

# Banded Killifish (*Fundulus diaphanus*)

## Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, December 2016

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## 1 Native Range and Status in the United States

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### Native Range

From Fuller and Neilson (2016):

“Atlantic Slope drainages from Newfoundland to Pee Dee River, South Carolina; St. Lawrence-Great Lakes and Mississippi River basins from Quebec to Manitoba, and south to southern Pennsylvania, northern Illinois, and northeastern Nebraska. Two subspecies with intergrades in

St. Lawrence and Lake Erie drainages: *F[undulus]. d[iaphanus]. diaphanus* on the Atlantic Slope, *F. d. menona* in the rest of the range (Page and Burr 1991).”

From NatureServe (2013):

“Range includes Atlantic Slope drainages from the Peedee River, South Carolina, north to the Maritime Provinces and Newfoundland; St. Lawrence-Great Lakes and Mississippi River basins from Quebec to Manitoba, south to southern Pennsylvania, northern Illinois, and northeastern Nebraska (Page and Burr 2011).”

## **Status in the United States**

The native range of this species is within the United States (Fuller and Neilson 2016).

From Fuller and Neilson (2016):

“The species is established in Silvio O. Conte National Fish and Wildlife Refuge, Franklin County, Massachusetts [sic] (USFWS 2005). The eastern subspecies *F. d. diaphanus* was introduced into Lake Erie, the Little Miami drainage, and several areas in the upper Ohio River basin in Ohio, and into the Ohio and Beaver River drainages (Raney 1938, cited in Trautman 1981), the Monongahela drainage (Hocutt et al. 1986), and the Youghiogheny River (Hendricks et al. 1979) in Pennsylvania. This species was accidentally stocked in Lake Andes, South Dakota, by a federal hatchery stocking of largemouth bass (Bailey and Allum 1962). *Fundulus diaphanus* is known from Baskett Slough, and the Columbia, Lewis and Clark, and Willamette rivers, Oregon (Bond 1994). It is established in Big McNary Lake on Sauvie Island in the Columbia River, Oregon (Logan 1994). It also has been reported from the Columbia and Kalama Rivers, and Lake Sacajawea, Washington (Fletcher, personal communication).”

“Established in Ohio, Pennsylvania, South Dakota, Oregon, and Washington. In Pennsylvania, known from the Ohio and Beaver drainages and established in the Youghiogheny.”

“According to Bond (1994), the Oregon introduction involved the subspecies *Fundulus diaphanus diaphanus*; however, Li (personal communication) reported it as being the western subspecies *F. d. menona*. The Washington record was also reported as *F. d. menona* (Fletcher, personal communication).”

## **Means of Introductions in the United States**

From Fuller and Neilson (2016):

“The fish was transplanted to parts of eastern Ohio and western Pennsylvania from the Delaware River drainage of eastern Pennsylvania (Raney 1938, cited in Trautman 1981). A population in Clough Creek, Ohio, was likely the result of an aquarium release (Trautman 1981). One lake in South Dakota was stocked accidentally with largemouth bass (Bailey and Allum 1962). The species was introduced into other areas through unknown means; possibly bait bucket releases.”

## Remarks

*Fundulus diaphanus* can hybridize with *F. heteroclitus* (NatureServe 2015).

No information on commercial trade of this species in the United States was found.

## 2 Biology and Ecology

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### Taxonomic Hierarchy and Taxonomic Standing

According to Eschmeyer et al. (2017), *Fundulus diaphanus* (Lesueur 1817) is the current valid name for this species. It was originally described as *Hydrargira diaphana*.

