U.S. Fish & Wildlife Service

Variable Platyfish (*Xiphophorus variatus*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, January 2017
Revised, December 2017
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1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2017):

"North America: endemic to Mexico from southern Tamaulipas to northern Veracruz."

From Culumber and Rosenthal (2013):

"*Xiphophorus variatus* is a species of platyfish inhabiting streams of north- and east-central Mexico from the coastal plain to the foothills of the Sierra Madre Oriental."

Status in the United States

From Froese and Pauly (2017):

"Introduced in the 1960s. Suspected self-sustaining populations reported to exist on the island of Oahu. However, the species is not contained in the 1992 list of introduced and established freshwater fishes of Hawaii. Also [Maciolek 1984]."

From NatureServe (2016):

"Established in springs in Beaverhead, Granite, and Madison counties, Montana; in canals along the eastern shore of Tampa Bay, Hillsborough County, Florida; and in Gainesville, Alachua County, Florida; uncommon (Page and Burr 1991). Populations reported from Arizona and California apparently are no longer extant."

From Nico (2017):

"This species has been recorded from Yuma and Tempe, Arizona (Minckley 1973); several sites in southern California (St. Amant and Hoover 1969; St. Amant and Sharp 1971; Moyle 1976; Hubbs et al. 1979; Shapovalov et al. 1981; Courtenay et al. 1984, 1991; Swift et al. 1993); Colorado (Zuckerman and Behnke 1986); as many as six counties in Florida (Courtenay et al. 1974; Burgess et al. 1977; J. D. Williams, personal observation; museum specimens); Oahu, Hawaii (Maciolek 1984; Mundy 2005); and Beaverhead, Broadwater, Granite, and Madison counties, Montana (Brown 1971; Courtenay 1985; Holton 1990)."

"Locally established in Florida (Courtenay and Meffe 1989; museum specimens): a population in Alachua County, Florida, first recorded in the 1970s (Burgess et al. 1977), still survives. Locally established in Montana (Courtenay and Meffe 1989); possibly established locally in California (Swift et al. 1993). Possibly established on Oahu, Hawaii: listed as established by Maciolek (1984), but this species is not listed in the state by recent reports (Devick 1991; Yamamoto and Tagawa 2000; Mundy 2005). It was established locally in Arizona from 1963 to 1965, but that population was presumably destroyed by a flood in late 1965 (Minckley 1973). The species was reported [as extirpated] from Colorado (Zuckerman and Behnke 1986)."

"It has been popular as an ornamental fish for many years."

From Courtenay and Stauffer (1990):

"As with other species of *Xiphophorus*, variable platyfish are known to have escaped from aquarium fish farms in Hillsborough County, Florida, and in Orange and Riverside counties, California (St. Amant and Hoover 1969; St. Amant and Sharp 1971; Courtenay et al. 1974). None of these introductions results in permanent establishment. The species was established in canals in Tempe, Arizona, but was extirpated by a flood; individuals have been collected periodically from drains near Yuma, Yuma County, Arizona, without evidence of establishment (Minckley 1973). The species is established in Gainesville, Alachua County, Florida (Burgess et al. 1977), probably from introductions by university students (Courtenay et al. 1986). Brown

(1971) reported established populations, released by aquarists, in thermal outflows in Beaverhead, Granite, and Madison counties, Montana; the population in Beaverhead County remains extant (Courtenay et al. 1986)."

From Cohen et al. (2014):

"Here we provide the first report of establishment of this species in Texas, where it has persisted for at least a decade in Waller Creek in the city of Austin (Travis County)."

Means of Introductions in the United States

From Courtenay and Stauffer (1990):

"As with other species of *Xiphophorus*, variable platyfish are known to have escaped from aquarium fish farms in Hillsborough County, Florida, and in Orange and Riverside counties, California (St. Amant and Hoover 1969; St. Amant and Sharp 1971; Courtenay et al. 1974). […] The species is established in Gainesville, Alachua County, Florida (Burgess et al. 1977), probably from introductions by university students (Courtenay et al. 1986). Brown (1971) reported established populations, released by aquarists, in thermal outflows in Beaverhead, Granite, and Madison counties, Montana; the population in Beaverhead County remains extant (Courtenay et al. 1986)."

