Redspotted Sunfish (*Lepomis miniatus*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, March 2023
Revised, April 2023
Web Version, 4/3/2024

Organism Type: Fish
Overall Risk Assessment Category: Uncertain

Photo: Fishes of Texas team. Licensed under Creative Commons Attribution-ShareAlike 4.0 International. Available: https://www.inaturalist.org/photos/2237822 (March 2023).

1 Native Range and Status in the United States

Native Range

From NatureServe (2023):

"Range includes Gulf Slope drainages from about the Apalachicola drainage westward to the Nueces River, Texas; it extends northward in the Mississippi River basin to central Illinois; […]"

From Warren (2009):

"The redspotted sunfish is native to the Illinois River, Illinois (relictual population, Burr and Page 1986), and south in the Mississippi River Valley to the Gulf Slope. On the Gulf Slope, the species occurs from the Nueces River, Texas, to, and inclusive of, the Mobile Basin, Alabama (Warren 1992)."

According to Fuller and Cannister (2023), *Lepomis miniatus* is native to the following States: Alabama, Arkansas, Georgia, Iowa, Illinois, Indiana, Kentucky, Louisiana, Missouri, Mississippi, Oklahoma, Tennessee, and Texas.

Status in the United States

From NatureServe (2023):

"Range includes Gulf Slope drainages from about the Apalachicola drainage westward to the Nueces River, Texas; it extends northward in the Mississippi River basin to central Illinois; the species has been introduced in the Devils River (Rio Grande drainage), Texas, and in several places near the outer margin of the range."

From Fuller and Cannister (2023):

"Western spotted sunfish are native to the Illinois River in Illinois, ranging south through the Mississippi River and along the Gulf Coast from Alabama to Texas (Warren 1992)."

"Established in Indiana, reported in Kentucky."

According to Fuller and Cannister (2023), nonindigenous occurrences of *Lepomis miniatus* have been reported in the following States. Range of observation years, number of watersheds (8-digit hydrologic unit), and population status where reported (one or more watersheds) in parentheses.

- Kentucky (1980; Red; unknown)
- Oklahoma (1980; Lower North Canadian, Middle Verdigris; failed)
- Tennessee (2015, Upper Cumberland-Cordell Hull Reservoir; established)
- Texas (1959-2001; International Falcon Reservoir, Red-Washita, Wichita; established)

From Fuller and Cannister (2023):

"These reports [above] were all made before *L punctatus* was split into *L. punctatus* and *L. miniatus*. We assumed these collections were of *L. miniatus* because that is the species native to three of these states, and closest to the fourth (Oklahoma). The report from Oklahoma is somewhat questionable. Burr and Warren (1986) considered the records of introduced populations in the Red River (Cumberland drainage), Kentucky, depicted in Lee et al. (1980 et seq.), to be unsubstantiated and likely erroneous. However, Warren (1992) did map a collection (with specimens he examined) from the Cumberland just over the border in Tennessee. But, Etnier and Starnes (1993) did not include this location in their distribution map for the species in

Tennessee. Therefore, whether it does now or has ever occurred in the Cumberland drainage is not clear. It is not clear whether this species is native or introduced in Indiana."

Individuals of *Lepomis miniatus* were found for sale in the United States. For example, the following record was found from a vender in the United States.

Jonah's Aquarium (2023) lists *Lepomis miniatus* for $12.00 per individual or $7.00 per individual with bulk purchase of 7 or more.

Regulations

Lepomis miniatus is listed as a regulated commercial aquaculture species in Arkansas (Arkansas Game and Fish Commission 2022).

Lepomis spp. are listed as regulated in New Hampshire (New Hampshire Fish and Game Department 2022).

All species of the family Centrarchidae are listed as restricted live wildlife in Arizona (Arizona Game and Fish Commission 2022).

All species of the family Centrarchidae are listed as regulated in New Mexico (New Mexico Department of Game and Fish 2010).

While every effort has been made to list all applicable State laws and regulations pertaining to this species, this list may not be comprehensive.

Means of Introductions within the United States

From Fuller and Cannister (2023):

"Unknown, possibly stock contamination."

From Wellemeyer et al. (2016):

"Range expansion in the Cumberland River basin is likely related to human introduction ultimately arising from stock contamination."

Remarks

From NatureServe (2023):

"Formerly regarded as a subspecies of *Lepomis punctatus*. Warren (1992) examined morphological variation and considered biochemical data (e.g., Bermingham and Avise 1986) and hypothesized that *punctatus* and *miniatus* are separate species and that upper Coosa system and Lookout Creek (Tennessee drainage) populations are of uncertain taxonomic status. Etnier and Starnes (1993) tentatively allocated the problematic populations to *L. punctatus* and accepted Warren's recognition of *miniatus* as a full species."

"*Lepomis miniatus* hybridizes with *L. punctatus* in portions of Georgia, Alabama, and the Florida Panhandle."

