

Spotted Bass (*Micropterus punctulatus*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, January 2023

Revised, February 2023

Web Version, 3/25/2024

Organism Type: Fish

Overall Risk Assessment Category: High



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https://commons.wikimedia.org/wiki/File:1351_largemouth_bass_%28Micropterus_salmoides%29_300_dpi.jpg (February 2023)

1 Native Range and Status in the United States

Native Range

From Fuller et al. (2023):

“Mississippi River basin from southern Ohio and West Virginia to southeastern Kansas, and south to the Gulf; Gulf Slope drainages from the Chattahoochee River, Georgia (where possibly introduced), to the Guadalupe River, Texas (Page and Burr 1991).”

From Texas Parks and Wildlife Department (2023):

“Spotted bass are native to portions of East Texas from the Guadalupe River to the Red River, exclusive of the Edwards Plateau region.”

Status in the United States

From Fuller et al. (2023):

“Mississippi River basin from southern Ohio and West Virginia to southeastern Kansas, and south to the Gulf; Gulf Slope drainages from the Chattahoochee River, Georgia (where possibly introduced), to the Guadalupe River, Texas (Page and Burr 1991).”

From Texas Parks and Wildlife Department (2023):

“Spotted bass are native to portions of East Texas from the Guadalupe River to the Red River, exclusive of the Edwards Plateau region.”

According to Fuller et al. (2023), nonindigenous occurrences of *Micropterus punctulatus* have been reported in the following states. Range of observation years, watersheds, and population status (one or more watersheds) where reported in parentheses.

- Alabama (1980-1996; Apalachicola Basin, Cahaba, Locust, Lower Alabama, Lower Black Warrior, Lower Coosa, Lower Tallapoosa, Lower Tombigbee, Middle Alabama, Middle Chattahoochee-Lake Harding, Middle Chattahoochee-Walter F, Middle Coosa, Middle Tallapoosa, Middle Tombigbee-Chickasaw, Middle Tombigbee-Lubbub, Mobile Bay, Mobile-Tensaw, Mulberry, Noxubee, Sipsey, Sipsey Fork, Sucarnoochee, Upper Alabama, Upper Black Warrior, Upper Coosa, Upper Tallapoosa; established)
- Arizona (1942-1973; Lower Verde, Verde; established)
- California (1933-2002; California Region, Clear Creek-Sacramento River, Honcut Headwaters-Lower Feather, Los Angeles, Lower American, Lower Sacramento, Middle Fork Feather, Middle San Joaquin-Lower Chowchilla, San Diego, San Pablo Bay, Santa Ana, South Fork American, Tomales-Drake Bays, Upper Calaveras California, Upper Cosumnes, Upper Kern, Upper San Joaquin, Upper Yuba; established)
- Colorado (1985-2009; Middle South Platte-Cherry Creek, Upper Arkansas, Upper Arkansas-Lake Meredith; established)
- Florida (1941-1980; Apalachicola, Lower Chattahoochee, Lower Flint; established)
- Georgia (1962-2019; Altamaha, Apalachicola Basin, Broad, Coosawattee, Etowah, Ichawaynochaway, Lower Flint, Middle Chattahoochee-Lake Harding, Middle Chattahoochee-Walter F, Middle Flint, Oostanaula, Upper Chattahoochee, Upper Flint, Upper Ocmulgee, Upper Oconee, Upper Savannah; established)
- Illinois (2008-2009; Cache, Kishwaukee, Mackinaw; established)
- Iowa (1963-2001; Lake Red Rock, Lower Iowa, Middle Iowa, South Raccoon; established)
- Kansas (1967-1995; Kansas, Little Osage, Middle Kansas, Missouri-Nishnabotna, Osage; established)
- Kentucky (1986-1986; Upper Cumberland; established)

