FANSHELL

RECOVERY PLAN

RECOVERY PLAN

for

Fanshell (*Cyprogenia stegaria* (=*C. irrorata*))

Prepared by

Richard G. Biggins
Asheville Field Office
Asheville, North Carolina

for

Southeast Region
U.S. Fish and Wildlife Service
Atlanta, Georgia

Approved: _____
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Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect the species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Objectives will only be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans do not necessarily represent the views nor the official positions or approvals of any individuals or agencies, other than the U.S. Fish and Wildlife Service, involved in the plan formulation. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1991. Fanshell (*Cyprogenia stegaria* (=*C. irrorata*)) Recovery Plan. Atlanta, GA. 37 pp.

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EXECUTIVE SUMMARY FOR THE FANSHELL RECOVERY PLAN

Current Status: The species is listed as endangered. Presently, the fanshell is known from only three reproducing populations--the Green and Licking Rivers in Kentucky and the Clinch River in Tennessee and Virginia. A few apparently nonreproducing populations still survive in some other rivers in the Ohio River basin in Ohio, Indiana, West Virginia, and Illinois.

Habitat Requirements and Limiting Factors: The fanshell inhabits gravel substrate in medium to large rivers of the Ohio River basin. The species' distribution and reproductive capacity has been seriously impacted by the construction and operation of reservoirs and by other impacts on water and substrate quality. Unless new populations are found or created and existing populations are maintained, this species will likely become extinct in the foreseeable future.

Recovery Objective: Downlisting. Because of the lack of available habitat for establishment of all needed populations, recovery is unlikely.

Recovery Criteria: To establish 12 distinct viable populations.

Actions Needed:

1. Utilize existing legislation/regulations to protect species.
2. Search for new populations and monitor existing populations.
3. Develop and utilize an information/education program.
4. Determine species' life history requirements.
5. Determine threats and alleviate those that threaten species' existence.
6. Through reintroduction and protection, establish eight viable populations.
7. Develop and implement cryopreservation protection of species.

Cost (1,000's):

Year	Need 1	Need 2	Need 3	Need 4	Need 5	Need 6	Need 7	Total
1991	7.0	30.0	25.0	25.0	0.0	40.0	5.0	132.0
1992	7.0	30.0	20.0	25.0	25.0	40.0	5.0	152.0
1993	7.0	8.0	2.0	25.0	25.0	40.0	5.0	112.0
1994	7.0	0.0	2.0	0.0	25.0	20.0	2.0	56.0
1995	7.0	8.0	2.0	0.0	?	15.0	2.0	34.0*
1996	7.0	0.0	2.0	0.0	?	15.0	2.0	26.0*
1997	7.0	8.0	2.0	0.0	?	5.0	2.0	24.0*
1998	7.0	0.0	2.0	0.0	?	0.0	2.0	11.0*
1999	7.0	8.0	2.0	0.0	?	5.0	2.0	24.0*
2000	7.0	0.0	2.0	0.0	?	0.0	2.0	11.0*
2001	7.0	8.0	2.0	0.0	?	5.0	2.0	24.0*
Total:	77.0	100.0	63.0	75.0	75.0*	185.0	31.0	606.0*

*See next page.

*Habitat improvement costs needed for the species' recovery will not be known until the magnitude of specific threats is determined through research.

Date of Recovery: Total recovery is unlikely for this species. The downlisting date cannot be estimated at this time. As mussels do not reproduce until about age 5, more than 10 years will be needed to document reproduction and assess viability.

PART I

INTRODUCTION

The fanshell (Cyprogenia stegaria (=C. irrorata)), was listed as an endangered species in the Federal Register (55 FR 25591) on June 21, 1990, under the Endangered Species Act of 1973, as amended. This freshwater mussel historically occurred in the Ohio River and many of its large tributaries in Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Kentucky, Tennessee, Alabama, and Virginia. Presently, the fanshell is believed to be reproducing in only three rivers--the Green and Licking Rivers in Kentucky and the Clinch River in Tennessee and Virginia. Additionally, small (apparently nonreproducing) populations (based on the collection of a few old specimens in the 1980s) may still persist in the Muskingum (specimen taken as recently as 1988) and Walhonding River, Ohio; the Kanawha River, West Virginia; the Wabash River system in Illinois and Indiana; the Barren River and Tygarts Creek, Kentucky; and the Tennessee and Cumberland Rivers in Tennessee. The distribution and reproductive capacity of this species has been seriously impacted by the construction of impoundments and navigation facilities, dredging for channel maintenance, sand and gravel mining, and water pollution.

