

<b>Taxon:</b> <i>Limnobium laevigatum</i>	<b>Family:</b> Hydrocharitaceae
<b>Common Name(s):</b> Amazon frogbit smooth frogbit South American spongeplant West Indian spongeplant	<b>Synonym(s):</b> <i>Hydromystria laevigata</i> (Humb. & Bonpl.) <i>Hydromystria stolonifera</i> G. Mey. <i>L. spongia</i> subsp. <i>laevigatum</i> (Humb. & Bonpl.) <i>Limnobium stolonifera</i> (G. Mey.) <i>Salvinia laevigata</i> Humb. & Bonpl. ex Mart.

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> Assessor Approved	<b>End Date:</b> 16 Sep 2015
<b>WRA Score:</b> 24.0	<b>Designation:</b> H(HPWRA)	<b>Rating:</b> High Risk

**Keywords:** Aquatic, Environmental Weed, Dense Cover, Water-Dispersed, Spreads Vegetatively

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)		
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle		
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	y
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic		
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)		
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed		
707	Propagules dispersed by other animals (externally)	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m <sup>2</sup> )		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	y
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

**Supporting Data:**

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	No evidence

102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	High
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 15 Sep 2015]	"Native: NORTHERN AMERICA Southern Mexico: Mexico - Federal District, Mexico, Michoacan, Morelos, Tabasco SOUTHERN AMERICA Caribbean: Antigua and Barbuda - Antigua; Cuba; Dominican Republic; Guadeloupe; Martinique; Montserrat; Puerto Rico; St. Lucia; Trinidad and Tobago - Trinidad Mesoamerica: Costa Rica; El Salvador; Guatemala; Nicaragua; Panama Northern South America: French Guiana; Guyana; Suriname; Venezuela [n.] Brazil: Brazil Western South America: Colombia; Ecuador; Peru Southern South America: Argentina - Buenos Aires, Chaco, Corrientes, Entre Rios, Formosa, Salta, Santa Fe, Tucuman; Chile [n.]; Paraguay; Uruguay"

Qsn #	Question	Answer
202	Quality of climate match data	High
	Source(s)	Notes
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 15 Sep 2015]	

203	Broad climate suitability (environmental versatility)	
	Source(s)	Notes
	Dave's Garden. 2015. Sponge Plant, Amazon Frogbit - <i>Limnobium laevigatum</i> . <a href="http://davesgarden.com/guides/pf/go/31858/">http://davesgarden.com/guides/pf/go/31858/</a> . [Accessed 16 Sep 2015]	"Hardiness: USDA Zone 8b: to -9.4 °C (15 °F) USDA Zone 9a: to -6.6 °C (20 °F) USDA Zone 9b: to -3.8 °C (25 °F) USDA Zone 10a: to -1.1 °C (30 °F) USDA Zone 10b: to 1.7 °C (35 °F) USDA Zone 11: above 4.5 °C (40 °F)"
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	[Elevation range may exceed 1000 m] "Very rare, in shallow ponds, sluggish shaded streams, and in fresh-water ditches or swamps at or near sea level. It is noteworthy that this species grows at elevations of up to more than 2, 000 meters in South America."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Origin: Introduced from tropical to sub-tropical Central and South America. In California, smooth frogbit has escaped cultivation as a pond ornamental"

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	Introduced to & naturalized in Japan, Australia, and California [see 3.01]

301	Naturalized beyond native range	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Range: Only found in California to date. Habitat: Found growing wild in lakes, ponds, and slow rivers. Origin: Introduced from tropical to sub-tropical Central and South America. In California, smooth frogbit has escaped cultivation as a pond ornamental"

Qsn #	Question	Answer
	Kadono, Y. (2004). Alien aquatic plants naturalized in Japan: history and present status. <i>Global Environmental Research</i> , 8(2): 163-169	"Species which have been cultivated in aquaria and ponds such as <i>Limnobium laevigatum</i> and <i>Hydrocleis nymphoides</i> have sometimes been observed to grow in the wild. They must have been transplanted intentionally by some aquarium enthusiasts. It is, however, doubtful if they will spread in the future. They may be of temporal occurrence, but some plants which were transplanted to the wild have established themselves."
	Waterhouse, B. M., Mitchell, A. A., & Eldershaw, V. (2012). Weeds of tropical Australia: how do they get here?. In <i>Developing solutions to evolving weed problems. 18th Australasian Weeds Conference, Melbourne, Victoria, Australia, 8-11 October 2012 (pp. 9-12). Weed Science Society of Victoria Inc.</i>	"Table 1. Date of first naturalised record and probable entry pathways for some recent weeds of northern Australia (Queensland unless otherwise indicated)." [ <i>Limnobium laevigatum</i> - Date = 2011; Probable pathway = Via aquarium industry]

