Green Floater (*Lasmigona subviridis*)
Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, December 2022
Revised, December 2022
Web Version, 2/27/2025

Organism Type: Mollusk
Overall Risk Assessment Category: Uncertain

Photo: Michelle Brown. Public domain. Available: https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=146 (December 2022).

1 Native Range and Status in the United States

Native Range

From Kipp et al. (2022a):

"*Lasmigona subviridis* was historically found throughout the Atlantic slope drainages in the Hudson, Susquehanna, Potomac, upper Savannah, Kanawha-New, and Cape Fear rivers. However, its range has retracted and it now occurs as disjunct populations in headwaters of coastal and inland rivers and streams of these drainages (Burch 1975, Mills et al. 1993, King et al. 1999, Clayton et al. 2001)."

Status in the United States

From Kipp et al. (2022a):

"*Lasmigona subviridis* was historically found throughout the Atlantic slope drainages in the Hudson, Susquehanna, Potomac, upper Savannah, Kanawha-New, and Cape Fear rivers. However, its range has retracted and it now occurs as disjunct populations in headwaters of coastal and inland rivers and streams of these drainages (Burch 1975, Mills et al. 1993, King et al. 1999, Clayton et al. 2001)."

From Kipp et al. (2022b):

"*Lasmigona subviridis* was recorded for the first time in the Lake Ontario drainage around 1959 in the Erie Barge Canal at Syracuse and in Chitenango Creek at Kirkville, New York. Around 1980 it was also found in the Finger Lakes area in New York State, part of the Lake Ontario drainage (Clark and Berg 1959, Johnson 1980, Mills et al. 1993)"

From NatureServe (2022):

"Many historic occurrences are documented as extirpated, and few new occurrences being discovered. Very few sites are left in New York (Strayer and Jirka, 1997). As searches become more intense recently more populations are being found. Most occurrences are ranked as having poor to no viability with few individuals. In New York, it is extirpated in the Hudson River, Mohawk River, and is rare in the Oswego, Genesee, and Susquehanna basins (Strayer and Jirka, 1997). In New Jersey, it is historical in the middle Delaware and Raritan and still extant in Stony Brook (Cordeiro, 2003). Historical occurrences throughout much of Pennsylvania (Ortmann, 1919) have now been reduced to the upper and lower Susquehanna, Pine, Lower Juniata, and Sinnemahoning (PA NHP, pers. comm., 2007; Bogan, 1993). In Maryland, it is known from the Upper Potomac, Middle Potomac, and Washington Metro drainages (Bogan and Proch, 1995). It is known from the Upper Potomac in West Virginia (Taylor, 1985) as well as the Kanawha, New, Cascapon and Greenbrier (R. Taylor, [Marshall University, West Virginia], pers. comm., 2007; Clayton et al., 2001). Surveys of the upper Greenbrier River drainage in West Virginia uncovered three localities (anonymous, 1996). In Virginia, it is largely confined to the western (along the West Virginia border) and central portions of the state and in the Holston and Clinch Rivers but in a survey of 134 sites in the New River drainage, Pinder et al. (2002) found it at 3 sites (Kimberling Creek, Bland Co.; Little River, Grayson Co.; New River, Grayson Co.; Middle and Upper New River drainages). In North Carolina, it is known from the Watauga and New River basins in the west and the Roanoke (Dan River), Tar, Neuse, and Cape Fear River basins in the east (Bogan, 2002) in Alleghany, Ashe, Durham, Edgecombe, Granville, Halifax, Johnston, Nash, Northampton, Orange, Person, Rockingham, Stokes, Wake, and Watauga Cos. (LeGrand et al., 2006). In Tennessee, it is known from the Watauga River, Johnson Co. (Parmalee and Bogan, 1998). Historical records (1967) are known from the Flint River, east of Gay, Pike, and Meriwether Cos., Georgia, but identification has not been confirmed (Athearn, 1992). In the Apalachicola Basin (ACF basin = Apalachicola, Chattahoochee, and Flint Rivers) of Alabama, Florida, and Georgia, a form variant (potential undescribed species) is historically known from only 2 records from the Chattahoochee River in Columbus, Georgia from the 1800s and a recent record from 1967 in the Flint River, Pike and Meriwether Cos. (see Athearn, 1992), but no specimens were found in a recent survey of 324 sites in the basin (Brim Box and Williams, 2000; Williams et al., 2008)."

No records of *Lasmigona subviridis* in trade in the United States were found.

Regulations

Lasmigona subviridis is regulated in South Carolina (South Carolina Code of Laws 2022) and Virginia (Virginia Administrative Code 2022). Please refer back to state agency regulatory documents for details on the regulations, including restrictions on activities involving this species. While effort was made to find all applicable regulations, this list may not be comprehensive. Notably, it does not include regulations that do not explicitly name this species or its genus or family, for example, when omitted from a list of authorized species with blanket regulation for all unnamed species.

