

White Catfish (*Ameiurus catus*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, June 2017

Revised, September 2017

Web Version, 11/29/2017



Photo: Presidents and Fellows of Harvard College, Museum of Comparative Zoology, Harvard University. Available: http://eol.org/data_objects/26680880. (August 2017).

1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2017):

“North America: Rivers of the Atlantic coastal states of USA from Florida to New York.”

From Fuller and Neilson (2017):

“Atlantic and Gulf Slope drainages from lower Hudson River, New York, to Apalachicola basin in Florida, Georgia, and Alabama; south in peninsular Florida to Peace River drainage (modified from Page and Burr 1991).”

Status in the United States

From Fuller and Neilson (2017):

“**Nonindigenous Occurrences:** White Catfish was introduced into the Choctawhatchee, Tennessee, Cahaba, Coosa and Tallapoosa drainages, and the Mobile Delta, **Alabama** (Mettee et al. 1996); the lower White, lower Ouachita, lower St. Francis, lower Red (Lake Erling), and

Arkansas drainages, and the Illinois system, **Arkansas** (Buchanan 1973; Cross et al. 1986; Robison and Buchanan 1988); at least 22 counties in **California** including sites in the Sacramento, San Joaquin, Suisun Bay, central California coastal, Tulare-Buena Vista lakes, and San Francisco Bay drainages (Smith 1896; Shebley 1917; Neale 1931; Moyle et al. 1974; Moyle 1976; Swift et al. 1993; Dill and Cordone 1997; Sommer et al. 2001; Matern et al. 2002); most basins in **Connecticut** (Behnke and Wetzel 1960; Whitworth et al. 1968; Schmidt 1986; Whitworth 1996); the panhandle west of the Apalachicola basin, **Florida** (Boschung 1992) (FLMNH has records from the Yellow drainage); the Illinois, Mississippi, and Kaskaskia rivers in **Illinois** (Smith 1979; Burr and Page 1986; Burr 1991); northern and southern **Indiana** (Nelson and Gerking 1968); reported in the Mississippi River pool 16, **Iowa** (Ber[n]stein and Olson 2001); the Ohio River, Kinniconick and Tygarts creeks, and Greenbo Lake in **Kentucky** (Clay 1975; Burr 1980; Burr and Warren 1986); the lower Kennebec River and Merrymeeting Bay in **Maine** (Halliwell 2003); the Charles, Connecticut, and Merrimack drainages in **Massachusetts** (Schmidt 1986; Hartel 1992; Cardoza et al. 1993; Hartel et al. 1996); the Tombigbee River system, **Mississippi** (Ross and Brenneman 1991); Missouri River drainage in **Missouri** (Pflieger 1997); the Truckee, Carson, and Humboldt rivers in **Nevada** (Smith 1896; Miller and Alcorn 1946; La Rivers 1962; Deacon and Williams 1984; Sigler and Sigler 1996; Insider Viewpoint 2001; Vinyard 2001); the French Broad River (Menhinick 1991; Etnier and Starnes 1993), the Pigeon and Hiawasse systems in the Tennessee drainage (Starnes and Etnier 1986; Menhinick 1991), and in Obids Creek (Upper New drainage; B. Tracy, personal communication) **North Carolina**; Lake Erie, Sandusky Bay, the mouth of the Portage River, Sippo Lake east of Canton, Springdale Lake near Cincinnati, the Blanchard system, the Muskingum drainage, and the Ohio River in **Ohio** (Trautman 1981; Emery 1985; Hocutt et al. 1986); the Willamette River and other locations in western **Oregon** including the Tualatin River (Smith 1896; Wydoski and Whitney 1979; Bond 1994; State of Oregon 2000); Lake Erie and the Ohio River basin in **Pennsylvania** (Hendricks et al. 1979; Cooper 1983; Emery 1985); **Rhode Island** (Lapin, personal communication); the Clinch River in **Tennessee** (Burkhead, personal communication), and the Cowlitz River and Silver Lake in **Washington** (Smith 1896; Lampman 1946). Underhill (1986) reports this species as introduced into the Lake Erie drainage (state unlisted).”

“White Catfish is also established in several reservoirs in **Puerto Rico**, possibly through stock contamination with channel catfish (Erdsman 1984; Lee 1983).”

“**Status:** Many of these introductions have led to established populations. The Mississippi report is of a single individual presumably taken after 1989, because it was not reported in two publications in 1989. In apparent reference to its occurrence in the Willamette drainage and Columbia River of Oregon, Bond (1994) noted establishment as uncertain. A single individual was reported from Tennessee on an angler's stringer in 1993 (Burkhead, personal communication). Apparently not established in Arkansas (Robison and Buchanan 1988). Status in Tennessee is unknown.”