From Warren (2009):

"The introduced or native status of individuals from the Devils River (Rio Grande drainage), Texas, is equivocal (Warren 1990). Populations in drainages of the Florida Panhandle (inclusive of drainages from the Perdido to Apalachicola rivers), upper Coosa River tributaries (Alabama River drainage), and Lookout Creek (Tennessee River drainage) form a zone of contact in which individuals cannot be clearly identified morphologically as redspotted or spotted sunfishes (Warren 1992)."

"*Lepomis miniatus* is the sister species of *L. punctatus* (Near *et al*. 2004, 2005). Although long recognized as distinct (Jordan 1877), *L. miniatus* was considered a subspecies of *L. punctatus* throughout most of the twentieth century (Bailey 1938; Bailey *et al*. 1954)."

Other common names used for *Lepomis miniatus* include, but are not limited to, scarlet sunfish (ITIS 2023) and western spotted sunfish (Fuller and Cannister 2023).

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

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 *Lepomis*
Species *Lepomis miniatus* (Jordan, 1877)

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

Size, Weight, and Age Range

From Froese and Pauly (2023):

"Max length: 16.0 cm SL [standard length] male/unsexed; [Hassan-Williams et al. 2007]"

From Fuller and Cannister (2023):

“Size: 20 cm.”

From Warren (2009):

“Typically reach 30 to 80 mm TL [total length] at age 1. Large individuals measure 133 to 153 mm TL and attain age 4+ (maximum about 164 mm TL) (Carlander 1977; Warren 1992; Roberts *et al*. 2004).”

Environment

From Warren (2009):

“The redspotted sunfish inhabits well-vegetated ponds, lakes, and slow-flowing pools of creeks and small to medium rivers, being most abundant in natural floodplain lakes (Page and Burr 1991), where it tolerates periodic hypoxic conditions (<1 mg/l DO, Killgore and Hoover 2001). […] The species also occurs in coastal habitats of low salinity (usually <4 ppt), where it can be one of the most abundant centrarchids (Desselle *et al*. 1978; Peterson and Ross 1991).”

Climate

From Froese and Pauly (2023):

“Temperate”

Distribution Outside the United States

Native

The native range of *Lepomis miniatus* is entirely within the United States, see Native Range in Section 1.

Introduced

No records were found for introduction of *Lepomis miniatus* in the wild outside of the United States.

Means of Introduction Outside the United States

No records were found for introduction of *Lepomis miniatus* in the wild outside of the United States.

Short Description

From Warren (2009):

"Body deep, compressed, depth 0.45 to 0.50 of SL. Mouth moderate, terminal, oblique, supramaxilla small (> 3 times and ≤ 4 times length of maxilla), upper jaw extending just to or slightly beyond anterior margin of eye. Iridescent turquoise crescent outlining ventral curvature of red or dark eye. No wavy blue lines on head. Two to three diffuse bars often radiate posterior to the eye, and small spots on head, if present, most prominent on the preopercle and subopercle, often diffuse or coalesce to form dark, short streaks. Body in breeding males with horizontal rows of red-orange spots (one per scale) below the lateral line; black specks rarely present. Opercular flap, stiff, short with black center narrowly bordered above and below by pale white, posterior edge with narrow pale white border, often lacking; dorsal edge of flap red-orange in breeding males. Pectoral fin short and rounded, tip usually not reaching eye when laid forward across cheek. Gill rakers moderate to long, 8 to 11, longest about two to four times greatest width. Lateral line complete. Lateral scales, (33)35 to 41(42); rows above lateral line, (4)6 to 7(8); rows below lateral line, (11)12 to 14(15); cheek scale rows 4 to 6(7); breast scale rows (11)12 to 15(18); caudal peduncle scale rows, (15)18 to 21(22); pectoral rays (12)13 to 14(15). Pharyngeal arches narrow with sharply pointed teeth. Teeth present or absent on palatine bones. No teeth on endopterygoid, ectoptelygoid, or glossohyal (tongue) bones (Bailey 1938; Warren 1992; Mabee 1993)."

"Sides with red-orange, horizontal rows of spots, best developed at level of pectoral fin in breeding males. Ventral curvature of dark or red eye outlined with iridescent turquoise crescent (in life), a characteristic unique to *L. miniatus* and *L. punctatus*. Dark olive above; pale to yellow on breast and anterior belly. Breeding males with red-orange on breast, anterior belly, and pale circular to quadrate blotch above ear flap; dusky to dark pelvic fins; distal one-half to one-third of soft dorsal, soft anal, and caudal fins suffused with red-orange to reddish brown and narrowly edged in silvery, creamy, pinkish, or white margins (Page and Burr 1991; Warren 1992)."

Biology

From NatureServe (2023):

"Spawning probably peaks in spring and summer; male guards eggs; sexually mature at 2 years old or older (Manooch 1984, Lee et al. 1980, Etnier and Starnes 1993)."

"Swamps, sloughs, bottomland lakes, pools of creeks and small to medium rivers, less brackish portions of coastal estuaries; common in quiet or moderately flowing waters with heavy vegetation or other cover and bottom of mud or sand. Eggs are laid in a nest made on the bottom in shallow water near cover by the male."

