NAME OF SPECIES: *Viviparus georgianus*	
Synonyms: Mystery snail, banded apple snail, pond snail	
Common Name: Banded mystery snail	
A. CURRENT STATUS AND DISTRIBUTION	
I. In Wisconsin?	1. YES ☒ NO ☐
	2. Abundance: Found in over 300 waterbodies in Wisconsin[1].
	3. Geographic Range: Found mainly in the northern and eastern parts of the state[1].
	4. Habitat Invaded: Disturbed Areas ☒ Undisturbed Areas ☒
	5. Historical Status and Rate of Spread in Wisconsin: Was reported in Lake Michigan in 1906[2]
	6. Proportion of potential range occupied: Much more widespread in southern Wisconsin than northern Wisconsin.
II. Invasive in Similar Climate Zones	1. YES ☒ NO ☐ Where (include trends): Invasive populations have been reported in Ohio, Michigan, Virginia, Pennsylvania, New York, New Jersey, New England and Quebec[3].
III. Invasive in Which Habitat Types	1. Wetland ☐ Bog ☐ Fen ☐ Swamp ☐ Marsh ☐ Lake ☒ Pond ☒ River ☒ Stream ☒ Other: Prefers standing or slow-moving waters
IV. Habitat Affected	1. Soil types favored or tolerated: Favor silt, detritus and sand[4]
	2. Conservation significance of threatened habitats:
V. Native Range and Habitat	1. List countries and native habitat types: Native to the Mississippi River system from the Gulf of Mexico to Illinois[2].
VI. Legal Classification	1. Listed by government entities? No
	2. Illegal to sell? YES ☐ NO ☒ Notes:
B. ESTABLISHMENT POTENTIAL AND LIFE HISTORY TRAITS	
I. Life History	1. Average Temperature: Growth occurs when temperatures are above 14˚C[4].
	2. Spawning Temperature: No information found.
	3. Methods of Reproduction: Asexual ☐ Sexual ☒ Notes: Species is dioecious, iteroparous and ovoviviparous. Females can carry multiple broods at once and the gestation period is 9-10 months[4].
	4. Number of Eggs: Average brood size of 11.2 young/female/year, up to 81 young/female/year[4]. The females can carry two developing broods simultaneously[4].
	5. Hybridization potential: No information found.
	6. Salinity tolerance: Freshwater only[2]

	7. Oxygen Regime: No information found.
	8. Water Hardness Tolerance: Found in both soft (as low at 6 mg Ca/L) and hard water (> 40 mg Ca/L)[2]
III. Dispersal Potential	1. Pathways - Please check all that apply: Unintentional: Bird ☐ Animal ☐ Vehicles/Human ☐ Wind ☐ Water ☒ Other: Independent downstream movement Intentional: Aquarium release ☒ Forage/Erosion control ☐ Medicine/Food: Other:
	2. Distinguishing characteristics that aid in its survival and/or inhibit its control: Species has operculum. Can act as a facultative filter feeder[3]. Long lived females (up to 4 years) brood the young inside their shell for up to nine months[4].
IV. Ability to go Undetected	1. HIGH ☐ MEDIUM ☐ LOW ☒
C. DAMAGE POTENTIAL	
I. Competitive Ability	1. Presence of Natural Enemies: Larger individuals have few predators, but the smaller snails are eaten by turtles, fish, and crayfish[4].
	2. Competition with native species: No information found
	3. Rate of Spread: -changes in relative dominance over time: -change in acreage over time: HIGH(1-3 yrs) ☐ MEDIUM (4-6 yrs) ☐ LOW (7-10 yrs) ☐ Notes: No information found
II. Environmental Effects	1. Alteration of ecosystem/community composition? YES ☐ NO ☐ Notes: No information found
	2. Alteration of ecosystem/community structure? YES ☐ NO ☐ Notes: No information found
	3. Alteration of ecosystem/community functions and processes? YES ☐ NO ☐ Notes: Populations can reach densities that dominate the benthic and littoral fauna[4].
D. SOCIO-ECONOMIC EFFECTS	
I. Positive aspects of the species to the economy/society:	Notes: No information found
II. Direct and indirect effects of the invasive species:	Notes: Prey on fish eggs[5].
III. Type of damage caused by organism:	Notes: Species can reach really high densities. Populations of up to 864/m^2 have been found[6].
IV. Industries affected by invasive:	Notes: No information found
V. Effects on human health:	Notes: No information found

