Cutleaf Watermilfoil (*Myriophyllum pinnatum*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, March 2021
Revised, March 2021
Web Version, 7/26/2021

Organism Type: Plant
Overall Risk Assessment Category: Uncertain

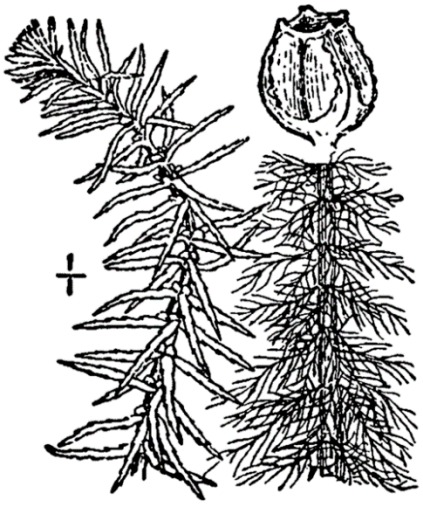

Image: Britton NL, Brown A. Licensed under Public Domain in the United States. Available: https://commons.wikimedia.org/wiki/File:Myriophyllum_pinnatum_BB-1913.png (March 2021).

1 Native Range and Status in the United States

Native Range

From CABI (2021):

"*M. pinnatum* is native to North America, with evidence of its presence in Iowa since the Holocene (Baker et al., 1996; USDA-NRCS, 2017). Urquiola Cruz and Betancourt Gandul (2000) consider the species native to Cuba, but Maldonado González (2009-2010) and Oviedo Prieto et al. (2012) list it as introduced in the country."

According to CABI (2021), *Myriophylla pinnatum* is native to Canada (British Columbia, Manitoba, Saskatchewan), Cuba, and the United States (Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, North

Carolina, North Dakota, Ohio, Oklahoma, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Virginia, West Virginia).

Status in the United States

According to CABI (2021), *Myriophyllum pinnatum* has been reported as native in: Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Virginia, and West Virginia.

From CABI (2021):

"In some areas of its native range in North America, it is considered rare, endangered or extirpated due to habitat fragmentation and loss. In the USA, the species is considered endangered in Connecticut, Massachusetts, Indiana, New Jersey, New York, Rhode Island and Tennessee."

M. pinnatum is widely available for purchase online through many sources, typically for the aquarium trade. A set of two bunches can be purchased for $7.95 online through Modern Aquarium (2021), which is located in Ronkonkoma, New York.

M. pinnatum is on Illinois' Aquatic Life Approved List (Illinois DNR 2015). "The following aquatic life categories will be considered approved for aquaculture, transportation, stocking, importation and/or possession in the State of Illinois."

Means of Introductions in the United States

Myriophyllum pinnatum is listed as native to the United States, but a hybrid is reported as non-native in Connecticut by Moody and Les (2002). There were no records found specifying the pathway of introduction for the non-native introductions in the United States, but the species is sold widely in the aquarium trade.

Remarks

From CABI (2021):

"Species identification in this genus is difficult without the presence of reproductive structures."

"International Common Names
English: foxtail green; green foxtail; green myrio
Spanish: cola de zorra verde; milenrama; ramo-cola de zorra

Local Common Names
Canada: cutleaf water-milfoil; green parrot's feather
Cuba: miriofilum; pinillo
Hungary: grönes tausenblatt; stolístek zpeřeny; zierliches tausendblatt

USA: alternate-leaved water-milfoil; Eastern water-milfoil; foxtail moss; pinnate water-milfoil; rooted coontail; rough water milfoil"

Information for this Ecological Risk Screening Summary was found searching the accepted name *Myriophyllum pinnatum* and the synonyms *Myriophyllum scabratum* and *Potamogeton pinnatum* (CABI 2021).

Myriophyllum pinnatum is native to the United States and is not listed as invasive or on any states' prohibited lists. According to USDA NRCS (2021), *Myriophyllum pinnatum* is classified as Threatened in Rhode Island and Tennessee; endangered in Indiana, New Jersey and New York; and Of Special Concern in Connecticut and Massachusetts. According to NatureServe (2021) it is also considered Critically Imperiled in Iowa, North Carolina, Nebraska, and West Virginia.