Means of Introductions in the United States

From Fuller and Neilson (2017):

“Intentional stocking for sport and food. Whitworth (1996) points out that because of this species' high tolerance for salinity, the original movement to large rivers in Connecticut could

have been a natural range extension. Primary source of stocked fish in Kentucky is the James River, Virginia (Clay 1975). Stock planted in Indiana is from southeastern Virginia (Nelson and Gerking 1968). It is frequently stocked in fee-fishing lakes and other private waters. Pflieger (1997) indicated that specimens recorded from natural waters in Missouri may represent escapes from such situations.”

Remarks

From Fuller and Neilson (2017):

“Yerger (1977) and Dahlberg and Scott (1971) considered the White Catfish as introduced into the Chattahoochee River. However, Mettee et al. (1996) believe it is native to the Chattahoochee based on its abundance; Boschung (1992) listed it as introduced only west of the Apalachicola; and Lee et al. (1980 et seq.) reported it as native. We have chosen to regard it as native to the Apalachicola-Chattahoochee drainage based on early records and zoogeographic pattern. The Apalachicola-Chattahoochee drainage is commonly the western edge of the distributional range of upland species that occur further to the east, as White Catfish do. This species was introduced into California under the common name of "Schuylkill catfish" (Dill and Cordone 1997).”

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 Actinopterygii
Class Teleostei
Superorder Ostariophysi
Order Siluriformes
Family Ictaluridae
Genus *Ameiurus*
Species *Ameiurus catus* (Linnaeus, 1758)”

“Current Standing: valid”

Size, Weight, and Age Range

From Froese and Pauly (2017):

“Max length : 95.0 cm TL male/unsexed; [IGFA 2001]; common length : 30.5 cm TL male/unsexed; [Hugg 1996]; max. published weight: 9.8 kg [IGFA 2001]; max. reported age: 14 years [Schwartz and Jachowski 1965]”

Environment

From Froese and Pauly (2017):

“Freshwater; brackish; demersal; potamodromous [Riede 2004]; depth range 10 - ? m.”

From NatureServe (2013):

“This catfish inhabits sluggish lower reaches of coastal streams, sloughs, warmwater lakes, reservoirs, farm ponds, and tidal freshwater estuaries [...]”

Climate/Range

From Froese and Pauly (2017):

“Subtropical, preferred ?; 46°N - 27°N”

From NatureServe (2013):

“[...] it requires water above 20 °C in summer.”

Distribution Outside the United States

Native

The native distribution lies entirely within the boundaries of the United States. See “Native Range and Status in the United States.”

Introduced

From Britton and Davies (2006):

“In August 2005, a recreational angler captured a catfish from a lake called Epsom Stew Pond, located on Epsom Common, Surrey, southern England (51°200 060 N; 0°180 090 W) that was identified initially as an albino *Ictalurus punctatus* [...] the species was actually *Ameiurus catus* (L., 1758), with the defining characters being the anal fin ray count and morphology of the caudal fin.”

“[...] introductions of *A. catus* into countries outside of North America have been rare. Records suggest the only introductions have been into the Philippines in 1935 (Juliano *et al.*, 1989) and Puerto Rico in 1938 (Erdman, 1984; Welcomme, 1988; Lever, 1996).”

From FAO (2017):

“Status of the introduced species in the wild [in the Philippines]: Not established”

Means of Introduction Outside the United States

From Britton and Davies (2006):

“The *A. catus* specimen in southern England was probably a discarded ornamental fish. As albino *I. punctatus* specimens are available from North America as ornamental fish, it may be that this fish was imported mistakenly as this species and sold to an aquarium or pond owner, who subsequently introduced it into the lake, perhaps as it outgrew its surroundings.”

From FAO (2017):

“Reasons of Introduction [in the Philippines]: 1) aquaculture”

Short Description

From Fuller and Neilson (2017):

“Generally similar to Blue Catfish (*Ictalurus furcatus*) and Channel Catfish (*I. punctatus*), but can be distinguished by the presence of a dusky or black adipose fin, shorter anal fin base, and lower degree of forking in the caudal fin.”

From Page and Burr (2006):

“The White Catfish is normally gray to blue-black above - without a dark blotch at the dorsal fin base, white to light yellow below, and has a dusky black adipose fin and white or yellow chin barbels. Very large individuals are blue-black above and white or blue below. The White Catfish has a moderately forked caudal fin, and an anal fin with a short base, a rounded outline, and 22-25 rays. There are 11-15 fairly large sawlike teeth on the rear edge of the pectoral fin spine, and 18-21 rakers on the 1st gill arch.”