Means of Introductions within the United States

From Kipp et al. (2022a):

"*Lasmigona subviridis* very likely dispersed into the Lake Ontario drainage from its native range or migrated via the Erie Canal but it could have been intentionally introduced."

Remarks

Some sources report *Lasmigona subviridis* as introduced to the Lake Ontario drainage in central New York. However, this species is listed as Threatened by New York State and reported occurrences in New York do not appear to be treated as introduced by the State (NYSDEC 2022).

From NYSDEC (2022):

"Status […] New York […] Threatened – Species of Greatest Conservation Need"

"Trends for New York populations [native freshwater mussels in New York] are difficult to determine as most historic data comes from opportunistic naturalist collections, as opposed to more comprehensive baseline surveys. For example, mussels were documented for the first time in 50 of the 106 streams surveyed to date by the Southern Lake Ontario mussel inventory project (Mahar & Landry 2015). This is because many of these streams had never before been surveyed for mussels, not because mussel distribution has dramatically increased."

"Since 1970, this species [*Lasmigona subviridis*] has been found live in thirteen New York waterbodies. Most records are from the Susquehanna River drainage, but records from the Mohawk, Hudson, Genesee, and Oswego River basins, and the Erie Canal also exist. The species has declined throughout most of its range, and relatively few populations remain in New York (Strayer & Jirka 1997).

From Kipp et al. (2022a):

"Populations in the Susquehanna and Potomac Rivers are genetically distinct from populations found further south due to reproductive isolation, […]"

From Pennsylvania Natural Heritage Program (2022):

"The green floater was listed as threatened in an assessment of the conservation status of the freshwater mussels of the United States by the American Fisheries Society (Williams et al. 1993)."

From NatureServe (2022):

"**U.S. Endangered Species Act**: Under Review (9/27/2011)"

"This taxon [*Lasmigona subviridis*] is recognized as a distinct species over most of its range. The only area of contention is in the drainages south of the Cape Fear basin of North Carolina. A second recognized species, *Lasmigona decorata*, appears here and most, if not all, older records of *Lasmigona subviridis* from south of the Cape Fear Basin are now assigned to *L. decorata*. See Clarke (1985) for a full discussion of taxonomy of this genus. West Virginia populations off the Atlantic Slope may represent another species. King, Eackles, and Hoeh (1999) found a zone of discontinuity in the genetic population structure between a group of *L. subviridis* inhabiting the Susquehana [sic] and Potomac rivers and more southerly distributed populations. Also, Brim Box and Williams (2000) reported *L. subviridis* from [the] Apalachicola Basin in Georgia and Alabama, based on three records, but these Apalachicoal [sic] speicmens [sic] are slightly different conchologically (lateral teeth) from those of the southern Atlantic Coast. These specimens could rpresent [sic] an undescribed species, but it appears the population is extinct so the question may never be resolved (Williams et al., 2008)."

"The southern edge of range has been indistinct as Johnson (1970) previously reported specimens from South Carolina and North Carolina as *Lasmigona subviridis* which are now recognized as *Lasmigona decorata* (Clarke, 1985)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2022):

Kingdom Animalia
  Subkingdom Bilateria
    Infrakingdom Protostomia
      Superphylum Lophozoa
        Phylum Mollusca
            Class Bivalvia
              Subclass Palaeoheterodonta

Order Unionoida
Superfamily Unionoidea
Family Unionidae
Subfamily Unioninae
Tribe Alasmidontini
Genus *Lasmigona*
Species *Lasmigona subviridis* (Conrad, 1835)

According to Bieler (2015), *Lasmigona subviridis* is the current valid name for this species.

Size, Weight, and Age Range

From Kipp et al. (2022a):

"The height to width ratio is greater than 0.48 and the beaks are low compared to the line of the hinge. […] *Lasmigona subviridis* can grow to 60–65 mm in length (Peckarsky et al. 1993, Bogan 2002)."

From NYSDEC (2022):

"*L. subviridis* is a short lived species, usually living 3 to 4 years, and rarely attaining 7 years of age (Watters et al. 2009)."

Environment

From NYSDEC (2022):

"*L. subviridis* is most commonly found in gravel or sandy substrate in water depths of one to four feet (NatureServe 2013, Ortmann 1919, Spoo 2008, Watters et al. 2009)."

From NatureServe (2022):

"**Habitat Type:** Freshwater
Riverine Habitats: CREEK, Pool, Low gradient, Moderate gradient, MEDIUM RIVER"

Climate

No information was found on climate requirements for *Lasmigona subviridis*.

Distribution Outside the United States

Native Range

The native range for *Lasmigona subviridis* is wholly within the United States, see section 1.

