NEW YORK
FISH & AQUATIC INVERTEBRATE INVASIVENESS RANKING FORM

Scientific name:	Bithynia tentaculata
Common names:	Faucet Snail, Mud Bithynia
Native distribution:	Europe, from Scandinavia to Greece
Date assessed:	
Assessors:	E. Schwartzberg
Reviewers:	
Date Approved:	Form version date: 8 June 2009

New York Invasiveness Rank:

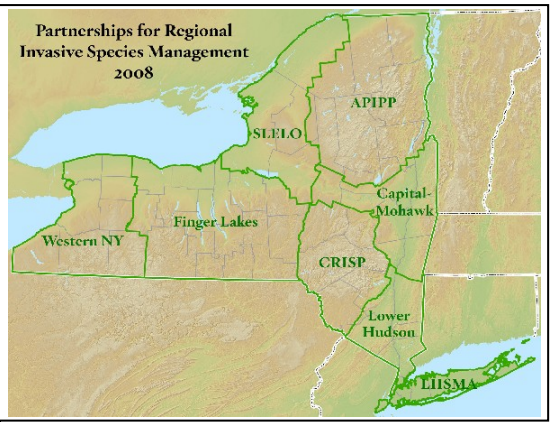
Distribution and Invasiveness Rank (*Obtain from PRISM invasiveness ranking form*)			
	Status of this species in each PRISM:	Current Distribution	PRISM Invasiveness Rank
1	Adirondack Park Invasive Program	Not Assessed	Not Assessed
2	Capital/Mohawk	Not Assessed	Not Assessed
3	Catskill Regional Invasive Species Partnership	Not Assessed	Not Assessed
4	Finger Lakes	Not Assessed	Not Assessed
5	Long Island Invasive Species Management Area	Not Assessed	Not Assessed
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	30 (17)	17
2	Biological characteristic and dispersal ability	30 (24)	24
3	Ecological amplitude and distribution	30 (27)	20
4	Difficulty of control	10 (7)	6
	Outcome score	100 (94)[b]	67[a]
	Relative maximum score †		71.28
	New York Invasiveness Rank §	High (Relative Maximum Score 70.00-80.00)	

* 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

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

A1.1. Has this species been documented in NY? (reliable source; voucher not required)	
☒	Yes – continue to A1.2
☐	No – continue to A2.1; Yes ☐ NA; Yes ☐ USA
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:
iMapInvasives, 2012; USGS, 2012.

A2.0. Is this species listed on the Federal Injurious Fish and Wildlife list?
☐ Yes – the species will automatically be listed as Prohibited, no further assessment required.
☒ No – continue to A2.1

A2.1. What is the likelihood that this species will occur and persist given the climate in the following PRISMs? (obtain from PRISM invasiveness ranking form and/ or Climatch score)

Very Likely	Adirondack Park Invasive Program
Very Likely	Capital/Mohawk
Very 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):
ADAFF, 2012; iMapInvasives, 2012; USGS, 2012.

If the species does not occur and is not likely to survive and reproduce within any of the PRISMs, then stop here as there is no need to assess the species.

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	Not Assessed
Lower Hudson	Not Assessed
Saint Lawrence/Eastern Lake Ontario	Not Assessed
Western New York	Not Assessed

Documentation:
Sources of information:

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

Other potential or known suitable habitats within New York:
Canals

Documentation:
Sources of information:
Kipp et al., 2012.

B. INVASIVENESS RANKING

1. ECOLOGICAL IMPACT

1.1. Impact on Natural Ecosystem Processes (e.g., water cycle, energy cycle, mineral and cycle)

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, has a perceivable but mild influence	3
C.	Significant alteration of ecosystem processes	7
D.	Major, possibly irreversible, alteration or disruption of ecosystem processes	10
U.	Unknown	

Score 0

Documentation:
Identify ecosystem processes impacted (or if applicable, justify choosing answer A in the absence of impact information)
Google Scholar searches on species + question title key words yeilded no reports of effecting ecosystem processes other than affecting food source abundance (See B1.2). Web of Science search for "ts=Bithynia tentaculata" in combination with key words yeild only results from performance studies of Bithynia tentaculata in response to ecosystem processes. Likewise Web of Science search "ts=Bithynia tentaculata" yeilded 110 peer reviewd papers since 1969. Present in U.S. since 1870 (Mills et al., 1993).
Sources of information:
Mills et al., 1993.

