Claspingleaf Pondweed (*Potamogeton perfoliatus*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, March 2023
Revised, April 2023, April 2024
Web Version, 5/22/2024

Organism Type: Flowering Plant
Overall Risk Assessment Category: Uncertain

Photo: Natural Resources Wales. Licensed under Creative Commons BY-SA 4.0. Available: https://commons.wikimedia.org/wiki/File:Potamogeton_perfoliatus_bed,_Llyn_Cregennan_Isaf_2014.jpg (March 2023).

1 Native Range and Status in the United States

Native Range

From Gupta and Lansdown (2013):

"*P. perfoliatus* has an almost cosmopolitan distribution with a few curiously isolated occurrences, such as Sumatra [Indonesia] and Guatemala. It is found throughout most of Europe,

including the Mediterranean north to northern Scandinavia and Iceland, east through Siberia to Japan and the Korean peninsula, as well as eastern, northern and central North America and Greenland. It also occurs in North and Central Africa, the Middle East and Caucasus, Mongolia, throughout much of China, Mongolia and the Himalayas and Australia."

POWO (2023) reports *Potamogeton perfoliatus* as native to Afghanistan, Albania, Algeria, Armenia, Austria, Australia (New South Wales, Queensland, South Australia, Tasmania, Victoria), Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada (Labrador, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, and Québec), Chad, China (Inner Mongolia, Manchuria, North-Central, South-Central, Southeast, Qinghai, Tibet, Xinjiang), Croatia, Cuba, Cyprus, Czech Republic, Denmark (including Faroe Islands and Greenland), Egypt (including Sinai Peninsula), Estonia, Ethiopia, Finland, France, Georgia, Germany, Great Britain, Greece, Guatemala, Hungary, Iceland, India, Indonesia (Sumatra), Iran, Iraq, Ireland, Israel-Palestine, Italy (mainland and Sicily), Japan, Kazakhstan, Korea, Kyrgyzstan, Latvia, Lebanon, Libya, Lithuania, Macedonia, Madagascar, Mauritania, Mongolia, Montenegro, Netherlands, Niger, Norway, Pakistan, Poland, Portugal, Romania, Russia (Altay, Amur, Buryatiya, European Russia, Chita, Irkutsk, Kamchatka, Khabarovsk, Krasnoyarsk, Krym, Kuril Islands, Magadan, North Caucasus, Primorye, Sakhalin, Tuva, West Siberia, Yakutskiya), Serbia, Slovakia, Slovenia, Spain, Sudan, Sweden, Switzerland, Syria, Tajikistan, Turkey, Ukraine, and Uzbekistan.

Within the United States, USDA, NRCS (2024) reports *Potamogeton perfoliatus* as native to Alabama, Connecticut, Delaware, District of Columbia, Florida, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Texas, Vermont, Virginia, and Wisconsin.

Status in the United States

From Haynes (1985):

"DISTRIBUTION: In the Western Hemisphere, from [Canada] SW to […] North Carolina; […] and the Gulf of Mexico outer coastal plain from western Florida to eastern Louisiana."

USDA, NRCS (2024) reports *Potamogeton perfoliatus* as native to Alabama, Connecticut, Delaware, District of Columbia, Florida, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Texas, Vermont, Virginia, and Wisconsin.

This species is present in the aquarium trade. For example, Aquariumplantfactory (2023) lists *P. perfoliatus* for sale as an aquarium plant at prices from $7.99 to $15.99.

Regulations

No species-specific regulations on possession or trade were found for *Potamogeton perfoliatus* in the United States.

Means of Introductions within the United States

This species is native to the United States and has not been documented as introduced or established outside of its range in the United States.

Remarks

From Gupta and Lansdown (2013):

"*P. perfoliatus* has been shown to hybridize with the following European taxa: *P. alpinus* (*P.* × *prussicus* Hagstr.), *P. crispus* (*P.* ×*cooperi* (Fryer) Fryer), *P. gramineus* (*P.* × *nitens* Weber*), P. lucens* (*P.* ×*salicifolius* Wolfg. in Schult. & Schult.), *P. praelongus* (*P.* ×*cognatus* Asch. & Graebn.), *P. pusillus* (*P.* × *mysticus* Morong) and *P. schweinfurthii* (*P.* × *vaginans* (Bojer ex A. Benn.) Hagstr.)."

From Haynes (1985):

"*Potamogeton richardsonii* has been included with *P. perfoliatus* (Ascherson and Graebner 1907) and accepted at the specific level by Ogden (1943) and Hagström (1916)."

World Flora Online, the taxonomic authority used for this risk screening summary, treats *P. richardsonii* as an accepted species (WFO 2024), distinct from *P. perfoliatus*. Although USDA, NRCS (2024) reports *P. perfoliatus* as native to British Columbia, Canada, other sources report *P. perfoliatus* as native to eastern Canada only (see Native Range, this section). Haynes (1985) includes British Columbia within the range of *P. richardsonii* and not *P. perfoliatus*.

Other common names used for this species include perfoliate pondweed, redhead grass, and clasped pondweed (GBIF 2017; Champion et al. 2020).

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2023):

Kingdom Plantae
Subkingdom Viridiplantae
Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina
Class Magnoliopsida
Superorder Lilianae
Order Alismatales
Family Potamogetonaceae
Genus *Potamogeton*
Species *Potamogeton perfoliatus* L.

According to WFO (2023), *Potamogeton perfoliatus* is the current valid name for this species.

