

# Green Swordtail (*Xiphophorus hellerii*)

## Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2011

Revised, March 2018

Web Version, 11/7/2019



Photo: Usien. Licensed under Creative Commons (CC0 1.0). Available: [https://commons.wikimedia.org/wiki/File:Xiphophorus\\_helleri\\_Annanasschwerttaeger\\_Maennchen.JPG](https://commons.wikimedia.org/wiki/File:Xiphophorus_helleri_Annanasschwerttaeger_Maennchen.JPG). (March 2018).

## 1 Native Range and Status in the United States

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### Native Range

From Nico et al. (2018):

“Middle America from Rio Nautla (= Rio Nantla), Veracruz, Mexico, to northwestern Honduras (Rosen 1960, 1979; Page and Burr 1991; Greenfield and Thomerson 1997; Miller et al. 2005).”

From Eschmeyer et al. (2018):

“Central America: Belize, Guatemala, Honduras, Mexico”

## Status in the United States

From Nico et al. (2018):

“This species has been recorded from Rock Spring in Maricopa County, Arizona (Minckley 1973); several counties in California (Coots 1956; St. Amant and Hoover 1969; St. Amant 1970; Mearns 1975; Courtenay et al. 1984, 1986, 1991; Swift et al. 1993; Dill and Cordone 1997); Conejos and Sagauche counties in Colorado (Woodling 1985, Zuckerman and Behnke 1986; S. Platania, personal communication); several counties in Florida (Courtenay and Robins 1973; Courtenay et al. 1974; Courtenay and Hensley 1979; Dial and Wainright 1983; museum specimens); Hawaii (Brock 1960; Maciolek 1984; Devick 1991; Mundy 2005); several geothermal waters in Idaho (Courtenay 1985; Courtenay et al. 1987; Idaho Fish and Game 1996); St. Tammany Parish, Louisiana (K. Piller, pers. comm.); Madison County, Montana (Brown 1971; Courtenay 1985; Courtenay and Meffe 1989; Holton 1990); Indian Spring and Rogers Spring, Clark County, Nevada (La Rivers 1962; Deacon et al. 1964; Minckley 1973; Courtenay and Deacon 1982; Deacon and Williams 1984; Vinyard 2001); the Verdigris River near Catoosa, Oklahoma (Pigg et al. 1996); Bexar County, Texas (Howells 1992); and Teton County, Wyoming (Courtenay et al. 1987; Hubert 1994; Stone 1995; Tilmant 1999). Also collected in several locations throughout Puerto Rico (Erdsman 1984; Lee et al 1980 et seq), and in the Tarzan River, Guam (S. Walsh, pers. communication).”

“It is locally established, or possibly so, in Colorado (Zuckerman and Behnke 1986), Florida (Nico, personal communication), Hawaii (Devick 1991), Idaho (Courtenay and Meffe 1989), Montana (Courtenay and Meffe 1989), Nevada (Courtenay and Meffe 1989), Texas (Howells 1992), and Wyoming (Stone 1995). A breeding population existed in Arizona at Rock Spring, but it disappeared after a flood in 1965 (Minckley 1973). It has been reported from several sites in California (Dill and Cordone 1997) and a single locality in Oklahoma (Pigg et al. 1996).”

Chapman et al. (1997) report that 150,053 individual *X. hellerii* were imported in the United States in October 1992, accounting for 1.0% of all ornamental fishes imported into the country in that month. Rixon et al. (2005) found *X. hellerii* in 17 of 20 pet and aquarium stores surveyed in the U.S. and Canada.

## Means of Introductions in the United States

From Nico et al. (2018):

“Most introductions probably due to aquarium releases. Its origin in the Westminster flood control channel in California was believed to be a goldfish farm (St. Amant and Hoover 1969). Florida records may also be fish farm escapes or aquarium releases.”

## Remarks

From Nico et al. (2018):

“This species exhibits a wide natural range of body form and color patterns (Rosen 1960, 1979; Dawes 1991; Wischnath 1993). It has long been popular as an ornamental fish, and has been

used in genetics research. Many ornamental swordtails are hybrids of *X. hellerii* with the either *X. maculatus* or *X. variatus*.”