Introduced

No records were found for introduction of *Lasmigona subviridis* in the wild outside the United States.

Means of Introduction Outside the United States

No records were found of introduction of *Lasmigona subviridis* in the wild outside the United States.

Short Description

From Kipp et al. (2022a):

"This freshwater bivalve exhibits a somewhat compressed to slightly inflated thin shell that is subrhomboid to subovate in shape. The periostracum [outer shell] is yellow, tan, dark green, or brown with dark green rays, and the nacre [inner shell] is white or light blue and sometimes pink near the beaks."

"There are two true lamellate pseudocardinal teeth and one relatively small interdental tooth in the left valve, as well as one long and thin lateral tooth in the right valve (Burch 1975, Peckarsky et al. 1993, Bogan 2002)."

Biology

From Kipp et al. (2022a):

"*Lasmigona subviridis* usually occurs in streams, small rivers, and canals of low to medium gradient with slow pools and eddies, fine gravel and sand bottom, and mid-range calcium concentrations. It cannot tolerate either flooding or droughts. In general, freshwater mussels (unionids) are filter feeders and remove particulate organic matter from the water column (Bogan 2002, Harman 1970, Howard and Cuffey 2006, Strayer 1993)."

"Unionids typically require fish hosts for glochidial (larval) dispersal and transformation to the juvenile stage. The host species for *L. subviridis* is unknown, although evidence indicates that it may: a) rely on different fish species depending on different localities; or b) may not require a host fish, which is rare in North American unionids. *Lasmigona subviridis* is usually a simultaneous hermaphrodite and is bradytictic, or a long term [sic] brooder (Bogan 2002, King et al. 1999, Van der Schalie 1966)."

"Spawns in August and releases glochidia the following June."

From NYSDEC (2022):

"Most species are long-term brooders. This life history strategy is considered an adaptation to allow species to persist in unproductive habitats or habitats that are subject to large-scale, cylindrical environmental variation or stress (Haag 2012)."

"It [*Lasmigona subviridis*] is one of few hermaphroditic unionids (Strayer & Jirka 1997, Watters et al. 2009). Hermaphroditism affords benefits when population densities are low; under such conditions, females may switch to self-fertilization to ensure that recruitment continues. In addition, this is one of only two North American species confirmed to metamorphose without a host."

From NatureServe (2022):

"There is recent evidence that juveniles of this species can metamorphose without a host within the marsupia of the adult female (Barfield and Watters, 1998; Lellis and King, 1998). In a survey of the New River Drainage in Virginia, Pinder et al. (2002) found this species to be gravid in August 1998."

"Adult mussels are filter feeders. General literature has assumed that plankton constitute majority of food. Recent studies indicate that detritus is the primary energy source (James, 1987)."

Human Uses

From Grabarkiewicz and Davis (2008):

"The *Lasmigona* are rarely used in laboratory toxicity testing. However, Black (2001) did utilize the Green Floater (*L. subviridis*) as a surrogate to derive water quality standards for the protection of North Carolina's endangered mussels."

Diseases

No information was found associating *Lasmigona subviridis* with any diseases listed by the World Organisation for Animal Health (December 2022).

No information was found on diseases associated with *Lasmigona subviridis*.

Threat to Humans

No information was found on threats to humans from *Lasmigona subviridis*.

3 Impacts of Introductions

From Kipp et al. (2022a):

"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."

Lasmigona subviridis is regulated in South Carolina (South Carolina Code of Laws 2022) and Virginia (Virginia Administrative Code 2022). See section 1.

4 History of Invasiveness

The History of Invasiveness for *Lasmigona subviridis* is classified as Data Deficient. There are records of *L. subviridis* in central New York where this species is reportedly introduced and established beyond its native range. However, there is currently no information regarding the impact of established populations. Additionally, occurrences in New York are not treated as introduced populations by all sources. No information on trade was found for *L. subviridis*.

5 Global Distribution

Figure 1. Reported global distribution of *Lasmigona subviridis*. Map from GBIF Secretariat (2022). Observations are reported from New Hampshire, Vermont, New York, Pennsylvania, New Jersey, Maryland, West Virginia, Virginia, North Carolina, Georgia, and Florida. Observations in the Atlantic Ocean, New Hampshire, Vermont, Georgia, Florida, and those south of the Cape Fear River basin in North Carolina do not represent established populations of *L. subviridis* and have been omitted from the climate match analysis. These occurrences have coordinate errors or may represent misidentified specimens of *L. decorata* or other related species (see Remarks).