Size, Weight, and Age Range

From Zinecker and West (2010):

"Leaves measure 0.4-2.75 inches long and are from 0.4 to 1 inch wide. They typically start no more than about 2 inches from the base of the plant and extend regularly along the stem in an alternate or slightly opposite pattern. Leaves extend to either the top of the stem or to the flowering end (terminal inflorescence) of the plant. Stem densities in the wild are highly variable. Due to its rhizomatous nature, it is quite rare to find just a single plant."

Environment

From GISD (2017):

"*Potamogeton perfoliatus* grows best on firm, muddy soils and in quiet water with slow-moving current (MDNR, 2003). The pond weed is indicative of a wide range of nutrient conditions and pH tolerance. However some are only found in moderately acid to moderately alkaline conditions. Habitat types: Fresh to brackish water; high pH; muddy, fine sediment; slow moving water; shallow water; […]"

From Caffrey and Kemp (1990):

"*P. perfoliatus* […] occurs in oligohaline to mesohaline regions (salinity 0 to 15 ‰), […]"

Climate

From GISD (2017):

"*Potamogeton perfoliatus* is a submerged aquatic plant that occurs in […] temperate climates."

Distribution Outside the United States

Native

Part of the native range for this species is within the United States, see section 1 for a complete description of the native range.

From Gupta and Lansdown (2013):

"*P. perfoliatus* has an almost cosmopolitan distribution with a few curiously isolated occurrences, such as Sumatra [Indonesia] and Guatemala. It is found throughout most of Europe, including the Mediterranean north to northern Scandinavia and Iceland, east through Siberia to Japan and the Korean peninsula, as well as eastern, northern and central North America and Greenland. It also occurs in North and Central Africa, the Middle East and Caucasus, Mongolia, throughout much of China, Mongolia and the Himalayas and Australia."

POWO (2023) reports *Potamogeton perfoliatus* as native to Afghanistan, Albania, Algeria, Armenia, Austria, Australia (New South Wales, Queensland, South Australia, Tasmania,

Victoria), Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada (Labrador, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, and Québec), Chad, China (Inner Mongolia, Manchuria, North-Central, South-Central, Southeast, Qinghai, Tibet, Xinjiang), Croatia, Cuba, Cyprus, Czech Republic, Denmark (including Faroe Islands and Greenland), Egypt (including Sinai Peninsula), Estonia, Ethiopia, Finland, France, Georgia, Germany, Great Britain, Greece, Guatemala, Hungary, Iceland, India, Indonesia (Sumatra), Iran, Iraq, Ireland, Israel-Palestine, Italy (mainland and Sicily), Japan, Kazakhstan, Korea, Kyrgyzstan, Latvia, Lebanon, Libya, Lithuania, Macedonia, Madagascar, Mauritania, Mongolia, Montenegro, Netherlands, Niger, Norway, Pakistan, Poland, Portugal, Romania, Russia (Altay, Amur, Buryatiya, European Russia, Chita, Irkutsk, Kamchatka, Khabarovsk, Krasnoyarsk, Krym, Kuril Islands, Magadan, North Caucasus, Primorye, Sakhalin, Tuva, West Siberia, Yakutskiya), Serbia, Slovakia, Slovenia, Spain, Sudan, Sweden, Switzerland, Syria, Tajikistan, Turkey, Ukraine, and Uzbekistan.

Introduced

From Champion et al. (2020):

"Presence in New Zealand: Nationally eradicated, first record from a pond near Lake Hayes, Otago in 1996."

From Manaaki Whenua – Landcare Research (2024):

"*Potamogeton perfoliatus* was present in cultivation in New Zealand but has now been eradicated."

Means of Introduction Outside the United States

From Champion et al. (2020):

"To date, all dispersal between waterbodies is human mediated via deliberate introduction. Potentially it could be spread by waterfowl dispersed seed."

From Champion and Clayton (2001):

"It was first found in an ornamental pond near Queenstown and was traced back to nurseries in Queenstown and Christchurch. Since its discovery this plant has been banned from sale and distribution and all plant material from three sites has been destroyed. […] Further introductions into New Zealand could occur through the aquarium trade."

Short Description

From GISD (2017):

"*Potamogeton perfoliatus* is one of the common pondweeds, rather robust, with the leaf bases wrapped around the stem. All the leaves grow under water and there are no floating leaves. Leaves are flat, oval-shaped, 2-6cm long, narrow (due to lack of light and calcium) but margins are slightly crisped (Farmer, 2003; MDNR, 2005). Plants have thicker, darker green foliage than

do plants growing in deeper water (MDNR, 2005). Ailstock and Shafer (2004) state 'reedgrass typically survives in winter by persistence of sparsely branched pale rhizomes embedded in the sediments. Inflorescences are variable but mostly consisting of 5-12 flowers with each consisting of 4 carpels which in turn contain a single ovule. Seed formation ranges from 20-48 seeds per inflorescence'. Redhead grass has an extensive root and rhizome system that securely anchors the plant (MDNR, 2005)."

From Zinecker and West (2010):

"The number of inflorescences per stem ranges from 1-3. Each inflorescence contains about 5-12 (four carpel) flowers producing 20-48 seeds each, for a total of about 48-115 seeds per flowering stem (STAC 2007)."

"Stems are light beige to reddish brown or green-yellow in color typically consisting of one straight main stem at the base of the plant. Sometimes two or three (rarely more) stems may branching [sic] from the main stem. The parallel-veined leaves are almost perfoliate (stem through the leaves), cordate (heart shaped) clasping the stem by curving around it."