From Warren (2009):

"The redspotted sunfish is an invertivore that forages primarily in submerged aquatic vegetation and bottom sediments but can also exploit surface prey."

"The reproductive biology of the redspotted sunfish is not well studied but is presumably similar to that of its sister species, the spotted sunfish, *L. punctatus*. Nesting activity was observed from early April to August in Texas, May to early August in Illinois, and in July in Missouri (Forbes and Richardson 1920; Robison and Buchanan 1984; Pflieger 1997; Roberts *et al*. 2004). […] In Missouri streams, nests are placed in a few centimeters of water among stems of water willow over a bottom of sand and gravel. Some males nest solitarily, but two or more males often build adjacent or even confluent nests (Pflieger 1997). Eggs hatch in about 36 hours at 26°C, and larvae reach swim-up about 4 to 5 days after hatching (Roberts *et al*. 2004)."

Human Uses

From Warren (2009):

"The redspotted sunfish, although providing sport, is generally too small to be a significant pan fish. Even so, the species contributes to the bream creel, particularly for bank anglers using cane poles in wetlands, backwaters, and small, lowland streams."

Diseases

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

According to Poelen et al. (2014), *Lepomis miniatus* hosts the following parasites: *Actinocleidus brevicirrus, Actinocleidus subtriangularis, Barbulostomum cupuloris, Camallanus* sp.*, Cleidodiscus* sp.*, Cleidodiscus venardi, Crepidostomum* sp.*, Crepidostomum cooperi, Crepidostomum cornutum, Genarchella* sp.*, Huffmanela huffmani, Leptorhynchoides acanthidion, Leptorhynchoides apoglyphicus, Leptorhynchoides seminolus, Leptorhynchoides thecatus, Neoechinorhynchus cylindratus, Onchocleidus attenuates, Onchocleidus parvicirrus, Onchocleidus miniatus, Pomphorhynchus* sp.*, Spinitectus carolini,* and *Urocleidus chelatus.*

Threat to Humans

From Froese and Pauly (2023):

"Harmless"

3 Impacts of Introductions

Although *Lepomis miniatus* has been reported as introduced beyond its native range, no information on impacts from those introductions was found.

From Fuller and Cannister (2023):

"The impacts of this species are currently unknown, as no studies have been done to determine how it has affected ecosystems in the invaded range. The absence of data does not equate to lack

of effects. It does, however, mean that research is required to evaluate effects before conclusions can be made."

The importation, possession, and/or trade of *Lepomis miniatus* is regulated in the following States (see Section 1 for detailed information): Arkansas (Arkansas Game and Fish Commission 2022), Arizona (Arizona Game and Fish Commission 2022), New Hampshire (New Hampshire Fish and Game Department 2022), and New Mexico (New Mexico Department of Game and Fish 2010).

4 History of Invasiveness

The History of Invasiveness for *Lepomis miniatus* is classified as Data Deficient. Although established populations of *L. miniatus* have been found outside of its native range, there was no information found regarding actual impacts of introduction. *L. miniatus* also appears to be available from retail vendors in the United States. However, there were no records found quantifying the duration or number of individuals in-trade.

5 Global Distribution

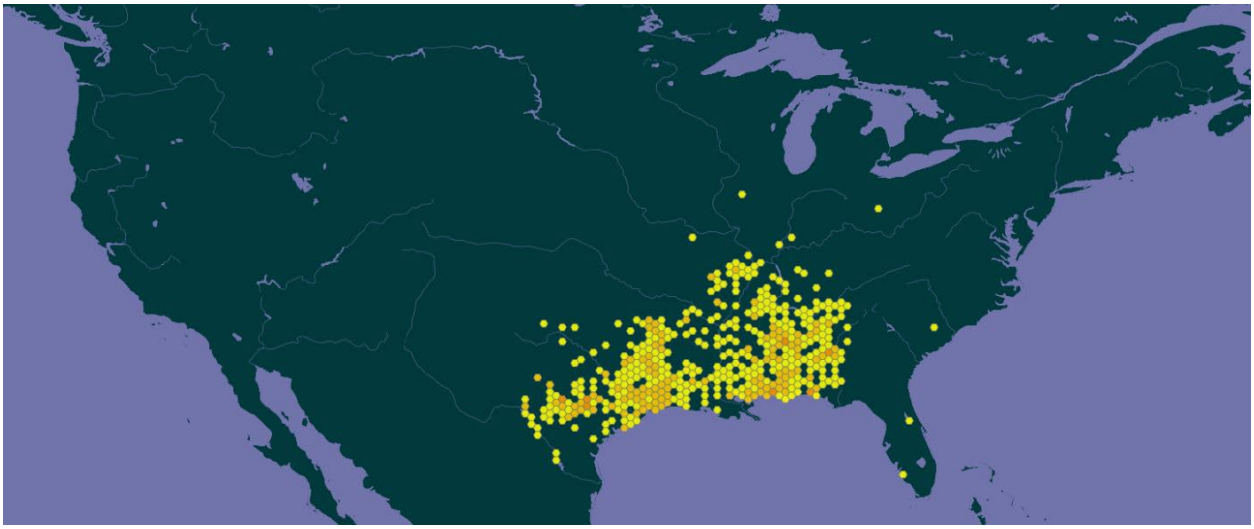

Figure 1. Known global distribution of *Lepomis miniatus*. Map from GBIF Secretariat (2022). Observations are all reported from the United States.

