

# Cooperative Conservation Plan to Preserve the Ohio River Freshwater Mussel Fauna From the Zebra Mussel (*Dreissena polymorpha*) Invasion

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**Abstract.** The globally significant freshwater mussel diversity of the Ohio River and its tributaries is critically threatened by the invasion of the exotic zebra mussel (*Dreissena polymorpha*). Zebra mussels were first found in the lower Ohio River in 1991. By 1994, a 2-inch carpet of zebra mussels covered the substrate of the lower river, infesting all native unionids. The immediate threat posed by the zebra mussel led to efforts by concerned natural resource management agencies, researchers, and organizations to organize an Ohio River Unionid Committee to cooperatively develop an action plan to preserve and manage the diverse unionid fauna of the Ohio River. This cooperative effort takes an ecosystem approach to develop and implement this action plan in an effort to prevent a wave of extirpations. Because time is critical, this plan implements simultaneous activities including monitoring, aggressive recovery and propagation of rare fauna, research, and public outreach. The results and implications of this management strategy will have wide application to other watersheds throughout the country as we battle the zebra mussel invasion and try to secure a future for native mussels.

## Introduction

The freshwater mussel fauna of North America consists of a diverse assemblage of about 297 species and subspecies (Turgeon et al. 1988) distributed principally throughout river systems in eastern North America. Of these species of freshwater mussels, at least 45% are either extinct, federally listed as endangered or threatened, or are identified as federal species of concern (Neves 1993). No other group of animals is at such high risk to disappear. Because the United States has the greatest diversity of freshwater mussels in the world, this loss of mussel species is of global significance.

In the past 30 years, the decline of freshwater mussel fauna has been attributed to habitat destruction and water pollution. Recently, there have been reports of some recovery of aquatic fauna, perhaps attributable to increased emphasis on conservation of protected species and to benefits of the Clean Water Act (CWA). Unfortunately, there is a new, immediate, and critical threat posed to these same aquatic systems by the invasion of the exotic zebra mussel (*Dreissena polymorpha*). The Ohio River basin historically contained approximately 127 distinct species and subspecies of freshwater mussels, making this one of the world's richest assemblages of freshwater mussels. In less than 100 years, nearly half (44%) of this river basin's mussel fauna has become extinct, endangered, or decimated to the

point where federal protection is being considered. Eight federally endangered as well as numerous state-listed freshwater mussel species occur within the Ohio River and its major tributaries. The federally endangered species are the fat pocketbook (*Potamilus capax*), orange-footed pimpleback (*Plethobasus cooperianus*), white wartyback (*Plethobasus cicatricosus*), rough pigtoe (*Pleurobema plenum*), ring pink (*Obovaria retusa*), pink mucket (*Lampsilis abrupta*), fanshell (*Cyprogenia stegaria*), and catssaw (*Epioblasma obliquata*).

## Zebra Mussel Invasion

Zebra mussels were first discovered in the Great Lakes in Lake St. Clair in 1986. By 1994, the Lake St. Clair native unionid fauna was decimated due to immense numbers of zebra mussels (Schloesser 1995). Zebra mussels are now found in all of the Great Lakes and in waterways in 18 states and 2 provinces (Kelch 1994). The Ohio River native fauna is one of the systems currently threatened by the zebra mussel invasion. Dunn (1995) reported that zebra mussels were first observed in the lower Ohio River in 1991; by 1994 infestation also was occurring in the upper river while all unionids observed in the lower river were infested with large numbers of

adult zebra mussels. This invasion poses an ominous threat to native molluscan fauna that dwarfs any other exotic intrusion to date.

Encrustation by zebra mussels has a severe energetic cost to native unionids (Berg et al. 1993). A strong relationship exists between the degree of zebra mussel infestation and mortality of native unionids in rivers and lakes (Schloesser 1995). Zebra mussels impair locomotion and burrowing of native unionids. They impact native unionids by preventing valve closure and opening and causing food deprivation. In Lake Wawasee, Indiana, data show that zebra mussel infestation may cause depletion of native unionid energy reserves (Schloesser 1995). Zebra mussel-related deformation of unionid shells may make native unionids more susceptible to parasites or vectors. Although the causes of native unionid mortality associated with zebra mussel infestation are not yet fully identified or documented, native unionid devastation occurs very quickly following the infestation.

