Roundleaf Toothcup (*Rotala rotundifolia*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, March 2024
Revised, April 2024
Web Version, 6/20/2025

Organism Type: Flowering Plant
Overall Risk Assessment Category: High

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1 Native Range and Status in the United States

Native Range

From Thayer et al. (2024):

"Native Range: *Rotala rotundifolia* originates from southeast Asia, southern India, and Japan (Cook 1976)."

According to POWO (2024), *Rotala rotundifolia* is native to: Bangladesh, China (including Hainan, South-Central, Southeast), East Himalaya (encompassing parts of Bhutan, China, and India), India (Assam), Japan (including Nansei-shoto), Laos, Myanmar, Nepal, Taiwan, Thailand, Vietnam, and West Himalaya (encompassing parts of India and Pakistan).

Status in the United States

From Thayer et al. (2024):

"Currently established in south Florida (Wunderlin and Hansen 2008), but likely eradicated in Alabama (Ervin and White 2007). Status is unknown in Mississippi, though the population is possibly contained from spreading further downstream of the Flint Creek Reservoir due to high salinity (Carl Della Torre, UF/IFAS, pers. comm.)."

From Ervin and White (2007):

"[…] *Rotala* [*rotundifolia*] has been recorded in two areas of the United States: canals in southern Florida (USGS FISC, 2006) and a single pond on the University of Alabama campus in Tuscaloosa, Alabama (Reese and Haynes, 2002). […] the Alabama pond in which it was detected in 2001 was drained during 2005, with no precautions taken to prevent the spread of this species into the immediately adjacent Black Warrior River. It subsequently was observed along the stream connecting the pond with the Black Warrior, and all individuals observed were removed (R. G. Westbrooks and V. Maddox, personal communications)."

"During August following drainage of the pond, *Rotala* was observed persisting in patches of gravel throughout the former pond shoreline, including a southward facing slope of the former shoreline, more than 15m from any remaining water."

From Ervin and Madsen (2009):

"The one population known from the Mid-South (Alabama) is thought to have been extirpated."

From Thayer et al. (2024):

"*Rotala rotundifolia* is widely available through the international aquarium plant trade. Aquarium and pond plant publications note the ease of propagation with this species, recommending planting of cut or trimmed tops into suitable substrate or simply through the natural creeping growth habit of the plant."

"It has been well received in the water garden trade for its brilliant, rose colored flowers and lush, creeping perennial growth."

Regulations

Rotala rotundifolia is regulated in Louisiana (LDWF 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 Gettys et al. (2015):

"[…] aquarium dumps were likely responsible for *Rotala*'s introduction to North American waters because many infestations originate near residential areas (Milius 2003)."

Remarks

From USDA (2016):

"*Rotala rotundifolia* is a prohibited species in Western Australia, Tasmania (Gettys and Tipping, 2014) and Honduras (APHIS, 2015)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2024):

Kingdom Plantae
Subkingdom Viridiplantae
Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina
Class Magnoliopsida
Superorder Rosanae
Order Myrtales
Family Lythraceae
Genus *Rotala*
Species *Rotala rotundifolia* (Buch.-Ham. ex Roxb.) Koehne

According to WFO (2024), *Rotala rotundifolia* (Buch.-Ham. ex Roxb.) Koehne is the current valid name for this species.

Size, Weight, and Age Range

From Thayer et al. (2024):

"Size: 15-200 cm height depending on light penetration (Gettys and Della Torre 2014)."

Environment

From Ervin and White (2007):

"In its native range, this *Rotala* species is reported to occur primarily in mountainous areas and at altitudes of more than 2600m."

From Thayer et al (2024):

"Emergent *R. rotundifolia* establishes along shorelines and into associated wetlands […]."

From India Biodiversity Portal (no date):

"Habitat and Ecology: It grows in the [rice] paddy fields, marshes, and stream sides."

Climate

From Gu et al. (2019):

"This species has both submerged and emergent forms […]. [The emergent form] is not considered cold-tolerant […]. However, the submerged *Rotala rotundifolia* found in the remote valley in Wenzhou city, Zhejiang Province, China, is able to survive across the winter under the temperature as low as 4 °C."

From EDDMapS (2024):

"HABITAT: Does best in warm, humid climates in wet soils and full sun, but can survive in colder climates and tolerates limited shade."

From POWO (2024):

"[…] grows primarily in the seasonally dry tropical biome."

Distribution Outside the United States

Native

From Thayer et al. (2024):

"Native Range: *Rotala rotundifolia* originates from southeast Asia, southern India, and Japan (Cook 1976)."