“The green swordtail was recorded from Indian Spring, Clark County, Nevada, as early as 1975 (Courtenay and Deacon 1982). However, the *Xiphophorus* taken from Indian Spring during later collections were identified as hybrids of *X. hellerii* x *X. maculatus* (Courtenay and Deacon 1982; Deacon and Williams 1984; Page and Burr 1991). That conclusion apparently was based on the fact that the live fish were yellow to pale orange (Courtenay and Deacon 1982). In 1989, Rauchenberger (personal communication) examined the preserved voucher material (UF 91919) and determined that all specimens were *X. hellerii*. Nevertheless, some of the other above records actually may represent hybrids rather than pure *X. hellerii*. Myers (1940) mentioned an unconfirmed report of *X. hellerii* breeding in the Florida Everglades; however, no *Xiphophorus* spp. are known to have established there (Loftus, personal communication).”

From Seriously Fish (2019):

“This species is among the world’s most recognisable aquarium fishes and ubiquitous in the ornamental trade, although its name is often misspelled *X. helleri* (with only a single *i*, vs. correct spelling *X. hellerii*) in both scientific and hobbyist literature.”

Fricke et al. (2019) list *Xiphophorus brevis*, *Xiphophorus guntheri*, *Xiphophorus jalapae*, *Xiphophorus rachovii*, and *Xiphophorus strigatus* as synonyms for *Xiphophorus hellerii*. All names were used in searching for information about this species.

## 2 Biology and Ecology

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### Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2018):

“Kingdom Animalia  
Subkingdom Bilateria  
Infrakingdom Deuterostomia  
Phylum Chordata  
Subphylum Vertebrata  
Infraphylum Gnathostomata  
Superclass Actinopterygii  
Class Teleostei  
Superorder Acanthopterygii  
Order Cyprinodontiformes  
Suborder Cyprinodontoidei  
Family Poeciliidae  
Subfamily Poeciliinae  
Genus *Xiphophorus*  
Species *Xiphophorus hellerii*”

From Fricke et al. (2019):

“**Current status:** Valid as *Xiphophorus hellerii* Heckel 1848. Poeciliidae: Poeciliinae.”

## **Size, Weight, and Age Range**

From Froese and Pauly (2018):

“Max length : 14.0 cm TL male/unsexed; [Wischnath 1993]; 16.0 cm TL (female); common length : 2.8 cm TL male/unsexed; [Hugg 1996]”

## **Environment**

From Nico et al. (2018):

“Inhabits fast-flowing streams and rivers around vegetation, and also lives in warm springs, ponds, and ditches (Miller et al. 2005).”

From Froese and Pauly (2018):

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

## **Climate/Range**

From Froese and Pauly (2018):

“Tropical; 22°C - 28°C [Adelaide Aquariums 2004]; 26°N - 12°N”

## **Distribution Outside the United States**

Native

From Nico et al. (2018):

“Middle America from Rio Nautla (= Rio Nantla), Veracruz, Mexico, to northwestern Honduras (Rosen 1960, 1979; Page and Burr 1991; Greenfield and Thomerson 1997; Miller et al. 2005).”

From Eschmeyer et al. (2018):

“Central America: Belize, Guatemala, Honduras, Mexico”

Introduced

From Nico et al. (2018):

“Widely introduced in locations worldwide, including Africa and Australia (Welcomme 1988).”

CABI (2018) list Australia, Canada, Hungary, Israel, Papua New Guinea, Puerto Rico, Singapore, South Africa, Sri Lanka, Hong Kong, Indonesia, Japan, Taiwan, Madagascar, Namibia, Zambia, Bahamas, Jamaica, Puerto Rico, Fiji, Guam, New Caledonia, and New

Zealand as places where *X. hellerii* has been introduced and is present. The source further lists Australia, Canada, Hungary, Israel, Papua New Guinea, Singapore, South Africa, and Sri Lanka as countries where it is established in the wild through natural reproduction.