From ITIS (2016):

“Kingdom Animalia  
Subkingdom Bilateria  
Infrakingdom Deuterostomia  
Phylum Chordata  
Subphylum Vertebrata  
Infraphylum Gnathostomata  
Superclass Osteichthyes  
Class Actinopterygii  
Subclass Neopterygii  
Infraclass Teleostei  
Superorder Acanthopterygii  
Order Cuprinodontiformes  
Suborder Cyprinodontoidei  
Family Fundulidae  
Genus *Fundulus*  
Species *Fundulus diaphanus* (Lesueur, 1817)  
Subspecies *Fundulus diaphanus diaphanus* (Lesueur, 1817)  
Subspecies *Fundulus diaphanus menona* Jordan and Copeland, 1877”

From NatureServe (2015):

“Two subspecies: *DIAPHANUS* and *MENONA*. The genus *FUNDULUS* was removed from Atheriniformes: Cyprinodontidae and placed in Cyprinodontiformes: Fundulidae by Parenti (1981); pending confirmation based on other character suites, this change was not accepted in the 1991 AFS checklist (Robins et al. 1991). See Wiley (1986) for a study of the evolutionary relationships of *FUNDULUS* topminnows based on morphological characters. See Cashner et al. (1992) for an allozyme-based phylogenetic analysis of the genus *FUNDULUS*.”

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

From Fuller and Neilson (2016):

“Size: 13 cm.”

From Froese and Pauly (2016):

“Max length: 13.0 cm TL male/unsexed; [Page and Burr 1991]; common length: 6.3 cm TL male/unsexed; [Hugg 1996]”

## **Environment**

From Froese and Pauly (2016):

“Enters brackish water [...] Euryhaline and salinity-tolerant [Scott and Scott 1988]. [...]; 10°C - 25°C [assumed to be recommended aquarium temperature range] [Baensch and Riehl 1985]”

## **Climate/Range**

From Froese and Pauly (2016):

“Temperate; [...]; 54°N - 34°N”

## **Distribution Outside the United States**

### **Native**

The native range of this species is within the United States (Fuller and Neilson 2016), see Section 1 for a description.

### **Introduced**

No records of *Fundulus diaphanus* introductions outside the United States were found.

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

No records of *Fundulus diaphanus* introductions outside the United States were found.

## **Short Description**

A short description of *Fundulus diaphanus* was not found.

## **Biology**

From Froese and Pauly (2016):

“Forms schools a few inches below surface of water [Page and Burr 1991, 2011] [...]. Not a seasonal killifish.”

“Freshwater; brackish; benthopelagic; non-migratory.”

“Inhabits shallow, quiet margins of lakes, ponds and sluggish streams, usually over sand or mud and often near vegetation.”

From NatureServe (2015):

“Spawns in late spring and summer. Eggs hatch in about 11-12 days. Sexually mature at age II in some localities (Becker 1983). On the Atlantic coast of Nova Scotia, hybrids of *F. DIAPHANUS* and *F. HETEROCLITUS* are unisexual diploid gynogens; sperm from males probably is required to stimulate embryogenesis (Dawley et al. 2000).”

“Eggs are released in clusters, attach by filaments to plants in quiet weedy pools (Scott and Crossman 1973).”

“Feeds at all water levels on various invertebrates and some plant material (Becker 1983) [...] largely diurnal in feeding habits (Becker 1983).”

“Habitat includes quiet waters of lakes, ponds, and sluggish streams, usually over sand, gravel, or detritus-covered bottom where there are patches of submerged aquatic plants; schools tend to stay in shallows in summer; this species also often occurs in estuaries (Lee et al. 1980, Page and Burr 2011).”

## Human Uses

From Froese and Pauly (2016):

“Is easy to maintain in the aquarium [Huber 1996].”

“Aquarium: commercial; bait: usually”

## Diseases

***Gyrodactylus salaris* is a 2017 OIE-reportable infection.**

Poelen et al. (2014) lists *Gyrodactylus* sp., *Homalometron pallidum*, *Creptotrema funduli*, *Crassiphiala bulboglossa*, *Posthodiplostomum minimum*, *Salsuginus angularis*, *Camallanus* sp., *Raphisascaris acus*, *Leptorhynchoides thecatus*, *Paratenuisentis ambiguus*, *Eustrongylides ignotus*, *Neoechinorhynchus* sp., *Neascus* sp., *Diplostomum spathaceum*, *Neoechinorhynchus cylindratus*, *Diplostomulum* sp., *Tylodelphys scheuringi*, *Ornithodiplostomum ptychocheilus*, *Clinostomum marginatum*, *Salsuginus fundulus*, and *Proteocephalus ambloplitis* as parasites of *Fundulus diaphanus*.