Description, Ecology, and Life History

The fanshell (Cyprogenia stegaria (=C. irrorata)) was described by Rafinesque (1820). The mussel has a medium-sized shell (seldom exceeding 3.2 inches [80 millimeters] in length) that is subcircular in outline (Johnson 1980). The shell exterior has green rays on a light green or yellow surface ornamented with green mottling. The inside surface of the shell (nacre) is usually silvery white.

Because of its rarity, little is known of the mussel's biology. The species, according to Bates and Dennis (1985), inhabits medium to large rivers. The fanshell has been reported primarily from relatively deep water in gravel substrate with moderate current (Gordon and Layzer 1989).

Specific food habits of the fanshell are unknown, but it likely feeds on food items similar to those consumed by other freshwater mussels. Freshwater mussels are known to feed on detritus, diatoms, phytoplankton, and zooplankton, which they filter out of the water (Churchill and Lewis 1924).

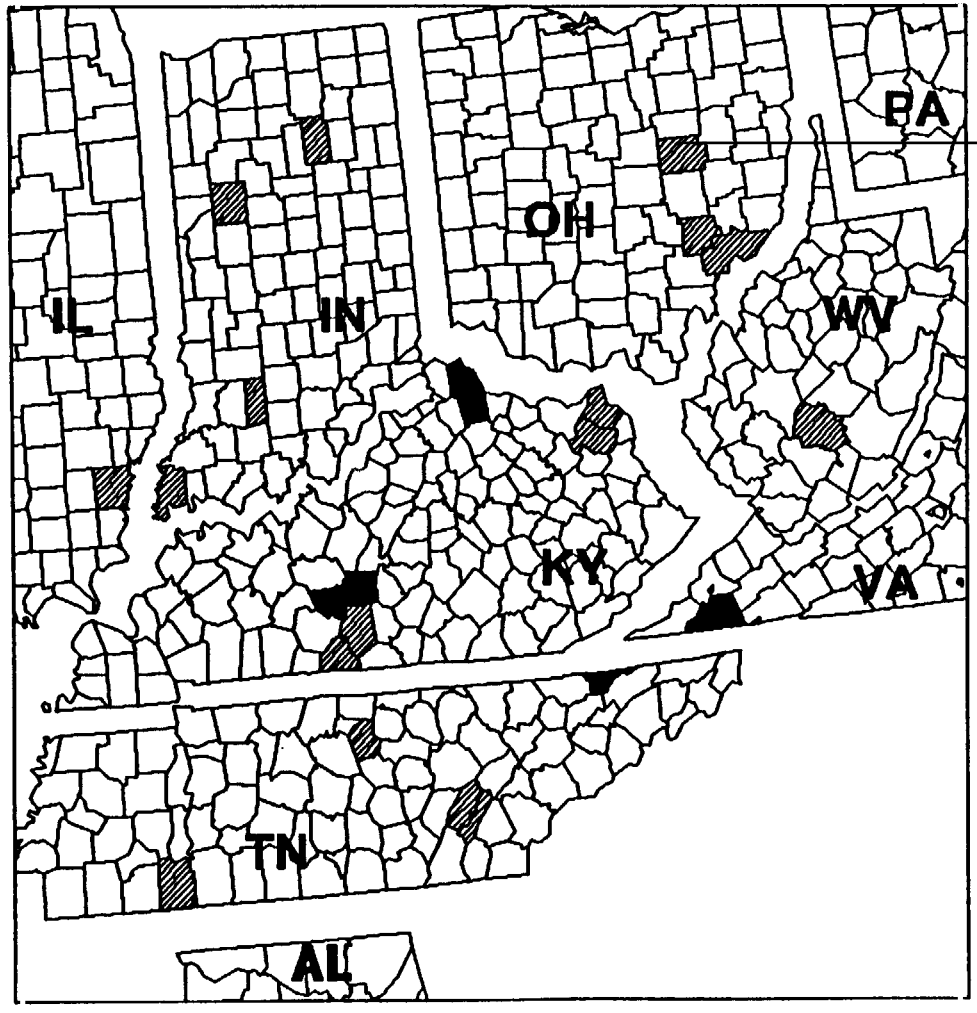
The fanshell's reproductive biology is unknown, but it probably reproduces like other freshwater mussels. Males release sperm into the water column. The sperm are taken in by the females through their siphons during feeding and respiration. The fertilized eggs are retained in the gills until the larvae (glochidia) fully develop. The glochidia attach and encyst on the gills or fins of the fish host. When metamorphosis is complete, they drop to the streambed as juvenile mussels. The species of host fish utilized by the fanshell is unknown. However, the fanshell's glochidia are released into the