1.2. Impact on Natural Habitat/ 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 of 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:
Grazing by this generalist consumer affects periphyton biomass (Burgmer et al., 2012) and has displaced molusks in the Family Pleuroceridae (Harman, 2000 and references therein).
Sources of information:
Burgmer et al., 2012; Harman, 2000.

1.3. Impact on other species or species groups, including cumulative impact of this species on other organisms in the community it invades. (e.g., interferes with native predator/ prey dynamics; injurious components/ spines; reduction in spawning; hybridizes with a native species; hosts a non-native disease which impacts a native species)

A.	Negligible perceived impact	0
B.	Minor impact (e.g. impacts 1 species, <20% population decline, limited host damage)	3
C.	Moderate impact (e.g. impacts 2-3 species and/ or 20-29% population decline of any 1 species, kills host in 2-5 years, ,)	7
D.	Severe impact on other species or species groups (e.g. impacts >3 species and/ or ≥30%	10

population decline of any 1 species, kills host within 2 years, extirpation)

U. Unknown

Score 7

Documentation:
Identify type of impact or alteration:
Die-offs of water birds attributed to snails being the first and second intermediate host for the pathogenic trematodes Cyathocotyle bushiensis and Sphaeridiotrema globulus.
Sources of information:
Sauer et al., 2007; Lawrence at al., 2009.

Total Possible 30

Section One Total 17

2. BIOLOGICAL CHARACTERISTICS AND DISPERSAL ABILITY

2.1. Mode and rate of reproduction (provisional thresholds, more investigation needed)

A. No reproduction (e.g. sterile with no sexual or asexual reproduction). 0

B. Limited reproduction (e.g., intrinsic rate of increase <10%, low fecundity, complete one life cycle) 1

C. Moderate reproduction (e.g., intrinsic rate of increase between 10-30%, moderate fecundity, complete 2-3 life cycles) 2

D. Abundant reproduction (e.g., intrinsic rate of increase >30%, parthenogenesis, large egg masses, complete > 3 life cycles) 4

U. Unknown

Score 1

Documentation:
Describe key reproductive characteristics:
Dioecious: protandry observed, and this offset of alternate sexes presumably limits asexuality. Semelparous.
Sources of information:
Browne and Russel-Hunter, 1978; Dussart, 1979.

2.2. Migratory behavior

A. Always migratory in its native range 0

B. Non-migratory or facultative migrant in its native range 2

U. Unknown

Score 2

Documentation:
Describe migratory behavior:
No socumentation of migratory behaviors or adaptations found.
Sources of information:

2.3. Biological potential for colonization by long-distance dispersal/ movement (e.g., veligers, resting stage eggs, glochidia)

A. No long-distance dispersal/ movement mechanisms 0

B. Adaptations exist for long-distance dispersal, but studies report that most individuals (90%) establish territories within 5 miles of natal origin or within a distance twice the home range of the typical individual, and tend not to cross major barriers such as dams and watershed divides 1

C. Adaptations exist for long-distance dispersal, movement and evidence that offspring often disperse greater than 5 miles of natal origin or greater than twice the home range of typical individual and will cross major barriers such as dams and watershed divides 2

U. Unknown

Score 1

Documentation:
Identify dispersal mechanisms:
Endozoochory possible in this snail, but not reported (Van Leeuwen at al., 2012).
Sources of information:
Van Leeuwen, 2005.