## Threat to Humans

From Froese and Pauly (2016):

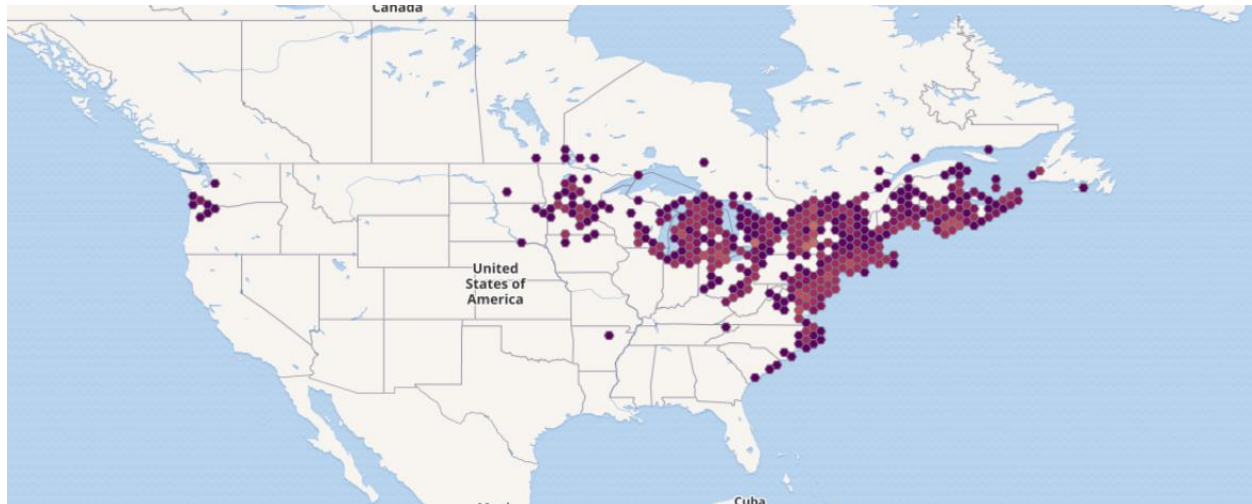
“Harmless”

### 3 Impacts of Introductions

From Fuller and Neilson (2016):

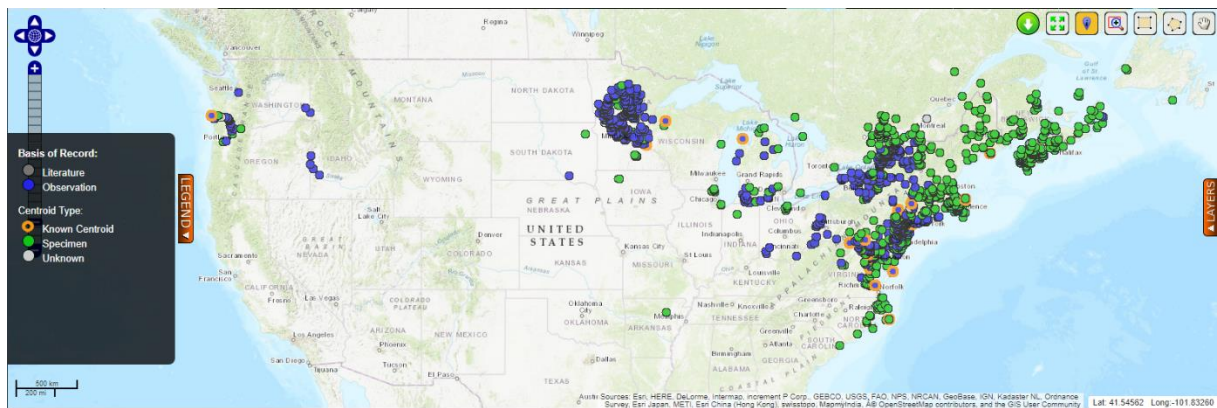
“Unknown”

### 4 Global Distribution



**Figure 1.** Known global distribution of *Fundulus diaphanus*. Locations are in the United States and Canada. Map from GBIF Secretariat (2018).