Biology

From University of California (2017):

“In rivers they stay more than 2 m deep throughout the day but move to shallow vegetation beds at night. In lakes and reservoirs they shift depth with the seasons. In late spring and early summer they stay together between 3 m and 10 m deep but disperse into deeper regions as the summer goes on and by the time winter arrives they are spread out between 17 m and 30 m deep. This will change slightly if the lake’s temperatures become stratified. In this case white catfish will seek out areas greater than 21°C.”

“White catfish are mostly carnivorous bottom feeders starting on amphipods, shrimp and insect larvae as juveniles before shifting their diet towards fish and large invertebrates as they get larger. It is also not uncommon for catfish to scavenge carrion or swim to the surface to feed on planktivorous fish. The focus of a population’s diet depends mainly on what is available in the area leading to some important differences in growth rates. Adults from the south-central San Joaquin-Sacramento Delta will still include amphipods and opossum shrimp as a major portion of their diet, leading to a slower growth rate than other populations feeding mainly on fish.”

“They begin spawning in June and July when water temperatures are greater than 21°C and can sometimes continue into September. Nests are built by males out of sand or gravel, near vegetative cover or rocky, cave-like areas. Females lay 2,000-3,000 eggs that hatch a week later when temperatures are between 24°C and 29°C. The young will stay together, protected by the male, for a short period after hatching until they are large enough to disperse on their own.”

Human Uses

From NatureServe (2013):

“This species is of local importance as a gamefish.”

Diseases

From CABI (2017):

“Enteric septicaemia of catfish (ESC) is caused by the bacterium *Edwardsiella ictaluri*, which belongs to the Enterobacteriaceae family (Hawke et al., 1981). ESC is one of the most important infectious disease problems in the commercial catfish industry in the USA. Most reported cases of disease caused by *E. ictaluri* are in channel catfish (*Ictalurus punctatus*), but the bacterium has been isolated from related North American catfish including blue catfish (*I. furcatus*), white catfish (*Ameiurus catus*), brown bullhead (*A. nebulosus*) (Hawke et al., 1981) and wild tadpole madtom (*Noturus gyrinus*) (Klesius et al., 2003).”

Threat to Humans

From Froese and Pauly (2017):

“Harmless”

3 Impacts of Introductions

From Fuller and Neilson (2017):

“White Catfish were apparently responsible for the disappearance of Sacramento perch *Archoplites interruptus* in Thurston Lake, California (McCarragher and Gregory 1970).”

From O’Rear (2012):

“One large catfish species that has been widely introduced outside its native range that has not been assessed for predation effects on native fishes is the white catfish (*Ameiurus catus*). Of particular concern is the increasingly abundant white catfish population in Suisun Marsh, a brackish-water network of tidal sloughs in the San Francisco Estuary that is vital habitat for declining native fishes, as well as species that support fisheries. To address this issue, I examined the diet of large juvenile and adult white catfish over a year. I found that they mainly ate abundant amphipods and either introduced fishes or native fishes that are widespread and abundant. [...] The diets revealed that white catfish present little threat to at-risk fishes.

However, their heavy use of food items produced by or affected by managed wetlands may make them dangerous for human consumption since the managed wetlands contribute to the methylation of mercury.”