6 Distribution Within the United States

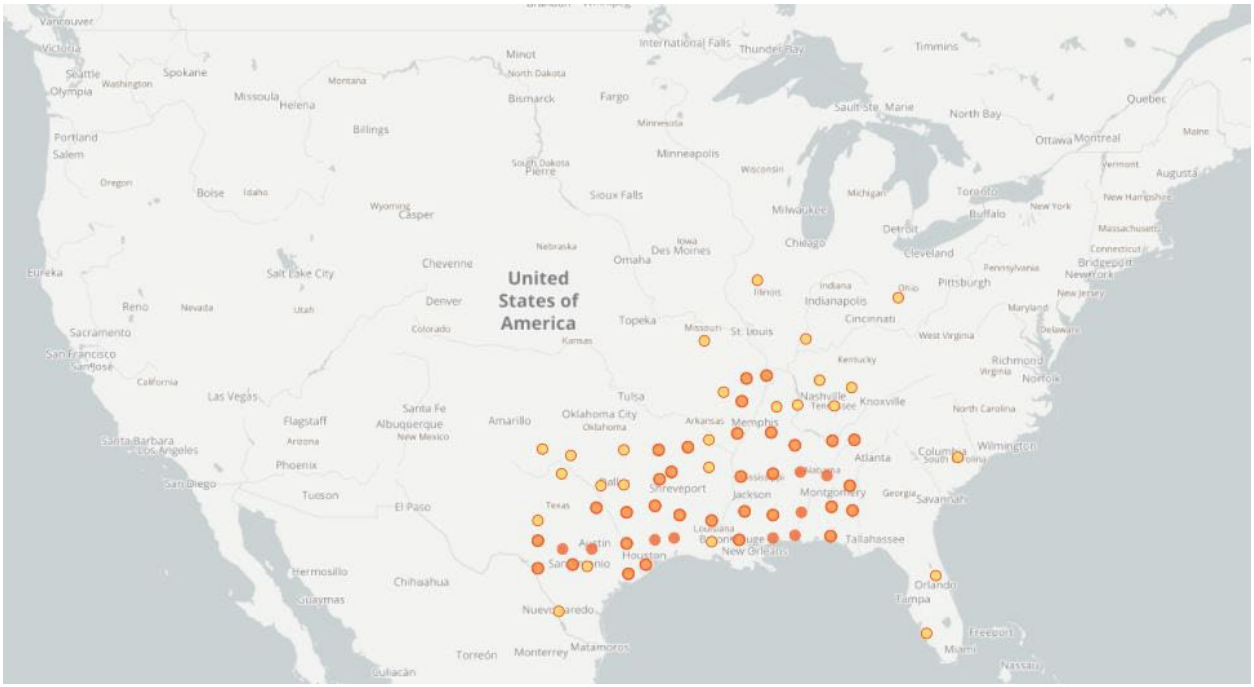

Figure 2. Reported distribution of *Lepomis miniatus* in the United States. Map from GBIF-US (2023). Points in peninsular Florida, Oklahoma, Ohio, and South Carolina were not found to be indicative of established populations and were excluded from the climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Lepomis miniatus* in the contiguous United States was generally high in the southcentral and southeastern regions and along the Gulf coast, spanning upward to the Midwest regions of the United States, which encompasses this species' native range. Medium matches were found in isolated portions of the Northeast, the Rocky Mountains, and the Southwest. Low matches were restricted to the central and northern Pacific Coast, Cascade-Sierra Mountains, and surrounding areas. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.679, indicating that Yes, there is establishment concern for this species outside its native range. The Climate 6 score is calculated as: (count of target points with scores ≥ 6)/(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 *Lepomis miniatus* (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.