Biology

From GISD (2017):

"Reproduction is through a combination of vegetative or clonal offspring and those resulting from seeds (Ailstock and Shafer, 2004). […] MDNR (2005) reports that 'asexual reproduction occurs by formation of over-wintering, resting buds at the ends of rhizomes. Sexual reproduction regularly occurs in early to mid-summer. Spikes of tiny flowers emerge from leaf axils on ends of plant stems. Flower spikes extend above the water surface and the pollen is carried by wind. As fruits mature they sink below the surface where they release seeds'."

From Zinecker and West (2010):

"Claspingleaf pondweed beds stabilize sediments, reduce shoreline erosion, and provide valuable habitat and food source for a variety of fish, macroinvertebrates, crustaceans and waterfowl (Thayer et al [sic] 1975, Lubbers et al. 1990). They provide protection from predators, as well as attracting epiphytes and zooplankton upon which other species graze, providing an important link in the food web. During the breeding season up to 80 percent of waterfowl's diet is plant material, much of it aquatic (Kenow and Rusch 1996). Migratory waterfowl dive and scavenge for rhizomes buried in sediments of claspingleaf pondweed beds. […] Bushman and Ailstock (2006), [sic] found claspingleaf pondweed exhibited antibacterial activity against a number of different strains of bacteria. This could be critical for the health of the organisms dwelling in the grass beds such as the blue crab, the waterfowl that consume it, as well as any plant community dynamics affected by this trait."

"The plant has a well-developed rhizomatous network (horizontally branching roots). At the end of the vegetative season rhizomes overwinter in the form of resting buds. These buds develop at the tips of rhizomes and are the source of the next year's shoots (Hutchinson 1975). Resting bud

depth is variable from just below the sediment surface to depths of more than 8 inches into the sediment."

Human Uses

This species has been used in the nursery trade (e.g., Champion and Clayton 2021) and the aquarium trade (e.g., Aquariumplantfactory 2023).

Diseases

No information was found on diseases associated with *Potamogeton perfoliatus*.

Threat to Humans

No information was found on threats to humans from *Potamogeton perfoliatus*.

3 Impacts of Introductions

No information was found on impacts of introduction of *Potamogeton perfoliatus*.

4 History of Invasiveness

The History of Invasiveness for *Potamogeton perfoliatus* is classified as No Known Nonnative Population. *Potamogeton perfoliatus* was introduced in New Zealand, but it is unclear whether it ever established in the wild before it was eradicated from the country. There is no information available describing the impact, or lack of impact, of nonnative introductions, and limited information on trade in this species.

5 Global Distribution

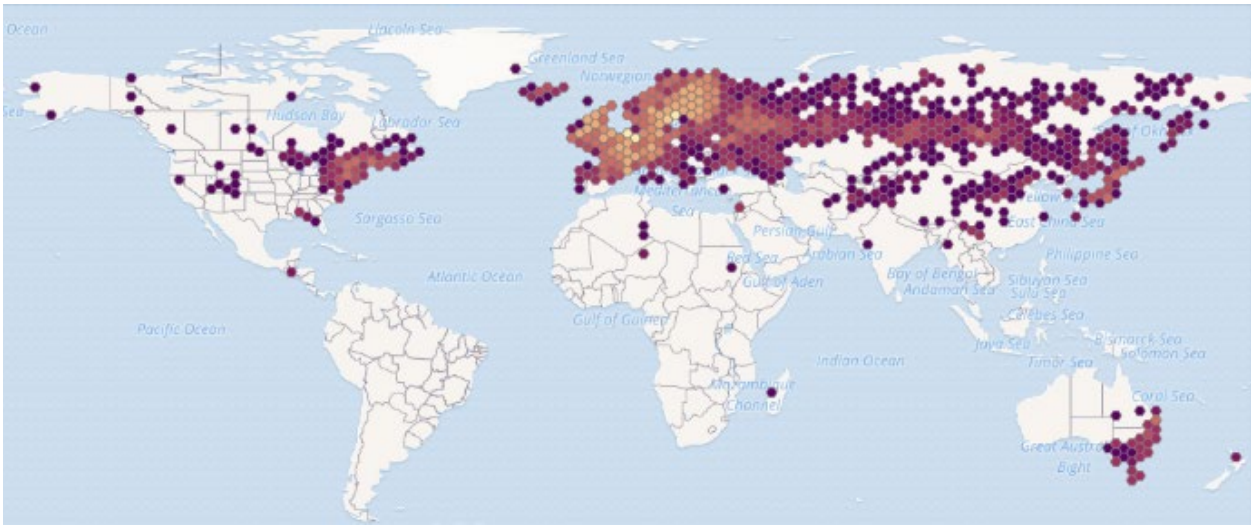

Figure 1. Reported global distribution of *Potamogeton perfoliatus*. Map from GBIF Secretariat (2023). Observations are reported from United States, Canada, Guatemala, Europe, Asia, Australia, New Zealand, Niger, Algeria, and Sudan.

Points located in British Columbia, Manitoba, Nunavut, Saskatchewan, and the Yukon, Canada; Alaska, California, Colorado, North Dakota, Utah, and Wyoming, United States; New Zealand; and Myanmar may not represent established populations of *Potamogeton perfoliatus* and were not used to select source locations for the climate matching analysis.