6 Distribution Within the United States

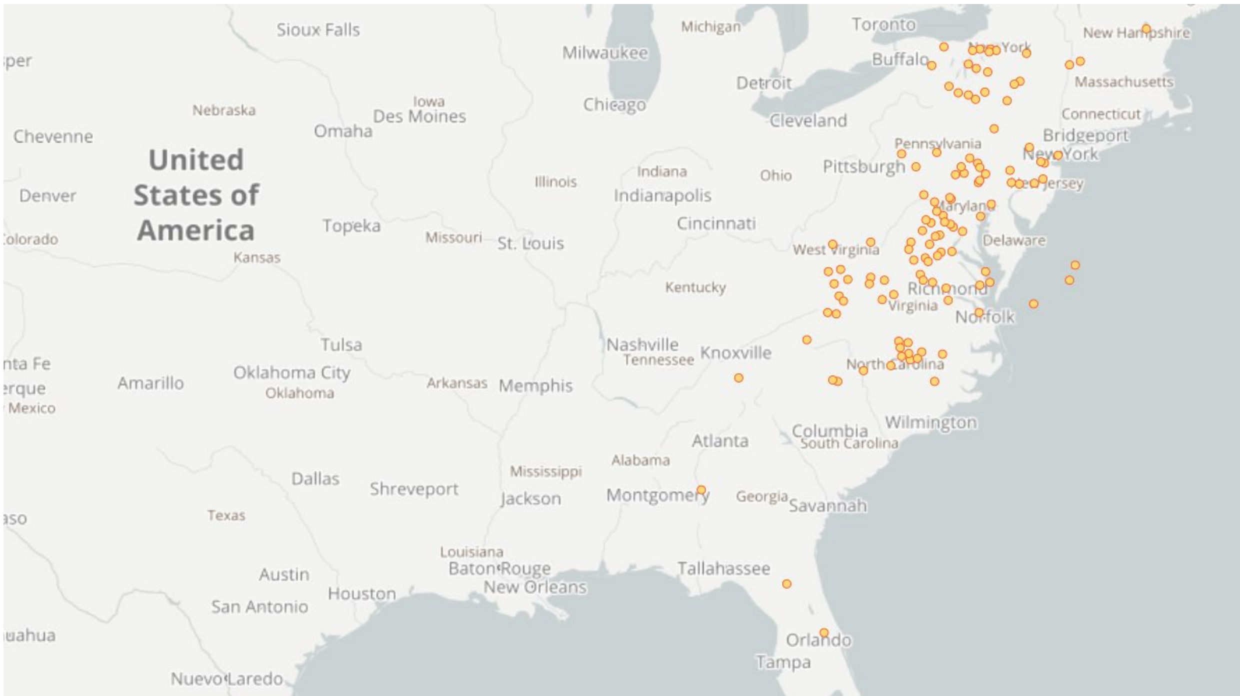

Figure 2. Reported distribution of *Lasmigona subviridis* in the United States. Map from GBIF-US (2022). Observations are reported from New Hampshire, Vermont, New York, Pennsylvania, New Jersey, Maryland, West Virginia, Virginia, North Carolina, Georgia, and Florida. Observations in the Atlantic Ocean, New Hampshire, Vermont, Georgia, Florida, and those south of the Cape Fear River basin in North Carolina do not represent established populations of *L. subviridis* and have been omitted from the climate match analysis. These occurrences have coordinate errors or may represent misidentified specimens of *L. decorata* or other related species (see Remarks).

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Lasmigona subviridis* was generally high for the eastern contiguous United States, with the highest matches found within this species' native range in the Northeast, Mid-Atlantic, Southeast, Appalachia, and extending westward into the Midwest. Medium matches were generally found throughout the Great Plains, in patches in the Intermountain West, interior Southeast, and peninsular Florida. Low matches were found along Pacific Coast and in portions of most western States. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.481, 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 *Lasmigona subviridis* (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.