2.4. Practical potential to be spread by human activities, both directly and indirectly – possible vectors include: commercial bait sales, deliberate illegal stocking, aquaria releases, boat trailers, canals, ballast water exchange, live food trade, rehabilitation, pest control industry, aquaculture escapes, 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)	4
U.	Unknown	

Score 4

Documentation:
Identify dispersal mechanisms:
Can be carried on fisheries equipment can withstand equipment dissinfection (Mitchell and Cole, 2008) and has recently spread to Mississippi river system (Sauer at at., 2007).
Sources of information:
Mitchell, 2008; Sauer et al., 2007.

2.5. Non-living chemical and physical characteristics that increase competitive advantage (e.g., tolerance to various extremes, pH, DO, temperature, desiccation, fill vacant niche, charismatic species)

A.	Possesses no characteristics that increase competitive advantage	0
B.	Possesses one characteristic that increases competitive advantage	4
C.	Possesses two or more characteristics that increase competitive advantage	8
U.	Unknown	

Score 8

Documentation:
Evidence of competitive ability:
Partially afffected by potasium and nitrate, but not calcium, and no mention of competitive advantage (Dussart, 1979). Can withstand dessication (Mitchell and Cole, 2008, Wood et al., 2011) and pH extremes (Mitchell and Cole, 2008).
Sources of information:
(Mitchell and Cole, 2008, Wood et al., 2011.

2.6. Biological characteristics that increase competitive advantage (e.g., high fecundity, generalist/ broad niche space, highly evolved defense mechanisms, behavioral adaptations, piscivorous, etc.)

A.	Possesses no characteristics that increase competitive advantage	0
B.	Possesses one characteristic that increases competitive advantage	4
C.	Possesses two or more characteristics that increase competitive advantage	8
U.	Unknown	

Score 8

Documentation:
Evidence of competitive ability:
Generalist and has the ability to filter feed, providing potential competitive advantage over

coocurring gastropods (Tashiro and Colman, 1982). Can close operculum as a defense against predatory leeches (Kelly and Cory, 1987).
Sources of information:
Burgmer, et al., 2012; Kelly and Cory, 1987; Tashiro and Colman, 1982.

2.7. Other species in the family and/ or genus invasive in New York or elsewhere?

A.	No	0
B.	Yes	2
U.	Unknown	

Score: 0

Documentation:
Identify species:
Google Scholar search for "Bithynia -tentaculata invasive" or "Bithyniidae -tentaculata invasive" yeilded no results.

Total Possible: 20
Section Two Total: 30

3. ECOLOGICAL AMPLITUDE AND DISTRIBUTION

3.1. Current introduced distribution in the northern latitudes of USA and southern latitude of Canada (e.g., between 35 and 55 degrees).

A.	Not known from the northern US or southern Canada.	0
B.	Established as a non-native in 1 northern USA state and/or southern Canadian province.	1
C.	Established as a non-native in 2 or 3 northern USA states and/or southern Canadian provinces.	2
D.	Established as a non-native in 4 or more northern USA states and/or southern Canadian provinces, and/or categorized as a problem species (e.g., "Invasive") in 1 northern state or southern Canadian province.	3
U.	Unknown	

Score: 3

Documentation:
Identify states and provinces:
Montana, Minnesotta, Wisconsin, Michagan, Ohio, Pennsylvania, Virginia, Maryland, New York, Vermont
Sources of information:
- See known introduced range at www.usda.gov, and update with information from states and Canadian provinces.

Kipp at al., 2008.

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

A.	Established in none of the PRISMs	0
B.	Established in 1 PRISM	1
C.	Established in 2 or 3 PRISMs	3
D.	Established in 4 or more PRISMs	5
U.	Unknown	

Score: 5

Documentation:
Describe distribution:
Found in all PRISMS.
Sources of information:
iMapInvasives, 2012; USGS, 2012.