6 Distribution Within the United States

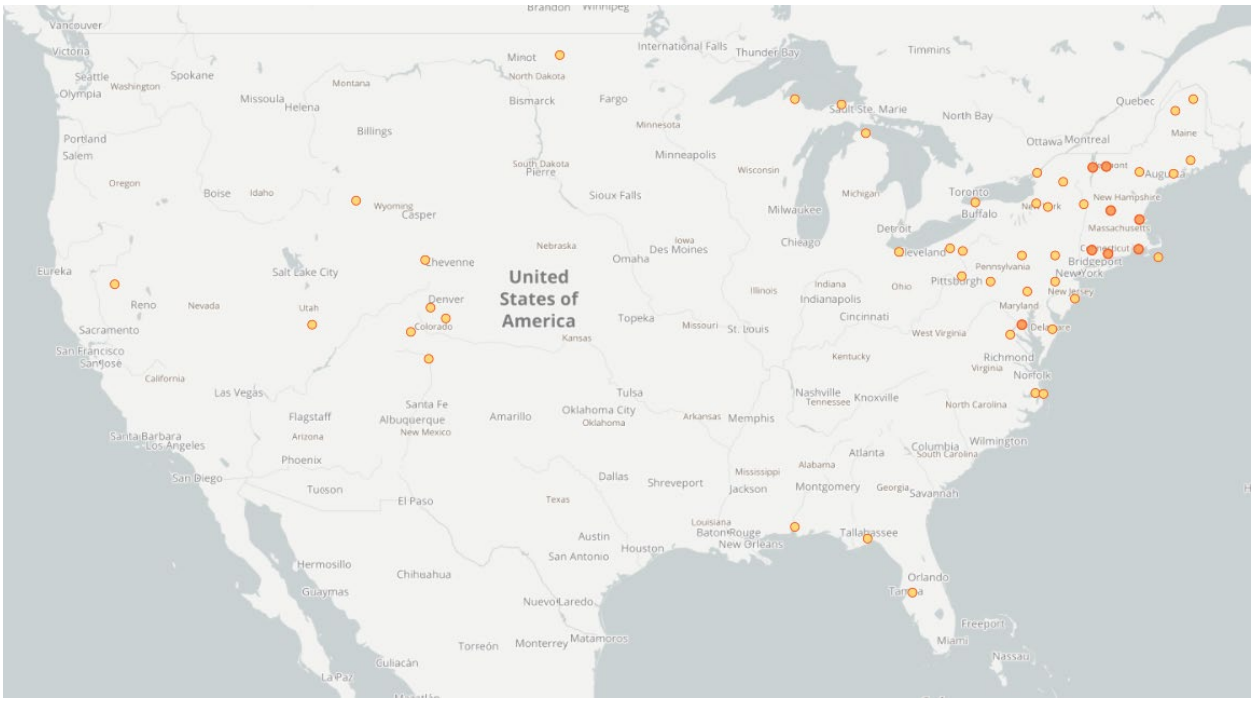

Figure 2. Reported distribution of *Potamogeton perfoliatus* in the United States. Map from GBIF-US (2023). Observations are reported from Alabama, California, Colorado, Connecticut, Delaware, Florida, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Pennsylvania, Rhode Island, Vermont, Virginia, Wisconsin, and Wyoming. The observations in California, Colorado, North Dakota, Utah, and Wyoming do not represent established populations of *Potamogeton perfoliatus* and were not used to select source locations for climate matching.