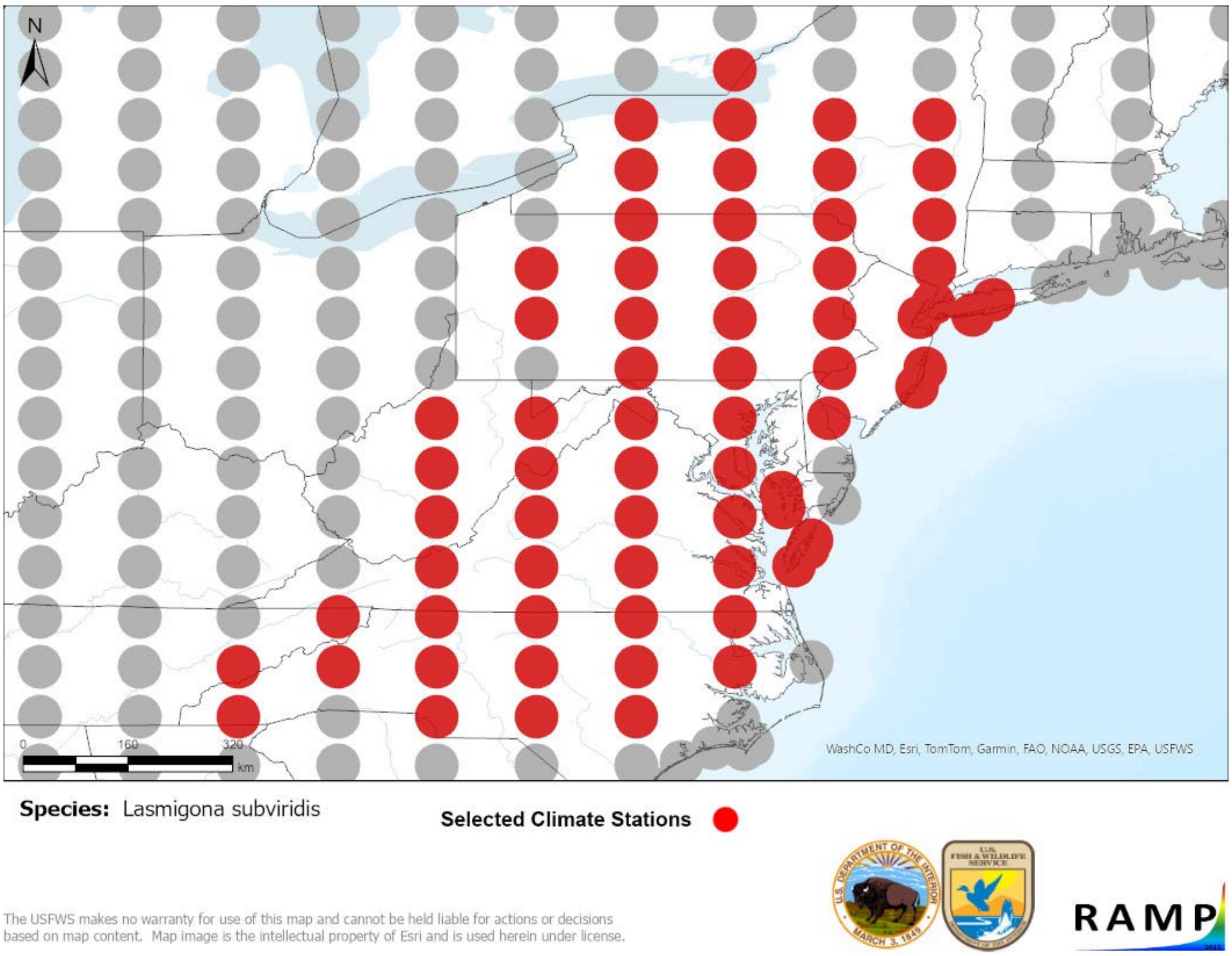

Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations in the eastern United States and Canada selected as source locations (red; Canada (southeastern Ontario), North Carolina, Tennessee, Virginia, West Virginia, Pennsylvania, New Jersey, New York, and Maryland) and non-source locations (gray) for *Lasmigona subviridis* 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.