### 5 Distribution Within the United States

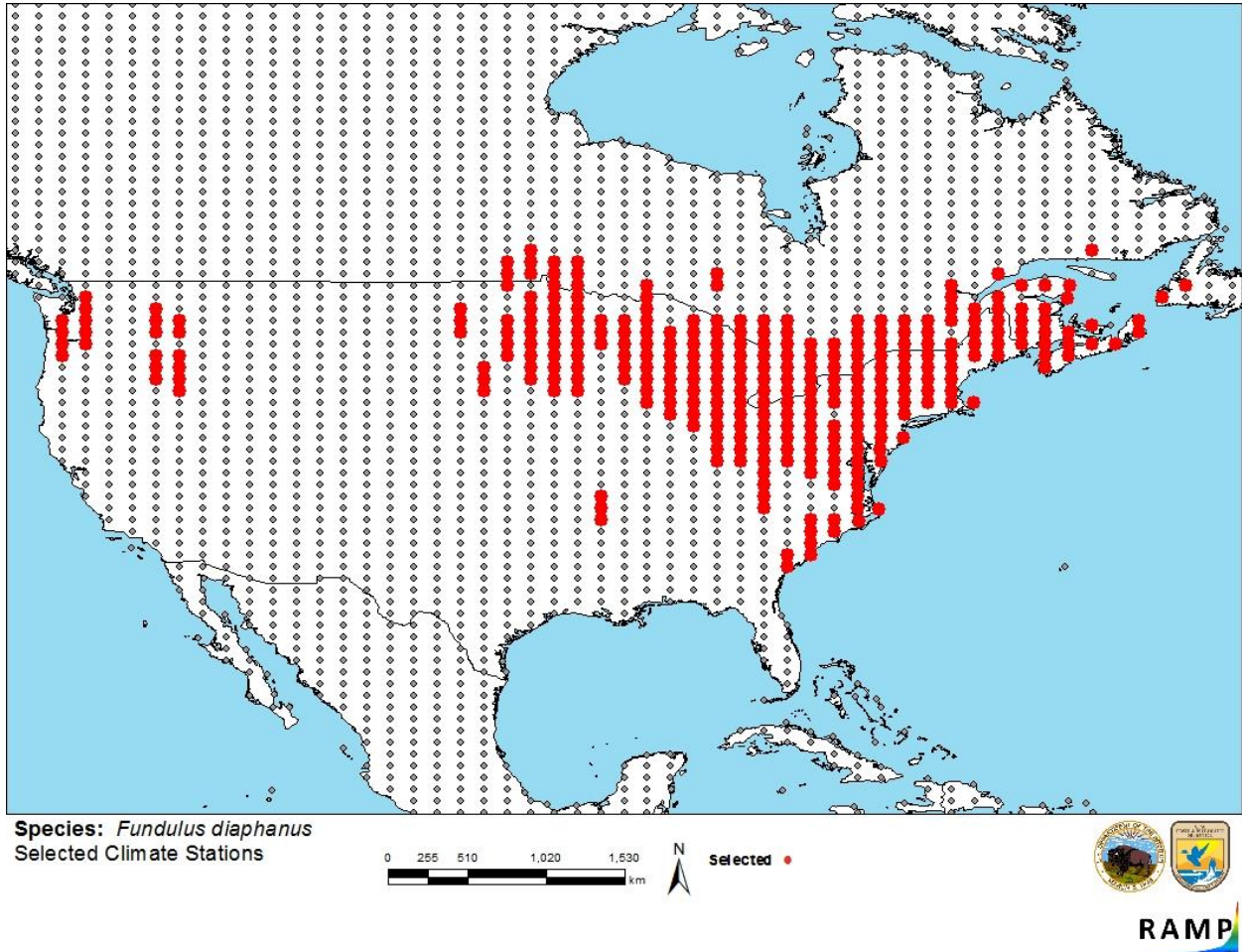


**Figure 2.** Known distribution of *Fundulus diaphanus* in the United States. Map from BISON (2016).

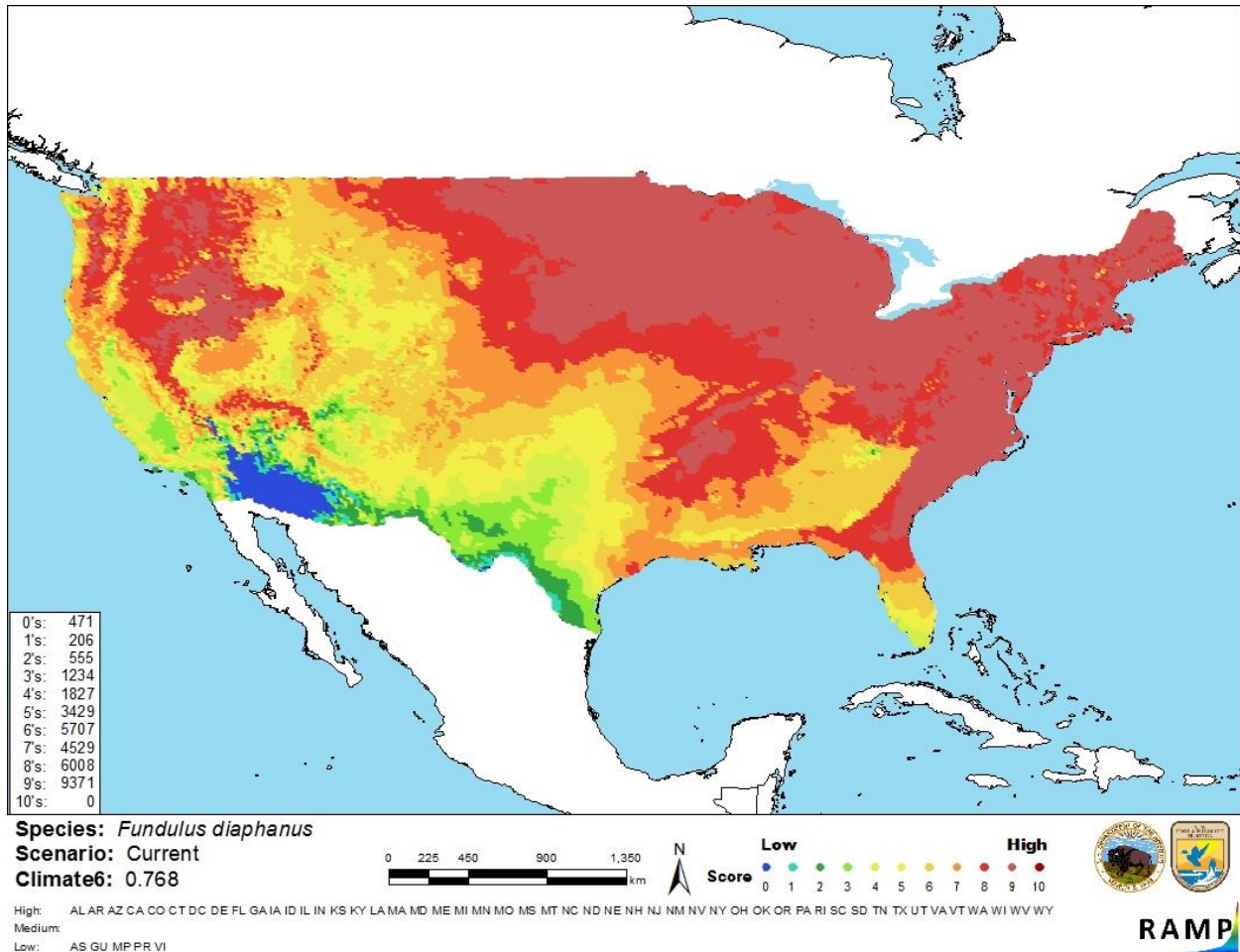
# 6 Climate Matching

## Summary of Climate Matching Analysis

The climate match for *Fundulus diaphanus* was very high for most of the United States, including the native range of the species. The southern border of the country has a low match, everywhere else was medium. The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.768, high. All states in the contiguous United States had high individual climate scores.



**Figure 3.** RAMP (Sanders et al. 2018) source map showing weather stations selected as source locations (red; United States, Canada) and non-source locations (gray) for *Fundulus diaphanus* climate matching. Source locations from BISON (2016) and GBIF Secretariat (2018).



**Figure 4.** Map of RAMP (Sanders et al. 2018) climate matches for *Fundulus diaphanus* in the contiguous United States based on source locations reported by BISON (2016) and 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
$0.000 \leq X < 0.005$	Low
$0.005 < X < 0.103$	Medium
$\geq 0.103$	High

## 7 Certainty of Assessment

The certainty of assessment is medium. There was adequate biological and ecological information available. Records of introductions were found but no information on potential or actual impacts of those introductions.