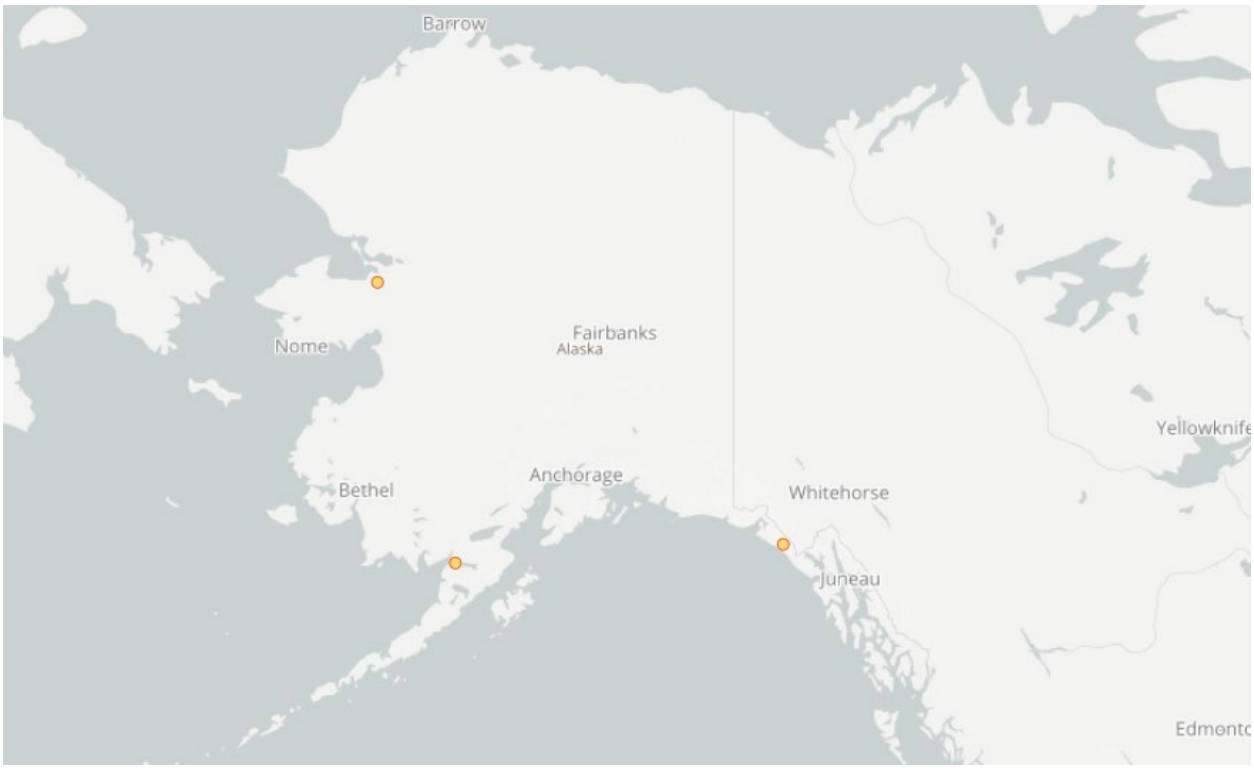

Figure 3. Reported distribution of *Potemogeton perfoliatus* in Alaska, United States. Map from GBIF-US (2023). These occurrences do not represent established populations and were not used to select source locations for climate matching.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Potamogeton perfoliatus* in the contiguous United States was almost uniformly high. The areas with the highest climate match were located around the Great Lakes and along the Atlantic coast to North Carolina, and in limited areas of Florida and the Gulf Coast, approximating the native range of the species. The only low climate matches were found along the northern Pacific coast and in parts of the Cascade Mountains and Sierra Nevada. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.991, 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 *Potamogeton perfoliatus* (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.

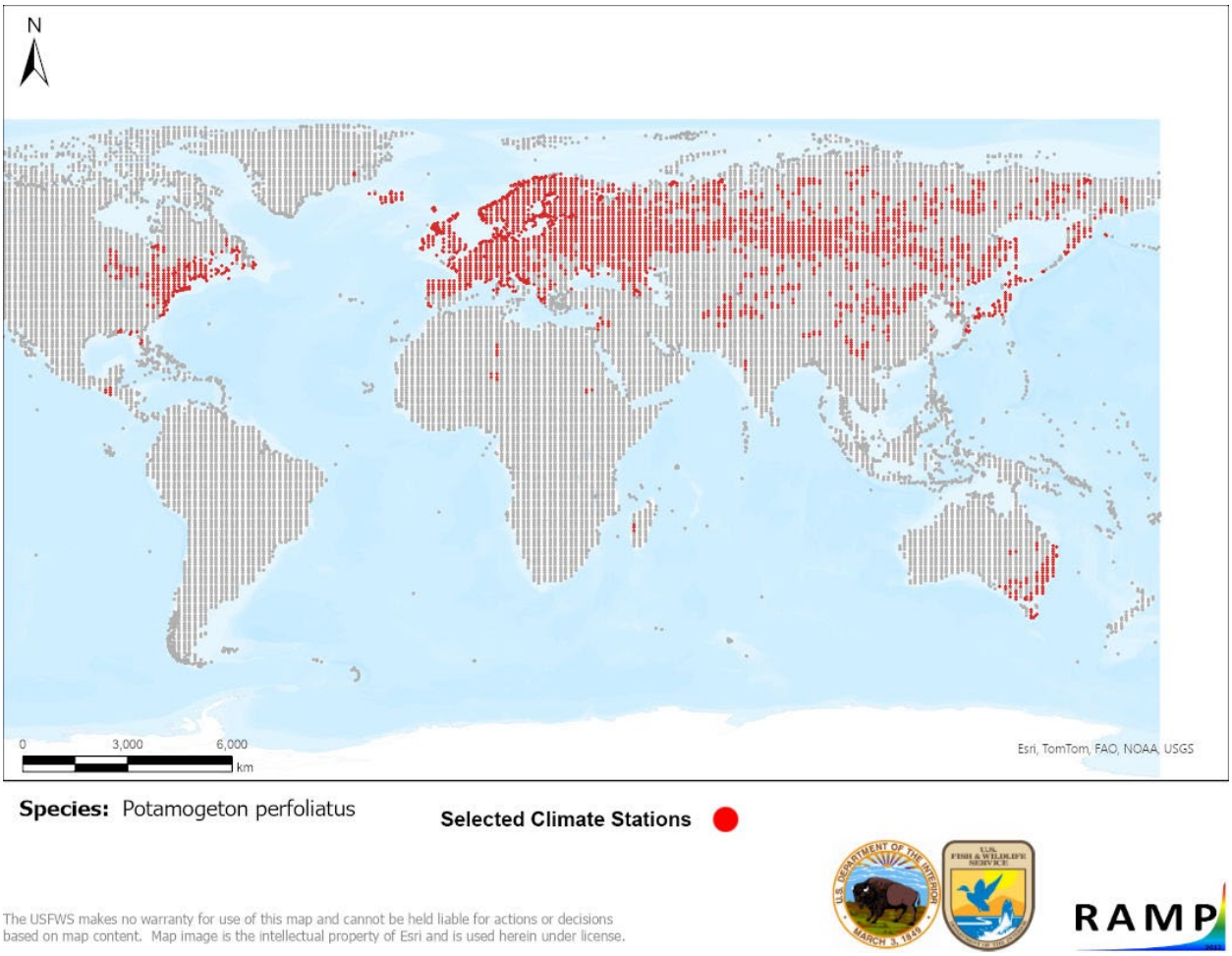

Figure 4. RAMP (Sanders et al. 2023) source map showing global weather stations selected as source locations (red; United States, Canada, Guatemala, Greenland, Iceland, nearly all of Europe, Algeria, Niger, Madagascar, much of Asia, Australia) and non-source locations (gray) for *Potamogeton perfoliatus* 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.