The loss of native unionids of the Ohio River basin is cause for concern for several reasons: 1) unionids often serve as indicators of water quality—they are often compared to the “canaries in the coal mine” because their decline serves as a barometer for pollution, compromised fishery resources, and an overall decline in the health of the system for all species utilizing the water source; 2) freshwater mussels are essential to a viable commercial mussel industry in some states; 3) unionids have potential environmental and medical research value; 4) mussels hold aesthetic value to people interested in bivalves and/or aquatic systems; and, 5) unionids have an inherent value as a major component of our nation’s aquatic biodiversity.

## Management Strategy

The zebra mussel will likely cause many rare mussel species to become extinct and may cause current stable mussel species to be threatened with extinction. The immediate threat posed by the zebra mussel in the Ohio River has led to efforts by concerned natural resource management agencies, researchers, and organizations to organize the Ohio River Unionid Conservation Committee (working group). The working group was charged with the task of developing an action plan (*Ohio River Unionid Conservation Plan, Zebra Mussel Strategic Action Plan - Phase 1*) to preserve and manage the diverse unionid fauna of the Ohio River. For a copy of this plan, please contact Cindy Chaffee, U.S. Fish and Wildlife Service, 620 South Walker, Bloomington, Indiana 47403.

Cooperators involved in the development and implementation of this action plan include representatives from the Army Corps of Engineers (COE); Illinois/Indiana Sea Grant, Ohio River Valley Water Sanitation Commission (ORSANCO); National Biological Service (NBS); state resource agencies from Illinois, Indiana, Kentucky, North Carolina, Ohio, Pennsylvania, and West Virginia; U.S. Fish and Wildlife Service (FWS) Ecological Services (ES) field offices in each bordering state (involving three FWS regions); Ohio River Islands National Wildlife Refuge (ORINWR); FWS Fisheries; FWS Law Enforcement; and U.S. Geological Survey (USGS). This diverse working group developed strategies for the action plan that embody a true ecosystem approach. The FWS-sponsored Ohio River Valley Ecosystem (ORVE) team, composed of federal and state wildlife agencies, has determined unionid mussels to be the greatest federal priority in the Ohio River ecosystem. Through adoption of the working group as a subgroup of the ORVE team, funding and support has been made available for implementing the action plan.

This action plan is a dynamic document that will evolve as more information is gained on the impacts of the zebra mussel infestation and the appropriate management techniques. The working group fully recognizes the authorities and jurisdictions of state and regional resource agencies with respect to native mollusks within the Ohio River basin and strongly believes that a strategic course of action will be successful only with the full support and participation of state and regional resource agency partners.

## Action Plan

The first phase of the plan focuses on selected unionids found only within the Ohio River mainstem and the lower portion of a few major tributaries that receive barge traffic. The five major components of the first phase of the action plan are: 1) monitoring activities, 2) aggressive propagation protocols, 3) research requirements, 4) tributary data management and outreach, and 5) education efforts targeting the public and to solicit support and funding for this management effort. Individual working group members have volunteered to oversee and coordinate the implementation of each of these components.

The objective of the monitoring component of the plan is to monitor the presence and condition of Ohio River unionids before and during zebra mussel infestation in order to develop predictive information. The strategies to achieve this monitoring

objective involve monitoring the distribution rates of zebra mussels; impacts of zebra mussel infestation on various unionid species (lethal and sublethal); additional impacts to the ecosystem from the zebra mussel invasion, such as fish, macroinvertebrates, and water quality; and development of a database to correlate zebra mussel infestation information throughout the Ohio River system. These monitoring activities will provide valuable information for development of appropriate management actions for the unionids of the Ohio River basin as well as for other freshwater systems throughout the nation.

