NEW YORK
NON-NATIVE PLANT INVASIVENESS RANKING FORM

Scientific name:	Trapa natans L.	USDA Plants Code: TRNA
Common names:	water chestnut, water caltrop	
Native distribution:	Central and eastern Europe, central Asia, tropical Africa and Asia	
Date assessed:	April 9, 2008; edited August 12, 2009	
Assessors:	Steven Clemants	
Reviewers:	LIISMA SRC	
Date Approved:	June 16, 2008	Form version date: 10 July 2009

New York Invasiveness Rank: Very High (Relative Maximum Score >80.00)

Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form*)			
	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program	Not Assessed	Not Assessed
2	Capital/Mohawk	Not Assessed	Not Assessed
3	Catskill Regional Invasive Species Partnership	Not Assessed	Not Assessed
4	Finger Lakes	Not Assessed	Not Assessed
5	Long Island Invasive Species Management Area	Restricted	Moderate
6	Lower Hudson	Not Assessed	Not Assessed
7	Saint Lawrence/Eastern Lake Ontario	Not Assessed	Not Assessed
8	Western New York	Not Assessed	Not Assessed

Invasiveness Ranking Summary (see details under appropriate sub-section)		Total (Total Answered*) Possible	Total
1	Ecological impact	40 (40)	40
2	Biological characteristic and dispersal ability	25 (25)	13
3	Ecological amplitude and distribution	25 (25)	23
4	Difficulty of control	10 (10)	6
	Outcome score	100 (100)[b]	82[a]
	Relative maximum score †		82.00
	New York Invasiveness Rank §	Very High (Relative Maximum Score >80.0	

* For questions answered "unknown" do not include point value in "Total Answered Points Possible." If "Total Answered Points Possible" is less than 70.00 points, then the overall invasive rank should be listed as "Unknown."
†Calculated as 100(a/b) to two decimal places.
§Very High >80.00; High 70.00–80.00; Moderate 50.00–69.99; Low 40.00–49.99; Insignificant <40.00
Not Assessable: not persistent in NY, or not found outside of cultivation.

A. DISTRIBUTION (KNOWN/POTENTIAL): Summarized from individual PRISM forms

A1.1. Has this species been documented to persist without cultivation in NY? (reliable source; voucher not required)	
☒	Yes – continue to A1.2
☐	No – continue to A2.1
A1.2. In which PRISMs is it known (see inset map)?	
☒	Adirondack Park Invasive Program
☒	Capital/Mohawk
☐	Catskill Regional Invasive Species Partnership
☒	Finger Lakes
☒	Long Island Invasive Species Management Area
☒	Lower Hudson
☒	Saint Lawrence/Eastern Lake Ontario
☒	Western New York

Documentation:
Sources of information:
Brooklyn Botanic Garden 2008; IPCNYS 2008; Weldy & Werier 2005

A2.1. What is the likelihood that this species will occur and persist outside of cultivation, given the climate in the following PRISMs? (obtain from PRISM invasiveness ranking form)

Very Likely	Adirondack Park Invasive Program
Very Likely	Capital/Mohawk
Moderately Likely	Catskill Regional Invasive Species Partnership
Very Likely	Finger Lakes
Very Likely	Long Island Invasive Species Management Area
Very Likely	Lower Hudson
Very Likely	Saint Lawrence/Eastern Lake Ontario
Very Likely	Western New York

Documentation:
Sources of information (e.g.: distribution models, literature, expert opinions):
Occurs in all but one PRISM.

If the species does not occur and is not likely to occur in any of the PRISMs, then stop here as there is no need to assess the species. Rank is "Not Assessable."

A2.2. What is the current distribution of the species in each PRISM? (obtain rank *from PRISM invasiveness ranking forms*)

	Distribution
Adirondack Park Invasive Program	Not Assessed
Capital/Mohawk	Not Assessed
Catskill Regional Invasive Species Partnership	Not Assessed
Finger Lakes	Not Assessed
Long Island Invasive Species Management Area	Restricted
Lower Hudson	Not Assessed
Saint Lawrence/Eastern Lake Ontario	Not Assessed
Western New York	Not Assessed

Documentation:
Sources of information:
IPCNYS 2008; Brooklyn Botanic Garden 2008

A2.3. Describe the potential or known suitable habitats within New York. Natural habitats include all habitats not under active human management. Managed habitats are indicated with an asterisk.