water in the form of a unique spiral conglutinate. This worm-like shape suggests that a fish that visually searches for its food may be its host (Robert Anderson, Indiana Department of Natural Resources, in litt., 1991)

Distribution, Reasons for Decline, and Threats to Its Continued Existence

Since the turn of the century, the fanshell has undergone a substantial reduction in its range. It was historically widely distributed in the Ohio, Wabash, Cumberland, and Tennessee Rivers and their larger tributaries in Pennsylvania, Ohio, West Virginia, Illinois, Indiana, Kentucky, Tennessee, Alabama, and Virginia (Johnson 1980, Kentucky State Nature Preserves Commission 1980, Ahlstedt 1986, Bates and Dennis 1985, Lauritsen 1987, Cummings et al. 1987 and 1988, and Starnes and Bogan 1988). The loss of many historic populations was likely due to the impacts of impoundments, navigation projects, pollution, and habitat alterations, such as gravel and sand dredging, that directly affected the species and reduced or eliminated its fish host.

Based on a review of current literature on the species (see above) and on the following personal communications and letters from knowledgeable individuals and State and Federal agency personnel, it is believed that reproducing populations are now present (see map) in only three rivers--the Clinch River, Hancock County, Tennessee, and Scott County, Virginia; the Green River, Hart and Edmonson Counties, Kentucky; and the Licking River, Kenton, Campbell, and Pendleton Counties, Kentucky (Steven Ahlstedt and John Jenkinson, Tennessee Valley Authority, personal communications, 1988; Robert Anderson and Mark Gordon, Tennessee Cooperative Fishery Research Unit, personal communications, 1988; Carl Becker, Illinois Department of Conservation, in litt., 1988; Charles Bier, Western Pennsylvania Conservancy, in litt., 1989; Richard Connor and William Sinozich, U.S. Army Corps of Engineers, in litt., 1989; Kevin Cummings, Illinois State Natural History Survey Division, in litt., 1989; Ronald Cicerello and Richard Hannan, Kentucky State Nature Preserves Commission, in litt., 1988; Wendal Haag, Ohio State University Museum of Zoology, in litt., 1988; Edward Hansen, Indiana Department of Natural Resources, Division of Fish and Wildlife, in litt., 1989; Michael Hoggarth, Ohio Department of Transportation, in litt., 1990; Patricia Jones, Ohio Department of Natural Resources, in litt., 1988; Richard Neves, Virginia Cooperative Fish and Wildlife Research Unit, in litt., 1988; Brian McDonald and Michael Zeto, West Virginia Department of Natural Resources, in litt., 1988 and 1989; James Sickle, Murray State University, personal communication, 1989; Clarke Shiffer, Pennsylvania Fish Commission, personal communication, 1989; William Tolin, U.S. Fish and Wildlife Service, personal communication, 1988; and Paul Yokley, University of North Alabama, personal communication, 1988). Additionally, small remnant (apparently nonreproducing) populations (based on collections of a



Distribution of the fanshell (Cyprogenia stegaria (=C. irrorata)): All States with historic population records, counties with extant populations, and counties with possible extant populations.

PRESENT POPULATIONS

REPRODUCING
NONREPRODUCING

few old individuals in the 1980s) may still persist in the Muskingum River (specimen taken as recently as 1988) in Morgan and Washington Counties, Ohio; the Walhonding River in Coshocton County, Ohio; the Wabash River in White County, Illinois, and Posey and Wabash Counties, Indiana; the East Fork White River, Martin County, Indiana; the Tippecanoe River, Tippecanoe County, Indiana; the Kanawha River, Fayette County, West Virginia; Tygarts Creek, Greenup and Carter Counties, Kentucky; Barren River, Allen and Barren Counties, Kentucky; the Cumberland River, Smith County, Tennessee; and the Tennessee River, Rhea, Meigs, and Hardin County, Tennessee.

