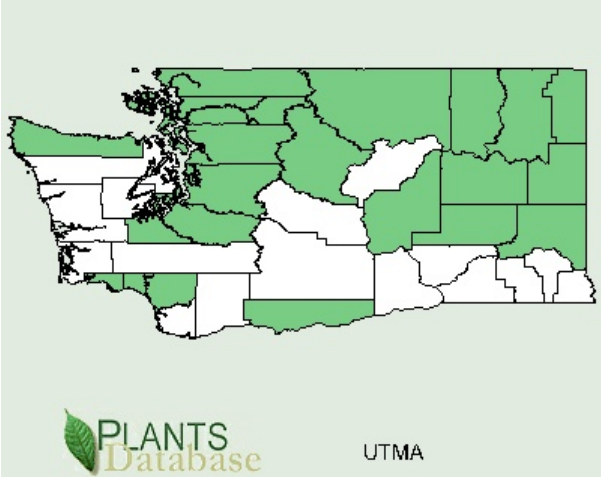
Plant Propagation Protocol for *Utricularia macrorhiza*
ESRM 412 – Native Plant Production
Spring 2009

Distribution in the US and Canada[i]

Distribution in Washington State[i]



TAXONOMY	
Family Names	
Family Scientific Name:	Lentibulariaceae
Family Common Name:	Bladderwort Family
Scientific Names	
Genus:	*Utricularia*
Species:	*macrorhiza*
Species Authority:	Leconte
Variety:	
Sub-species:	
Cultivar:	
Authority for Variety/Sub-species:	
Common Synonym(s) (include full scientific names (e.g., *Elymus glaucus* Buckley), including variety or subspecies information)	*Utricularia vulgaris* L. p.p. *Utricularia vulgaris* L. ssp. *macrorhiza* (Leconte) R.T. Clausen *Utricularia vulgaris* L. var. *americana* A. Gray[ii]
Common Name(s):	common bladderwort, greater bladderwort
Species Code (as per USDA Plants database):	UTMA
GENERAL INFORMATION	
Geographical range (distribution maps for North America and Washington state)	See maps above for distribution in the US/Canada and Washington State. Distributed widely across the Northern Hemisphere[iii] and Pacific Northwest Coast[iv] and may also be found in North Africa.[v]
Ecological distribution (ecosystems it occurs in, etc):	Freshwater wetlands and streams; can thrive in the upper 3 ft. of the water column.[vi] Prefers still, shallow,

	and slightly acidic water.[vii]
Climate and elevation range	"Frost hardy" and widely distributed in North America in areas where minimum winter temperature is between –20º F and 30º F (zones 5-9 in Robinson 1997)[viii]; low to middle elevations.[ix]
Local habitat and abundance; may include commonly associated species	Found in "ponds, lakes, sluggish streams"[x] and can become very abundant, filling large basins under good conditions[xi] and reach several feet in length.[xii] Frequently colonized by algae and requires animal prey such as *Daphnia* to thrive. [xiii] Can live sympatrically with a wide variety of emergent aquatic plants.[xiv] Empirical studies suggest that *Utricularia* growth and development is related to abundance of algae and arthropod prey in a complex network of positive feedback possibly mediated by ambient nutrient levels.[xv]
Plant strategy type / successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)	Competitor in suitable aquatic habitat. Favored by an established arthropod community that both feeds on algal competitors and provides prey.[xvi] Requires a no- or low-flow aquatic environment.[xvii]
Plant characteristics (life form (shrub, grass, forb), longevity, key characteristics, etc)	Perennial, carnivorous, free-floating, submerged, obligate aquatic herb.[xviii] Shows little differentiation of typical organs (no cotyledons or roots, lack of true leaves).[xix] Plant "stems" (actually stolons) can be up to 2 meters long and "leaves" are deep green, highly dissected, and feathery. Small, hair-triggered bladder traps interspersed among leaves serve to capture arthropod prey.[xx] Sexual reproduction occurs through seeds (borne in capsules[xxi]). Chasmogamous flowers emerge in late summer and are borne on pedicels above the water's surface. Flowers are bright yellow and snapdragon-like.[xxii] Pollinators are currently unknown.[xxiii] Asexual reproduction occcurs through vegetative resprouting from turions (hairy, walnut-sized modified apical buds).[xxiv] Turions form in autumn, overwinter in the substrate, and sprout in spring.[xxv]
PROPAGATION DETAILS[1]	
Ecotype (this is meant primarily for experimentally derived protocols,	