Froese and Pauly (2019) report *X. hellerii* as established in Hong Kong, Jamaica, Japan, Madagascar, Martinique, Namibia, New Caledonia, New Zealand, Reunion, Guam, Fiji, Colombia, Taiwan, Bahamas, Israel, Sri Lanka, Papua New Guinea, Australia, and South Africa. Froese and Pauly (2019) report *X. hellerii* as probably established in India, Indonesia, Mauritius, Slovakia, Czech Republic, and Singapore.

According to Lincoln Barroso de Magalhães and Jacobi (2010), *X. hellerii* is established in Brazil.

## **Means of Introduction Outside the United States**

CABI (2018) list biological control, intentional release, pet trade, and flooding as potential vectors for introduction.

## **Short Description**

From Froese and Pauly (2018):

“Dorsal spines (total): 0; Dorsal soft rays (total): 11-14; Anal spines: 0; Anal soft rays: 8 - 10. This species is distinguished by having a medium to large swordtail with a long straight caudal appendage; midlateral stripe may be dusky or brownish (northern populations) or red; 2 additional reddish stripes may be present above midlateral line and one beneath; terminal segment of gonopodial ray 3 produced into a crescent-shaped hook and blade pointed distally; ray 4a curves strongly backward over the blade at an angle greater than 90°; distal serrae of ray 4p reduced in size and number and proximal serrae rather slender; terminal segment of ray 5a produced into a claw, several times larger than the distal serrae of ray 4p [Kallman et al. 2004].”

## **Biology**

From Froese and Pauly (2018):

“Adults are found mainly in rapidly flowing streams and rivers, preferring heavily vegetated habitats [Wischnath 1993]. They occur in warm springs and their effluents, weedy canals and ponds [Page and Burr 1991] They feed on worms, crustaceans, insects and plant matter [Mills and Ververs 1989]. Used for genetics research [Robins et al. 1991]. Especially the red varieties are very popular aquarium fishes [Riehl and Baensch 1991]. Aquarium keeping: the males aggressive towards each other; minimum aquarium size 80 cm [BMELF 1999].”

## **Human Uses**

From Froese and Pauly (2018):

“Fisheries: of no interest; aquarium: highly commercial”

Chapman et al. (1997) report that 150,053 individual *X. hellerii* were imported in the United States in October 1992, accounting for 1.0% of all ornamental fishes imported into the country in that month. Rixon et al. (2005) found *X. hellerii* in 17 of 20 pet and aquarium stores surveyed in the U.S. and Canada.

## Diseases

From Froese and Pauly (2018):

“Fin-rot Disease (late stage), Bacterial diseases  
Costia Disease, Parasitic infestations (protozoa, worms, etc.)  
Dactylogyrus Gill Flukes Disease, Parasitic infestations (protozoa, worms, etc.)  
Skin Flukes, Parasitic infestations (protozoa, worms, etc.)  
Fin Rot (early stage), Bacterial diseases  
Columnaris Disease (e.), Bacterial diseases  
Skin Fungi (*Saprolegnia* sp.), Fungal diseases  
Pseudomonas infection, Bacterial diseases  
Bacterial Infections (general), Bacterial diseases  
Aeromonosis, Bacterial diseases  
Velvet Disease, Parasitic infestations (protozoa, worms, etc.)  
Cryptobia Infestation, Parasitic infestations (protozoa, worms, etc.)  
Metacercaria Infection (Flatworms), Parasitic infestations (protozoa, worms, etc.)  
Fungal Infection (general), Fungal diseases  
Viral Diseases (general), Viral diseases  
Mexiconema Infestation, Parasitic infestations (protozoa, worms, etc.)”

No reported OIE-listed diseases.

