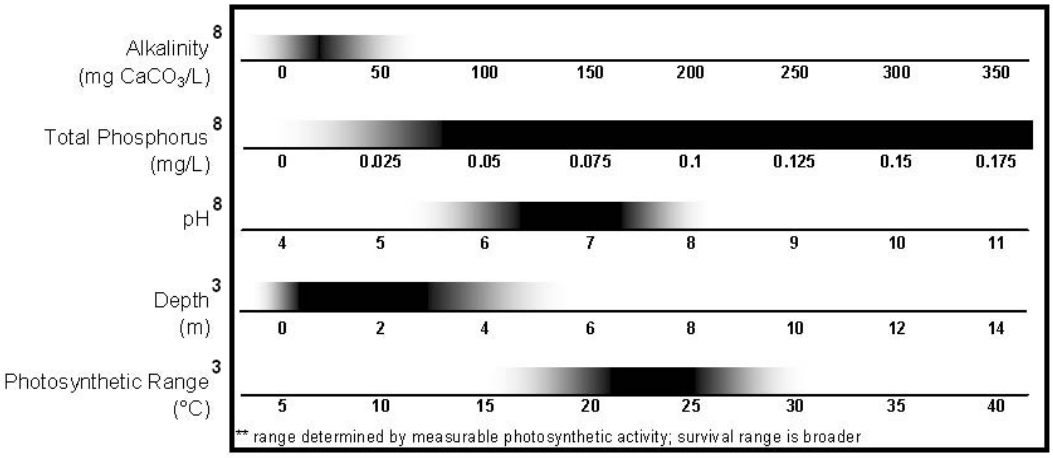
Aquatic Plant	Limnophila; Asian marshweed; Ambulia

I. Current Status and Distribution — *Limnophila sessiliflora*

a. Range	Global/Continental	Wisconsin
Native Range Asia[1]	 *Figure 1: U.S and Canada Distribution Map*[2]	Not recorded in Wisconsin
Abundance/Range		
Widespread:	Southern United States; Florida[2,3]	Not applicable
Locally Abundant:	Texas, southern Georgia[3]	Not applicable
Sparse:	Anaerobic conditions (no seed germination)[4]; thermal waters of Hungary[5]	Not applicable
Range Expansion		
Date Introduced:	Lake Seminole, Florida/Georgia, 1965[3]	Not applicable
Rate of Spread:	May be stabilizing; in Florida, 27 acres in 1979[6]; 24 acres found in 1992[7]	Not applicable
Density		
Risk of Monoculture:	High	Unknown
Facilitated By:	Ability to outshade and outcompete native submerged aquatic vegetation[3]	Unknown
b. Habitat	Streams, rivers, lakes, damp soils[3]; wetlands, agricultural areas, rice paddy fields, ditches[1]	
Tolerance	Chart of tolerances: Increasingly dark color indicates increasingly optimal range	



Preferences	In or near organically stained, acidic or clear, slightly alkaline water[9]; light intensity of 215 micro-einsteins/m^2/hr[(3)]

c. Regulation	
Noxious/Regulated[2]:	Federal Noxious Weed List; AL, CA, FL, MA, NC, OR, SC, VT
Minnesota Regulations:	*Prohibited*; One may not possess, import, purchase, propagate, or transport
Michigan Regulations:	*Not regulated*
Washington Regulations:	*Not regulated*
II. Establishment Potential and Life History Traits	
a. Life History	Freshwater amphibious herbaceous dicot perennial; polymorphic submersed and emersed leaf forms[3]
Fecundity	High
Reproduction	Sexual[4]; Asexual[3]
Importance of Seeds:	Each flower may set 200-300 seeds, with up to 96% germination rate[4]; fruit is a capsule containing up to 150 seeds[9,10]
Vegetative:	Somewhat important; though seeds appear to play a larger factor[4]
Hybridization	*Limnophila sessiliflora* X *L. indica* hybrid reported in rice paddy fields[11]
Overwintering	
Winter Tolerance:	Low; minimum survival temperature of 15°C (59°F)[3]
Phenology:	Starts growing in low light before other plants; flowers July through November in Florida and Texas[3]
b. Establishment	
Climate	
Weather:	Warm tropical/subtropical climate; minimum survival temperature is 15°C (59°F); optimum of 20-26°C[(3)]
Wisconsin-Adapted:	Uncertain; depends on overwintering abilities of seeds
Climate Change:	Warmer climate likely to facilitate growth and distribution
Taxonomic Similarity	
Wisconsin Natives:	Medium; family Scrophulariaceae
Other US Exotics:	High; similar to *Limnophila indica*[3]
Competition	
Natural Predators:	Undocumented
Natural Pathogens:	Undocumented
Competitive Strategy:	Low light compensation and saturation points[4,12]; fast-growing[3]
Known Interactions:	Can outshade native submersed species[1,3]; reported to outcompete Hydrilla[10]
Reproduction	
Rate of Spread:	High[1]
Adaptive Strategies:	Can regrow from small fragments[1,3]; floating mats can transport fragments and seeds downstream[9]
Timeframe	Florida DEP recently reported non-nuisance levels for the past 25 years[3]
c. Dispersal	
Intentional:	Aquarium trade[3]
Unintentional:	Water currents; mechanical harvesters[3]
Propagule Pressure:	Medium; fragments easily accidentally introduced; source populations not near Wisconsin

Figures 2 and 3: Courtesy of Vic Ramey, University of Florida[3]