VI. Loss of aesthetic value affection recreation and tourism:	Notes: Dense populations can go through a mass spring die-off, which are aesthetically unpleasant[4].
VII. Cost of prevention or control relative to cost of allowing invasion to occur (cost of prevention is borne by different groups than cost of control):	Notes: No information found on control efforts for this species.
E. CONTROL AND PREVENTION	
I. Costs of Prevention (please be as specific as possible):	Notes: The cost of prevention is likely low as this species is not widespread in the aquarium trade. Prevention steps to stop movement of aquatic plants on recreational boats already taking place.
II. Responsiveness to prevention efforts:	Notes: No information found on prevention efforts for this species. WI-DNR is currently monitoring the statewide spread of the species as a measure of watercraft inspection efforts.
III. Effective Control tactics: (provide only basic info)	Mechanical ☐ Biological ☒ Chemical ☒ Times and uses: There is limited information published in scientific literature concerning prior application and effectiveness of control methods on *Viviparus georgianus.* Chemical control with copper sulfate compounds[7], hydrated lime[8], niclosamide compounds[9] and some plant based molluscides have been shown to be successful for planorbid, physid and thiarid snails in ponds. Stocking of molluscivorous fish has been shown to control snails in fish production ponds[10].
IV. Costs of Control:	Notes: No information found
V. Cost of prevention or control vs. Cost of allowing invasion to occur:	Notes: No information found
VI. Non-Target Effects of Control:	Notes: The niclosamide compound listed appears selective for snails, but not necessarily snail species[10]. There would likely be no way to control damage to other snail species with the chemical controls above.
VII. Efficacy of monitoring:	Notes:
VIII. Legal and landowner issues:	Notes: To use a registered molluscicide a DNR permit and possibly EPA Special Local Needs Exemption would need to be obtained.

Notes:
Very few articles on this species.

Data Bases Searched:
Biological Abstracts
CAB Abstracts (Agriculture and Veterinary)
Environmental Sciences and Pollution Management
JSTOR: The Scholarly Journal Archive
Web of Knowledge (Web of Science)
Wildlife and Ecology Studies Worldwide

Aquatic Sciences and Fisheries Abstracts
Ecology Abstracts
Fish, Fisheries & Aquatic Biodiversity Worldwide
Water Resources Abstracts
Zoological Record
Google Scholar

G. REFERENCES USED:

Number	Reference
1	WDNR. Surface Water Integrated Monitoring System (SWIMS). Viewed on 08/16/2012.
2	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.
3	Kipp, R.M., A.J. Benson, J. Larson, and A. Fusaro. 2012. *Viviparus georgianus*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL. http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=1047 Revision Date: 6/12/2012
4	Jokinen, E.H., J. Guerette, and R.W. Kortmann. 1982. The natural history of an ovoviviparous snail *Viviparus georgianus* in a soft water eutrophic lake. Freshwater Invertebrate Biology 1(4):2-17.
5	Eckblad, J.W., and M.H. Shealy. 1972. Predation on largemounth bass embryos by the pond snail *Viviparus georgianus*. *Transactions of the American Fisheries Society* 101(4): 734-738.
6	Pace, G.L., and E.J. Szuch. 1985. An exceptional stream population of the banded apple snail *Viviparus georgianus* in Michigan, USA. *Nautilus* 99(2-3):48-53. http://biodiversitylibrary.org/page/8276700
7	Wise,D.J., Mischke C.C., Greenway T., Byars T.S. and Mitchell A.J. 2006. Uniform Application of Copper Sulfate as a Potential Treatment for Controlling Snail Populations in Channel Catfish Production Ponds. North American Journal of Aquaculture, 68:4, 364-368.
8	Mitchell, A.J., Snyder S., Wise D.J. and Mischke C.C. 2007. Evaluating Pond Shoreline Treatments of Slurried Hydrated Lime for Reducing Marsh Rams-Horn Snail Populations. North American Journal of Aquaculture, 69:4, 313-316.
9	Francis-Floyd, R., Gildea J., Reed P. and Klinger R.1997. Use of Bayluscide (Bayer 73) for Snail Control in Fish Ponds. Journal of Aquatic Animal Health, 9:1, 41-48.
10	Ledford, J.J. and A.M. Kelly. 2006. A Comparison of Black Carp, Redear Sunfish, and Blue Catfish as Biological Controls of Snail Populations. North American Journal of Aquaculture, 68:4, 339-347.

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