According to POWO (2024), *Rotala rotundifolia* is native to: Bangladesh, China (including Hainan, South-Central, Southeast), East Himalaya (encompassing parts of Bhutan, China, and India), India (Assam), Japan (including Nansei-shoto), Laos, Myanmar, Nepal, Taiwan, Thailand, Vietnam, and West Himalaya (encompassing parts of India and Pakistan).

Introduced
From POWO (2024):

"Introduced into: […] Brazil Southeast, […], Queensland [Australia]."

From USDA (2016):

"*Rotala rotundifolia* has become naturalized in Australia in Queensland and New South Wales (Csurhes and Edwards, 1998; Hosking et al., 1997) and in thermal water bodies in Hungary (Lukács et al., 2014; Mesterházy et al., 2009)."

Means of Introduction Outside the United States

No information was found regarding means of introduction for introductions outside the United States.

Short Description

From EDDMapS (2024):

"GROWTH TRAITS: Fast-growing herbaceous perennial that can grow fully submersed, as an emerged aquatic, and as a terrestrial on shores of drained water bodies. All forms are rooted to the substrate with numerous branched stems growing 1-2.3' (0.3-0.7 m) long and forming creeping clumps by regularly rooting at stem nodes. Stems are soft and green, turning reddish with high light exposure, and have opposite leaves. Submersed leaves are green to reddish, narrow, lance-shaped, and up to 0.9" (2.2 cm) long. Emergent leaves are green, round, 0.4-0.8" (1-2 cm) long, and attach to the stem without petioles. Flowers are produced in clumped spikes at the ends of emergent stems in spring and early summer. Each flower has 4 small, bright pink petals. Fruits are small capsules that split at maturity to release 15-20 seeds each. Plants grow year-round."

From Thayer et al. (2024):

"*Rotala rotundifolia* (Buch.-Ham. ex Roxb.) Koehne is a tropical to sub-tropical perennial plant with considerable phenotypic plasticity."

"Leaves are decussate (arranged in opposite pairs at right angles to those above or below)."

"Emergent *R. rotundifolia* establishes along shorelines and into associated wetlands rarely growing more than 15 cm in height, while submersed plants grow in tight, dense colonies more than 2 meters high reaching the water surface where the plant grows to thick surface mats (Gettys and Della Torre 2014)."

Biology

From EDDMapS (2024):

"REPRODUCTION: Spreads by seed and fragmentation. Seed longevity is unknown, but seeds of other Lythraceae are viable for three to many years."

From Thayer et al. (2024):

"The plant spreads vegetatively from stem fragments, which form adventitious roots at nodes and also spreads from dispersed seeds (Ervin and White 2007). *Rotala rotundifolia* can produce extremely dense submersed communities and large thick floating mats"

From USDA (2016):

"In Florida, *R. rotundifolia* can grow at a rate of 4 to 5 inches per week, which allows it to quickly spread across water surfaces (UF/IFAS, 2015)."

Human Uses

From Thayer et al. (2024):

"*Rotala rotundifolia* is widely available through the international aquarium plant trade. Aquarium and pond plant publications note the ease of propagation with this species, recommending planting of cut or trimmed tops into suitable substrate or simply through the natural creeping growth habit of the plant."

"It has been well received in the water garden trade for its brilliant, rose colored flowers and lush, creeping perennial growth."

"*Rotala rotundifolia* is used in its native range as a medicinal plant. The species is known for its anti-pyretic, detoxication, anti-swelling, and diuresis properties. Also used in treatment of cirrhosis, gonorrhea, menstrual cramps and piles in China (Karatas et al. 2014)."

Diseases

No information was found on diseases associated with *Rotala rotundifolia*.

Threat to Humans

From Gettys and Della Torre (2014):

"[…] water flow is restricted because of the species' excessive growth. Many of the south Florida canals are critically important components of the flood control system, and resource managers rely on these systems to quickly move stormwater. Because the rapid and vigorous growth of rotala inhibits water flow, the ability of infested canals to function properly in flood events is greatly hindered."

3 Impacts of Introductions

From Gettys and Della Torre (2014):

"Rotala [*R. rotundifolia*] produces extremely dense submersed populations and large thick mats that dominate the surface of the water. This greatly reduces ecosystem services, because oxygen level and light penetration are hampered. In addition, water flow is restricted because of the species' excessive growth. Many of the south Florida canals are critically important components of the flood control system, and resource managers rely on these systems to quickly move stormwater. Because the rapid and vigorous growth of rotala inhibits water flow, the ability of infested canals to function properly in flood events is greatly hindered. As such, management of this aquatic weed is a major concern for resource managers."