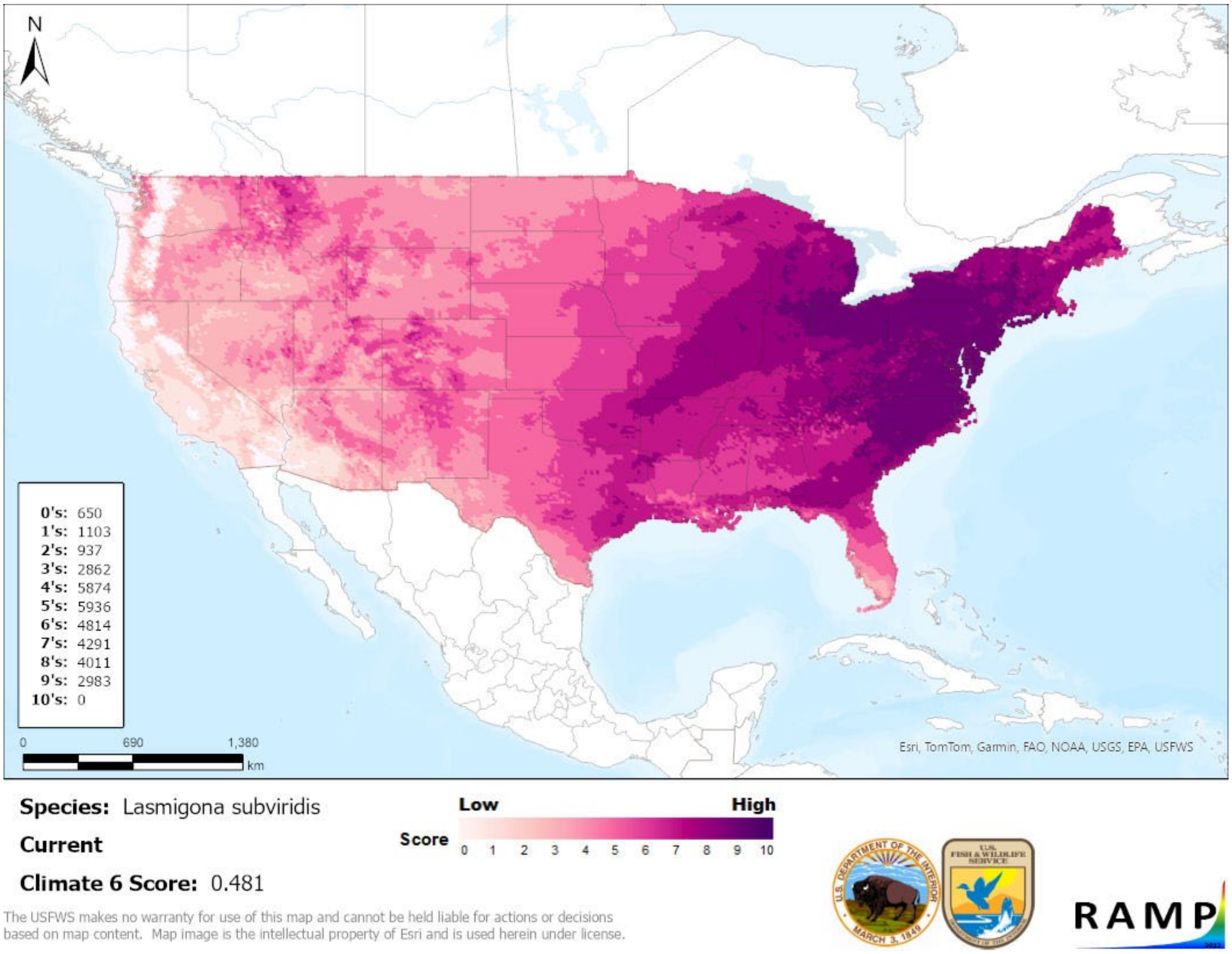

Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Lasmigona subviridis* in the contiguous United States based on source locations reported by GBIF Secretariat (2022). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Lasmigona subviridis* is classified as Low. While there is adequate information on the biology of this species, there is conflicting information regarding the distribution of *L. subviridis* both within its native range and introduced status of some populations. Several sources note that historical occurrences may have been misidentified.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Lasmigona subviridis, Green Floater, is freshwater mussel native to Atlantic Slope drainages including the Hudson, Susquehanna, Potomac, upper Savannah, Kanawha-New, and Cape Fear rivers. Several States within this species' native range have listed populations of *L. subviridis* as threatened. This species lives 3 to 4 years and can grow to 65 mm in length. *L. subviridis* is found in small rivers, streams, and canals with fine gravel and sand substrate. They are intolerant to strong currents, flooding, erosion, and pollution. *L. subviridis* is one of few North American unionid mussels that do not require a host fish for larval dispersal, self-fertilizing when population densities are low. Although this species has been reported as introduced and established outside of its native range, there is no information on the impact of these populations. The History of Invasiveness is thus classified as Data Deficient. Possession of *L. subviridis* is currently regulated in South Carolina and Virginia where this species is listed as threatened. The climate matching analysis for the contiguous United States indicates establishment concern outside its native range. The highest matches were found within this species' native range in the Northeast, Mid-Atlantic, Southeast, Appalachia, and expanding westward into the Midwest. The Certainty of Assessment for this ERSS is classified as Low due to the lack of information regarding introduced populations and uncertainty with this species' distribution. The Overall Risk Assessment Category for *L. subviridis* 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: Historically, populations of *L. decorata* in the southern United States may have been misidentified as this species.**
- **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 *Lasmigona subviridis* was projected to occur in the Appalachian Range, Great Lakes, Mid-Atlantic, and Northeast regions of the contiguous United States. These areas include the native range of the species. Areas of low climate match were projected to occur in California, the Northern Pacific Coast, and Southwest regions. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.225 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.449 (model: MPI-ESM1-2-HR, SSP5, 2055). 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 (0.481, figure 4) falls above 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. Under one or more time step and climate scenarios, areas within the Colorado Plateau and Western Mountains saw a moderate increase in the climate match relative to current conditions. No large increases were observed regardless of time step and climate scenarios. Under one or more time step and climate scenarios, areas within the Appalachian Range, Gulf Coast, Mid-Atlantic, Northeast, Southeast, and Southern Atlantic Coast saw a large decrease in the climate match relative to current conditions. Additionally, areas within California, the Colorado Plateau, Great Lakes, Northern Plains, Southern Plains, and Southwest saw a moderate decrease in the climate match relative to current conditions. Additional, very small areas of large or moderate change may be visible on the maps (figure A3). The degree of change increased with time.