- Mississippi (1991-2015; Tibbee, Town, Upper Tombigbee; established)
- Missouri (1935-2009; Big, Bourbeuse, Cahokia-Joachim, Chariton, Grand, Harry S. Truman Reservoir, Lake of the Ozarks, Lamine, Lower Gasconade, Lower Missouri, Lower Missouri-Moreau, Lower Osage, Meramec, Niangua, Peruque-Piasa, Pomme De Terre, Sac, Salt, South Fork Salt, Thompson, Upper Grand (failed), Upper Mississippi-Salt, Whitewater; established)
- Nebraska (1974-1974; Harlan County Reservoir, Middle Niobrara, Middle Platte-Buffalo, Niobrara Headwaters, Upper Niobrara; established)
- Nevada (1983-2001; Lower Humbolt, Meadow Valley Wash, Middle Carson; established)
- New Jersey (1997-1997; Lower Delaware; established)
- New Mexico (1990-1990; Pecos Headwaters, Upper Pecos-Black; established)
- North Carolina (1983-2017; Black, Cape Fear, Fishing, Haw, Hiwassee, Lower Cape Fear, Lower Little Tennessee, Lower Yadkin, Lumber, Nolichucky, Northeast Cape Fear, Pigeon, Roanoke, Rocky, South Yadkin, Tuckasegee, Upper Broad, Upper Cape Fear, Upper Catawba, Upper Dan, Upper French Broad, Upper Little Tennessee, Upper New, Upper Yadkin, Watauga, North Carolina, Tennessee; established)
- Oklahoma (1980-1980; Lower North Fork Red, West Cache; established)
- Oregon (2002-2008; Coast Fork Willamette, Upper Rogue, Upper Willamette; established)
- Pennsylvania (1983-1983; Upper Ohio; established)
- South Carolina (1975-2021; Enoree, Saluda, Seneca, Tugaloo, Upper Broad, Upper Savannah; established)
- Tennessee (1993-1993; Conasauga; established)
- Texas (1954-2013; Lower Colorado-Cummins, Medina, Middle Brazos-Palo Pinto, Red-Washita, San Marcos, Upper West Fork Trinity, Wichita; established)
- Utah (1987-1987; Middle Bear; established)
- Virginia (1973-2011; Albemarle-Chowan, Appomattox, James, Kanawha, Middle New, Middle Roanoke, Nottoway, Pamunkey, Roanoke, York; established)
- Washington (1987-1987; Pacific Northwest Region; established)
- West Virginia (1981-1993; Middle New, Upper Ohio-Wheeling; established)

No records of *Micropterus punctulatus* in trade in the United States were found.

Regulations

Micropterus punctulatus is listed as Prohibited in Arkansas (Arkansas Game and Fish Commission (2022)).

Micropterus punctulatus is regulated in Maryland (Code of Maryland Regulations 2022).

New Jersey Division of Fish and Wildlife (2022) lists *Micropterus punctulatus* as a “potentially dangerous fish.”

Colorado Parks and Wildlife (2022) restricts the possession of *Micropterus punctulatus*.

While effort was made to find all applicable regulations, this list may not be comprehensive.

Means of Introductions within the United States

From Fuller et al. (2023):

“Intentional stocking for sportfishing. In Missouri, the Spotted Bass was stocked in the Sac River and spread downstream through the Osage River into the Missouri River (MacCrimmon and Robbins 1975).”

Remarks

From Fuller et al. (2023):

“This species was formerly composed of three subspecies: the northern Spotted Bass (*M. p. punctulatus*), the Alabama Spotted Bass (*M. p. henshalli*) and the Wichita Spotted Bass (*M. p. wichitae*). Cofer (1995) determined the Wichita subspecies was actually a hybrid with *M. dolomieu* and is therefore invalid.”

From NatureServe (2023):

“*Micropterus henshalli* of the Mobile River basin formerly was included in *M. punctulatus*; Baker et al. (2008) recognized *henshalli* as a distinct species. [...] This species has hybridized with smallmouth bass in Missouri (Koppleman 1994). Nominal subspecies *wichitae* is an invalid taxon (= *M. punctulatus*, or *M. punctulatus* X *M. dolomieu*) (Cofer 1995).”

Micropterus punctulatus has been intentionally stocked outside its native range within the United States by State fishery managers to achieve fishery management objectives. State fish and wildlife management agencies are responsible for balancing multiple fish and wildlife management objectives. The potential for a species to become invasive is now one important consideration when balancing multiple management objectives and advancing sound, science-based management of fish and wildlife and their habitat in the public interest.

M. punctulatus and other species in the genus *Micropterus* may be collectively referred to as “black bass” (e.g., Khosa et al. 2019).

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to Fricke et al. (2023), *Micropterus punctulatus* is the current valid name for this species.

From ITIS (2023):

Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia

Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Acanthopterygii
Order Perciformes
Suborder Percoidei
Family Centrarchidae
Genus *Micropterus*
Species *Micropterus punctulatus* (Rafinesque, 1819)

The following synonyms of *Micropterus punctulatus* from Fricke et al. (2023) were used to search for information for this report: *Micropterus pseudaplites*, *Calliurus punctulatus*, and *Micropterus punctulatus wichitae*.

Size, Weight, and Age Range

Froese and Pauly (2023) list the common length of *M. punctulatus* as 30.0 cm or 300 mm total length with a max length of 63.5 cm or 635 mm, the max published weight as 4.7 kg or 10.36 lbs, and the max reported age as 7 years.

Environment

From NatureServe (2023):

“[...] at depths averaging 1.5-6.7 m in reservoirs, 33-73 cm in streams.”

From Froese and Pauly (2023):

“Freshwater; demersal.”

Climate

From Froese and Pauly (2023):

“Subtropical; 40°N - 29°N”

Distribution Outside the United States

Native

Micropterus punctulatus is indigenous to the United States. See Native Range in section 1.

Introduced

From Froese and Pauly (2023):

“Introduced in southern Africa and has become established in several isolated water bodies.”