Aquatic Habitats	Wetland Habitats	Upland Habitats
☐ Salt/brackish waters	☐ Salt/brackish marshes	☐ Cultivated*
☒ Freshwater tidal	☐ Freshwater marshes	☐ Grasslands/old fields
☒ Rivers/streams	☐ Peatlands	☐ Shrublands
☒ Natural lakes and ponds	☐ Shrub swamps	☐ Forests/woodlands
☐ Vernal pools	☐ Forested wetlands/riparian	☐ Alpine
☒ Reservoirs/impoundments*	☐ Ditches*	☐ Roadsides*
	☐ Beaches and/or coastal dunes	

Other potential or known suitable habitats within New York:

Documentation:
Sources of information:
IPCNYS 2008

B. INVASIVENESS RANKING

Questions apply to areas similar in climate and habitats to New York unless specified otherwise.

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes and System-Wide Parameters (e.g. fire regime, geomorphological changes (erosion, sedimentation rates), hydrologic regime, nutrient and mineral dynamics, light availability, salinity, pH)

A.	No perceivable impact on ecosystem processes based on research studies, or the absence of impact information if a species is widespread (>10 occurrences in minimally managed areas), has been well-studied (>10 reports/publications), and has been present in the northeast for >100 years.	0
B.	Influences ecosystem processes to a minor degree (e.g., has a perceivable but mild influence on soil nutrient availability)	3
C.	Significant alteration of ecosystem processes (e.g., increases sedimentation rates along streams or coastlines, reduces open water that are important to waterfowl)	7
D.	Major, possibly irreversible, alteration or disruption of ecosystem processes (e.g., the species alters geomorphology and/or hydrology, affects fire frequency, alters soil pH, or fixes substantial levels of nitrogen in the soil making soil unlikely to support certain native plants or more likely to favor non-native species)	10
U.	Unknown	

Score: 10

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
Dense beds alter geochemistry (periods of hypoxia affect redox sensitive chemical reactions) and can intercept 95% of incident sunlight. May result in reduced availability of nitrogen due to dentrification losses.
Sources of information:
Caraco & Cole 2002; Groth et al. 1996; Hummel & Kiviat 2004; Hummel & Findlay 2006

1.2. Impact on Natural Community Structure

A.	No perceived impact; establishes in an existing layer without influencing its structure	0
B.	Influences structure in one layer (e.g., changes the density of one layer)	3
C.	Significant impact in at least one layer (e.g., creation of a new layer or elimination of an existing layer)	7
D.	Major alteration of structure (e.g., covers canopy, eradicating most or all layers below)	10
U.	Unknown	

Score: 10

Documentation:
Identify type of impact or alteration:
Dense floating beds exclude other floating species and shade out vegetation beneath.
Sources of information:
Groth et al. 2006; Hummel & Kiviat 2004

1.3. Impact on Natural Community Composition

A.	No perceived impact; causes no apparent change in native populations	0
B.	Influences community composition (e.g., reduces the number of individuals in one or more native species in the community)	3
C.	Significantly alters community composition (e.g., produces a significant reduction in the population size of one or more native species in the community)	7
D.	Causes major alteration in community composition (e.g., results in the extirpation of one or several native species, reducing biodiversity or change the community composition towards species exotic to the natural community)	10
U.	Unknown	

Score 10

Documentation:
Identify type of impact or alteration:
In Hudson river Trapa natans has apparently displaced submersed aquatic plant beds but tall emergent vegetation seems unaffected. Local extirpation of species.
Sources of information:
Hummel & Kiviat 2004; C. O'Neil per. obser.

1.4. Impact on other species or species groups (cumulative impact of this species on the animals, fungi, microbes, and other organisms in the community it invades. Examples include reduction in nesting/foraging sites; reduction in habitat connectivity; injurious components such as spines, thorns, burrs, toxins; suppresses soil/sediment microflora; interferes with native pollinators and/or pollination of a native species; hybridizes with a native species; hosts a non-native disease which impacts a native species)

A.	Negligible perceived impact	0
B.	Minor impact	3
C.	Moderate impact	7
D.	Severe impact on other species or species groups	10
U.	Unknown	

Score 10

Documentation:
Identify type of impact or alteration:
Epiphyton and macroinvertebrate abundance was markedly reduced under waterchestnut beds in most studies but some indicate the reverse. Fish species inhabiting water chestnut beds are the common, very tolerant species. Dense beds are poor habitats for sensitive fish and invertebrates due to low oxygen levels; fish diversity is reduced under Trapa. Reduces duck food.
Sources of information:
Cattaneo et al. 1998; Feldman 2001; Hummel & Kiviat 2004; Strayer et al. 2003; C. O'Neil per. obser.

