NAME OF SPECIES: Zebra mussel (Dreissena polymorphia)

A. CURRENT STATUS AND DISTRIBUTION	
1. In Wisconsin?	a. YES ☒ NO ☐
	b. Abundance: abundant in Great Lakes, found in 75 inland lakes and WI's major river systems
	c. Geographic Range: statewide
	d. Type of Waters Invaded (rivers, ponds, lakes, etc): lakes, rivers
	e. Historical Status and Rate of Spread in Wisconsin: Zebra mussels were first found in Wisconsin waters of Lake Michigan in 1990. They are now found in 75 of inland Wisconsin lakes. By 1991, the mussels had made their way into Pool 8 of the Mississippi River, most likely originating in the Illinois River (currents may have carried them to the confluence with the Mississippi, from which barges could carry them upriver). Populations of zebra mussels are steadily increasing to over several thousand per square meter in some portions of the Mississippi river. As of 2003, their distribution included the entire Wisconsin portion of the Mississippi and extended up to Stillwater in the St Croix River. They are also found in the Wisconsin River system.
2. Invasive in Similar Climate Zones	YES ☒ NO ☐ Where: throughout Great Lakes region
3. Similar Habitat Invaded Elsewhere	YES ☒ NO ☐ Where: throughout the Great Lakes region
4. In Surrounding States	YES ☒ NO ☐ Where: Infestations present in all surrounding states, Canada, and the Great Lakes
5. Competitive Ability	High: These mussels are well suited to the climate and aquatic habitats in WI, as is proven by their rapid spread over that last 2 decades. Their rapid reproduction once introduced makes them highly competitive. Great numbers of boaters moving between waterbodies means there is great potential for further spread if prevention steps aren't taken. Low:
B. ESTABLISHMENT POTENTIAL AND LIFE HISTORY TRAITS	
1. Temperature:	Range: 32 - 86 deg. F (0 - 30 deg. C); limited by summer temps. above 81 deg. F or below 54 deg. F
2. Spawning Temperature:	Range: Starts when temps. reach 54 deg. F (12 deg. C), peaks at 68 deg. F (20 deg. C), stops when temps. fall back to 54 deg. F
3. Number of Eggs:	Range: mature females may produce up to 1 million eggs per season
4. Preferred Spawning Substrate:	Adults can colonize any hard surface that's not toxic, including other zebra mussels
5. Hybridization Potential:	Hybridization with quagga mussels is of some concern. Has worked in lab setting, but is thought to be rare in nature and, if present, hybrids will likely make up a very small percentage of the dreissenid

	community.
6. Salinity Tolerance	Fresh: ☒ Marine: ☐ Brackish: ☐
7. Oxygen Regime	Range: prefer high DO, high potentail for colonization at DO 8 - 10 ppm, intermediate potential at DO 6 - 8 ppm
8. Water Hardness Tolerance	Range: high potential for colonization at >90 mg/L calcium carbonate, intermedate potential at 45 - 90 mg/L
9. Easily confused for Native Species?	List: none found, is easily confused with invasive quagga mussel
C. DAMAGE POTENTIAL	
1. Likelihood of Damage	a. Presence of Natural Enemies: migrating diving ducks, fish, crayfish; appears that any decrease in population size caused by predation is short lived.
	b. How well introductory and expansion pathways can be described and quantified: Initial introduction to and spread within Great Lakes attributed to ballast water; larvae spread by drift in currents; movement within waters and to new waters primarily attributed to recreational boaters and anglers transporting mussels/larvae on boats and equipment, in bilge and bait water
2. Environmental Impacts	a. Alteration of ecosystem composition, structure and function: Prodigious filter feeders - remove phytoplankton and particulates from water, disrupting the base of the food web.
	c. Damage to ecosystem resilience/sustainability: Damage to base of food web has potential to destabilize entire ecosystem
	d. Loss of biological diversity: Potential for species diversity to change based on change in food availability
	e. Abiotic modifications (affects on turbidity, H2O chemistry, etc.): Increase water transparencey, decrease chlorophyll a concentrations, increase pseudofeces (waste product excreted) - decomposition of this waste lowers DO, makes pH more acidic, and produces toxic byproducts. Also, mussels accumulate organic toxins, then excreted in pseudofeces and passed up food chain. Since mussels can attach to/live on substrate in great numbers, they can alter the substrate itself, actually becoming the substrate.
	f. Biotic effects on other species (loss of cover, nesting sites, forage, changing competitive relationships: Drastically change substrate and food availability; foul native mussels, inhibiting feeding. Filtering can lead to increased water clarity and a depleted food supply for other aquatic organisms, including fish. The higher light penetration fosters growth of rooted aquatic plants which, although creating more habitat for small fish, may inhibit the larger, predatory fish from finding their food. This thicker plant growth can also interfere with boaters, anglers and swimmers. Zebra mussel infestations may also promote the growth of blue-green algae, since they avoid consuming this type of algae but not others.

D. NET SOCIO/ECONOMIC IMPACT	
1. Positive aspects of the species to the economy/society:	Effect:
2. Direct and indirect effects of the invasive species:	Effect: impact industry, recreation, aesthetics
3. Type of damage caused by organism:	Effect: biofoulers, attach to structures in water and clog pipes, can damage recreational equipment and other property
Industries affected by invasive:	Effect: industries with water intake pipes, water recreation
4. Loss of aesthetic value affecting recreation and tourism:	Effect: beaches may become fouled with shells of dead mussles - shells cut the feet of swimmers and the odor of dead mussels is very unpleasant; mussles attach to boats, buoys, breakwalls, docks, etc.
5. Increased cost to a sector (monitoring, inspection, control, public education, modifying practices, damage repair, lower yield, loss of export markets due to quarantine:	Effect: cost in industries (passed along to consumers) to clean pipes. In 2001, for example, Wisconsin Electric Power Company reported that they were spending $1.2 million per year in the control of zebra mussels on their Lake Michigan power plants. Lock and dam operators on the Mississippi River and raw water users have also incurred costs. The estimated annual cost of controlling zebra mussels in the Great Lakes now range from $100 to $400 million Costs to boaters and riparian home owners to protect equipment and to deal with damage caused by mussels.
6. 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):	Effect: Cost of control by industry is borne by the industry and the consumers
7. Cost at different levels of invasion:	Effect:
E. CONTROL AND PREVENTION POTENTIAL	
1. Costs of Prevention (including Education):	
2. Responsiveness to Prevention Efforts:	Spread between water bodies likely to be caused by recreational boaters and anglers, to an ideal group exists to target with prevention education
3. Detection Capability:	detection is not difficult at high densities with active monitoring

4. Control Tactics Effective:	Mechanical: ☒ Biological: ☐ Chemical: ☐ No large scale control available; methods only work to remove mussles from an individual structure or from within pipes.
5. Efficacy/Feasibility of Control (effort, # of staff):	not feasible in natural, large-scale setting
6. Cost of Control:	High: ☒ Medium: ☐ Low: ☐
7. Non-Target Effects of Control:	native mussles, other species
8. Threshold at which control would be attempted:	
9 Efficacy of Monitoring:	effective monitoring protocols are in place for both veligers (larvae) and adult zebra mussels