is relatively benign. I investigated the hypothesis that the shortfin molly caused the decline of the Moapa dace through competition or predation on larvae, pressures not experienced by the Moapa White River springfish. Relative interspecific competition was analyzed by contrasting the ranges of spatial and dietary overlap among larval, juvenile, and adult life stages. There appeared to be moderate to low spatial overlap between the various life stages of native and nonnative fishes. Overlap in diet was highest between adult Moapa White River springfish and shortfin mollies. Laboratory experiments suggested that shortfin mollies prey vigorously upon fish larvae. In terms of spatial habitat use, Moapa White River springfish larvae were less available to adult shortfin mollies for consumption than were Moapa dace larvae. When predation on larvae is the mechanism by which nonnative fish reduce native forms, aggressiveness of the predator and the degree to which the predator overlaps in habitat with the prey may influence the degree to which a native fish population is affected."

From Minckley and Deacon (1968):

"The status of the Moapa dace, *Moapa coriacea* is less readily defined than that of *Empetrichthys*. The minnow was abundant in the headwaters of the Moapa River, Nevada, when the first collections were made in 1933 [Hubbs and Miller 1948]. Its abundance was apparently maintained at least until the early 1950's [LaRivers 1942]. In our studies which began in 1964 [Bradley and Deacon 1965, Wilson et al. 1966], the species was found to be rare. The low population density of *Moapa* closely followed the introduction and establishment of the shortfin molly, *Poecilia mexicana,* in the river. After 2 years the population of *Moapa* suddenly became more dense. In this case there was no physical deterioration of the habitat, thus changes in habitat were obviously not a factor in either the decline or the recovery of this species. […] The major problem is alteration of the biotic habitat by the introduction of exotic species. The introduction of *P. mexicana* resulted in a decrease in the population density of *Moapa* apparently through an increase in parasitism [Wilson et al. 1966] and possibly through direct competitive interaction."

From Font (2007):

"Among the several species of poeciliids that have been brought to the archipelago, the most widely distributed and abundant species are the guppy, *Poecilia latipinna* [*sic*; guppy = *Poecilia reticulata*, sailfin molly = *Poecilia latipinna*], the shortfin molly, *P. mexicana*, the green swordtail, *Xiphophorus helleri*, and the mosquitofish, *Gambusia affinis*. […] In association with the introduction of these fishes, the helminths that parasitized them at the time of their release into Hawaiian streams also became established in the streams. Furthermore, most of these helminths display broad host specificity and were able to infect the native gobioid fishes inhabiting these streams."

From Englund (1999):

"Since the beginning of this century there have been substantial declines in the distribution and abundance of native *Megalagrion* damselflies on the Hawaiian Island of Oahu. […] It is hypothesized that poeciliid fish introduced for biological control have caused the decline of four stream-breeding damselfly species on Oahu, and the extinction or near-extinction of two other species in Hawaii. […] Native damselfly and introduced poeciliid fish distributions were mutually exclusive on Oahu, and it is concluded that this is probably due to predation by the introduced fish."

"In upper Kahaluu Stream, *M. oceanicum*, *M. n. nigrolineatum* and *M. hawaiiense* were found above two forks of the stream, with one fork containing a 2 m high concrete barrier and the other a series of high gradient cascades 2–3 m in height. […] *Poecilia mexicana* and *Megalagrion* distributions were always mutually exclusive."

"In lower Punaluu Stream […] high densities of tilapia and *Poecilia mexicana* were found, and native damselflies were not observed."

"The current absence of native damselflies in lowland coastal areas of Oahu is clearly not due to a lack of suitable aquatic habitats. For example, large amounts of formerly suitable native damselfly habitat are still found adjoining springs in the Pearl Harbor region, with watercress (*Nasturtium microphyllum*) and taro cultivated here in large quantities. These spring areas also feed an extensive fresh and brackish water coastal wetland system that is now completely devoid of native damselfly species. […] All taro fields in the Kaneohe Bay watershed were surveyed and were found to contain high densities of not only *P. mexicana*, but also *P. reticulata*, and *Xiphophorus helleri*. Neither *M. pacificum* nor *M. xanthomelas* were found in any Oahu taro fields, although both of these species were recently found in Molokai taro fields where introduced fish are absent (R.A. Englund and W. Puleloa, unpub.). Thus, lowland native damselfly species appear to be adaptable to artificial wetlands created by taro cultivation, but are not found in taro fields containing introduced fish species."