Total Possible 40
Section One Total 40

2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction

A.	No reproduction by seeds or vegetative propagules (i.e. plant sterile with no sexual or asexual reproduction).	0
B.	Limited reproduction (fewer than 10 viable seeds per plant AND no vegetative reproduction; if viability is not known, then maximum seed production is less than 100 seeds per plant and no vegetative reproduction)	1
C.	Moderate reproduction (fewer than 100 viable seeds per plant - if viability is not known, then maximum seed production is less than 1000 seeds per plant - OR limited successful vegetative spread documented)	2
D.	Abundant reproduction with vegetative asexual spread documented as one of the plants prime reproductive means OR more than 100 viable seeds per plant (if viability is not known, then maximum seed production reported to be greater than 1000 seeds per plant.)	4
U.	Unknown	

Score 2

Documentation:
Describe key reproductive characteristics (including seeds per plant):
Each rosette produces 10-15, 1-seeded fruits

Sources of information:
Countryman 1978; Groth et al. 1996; Kiviat & Beecher 1991

2.2. Innate potential for long-distance dispersal (e.g. bird dispersal, sticks to animal hair, buoyant fruits, pappus for wind-dispersal)

A.	Does not occur (no long-distance dispersal mechanisms)	0
B.	Infrequent or inefficient long-distance dispersal (occurs occasionally despite lack of adaptations)	1
C.	Moderate opportunities for long-distance dispersal (adaptations exist for long-distance dispersal, but studies report that 95% of seeds land within 100 meters of the parent plant)	2
D.	Numerous opportunities for long-distance dispersal (adaptations exist for long-distance dispersal and evidence that many seeds disperse greater than 100 meters from the parent plant)	4
U.	Unknown	

Score 2

Documentation:
Identify dispersal mechanisms:
Seeds are few and heavy but may move with currents and floods. They are better developed for persistance than dispersal. Whole plants or fragments may be unintentionally dispersed by drift downstream. Occasionally the fruit can cling to birds, mammals, or other objects.
Sources of information:
Bickley & Cory 1955; Hummel & Kiviat 2004; Kurihara & Ikusima 1991;A. Lindberg & B. Titus pers. obser.

2.3. Potential to be spread by human activities (both directly and indirectly – possible mechanisms include: commercial sales, use as forage/revegetation, spread along highways, transport on boats, contaminated compost, land and vegetation management equipment such as mowers and excavators, etc.)

A.	Does not occur	0
B.	Low (human dispersal to new areas occurs almost exclusively by direct means and is infrequent or inefficient)	1
C.	Moderate (human dispersal to new areas occurs by direct and indirect means to a moderate extent)	2
D.	High (opportunities for human dispersal to new areas by direct and indirect means are numerous, frequent, and successful)	3
U.	Unknown	

Score 2

Documentation:
Identify dispersal mechanisms:
Occasionally grown in water gardens and aquaria. Whole plants or fragments transported by boats or other vehicles.
Sources of information:
Countryman 1978; Hummel & Kiviat 2004

2.4. Characteristics that increase competitive advantage, such as shade tolerance, ability to grow on infertile soils, perennial habit, fast growth, nitrogen fixation, allelopathy, etc.

A.	Possesses no characteristics that increase competitive advantage	0
B.	Possesses one characteristic that increases competitive advantage	3
C.	Possesses two or more characteristics that increase competitive advantage	6
U.	Unknown	

Score 3

Documentation:
Evidence of competitive ability:

Fast growing plant producing up to 50 rosettes per sq. m. in one year
Sources of information:
Besha & Countryman 1979; Hummel & Kiviat 2004; Pemberton 2002; Tsuchiya & Iwaki 1984

2.5. Growth vigor

A.	Does not form thickets or have a climbing or smothering growth habit	0
B.	Has climbing or smothering growth habit, forms a dense layer above shorter vegetation, forms dense thickets, or forms a dense floating mat in aquatic systems where it smothers other vegetation or organisms	2
U.	Unknown	

Score 2

Documentation:
Describe growth form:
Floating rosettes can produce very dense vegetetation shading out submersed vegetation
Sources of information:
Caraco & Cole 2002; Goth et al. 1996; Hummel & Kiviat 2004