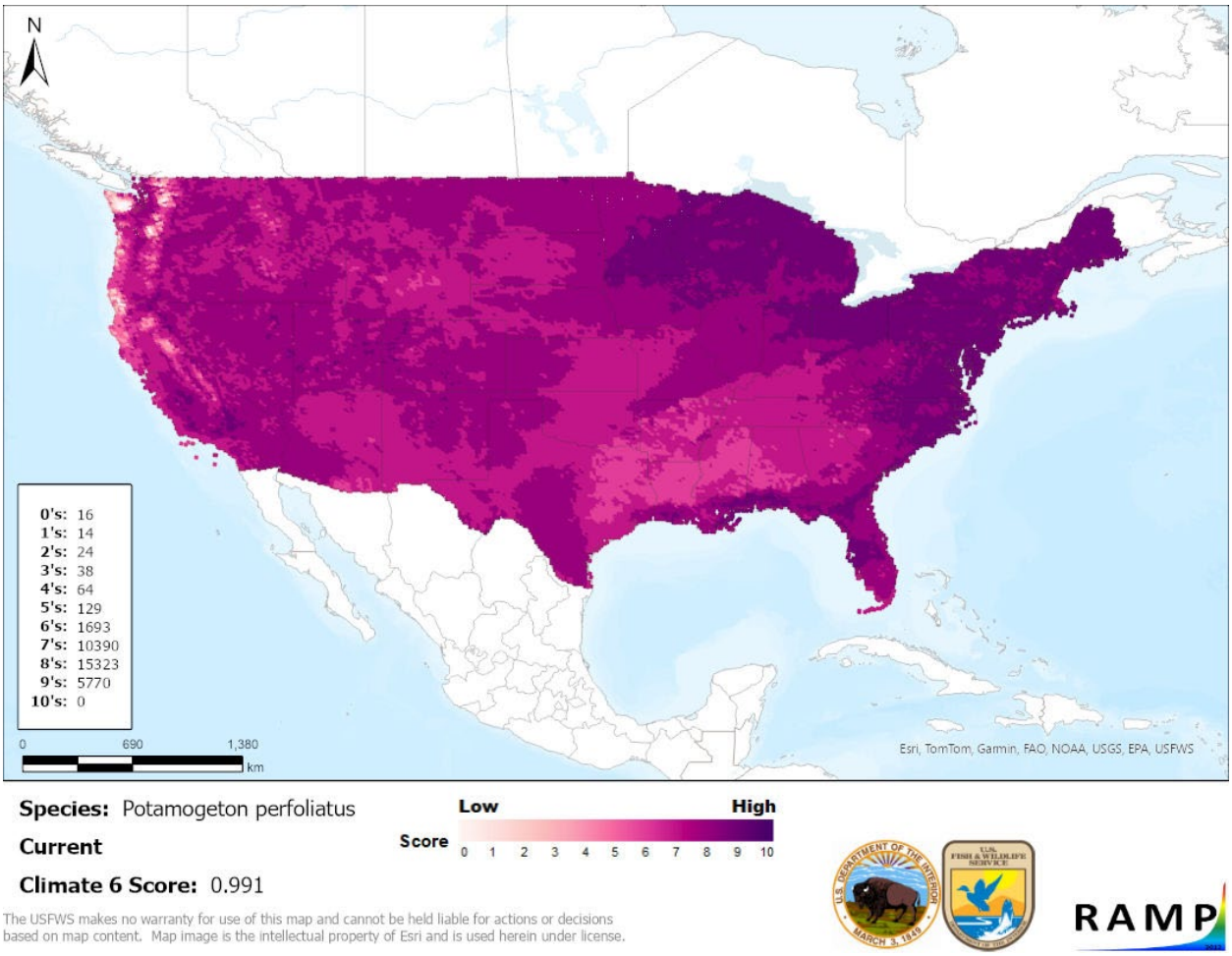

Figure 5. Map of RAMP (Sanders et al. 2023) climate matches for *Potamogeton perfoliatus* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Potamogeton perfoliatus* is classified as Low. There is a reasonable amount of information regarding species distribution, biology, and ecology. There is evidence of introduction outside the native range, but establishment there is uncertain and no information was available regarding impacts caused by this species outside of its native range. Additionally, there was limited information available on trade in *P. perfoliatus*.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Potamogeton perfoliatus, Claspingleaf Pondweed, is a submerged, rooted, flowering aquatic plant that is native to most of Europe, Asia, the Mediterranean, Guatemala, the northeastern and southeastern United States, and eastern Canada. *P. perfoliatus* occurs in temperate climates and has a broad tolerance for different growing conditions. This species has been found in use in both

the nursery and aquarium trades. No species-specific regulations on possession or trade were found for *P. perfoliatus* in the United States. *P. perfoliatus* was introduced to New Zealand in the late twentieth century but it is unclear whether the species became established in the wild; it has now been intentionally eradicated from New Zealand. The History of Invasiveness for *Potamogeton perfoliatus* is classified as No Known Nonnative Population. The climate matching analysis to the contiguous United States indicates establishment concern for this species outside its native range. The climate match was high across the contiguous United States except for very limited areas of low match along the Pacific coast. The Certainty of Assessment is classified as Low due to lack of information on the impact of nonnative populations. The Overall Risk Assessment Category for *Potamogeton perfoliatus* in the contiguous United States is Uncertain.