# 4 Global Distribution

**Figure 1**. Known global distribution of *Poecilia mexicana*. Map from GBIF Secretariat (2017). Occurrences in Brazil were removed due to being museum specimens. Occurrences in the Philippines were removed due to incomplete records and invalid coordinates.

# 5 Distribution Within the United States

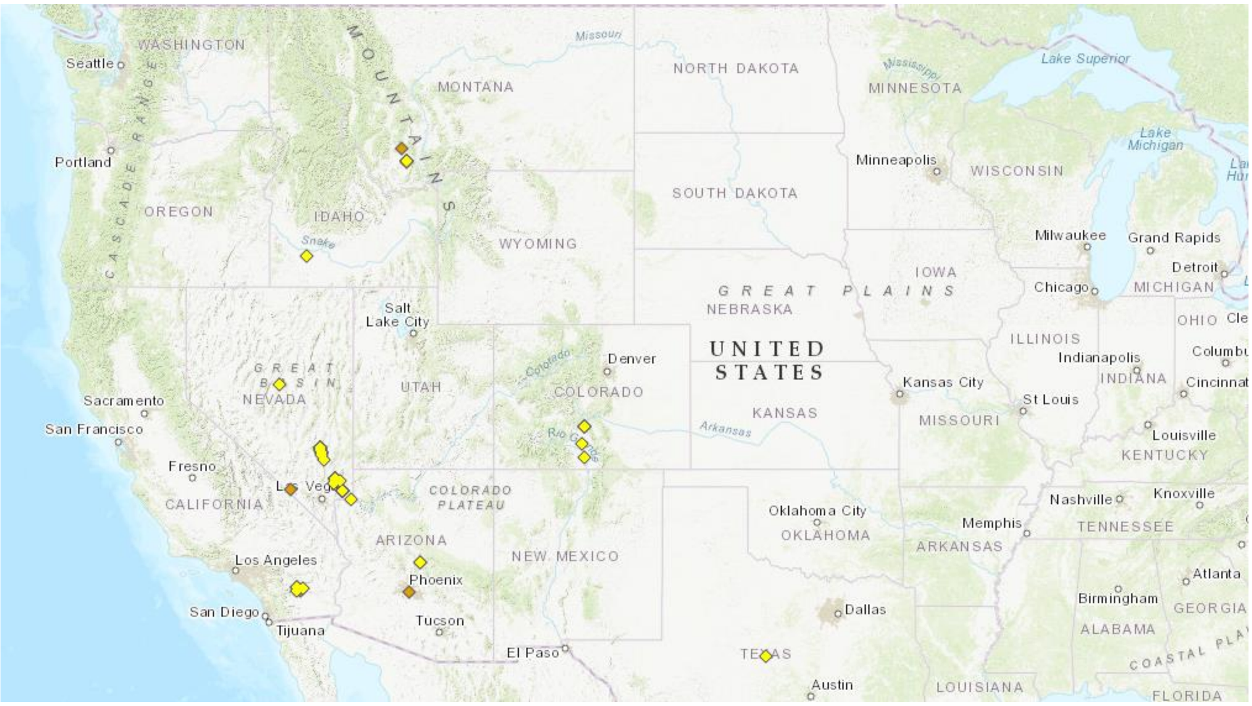


**Figure 2**. Known distribution of *Poecilia mexicana* in the United States. Map from Nico and Schofield (2017). Yellow diamonds represent established populations; orange diamonds represent non-established or unknown status occurrences.

# 6 Climate Matching

## Summary of Climate Matching Analysis

The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous U.S. was 0.212, which is a high climate match. The climate match was high in Arizona, California, Florida, Idaho, New Mexico, Nevada, Oregon, Texas, Utah, and Washington. The climate match was medium in Colorado and Oklahoma, and low elsewhere in the United States.