3.3. Number of known, or potential (each individual possessed by a vendor or consumer), individual releases and/ or release events

A.	None	0
B.	Few releases (e.g., <10 annually).	2
C.	Regular, small scale releases (e.g., 10-99 annually).	4
D.	Multiple, large scale (e.g., ≥100 annually).	6
U.	Unknown	

Score 0

Documentation:
Describe known or potential releases:
No known reason for itentional release.
Sources of information:

3.4. Current introduced population density, or distance to known occurrence, in northern USA and/ or southern Canada.

A.	No known populations established.	0
B.	Low to moderate population density (e.g., ≤1/4 to < 1/2 native population density) with few other invasives present and/ or documented in 1 or more non-adjacent state/ province and/ or 1 unconnected waterbody.	1
C.	High or irruptive population density (e.g., ≥1/2 native population density) with numerous other invasives present and/ or documented in 1 or more adjacent state/ province and/ or 1 connected waterbody.	2
U.	Unknown	

Score 2

Documentation:
Describe population density:
Outnumbers native species (Harman, 2000) and densities in England observed at 191/sq meter (Bishop and Garis, 1976).
Sources of information:
Bishop and Garis, 1976; Harman, 2000.

3.5. 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 2 or 3 of the habitats given at A2.3, with at least 1 or 2 natural habitat(s).	2
C.	Known to occur in 4 or more of the habitats given at A2.3, with at least 3 natural habitats.	3
U.	Unknown.	

Score 2

Documentation:
Identify type of habitats where it occurs and degree/type of impacts:
Colonizes and outcompetes other species in rivers/streams, natural lakes or ponds. Also occurs in non-natural habitats including canals.
Sources of information:
Harman, 2000; Sauer et al., 2007.

3.6. Role of anthropogenic (human related) and natural disturbance in establishment (e.g. water level management, man-made structures, high vehicle traffic, major storm events, etc).

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. 3
U. Unknown.

Score U

Documentation:
Identify type of disturbance:

Sources of information:

3.7. Climate in native range (e.g., med. to high, ≥5, Climatch score; within 35 to 55 degree latitude; etc.)

A. Native range does not include climates similar to New York (e.g., <10%). 0
B. Native range possibly includes climates similar to portions of New York (e.g., 10-29%). 4
C. Native range includes climates similar to those in New York (e.g., ≥30%). 8
U. Unknown.

Score 8

Documentation:
Describe known climate similarities:
Great Lakes region scores with a very similar climate (~8).
Sources of information:
ADAFF, 2012.

Total Possible 20
Section Three Total 27

4. DIFFICULTY OF CONTROL

4.1. Re-establishment potential, nearby propagule source, known vectors of re-introduction (e.g. biological supplies, pets, aquaria, aquaculture facilities, connecting waters/ corridors, mechanized transportation, live wells, etc.)

A. No known vectors/ propagule source for re-establishment following removal. 0
B. Possible re-establishment from 1 vector/ propagule source following removal and/ or viable <24 hours. 1
C. Likely to re-establish from 2-3 vectors/ propagule sources following removal and/ or viable 2-7 days. 2
D. Strong potential for re-establishment from 4 or more vectors/ propagule sources following removal and/or viable >7 days. 3
U. Unknown.

Score 2

Documentation:
Identify source/ vectors:
Fishing equipment, boots, ballasts, mechanized transportation.
Sources of information:
Mitchell et al., 2008.

4.2. Status of monitoring and/ or management protocols for species

A. Standardized protocols appropriate to New York State are available. 0
B. Scientific protocols are available from other countries, regions or states. 1
C. No known protocols exist. 2
U. Unknown

Score 2

Documentation:
Describe protocols:
No current management found.
Sources of information:
Hoverson, 2010.

4.3. Status of monitoring and/ or management resources (e.g. tools, manpower, travel, traps, lures, ID keys, taxonomic specialists, etc.)

A.	Established resources are available including commercial and/ or research tools	0
B.	Monitoring resources may be available (e.g. partnerships, NGOs, etc)	1
C.	No known monitoring resources are available	2
U.	Unknown	

Score: 2

Documentation:
Describe resources:
Mention of management planning on University of Minnesota website.
Sources of information:
University of Minnesota Website, 2012.

