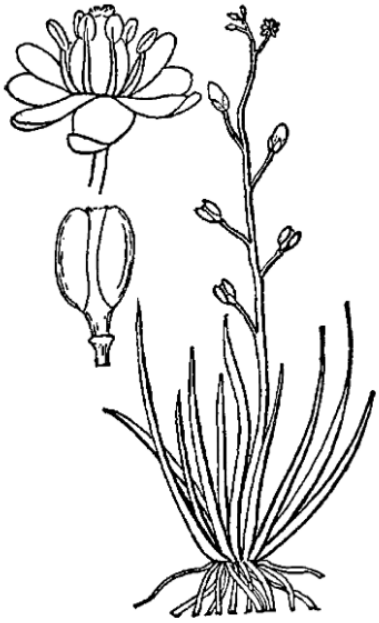
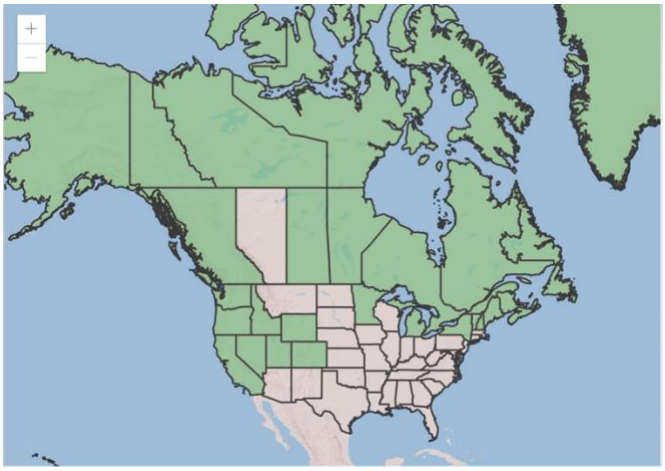
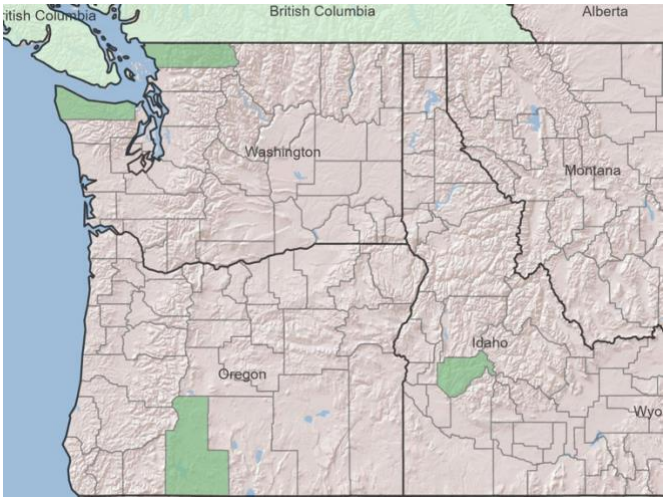
Plant Propagation Protocol for *Subularia aquatica*
ESRM 412 – Native Plant Production
URL: https://courses.washington.edu/esrm412/protocols/2023/[SUAQ.pdf]

Source: DNR MN



Source: DNR WA

TAXONOMY	
Plant Family	
Scientific Name	Brassicaceae[2]
Common Name	Mustard/Cabbage Family[6]
Species Scientific Name	
Scientific Name	*Subularia aquatica* L.[5]
Varieties	*Subularia aquatica* L. var. *americana* Mulligan & Calder[5] *Subularia aquatica* L. var. *aquatica* Boivin[8]
Sub-species	*Subularia aquatica* L. var. *mexicana* Mulligan & Calder[4]
Cultivar	N/A
Common Synonym(s)	N/A
Common Name(s)	Water-awlwort[5]
Species Code (as per USDA Plants database)	SUAQ[5]

GENERAL INFORMATION	
Geographical range	 North American Distribution[5]  Washington Distribution[5]
Ecological distribution	*S. aquatica* L. inhabits lacustrine ecosystems, shores of rivers or lakes, and wetland margins[3] Obligate wetland species[6]
Climate and elevation range	In Washington, this species has been found at elevations from 30 – 750 ft[6]
Local habitat and abundance	Often found submerged and blooming beneath the surface of shallow water near margins of freshwater lakes and ponds and on streambanks[6] Usually grows on sandy or gravelly sediments[2]