From Moody and Les (2002):

"Both *M. heterophyllum* and *M. heterophyllum* X *M. pinnatum* hybrids are nonindigenous to New England. *M. heterophyllum* is nonaggressive in other parts of the country where it is native, in some cases to the extent of being categorized as an imperiled species [Stuckey and Roberts 1977]. Similarly, our field observations indicate that New England populations of pure *M. heterophyllum* rarely exhibited invasive characteristics, whereas the hybrids always did."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to World Flora Online (2021), *Myriophyllum pinnatum* is the accepted scientific name for this species.

From ITIS (2021):

Kingdom Plantae
Subkingdom Viridiplantae
Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina
Class Magnoliopsida
Superorder Saxifraganae
Order Saxifragales
Family Haloragaceae
Genus Myriophyllum
Species *Myriophyllum pinnatum*

According to CABI (2021), *Myriophyllum scabratum* Michx., and *Potamogeton pinnatum* Walter are synonyms for *M. pinnatum*.

Size, Weight, and Age Range

From CABI (2021):

"Emersed leaves are 0.5-3 cm long, […] Flowers green to purplish, small, four-parted, with 1.5-2 mm long petals that are rounded above and narrow-clawed. Fruit is a deeply four-lobed nut-like cluster, pale, 1.3-2 mm long, […]"

Environment

From CABI (2021):

"*M. pinnatum* occurs in shallow water, in ditches and ponds, usually less than 1 m deep (Knepper et al., 2002; SEINet, 2017). It is also reported from forest swales, wetlands, creeks, borders of brackish marshes, swamps and rivers (Fernald, 1936; Abbott and Judd, 2000; Rosen et al., 2003; Hercombe et al., 2007; Maldonado González, 2009-2010)."

"Most information available concerns cultivation of *M. pinnatum* as an aquarium plant. The species grows in shallow water in full to partial shade, at water temperatures of 16-24°C. It grows in clay, sand, limestone and gravel substrates, with water pH of 6.5-7.5 and water hardness of 3-8 mg/l CaCO3 (Maldonado González, 2009-2010; Live Aquaria, 2017)"

Climate

According to CABI (2021) the preferred climates for *M. pinnatum* are:

"Tropical wet and dry savanna climate, […] < 60mm precipitation driest month (in winter) and < (100 - [total annual precipitation{mm}/25])."

"Warm temperate climate with dry summer, […] Warm average temp. > 10°C, Cold average temp. > 0°C, dry summers."

"Warm temperate climate with dry winter, […] Warm temperate climate with dry winter (Warm average temp. > 10°C, Cold average temp. > 0°C, dry winters)."

"Continental climate with dry summer, […] Continental climate with dry summer (Warm average temp. > 10°C, coldest month < 0°C, dry summers)"

"Latitude North, 52. Latitude South, 17"

Distribution Outside the United States

Native

Native range of *Myriophyllum pinnatum* is partially within the United States, see Native Range in Section 1.

From CABI (2021):

"*M. pinnatum* is native to North America, […] (Baker et al., 1996; USDA-NRCS, 2017). Urquiola Cruz and Betancourt Gandul (2000) consider the species native to Cuba, but Maldonado González (2009-2010) and Oviedo Prieto et al. (2012) list it as introduced in the country."

According to CABI (2021), *Myriophylla pinnatum* is native to Canada (British Columbia, Manitoba, Saskatchewan) and Cuba.

Introduced

From CABI (2021):

"Urquiola Cruz and Betancourt Gandul (2000) consider the species native to Cuba, but Maldonado González (2009-2010) and Oviedo Prieto et al. (2012) list it as introduced in the country. *M. pinnatum* has also been introduced to Mexico (in 1974) and to Jamaica (in 1976) (Proctor, 1982; Red de Herbarios del Noroeste de México, 2017)."

Means of Introduction Outside the United States

From CABI (2021):

"*M. pinnatum* is widely used as an aquarium plant (Live Aquaria, 2017). Because of this, it is sold commercially at aquarium supply stores worldwide and on the internet, which facilitates its spread."

"The species is also maintained as part of the permanent National Botanical Garden collection in Cuba (Maldonado González, 2009-2010)."