2.6. Germination/Regeneration

A.	Requires open soil or water and disturbance for seed germination, or regeneration from vegetative propagules.	0
B.	Can germinate/regenerate in vegetated areas but in a narrow range or in special conditions	2
C.	Can germinate/regenerate in existing vegetation in a wide range of conditions	3
U.	Unknown (No studies have been completed)	

Score 3

Documentation:
Describe germination requirements:
Seeds germinate in spring, after 4 months dormancy. At that time there is no aquatic vegetation and temperatures get about 12 C.
Sources of information:
Cozza et al. 1994; Countryman 1978; Hummel & Kiviat 2004; Kurihara & Ikusima 1991

2.7. Other species in the genus invasive in New York or elsewhere

A.	No	0
B.	Yes	3
U.	Unknown	

Score 0

Documentation:
Species:
Only one species in North America. Most botanists recognize 2 varieties. Some recognize up to 25 sp.

Total Possible	25
Section Two Total	13

3. ECOLOGICAL AMPLITUDE AND DISTRIBUTION

3.1. Density of stands in natural areas in the northeastern USA and eastern Canada (use same definition as Gleason & Cronquist which is: "The part of the United States covered extends from the Atlantic Ocean west to the western boundaries of Minnesota, Iowa, northern Missouri, and southern Illinois, south to the southern boundaries of Virginia, Kentucky, and Illinois, and south to the Missouri River in Missouri. In Canada the area covered includes Nova Scotia, Prince Edward Island, New Brunswick, and parts of Quebec and Ontario lying south of the 47th parallel of latitude")

A.	No large stands (no areas greater than 1/4 acre or 1000 square meters)	0
B.	Large dense stands present in areas with numerous invasive species already present or disturbed landscapes	2
C.	Large dense stands present in areas with few other invasive species present (i.e. ability to invade relatively pristine natural areas)	4
U.	Unknown	

Score: 4

Documentation:
Identify reason for selection, or evidence of weedy history:
Forms dense stands in nearly all sheltered subtidal shallow areas along the Hudson River.
Forms dense stands in southern Lake Champlain.
Sources of information:
ummel & Kiviat 2004; IPCNYS 2008; BBG staff observation

3.2. Number of habitats the species may invade

A.	Not known to invade any natural habitats given at A2.3	0
B.	Known to occur in one natural habitat given at A2.3	1
C.	Known to occur in two natural habitats given at A2.3	2
D.	Known to occur in three natural habitat given at A2.3	4
E.	Known to occur in four or more natural habitats given at A2.3	6
U.	Unknown	

Score: 4

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
See A2.3 Three natural habitats (freshwater tidal areas, river and streams, natural lakes and ponds)
Sources of information:
Countryman 1978; Hummel & Kiviat 2004; IPCNYS 2008; BBG staff observations

3.3. Role of disturbance in establishment

A.	Requires anthropogenic disturbances to establish.	0
B.	May occasionally establish in undisturbed areas but can readily establish in areas with natural or anthropogenic disturbances.	2
C.	Can establish independent of any known natural or anthropogenic disturbances.	4
U.	Unknown	

Score: 4

Documentation:
Identify type of disturbance:
Establishes well in eutrophic low-energy systems. Some of these are anthropogenic but many are not.
Sources of information:
Humme & Kiviat 2004

3.4. Climate in native range

A.	Native range does not include climates similar to New York	0
B.	Native range possibly includes climates similar to at least part of New York.	1
C.	Native range includes climates similar to those in New York	3
U.	Unknown	

Score: 3

Documentation:
Describe what part of the native range is similar in climate to New York:
Central Europe (Poland, German, France)
Sources of information:
GRIN n.d.

3.5. Current introduced distribution in the northeastern USA and eastern Canada (see question 3.1 for definition of geographic scope)

A.	Not known from the northeastern US and adjacent Canada	0
B.	Present as a non-native in one northeastern USA state and/or eastern Canadian province.	1
C.	Present as a non-native in 2 or 3 northeastern USA states and/or eastern Canadian provinces.	2
D.	Present as a non-native in 4–8 northeastern USA states and/or eastern Canadian provinces, and/or categorized as a problem weed (e.g., "Noxious" or "Invasive") in 1 northeastern state or eastern Canadian province.	3
E.	Present as a non-native in >8 northeastern USA states and/or eastern Canadian provinces. and/or categorized as a problem weed (e.g., "Noxious" or "Invasive") in 2 northeastern states or eastern Canadian provinces.	4
U.	Unknown	