## Threat to Humans

From Froese and Pauly (2018):

“Potential pest”

## 3 Impacts of Introductions

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From Nico et al. (2018):

“Largely unknown. The green swordtail has been implicated in the decline of the Utah sucker *Catostomus ardens* in a thermal spring in Wyoming (Courtenay et al. 1988). Green swordtails, and other introduced poeciliids, have been implicated in the decline of native damselflies on Oahu, Hawaii. Often the distributions of the damselflies and introduced fishes were found to be mutually exclusive, probably resulting from predation by the fish on the insects (Englund 1999).”

From Froese and Pauly (2018):

“Several countries report adverse ecological impact after introduction.”

From CABI (2018):

“Although much literature has considered the invasive potential and ecological impacts of *X. hellerii* (e.g. McKay, 1978; Arthington, 1991; Arthington et al., 1999; Bomford and Glover, 2004; Corfield et al., 2007), the ecological impacts are poorly understood (Arthington and Lloyd, 1989; Arthington, 1991) and specific mechanisms have not been clearly defined. An example is the difficulty of dissociating the effects of habitat and hydrological changes compared with the effects of *X. hellerii* on indigenous fauna in Queensland (Milton and Arthington, 1983; Arthington et al., 1990).”

“While the specific ecological impacts of *X. hellerii* may be unclear, research from locations including Australia (McKay, 1978; Arthington et al., 1983), Hawaii (Englund, 1999), Hong Kong (Dudgeon and Corlett, 1994), Israel (Goren and Galil, 2005) and the USA (Courtenay et al., 1988) suggests that when *X. hellerii* occurs in high numbers, and particularly in sympatry with other introduced poeciliids (*Gambusia*, *Poecilia* or *Xiphophorus spp.*), impacts are observed on aquatic ecosystems.”

“A negative synergistic effect may exist between introduced *X. hellerii* and *G. holbrooki* in Queensland, as where both species co-exist in large numbers native fishes are rare or absent, particularly surface-dwelling species (McKay, 1978, 1984; Arthington et al., 1983; Arthington, 1989a, 1991). Similar observations have been made in Israel where *X. hellerii* and *Gambusia affinis* co-occur and indigenous fish are depressed (Goren and Galil, 2005). Similarly, Courtenay et al. (1988) implicated *P. reticulata* and *X. hellerii* in the decline of the Utah sucker (*Catostomus arden*) in a thermal Spring in northwestern Wyoming. Controlled laboratory trials with *X. hellerii*, *G. holbrooki* and two small, Australian native fishes demonstrated increased aggression and resource competition with both poeciliids present (Warburton and Madden, 2003).”

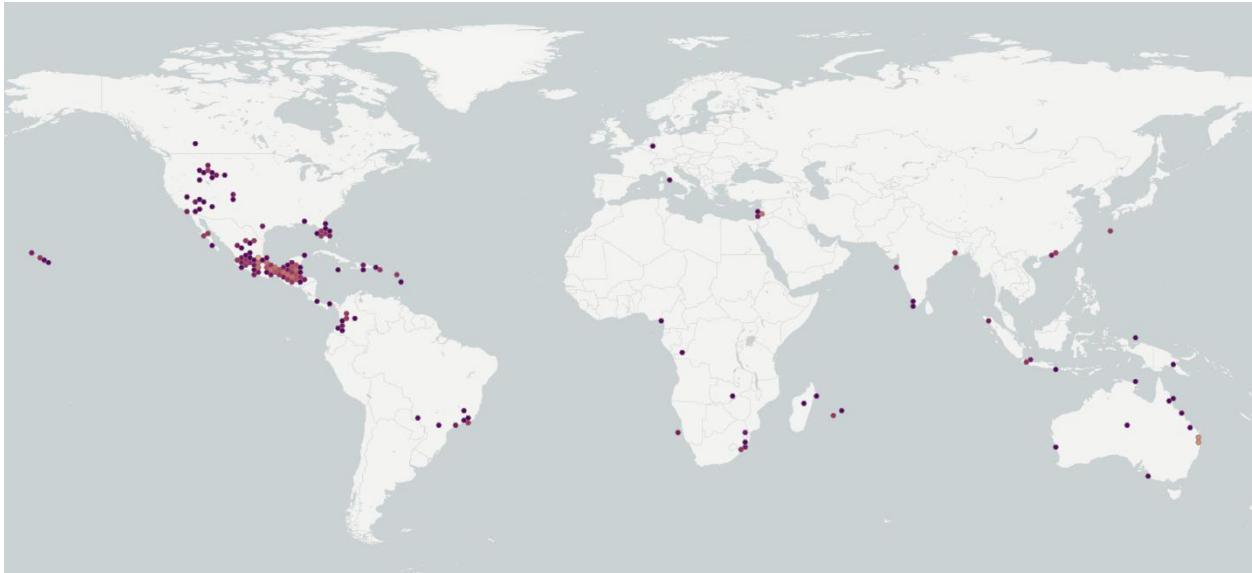
“Other potential ecological impacts of *X. hellerii* may include the consumption fish eggs and/or juveniles of indigenous fishes (Mackenzie et al., 2001) and predation upon invertebrate communities, which may also indirectly affect the food resources of native fishes (Arthington and McKenzie, 1997), and therefore the aquatic food web as a whole.”

