

ZEBRA MUSSEL PREVENTION

POLICY

The Missouri Department of Conservation will work to prevent the spread of zebra mussels from infested waters to uninfested waters.

est. 10/05

PROCEDURES

● RESOURCE THREAT

Zebra mussels can clog power plants, industrial and public drinking water intakes, foul boat hulls, decimate populations of freshwater mussels and other native aquatic organisms, impact fisheries and disrupt aquatic ecosystem functions. Economic impacts of zebra mussels in North America are estimated to be in the billions of dollars.

Because of the ease with which microscopic larval zebra mussels may be transported by the public, it may take several years to detect an infestation. Avoiding known infested areas, or staging equipment use such that waters known, or suspected to be infested, are visited last, will help prevent the spread of zebra mussels. However, boats, equipment, and gear must be decontaminated prior to use in different waters. Personnel will take reasonable precautions to avoid exposure of equipment, facilities, and other waters to zebra mussels.

● PUBLIC OUTREACH AND EDUCATION

Increased public outreach and education will enhance understanding of the potential problems associated with zebra mussels and the measures that may help deter their expansion. Signs should be posted at all MDC owned and managed boat ramps highlighting the potential problems associated with zebra mussels. Information should be distributed through our state, federal and non-governmental agency partners, MDC managed waterfowl areas, trapping associates, sport fishing groups, marinas, lake associations, Department offices and Nature Centers, media outlets and to other water users in Missouri.

● EQUIPMENT DECONTAMINATION PROCEDURES

Appropriate safeguards to prevent the transfer of zebra mussels from one waterbody to another are mandatory and include inspection, treatment, and, if possible, avoidance. The following steps detail equipment decontamination procedures:

1. Thoroughly inspect boats (hulls, drive units, trim plates, transducers), trailers and components (rollers, bunk boards, axles, etc.), equipment (i.e., water pumps, hatchery equipment, siphons, nets, ropes, traps, etc.), and machinery (tractors, bulldozers, etc.) for adult zebra mussels. Pay close attention to nooks, crannies and other inconspicuous places (i.e., around the motor housing, trim tabs, and water intake screens, or pump fittings). All trash, mud, vegetation, and suspected zebra

mussels should be removed and properly disposed of in the trash. Immediately report suspected occurrences of zebra mussels to the Invasive Species Coordinator.

Carpeted bunks and runners on existing boat trailers should be replaced with poly, plastic or wooden bunks as soon as practical; boat trailers regularly moved between known zebra mussel infested waters and other waters should have carpeted bunks and runners replaced immediately. As available, future boat trailers should be purchased with poly/plastic/wooden bunks.

2. All water should be drained from boats, trailers, motors, live wells, bilges, transom wells, holding tanks and live wells, water pumps, pipes, and other equipment prior to leaving a waterway. Pay particular attention to boat hulls under installed decking. Drain as much water as possible from equipment such as lower motor units and portable pumps.
3. Any boat, trailer, tank, equipment, machinery, gear, or net transferred from one body of water into a different body of water or from known infested waters to potentially infested waters must be decontaminated using one of the treatments in Table 1 prior to being used in a new body of water. Equipment decontamination procedures should be completed when moving equipment from infested areas of a water body to uninfested areas of the same water body.

If boats, nets, and other equipment are only used in one body of water, cleaning between uses is not necessary, but these boats, nets, and other equipment **MUST** be clearly labeled for use in that body of water **ONLY**. Periodic cleaning and decontamination (i.e., during winterization or other maintenance) should be conducted to prevent costly repairs. If management or research activities require this equipment to be moved in the future, decontamination procedures will be implemented.

● HATCHERY PRECAUTIONS

Best management practices should be used to protect equipment and facilities and to reduce the opportunity for the spread of zebra mussels to uninfested areas. Introductions of zebra mussels into MDC fish hatcheries or water supply sources would have devastating impacts upon hatchery infrastructure. If infested, hatcheries would then be a possible mechanism for transporting the organisms to uninfested waters.

Therefore, the following precautionary measures will be enacted by MDC fish hatcheries:

1. All attempts will be made to secure fish from sources known to be free of zebra mussels (veligers and adults) (see map at <http://intranet/Documents/17407.pdf>)
2. All fish and eggs exposed to surface water coming into or leaving any of MDC's hatcheries or other facilities and any fish procured through contract or other means from outside sources must be treated during transportation using one of the treatments in Table 3. The only exception will be for fish that are stocked into the same water supply that is used by the hatchery (e.g., trout stocked in Bennett Spring branch by Bennett Spring Hatchery staff) and for selected species of conservation concern.

3. Specific limitations may be applied to native mussel and hellbender culture, and other species of conservation concern, on a case-by-case basis.
4. Some species or life stages of fish or other aquatic organisms may be less tolerant of chemical treatments. For these species or life stages whose chemical tolerances are unknown, bioassays must be performed prior to large scale use of the prescribed treatments listed below. Until these bioassays are conducted, brood stock of these species will only be obtained from waters known to be free of zebra mussels.