"can disperse naturally through waterways"

Short Description

From CABI (2021)

"Perennial aquatic or semi-aquatic herb. Stem highly variable, rooting in mud and freely branching or elongating in deeper water. Leaves alternate and whorled on same plant, pinnately divided, with submersed leaves having three to five pairs of divisions. Emersed leaves are 0.5-3 cm long, linear to lance-shaped, and have comb-like divisions or sharp teeth. Flowers either male or female, found on the same plant (monoecious), some bisexual, borne in a terminal spike above the water surface, with male flowers near the inflorescence tip. Bracts are longer than male flowers, triangular, with six to ten 1-2 mm long teeth that are angled toward the tip. Flowers green to purplish, small, four-parted, with 1.5-2 mm long petals that are rounded above and narrow-clawed. Fruit is a deeply four-lobed nut-like cluster, pale, 1.3-2 mm long, egg-shaped to cubic, splitting into four one-seeded segments that are flat-sided with two spiked ridges. Winter buds absent (Red de Herbarios del Noroeste de México, 2017)."

From World Flora Online (2021):

"Lvs partly or largely alternate or scattered, 1–3 cm, with capillary segments; emersed lvs sometimes developing and resembling the bracts, these chiefly whorled, much exceeding the fls, to 18 mm, with a flat rachis to 1 mm wide and on each side 3–5 ascending teeth 1–2 mm; spikes emersed; fr 2 mm, deeply lobed, each mericarp bearing a flat or concave longitudinal ridge with sharply tuberculate margins."

Biology

From CABI (2021):

"Genetics
The chromosome number reported for *M. pinnatum* is n = 5 (Moody and Les, 2002). DNA barcode information for the species is available at the Barcode of Life Data Systems (BOLD, 2017)."

"Reproductive Biology
M. pinnatum reproduces by cuttings and by flowers, if tips are left to grow outside of water (Live Aquaria, 2017). Propagation procedures in vitro have been developed for the species by Kane and Gilman (1991)."

"Physiology and Phenology
M. pinnatum is a rapid growing aquatic herb that can grow partially above water (Live Aquaria, 2017). It is reported to flower in July (SEINet, 2017)."

"*M. pinnatum* provides coverage and protection to newborn fish and tadpoles (Morin, 1981; Live Aquaria, 2017). It is foraged by the crayfishes Procambarus clarkii and P. spiculifer, the Canada goose *Branta canadensis* and the wood duck *Aix sponsa* (Drobney and Fredrickson, 1979; Cronin et al., 2002; Parker et al., 2007). It is a host species for aquatic and semiaquatic Lepidoptera (Minno, 1992)."

Human Uses

From CABI (2021):

"[…] it is sold commercially worldwide and on the internet to be used in freshwater aquaria."

"*M. pinnatum* is reported as having some antimicrobial activity (Nickell, 1959). It is recommended for sewage treatment systems, as it improves dissolved oxygen levels in water, providing a good habitat for bacteria growth (Mohan et al., 2010)."

"The species is also maintained as part of the permanent National Botanical Garden collection in Cuba (Maldonado González, 2009-2010)."

Diseases

No information on diseases was found.

Threat to Humans

No threats to humans were found.

3 Impacts of Introductions

From CABI (2021):

"*Myriophyllum pinnatum* is a perennial aquatic herb only reported as invasive in Cuba, where it is included in the management plan of the Ciénaga de Zapata Biosphere Reserve as a species that needs to be managed to prevent invasion of that wetland system."

Myriophyllum pinnatum was not found to be listed on any international, Federal, or State invasive/prohibited or restricted lists.

The following section refers to potential, not documented impacts of introductions.

From CABI (2021):

"*M. pinnatum* belongs to a genus recognized for the invasive species *M. spicatum*, *M. aquaticum* and *M. heterophyllum*."

"*M. pinnatum* is an aquatic herb with a low to medium risk of introduction. Although it is available commercially at aquarium supply stores, its specific water temperature and pH might limit its distribution (Live Aquaria, 2017). Where used only as a plant for indoor aquaria, the threat to natural environments is low. It can become problematic if its popularity increases or if used in sewage treatment plants (Mohan et al., 2010; Live Aquaria, 2017)."

The following section refers to impacts of a hybrid version of *M. pinnatum* within its native range where the species is listed of concern.

