

Zebra Danio (*Danio rerio*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, January 2016
Revised, March 2018
Web Version, 7/5/2018



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Available: https://commons.wikimedia.org/wiki/File:Danio_rerio_lab_left.JPG. (March 2018).

1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2018):

“Asia: Pakistan, India, Bangladesh, Nepal and Myanmar [Menon 1999]. Reported from Bhutan [Petr 1999].”

From Nico et al (2018):

“Tropical Asia. Pakistan, India, Bangladesh, and Nepal (Talwar and Jhingran 1991). Also reported from Myanmar (Menon 1999) and Bhutan (Petr 1999).”

Status in the United States

From Nico et al. (2018):

“This species was reported from the Westminster flood control channel near a fish farm in Westminster, Orange County, California, in 1968 (St. Amant and Hoover 1969; Courtenay et al. 1984, 1991). Specimens ranging from 2-4 cm were captured in the Thames River drainage in Connecticut in 1985 (Whitworth 1996). It was recorded from Lake Worth Drainage District canal L-15 adjacent to fish farm in Palm Beach County, Florida, in the early 1970s (Courtenay and Robins 1973; Courtenay et al. 1974). Specimens also were taken from two sites adjacent to fish farms in Hillsborough County, including a ditch in Gibsonton, and from a site in Adamsville (Courtenay and Hensley 1979; museum specimen). The species was locally established in McCauley Spring in Sandoval County, New Mexico (Sublette et al. 1990; M. Hatch, personal communication).”

“Extirpated in New Mexico by 2003 (S. Platania, pers.comm); reported from California, Connecticut, and Florida.”

From Lever (1996):

“Naturalized in Wyoming. A popular aquarium fish, found in 50% of pet shops near Lakes Erie and Ontario (Rixon et al 2005).”

Means of Introductions in the United States

From Nico et al. (2018):

“California (St. Amant and Hoover 1969) and Florida records probably resulted from release or escape from local fish farms. Source of New Mexico population is not known; possible aquarium release as was record from Connecticut (Whitworth 1996).”

Remarks

From Nico et al. (2018):

“This species is a popular aquarium fish and has been widely used in experimental and developmental research.”

2 Biology and Ecology

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 Ostariophysi
Order Cypriniformes
Superfamily Cyprinoidea
Family Cyprinidae
Genus *Danio*
Species *Danio rerio* (Hamilton, 1822)”

“Taxonomic status: valid”

Size, Weight, and Age Range

From Froese and Pauly (2018):

“Maturity: Lm 2.5 cm. Max length: 3.8 cm SL male/unsexed; [Menon 1999]”

Environment

From Froese and Pauly (2018):

“Freshwater; benthopelagic; pH range: 6.0 - 8.0; dH range: 5 - 19.”

“[...] 18°C - 24°C [Riehl and Baensch 1991; assumed to be recommended aquarium temperature range]”

Climate/Range

From Froese and Pauly (2018):

“Tropical; [...] 33°N - 8°N, 66°E - 98°E”

Distribution Outside the United States

Native

From Froese and Pauly (2018):

“Asia: Pakistan, India, Bangladesh, Nepal and Myanmar [Menon 1999]. Reported from Bhutan [Petr 1999].”

From Nico et al (2018):

“Tropical Asia. Pakistan, India, Bangladesh, and Nepal (Talwar and Jhingran 1991). Also reported from Myanmar (Menon 1999) and Bhutan (Petr 1999).”

Introduced

From Froese and Pauly (2018):

“Appearance in Colombian waters [...] [Welcomme 1988]”

From Shapiro (2012):

“Although details of the distribution are unclear, *D. rerio* may be widely distributed in shallow, slow-flowing waters on the Indian subcontinent.”

Means of Introduction Outside the United States

From Froese and Pauly (2018):

“[...] presumably by escape from an aquarium fish rearing facility [Welcomme 1988].”