From Khosa et al. (2019):

“Four species, Largemouth Bass *Micropterus salmoides* (Lacepède 1802), Florida Bass *Micropterus floridanus* (Lesueur 1822), Smallmouth Bass *Micropterus dolomieu* (Lacepède 1802) and Spotted Bass *Micropterus punctulatus* (Rafinesque 1819) have been introduced, and now contribute to economically important recreational fisheries, outside of their native range in North America, Europe, Asia, South America and Africa (Jackson 2002; Takamura 2007; Hargrove et al. 2015; Long et al. 2015; Weyl and Cowley 2015). [*Micropterus punctulatus* have only been reported in Africa.]”

Means of Introduction Outside the United States

From Khosa et al. (2019):

“[...] introduced into areas outside their natural distribution range to enhance angling opportunities (Long et al. 2015; Weyl et al. 2017)”

“In South Africa, Black Bass [*Micropterus* spp.] were specifically introduced to develop sport fisheries in areas that were too warm for Rainbow Trout *Oncorhynchus mykiss* (Walbaum 1792) and Brown Trout *Salmo trutta* Linnaeus 1758 (Ellender et al. 2014). [...] Spotted Bass [were introduced] in 1939 for use in more turbid riverine environments (Ellender et al. 2014). [...] Black Bass were subsequently stocked via government supported stocking programs (until the early 1990s) and directly by anglers.”

Short Description

From Florida Fish and Wildlife Conservation Commission (2023):

“Spotted bass are similar to largemouth bass, but unlike the largemouth, the spotted bass has scales on the base portion of the second dorsal fin; their first and second dorsal fins are clearly connected, and its upper jaw does not extend past the eye. A rectangular tooth patch on the tongue also helps distinguish the spotted bass from other black bass species such as the largemouth bass and shoal bass.”

Biology

From Froese and Pauly (2023):

“Inhabit clear, gravelly flowing pools and runs of creeks and small to medium rivers (de Moor and Burton 1988); also found in streams, lakes and reservoirs (Etnier and Starnes 1993). Juveniles feed on small crustaceans and midge larvae while adults eat insects, larger crustaceans, frogs, worms, grubs and small fish (de Moor and Burton 1988, Etnier and Starnes 1993).”

From NatureServe (2023):

“Spawns in late spring; eggs hatch in about 5 days at 14-16 C [57.2-60.8 F]; sexually mature in 2nd or 3rd year; [...]”

“Each adult frequently remains in one limited area for most of year, such as single stream pool, but spawning migrations are common in spring (Moyle 1976).”

“Secretive pool dweller in streams; in reservoirs adults mostly in deeper water, young near shore. After leaving nest, juveniles usually in schools in backwater or cove areas near cover (Sublette et al. 1990). Eggs are laid in a nest made by the male on bottoms ranging from mud to gravel in low-current areas (Moyle 1976)”

From Texas Parks and Wildlife Department (2023):

“[...] Females may lay between 1,150 and 47,000 eggs. Males guard the eggs during incubation and for up to four weeks after they have hatched. As young fish grow their diet shifts from zooplankton to insects, and finally to fish and crayfish.”

“Spotted bass seem to be segregated by habitat type from closely related species. They tend to be found in areas with more current than largemouth bass, and they usually inhabit areas that are too warm, turbid, and sluggish for smallmouth bass.”

Human Uses

According to Fuller et al. (2023), *Micropterus punctulatus* are intentionally stocked for sportfishing.

Diseases

No information was found associating *Micropterus punctulatus* with any diseases listed by the World Organisation of Animal Health (2023).

According to Poelen et al. (2014), *Micropterus punctulatus* hosts the following parasites: *Bothriocephalus* spp., *Bothriocephalus claviceps*, *Caecicola autumnae*, *Caecicola latostoma*, *Caecicola parvulus*, *Camallanus* spp., *Cleidodiscus rarus*, *Crepidostomum* spp., *Crepidostomum cornutum*, *Ephemeridae* spp., *Etheostoma nigrum*, *Gnathostomata* spp., *Insecta* spp., Largemouth Bass virus, *Leptorhynchoides thecatus*, *Myzobdella lugubris*, *Neoechinorhynchus cylindratus*, *Nerodia rhombifer*, *Onchocleidus* spp., *Onchocleidus heliciis*, *Posthodiplostomum minimum*, *Proteocephalus ambloplitis*, *Rhipidocotyle papillosum*, *Spinitectus carolini*, *Spinitectus micracanthus*, *Spiroxys contorta*, *Syncleithrium fusiformis*, Santee-Cooper ranavirus, *Textrema hopkinsi*, *Urocleidus principalis*, *Valipora minuta*, and *Villosa iris*.

Threat to Humans

No information was found on threats to humans from *Micropterus punctulatus*.