The population in the Green River is likely the best of the three remaining reproducing populations. Fresh-dead fanshells of various age classes from juvenile to adult have recently been found (1987 and 1988) in muskrat middens along the Green River (Ronald Cicerello, personal communication, 1988). However, the Green River, which lies partially within the Mammoth Cave National Park, is not free from threats. The river's mussel fauna have been seriously depleted. Cicerello (personal communication, 1988), based on his 1987 and 1988 surveys of the Green River within and above the Mammoth Cave National Park, believes that about 40 mussel species still survive in the area. Ortmann (1926) reported finding 66 species of mussels in the Green River. The Green River has been degraded by runoff from oil and gas exploration and production sites and by alteration of stream flows by an upstream reservoir.

The Clinch River fanshell population extends over about 86 river miles (Ahlstedt 1986). However, a Tennessee Valley Authority (1988) survey reported that the fanshell comprised less than 1 percent of the mussels collected at 11 Clinch River quantitative sampling sites in 1979 and 1988. The Tennessee Valley Authority (1988) also reported that overall mussel abundance in the Clinch River has decreased from an average of 11.64 mussels per square meter in 1979 to 6.0 mussels per square meter in 1988. The Clinch River also has environmental problems. Charles Sledd (Virginia Department of Game and Inland Fisheries, personal communication, 1988) stated that land use practices along the Clinch River have contributed to a decline in water quality and mussel populations. The Clinch River has experienced some adverse impacts from coal mining, and the river has been subjected to two mussel kills resulting from toxic substance spills from a riverside coal-fired power plant.

The Licking River also supports a reproducing fanshell population (Ronald Cicerello, personal communication, 1989). Live and fresh-dead individuals of several year classes have been collected. However, despite collections made throughout the drainage by Kentucky State Nature Preserves Commission biologists, the species is only known from the lower portion of the Licking River. This population could potentially be threatened by some of the water supply development alternatives presently under preliminary review for the Licking River watershed and by wastewater discharges.

Although the species has minimal commercial value, it does exist in small numbers within some harvested mussel beds, and the species can therefore be taken by mussel fishermen. As there has been a substantial increase in the value of mussel shells, the problem of incidental take is expected to increase.

Most of the fanshell populations are small, and all are geographically isolated from each other. This isolation restricts the natural interchange of genetic material between populations. The small population size also reduces the reservoir of genetic variability within populations. It is likely these populations, with the possible exception of the Clinch River population, are now below the generally accepted level required to maintain long-term genetic viability (Soulé 1980).

PART II

RECOVERY

A. Recovery Objectives

The ultimate goal of this recovery plan is to restore viable populations of the fanshell (Cyprogenia stegaria (=C. irrorata)) to a significant portion of its historic range in the Ohio River system and to remove the species from the Federal List of Endangered and Threatened Wildlife and Plants. However, total recovery of the fanshell may not be possible. Much of the habitat within the species' historic range may be unsuitable for reintroductions. **NOTE:** A viable population is defined as a reproducing population that is large enough to maintain sufficient genetic variation to enable it to evolve and respond to natural habitat changes. The number of individuals needed to reach a viable population will be determined as one of the recovery tasks.

The fanshell will be considered for reclassification to threatened status when the likelihood of the species' becoming extinct in the foreseeable future has been eliminated by achievement of the following criteria:

1. Through protection of existing populations and through successful establishment of reintroduced populations or the discovery of additional populations, a total of nine distinct viable populations exist. The populations shall be distributed throughout the Ohio River basin as follows: one in the upper Tennessee River system, one in the middle to lower Tennessee River system, one in the Cumberland River system, two in a Kentucky tributary to the Ohio River other than the Cumberland River, one in the Allegheny River system, one in the lower Muskingum or Walhonding River system, one in the Kanawha River system, and one in the Wabash River system.

2. One naturally reproduced year class exists within each of the nine populations. The year class must have been produced within 5 years of the downlisting date. Within 1 year of the downlisting date, gravid females of the species and its host fish must be present in each river.