From Moody and Les (2002):

"Both *M. heterophyllum* and *M. heterophyllum* X *M. pinnatum* hybrids are nonindigenous to New England. […] Similarly, our field observations indicate that New England populations of pure *M. heterophyllum* rarely exhibited invasive characteristics, whereas the hybrids always did. In Moodus Reservoir, Connecticut, where *M. heterophyllum* and *M. heterophyllum* X *M. pinnatum* hybrids coexist in a single lake, the former grows along the shoreline scattered among several native aquatic species, whereas the latter forms dense monospecific mats in deeper water. Thus, it seems that New England potentially comprises both benign *M. heterophyllum* populations and invasive hybrid populations. Because we have yet to locate any authentic records of *M. pinnatum* in New England, we conclude that hybridization of *M. heterophyllum* and *M. pinnatum* occurred outside of the region originally."

4 History of Invasiveness

Myriophyllum pinnatum is widely available for sale online and in stores through aquarium trade. There have been introductions to Mexico, Jamaica, and Cuba, although native status in Cuba is disputed. There is no information on documented impacts of introduction available in the literature. There is one record of a hybrid of this species forming dense mats within its native range where the species is considered of Special Concern. The history of invasiveness is classified as Data Deficient.

5 Global Distribution

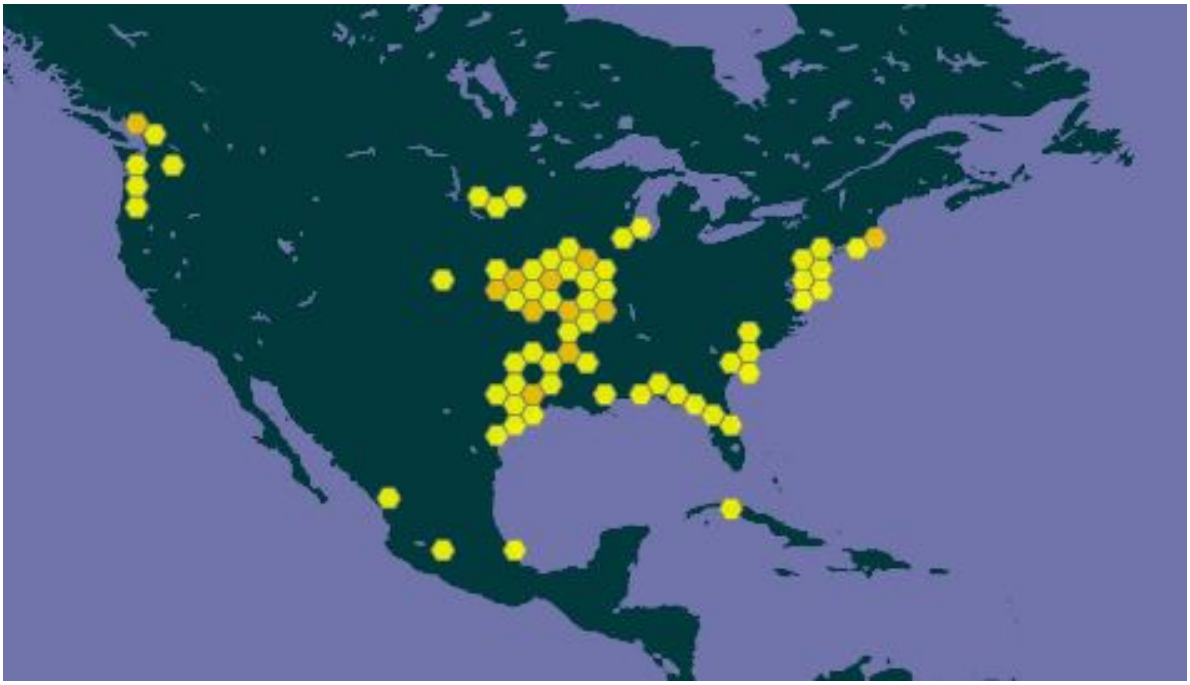

Figure 1. Known global distribution of *Myriophyllum pinnatum*. Observations are reported from North and Central America. Map from GBIF Secretariat (2021).

Georeferenced locations for populations reported in Jamaica were not found, and therefore not used for climate matching analysis.