Short Description

From Froese and Pauly (2018):

“Five uniformly, pigmented, horizontal stripes on the side of the body, all extending onto the end of caudal fin rays. Anal fin distinctively striped. Lateral line absent. Rostral barbels extend to anterior margin of orbit; maxillary barbels end at about middle of opercle. Branched anal fin rays 10-12. Vertebrae 31-32.”

Biology

From Froese and Pauly (2018):

“Adults inhabit streams, canals, ditches, ponds and beels [Rahman 1989]. Occur in slow-moving to stagnant standing water bodies, particularly rice-fields [Talwar and Jhingran 1991]; and lower reaches of streams [McClure et al. 2006]. Common in rivulets at foot hills [Menon 1999]. Feed on worms and small crustaceans [Mills and Vevers 1989]; also on insect larvae. Breed all year round [Spence et al. 2001]. Appears to be primarily an annual species in the wild, the spawning season starting just before the onset of the monsoon. Domesticated zebrafish live on average 3.5 years, with oldest individuals surviving up to 5.5 years [Gerhardt et al 2002]. Spawning is induced by temperature and commences at the onset of the monsoon season [Spence et al 2001]. Food availability also acts as cue for breeding [Spence et al. 2001]. Growth rate is a vital guiding environmental factor for sexual differentiation for this species as observed in a study [Lawrence et al 2007]. In this same study, frequency and amount of food prior to and throughout gonadal differentiation period resulted in more individuals differentiating to become females and is more pronounced in hybrid than pure bred groups [Lawrence et al 2007]. Often used for mosquito control.”

Human Uses

From Froese and Pauly (2018):

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

From Shapiro (2012):

“For many decades, *D. rerio* has been both a very popular aquarium fish and an important research model in several fields of biology (notably, developmental biology and toxicology). The development of *D. rerio* as a model organism for modern biological investigation began with the pioneering work of George Streisinger and colleagues at the University of Oregon (Streisinger et al. 1981; Briggs 2002), who recognized many of the virtues of *D. rerio* for research. Streisinger developed methods to produce homozygous strains by using genetically inactivated sperm, performed the first mutagenesis studies, and established that complementation methods (in which heterozygous mutant fish are paired) could be used to assign mutations to genetic complementation groups. Subsequently, the use and importance of *D. rerio* in biological research has exploded and diversified to the point that these fish are extremely important vertebrate models in an extraordinary array of research fields (see review by R[i]nkwitz et al. 2011; Vascotto et al. 1997).”

Diseases

From Froese and Pauly (2018):

“Plistophora Disease in neon fish, Parasitic infestations (protozoa, worms, etc.)
Bacterial Infections (general), Bacterial diseases
Ichthyobodo Infection, Parasitic infestations (protozoa, worms, etc.)”

Threat to Humans

From Froese and Pauly (2018):

“Harmless”

3 Impacts of Introductions

From Nico et al. (2018):

“Unknown.”

4 Global Distribution



Figure 1. Known global distribution of *Danio rerio*, reported from India, Nepal, and Bangladesh. Map by GBIF Secretariat (2018). Points in Spain, Australia, and Mexico were excluded because they could not be verified as established populations.