302	Garden/amenity/disturbance weed	n
	Source(s)	Notes
	Randall, R.P. 2012. <i>A Global Compendium of Weeds</i> . 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

303	Agricultural/forestry/horticultural weed	
	Source(s)	Notes
	Lallana, V. H. (2005). Lista de malezas del cultivo de arroz en Entre Ríos, Argentina. <i>Ecosistemas</i> , 14(2): 162-167	"Tabla 2. Lista de especies de malezas en campos de cultivo de arroz, ordenadas alfabéticamente." [Translation; "List of species of weeds in rice fields , sorted alphabetically." Includes <i>Limnobium laevigatum</i> . No description of impacts]

304	Environmental weed	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. <i>Weed Control in Natural Areas in the Western United States</i> . Weed Research and Information Center, University of California, Davis, CA	"Impacts: Can form dense stands in aquatic systems and impede the flow of water. Also weedy in Canada and South America. Western states listed as Noxious Weed: California California Invasive Plant Council (Cal-IPC) Inventory: High Invasiveness (Alert)"

305	Congeneric weed	y
	Source(s)	Notes
	Madsen, J. D., Owens, C. S., & Getsinger, K. D. (1998). Evaluation of four herbicides for management of American frogbit ( <i>Limnobium spongia</i> ). <i>Journal of Aquatic Plant Management</i> , 36: 148-150	"Although a native plant, American frogbit can produce extensive floating mats and create nuisance situations, such as blocking navigation, affecting water quality, fish and wildlife habitat, and recreational usage."

Qsn #	Question	Answer
	Les, D. H., & Mehrhoff, L. J. (1999). Introduction of nonindigenous aquatic vascular plants in southern New England: a historical perspective. <i>Biological Invasions</i> , 1(2-3): 281-300	"Limnobium spongia is included with nonindigenous aquatic monocots because it has been introduced outside of its former range ( <a href="http://nas.er.usgs.gov/monocots/monocotslist.htm">http://nas.er.usgs.gov/monocots/monocotslist.htm</a> ). Although native to North America, frog-bit is capable of weedy growth. Steward (1990) listed L. spongia among problematic aquatic plants in the eastern USA, but not as a major weed. Knight (1985) indicated that Limnobium was as troublesome as nonindigenous species. It is difficult to control and can assume water hyacinthlike growth in some Florida localities (Knight 1985; Bodle 1986). It hinders navigation in the St. John's River, Florida where it is targeted for control more often than water hyacinth (Knight 1985)."

401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Smooth frogbit or spongeplant is a floating to rooted stoloniferous perennial with foliage that may be confused with that of water hyacinth. The floating rosettes send runners out into the water, the ends of which form juvenile plants. The juvenile form has thick, spongy, floating ovate to spatula-shaped leaves, usually with rounded tips and on an inflated stalk. Juvenile rosettes gradually develop into mature clumps to about 2 ft tall, with leathery, emergent, broadly elliptic leaves. Unlike water hyacinth, smooth frogbit typically has juvenile leaves and sometimes mature leaves with a patch or disc of honeycomb-like spongy tissue (aerenchyma) on the lower surfaces."

402	Allelopathic	n
	Source(s)	Notes
	Elakovich, S. D., & Wooten, J. W. (1989). Aquatic Plant Control Research Program. Allelopathic Aquatic Plants for Aquatic Plant Management: A Feasibility Study. Technical Report A-89-2. University of Southern Mississippi, Hattiesburg, Mississippi	"Table 2 Results of Lettuce Seedling Radical Inhibition by Aqueous Extracts of Selected Aquatic Plants" ... "Table 4 Results of Lemna minor Dry Weight Reduction by Aqueous Extracts of Selected Aquatic Plants" [Extracts from a related species, Limnobium spongia, inhibit growth of both test plants]

403	Parasitic	n
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Smooth frogbit or spongeplant is a floating to rooted stoloniferous perennial with foliage that may be confused with that of water hyacinth." [Hydrocharitaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	Notes