3. Biological and ecological studies have been completed, and the recovery measures developed and implemented from these studies are beginning to be successful, as evidenced by an increase in population density and/or an increase in the length of the river reach inhabited by each of the nine populations.

The fanshell will be considered for removal from Endangered Species Act protection when the likelihood of the species' becoming threatened in the foreseeable future has been eliminated by the achievement of the following criteria:

1. Through protection of existing populations and successful establishment of reintroduced populations or the discovery of additional populations, a total of 12 distinct viable populations exist. These populations must be separated to the extent that it is unlikely that a single event would eliminate or significantly reduce more than one of these populations. The populations shall be distributed throughout the Ohio River basin as follows: two in the upper Tennessee River system, two in the middle to lower Tennessee River system, one in the Cumberland River system, three in a Kentucky tributary to the Ohio River other than the Cumberland River, one in the Allegheny River system, one in the lower Muskingum or Walhonding River system, one in the Kanawha River system, and one in the Wabash River system.

2. Two distinct naturally reproduced year classes exist within each of the 12 populations. Both year classes must have been produced within 10 years, and one year class within 5 years, of the recovery date. Within 1 year of the recovery date, gravid females of the species and its host fish must be present in each river.

3. Studies of the mussel's biological and ecological requirements have been completed, and recovery measures developed and implemented from these studies have been successful, as evidenced by an increase in population density and/or an increase in the length of the river reach inhabited by each of the 12 populations.

4. No foreseeable threats exist that would likely threaten the survival of any of these eight populations.

5. Where habitat had been degraded, noticeable improvements in water and substratum quality have occurred.

B. Narrative Outline

1. Preserve present populations and occupied habitat. Because so few fanshell populations exist, it is essential to the survival and eventual recovery of the species that all existing populations and their habitat be protected.

1.1 Continue to utilize existing legislation and regulations (Federal Endangered Species Act, Federal and State surface mining laws, water quality regulations, stream alteration regulations, etc.) to protect the species and its habitats. Prior to and during implementation of this recovery plan, the present fanshell populations can be protected only by the full enforcement of existing laws and regulations.

1.2 Solicit help in protecting the species and its essential habitats. Section 7 consultation under the Endangered Species Act, Fish and Wildlife Coordination Act requirements, and other habitat protection programs can assist in protection of the species, but these programs alone cannot recover the fanshell. The assistance of Federal and State agencies, conservation groups, and local governments will be essential. Also, support of the local industrial, business, and farming communities, as well as private citizens, will be needed to meet the goal of recovering the species. Without a commitment from the local people who have an influence on habitat quality in the streams inhabited by the species, recovery efforts will be doomed.

1.2.1 Meet with appropriate Federal, State, and local government officials and regional and local planners to inform them of our plans to attempt recovery and request their support. Other agencies, for example the U.S. Soil Conservation Service, have existing programs that benefit aquatic resources. By coordinating recovery efforts with such agencies, the species' recovery can benefit.

1.2.2 Meet with local business, mining, logging, farming, and/or industry interests and elicit their support in implementing protective actions.

1.2.3 Develop an educational program using such items as slide/tape shows, brochures, etc. Present this material to business groups, civic groups, youth groups, schools, church organizations, etc. Educational material outlining the Service's recovery goals must be presented to the public. However, this material should stress the other

benefits of maintaining diverse ecosystems and the use of mussels as indicators of good environmental quality.

1.3 Consider and, if determined necessary, use land acquisition as a means of protecting present and reintroduced populations.

2. Determine threats to the species, conduct research necessary for the species' management and recovery, and implement management where needed.

2.1 Conduct life history research on the species to include such factors as reproduction, food habits, age and growth, and mortality rates. Only very limited data on the fanshell's life history exists. Unless the species' life history and environmental requirements (especially its fish host) are defined, recovery efforts may be inconsequential or misdirected.

2.2 Characterize the species' habitat requirements (relevant physical, biological, and chemical components) for all life history stages. The fanshell appears to be sensitive to habitat degradation. The species coexists with other mussel species, but it occurs in much fewer numbers than most of the other species present. Knowledge of the species' habitat needs and ecological associations (especially fish host requirements) is needed to focus management and recovery efforts on the specific problems within the species' habitat.