## 8 Risk Assessment

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### Summary of Risk to the Contiguous United States

The history of invasiveness for *Fundulus diaphanus* is not documented. There were records of introductions but no information on any impacts from those introductions. There are areas of very high match outside of the native range of the species, indicating there are favorable climate conditions for further establishment of populations outside the native range. The certainty of assessment is medium. The overall risk assessment is uncertain.

### Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): Medium**
- **Remarks/Important additional information** No additional information.
- **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.**

BISON. 2016. Biodiversity Information Serving Our Nation (BISON). U.S. Geological Survey. Available: <https://bison.usgs.gov>. (May 2016).

Eschmeyer, W. N., R. Fricke, and R. van der Laan, editors. 2017. Catalog of fishes: genera, species, references. Available: <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>. (October 2017).

Froese, R., and D. Pauly, editors. 2016. *Fundulus diaphanus* (Lesueur, 1817). FishBase. Available: <http://www.fishbase.se/summary/Fundulus-diaphanus.html>. (May 2016).

Fuller, P., and M. Neilson. 2016. *Fundulus diaphanus*. U.S. Geological Survey, Nonindigenous Aquatic Species Database, Gainesville, Florida. Available: <http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=685>. (May 2016).

GBIF Secretariat. 2018. GBIF backbone taxonomy: *Fundulus diaphanus* (Lesueur, 1817). Global Biodiversity Information Facility, Copenhagen. Available: <http://www.gbif.org/species/5712054>. (August 2018).

ITIS (Integrated Taxonomic Information System). 2016. *Fundulus diaphanus* (Lesueur, 1817). Integrated Taxonomic Information System, Reston, Virginia. Available: [http://www.itis.gov/servlet/SingleRpt/SingleRpt?search\\_topic=TSN&search\\_value=165646](http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=165646). (May 2016).

NatureServe. 2013. *Fundulus diaphanus*. The IUCN Red List of Threatened Species 2013: e.T202381A18233141. Available: <http://www.iucnredlist.org/details/full/202381/0>. (December 2016).

NatureServe. 2015. NatureServe Explorer: an online encyclopedia of life, version 7.1. NatureServe, Arlington, Virginia. Available: <http://explorer.natureserve.org>. (May 2016).

Poelen, J. H., J. D. Simons, and C. J. Mungall. 2014. Global Biotic Interactions: an open infrastructure to share and analyze species-interaction datasets. *Ecological Informatics* 24:148–159.

Sanders, S., C. Castiglione, and M. Hoff. 2018. Risk assessment mapping program: RAMP, version 3.1. U.S. Fish and Wildlife Service.