5 Distribution Within the United States

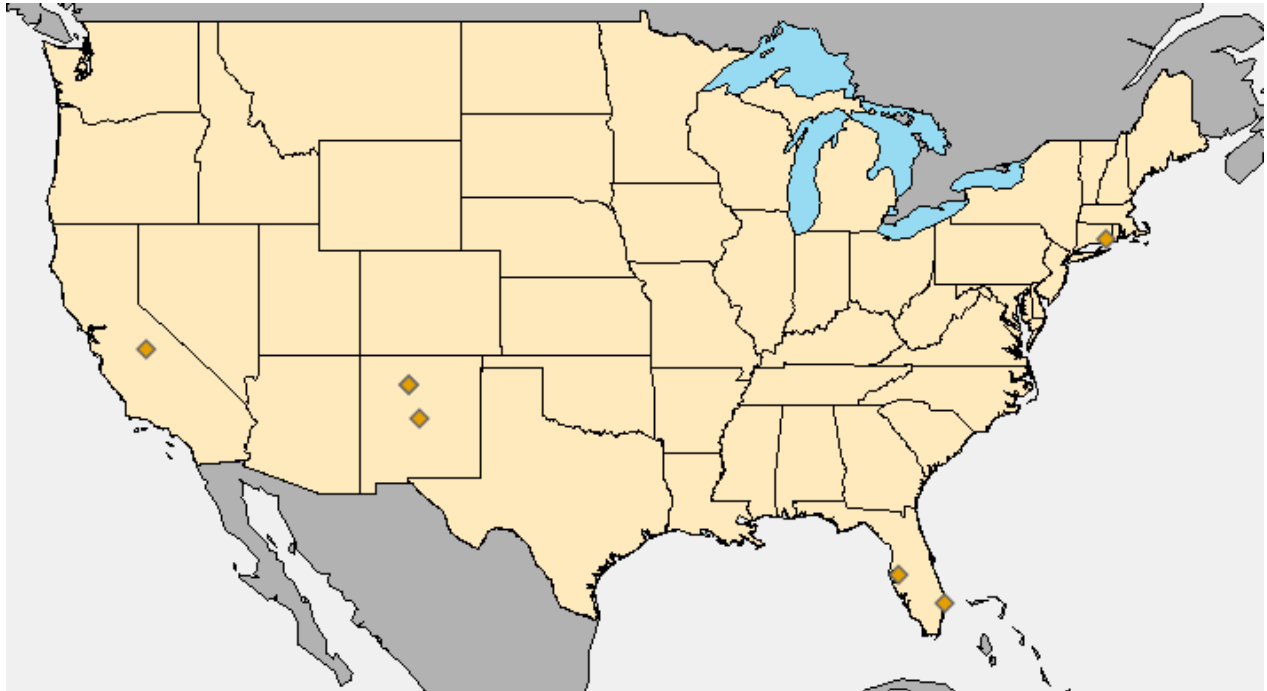