Score: 4

Documentation:
Identify states and provinces invaded:
Canada: ON; USA: DC, DE, MA, MD, NJ, NY, PA, VA, VT
Sources of information: See known introduced range in plants.usda.gov, and update with information from states and Canadian provinces.
NatureServe 2008; USDA, NRCS 2008

3.6. Current introduced distribution of the species in natural areas in the eight New York State PRISMs (Partnerships for Regional Invasive Species Management)

A.	Present in none of the PRISMs	0
B.	Present in 1 PRISM	1
C.	Present in 2 PRISMs	2
D.	Present in 3 PRISMs	3
E.	Present in more than 3 PRISMs or on the Federal noxious weed lists	4
U.	Unknown	

Score: 4

Documentation:
Describe distribution:
Reported from all PRISMs except Catskills. Along the Hudson from Saratoga to Orange Cos, in the lower Lake Champlain Basin; along the Mohawk, Oneida Lake Basin, Great Lakes Basin, one record for Chataqua and Nassau cos.
Sources of information:
Brooklyn Botanic Garden 2008; IPCNYS 2008; Mills et al. 1993; Szprygada 2002; Weldy & Werier 2007

Total Possible: 25
Section Three Total: 23

4. DIFFICULTY OF CONTROL

4.1. Seed banks

A.	Seeds (or vegetative propagules) remain viable in soil for less than 1 year, or does not make viable seeds or persistent propagules.	0
B.	Seeds (or vegetative propagules) remain viable in soil for at least 1 to 10 years	2
C.	Seeds (or vegetative propagules) remain viable in soil for more than 10 years	3
U.	Unknown	

	Score
	2

Documentation:
Identify longevity of seed bank:
Seeds stay viable for 5-10 years but quickly lose viability if they dry out
Sources of information:
Kunii 1988; Winne 1950

4.2. Vegetative regeneration

A.	No regrowth following removal of aboveground growth	0
B.	Regrowth from ground-level meristems	1
C.	Regrowth from extensive underground system	2
D.	Any plant part is a viable propagule	3
U.	Unknown	

	Score
	0

Documentation:
Describe vegetative response:
Plant is annual, reproducing exclusively from seed each year. Seeds may be produced from damaged or fragmented rosettes.
Sources of information:
Groth et al. 1996

4.3. Level of effort required

A.	Management is not required: e.g., species does not persist without repeated anthropogenic disturbance.	0
B.	Management is relatively easy and inexpensive: e.g. 10 or fewer person-hours of manual effort (pulling, cutting and/or digging) can eradicate a 1 acre infestation in 1 year (infestation averages 50% cover or 1 plant/100 ft^2).	2
C.	Management requires a major short-term investment: e.g. 100 or fewer person-hours/year of manual effort, or up to 10 person-hours/year using mechanical equipment (chain saws, mowers, etc.) for 2-5 years to suppress a 1 acre infestation. Eradication is difficult, but possible (infestation as above).	3
D.	Management requires a major investment: e.g. more than 100 person-hours/year of manual effort, or more than 10 person hours/year using mechanical equipment, or the use of herbicide, grazing animals, fire, etc. for more than 5 years to suppress a 1 acre infestation. Eradication may be impossible (infestation as above).	4
U.	Unknown	

	Score
	4

Documentation:
Identify types of control methods and time-term required:
Need to remove plants for at least 10-12 years. $500,000 spent to control T. natans in Champlain basin in 2000 by VT.
Sources of information:
Elser 1964; Pemberton 2002

Total Possible	10
Section Four Total	6

Total for 4 sections Possible	100
Total for 4 sections	82

C. STATUS OF CULTIVARS AND HYBRIDS:

At the present time (May 2008) there is no protocol or criteria for assessing the invasiveness of cultivars independent of the species to which they belong. Such a protocol is needed, and individuals with the

appropriate expertise should address this issue in the future. Such a protocol will likely require data on cultivar fertility and identification in both experimental and natural settings.

Hybrids (crosses between different parent species) should be assessed individually and separately from the parent species wherever taxonomically possible, since their invasiveness may differ from that of the parent species. An exception should be made if the taxonomy of the species and hybrids are uncertain, and species and hybrids can not be clearly distinguished in the field. In such cases it is not feasible to distinguish species and hybrids, and they can only be assessed as a single unit.