Assessment Elements

- **History of Invasiveness (see section 4): No Known Nonnative Population**
- **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 (2023).

Under the future climate scenarios (figure A1), on average, high climate match for *Potamogeton perfoliatus* was projected to occur in nearly all regions of the contiguous United States. The interior Southeast had medium to high climate match and the Northern Pacific Coast had limited areas of low match under all scenarios. The extent of the highest climate match areas declined from SSP3 to SSP5 and from time step 2055 to time step 2085. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.771 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.986 (model: GFDL-ESM4, SSP3, 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 (0.991, figure 5) 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 all time step and climate scenarios, only minor increases in the climate match relative to the current match were observed. These minor increases were mostly found in the western half of the contiguous United States. Under one or more time step and climate scenarios, areas within the Appalachian Range, Mid-Atlantic, Northeast, and Southeast saw a large decrease in the climate match relative to current conditions. Additionally, areas within California, the Colorado Plateau, Great Basin, Great Lakes, Northern Pacific Coast, Northern Plains, Southern Plains, Southwest, and Western Mountains 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 largest decreases in climate match appeared under scenario SSP5, 2085 for most regions, but California and the Gulf Coast appeared to have more substantial decreases in climate match relative to current conditions under SSP3, 2085.

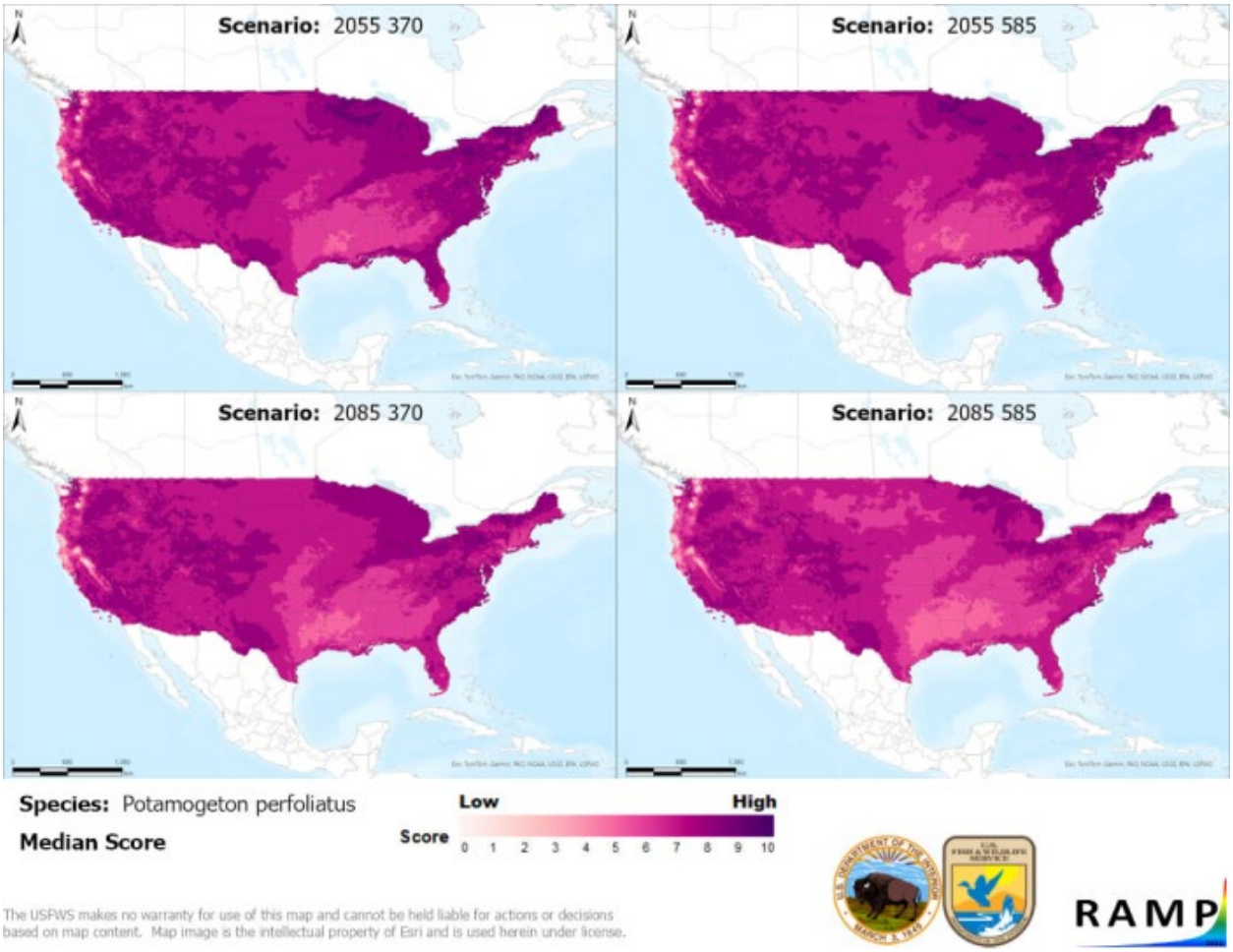

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Potamogeton perfoliatus* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023). Shared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