	Documented populations number in size from a few plants to over 100 individuals[7] Associated species include *Elatine minima* (small waterwort), *Eleocharis acicularis* (least spikerush), *Eriocaulon aquaticum* (pipewort), *Isoetes echinospora* (Braun's quillwort), *Lobelia dortmanna* (water lobelia), *Myriophyllum tenellum* (slender water milfoil), *Ranunculus repens* (creeping buttercup), and *Littorella americana* (American shore plantain)[7] Co-occurs with *Nasturtium officinale* (watercress), a similar yet larger species, across its range in Washington[6]
Plant strategy type / successional stage	Flowers freely and releases seeds whether completely submerged or temporarily in terrestrial conditions[9] Tolerates freezing of water layers in winter and seeds survive severe cold and ice in lake deposits; also, drought tolerant[9]
Plant characteristics	Forb/her[5] Annual[5] Basal leaf arrangement; simple narrow leaves (1-5 cm in length), wider at base and taper to a point[2] Short, thick, underground corm between leaves and roots[2] Roots are white and fibrous, lacks rhizomes[2] Leafless flower stalks (2-10 cm tall); small, white, 4-petaled flowers arranged in a loose cluster at the end of flower stalks; if submerged, flowers self-pollinate while remaining closed. Flowers open if above water surface[2] The fruit are inflated, oblong, ribbed pods (2-3 mm long); each pod contains several seeds[2]
PROPAGATION DETAILS *No specific information for the propagation of *S. aquatica* or any members of the same genus was found; propagation information is primarily from a general guide on the propagation of submerged aquatic plants*	
Ecotype	N/A
Propagation Goal	Plants[1]
Propagation Method	See[6]
Product Type	Large fiberglass or polyethylene tanks (> 500 gallons)[1]

Stock Type	N/A
Time to Grow	N/A
Target Specifications	Well-developed roots; anchored into submerged substrate[1]
Propagule Collection Instructions	N/A
Propagule Processing/Propagule Characteristics	N/A
Pre-Planting Propagule Treatments	Seeds should be submerged into a 5% bleach solution to reduce periphyton levels and kill unwanted algae, bacteria, or detritus for about 30 minutes[1]
Growing Area Preparation / Annual Practices for Perennial Crops	Fine textured, porous, or noncompacted substrates with low to moderate organic material is ideal[1] Lake sediment containing sand, silt, clay, muck, and organic matter can be extracted from field sites; while providing necessary nutrients and possessing qualities that allow for good growth, lake sediment has some unideal qualities – e.g.: undesirable seeds/propagules that can compromise stock population[1] >500-gallon tanks are ideal[1] Chlorine-free water source; water should be tested for toxic levels of nutrients/elements, especially if obtained from a field source[1]
Establishment Phase Details	Place seeds 2-4 cm below sediment of preprepared pot/tank and cover with sand[1] Once seeds have germinated, transplant propagules into pots/tank with desired growing media[1]
Length of Establishment Phase	N/A
Active Growth Phase	Water may become depleted of nutrients after several weeks or months and should be amended with a small amount of nutrients or fertilizer throughout the active growth phase to ensure healthy growth[1]
Length of Active Growth Phase	N/A
Hardening Phase	N/A
Length of Hardening Phase	N/A

Harvesting, Storage and Shipping	N/A
Length of Storage	N/A
Guidelines for Outplanting / Performance on Typical Sites	N/A
Other Comments	N/A
INFORMATION SOURCES	
References	[1] Mudge, Christopher R. "Propagation Methods of Submersed, Emergent, and Floating Plants for Research." *Journal of Aquatic Plant Management*, vol. 56s, no. Research Methods-Special Issue, 2018, pp. 2–9, https://www.apms.org/wp-content/uploads/2021/10/japm-56-01s-2.pdf. [2] "Submersed Plants." *Department of Ecology - State of Washington*, apps.ecology.wa.gov/publications/publications/0603004.pdf. Accessed 22 May 2023. [3] "Subularia Aquatica - Water-Awlwort." *Native Plant Trust: Go Botany*, gobotany.nativeplanttrust.org/species/subularia/aquatica/. Accessed 21 May 2023. [4] "Subularia Aquatica L." *GBIF: Global Biodiversity Information Facility*, www.gbif.org/species/102272851. Accessed 21 May 2023. [5] "Subularia Aquatica L." *USDA Plants Database*, plants.usda.gov/home/plantProfile?symbol=SUAQ. Accessed 21 May 2023. [6] "Subularia Aquatica L." *Washington Department of Natural Resources*, 2006, www.dnr.wa.gov/publications/amp_nh_subaqu.pdf. [7] "Subularia Aquatica Ssp. Americana : Awlwort: Rare Species Guide." *Minnesota Department of Natural Resources*, 2 July 2022, www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=PDBRA2H012. [8] "Water Awlwort, Subularia Aquatica." *California Native Plant Society*, 2010, calscape.org/plant.php?pl=70586%3Fsrchcr.

	[9] Woodhead, N. "Subularia L." *Journal of Ecology*, vol. 39, no. 2, 1951, pp. 465–69. *JSTOR*, https://doi.org/10.2307/2257947. Accessed 22 May 2023.
Other Sources Consulted	[1] "Aqua - Subularia Aquatica." *B-Aqua*, www.b-aqua.com/pages/plantsfiche.aspx?id=1447. Accessed 21 May 2023. [2] "Subularia Aquatica - Awlwort." *Michigan Natural Features Inventory*, mnfi.anr.msu.edu/species/description/13830/Subularia-aquatica. Accessed 21 May 2023.
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