4 Global Distribution

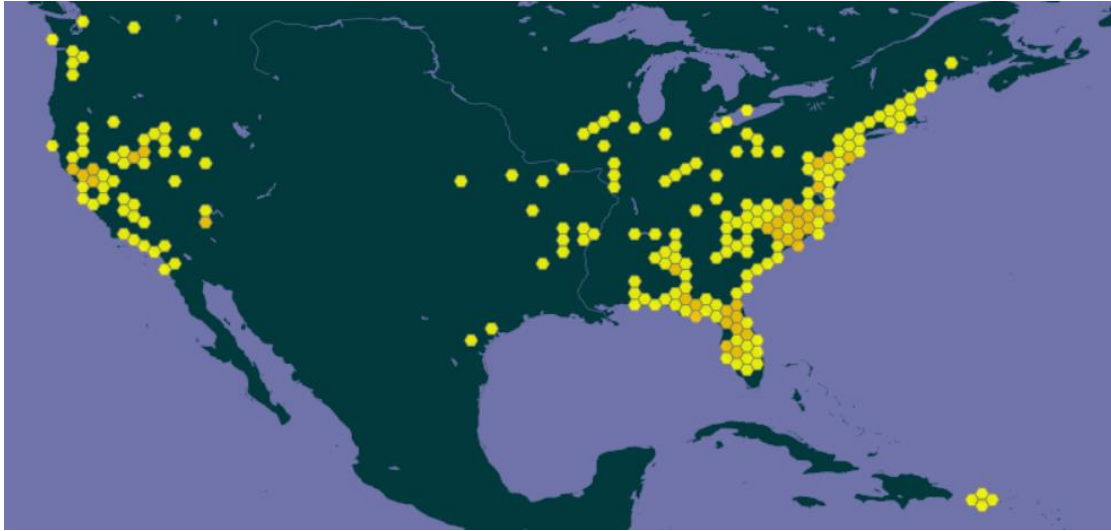


Figure 1. Known global distribution of *Ameiurus catus*. Map from GBIF (2017). Locations in Texas are not known to represent established populations, so they were not included in the climate matching analysis.

5 Distribution within the United States

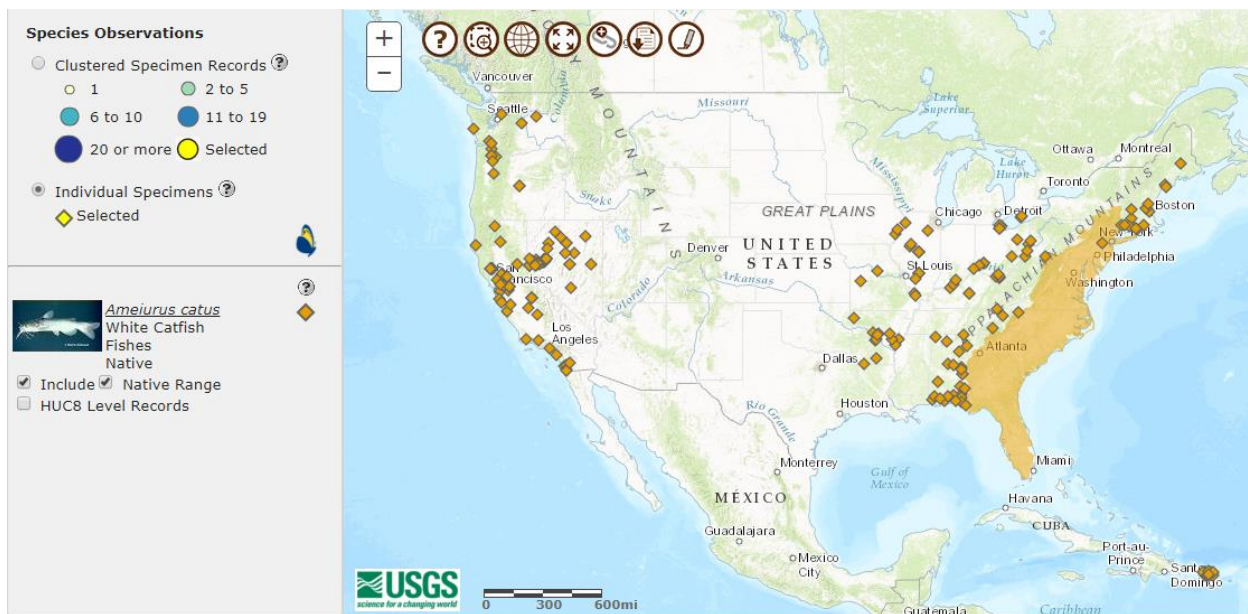


Figure 2. Known distribution of *Ameiurus catus* in the United States. Map from Fuller and Neilson (2017).

6 Climate Matching

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean distance) was high throughout the eastern U.S. and along the Pacific Coast. Medium matches occurred in the Great Plains and northern Maine. Climate 6 score indicated an overall high climate match for the contiguous U.S. Scores of 0.103 or greater are classified as high match; Climate 6 score for *A. catus* was 0.781.