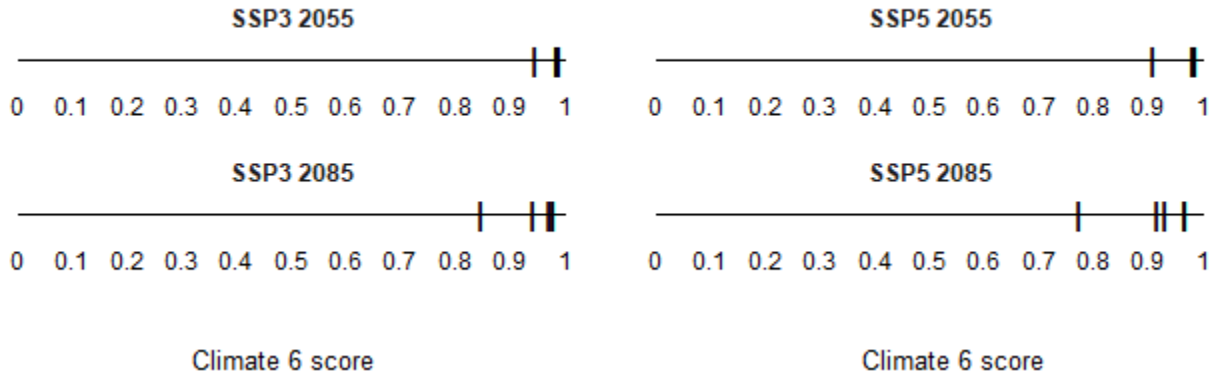

Figure A2. Comparison of projected future Climate 6 scores for *Potamogeton perfoliatus* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017,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

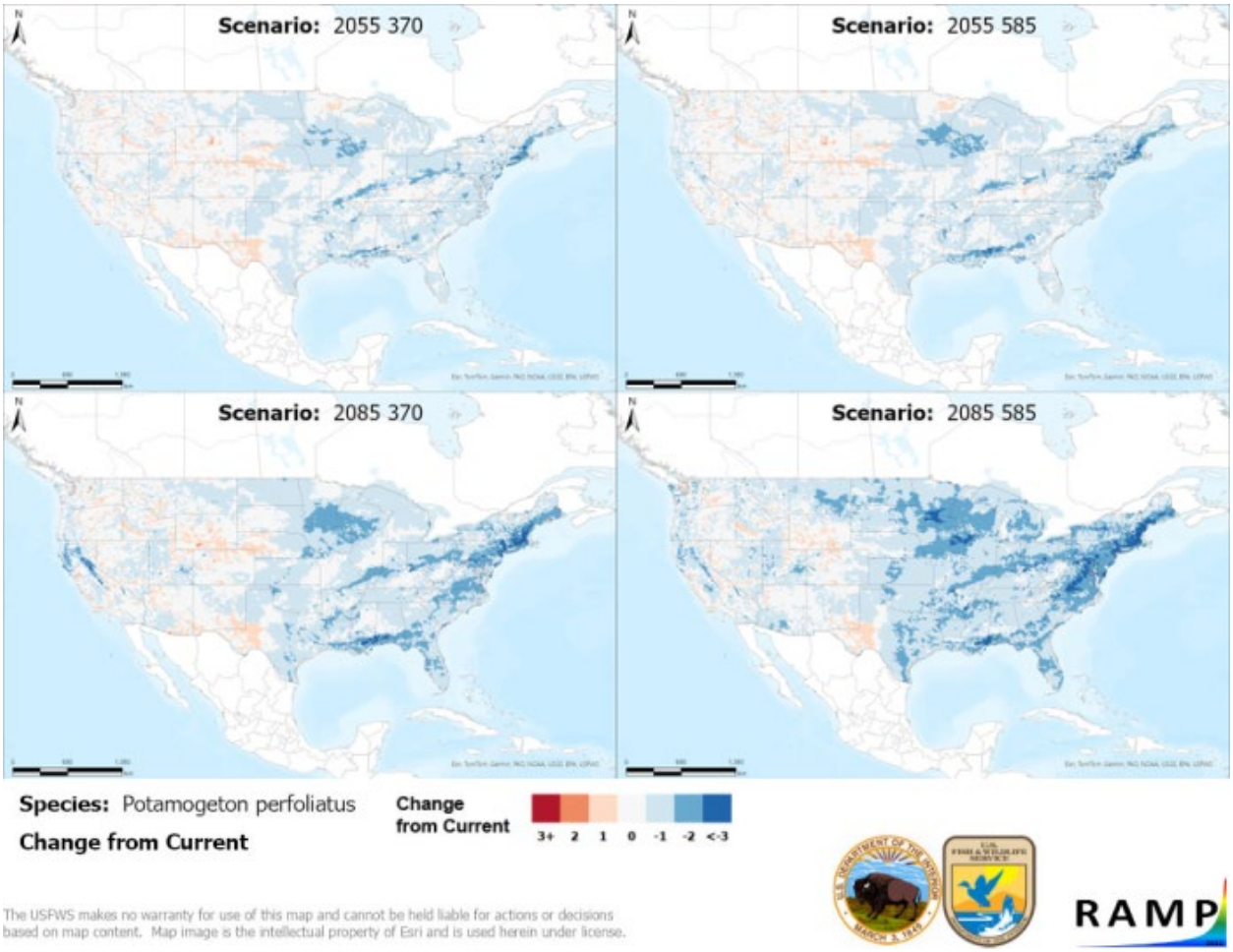

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Potamogeton perfoliatus* based on source locations reported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