Qsn #	Question	Answer
	Corti, P., & Pablo Schlatter, R. (2002). Feeding ecology of the black necked swan <i>Cygnus melancoryphus</i> in two wetlands of Southern Chile. <i>Studies on Neotropical Fauna and Environment</i> , 37(1): 9-14	[Consumed by geese] "The other two species constituting major fractions in the diet of swans are native to South America (Ramírez et al., 1980, 1982). Potamogeton berteroi, a sub-aquatic plant, is common in lagoons and rivers and is usually found in flowing waters (Ramírez et al., 1982), such as the Cruces River, while <i>Limnobium laevigatum</i> , a floating water plant, is usually abundant in still waters (Ramírez et al., 1982), such as the Chihua wetland. These findings indicate that blacknecked swans may forage in both types of wetlands."
	Corriale, M. J., Arias, S. M., & Quintana, R. D. (2011). Forage quality of plant species consumed by capybaras ( <i>Hydrochoerus hydrochaeris</i> ) in the Paraná River Delta, Argentina. <i>Rangeland Ecology &amp; Management</i> , 64(3): 257-263	[Not consumed by capybaras] "The least digestible species were <i>Pontederia cordata</i> , <i>Limnobium laevigatum</i> , and <i>Zizaniopsis bonariensis</i> , with acid detergent fiber values higher than 41%,..." ... "Table 2. Nutritional analysis of the main plant species consumed and not consumed by capybara in the Lower Delta of the Parana River." [ <i>Limnobium laevigatum</i> is NC - Not consumed]

405	Toxic to animals	n
	Source(s)	Notes
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	Joyner, B. G., & Freeman, T. E. (1973). Pathogenicity of <i>Rhizoctonia solani</i> to Aquatic Plants. <i>Phytopathology</i> , 63: 681-685	"A <i>Rhizoctonia solani</i> isolate (RhEa) from diseased anchoring hyacinth ( <i>Eichhornia azurea</i> ) in Panama was pathogenic to several aquatic plants, particularly to water hyacinth ( <i>E. crassipes</i> ) and water lettuce ( <i>Pistia stratiotes</i> )." ... "Symptoms induced by RhEa in other aquatics with large leaves (frogbit and pickerel weed) were similar to those on water hyacinth and water lettuce. However, secondary spread from the initial lesion was not as evident as on water hyacinth and water lettuce."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[No evidence. Aquatic] "Smooth frogbit or spongeplant is a floating to rooted stoloniferous perennial ... "

Qsn #	Question	Answer
409	<b>Is a shade tolerant plant at some stage of its life cycle</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Dave's Garden. 2015. Sponge Plant, Amazon Frogbit - <i>Limnobium laevigatum</i> . <a href="http://davesgarden.com/guides/pf/go/31858/">http://davesgarden.com/guides/pf/go/31858/</a> . [Accessed 16 Sep 2015]	"Sun Exposure: Full Sun"
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	[Shaded streams] " <i>Limnobium spongia</i> subsp. <i>laevigatum</i> " ... "Very rare, in shallow ponds, sluggish shaded streams, and in fresh-water ditches or swamps at or near sea level."

410	<b>Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)</b>	
	<b>Source(s)</b>	<b>Notes</b>
	Dave's Garden. 2015. Sponge Plant, Amazon Frogbit - <i>Limnobium laevigatum</i> . <a href="http://davesgarden.com/guides/pf/go/31858/">http://davesgarden.com/guides/pf/go/31858/</a> . [Accessed 16 Sep 2015]	"Soil pH requirements: Unknown - Tell us"

411	<b>Climbing or smothering growth habit</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Impacts: Can form dense stands in aquatic systems and impede the flow of water."

412	<b>Forms dense thickets</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Impacts: Can form dense stands in aquatic systems and impede the flow of water."

501	<b>Aquatic</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"Monoecious, freshwater perennials." [Generic description]

502	<b>Grass</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>



Qsn #	Question	Answer
	USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <a href="http://www.ars-grin.gov/">http://www.ars-grin.gov/</a> . [Accessed 16 Sep 2015]	"Family: Hydrocharitaceae subfamily: Hydrocharitoideae"

503	Nitrogen fixing woody plant	n
	Source(s)	Notes
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"Monoecious, freshwater perennials." [Hydrocharitaceae. No evidence]

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Smooth frogbit or spongeplant is a floating to rooted stoloniferous perennial with foliage that may be confused with that of water hyacinth."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Acevedo-Rodríguez, P. & Strong, M.T. 2005. Monocotyledons and Gymnosperms of Puerto Rico and the Virgin Islands. Contributions from the United States National Herbarium 52: 1-415	[No evidence] "General distribution: Mexico, Central America, Greater Antilles (except Jamaica), Lesser Antilles, Trinidad, and South America as far south as Argentina but rare or lacking in most of the Amazon basin."