From GISD (2018):

“*Xiphophorus helleri* is native to Central America. A very popular aquarium fish, it has been introduced to many countries around the world. Although *Xiphophorus hellerii* is rarely documented, its introduction into the natural environment has probably resulted in ecological consequences on native fish species.”

## 4 Global Distribution

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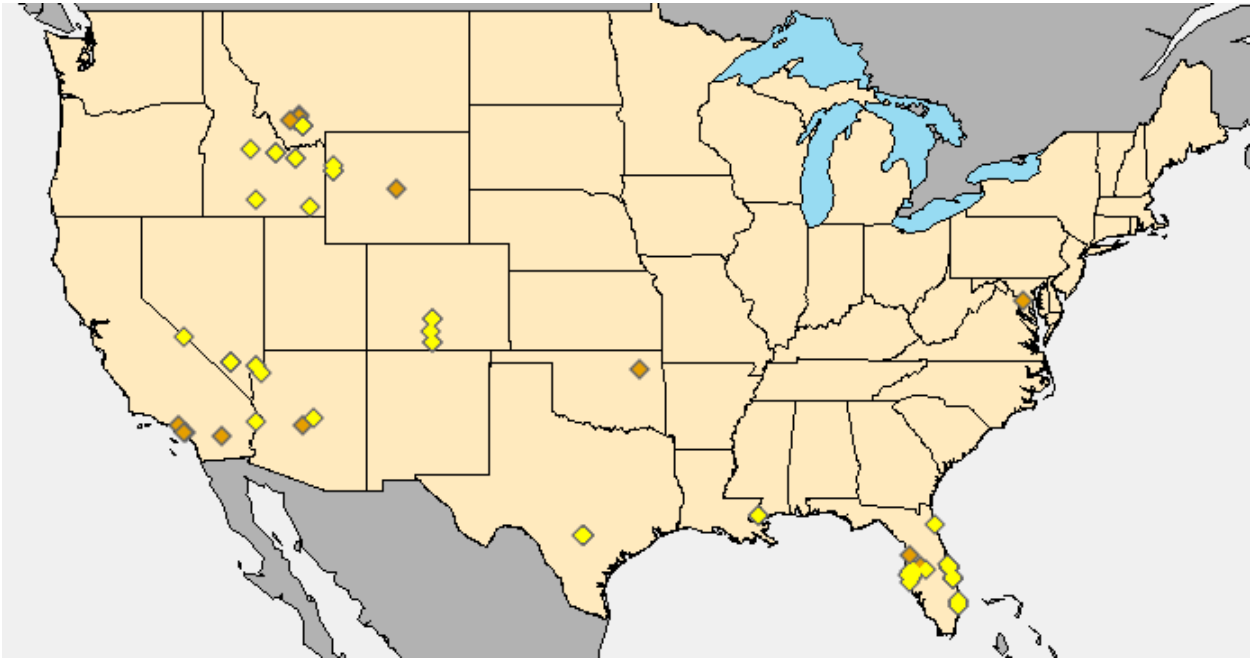