From Nico (2017):

"Probably due to aquarium releases."

From Froese and Pauly (2017):

"Accidentally released from aquaria and populations were found to be reproducing but it is uncertain whether it will become established in Florida [Shafland 1979]."

Remarks

From Magalhães and Jacobi (2017):

"This situation is already occurring in the area (Magalhães et al., 2011), as well as the probable intra-specific hybridization between *X. maculatus* and *X. variatus* (A.L.B. Magalhães, pers. obs.)."

From Cohen et al. (2014):

"This population likely includes genes from *X. maculatus* and/or *X. hellerii* that may enhance cold tolerance. *Xiphophorus hellerii* occurs in the wild at higher altitudes than *X. variatus* (Miller et al., 2005) and may have greater cold tolerance."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From Eschmeyer et al. (2017):

"**Current status:** Valid as *Xiphophorus variatus* (Meek 1904)."

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 Poecilidae
Subfamily Poecilinae
Genus *Xiphophorus*
Species *Xiphophorus variatus*"

Size, Weight, and Age Range

From Froese and Pauly (2017):

"Max length : 7.0 cm TL male/unsexed; [Page and Burr 1991]; common length : 3.9 cm TL male/unsexed; [Hugg 1996]"

From NatureServe (2016):

"Length: 6 centimeters"

Environment

From Froese and Pauly (2017):

"Freshwater; benthopelagic; pH range: 7.0 - 8.0; dH range: 9 - 19; non-migratory."

"15°C - 25°C [Riehl and Baensch 1991] [assumed to be recommended aquarium temperature range]"

From Cohen et al. (2014):

"Borowsky reports them occurring in water temperatures of 17°C (Borowsky, 1984) and 18–24°C (Borowsky, 1990) in winter and spring at a spring dominated site in the species' native range, but presumably the species can tolerate lower temperatures. Dawes (2001) puts the species' lower limit at 16°C, and Hoedman (1974) reports it tolerates temperatures as low as 15°C."

"The population had apparently survived a period of at least 4 days at or near 7°C, and their improved equilibrium suggests that they acclimated to the lower temperature."

Climate/Range

From Froese and Pauly (2017):

"Subtropical; […]; 25°N - 20°N"

Distribution Outside the United States

Native

From Froese and Pauly (2017):

"North America: endemic to Mexico from southern Tamaulipas to northern Veracruz."

From Culumber and Rosenthal (2013):

"*Xiphophorus variatus* is a species of platyfish inhabiting streams of north- and east-central Mexico from the coastal plain to the foothills of the Sierra Madre Oriental."

Introduced

Established populations of *Xiphophorus variatus* resulting from introductions have been documented in Hong Kong, Costa Rica, and Colombia. Probably established populations of *X. variatus* resulting from introductions have been documented in Singapore. An introduction to Spain was listed but no further information was available (Froese and Pauly 2017).

From Froese and Pauly (2017):

"Established in the Magdalena and Orinoco watersheds [in Colombia]."

"Recorded from several tributaries on the Río Reventazón drainage [in Costa Rica] [Bussing 1998]."

FAO (2017) lists *Xiphophorus variatus* as introduced to and established in Colombia, Puerto Rico, Hong Kong, and Costa Rica; introduced and probably established in Singapore.

From Magalhães and Jacobi (2017):

"We found females of *P. reticulata*, *P. sphenops*, *X. hellerii*, *X. maculatus*, and *X. variatus* in reproductive activity during the 12 months of the year in almost all creeks [in Paraíba do Sul River basin, southeastern Brazil], […]"

From Lee et al. (2006):

"Eight of the ten most common species recorded [in 220 study sites in Hong Kong, China] were native species .Two exotics were *Gambusia affinis* and *Xiphophorus variatus*."