[1] Though species in genus *Utricularia* reproduce both sexually and asexually, all propagation protocols consulted offered only vegetative propagation protocols for free-floating species such as *U. macrorhiza*.

and is a description of where the seed that was tested came from):	
Propagation Goal (Options: Plants, Cuttings, Seeds, Bulbs, Somatic Embryos, and/or Other Propagules):	Plants
Propagation Method (Options: Seed or Vegetative):	Vegetative
Product Type (options: Container (plug), Bareroot (field grown), Plug + (container-field grown hybrids, and/or Propagules (seeds, cuttings, poles, etc.))	Bareroot (an adult plant suitable for transplant to an outdoor environment)
Stock Type:	Divided plant or turion
Time to Grow (from seeding until plants are ready to be outplanted):	Indeterminate
Target Specifications (size or characteristics of target plants to be produced):	Indeterminate
Propagule Collection (how, when, etc):	Either collect turions in early spring (after overwintering) or divide an adult plant later in the growing season (summer).[xxvi]
Propagule Processing/Propagule Characteristics (including seed density (# per pound), seed longevity, etc):	Turions are modified apical buds, green or brown in color, hairy, and walnut-sized.[xxvii] Divided plants can simply be formed by dividing up an adult *U. macrorhiza*.
Pre-Planting Propagule Treatments (cleaning, dormancy treatments, etc):	Turions should have overwintered outdoors.
Growing Area Preparation / Annual Practices for Perennial Crops (growing media, type and size of containers, etc):	Most sources suggest that *U. macrorhiza* thrives in large containers such as a child's swimming pool or plastic tub (holding at least 50 gallons of water)[xxviii] or in outdoor ponds.[xxix] In this case, provide a peat substrate (one cup of peat mixed into each gallon of water[xxx]). Alternatively,[xxxi] obtain an aquarium or glass bowl and fill with 1 inch of wet peat moss, packed firm. This may be covered with a layer of clean, lime-free shingle. Add water without disturbing the peat moss until desired water level is reached. Introduce *Daphnia* either purchased live from an aquarium shop or by adding pond water. In the latter case, try not to introduce algae in the aquarium.
Establishment Phase (from seeding to germination):	Float the turion or divided plant – do not bury in substrate. For small containers, place in a sunless

	location for two weeks to prevent algae growth.[xxxii]
Length of Establishment Phase:	Indeterminate
Active Growth Phase (from germination until plants are no longer actively growing):	Return to lighted conditions if originally propagated in darkness. Sunny to partly sunny conditions are best.[xxxiii]
Length of Active Growth Phase:	Until winter dormancy
Hardening Phase (from end of active growth phase to end of growing season; primarily related to the development of cold-hardiness and preparation for winter):	When temperatures grow cool, new turions will develop.
Length of Hardening Phase:	Unspecified
Harvesting, Storage and Shipping (of seedlings):	Keep turions moist and cold, but do not freeze.
Length of Storage (of seedlings, between nursery and outplanting):	Until spring resprouting
Guidelines for Outplanting / Performance on Typical Sites (eg, percent survival, height or diameter growth, elapsed time before flowering):	Turions will rise to the surface and resprout once spring conditions return.[xxxiv] Transplant early in the growing season and start new colonies every two to three years.[xxxv]
Other Comments (including collection restrictions or guidelines, if available):	If algae develops, dissolve exactly .2 grams of copper sulfate crystals in 540 mL of distilled water. Add one ounce for each gallon of aquarium water – no more.[xxxvi] Introduce tadpoles (though they also consumer *Utricularia* or change peat and water if algae growth becomes severe.[xxxvii] Rice (2006) also notes that the *Alvondra* protocol (pp. 48-49) can be used to propagate submerged *Utricularia*. This protocol, however, is fairly complicated and probably not necessary for a species as robust as *Utricularia* macrorhiza.[xxxviii]
INFORMATION SOURCES	
References (full citations):	See Below
Other Sources Consulted (but that contained no pertinent information) (full citations):	See Below
Protocol Author (First and last name):	Jake J. Grossman
Date Protocol Created or Updated (MM/DD/YY):	15 April 2009

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Englund, G., and S. Harms. 2003. Effects of light and microcrustacean prey on growth and investment in carnivory in *Utricularia vulgaris*. *Freshwater Biology* 48:786-794.