6 Distribution Within the United States

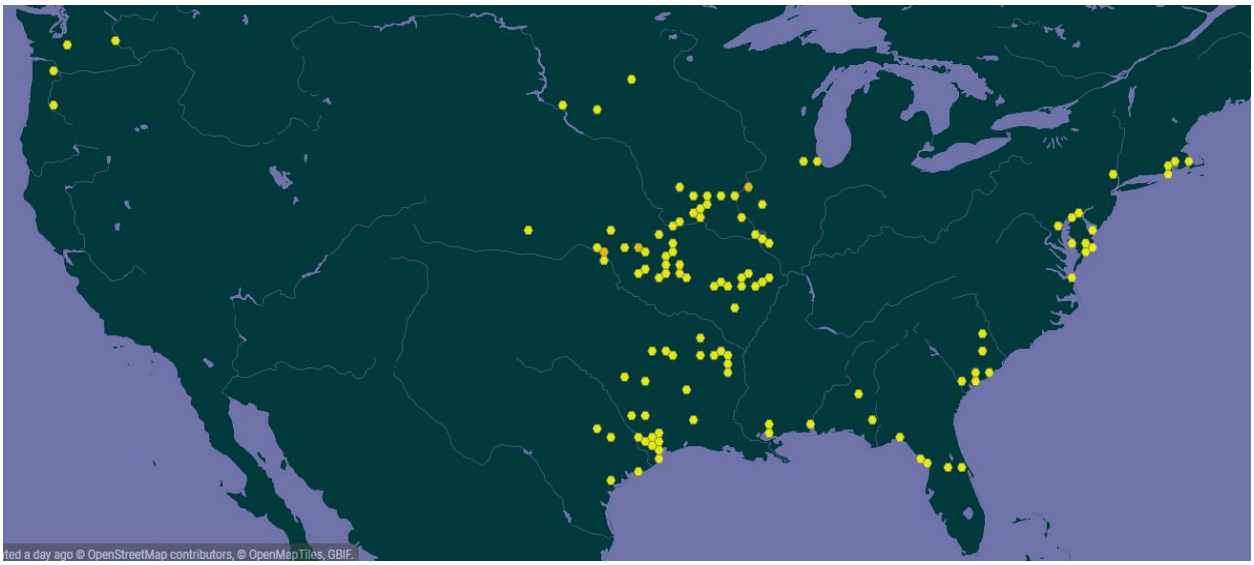

Figure 2. Known distribution of *Myriophyllum pinnatum* in the United States. Map from GBIF Secretariat (2021).

7 Climate Matching

Summary of Climate Matching Analysis

The majority of the Central and Eastern United States has a High Climate 6 Score. There was a small patch of lower match in the Desert Southwest, and areas of medium match in the central Midwest. The overall Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.781, high (scores greater than 0.103 are categorized as high). Almost all States had high individual Climate 6 scores. The only exception was Arizona, which had a medium individual Climate 6 score.