Means of Introduction Outside the United States

FAO (2017) listed reasons for introductions of *Xiphophorus variatus* include aquaculture, ornamental, and accidental.

From Froese and Pauly (2017):

"Widespread in fish rearing facilities and has presumably escaped into local waters [in Colombia]."

Short Description

From Nico (2017):

"Similar to some of the other poeciliids, this species exhibits considerable natural variation (e.g., Wischnath 1993)."

From Culumber and Rosenthal (2013):

"This species exhibits high polymorphism at the autosomal tailspot locus, with at least 6 known patterns that are exhibited in both sexes (Borowsky 1984)."

Biology

From Froese and Pauly (2017):

"[…] non-migratory."

"Occurs in warm springs, weedy canals and ditches [Page and Burr 1991]. Feeds on worms, crustaceans, insects and plant matter [Mills and Vevers 1989]."

"After 24 days gestation, up to 100 young are born."

"Reproductive guild: bearers, internal live bearers"

From NatureServe (2016):

"Usually lentic habitats in native range. Has been collected from habitats with low oxygen levels. Apparently has little tolerance for brackish water. North America: warm springs, weedy canals and ditches (Page and Burr 1991)."

"Food Comments: Feeds during day primarily on mud or bottom ooze."

Human Uses

From Froese and Pauly (2017):

"aquarium: commercial"

"One of the most frequently found species in the pet and aquarium stores [in Spain] [Maceda-Veiga et al. 2013].

"Used for genetic research [Robins et al. 1991]."

From Nico (2017):

"It has been popular as an ornamental fish for many years."

Diseases

No records of OIE-reportable diseases (OIE 2019) were found for *Xiphophorus variatus*.

From Froese and Pauly (2017):

"Fin-rot Disease (late stage), Bacterial diseases
White spot Disease, Parasitic infestations (protozoa, worms, etc.)
Fin Rot (early stage), Bacterial diseases
Skin Fungi (Saprolegnia sp.), Fungal diseases
Turbidity of the Skin (Freshwater fish),
Parasitic infestations (protozoa, worms, etc.)
Bacterial Infections (general), Bacterial diseases
Fin-rot Disease (late stage), Bacterial diseases
Costia Disease, Parasitic infestations (protozoa, worms, etc.)
Ichthyobodo Infection, Parasitic infestations (protozoa, worms, etc.)
Fish tuberculosis (FishMB), Bacterial diseases"

Poelen et al. (2014) list *Bothriocephalus acheilognathi*, *Centrocestus formosanus*, *Eustrongylides ignotus*, *Posthodiplostomum minimum*, and *Valipora campylancristrota* as parasites of *Xiphophorus variatus*.

Mendoza et al. (2015) report that *Xiphophorus variatus* could be a vector for introduction of the pathogen *Mycobacterium marium*.

Magalhães (2006) reports infection with *Lernaea* sp.

Threat to Humans

From Froese and Pauly (2017):

"Potential pest [FAO 1997]"

3 Impacts of Introductions

The follow information concerns ***potential*** impacts of introductions or broad generalizations.

From Froese and Pauly (2017):

"At least one country reports adverse ecological impact after introduction."

"The introduction of these two species (*Xiphophorus helleri* and *X. variatus*) is likely to have affected native cyprinid species such as *Aphyocypris lini*, the native endemic Hong Kong minnow."

From Nico (2017):

"Impact of Introduction [in the United States]: Unknown."

From Magalhães and Jacobi (2017):

"The presence of reproductive adults and juveniles of non-native poeciliids in these creeks, besides characterizing establishment by recruitment, may lead to biotic homogenization, i.e. the establishment of the same non-native species at two or more locations, decreasing beta-diversity over time (Olden et al., 2011). This situation is already occurring in the area (Magalhães et al., 2011), as well as the probable intra-specific hybridization between *X. maculatus* and *X. variatus* (A.L.B. Magalhães, pers. obs.)."