3 Impacts of Introductions

From Fuller et al. (2023):

“The Spotted Bass hybridizes with the smallmouth bass when stocked in the smallmouth bass's native range or when both species are stocked in the same area. Spotted Bass introduced into central Missouri have hybridized with the native smallmouth bass *M. dolomieu* (Pflieger and Fajen 1970; Pflieger 1975, 1997; Whitmore 1983). Reportedly, the decline of smallmouth populations in the Moreau drainage in Missouri is at least partly attributable to hybridization with introduced Spotted Bass (Pflieger 1997). The hybrid has also been found in the Verde River, Arizona (Minckley 1973); California (Moyle 1976); and the Marmaton River, Barbour County, Kansas (Cross 1967; museum specimen KU 4682). The form formerly believed to be the subspecies *M. p. wichitae* from southwest Oklahoma was determined to be this hybrid (Cofer 1995).”

“Sammons (2012) found significant overlap in diets between juvenile and subadult Spotted Bass and juveniles and subadults of both largemouth (*M. salmoides*) and shoal (*M. cataractae*) bass, indicating the potential for trophic competition.”

“Introduced predatory centrarchids are likely responsible for the decline of native ranid frogs in California and for the decline of California tiger salamander *Ambystoma californiense* populations (Hayes and Jennings 1986; Dill and Cordone 1997).”

From Khosa et al. (2019):

“[...] introductions [in South Africa] served the purpose of enhancing recreational fisheries, their subsequent invasions have also resulted in negative impacts on native biota (Ellender et al. 2014; Ellender and Weyl 2014) which include the extirpation of native fishes in Black Bass invaded habitats (e.g. Van Der Walt et al. 2016; Ellender et al. 2018).”

From van Wilgen et al. (2020):

“[...] *M. punctulatus* [introduced to South Africa] in 1939 for stocking in rivers too turbid to suit *M. dolomieu* (see Ellender et al. 2014). [...] *M. punctulatus* have invaded parts of many river systems in the Eastern and Western Cape (Khosa et al. 2019). *Micropterus* spp. have had deleterious impacts on native fish and invertebrate species (see Ellender and Weyl 2014; Ellender et al. 2014 for reviews). Most severe are the impacts on native minnows that have not coevolved with native predatory fishes (Ellender et al. 2018). For example, in the Olifants River system in the Western Cape, predation has fragmented native minnow populations to such an extent that most species now only persist in headwater refugia that are isolated from black bass invasion by the presence of waterfalls (van der Walt et al. 2016). This has reduced the available habitat for native fishes in the Olifants-Doring River system by more than 700 km of river (van der Walt et al. 2016). As a result, *Micropterus* spp. are typical conflict species that require management interventions that consider both, [sic] economic value and harm to biodiversity (Zengeya et al. 2017).”

Micropterus punctulatus is regulated in Arkansas, Colorado, Maryland, and New Jersey.

4 History of Invasiveness

The History of Invasiveness for *Micropterus punctulatus* is classified as High. There is reliable evidence showing established populations have led to negative impacts on U.S. native fish populations, such as smallmouth bass in Missouri, through hybridization and trophic competition. In South Africa, *M. punctulatus* has been reported to displace native species through predation and competition in conjunction with other introduced *Micropterus* species. However, there is limited information to support the role of *M. punctulatus* relative to other *Micropterus* spp. in these impacts.

5 Global Distribution



Figure 1. Reported global distribution of *Micropterus punctulatus*. Map from GBIF Secretariat (2022). Observations are reported from United States and South Africa. Points located in Mexico, Taiwan and the point off the West Coast of Africa do not represent established populations and were not used for the climate match.