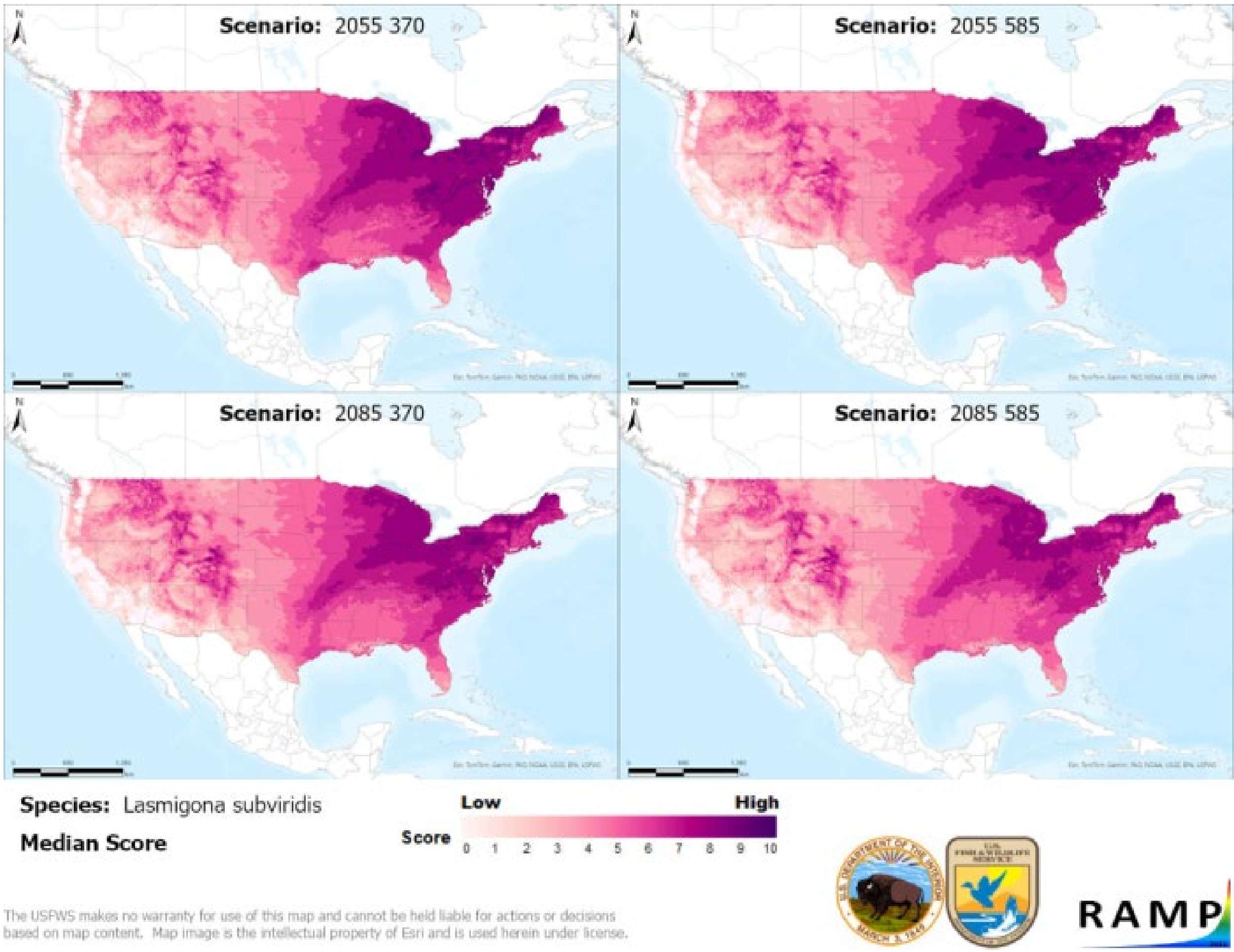

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Lasmigona subviridis* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2022). Shared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