4.4. Level of effort required

A.	Management is not required. (e.g., species does not persist without repeated human mediated action.)	0
B.	Management is relatively easy and inexpensive; invasive species can be maintained at low abundance causing little or no ecological harm. (e.g., 10 or fewer person-hours of manual effort can eradicate a local infestation in 1 year.)	1
C.	Management requires a major short-term investment, and is logistically and politically challenging; eradication is difficult, but possible. (e.g., 100 or fewer person-hours/year of manual effort, or up to 10 person-hours/ year for 2-5 years to suppress a local infestation.)	2
D.	Management requires a major investment and is logistically and politically difficult; eradication may be impossible. (e.g., more than 100 person-hours/ year of manual effort, or more than 10 person hours/year for more than 5 years to suppress a local infestation.)	3
U.	Unknown	

Score: U

Documentation:
Identify types of control methods and time required:

Sources of information:

Total Possible	7
Section Four Total	6
Total for 4 sections Possible	94
Total for 4 sections	67

C. STATUS OF GENETIC VARIANTS AND HYBRIDS:

At the present time there is no protocol or criteria for assessing the invasiveness of genetic variants 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.

Genetic variants of the species known to exist: 0

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.

Hybrids of uncertain origin known to exist: 0

References for species assessment:

Austrailian Department of Agriculture, Fisheries, and Forestry (ADAFF). 2012. Climatch Mapping Tool. <http://adl.brs.gov.au:8080/Climatch/climatch.jsp>; [Accessed on December 17, 2012].

Bishop, M.J., and H. Garis. 1976. A note on population densities of Mollusca in the River Great Ouse at Ely, Cambridgeshire. Hydrobiologia 48(3): 195−197.

Browne, R.A., and W.D. Russell-Hunter. 1978. Reproductive effort in molluscs. Oecologia 37(1): 23−27.

Burgmer, T., J. Reiss, S.A. Wickham, and H. Hillebrand. 2012. Effects of snail grazers and light on the benthic microbial food web in periphyton communities. Aquatic Microbial Ecology 61(2): 163−178.

Dussart, G.B.J. 1979. Life cycles and distribution of the aquatic gastropod molluscs Bithynia tentaculata (L.), Gyraulus albus (Muller), Planorbis planorbis (L.) and Lymnaea peregra (Muller) in relation to water chemistry. Hydrobiologia 67(3): 223−239.

Harman, W.N. 2000. Diminishing species richness of mollusks in Oneida Lake, New York State, USA. Nautilus 114(3):120-126.

Hoverson, D. 2010. Faucet snails: What they are and why we should care. Presemtation to MN/WI Invasive Species Conference, St. Paul, Minnesota. November 2, 2010. <http://mipn.org/MNWIISC%20talks/upload%20folder/Nov92010_1040am_AquaticInvInverts_Hoverson.pdf>; [Accessed on December 18, 2012].

iMapInvasives: An Online Mapping Tool for Invasive Species Locations. 2012. <http://www.iMapInvasives.org>; [Accessed on December 17, 2012].

Kelly, P.M., and J.S. Cory. 1987. Operculum closing as a defence against predatory leeches in four British freshwater prosobranch snails. Hydrobiologia 144(2): 121−124.

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Lawrence, J., P. Loegering, R.Cole, and S. Cordts. Scaup and coot die-off at Lake Winnibigoshish−2008 Update. 2009. Minnesota Deptartment of Natural Resources, Section of Wildlife. <http://files.dnr.state.mn.us/recreation/hunting/waterfowl/scaup_dieoff08.pdf>; [Accessed on December 17, 2012].

Mills, E.L., J.H. Leach, J.T. 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): 1−54.

Mitchell, J., and R.A. Cole. 2008. Survival of the faucet snail after chemical disinfection, pH extremes, and heated water bath treatments. North American Journal of Fisheries Management 28(5): 1597−1600.

Sauer, J., R. Cole, and J. Nissen. 2007. Finding the exotic faucet snail Bithynia tentaculata: Investigation of waterbird die-offs on the upper Mississippi River National Wildlife and Fish Refuge. U.S. Department of the Interior, U.S. Geological Survey. <http://pubs.usgs.gov/of/2007/1065/pdf/ofr_20071065.pdf>; [Accessed on December 17, 2012].