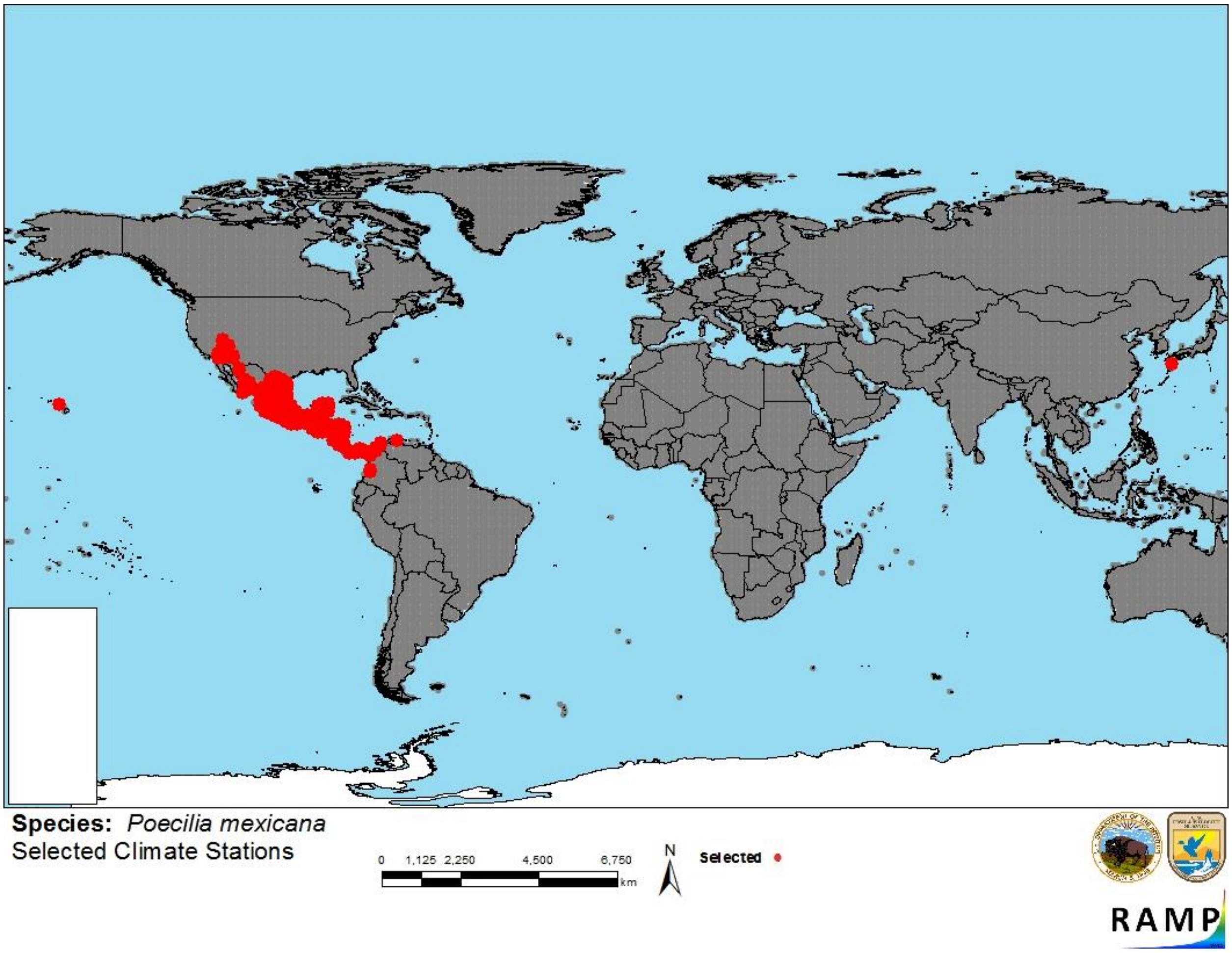


**Figure 3**. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *Poecilia mexicana* climate matching. Source locations from GBIF Secretariat (2017). Occurrence points in Montana, Utah, and Colorado were excluded from selected climate stations because they occurred in thermal spring-fed water bodies. Points excluded from the global distribution map were also removed from the selected climate stations.