6 Distribution Within the United States

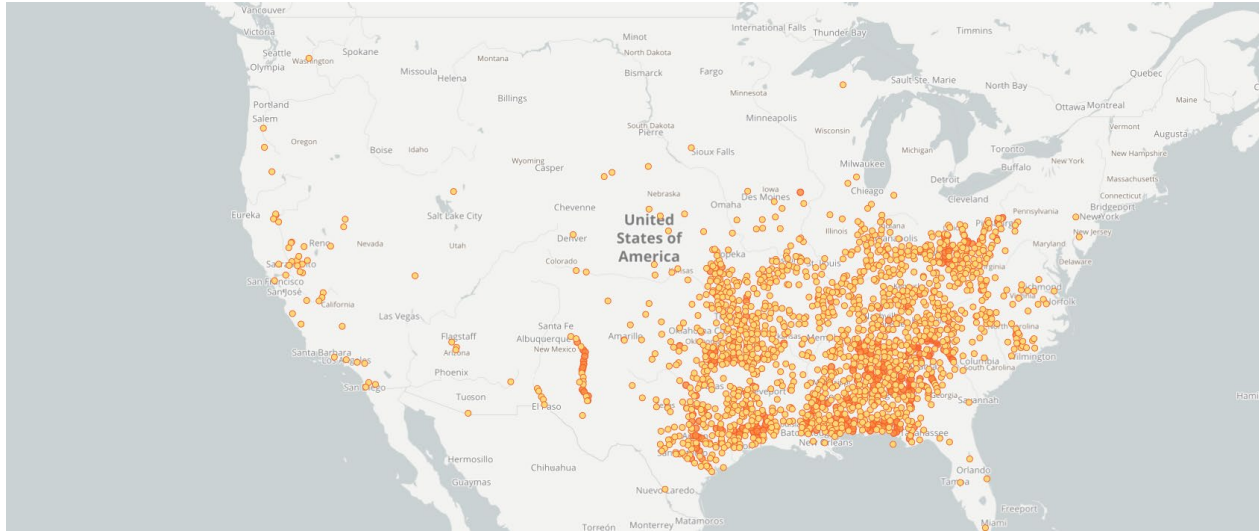


Figure 2. Reported distribution of *Micropterus punctulatus* in the United States. Map from GBIF-US (2023). Occurrences in Arizona, Colorado, southern Florida, Michigan, Nebraska, Nevada, New Jersey, Oregon, Utah, and Washington do not represent established populations and therefore have been excluded from climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The highest climate match for *M. punctulatus* in the contiguous United States was found in California, Midwest, the South, Northeast, and Eastern United States, encompassing the native range of the species. There were small areas of low match in the Pacific Northwest. Most of the Intermountain West had a medium climate match. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.934, indicating that Yes, there is establishment concern for this species outside its native range. The Climate 6 score is calculated as: $(\text{count of target points with scores} \geq 6) / (\text{count of all target points})$. Establishment concern is warranted for Climate 6 scores greater than or equal to 0.002 based on an analysis of the establishment success of 356 nonnative aquatic species introduced to the United States (USFWS 2024).

Projected climate matches in the contiguous United States under future climate scenarios are available for *Micropterus punctulatus* (see Appendix). These projected climate matches are provided as additional context for the reader; future climate scenarios are not factored into the Overall Risk Assessment Category.



Species: *Micropterus punctulatus*

Selected Climate Stations ●



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Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations in United States and South Africa selected as source locations (red; United States, South Africa) and non-source locations (gray) for *Micropterus punctulatus* climate matching. Source locations from GBIF Secretariat (2022). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