From Cohen et al. (2014):

"However, in some areas of Waller Creek, it [*X. variatus*] has become the dominant fish species, suggesting that it may be strongly impacting the community. It has replaced native fishes near Monterrey, Nuevo Léon, in Mexico (S. Contreras, in litt., 1976), but in Hawaii may have negligible ecological impact compared to *X. maculatus* and especially *X. hellerii* (Maciolek, 1984), […]"

4 Global Distribution

Figure 1. Known global distribution of *Xiphophorus variatus*. Locations are in the United States, Mexico, Costa Rica, Colombia, Dominican Republic, Mauritius, and China. Map from GBIF Secretariat (2017). The location in Mauritius was not used to select source points for the climate matching. The record information listed this observation as from a farm pond, therefore it was not representative of an established wild population.

An additional georeferenced locations in southern Brazil are provided in Magalhães (2006) and Magalhães and Jacobi (2017).

5 Distribution Within the United States

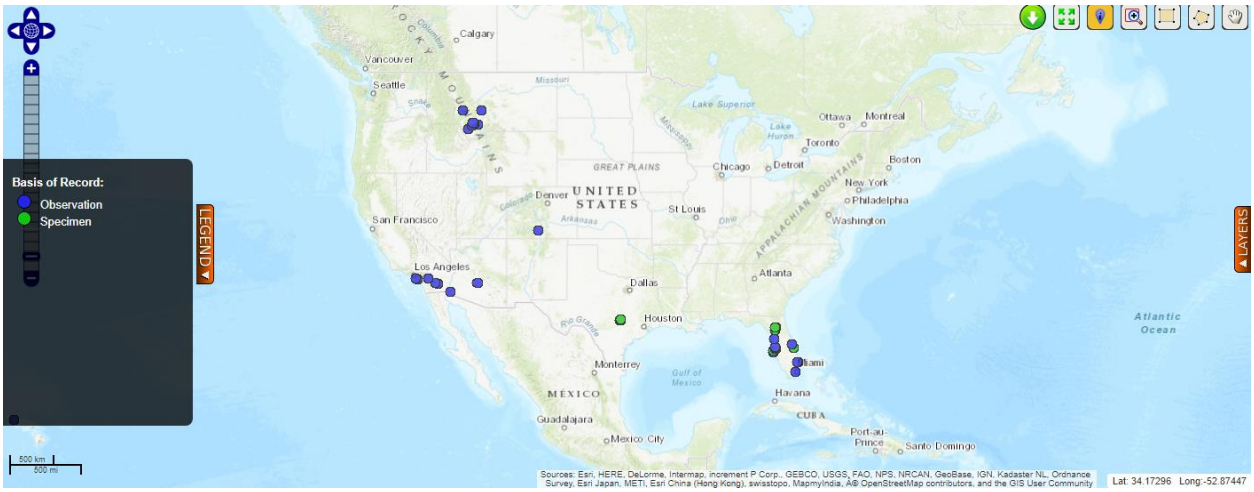

Figure 2. Known distribution of *Xiphophorus variatus* in the contiguous United States. Map from BISON (2017). The locations in Montana were not used to select source points for the climate match. Those populations only persist in thermal outflows (Courtenay and Stauffer 1990). The conditions in a thermal outflow would not be reflected accurately in the climate variables used in RAMP for those locations therefore including them as source points would result in an incorrect climate match. The locations in Arizona, California, and Colorado were not used to select source points for the climate match; they either did not establish populations or were extirpated (Courtenay and Stauffer 1990; NatureServe 2016; Nico 2017).