**Figure 1.** Known global distribution of *Xiphophorus hellerii*. Map from GBIF Secretariat (2019). Occurrences reported in the Dominican Republic, Guadeloupe, Martinique, Costa Rica, Panama, Germany, Italy, Cameroon, Democratic Republic of the Congo, and Zambia were excluded from the climate matching analysis because these countries have not been reported as having one or more established populations of *X. hellerii*. The occurrence reported in Canada was excluded from the climate matching analysis because it is located within a hot spring, where climatic conditions are not representative of the local climate overall. No georeferenced occurrences are available for portions of the species established range in Bahamas, Czech Republic, Fiji, Guam, Hungary, New Caledonia, New Zealand, Singapore, Slovakia, Sri Lanka, and Taiwan.



## 5 Distribution Within the United States

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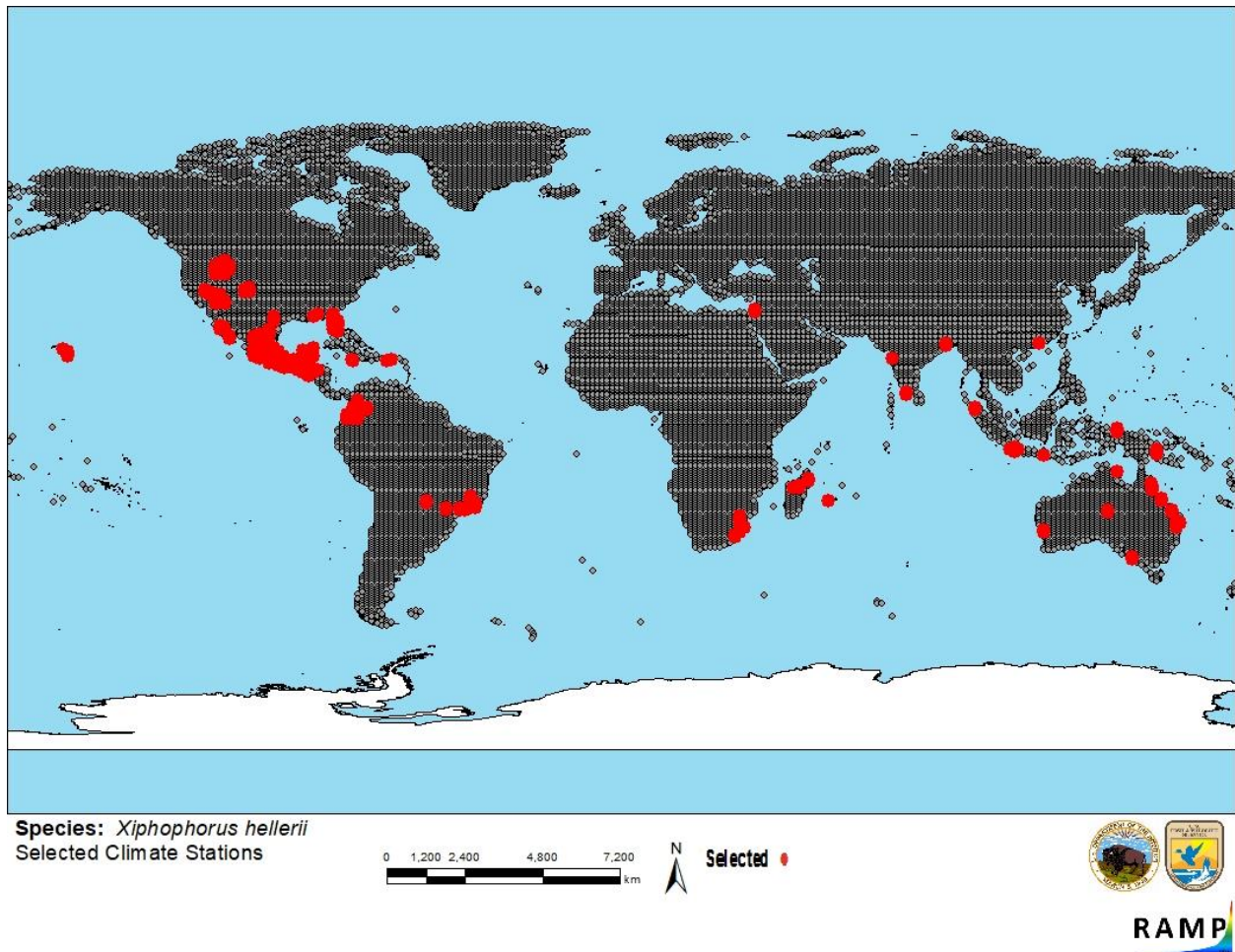
**Figure 2.** Distribution of *Xiphophorus hellerii* in the United States. Map from GBIF Secretariat (2018). The yellow diamonds represent established populations, while orange diamonds represent introductions. Only established populations are included in the climate match analysis.