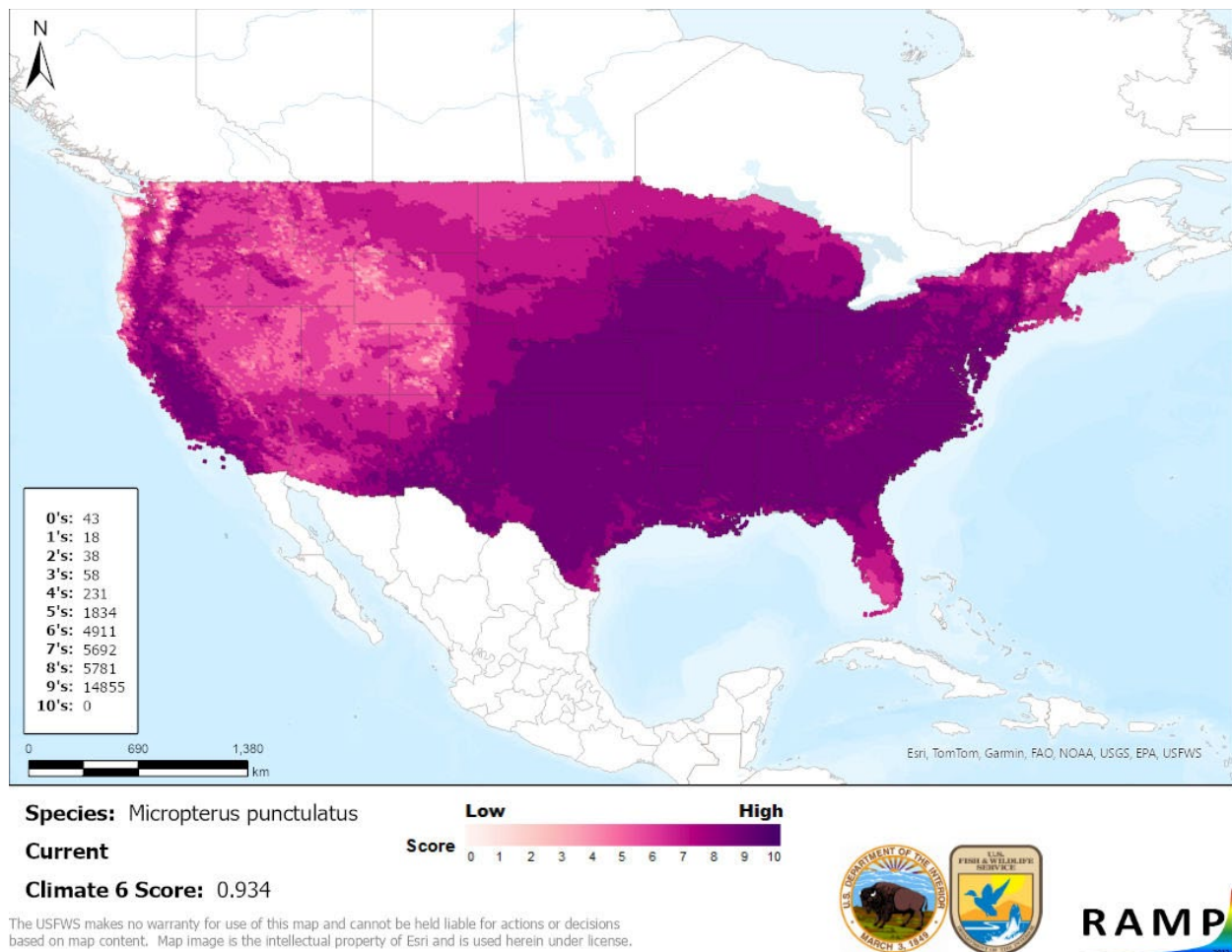


Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Micropterus punctulatus* in the contiguous United States based on source locations reported by GBIF Secretariat (2022). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Micropterus punctulatus* is classified as Medium. There is reasonably complete information regarding species native distribution. However, the understanding of the introduced range is complicated by hybridization that may have led to misidentified occurrences. There is information available that a negative impact occurred from the introduction of *M. punctulatus*; however, most impact information is for *Micropterus* species as a group.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Micropterus punctulatus, spotted bass, is a fish that is indigenous to the contiguous United States. Spotted bass are native to the Mississippi River basin from southern Ohio and West Virginia to southeastern Kansas, and south to the Gulf. They are native to portions of east Texas

from the Guadalupe River to the Red River. *M. punctulatus* has been known to hybridize with other species in the genus *Micropterus*. *M. punctulatus* is recognized as a popular game fish throughout the United States and South Africa which has contributed to establishment outside of its native range through intentional introduction and frequent stocking. *Micropterus punctulatus* is regulated in Arkansas, Colorado, Maryland, and New Jersey. The History of Invasiveness for *Micropterus punctulatus* is classified as High due to the negative impact of spotted bass populations have on smallmouth bass populations in Missouri through trophic competition and hybridization. In South Africa, *Micropterus* spp., including *M. punctulatus*, have been reported to contribute to the decline and fragment of native fish populations through predation and competition with indigenous species and invertebrates. The climate matching analysis for the contiguous United States indicates establishment concern for this species outside its native range. High climate match was found primarily around locations where the species is already established. The Certainty of Assessment for this ERSS is classified as Medium due to a limited amount of information regarding proven negative impacts and complications in understanding the species' introduced range. The Overall Risk Assessment Category for *Micropterus punctulatus* in the contiguous United States is therefore classified as High.

Assessment Elements

- **History of Invasiveness (see section 4): High**
- **Establishment Concern (see section 7): Yes**
- **Certainty of Assessment (see section 8): Medium**
- **Remarks, Important additional information: No additional remarks**
- **Overall Risk Assessment Category: High**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in section 11.

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11 Literature Cited in Quoted Material

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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Appendix

Summary of Future Climate Matching Analysis

Future climate projections represent two Shared Socioeconomic Pathways (SSP) developed by the Intergovernmental Panel on Climate Change (IPCC 2021): SSP5, in which emissions triple by the end of the century; and SSP3, in which emissions double by the end of the century. Future climate matches were based on source locations reported by GBIF Secretariat (2022).

Under the future climate scenarios (figure A1), on average, high climate match for *Micropterus punctulatus* was projected to occur in the Appalachian Range, California, Great Lakes, Gulf Coast, Mid-Atlantic, Northeast, Northern Plains, Southeast, Southern Plains, and Southwest regions of the contiguous United States. There were smaller areas of high match in the Pacific Northwest. Areas of high match became smaller with time and from scenario SSP3 to scenario SSP5. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.922 (model: MPI-ESM1-2-HR, SSP5, 2085) to a high of 0.969 (model: IPSL-CM6A-LR, SSP5, 2055). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is establishment concern for this species. The Climate 6 score for the current climate match (0.934, figure 4) falls within the range of scores for future projections. The time step and climate scenario with the most change relative to current conditions was SSP5, 2085 (figure A3). Limited areas with large increases in climate match relative to current conditions were found in the eastern Rocky Mountains under SSP5. Under one or more time step and climate scenarios, areas within the Colorado Plateau, Great Basin, Great Lakes, Northeast, Northern Plains, and Western Mountains saw a moderate increase in the climate match relative to current conditions. Under one or more time step and climate scenarios, areas within California saw a large decrease in the climate match relative to current conditions. Additionally, areas within the Appalachian Range, Gulf Coast, Mid-Atlantic, Northern Pacific Coast, Southeast, Southern Plains, Southwest, and Western Mountains saw a moderate decrease in the climate match relative to current conditions. The degree of change increased with time and from SSP3 to SSP5.