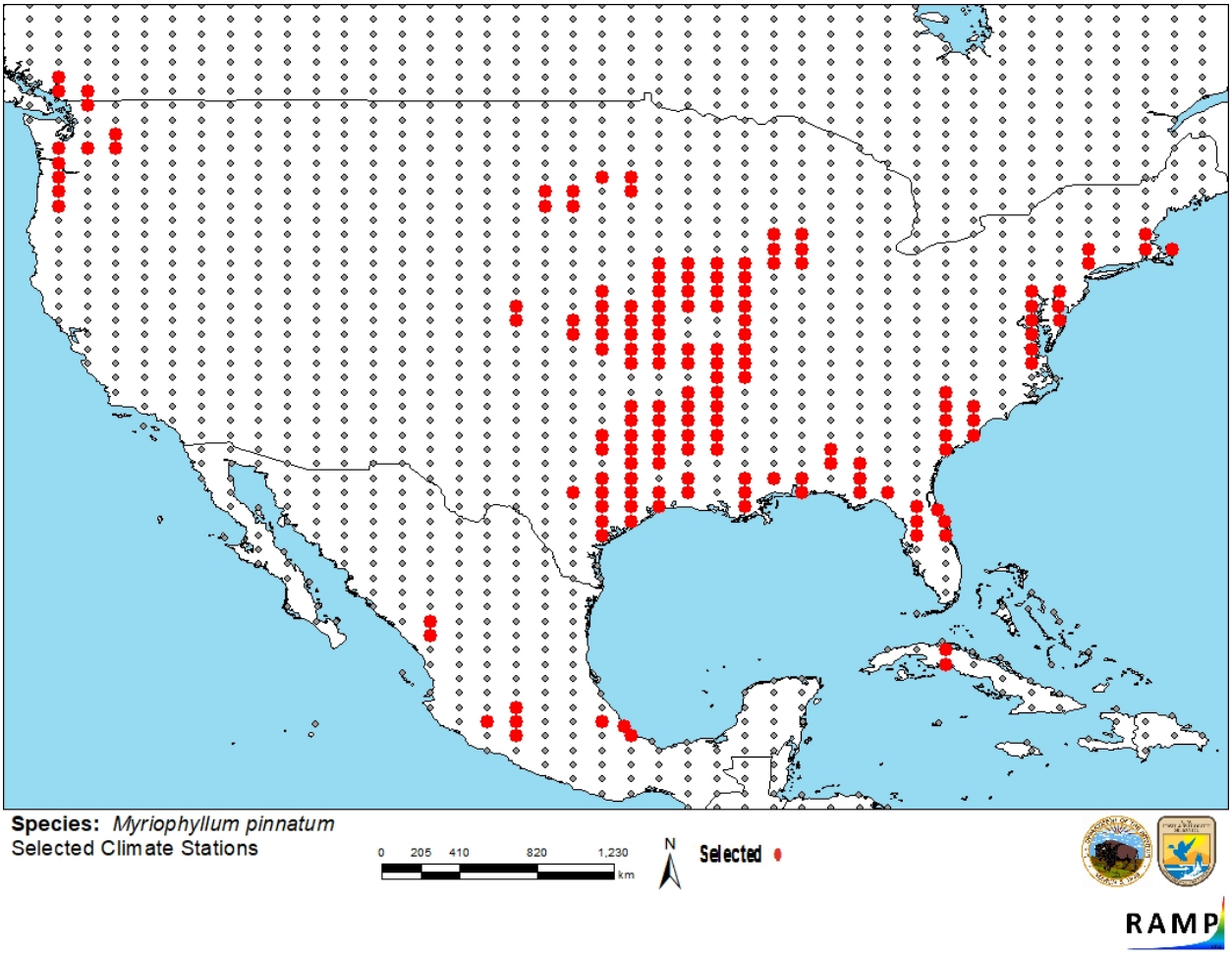

Figure 3. RAMP (Sanders et al. 2018) source map showing weather stations in North and Central America selected as source locations (red: United States, Canada, Mexico, Cuba and Jamaica) and non-source locations (gray) for *Myriophyllum pinnatum* climate matching. Source locations from GBIF Secretariat (2021). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