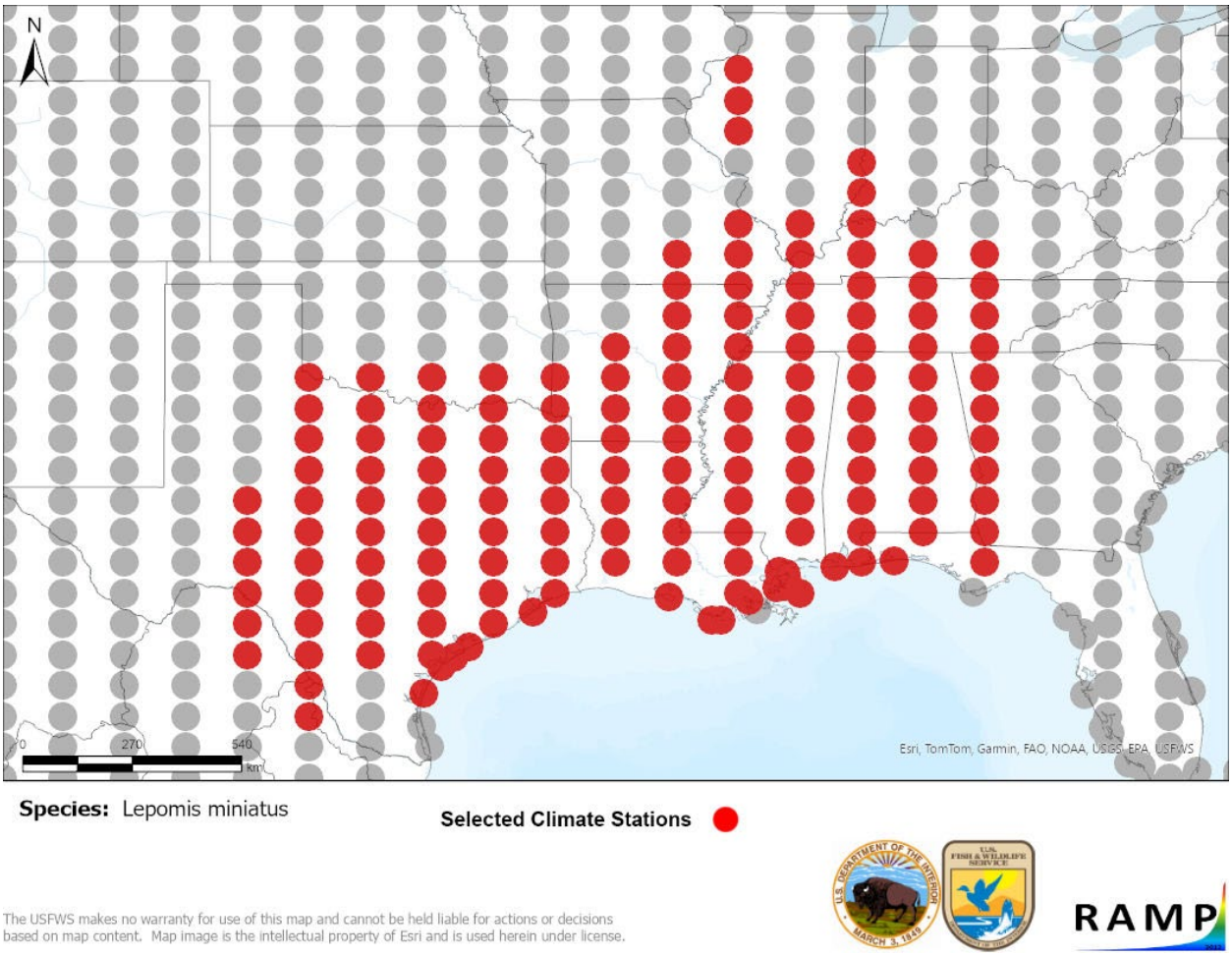

Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations in North America selected as source locations (red; United States [Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, Texas] and Mexico) and non-source locations (gray) for *Lepomis miniatus* 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.