4 History of Invasiveness

The History of Invasiveness for *Rotala rotundifolia* is classified as High. Established nonnative populations of *Rotala rotundifolia* have been recorded in southern Florida and Australia. Additional introductions have been reported in Alabama, Brazil, and Hungary. The populations in Florida are reported to have negative impacts on waterways, including modification of ecosystem functions and inhibiting the proper function of flood control canals.

5 Global Distribution

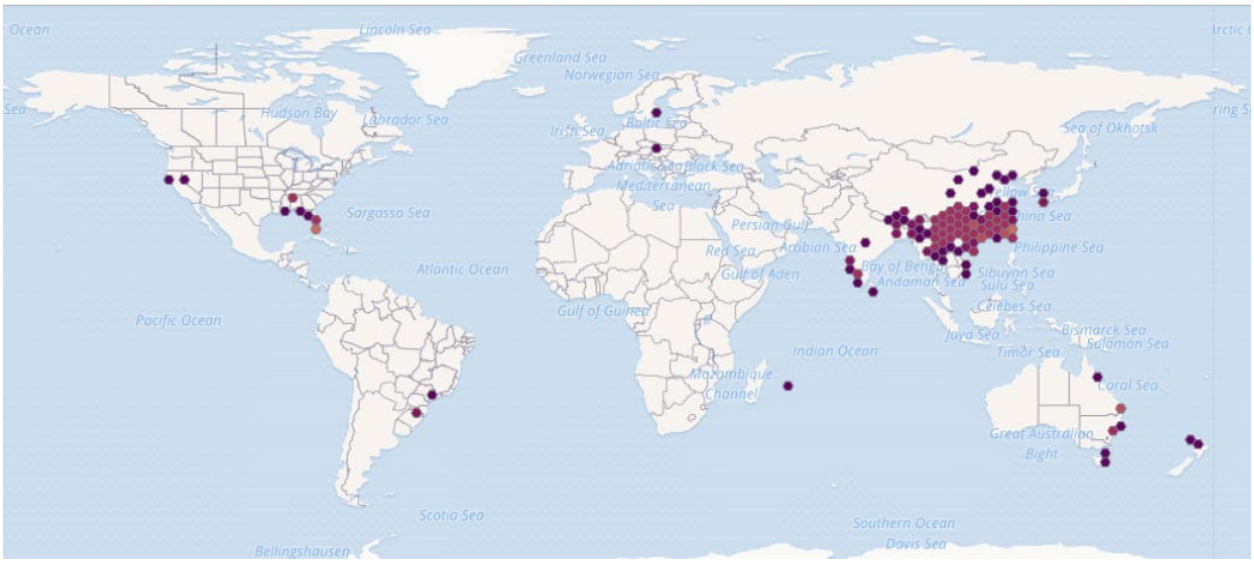

Figure 1. Reported global observations of *Rotala rotundifolia*. Map from GBIF Secretariat (2023). Observations are reported from China, India, the United States, Australia, Thailand, Brazil, Hong Kong, Nepal, Vietnam, Japan, Myanmar, Laos, Bangladesh, Bhutan, New Zealand, Reunion, Sweden, Hungary, and Sri Lanka.

Observations from Sweden, Reunion, New Zealand, Brazil, Tasmania (Australia) and some parts of the United States (see section 6) may not represent established populations and were not included in the climate matching analysis. The observation in Hungary is from a thermally

polluted water body (USDA 2016) and not reflective of ambient climate conditions; it was not used in the climate matching analysis.