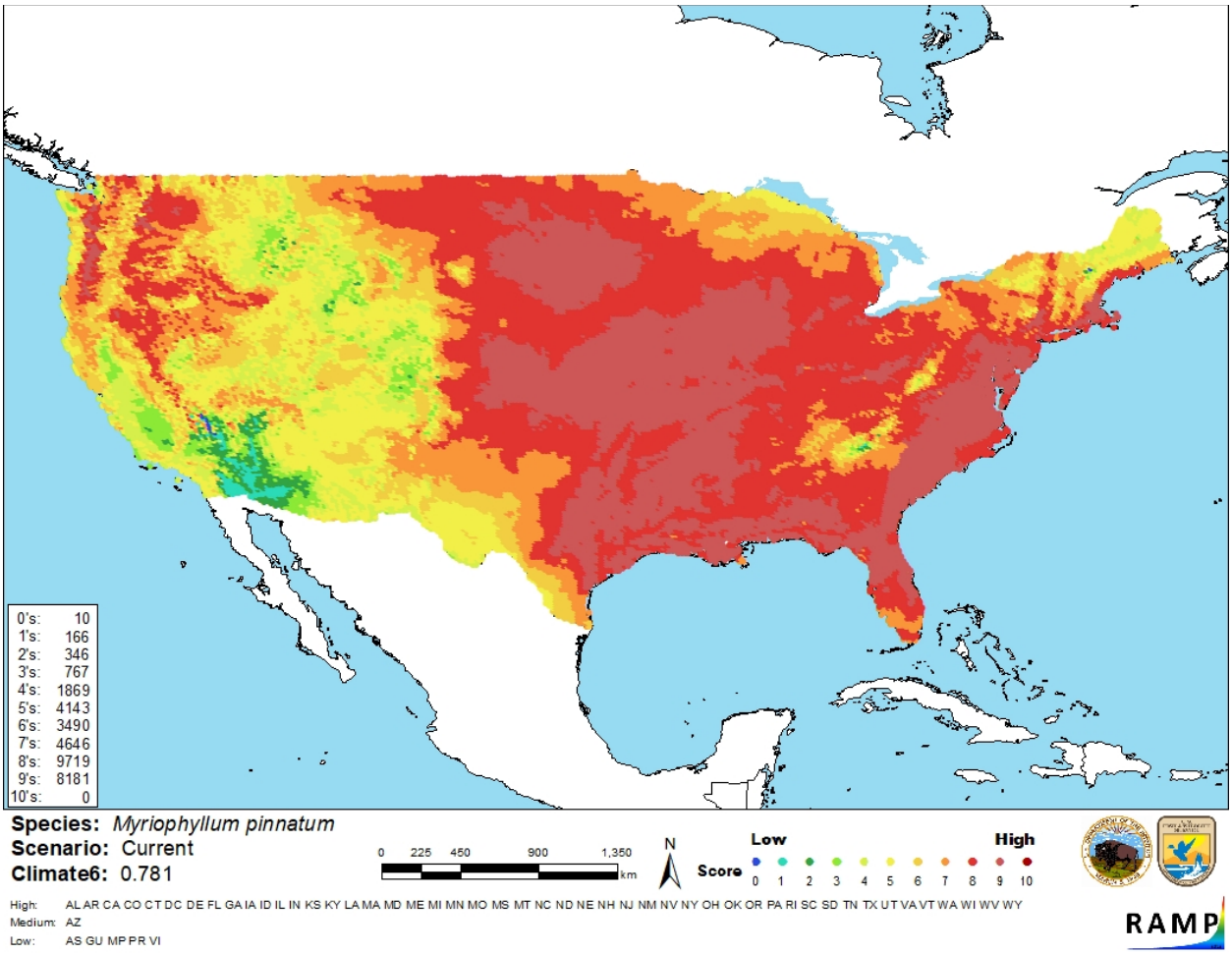

Figure 4. Map of RAMP (Sanders et al. 2018) climate matches for *Myriophyllum pinnatum* in the contiguous United States based on source locations reported by GBIF Secretariat (2021). Counts of Climate Match are tabulated on the left. 0/Blue = Lowest match, 10/Red = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: (Count of target points with climate scores 6-10)/ (Count of all target points)	Overall Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

8 Certainty of Assessment

Myriophyllum pinnatum has been reported outside of its native range and is listed as invasive in at least one area. However, there are no documented of impacts of introductions, and where this species is reported as invasive, the introduced or native status of the plant is in debate. Additionally, this species is difficult to identify when it is not flowering. The lack of reports and

scientific studies on the impact of this species leads to the certainty of assessment being classified as Low.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Myriophyllum pinnatum is a freshwater aquatic plant that grows in shallow waters in North and Central America (United States, Mexico, Jamaica, and Cuba). *M. pinnatum* is widely available online and in stores as it is used in aquariums. *M. pinnatum* has been reported outside of its native distribution (Mexico, Jamaica and Cuba), however there is no reporting on impacts of introductions, resulting in a history of invasiveness classification of Data Deficient. *M. pinnatum* was not found to be listed on any international, Federal, or State invasive/prohibited or restricted lists. It is listed as threatened or endangered in parts of its native rage in the United States. The climate match for the contiguous United States is high. The majority of the central and eastern United States has a high match. There was one main are of low match in the southwestern deserts. The certainty of assessment is classified as Low due to a lack of information. The overall risk assessment category for *Myriophyllum pinnatum* is Uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): Data Deficient**
- **Overall Climate Match Category (Sec. 7): High**
- **Certainty of Assessment (Sec. 8): Low**
- **Remarks/Important additional information: No additional information**
- **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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