Table 1. Zebra Mussel Disinfectants and Usage Guidelines for Boats and Equipment

Disinfectant	Concentration	Contact Time	Usage Guidelines, Safety Precautions, Drawbacks
Vinegar	100%	20 min	Use appropriate personal protective equipment (PPE) and caution. Stay upwind of the spray. Is corrosive to metal and toxic to fish at this concentration, so thoroughly rinse with tap water or water from the next lake or river after disinfection. Ensure that solution does not run-off directly into waterways.
Chlorine	200 ppm	10 min	Use appropriate PPE and caution. Stay upwind of the spray. Is corrosive to metal and rubber and toxic to fish at this concentration, so neutralize with 800 ppm sodium thiosulfate and rinse thoroughly with tap water or water from the next lake or river. Ensure that solution does not run-off directly into waterways.
Power wash with hot water	>104° F	20 min	Use appropriate PPE and caution when using hot water due to possibility of burns/scalding. Temperature and contact times are crucial, as efficiency is weather dependent. Most effective when used in conjunction with air drying (see below). Power wash with hot water, including thoroughly flushing lower motor unit.
Freezing	<32° F	24 hrs	Boats, gear, and equipment should be thoroughly frozen. Ambient air temperature should remain below freezing for the entire contact time. No safety precautions.
Air drying	N/A	3-5 days in hot sun 48 hrs in hot sun	Must dry completely to be effective. Most effective when used in conjunction with hot water (see above). To be used for small nets, gear, pumps, etc., <i>ONLY AFTER</i> power washing with hot (104°) water for appropriate contact time.
Salt Bath	1%	24 hrs	Due to the long contact time, may only be used as a bath solution and not sprayed. To be used only for pieces of equipment, gear, and nets that can be completely immersed in the solution.

Table 2. Disinfectant Amounts to Make Needed Concentrations

Disinfectant	1 gallon	2 gallons	5 gallons	20 gallons	100 gallons
100% Vinegar	1 gal	2 gal	5 gal	20 gal	100 gal
200 ppm Chlorine (household bleach, 5.25% Chlorine)	0.5 ounce (15 ml)	1.0 ounce (30 ml)	2.5 ounces (75 ml)	11.0 ounces (300 ml)	6 1/3 cups (1.5 L)
200 ppm Chlorine (HTH granular)	0.04 ounce (1.2 g)	0.08 ounce (2.4 g)	0.2 ounce (6 g)	0.8 ounce (24 g)	4.2 ounces (120 g)
800 ppm Sodium Thiosulfate	0.1 ounce (3 g)	0.2 ounce (6 g)	0.5 ounce (15 g)	2.1 ounces (60 g)	10.6 ounces (300 g)
1% Salt Bath (as NaCl)	1/8 cup	1/4 cup	2/3 cup	2 2/3 cups	13 1/3 cups

Notes:

1. Air drying and hot water are most effective when used in conjunction with each other because their effectiveness is highly dependent upon ambient temperatures and contact times. As needed, hot water wash units should be made available at selected Department facilities.
2. Household bleach (5.25% chlorine) and vinegar can be purchased from grocery or convenience stores. HTH granular chlorine (70% calcium hypochlorite) and Sodium Thiosulfate can be purchased at pool supply stores or chemical companies.
3. All bilges and hidden areas under boat decks must be thoroughly treated as described above.
4. Source: WI DNR (2007) *Equipment Disinfection Protocol for Invasive Species and Viruses*.

Table 3. Hatchery/Fish/Aquatic Organism Zebra Mussel Treatments and Usage Guidelines

Treatment	Concentration	Contact Time	Usage Guidelines/Comments
NaCl	20,000 ppm	2 hrs	Used for striped bass only. Treatment conducted during transport.
KCl/formalin	750 ppm KCl	1 hr	Used for all other fish species and eggs. Fish and hauling water are pretreated for 1 hour with 750 ppm KCl, followed by a 2 hour treatment with 25 ppm formalin during transport. <i>DO NOT</i> treat fish with NaCl to counteract shock, as this decreases the effectiveness of the treatment.
	25 ppm formalin	2 hrs	

Notes:

1. All fish, including those used in aquaria at nature centers, fairs, etc., are to be treated for zebra mussels while in transit.
2. Treatment concentrations and contact times that are currently exceeded during normal aquaculture operations (e.g., egg hardening and shipping) should be considered effective.
3. Some species or life stages of fish or other aquatic organisms may be less tolerant of chemical treatments. For these species or life stages whose chemical tolerances are unknown, bioassays must be performed prior to large scale use of the treatments listed above.
4. For species with known intolerances to recommended zebra mussel treatments, modifications of hatchery assignments, increased use of well water, UV treatment, sand filtration, and other system modifications or treatment/avoidance measures may be needed and should be considered on a case-by-case basis with the involvement and approval of Division Chiefs and the Invasive Species Coordinator.
5. Sources: IA DNR *Fairport Fish Hatchery ANS-HACCP*, Edwards *et al.* 2000.

● INVASIVE SPECIES COORDINATOR ROLE

The MDC Invasive Species Coordinator shall serve as the central point of contact for zebra mussel distribution information, prevention, and control. The coordinator shall maintain a Missouri zebra mussel distribution map on the Department Intranet and Internet websites identifying the location of confirmed sightings of zebra mussel adults and veligers in Missouri waters (see <http://intranet/Documents/17407.pdf> or <http://mdc4.mdc.mo.gov/Documents/17409.pdf>). Any collections, observations, sightings, etc., of zebra mussel adults or veligers, including instances when organisms have been found attached to equipment, must be immediately reported to the MDC Invasive Species Coordinator.

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