6 Distribution Within the United States

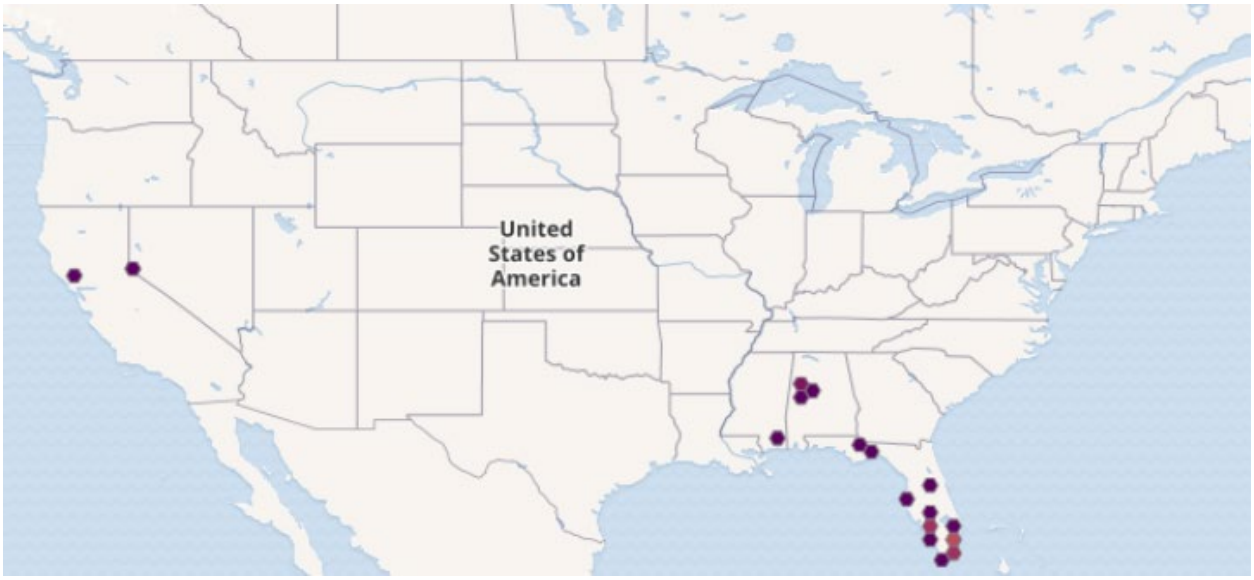

Figure 2. Reported distribution of *Rotala rotundifolia* in the United States. Map from GBIF Secretariat (2023). Observations are reported from California, Nevada, Mississippi, Alabama, and Florida. Observations from California, Nevada, Mississippi, and the panhandle of Florida may not represent established populations and were not included in the climate matching analysis. The observations in Alabama represent an eradicated population and were not used in the climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match analysis for *Rotala rotundifolia* to the contiguous United States found high climate matches throughout the coastal Southeast (the Gulf Coast to Virginia) and the Great Plains regions of the United States, and in limited areas of the southern Appalachian Mountains, Rocky Mountains, and Pacific Northwest. The highest matches were found in peninsular Florida, where the species is already established. Low matches were found in areas of New England, the Pacific Northwest, the southern Appalachian Mountains, Rocky Mountains, Great Basin, and along the Sierra-Nevada Range. The rest of the United States exhibited a medium climate match. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.609, indicating that Yes, there is establishment concern for this species. 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 (RAMP SOP).

Projected climate matches in the contiguous United States under future climate scenarios are available for *Rotala rotundifolia* (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.