## 6 Climate Matching

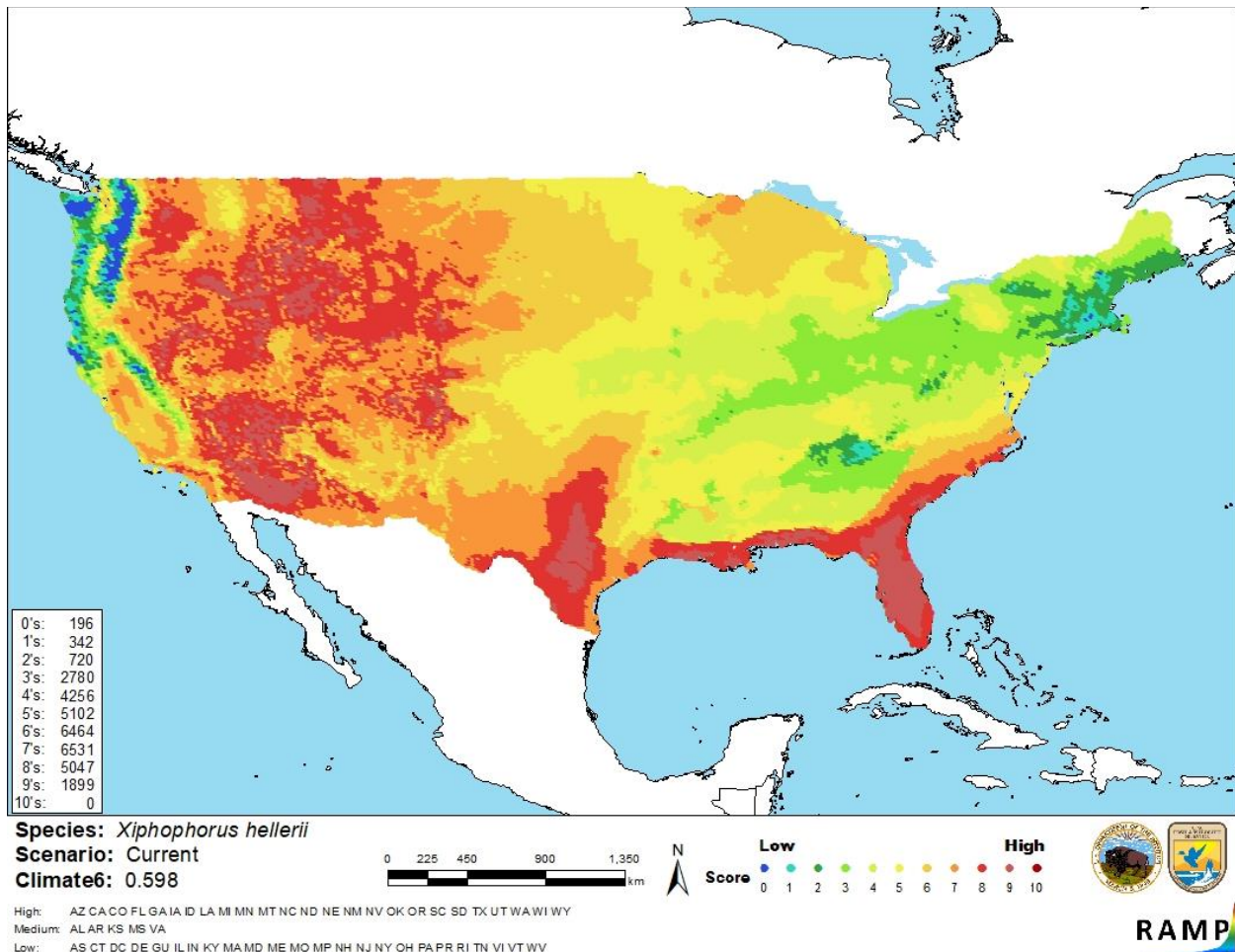
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### Summary of Climate Matching Analysis