602	Produces viable seed	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Plants are monoecious and produce small solitary or paired unisexual white flowers (~0.5 inches in diameter) with inferior ovaries on stalks up to ~1/3 the height of the leaves. Capsules are fleshy, berry-like, containing seeds that are covered with short hairs. Dispersal is by seed and stem fragments and by attaching to watercraft. A large mat of runners and adult plants can develop very quickly, shading plants growing below. Smooth frogbit seeds germinate rapidly to produce extremely small, floating seedlings that can resemble duckweed (e.g. Lemna spp.) and are easily dispersed by wind, currents, tidal action and also on waterfowl, boats and even trapped on water hyacinth plants. Seeds appear to survive for at least 4 years."

Qsn #	Question	Answer
603	Hybridizes naturally	
	Source(s)	Notes
	WRA Specialist. 2015. Personal Communication	Unknown. No evidence found

604	Self-compatible or apomictic	
	Source(s)	Notes
	Sutton, D.L. 1991. The Hydrocharitaceae or Frog's-bit Family. <i>Aquatics</i> 13(1): 4-12	[Unlikely. self-pollination prevented] "Small male and female flowers borne on short stalks are found on American Frog's-bit. Although male and female flowers occur on the same plant, they develop at different times to prevent self-pollination. After pollination the female flower coils downward and seed development occurs underwater."

605	Requires specialist pollinators	n
	Source(s)	Notes
	Cook, C. D. (1988). Wind pollination in aquatic angiosperms. <i>Annals of the Missouri Botanical Garden</i> , 75 (3): 768-777	"Within the Hydrocharitaceae, <i>Limnobium</i> is the only genus with dry, powdery, and buoyant pollen that is transported to the stigmas by movements of air and thus can be called anemophilous."
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	[Wind-pollinated] "Pollen transferred through air. In <i>Limnobium</i> (Fig. 62D,E), described in detail by Cook and Urmi-Konig (1983c), the male flowers are held above the females. Pollen is liberated from the anthers, where it is either directly blown away or falls onto the spreading sepals where it may be further transported by wind or fall as the sepals wither."

606	Reproduction by vegetative fragmentation	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Dispersal is by seed and stem fragments and by attaching to watercraft. A large mat of runners and adult plants can develop very quickly, shading plants growing below." ... "Mechanical choppers and shredders leave viable pieces of frogbit that can easily reestablish populations and also may disperse with moving water or wind."

607	Minimum generative time (years)	
	Source(s)	Notes
	Plant Finder. 2015. <i>Limnobium laevigatum</i> . <a href="http://www.aquaticplantcentral.com/forumapc/plantfinder/">http://www.aquaticplantcentral.com/forumapc/plantfinder/</a> . [Accessed 16 Sep 2015]	"Growth Rate: Very Fast"

Qsn #	Question	Answer
701	<b>Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Dispersal is by seed and stem fragments and by attaching to watercraft."

702	<b>Propagules dispersed intentionally by people</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. 2015. Personal Communication	Sold as an aquarium plant on a number of commercial websites

703	<b>Propagules likely to disperse as a produce contaminant</b>	
	<b>Source(s)</b>	<b>Notes</b>
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Possibly as a contaminant of other aquatic plants] "floating seedlings that can resemble duckweed (e.g. Lemna spp.) and are easily dispersed by wind, currents, tidal action and also on waterfowl, boats and even trapped on water hyacinth plants."

704	<b>Propagules adapted to wind dispersal</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"A large mat of runners and adult plants can develop very quickly, shading plants growing below. Smooth frogbit seeds germinate rapidly to produce extremely small, floating seedlings that can resemble duckweed (e.g. Lemna spp.) and are easily dispersed by wind, currents, tidal action and also on waterfowl, boats and even trapped on water hyacinth plants."

705	<b>Propagules water dispersed</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Dispersal is by seed and stem fragments and by attaching to watercraft. A large mat of runners and adult plants can develop very quickly, shading plants growing below. Smooth frogbit seeds germinate rapidly to produce extremely small, floating seedlings that can resemble duckweed (e.g. Lemna spp.) and are easily dispersed by wind, currents, tidal action and also on waterfowl, boats and even trapped on water hyacinth plants."
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"The seeds of Hydrocharis and Limnobium germinate at the water surface; at first, the testa is shed and the seedling floats on the surface."