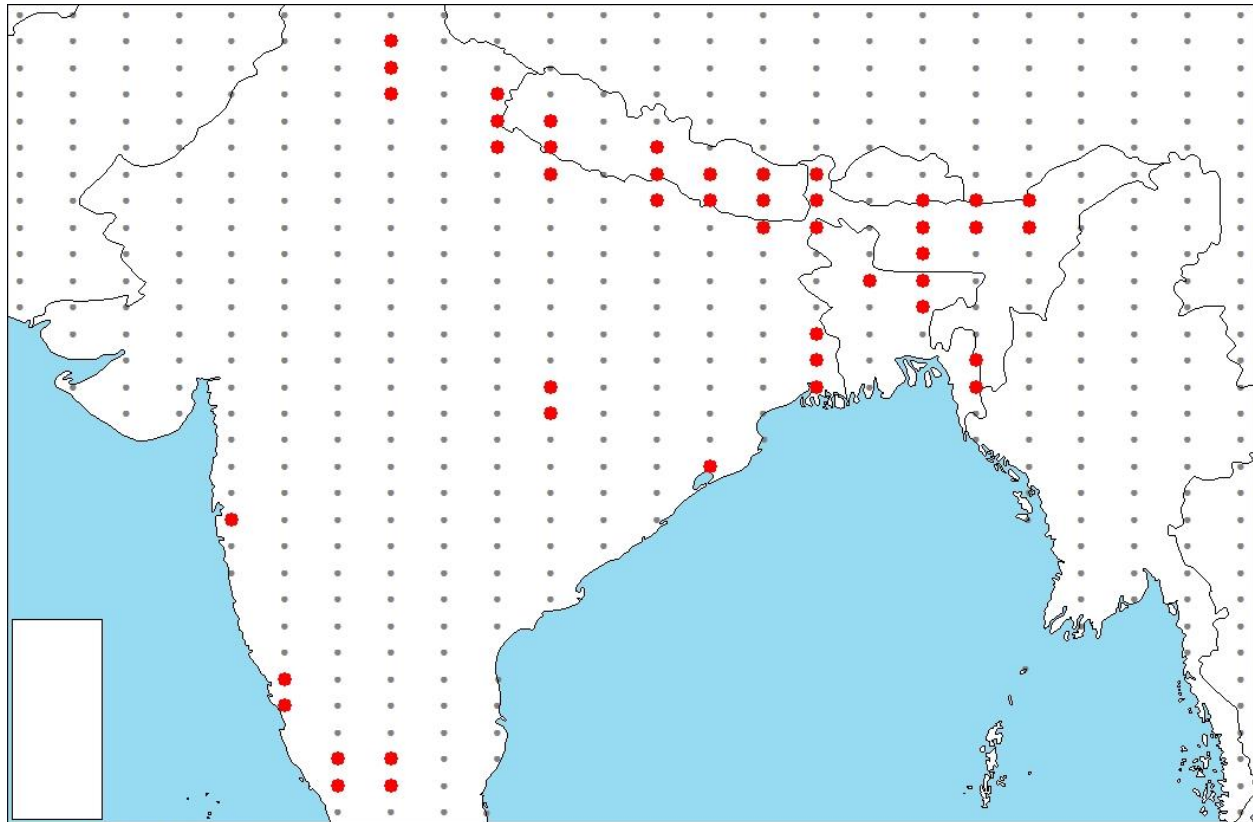