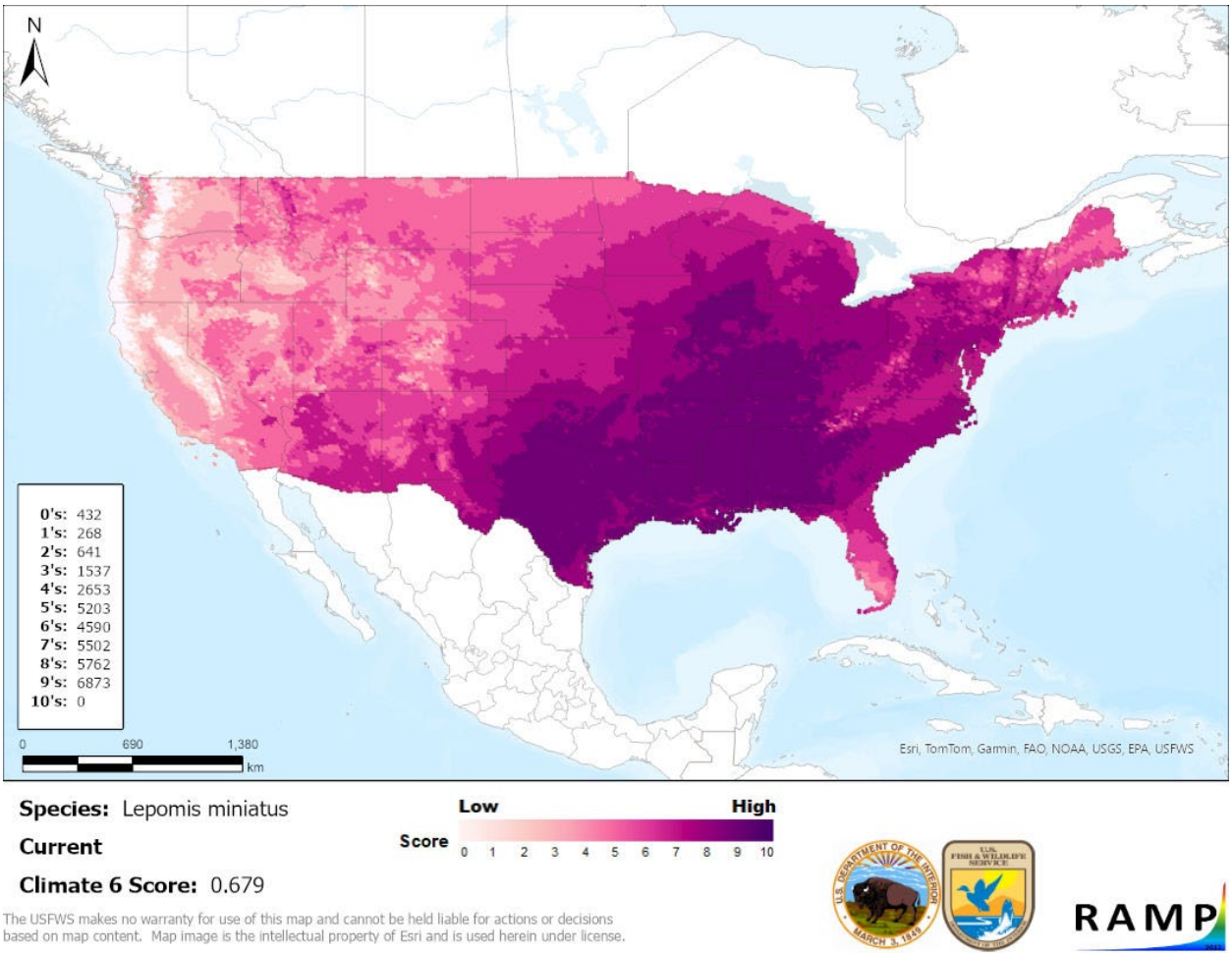

Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Lepomis miniatus* in the contiguous United States based on source locations reported by GBIF Secretariat (2022). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Lepomis miniatus* is classified as Low. Information is available on the biology, ecology, and distribution of *L. miniatus*, however, no information is available on actual impacts of introduction, and minimal information is available on the use and volume of *L. miniatus* in trade.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Lepomis miniatus, Redspotted Sunfish, is a freshwater fish that is native to the southcentral and southeastern regions, along the Gulf coast and upward along the Mississippi River to the Midwest region of the contiguous United States. *L. miniatus* is found in pools of creeks to medium size rivers and vegetated ponds and lakes. They can also be found in coastal habitats of low salinity and are able to tolerate periods of low oxygenated waters. They are not often

targeted by anglers but are present in the aquarium trade. *L. miniatus* has been introduced to watersheds adjacent to its native range. Means of introduction are unknown but is likely due to stock contamination. *L. miniatus* is regulated in Arkansas, Arizona, New Hampshire, and New Mexico. The History of Invasiveness for *L. miniatus* is classified as Data Deficient due to minimal information found on established populations and a lack of information regarding impacts of introduction. The climate matching analysis for the contiguous United States indicates establishment concern for this species outside its native range. There were areas of high match from the southcentral and southeastern regions and along the Gulf coast, spanning upward to the Midwest regions of the United States, which encompasses this species' native range. The Certainty of Assessment for this ERSS is classified as Low due to lack of information regarding impacts of introduction and trade. The Overall Risk Assessment Category for *Lepomis miniatus* in the contiguous United States is Uncertain.

Assessment Elements

- **History of Invasiveness (see section 4): Data Deficient**
- **Establishment Concern (see section 7): Yes**
- **Certainty of Assessment (see section 8): Low**
- **Remarks, Important additional information: None**
- **Overall Risk Assessment Category: Uncertain**

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 *Lepomis miniatus* was projected to occur in the Appalachian Range, Great Lakes, Gulf Coast, Mid-Atlantic, Northeast, Southeast, Southern Atlantic Coast, and Southern Plains regions of the contiguous United States. Areas of low climate match were projected to occur in the Northern Pacific Coast region and along the Sierra-Nevada Range. Areas of high match became smaller in extent with time and from SSP3 to SSP5. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.703 (model: MPI-ESM1-2-HR, SSP5, 2085) to a high of 0.821 (model: UKESM1-0-LL, SSP5, 2085). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is establishment concern for this species under future scenarios. The Climate 6 score for the current climate match (0.679, figure 4) falls below the range of scores for future projections. The time step and climate scenario with the most change relative to current conditions was SSP5, 2085, the most extreme climate change scenario (figure A3). Under one or more time step and climate scenarios, areas within the Colorado Plateau, Great Basin, and Northeast saw a large increase in the climate match relative to current conditions. Additionally, areas within the Great Lakes, 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 the Appalachian Range, Gulf Coast, Mid-Atlantic, Southeast, Southern Plains, and Southwest saw a moderate decrease in the climate match relative to current conditions. Central California also had some areas of moderate decrease, primarily under the SSP3 2085 scenario. No large decreases were observed regardless of time step and climate scenarios. Additional, very small areas of large or moderate change may be visible on the maps (figure A3). The areas of decrease were mainly concentrated within the species' native range. The degree of change increased with time and from SSP3 to SSP5.