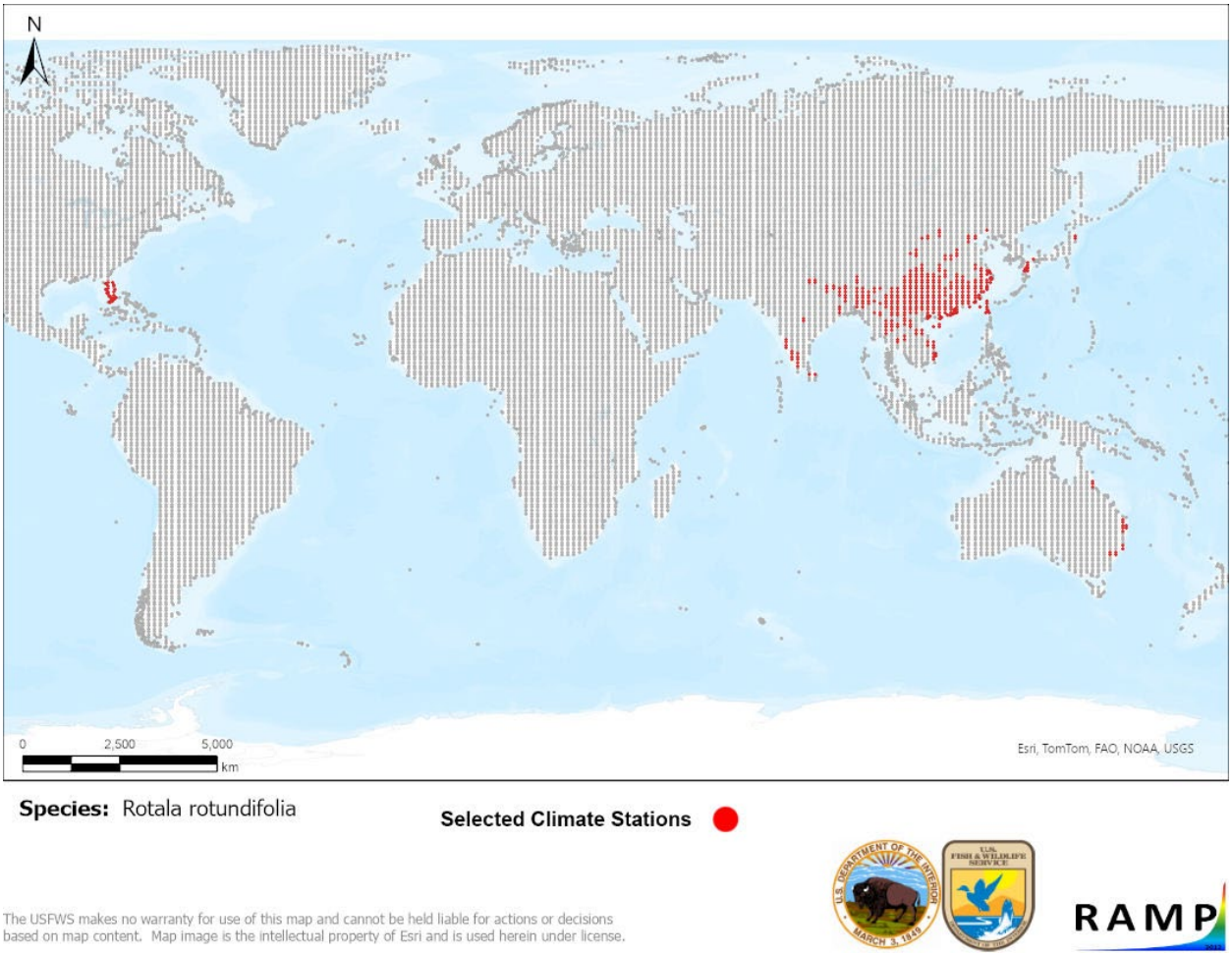

Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations selected as source locations (red; Australia, China, India, the United States, Thailand, Hong Kong, Nepal, Vietnam, Japan, Myanmar, Laos, Bangladesh, Bhutan, and Sri Lanka.) and non-source locations (gray) for *Rotala rotundifolia* climate matching. Source locations from GBIF Secretariat (2023). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