Figure 2. Distribution of *Danio rerio* in the United States. Map from Nico et al. (2018). No points were included in climate match analysis because they could not be verified as established populations.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) for *Danio rerio* within the contiguous United States is low overall. The Climate6 proportion for this species is 0.0. The range of proportions classified as low match is 0.000 to <0.005. Locally, no states within the contiguous United States were reported above a low match.



Species: *Danio rerio*

Selected Climate Stations



Selected ●

RAMP

Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations in southern Asia selected as source locations (red; India, Nepal, Bangladesh) and non-source locations (gray) for *Danio rerio* climate matching. Source locations from GBIF Secretariat (2018).

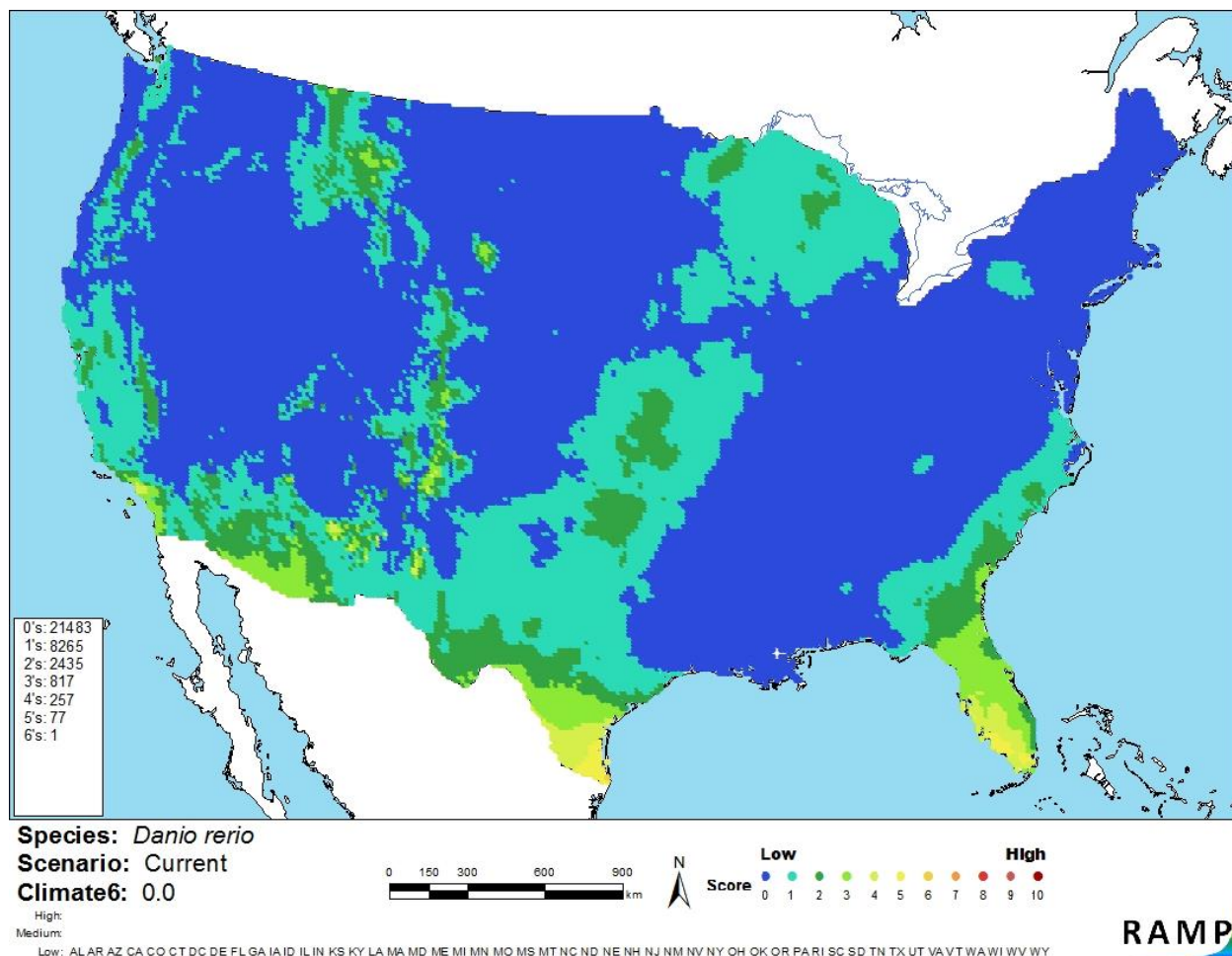


Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *Danio rerio* in the contiguous United States based on source locations reported by GBIF Secretariat (2018). 0=Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

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

A considerable amount of scientific literature is devoted to the study of *Danio rerio*. The species is well studied as a lab organism, but the ecology, distribution, and behavior in the wild has received far less consideration. Determination of an accurate distribution proved especially difficult and is currently unclear. Impacts from introduction are also unclear and poorly researched. Given these gaps in information and their importance in determining an assessment, certainty of assessment for *D. rerio* is low.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Danio rerio is a fish species native to Asian tropical waters in Pakistan, India, Bangladesh, Nepal, Bhutan, and Myanmar. The species has been both a very popular aquarium fish and an important biological research model for many years. A significant amount of information and research is available to support these areas of interest. However, far less research has been devoted to the species in its natural setting. For example, determining distribution of the species proves problematic. Several occurrences of *D. rerio* have been reported around the world with little other information available. Often these reports are provided by individuals outside the scientific community and cannot be verified as established populations. Review of sources addressing introductions within the contiguous United States also provides unclear information regarding established populations. Given these introductions could not be verified as established, they were not included in climate match analysis within the contiguous United States. Overall climate match for the United States was low. No impacts of introduction were reported for this species, but it is unclear if this area has been scientifically assessed. Given all factors, the overall risk assessment for *Danio rerio* is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): Uncertain**
- **Climate Match (Sec. 6): Low**
- **Certainty of Assessment (Sec. 7): Low**
- **Carrier of parasitic infestations and bacterial infections.**
- **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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