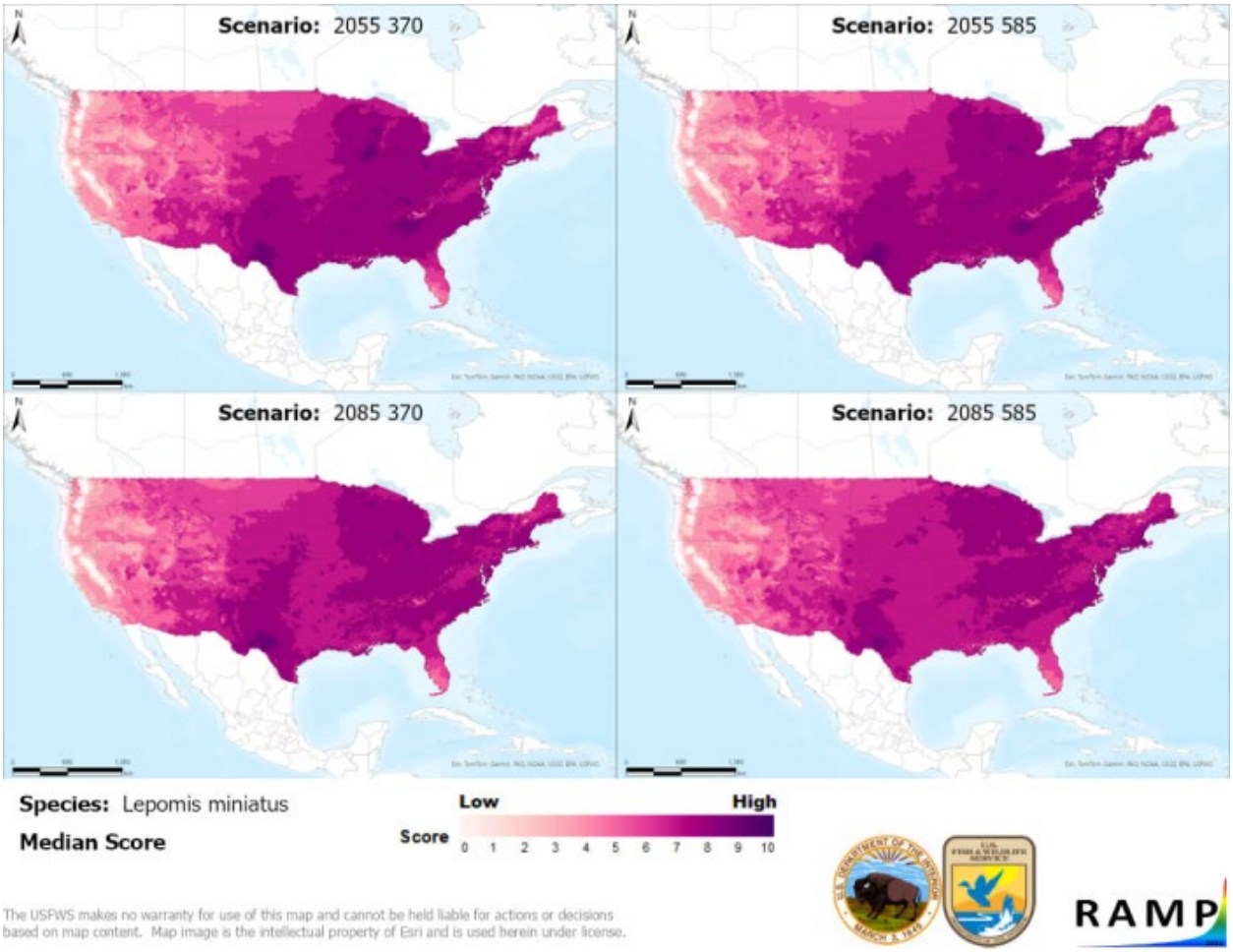

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Lepomis miniatus* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2022). Shared Socioeconomic 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.