## 10 References Quoted But Not Accessed

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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.**

Baensch, H. A., and R. Riehl. 1985. *Aquarien atlas. Band 2*. Mergus, Verlag für Natur-und Heimtierkunde GmbH, Melle, Germany.

Bailey, R. M., and M. O. Allum. 1962. *Fishes of South Dakota*. University of Michigan, Miscellaneous Publications of the Museum of Zoology 119, Ann Arbor.

Becker, G. C. 1983. *Fishes of Wisconsin*. University of Wisconsin Press, Madison.

Bond, C. E. 1994. *Keys to Oregon freshwater fishes*. Oregon State University Bookstores, Corvallis.

Cashner, R. C., J. S. Rogers, and J. M. Grady. 1992. Phylogenetic studies of the genus *Fundulus*. Pages 421–437 in R. L. Mayden, editor. *Systematics, historical ecology, and North American freshwater fishes*. Stanford University Press, Stanford, California.

Dawley, R. M., A. M. Yeakel, K. A. Beaulieu, and K. L. Phiel. 2000. Histocompatibility analysis of clonal diversity in unisexual hybrids of the killifishes *Fundulus heteroclitus* and *Fundulus diaphanus*. *Canadian Journal of Zoology* 78:923–930.

Hendricks, M. L., J. R. Stauffer, Jr., C. H. Hocutt, and C. R. Gilbert. 1979. A preliminary checklist of the fishes of the Youghiogheny River. *Chicago Academy of Sciences, Natural History Miscellanea* 203:1–15.

Hocutt, C. H., R. E. Jenkins, and J. R. Stauffer, Jr. 1986. Zoogeography of the fishes of the central Appalachians and central Atlantic Coastal Plain. Pages 161–212 in C. H. Hocutt, and E. O. Wiley, editors. *The zoogeography of North American freshwater fishes*. John Wiley and Sons, New York.

- Huber, J. H. 1996. Killi-data 1996. Updated checklist of taxonomic names, collecting localities and bibliographic references of oviparous Cyprinodont fishes (Atherinomorpha, Pisces). Société Française d'Ichtyologie, Muséum National d'Histoire Naturelle, Paris.
- Hugg, D. O. 1996. MAPFISH georeferenced mapping database. Freshwater and estuarine fishes of North America. Life Science Software. Dennis O. and Steven Hugg, Edgewater, Maryland.
- Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. 1980. Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh.
- Logan, D. J. 1994. A checklist of the fishes of Benton County, Oregon. American Currents 1994(summer):16–18.
- Page, L. M., and B. M. Burr. 1991. A field guide to freshwater fishes of North America north of Mexico. The Peterson Field Guide Series, volume 42. Houghton Mifflin, Boston.
- Page, L. M., and B. M. Burr. 2011. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Harcourt, Boston.
- Parenti, L. R. 1981. A phylogenetic and biogeographic analysis of cyprinodontiform fishes (Teleostei, Atherinomorpha). Bulletin of the American Museum Natural History 168:335–557.
- Raney, E. C. 1938. The distribution of the fishes of the Ohio drainage basin of western Pennsylvania. Doctoral dissertation. Cornell University, Ithaca, New York.
- Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1991. Common and scientific names of fishes from the United States and Canada. American Fisheries Society, Special Publication 20, Bethesda, Maryland.
- Scott, W. B., and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada, Bulletin 184.
- Scott, W. B., and M. G. Scott. 1988. Atlantic fishes of Canada. Canadian Bulletin of Fisheries and Aquatic Sciences 219, University of Toronto Press.
- Trautman, M. B. 1981. The fishes of Ohio. Ohio State University Press, Columbus.
- USFWS. 2005. [Source material did not provide full citation for this reference]
- Wiley, E. O. 1986. A study of the evolutionary relationships of *Fundulus* topminnows (Teleostei: Fundulidae). American Zoologist 26:121–130.