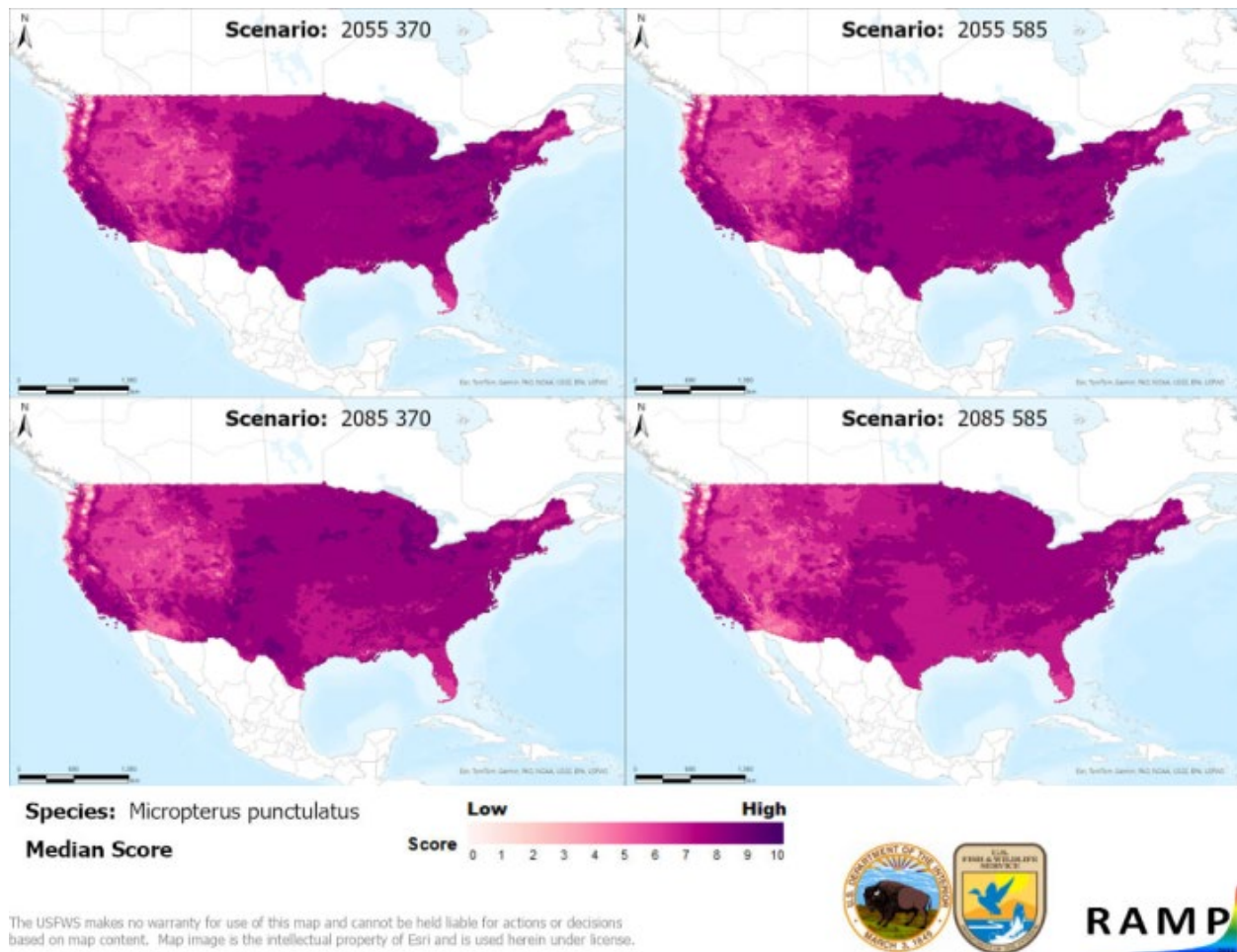


Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Micropterus punctulatus* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2022). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