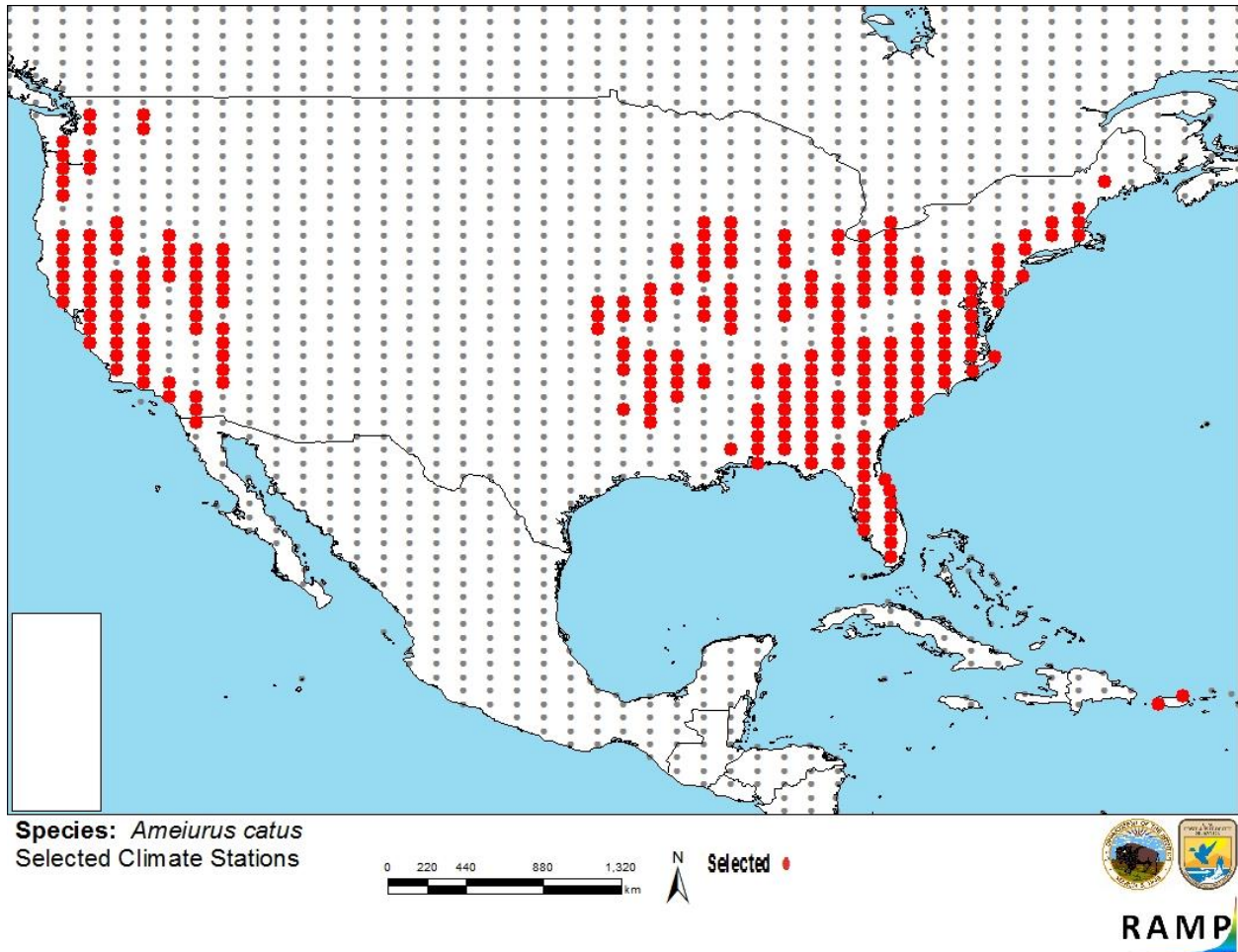


Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *Ameiurus catus* climate matching. Source locations from GBIF (2017).