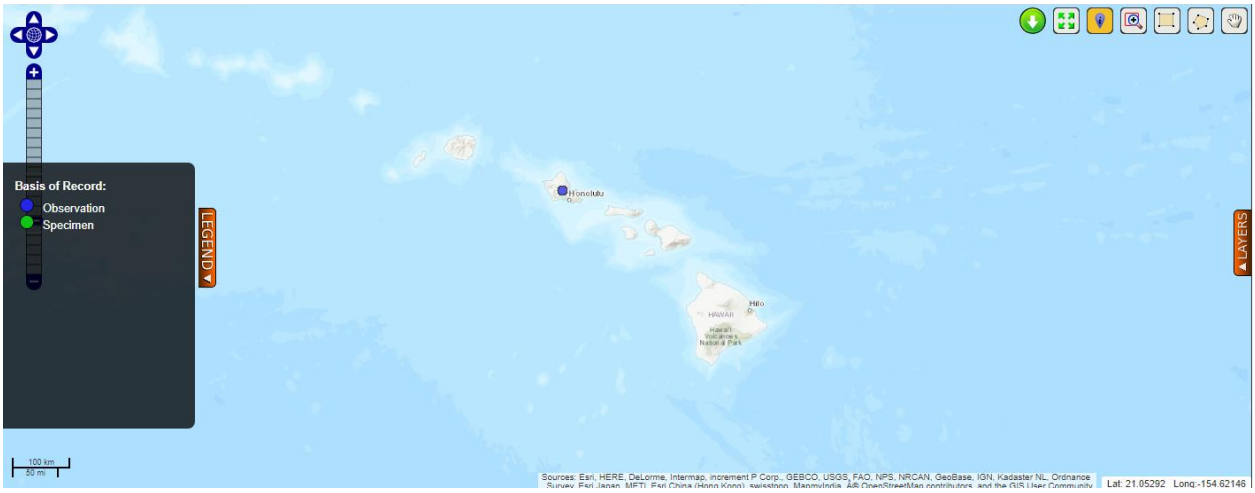

Figure 3. Known distribution of *Xiphophorus variatus* in Hawai'i. Map from BISON (2017).

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Xiphophorus variatus* was high along the southern Atlantic Coast, the eastern and western ends of the Gulf Coast, most of Texas, and in some areas in the southwest. The rest of the United States was low to medium match. The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.161, high (scores 0.103 and greater are classified as high). Most States had low individual Climate 6 scores, except for Arizona, Florida, Georgia, New Mexico, North Carolina, Oklahoma, South Carolina, and Texas, which had high individual scores, and Alabama, Arizona, California, Kansas, and Louisiana, which had medium individual scores.