The climate match (Sanders et al. 2018; 16 climate variables; Euclidean Distance) for *Xiphophorus hellerii* was high overall. The Climate 6 score for this species was 0.598. Scores of 0.103 and greater are classified as high. Locally, high matches exist in the coastal Southeast and Interior West, with medium matches in the Upper Midwest and Great Plains, and low matches in the Northeast, Appalachian Mountain range, and coastal Pacific Northwest.



**Figure 3.** RAMP (Sanders et al. 2018) source map showing weather stations across the world selected as source locations (red; Canada, United States, Mexico, Belize, Honduras, El Salvador, Guatemala, Colombia, Jamaica, Israel, South Africa, Madagascar, India, China, Indonesia, Papua New Guinea, Australia) and non-source locations (gray) for *Xiphophorus hellerii* climate matching. Source locations from GBIF Secretariat (2019).



**Figure 4.** Map of RAMP (Sanders et al. 2018) climate matches for *Xiphophorus hellerii* in the contiguous United States based on source locations reported by GBIF Secretariat (2019). 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
$0.000 < X < 0.005$	Low
$0.005 < X < 0.103$	Medium
$\geq 0.103$	High

## 7 Certainty of Assessment

Information on the biology, ecology, and distribution of *Xiphophorus hellerii* is readily available for review. However, information on impacts from introduction of *X. hellerii* are poorly understood. A fair amount of scientific literature suggests negative impacts, but further research is needed to reach definitive conclusions. Certainty of assessment for *Xiphophorus hellerii* is low.

## 8 Risk Assessment

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### Summary of Risk to the Contiguous United States

*Xiphophorus hellerii*, Green Swordtail, is a fish native to Central America, including the countries of Belize, Guatemala, Honduras, and Mexico. It inhabits fast-flowing streams and rivers around vegetation, but can also thrive in warm springs, ponds, and ditches. This species has a wide distribution beyond its native range, with established populations in Asian, African, European, Caribbean, Oceanic, and North American countries. Within the United States, it is established, or possibly so, in Colorado, Florida, Hawaii, Idaho, Montana, Nevada, Texas, Wyoming, California, and Oklahoma. Many introductions have occurred through intentional release or escape from captivity, as this is a popular aquarium fish globally. The species has been associated with negative impacts in many locations where introduced, although its direct influence relative to other factors is unclear. It has been implicated in the decline of the Utah sucker *Catostomus ardens* in a thermal spring in Wyoming and the decline of native damselflies on Oahu, Hawaii. Some of these records may actually represent hybrids rather than pure *X. hellerii*. *X. hellerii* is also a carrier of numerous parasites and diseases that could negatively influence native species in nonnative waters where it is established. History of invasiveness is classified as “none documented.” The climate match to the contiguous United States was high overall. Due to the lack of clear and convincing evidence on impacts of introductions, the overall risk assessment category for *Xiphophorus hellerii* 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: Carrier of numerous bacterial infections, viruses, and parasitic infestations**
- **Overall Risk Assessment Category: Uncertain**

## 9 References

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**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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**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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