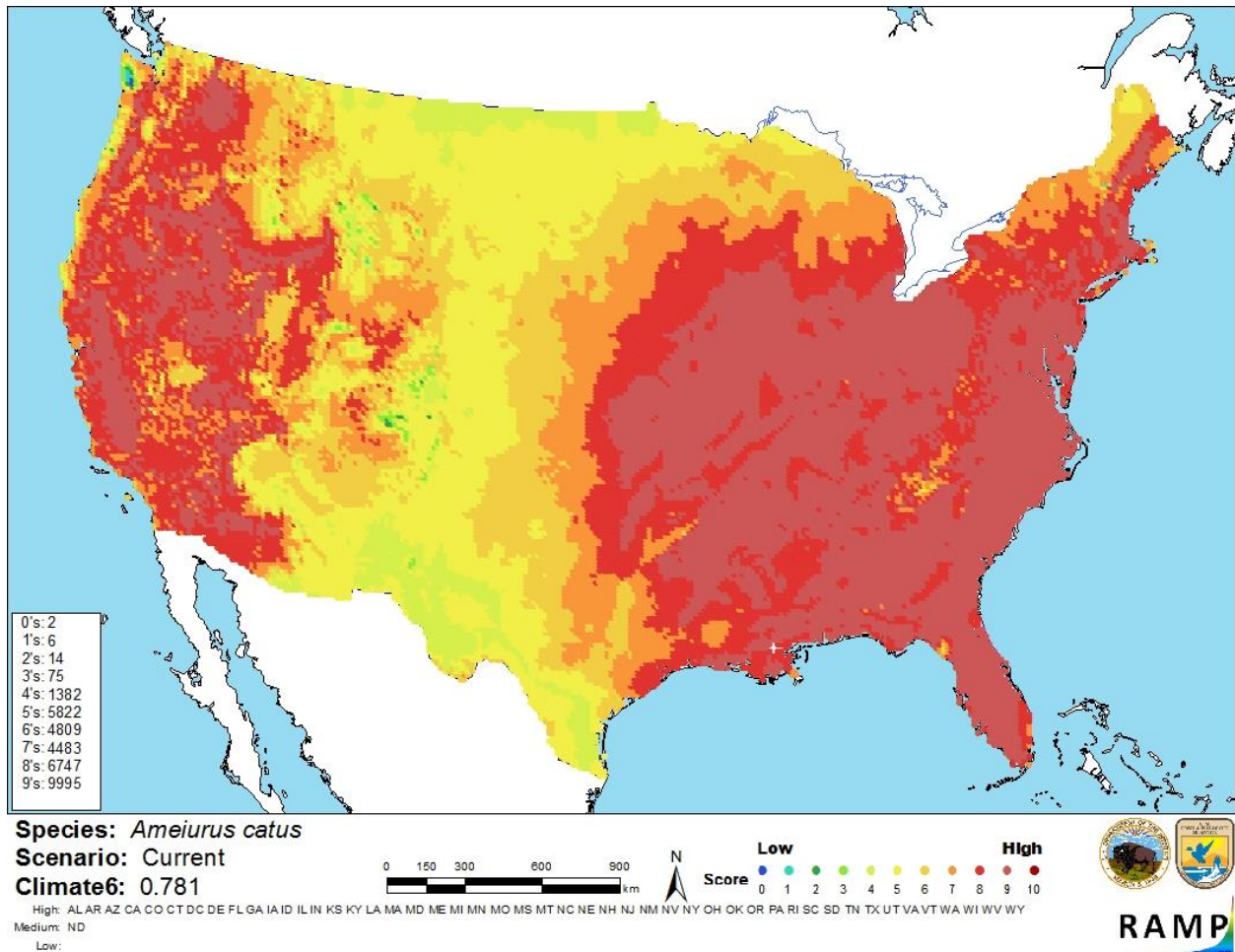


Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *Ameiurus catus* in the contiguous United States based on source locations reported by GBIF (2017). 0=Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

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
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

7 Certainty of Assessment

Information on the biology and distribution of this species is readily available. However, little information is available on the impacts of introduction of *A. catus*. Certainty of this assessment is low.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Ameiurus catus is native to the Atlantic Coast of the United States from New York to Florida. This catfish has been introduced widely outside the native range for gamefish purposes. Most introductions have occurred within the contiguous U.S. Individuals have also been reported in the U.K. and the Philippines, but these populations are not known to be established. Data on impacts of introductions are sparse, particularly in the peer-reviewed published literature. Climate match to the contiguous U.S. is high, with virtually all areas of the contiguous U.S. showing at least medium match. Overall risk posed by this species 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.

- Britton, J. R., and G. D. Davies. 2006. First record of the white catfish *Ameiurus catus* in Great Britain. *Journal of Fish Biology* 69:1236-1238.
- CABI. 2017. Enteric septicaemia of catfish. *Invasive Species Compendium*. CAB International, Wallingford, U.K. Available: <http://www.cabi.org/isc/datasheet/83805>. (September 2017).
- FAO. 2017. *Ameiurus catus* introduced to Philippines from USA (California). *Introduced Species Fact Sheets*. FAO, Rome. Available: <http://www.fao.org/fishery/introp/81/en>. (September 2017).
- Fuller, P., and M. Neilson. 2017. *Ameiurus catus*. *USGS Nonindigenous Aquatic Species Database*, Gainesville, Florida. Available: <https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=729>. (June 2017).
- GBIF (Global Biodiversity Information Facility). 2017. GBIF backbone taxonomy: *Ameiurus catus* (Linnaeus, 1758). GBIF Secretariat, Copenhagen. Available: <https://www.gbif.org/species/2340972>. (September 2017).
- Integrated Taxonomic Information System (ITIS). 2017. *Ameiurus catus* (Linnaeus, 1758). *Integrated Taxonomic Information System*, Reston, Virginia. Available: https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=164037#null. (June 2017).