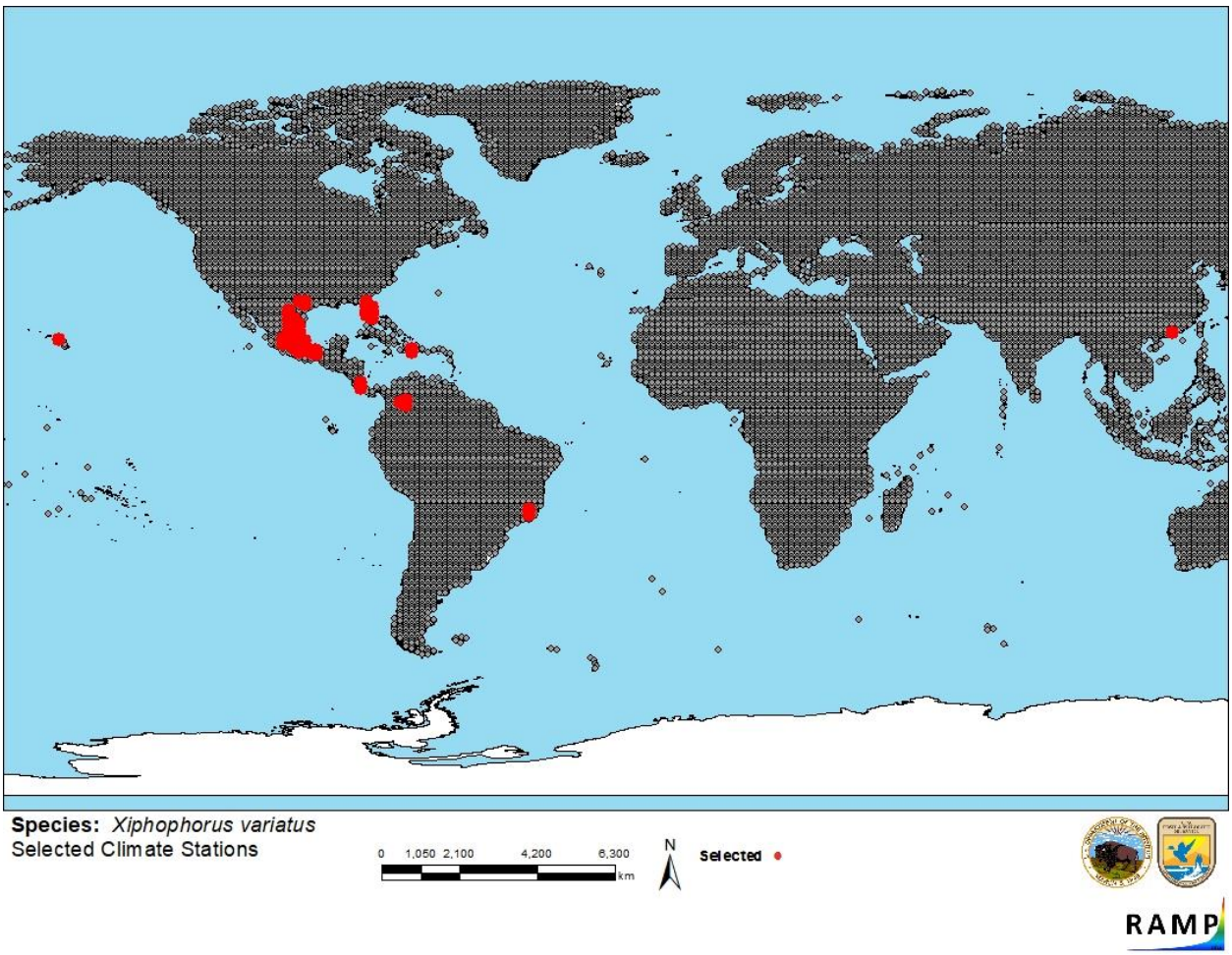

Figure 4. RAMP (Sanders et al. 2018) source map showing weather stations selected as source locations (red; China, United States (Florida, Texas, Hawaii), Mexico, Costa Rica, Colombia, Dominican Republic) and non-source locations (gray) for *Xiphophorus variatus* climate matching. Source locations from Courtenay and Stauffer (1990), Magalhães (2006), NatureServe (2016), BISON (2017), GBIF Secretariat (2017), and Magalhães and Jacobi (2017). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