Tashiro, J. Shiro, and S.D. Colman. 1982. Filter-feeding in the freshwater prosobranch snail Bithynia tentaculata: Bioenergetic partitioning of ingested carbon and nitrogen. American Midland Naturalist 107(1): 114−132.

United States Geolocial Survey, Nonindigenous Aquatic Species (USGS). 2012. Map for Bythinia tentaculata. <http://nas2.er.usgs.gov/viewer/omap.aspx?SpeciesID=987>; [Accessed on December 17, 2012].

University of Minnesota website. 2012. Faucet snail: Impacts on other wildlife. <http://fwcb.cfans.umn.edu/courses/nresexotics3002/GradPages/Faucet_snail/impacts.html>; [Accessed on December 17, 2012].

Van Leeuwen, C.H.A., G. van der Velde, B. van Lith, and M. Klaassen. 2012. Experimental quantification of long distance dispersal potential of aquatic snails in the gut of migratory birds." PLoS ONE 7(3): e32292.

Wood, A.M., C.R. Haro, R.J. Haro, and G.J. Sandland. 2011. Effects of desiccation on two life stages of an invasive snail and its native cohabitant. Hydrobiologia 675(1): 167−174.

Citation: The New York Fish & Aquatic Invertebrate Invasiveness Ranking Form is an adaptation of the New York Plant Invasiveness Ranking Form. The original plant form may be cited as: Jordan, M.J., G. Moore and T.W. Weldy. 2008. Invasiveness ranking system for non-native plants of New York. Unpublished. The Nature Conservancy, Cold Spring Harbor, NY; Brooklyn Botanic Garden, Brooklyn, NY; The Nature Conservancy, Albany, NY.

Acknowledgments: The New York Fish and Aquatic Invertebrate Invasiveness Ranking Form incorporates components and approaches used in several other systems, cited in the references below. Valuable contributions by members of the Invasive Species Council and Invasive Species Advisory Committee were incorporated in revisions of this form. Members of the Office of Invasive Species Coordination's Four-tier Team, who coordinated the effort, included representatives of the New York State Department of Environmental Conservation* (Division of Fish, Wildlife and Marine Resources, Division of Lands and Forests, Division of Water); The Nature Conservancy; New York Natural Heritage Program; New York Sea Grant*; Lake Champlain Sea Grant*; New York State Department of Agriculture and Markets (Division of Plant Industry and Division of Animal Industry); Cornell University (Department of Natural Resources and Department of Entomology); New York State Nursery and Landscape Association; New York Farm Bureau; Brooklyn Botanic Garden; Pet Industry Joint Advisory Council*; Trout Unlimited*; United States Department of Agriculture Animal and Plant Health Inspection Service (Plant Protection and Quarantine and Wildlife Services); New York State Department of Transportation; State University of New York at Albany and Plattsburgh*; and Cary Institute of Ecosystem Studies. Those organizations listed with an asterisk comprised the Fish and Aquatic Invertebrate Working Group.

References for ranking form:

Bomford, M. 2008. Risk Assessment Models for Establishment of Exotic Vertebrates in Australia and New Zealand. Invasive Animals Cooperative Research Centre, Canberra.

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Copp, G. H., R. Garthwaite and R. E. Gozlan. 2005. Risk Identification and Assessment of Non-native Freshwater Fishes: Concepts and Perspectives on Protocols for the UK. Sci. Ser. Tech Rep., Cefas Lowestoft, 129: 32pp.

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Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process. 1996. Risk Assessment and Management Committee, Aquatic Nuisance Species Task Force.

International Conference on Marine Bioinvasions. 2007. The Massachusetts Institute of Technology, Cambridge, Massachusetts.

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Long Island Sound Interstate Aquatic Invasive Species Management Plan. 2007. Balcom, N. editor, New England Interstate Water Pollution Control Commission.

Molnar, J., R. Gamboa, C. Revenga, and M. Spalding. 2008 Assessing the Global Threat of Invasive Species to Marine Biodiversity. Front. Ecol. Environ.

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