- NatureServe. 2013. *Ameiurus catus*. The IUCN Red List of Threatened Species 2013: e.T202673A2746463. Available: <http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T202673A2746463.en>. (June 2017).
- O'Rear, T. A. 2012. Diet of an introduced estuarine population of white catfish in California. Master's thesis. University of California, Davis.
- Page, L. M., and B. M. Burr. 2006. White catfish *Ameiurus catus*. In G. E. Sheehy. Catfishes: Siluriformes. Taxonomic information on catfishes. Florida Museum of Natural History, Gainesville, Florida. Available: <https://www.floridamuseum.ufl.edu/catfish/ictaluridae/whitecatfish.htm>. (September 2017).
- Sanders, S., C. Castiglione, and M. H. Hoff. 2014. Risk Assessment Mapping Program: RAMP. U.S. Fish and Wildlife Service.
- University of California. 2017. California fish species: white catfish. California Fish Website. University of California, Division of Agriculture and Natural Resources, Oakland, California. Available: <http://calfish.ucdavis.edu/species/?uid=111&ds=241>. (September 2017).

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.

- Behnke and Wetzel 1960 [*Source did not provide complete citation for this reference.*]
- Bernstein, N. P., and J. R. Olson. 2001. Ecological problems with Iowa's invasive and introduced fishes. *Journal of the Iowa Academy of Science* 108(4):185-209.
- Bond 1994 [*Source did not provide complete citation for this reference.*]
- Boschung, H. T. 1992. Catalogue of freshwater and marine fishes of Alabama. *Alabama Museum of Natural History Bulletin* 14:1-266.
- Buchanan, T. M. 1973. Key to the fishes of Arkansas. Arkansas Game and Fish Commission, Little Rock, Arkansas.
- Burr 1980 [*Source did not provide complete citation for this reference.*]
- Burr, B. M. 1991. The fishes of Illinois: an overview of a dynamic fauna. *Illinois Natural History Survey Bulletin* 34(4):417-427.
- Burr and Page 1986 [*Source did not provide complete citation for this reference.*]

- Burr, B. M., and M. L. Warren, Jr. 1986. A distributional atlas of Kentucky fishes. Kentucky Nature Preserves Commission Scientific and Technical Series 4.
- Cardoza et al. 1993 [*Source did not provide complete citation for this reference.*]
- Cooper, E. L. 1983. Fishes of Pennsylvania. Pennsylvania State University Press, University Park, Pennsylvania.
- Cross et al. 1986 [*Source did not provide complete citation for this reference.*]
- Dahlberg, M. D., and D. C. Scott. 1971. The freshwater fishes of Georgia. Bulletin of the Georgia Academy of Science 29:1-64.
- Deacon and Williams 1984 [*Source did not provide complete citation for this reference.*]
- Dill, W. A., and A. J. Cordone. 1997. History and status of introduced fishes in California, 1871-1996. Fish Bulletin 178. California Department of Fish and Game, Sacramento, CA. Available: <http://content.cdlib.org/view?docId=kt8p30069f&brand=calisphere>.
- Emery 1985 [*Source did not provide full citation for this reference.*]
- Erdman, D. S. 1984. Exotic fishes in Puerto Rico. Pages 162-176 in W. R. Courtenay, Jr., and J. R. Stauffer, Jr, editors. Distribution, biology, and management of exotic fishes. John Hopkins University Press, Baltimore, Maryland.
- Etnier, D. A., and W. C. Starnes. 1993. The fishes of Tennessee. University of Tennessee Press, Knoxville, Tennessee.
- Halliwell, D. B. 2003. Introduced fish in Maine. MABP series: Focus on Freshwater Biodiversity.
- Hartel, K. 1992. Non-native fishes known from Massachusetts freshwaters. Occasional Reports of the MCZ Fish Department 2:1-9.
- Hartel et al. 1996 [*Source did not provide full citation for this reference.*]
- Hawke, J. P., A. C. McWhorter, A. G. Steigerwalt, and D. J. Brenner. 1981. *Edwardsiella ictaluri* sp. nov., the causative agent of enteric septicemia of catfish. International Journal of Systematic Bacteriology 31(4):396-400.
- 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.
- Hugg, D. O. 1996. MAPFISH georeferenced mapping database. Freshwater and estuarine fishes of North America. Life Science Software, Edgewater, Maryland.
- IGFA. 2001. Database of IGFA angling records until 2001. IGFA, Fort Lauderdale, Florida.
- Insider Viewpoint. 2001. Fishing records – Nevada. Insider Viewpoint Magazine.
- Juliano, R. O., R. Guerrero, and I. Ronquillo. 1989. The introduction of exotic aquatic species in the Philippines. Pages 83-90 in S. S. De Silva, editor. Exotic aquatic organisms in Asia. Asian Fisheries Society Special Publication 3.
- Klesius, P., J. Lovy, J. Evans, E. Washuta, and C. Arias. 2003. Isolation of *Edwardsiella ictaluri* from tadpole madtom in a southwestern New Jersey river. Journal of Aquatic Animal Health 15:295-301.
- La Rivers 1962 [*Source did not provide full citation for this reference.*]
- Lampman 1946 [*Source did not provide full citation for this reference.*]
- Lee 1983 [*Source did not provide full citation for this reference.*]
- Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. 1980 et seq. Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh, North Carolina.
- Lever, C. 1996. Naturalized fishes of the world. Academic Press, London.
- Matern, S. A., P. B. Moyle, and L. C. Pierce. 2002. Native and alien fishes in a California estuarine marsh: twenty-one years of changing assemblages. Transactions of the American Fisheries Society 131:797-816.
- McCarragher, D. B., and R. W. Gregory. 1970. Adaptability and status of introductions of Sacramento perch, *Archoplites interruptus*, in North America. Transactions of the American Fisheries Society 99(4):700-707.
- Menhinick, E. F. 1991. The freshwater fishes of North Carolina. North Carolina Wildlife Resources Commission, Raleigh, North Carolina.
- Mettee, M. F., P. E. O'Neil, and J. M. Pierson. 1996. Fishes of Alabama and the Mobile Basin. Oxmoor House, Inc., Birmingham, Alabama.