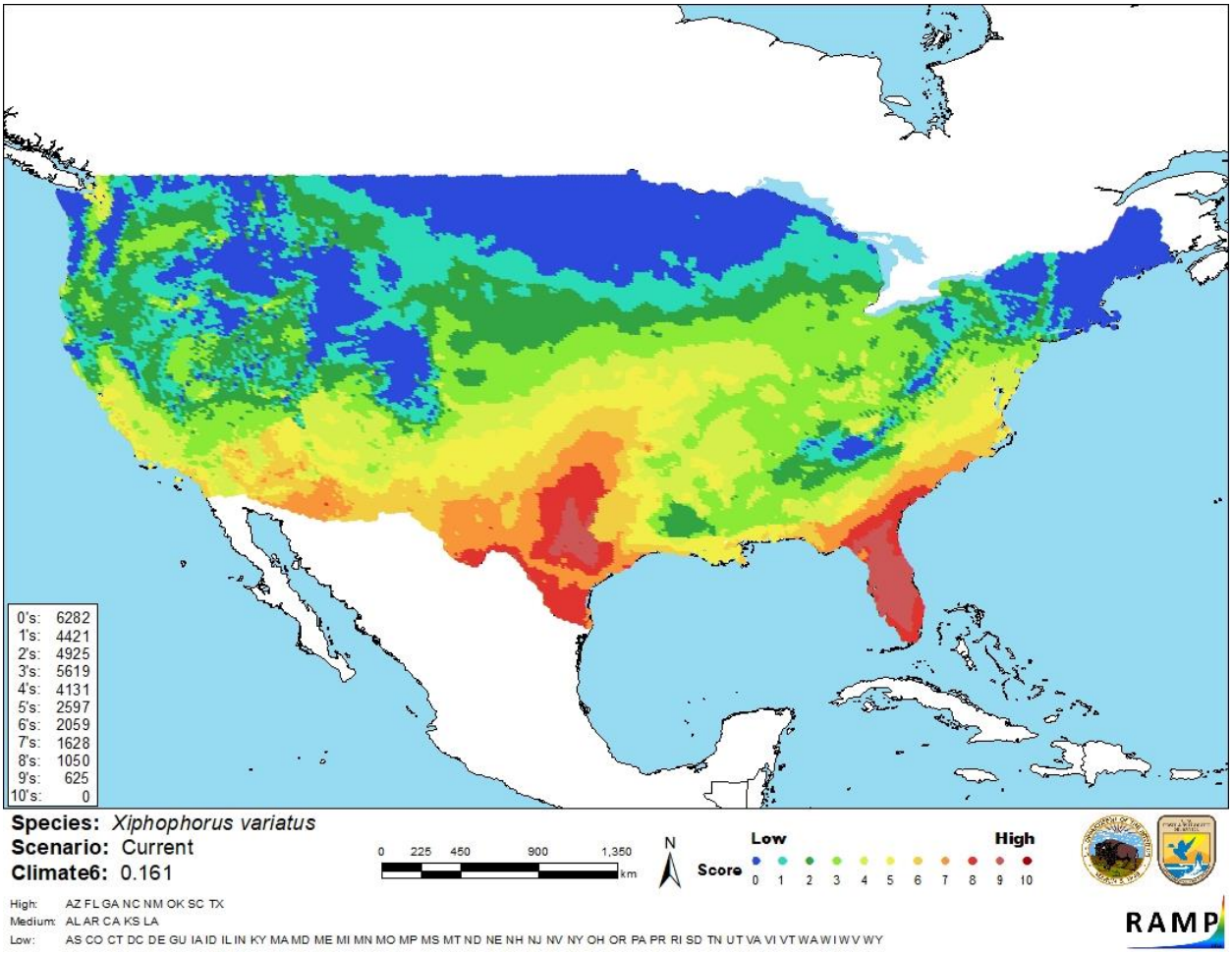

Figure 5. Map of RAMP (Sanders et al. 2018) climate matches for *Xiphophorus variatus* in the contiguous United States based on source locations reported by Courtenay and Stauffer (1990), Magalhães (2006), NatureServe (2016), BISON (2017), GBIF Secretariat (2017), Magalhães and Jacobi (2017). Counts of climate match scores are tabulated on the left. 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
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

7 Certainty of Assessment

The certainty of this assessment is low. There was information regarding the ecology, biology, and distribution of *Xiphophorus variatus*. Many records of introductions were found that resulted in established populations. Many records of potential impacts were found but no scientifically defensible records of documented impacts.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Variable Platyfish (*Xiphophorus variatus*) is a freshwater fish native to Mexico. The species is popular in the aquarium industry and has been used as a research subject. *X. variatus* is in trade within the United States. The history of invasiveness for *X. variatus* is None Documented. There were numerous records of introductions resulting in established populations. There were many records of potential impacts but no scientifically defensible information on documented impacts. The overall climate match is high. Most of the contiguous United States had a low of medium match with the areas of high match in the Southeast and Gulf. The certainty of assessment is low due to lack of information on impacts. The 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**
- **Remarks/Important additional information** No additional information.
- **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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