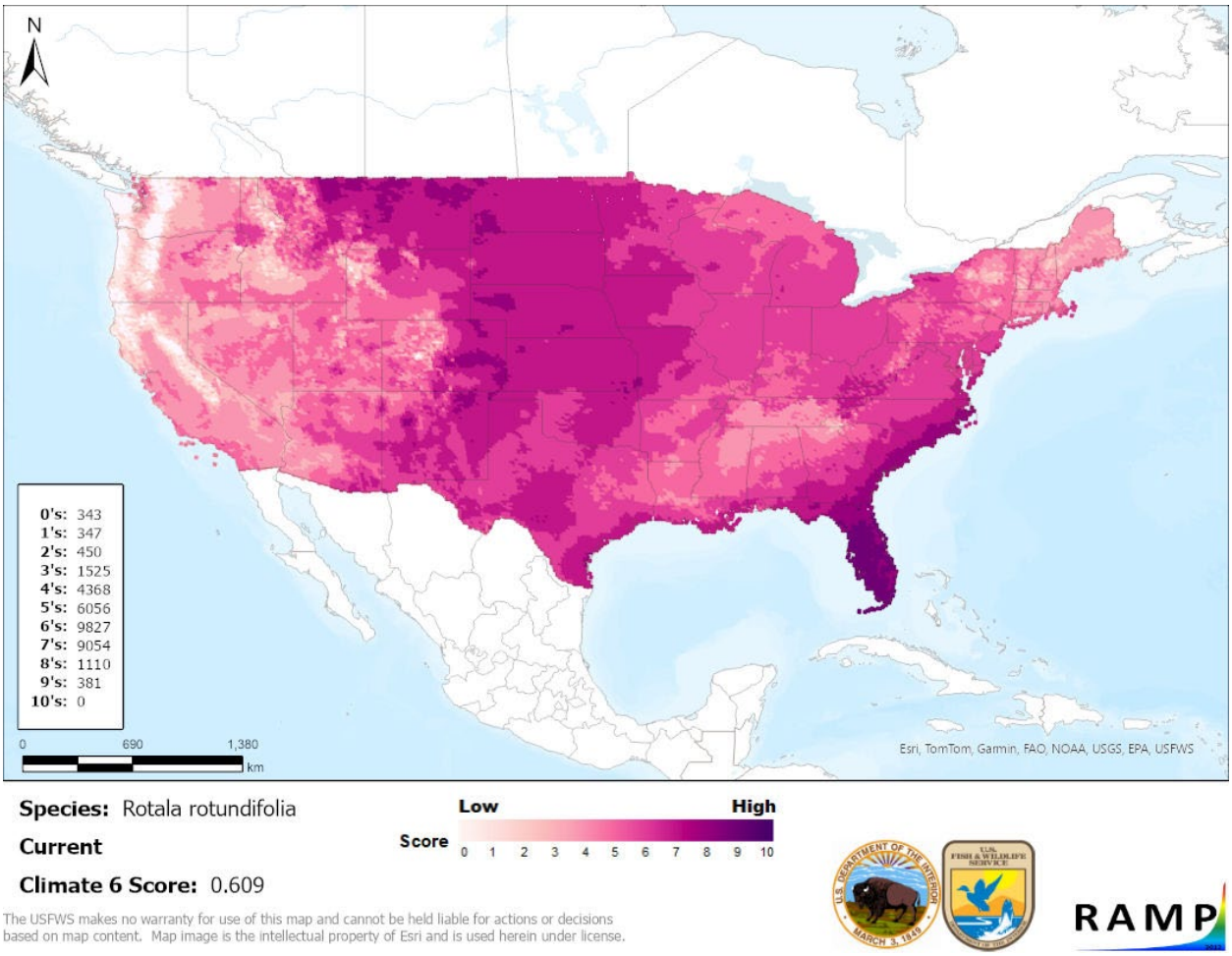

Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Rotala rotundifolia* in the contiguous United States based on source locations reported by *citation*. Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Rotala rotundifolia* is classified as Medium. Information regarding the native range and general biology and ecology of the species was available. Records of introduction and limited establishment were found. In general, information regarding the introductions and establishment status was limited. Impacts of introductions are from a single source and are not from scientifically rigorous studies.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Rotala rotundifolia, Roundleaf Toothcup, is a plant native to southeast Asia, southern India, China, and Japan. This species exhibits great phenotypic plasticity and can grow fully submersed, as an emerged aquatic, and as a terrestrial on shores of drained water bodies. *Rotala rotundifolia* is popular in the aquarium trade and also present in the water garden trade. It has been introduced and established populations in the United States, Australia, and Hungary. It has

also been reported as introduced to Brazil. The History of Invasiveness for *Rotala rotundifolia* is classified as High due to its reported impacts to ecosystem and water control functions in Florida flood control canals. The climate matching analysis for the contiguous United States indicates establishment concern. High matches were concentrated in the southeastern and central regions of the United States. The majority of the United States had a medium climate match. The Certainty of Assessment for this ERSS is classified as Medium primarily due to the impact information only coming from observational reports through a single non-peer-reviewed source. The Overall Risk Assessment Category for *Rotala rotundifolia* in the contiguous United States is 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: None**
- **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

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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 (2023).

Under the future climate scenarios (figure A1), on average, high climate match for *Rotala rotundifolia* was projected to occur in the Southern Atlantic Coast and Southern Florida regions of the contiguous United States. Under some SSP and time step scenarios, isolated portions of the Colorado Plateau, Northern Plains, and Southwest had high matches as well. Areas of low climate match were projected to occur in the Northern Pacific Coast region, extending into California and the Great Basin. The Northeast region and interior Southeast also had some areas of low climate match under most scenarios. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.395 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.667 (model: MRI-ESM2-0, 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 (0.609, 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, the most extreme climate change scenario. Under one or more time step and climate scenarios, areas within the Colorado Plateau and Northern Pacific Coast 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, Great Basin, Gulf Coast, Mid-Atlantic, Northern Plains, Southeast, Southern Atlantic Coast, Southern Florida, Southwest, and Western Mountains saw a moderate decrease in the climate match relative to current conditions. 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 magnitude of change increased with time and from SSP3 to SSP5 for areas of both increasing and decreasing climate match.