III. Damage Potential	
a. Ecosystem Impacts	
Composition	Native plant richness and abundance decreases[3]
Structure	Dense stands of stems occur throughout water column[3]; biomass distributed both at and above the water surface[4]
Function	Decrease in light penetration
Allelopathic Effects	Yes; toxins present in stem tissue may deter herbivorous fish[9]
Keystone Species	Undocumented
Ecosystem Engineer	Yes; dense canopy decreases light penetration to natives
Sustainability	Undocumented
Biodiversity	Decreases
Biotic Effects	Potentially impacts native species at multiple trophic levels
Abiotic Effects	Undocumented
Benefits	Undocumented
b. Socio-Economic Effects	
Benefits Caveats	Undocumented Not applicable
Impacts of Restriction	Increase in monitoring, education, and research costs
Negatives	Clogs irrigation, flood-control canals, pumping and power stations[3]; major problem weed of rice paddies of India, China, Japan, and the Philippines[3]; large amounts of surface biomass could inhibit recreational activities[4]
Expectations	Undocumented
Cost of Impacts	Decreased recreational and aesthetic value; decline in ecological integrity; increased research expenses
"Eradication" Cost	Expensive
IV. Control and Prevention	
a. Detection	
Crypsis: Benefits of Early Response:	Medium; similar to *L. indica*[3] and *Cabomba caroliniana*[1,3] Undocumented

b. Control	
Management Goal 1	Eradication
Tool:	Chemical (2-4,D)[1,13]
Caveat:	High levels of chemical needed[13]; non-target plant species are negatively impacted
Cost:	Expensive
Efficacy, Time Frame:	Very limited control
Tool:	Chemical (paraquat)[14]
Caveat:	Non-target plant species are negatively impacted; *L. sessiliflora* has developed resistance to Sulfonylurea (SU) herbicides
Cost:	Expensive
Efficacy, Time Frame:	High levels of 2,4-D and daily spraying of paraquat for 8 straight days at 1000ppm[(14)]
Management Goal 2	Nuisance relief
Tool:	Mechanical harvesting
Caveat:	Non-target plant species are negatively impacted; fragments created by harvesting may increase spread[3]
Cost:	Expensive
Efficacy, Time Frame:	Not an efficient management plan

[1] Global Invasive Species Database. 2006. *Limnophila sessiliflora*. Retrieved December 23, 2010 from: http://www.issg.org/database/species/ecology.asp?si=602&fr=1&sts=

[2] United States Department of Agriculture, Natural Resource Conservation Service. 2010. The PLANTS Database. National Plant Data Center, Baton Rouge, LA, USA. Retrieved December 23, 2010 from: http://plants.usda.gov/java/profile?symbol=LISE3

[3] Ramey, V. 2001. University of Florida, Center for Aquatic and Invasive Plants. *Limnophila sessiliflora*. Retrieved December 23, 2010 from: http://plants.ifas.ufl.edu/node/234

[4] Spencer, W. and G. Bowes. 1985. *Limnophila* and *Hygrophila*: a review and physiological assessment of their weed potential in Florida. Journal of Aquatic Plant Management. 23:7-16.

[5] Brunel, S. 2009. Pathway analysis: aquatic plants imported in 10 EPPO countries. Bulletin OEPP/EPPO Bulletin 39:201-213.

[6] Tarver, D.P. 1979. The 1979 Florida Aquatic Flora Survey Report. Department of Natural Resources, Bureau of Aquatic Plant Research and Control. 56pp.

[7] Schardt, J. 1992. Florida Aquatic Plant Survey Report. Florida Department of Environmental Protection, Bureau of Aquatic Plant Management. 83pp.

[8] Kunii, H. 1991. Records of Aquatic Macrophyte Flora and Environmental Factors from the Irrigation Ponds around Lake Shinji, Shimane, Japan. Memoirs of the Faculty of Science, Shimane University.

[9] Hall, D.W., V.V. Vandiver and C.J. Gray. 2006. University of Florida, Institute of Food and Agriculture Studies Extension. Limnophila, *Limnophila sessiliflora* (Vahl). Retrieved December 23, 2010 from: http://edis.ifas.ufl.edu/pdffiles/FW/FW02500.pdf

[10] Scher, J.L. and D.S. Walters. 2010. Federal noxious weed disseminules of the U.S. California Department of Food and Agriculture, and Center for Plant Health Science and Technology, USDA, APHIS, PPQ. *Limnophila sessiliflora* (Vahl) Blume. Retrieved December 23, 2010

from: http://keys.lucidcentral.org/keys/v3/FNWE2/key/FNW_Seeds/Media/Html/fact_sheets/Limnophila_sessiliflora.htm

[11] Piccoli, F. 1974. A previously unrecorded weed in rice fields *Limnophila indica* and *Limnophila sessiliflora* hybrid. Riso (Milan) 23:181-190.

[12] Spencer, W. and G. Bowes. 1984. Baseline Physiology of the Potential Problem Plants, *Limnophila sessiliflora* and *Hygrophila polysperma*. Final Project Report to DNR.

[13] Mahler, M.J. 1980. *Limnophila*, a new exotic pest. Aquatics 2:4-7.

[14] Wang, G-X., H. Watanabe, A. Uchino and K. Itoh. 2000. Response of a Sulfonylurea (SU)-resistant biotype of *Limnophila sessiliflora* to selected SU and alternative herbicides. Pesticide Biochemistry and Physiology 68(2):59-66.