Some cultivars of the species known to be available:

References for species assessment:

Besha, J.A. and W.D. Countryman. 1980. Feasibility assessment of anaerobic digestion of European water chestnuts (Trapa natans L.). New York State Energy Research and Development Authority 80-13, Albany.

Bickley, W.E. and E.N. Cory. 1955. Water calthrop in the Chesapeake Bay. Association of Southeastern Biologists Bulletin 2: 27-28.

Brooklyn Botanic Garden. 2008. AILANTHUS database. [Accessed on April 4, 2008].

Caraco, N.F. and J.J. Cole. 2002. Contrasting impacts of a native and alien macrophyte on dissolved oxygen in a large river. Ecological Applications 12(5): 1496-1509.

Cattaneo, A, G. Galanti, S. Gentinetta, and S. Romo. 1998. Epiphytic algae and macroinvertebrates on submersed and floating-leaves macrophytes in an Italian lake. Freshwater Biology 39: 725-740.

Countryman, W.D. 1978. Nuisance aquatic plants in Lake Champlain: Lake Champlain Basin Study, Burlington, VT. US Department of Commerce, National Technical Information Service PB-293 439.

Cozza, R., G. Galanti, M. B. Bitonti, and A. M. Innocenti. 1994. Effect of storage at low temperature on the germination of the waterchestnut (Trapa natans L.) Phyton 34: 315-320.

Elser, H.J. 1964. Control of water chestnut by machine, in Maryland, 196401965. Proceedings of the Northeastern Weed Conference 20: 682-687.

Feldman, R.S. 2001. Taxonomic and size structures of phytophilous macroinvertebrate communities in Vallisneria and Trapa beds of the Hudson River, New York. Hydrobiologia 452: 233-245.

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Groth, A.T.L., L. Lovett-Doust and J. Lovette-Doust. 1996. Population density and module demography in Trapa natans (Trapaceae), an annual, clonal aquatic macrophyte. American Journal of Botany. 83(11): 1406-1415.

Hummel, M. and E. Kiviat. 2004. Review of World Literature on Water Chestnut with Implications for Management in North America. Journal of Aquatic Plant Management 42: 17-28.

Hummel, M. and S. Findlay. 2006. Effects of water chestnut (Trapa natans) beds on water chemistry in the tidal freshwater Hudson river. Hydrobiologia 559: 169-181.

IPCNYS. 2008. Target Plants: Water Chestnut. Invasive Plant Council of New York State website. http://ipcnys.org/sections/target/water_chestnut_overview.htm. Accessed 4/8/2008.

Kiviat, E. and E. Beecher. 1991. Vegetation in the fresh-tidal habitats of Tivoli Bays, Hudson River. Corrected version. Report to National Oceanic and Atmospheric Administration, Washington, D.C.

Kunii, H. 1988. Longevity and germinability of buried seed in Trapa sp. Memoirs of the Faculty of Science of Shimane University 22: 83-91.

Kurihara, M. and I. Ikusima. 1991. The ecology of the seed in Trpapa natans var. japonica in a eutrophic lake. Vegetatio 97: 117-124.

Mills, E. L., J. H. Leach, J. Carlton, and C. L. Secor. 1993. Exotic species in the Great Lakes: a history of biotic crises and anthropogenic introductions. Journal of Great Lakes Research 19: 1-54.

NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: March 19, 2008).

Pemberton, R. W. 2002. 3. Water Chestnut. In: Van Driesche, R., et al., Biological Control of Invasive Plants in the Eastern United States, USDA Forest Service Publication FHTET-2002-04, 413 p.

Strayer, D.L., C. Lutz, H.M. Malcom, K. Munger, and W.H. Shaw. 2003. Invertebrate communities associated with a native (Vallisneria americana) and an alien (Trapa natans) macrophyte in a large river. Freshwater biology 48(11): 1938-1949.

Syprygada, K. 2002. Regional Water Chestnut Investigation Project Summary. Central New York Regional Planning and Development Board. http://www.cnyrpdb.org/programs/env/reg/wcproj.asp. Accessed 4/10/2008

Tsuchiya, T. and H. Iwaki. 1984. Seasonal changes in phytosynthesis and primary production of a floating leaved plant, Trapa natans L., community in Lake Kasumiguara, Japan. Japanese Journal of Ecology 34: 367-374.

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Winne, W.T. 1950. Water chestnut: A foreign menace. Bulletin to the Schools 36(7): 230-234.Brooklyn Botanic Garden. 2008.

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References for ranking form:

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