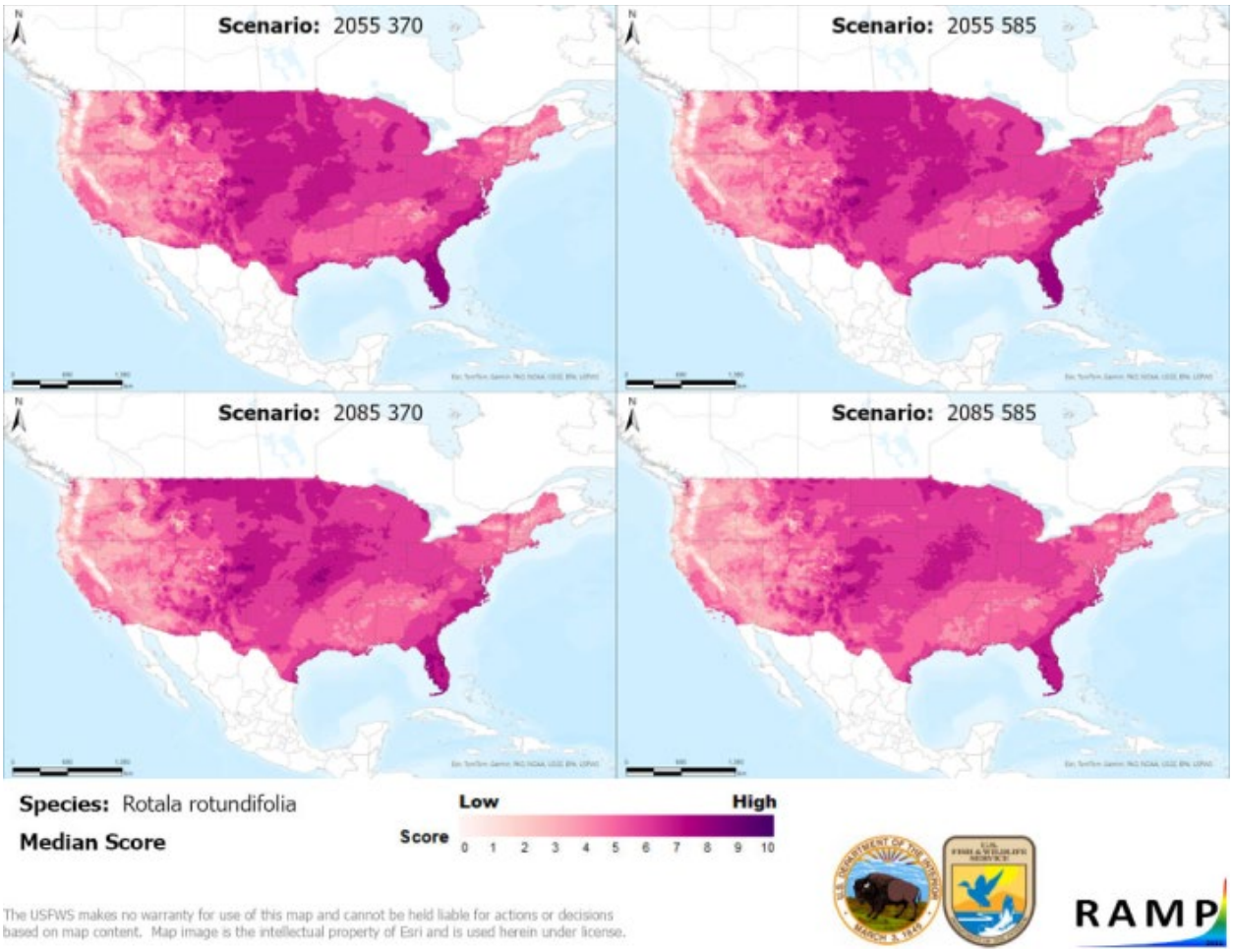

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Rotala rotundifolia* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023). Shared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

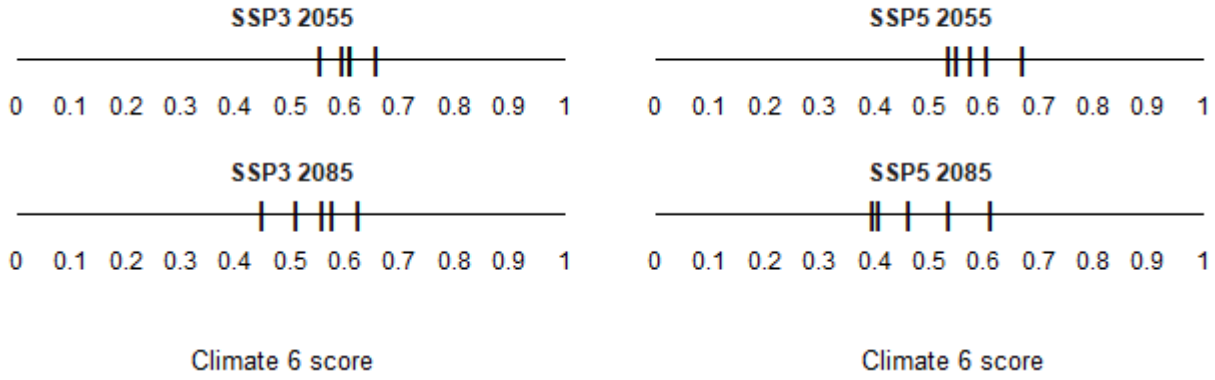

Figure A2. Comparison of projected future Climate 6 scores for *Rotala rotundifolia* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018;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