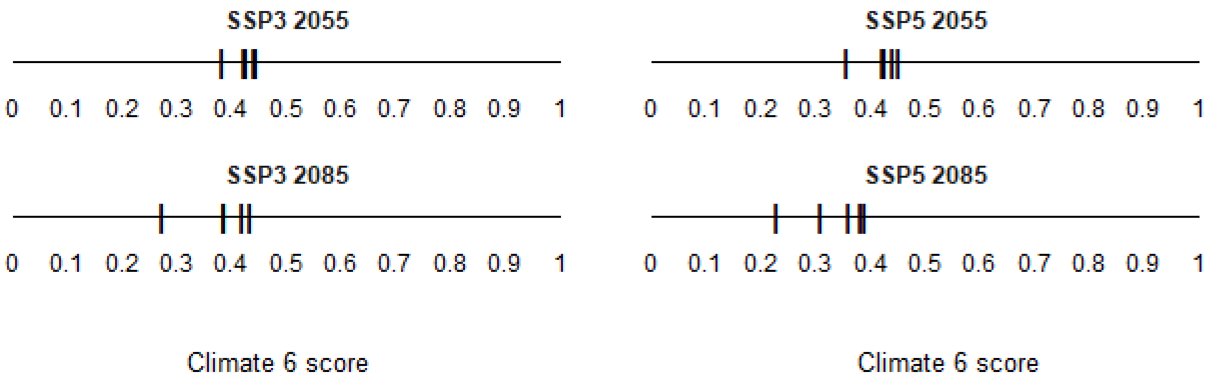

Figure A2. Comparison of projected future Climate 6 scores for *Lasmigona subviridis* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018;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

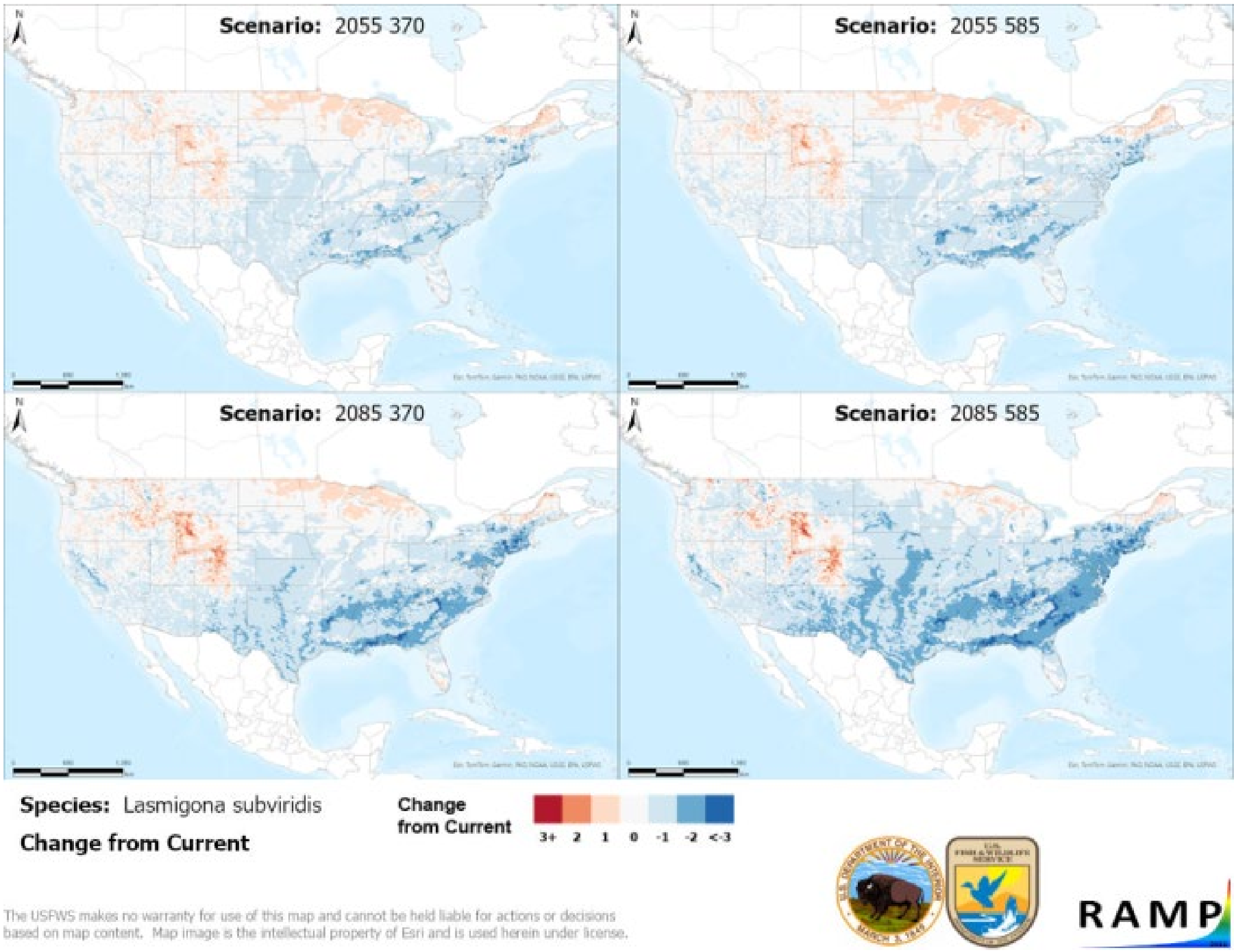

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Lasmigona subviridis* based on source locations reported by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