Everettt, T.H. 1981. *The New York Botanical Garden encyclopedia of horticulture* Vol. 10. New York: Garland Publishing, pp.3453.

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Note: This template was modified by J.D. Bakker from that available at: http://www.nativeplantnetwork.org/network/SampleBlankForm.asp

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[i] "*Utricularia macrorhiza* Leconte." USDA, NRCS. 2009. The PLANTS Database (http://plants.usda.gov, 11 April 2009). National Plant Data Center, Baton Rouge, LA 70874-4490, USA.

[ii] "*Utricularia macrorhiza* Leconte" 2009.
Note: *U. vulgaris* remains a very common synonym for *U. macrorhiza*.

[iii] "*Utricularia vulgaris*." Washington State Department of Ecology. 2009. An on-line version of an aquatic plant identification manual for Washington's freshwater plants (http://www.ecy.wa.gov/programs/wq/plants/plantid2/index.html 11 April 2009). Washington State Department of Ecology, Olympia, WA 98504-7600.

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[v] Fenner, B. The amazing bladderworts, genus *Utricularia*. The Aquarium Gardener Series (http://www.wetwebmedia.com/PlantedTksSubWebIndex/utricularia.htm, 11 April 2009.) WetWebMedia.com.

[vi] Robinson, P. 1997. *The American Horticultural Society complete guide to water gardening*. New York, NY: DK, pp. 179.

[vii] Nash, H., and S. Stroupe. 1998. *Aquatic plants & their cultivation: a complete guide for water gardeners*. New York, NY: Sterling Publishing Co., pp. 179.

[viii] Robinson 1997.

[ix] Pojar and MacKinnon 1994.

[x] Pojar and MacKinnon 1994.

[xi] D'Amato, P. 1998. *The savage garden: cultivating carnivorous plants.* Berkeley, CA: Ten Speed Press, pp. 231-235.

[xii] Robinson 1997.

[xiii] Slack, A. 1980. *Carnivorous Plants*. Cambridge, MA: MIT Press, pp. 224-225; D'Amato 1998.

[xiv] Personal Observation, JJG

[xv] Ulanowicz, R.E. 1995. Utricularia's secret: the advantage of positive feedback in oligotrophic environments. *Ecological Modeling* 79:49-57; Englund, G., and S. Harms. 2003. Effects of light and microcrustacean prey on growth and investment in carnivory in *Utricularia vulgaris*. *Freshwater Biology* 48:786-794.

[xvi] Slack 1980.

[xvii] Pojar and MacKinnon 1994.

[xviii] Robinson 1997.

[xix] Schnell, D.E. 2002. *Carnivorous plants of the United States and Canada*, 2nd ed. Portland, OR: Timber Press, pp. 361.

[xx] "*Utricularia vulgaris*" 2009.

[xxi] "*Utricularia vulgaris*" 2009.

[xxii] "*Utricularia vulgaris*" 2009.

[xxiii] Schnell 2002

[xxiv] Robinson 1997; D'Amato 1998

[xxv] Schnell 2002

[xxvi] Robinson 1997; D'Amato 1998

[xxvii] D'Amato 1998

[xxviii] D'Amato 1998; Schnell 2002

[xxix] Everett, T.H. 1981. *The New York Botanical Garden encyclopedia of horticulture* Vol. 10. New York: Garland Publishing, pp.3453.

[xxx] D'Amato 1998

[xxxi] Slack 1980

[xxxii] Slack 1980

[xxxiii] D'Amato 1998
[xxxiv] Schnell 2002
[xxxv] D'Amato 1998
[xxxvi] Slack 1980
[xxxvii] D'Amato 1998
[xxxviii] Rice, B.A. 2006. *Growing carnivorous plants*. Portland, OR: Timber Press, pp. 48-49, 159.