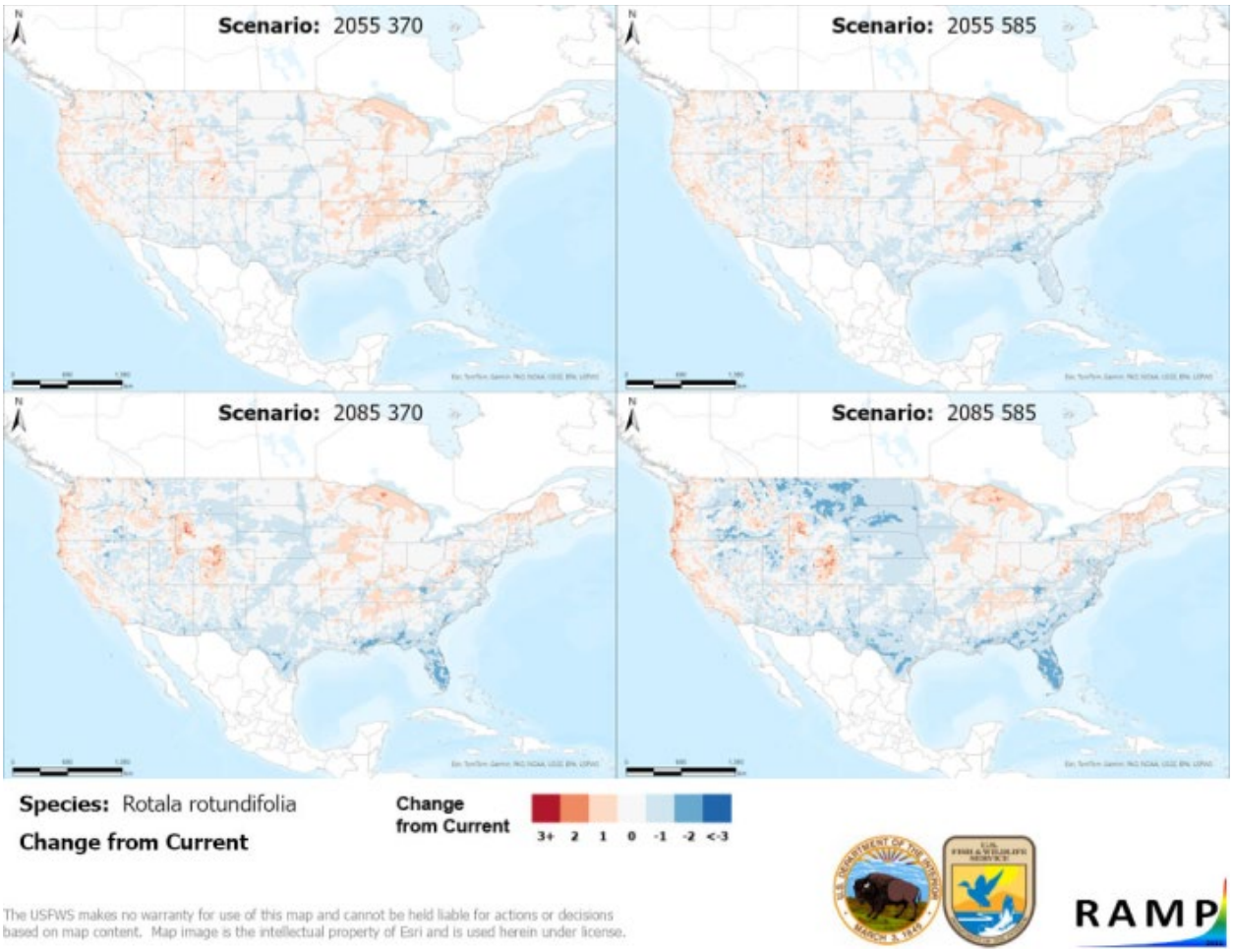

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Rotala rotundifolia* based on source locations reported by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