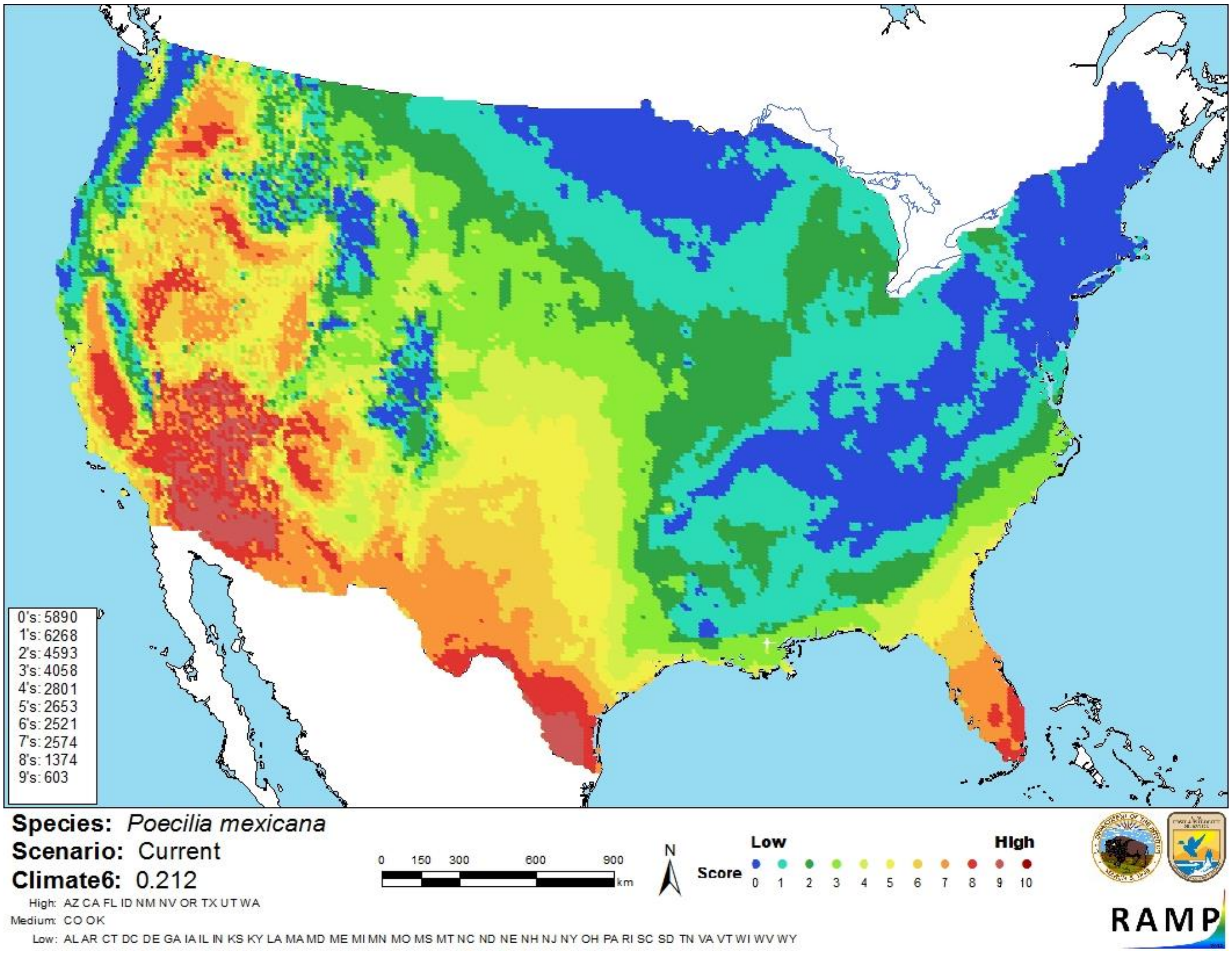


**Figure 4**. Map of RAMP (Sanders et al. 2014) climate matches for *Poecilia mexicana* in the contiguous United States based on source locations reported by GBIF Secretariat (2017). 0=Lowest match, 10=Highest match.

The "High", "Medium", and "Low" climate match categories are based on the following table:

| Climate 6: Proportion of (Sum of Climate Scores 6-10) / (Sum of total Climate Scores) | Climate Match Category |
|---|---|
| 0.000≤X≤0.005 | Low |
| 0.005<X<0.103 | Medium |
| ≥0.103 | High |

# 7 Certainty of Assessment

*Poecilia mexicana* has been well studied. Multiple introductions of this species outside of its native range have been documented. Some impacts of this species where introduced have only been inferred, such as the decrease in population of endangered native species in the Moapa River following *Poecilia mexicana* introduction. Other impacts, specifically the extirpation of native damselflies from reaches of streams in Oahu where *P. mexicana* is established, are clearer but not certain because of the presence of other exotic fish species such as tilapia. Because of the lack of clarity in information on impacts of introduction, certainty of this assessment is low.

# 8 Risk Assessment

## Summary of Risk to the Contiguous United States

*P. mexicana* is a freshwater fish native to Mexico and Central America. It is reported from and established in several western U.S. States, and it is present in the aquarium trade in the United States. History of invasiveness was classified as "None Documented" for *P. mexicana* because research on introduced populations of the species has failed to directly link *P. mexicana* with negative impacts on native species. Nevertheless, several authors argue that introduced *P. mexicana* has been involved in the decline of certain native species in the western contiguous United States and Hawaii through mechanisms of competition, predation, and parasite introduction. *P. mexicana* has a high climate match with the contiguous United States, especially in areas of the country where it is already established in the wild. Overall risk assessment category is uncertain.

## Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): Low**
- **Overall Risk Assessment Category: Uncertain**

# 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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