706	<b>Propagules bird dispersed</b>	
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Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[External dispersal by birds] "Smooth frogbit seeds germinate rapidly to produce extremely small, floating seedlings that can resemble duckweed (e.g. Lemna spp.) and are easily dispersed ... on waterfowl, boats and even trapped on water hyacinth plants."

<b>707</b>	<b>Propagules dispersed by other animals (externally)</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Seedlings attach externally to waterfowl] "Smooth frogbit seeds germinate rapidly to produce extremely small, floating seedlings that can resemble duckweed (e.g. Lemna spp.) and are easily dispersed ... on waterfowl, boats and even trapped on water hyacinth plants."

<b>708</b>	<b>Propagules survive passage through the gut</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	Kubitzki, K. (ed.). 1998. The Families and genera of vascular plants. Volume IV. Flowering plants, Monocotyledons: Alismatanae and Commelinanae (except Gramineae). Springer-Verlag, Berlin, Heidelberg, New York	"In Halophila, Hydrocharis, Limnobium, and Stratiotes the fruit is somewhat fleshy and is perhaps eaten by animals."

<b>801</b>	<b>Prolific seed production (&gt;1000/m2)</b>	
	<b>Source(s)</b>	<b>Notes</b>
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Densities unknown] "Capsules are fleshy, berry-like, containing seeds that are covered with short hairs. Dispersal is by seed and stem fragments and by attaching to watercraft. A large mat of runners and adult plants can develop very quickly, shading plants growing below. Smooth frogbit seeds germinate rapidly to produce extremely small, floating seedlings that can resemble duckweed (e.g. Lemna spp.) and are easily dispersed by wind, currents, tidal action and also on waterfowl, boats and even trapped on water hyacinth plants. Seeds appear to survive for at least 4 years."

<b>802</b>	<b>Evidence that a persistent propagule bank is formed (&gt;1 yr)</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Seeds appear to survive for at least 4 years."

<b>803</b>	<b>Well controlled by herbicides</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>

Qsn #	Question	Answer
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Certain herbicides provide effective control] "2,4-D is a relatively fast-acting, selective systemic herbicide. Effects (symptoms) usually appear within a few days to a week and include collapse of petioles and twisted petioles." ... "Glyphosate is a slow-acting systemic herbicide. Efficacy can be reduced if plants have dust and fine debris on the petioles (leaves). Therefore, applications made 24 hr after rains wash off the dust can often have increased efficacy." ... "Imazamox ... Use an approved surfactant. Aerial application is approved in some states." ... "Imazapyr ... May require repeated applications to maintain desired concentration for 5 to 7 weeks." ... "Penoxsulam is a slow acting herbicide and may take 4 to 6 weeks to show effects." ... "Diquat is a contact herbicide that is inactivated in turbid water. Only clean water should be used to mix and spray the herbicide." ... "Flumioxazin ... If infestation is dense, treat in sections and wait 10 to 14 days before treating the next section. Do not treat the same section of water within 28 days. Flumioxazin may be tank mixed with 2,4-D."

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Cutting results in dispersal of viable fragments] "Mechanical choppers and shredders leave viable pieces of frogbit that can easily reestablish populations and also may disperse with moving water or wind. An added concern with mechanical removal is that it can dislodge and spread very small (ca. 0.1 to 2 cm) frogbit seedlings that then float to adjacent areas. These can also be easily transported by the workboats and harvesting equipment. Where possible, containment nets or curtains should be deployed to minimize off-site dispersal of seedling and small plants. When populations are discovered early and before seeds are produced, physical removal can be a very effective tool."

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	Notes
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"There are no host-specific biological control agents available for <i>Limnobium</i> . The triploid grass carp may be useful in small infestations but it is a nonselective herbivore that prefers submersed plants, which it is likely to consume before it feeds on frogbit."
	WRA Specialist. 2015. Personal Communication	Unknown

**Summary of Risk Traits:**

## High Risk / Undesirable Traits

- Elevation range exceeds 1000 m, demonstrating environmental versatility
- Grows in tropical climates
- Naturalized in California, Australia, Japan & possibly elsewhere
- An environmental weed
- *Limnobium spongia* also invasive
- Can form dense stands in aquatic systems & impede the flow of water
- Reproduces by seeds & vegetatively
- Seeds & vegetative fragments dispersed by water, stuck to boats & animals, intentionally by people, and internally by animals
- Seeds persist for 4 or more years
- Mechanical damage & control efforts can contribute to spread of viable vegetative fragments

## Low Risk Traits

- Unarmed (no spines, thorns or burrs)
- Non-toxic
- Ornamental
- Several herbicides provide effective control