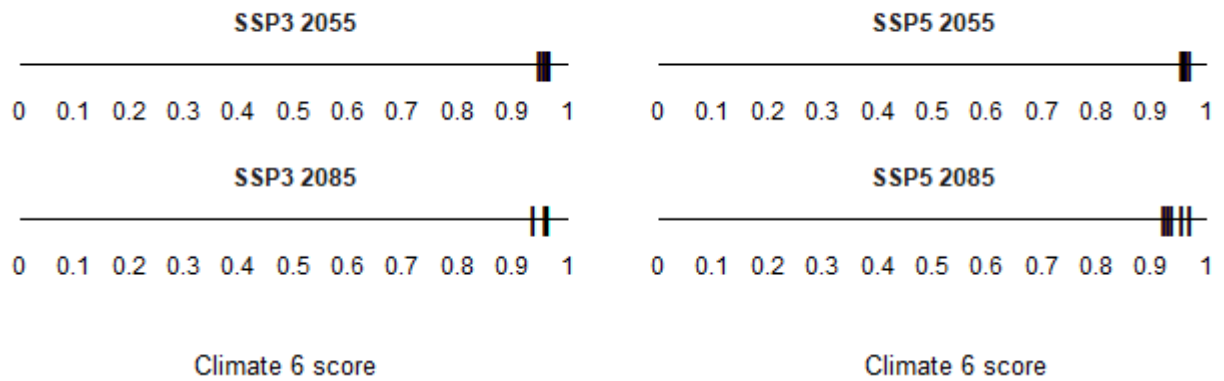


Figure A2. Comparison of projected future Climate 6 scores for *Micropterus punctulatus* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0.

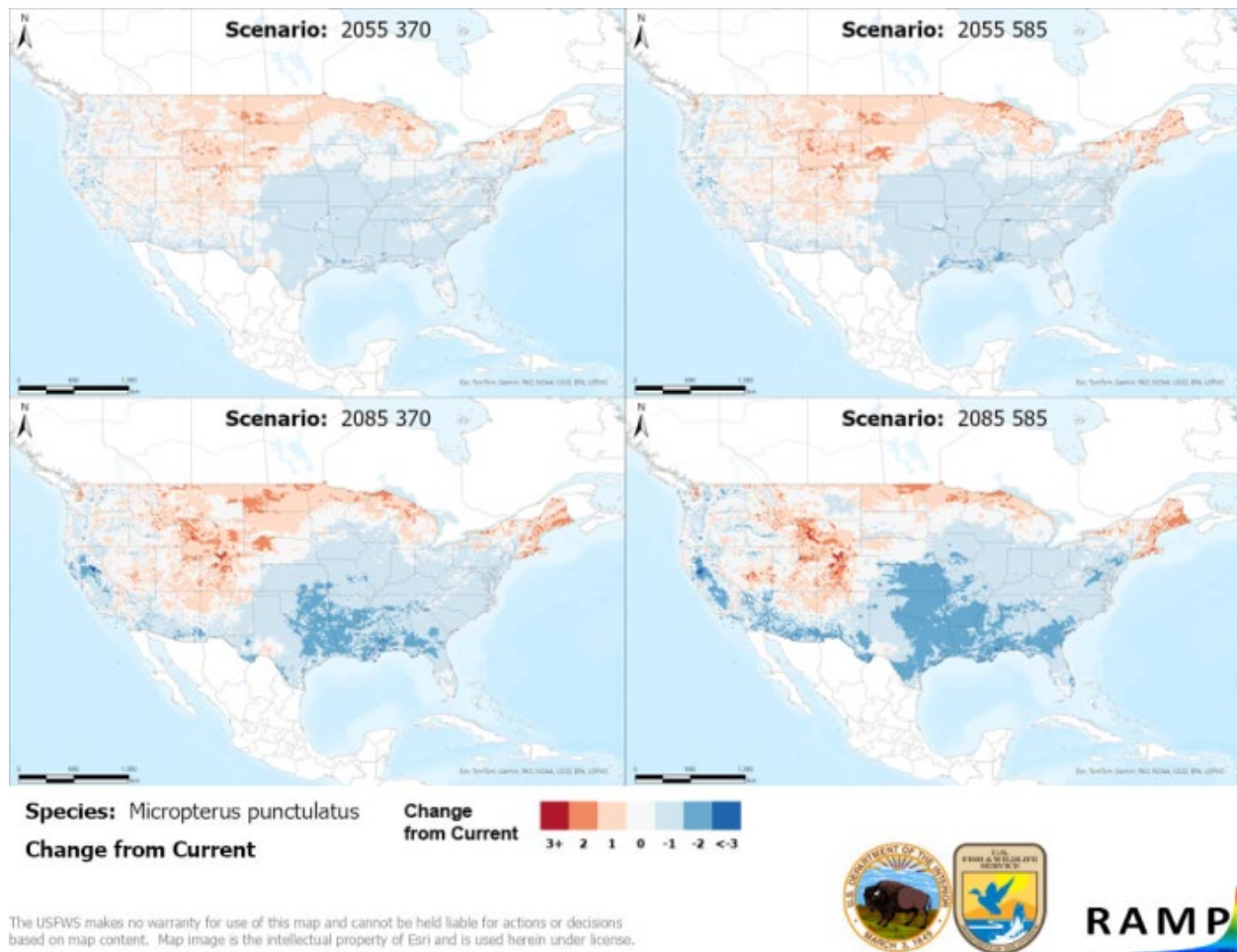


Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Micropterus punctulatus* based on source locations reported by GBIF Secretariat (2022). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. Shades of blue indicate a lower target point score under future scenarios than under current conditions. Shades of red indicate a higher target point score under future scenarios than under current conditions. Darker shades indicate greater change.

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