- Miller, R. R., and J. R. Alcorn. 1946. The introduced fishes of Nevada, with a history of their introduction. *Transactions of the American Fisheries Society* 73:173-193.
- Moyle, P. B., F. W. Fisher, and H. Li. 1974. Mississippi silversides and logperch in the Sacramento-San Joaquin River system. *California Department of Fish and Game* 60(2):145-147.
- Moyle, P. B. 1976. *Inland fishes of California*. University of California Press, Berkeley, California.
- Neale 1931 [*Source did not provide full citation for this reference.*]
- Nelson, J. S., and S. D. Gerking. 1968. Annotated key to the fishes of Indiana. Project 342--303--815. Department of Zoology, Indiana Aquatic Research Unit, Indiana State University, Bloomington, Indiana.
- 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 Company, Boston.
- Pflieger 1997 [*Source did not provide full citation for this reference.*]
- Riede, K. 2004. Global register of migratory species - from global to regional scales. Final report of the R&D-Projekt 808 05 081. Federal Agency for Nature Conservation, Bonn, Germany.
- Robison and Buchanan 1988 [*Source did not provide full citation for this reference.*]
- Ross, S. T., and W. M. Brenneman. 1991. Distribution of freshwater fishes in Mississippi. Freshwater fisheries report no. 108. D-J project completion report F-69. Mississippi Department of Wildlife, Fisheries and Parks, Jackson, Mississippi.
- Schmidt 1986 [*Source did not provide full citation for this reference.*]
- Schwartz, F. J. and R. Jachowski. 1965. The age, growth, and length-weight relationship of the Patuxent River, Maryland Ictalurid white catfish, *Ictalurus catus*. *Chesapeake Science* 6:226-229.
- Shebley, W. H. 1917. History of the introduction of food and game fishes into the waters of California. *California Fish and Game* 3(1):3-10.
- Sigler and Sigler 1996 [*Source did not provide full citation for this reference.*]
- Smith, H. M. 1896. A review of the history and results of the attempts to acclimatize fish and other water animals in the Pacific states. *Bulletin of the U.S. Fish Commission for 1895*, 40:379-472.

- Smith, P. W. 1979. The fishes of Illinois. University of Illinois Press, Urbana, Illinois.
- Sommer, T., B. Harrell, M. Nobriga, R. Brown, P. Moyle, W. Kimmerer, and L. Schemel. 2001. California's Yolo Bypass: evidence that flood control can be compatible with fisheries, wetlands, wildlife, and agriculture. *Fisheries* 26(8):6-16.
- Starnes and Etnier 1986 [*Source did not provide full citation for this reference.*]
- State of Oregon. 2000. Warm water game fish records.
- Swift et al. 1993 [*Source did not provide full citation for this reference.*]
- Trautman, M. B. 1981. The fishes of Ohio. Ohio State University Press, Columbus, Ohio.
- Underhill 1986 [*Source did not provide full citation for this reference.*]
- Vinyard 2001 [*Source did not provide full citation for this reference.*]
- Welcomme, R. L. 1988. International introductions of inland aquatic species. FAO Fisheries Technical Paper 294.
- Whitworth 1996 [*Source did not provide full citation for this reference.*]
- Whitworth et al. 1968 [*Source did not provide full citation for this reference.*]
- Wydoski and Whitney 1979 [*Source did not provide full citation for this reference.*]
- Yerger, R. W. 1977. Fishes of the Apalachicola River. Florida Marine Research Publications 26:22-33.