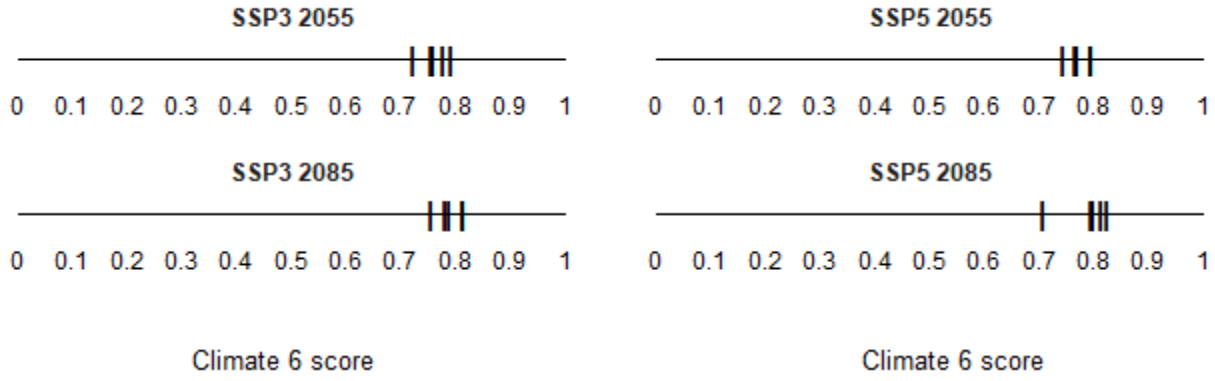

Figure A2. Comparison of projected future Climate 6 scores for *Lepomis miniatus* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 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.

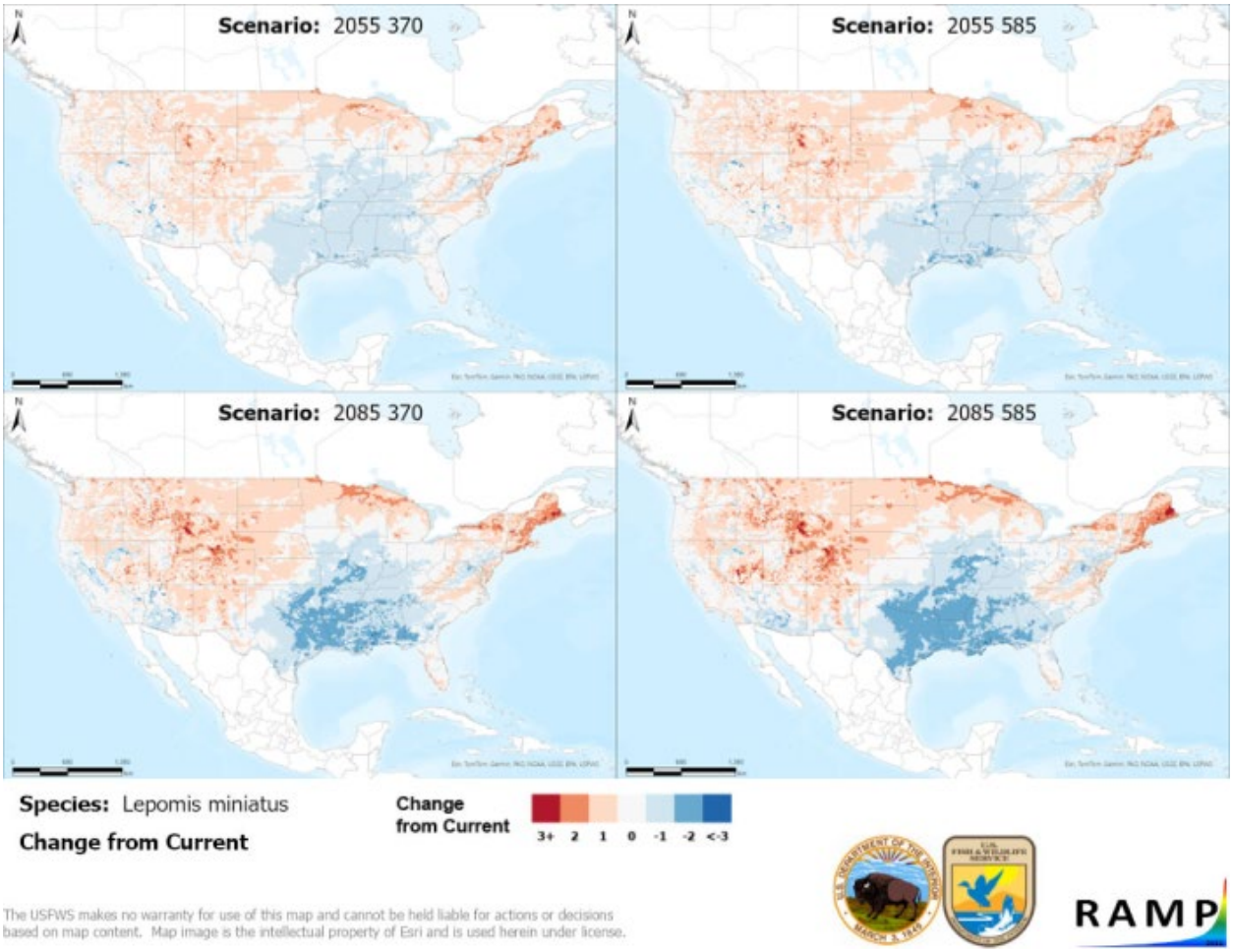

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Lepomis miniatus* based on source locations reported by GBIF 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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