The objective of the aggressive propagation component of the action plan is to reduce or eliminate mortality of unionids due to zebra mussels and to preserve unionid diversity for reintroduction into the main stem or tributaries of the Ohio River. To accomplish this goal, federally listed mussels encountered in zebra mussel-infested portions of the main stem of the Ohio River will be collected under the salvage provisions of 50 CFR 17.21 (c) and placed in refugium until relocation back to native habitat is possible. This component of the action plan will allow for the salvage of species that have a high potential for becoming extinct/extirpated as a result of zebra mussel infestation. Although numerous alternatives to salvage were discussed and considered, the working group concluded that federally protected animals should be collected when and if the opportunity arises since it would be unlikely that another opportunity would present itself to remove individuals at a later date. The working group will continue to identify other options as the action plan is implemented.

The objective of the research component is to identify and coordinate research that is required for the complete implementation of the management activities. The working group has identified research items recognized as essential to the goal of the action plan. Each research item has been ranked by priority on the basis of urgency; all are considered important and necessary as dictated by the action plan. Research that addresses the requirements of holding and propagating native species in temporary refugium was given a high priority and has been initiated.

The first phase of the plan limits the primary focus to the Ohio River mainstem and the lower portions of a few select tributaries where the threat is most imminent and immediate. However, the working group recognizes that much of the rare fauna resides in the tributaries and is concerned about potential impacts the tributary fauna may suffer from zebra mussel infestation. The objective of the tributary data management and outreach component is to disseminate information and

provide support to resource agencies addressing zebra mussel concerns in tributaries. The working group includes tributaries in outreach efforts and offers to collect and correlate monitoring data throughout the watershed. Data management of zebra mussel survey results throughout the watershed will provide the working group with additional information for future prioritization. The working group also envisions that successful management actions implemented in the mainstem may be adopted for tributary management and that the Ohio River tributaries will benefit from the visibility of this action plan.

Finally, the objective of the public outreach and funding component of the action plan is to educate the general public and resource professionals about the seriousness of the zebra mussel invasion in the Ohio River system, inform the public and resource professionals on ways to decrease the spread of zebra mussels, and solicit additional support and funding for the project. Members of the working group intend to continue to capitalize on opportunities to present the strategic plan, activities, and successes and solicit additional support. The working group has and will continue to identify potential funding sources for implementation of the action plan.

## Summary

This plan was developed with the intention of being a true action plan with immediate implementation. Components of the plan have already been aggressively enacted by the working group. The working group originally met and developed the action plan in April 1995. By October 1995 the following had been accomplished:

1. The action plan document was drafted.
2. Monitoring protocols and standardized monitoring reporting forms were developed.
3. Monitoring sites were established.
4. A rigorous monitoring effort was completed providing essential information to continue towards the action plan goal.
5. Standard procedures were developed for collecting and transporting federally endangered species.
6. Facilities were pre-approved as holding facilities for endangered species.
7. Pre-approval from three FWS Regions of Law Enforcement to salvage federally endangered individuals was sought and granted.

8. An endangered mussel was collected from an infested area of the river, held in quarantine, and transported to a holding facility.
9. Aggressive research is being cooperatively implemented to better understand the requirements of big-river mussels in holding facilities and to assess the concept of broodstock and mussel reproduction in holding ponds.
10. Impacts of cleaning and holding native unionids within infested areas is being researched.
11. The outreach component of the action plan has been implemented through various presentations at natural resource-related meetings and conferences to gain additional understanding and support for this project.

Despite the imminent threat to big rivers from the zebra mussel invasion, the working group believes that it is important to recognize that native mussels face many threats. Therefore, it is paramount that all causes of mussel decline and the health of the entire aquatic environment continue to be assessed. This includes continued efforts to prevent further unionid declines from habitat alteration and water quality degradation. Laws such as the Clean Water Act and Endangered Species Act help to ensure the continuance and recovery of rare species by maintaining suitable habitat for natural propagation and native mussel reintroductions.

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