2.3 Determine present and foreseeable threats to the species. Coal mining and oil and gas well development appear to have been major factors in altering the species' habitat and in reducing its range. Siltation from poor land use practices and impoundment have also had an impact. However, other impacts are also probable. The nature of and the mechanisms by which they impact the species and its habitat are not entirely understood. The extent to which the species can withstand these adverse impacts is unknown. To minimize and eliminate these threats where necessary to meet recovery, the information gathered under Tasks 2.1 and 2.2 must be utilized to target specific problem areas and determine the specific causative agent(s).

2.4 Investigate the relationships with nonnative bivalves. Many malacologists believe the Asiatic clam (Corbicula fluminea) poses a threat to the native mussel fauna. Another exotic clam, the zebra clam (Dreissena polymorpha), has recently invaded the Great Lakes, and some adverse impacts to endemic mussels have been noted.

The zebra clam has not yet been seen in the Ohio River basin. However, as the species has spread quickly in the Great Lakes, it is expected to invade other basins in the near future. The relationship between these nonnative mollusks and the native fauna needs to be understood, and (where feasible) measures should be taken to minimize their impact. It has been suggested (Arthur H. Clarke, Ecosearch Inc., personal communication, 1990) that Corbicula may adversely impact native mussels by consuming a significant portion of their sperm. Clarke suggests that, by concentrating endangered mussels, the loss of sperm would decrease, and reproductive success would increase. A study using nonendangered mussels should be used to test this hypothesis.

2.5 Determine the impact of commercial mussel fishing on the species and eliminate impacts determined to be detrimental to the species. There has been a substantial increase in mussel fishing, and the fanshell exists on some harvested mussel beds. The impact of mussel fishing on the species needs to be assessed and eliminated.

2.6 Based on the biological data and threat analysis, investigate the need for management, including habitat improvement. Implement management, if needed, to secure viable populations. Specific components of the fanshell's habitat may be lacking, and these may limit the species' potential expansion. Habitat improvement programs may be needed to alleviate limiting factors.

2.7 Determine number of individuals required to maintain a viable population. Theoretical considerations by Franklin (1980) and Soulé (1980) indicate that 500 breeding individuals represent a minimum population level (effective population size) that would contain sufficient genetic variation to enable that population to evolve and respond to natural habitat changes. The actual population size in a natural ecosystem necessary to provide 500 breeding individuals can be expected to be larger than this number, possibly by as much as 10 times. The factors that will influence effective population size include sex ratio, length of species' reproductive life, fecundity, and extent of exchange of genetic material within the population, plus other life history aspects. Some of these factors can be addressed under Task 2.1, while others will need to be addressed as part of this task.

3. Search for additional populations and/or habitat suitable for reintroduction efforts. Much of the species' potential

available habitat has been surveyed in recent years. An extensive 4-year survey of the Wabash River system in Indiana and Illinois has recently been completed, and the Tennessee River system has also received considerable attention in the last few years. However, it is possible that some relic populations were missed. Further study may yield additional populations; and, more importantly, suitable habitat for transplants could be identified during these surveys.

4. Determine, through research, the feasibility of augmenting extant populations and reestablishing the fanshell into historic habitat and reintroduce where feasible. The historic distribution of the fanshell is unknown, but available records indicate that the species was once widespread in the Ohio River system. Streams for possible reintroductions will be selected based on present and expected future habitat and water quality.

   4.1 Determine the need, appropriateness, and feasibility of augmenting and expanding existing populations. Most of the populations are likely below the number needed to maintain long-term viability. These populations may be able to expand naturally if environmental conditions are improved. However, some populations may be too small and may need to be supplemented to reach a viable size. Populations for this task will be selected based on present population size, habitat quality, and the likelihood of long-term benefits from the task.

   4.2 Develop a successful technique for reestablishing and augmenting populations. Sufficient specimens of the mussel are not presently available to allow for translocation of enough adults to establish populations. Propagation and reintroduction techniques should be developed for the species to help ensure success.

   4.3 Coordinate with appropriate Federal and State agency personnel, local governments, and interested parties to identify streams suitable for augmentation and reintroduction and those most easily protected from further threats.

   4.4 Reintroduce the species into its historic range and evaluate success. Using techniques developed in Task 4.2, introduce and monitor success.

   4.5 Implement the same protective measures for introduced populations that were outlined for established populations.

5. Develop and implement cryogenic techniques to preserve the species' genetic material until such time as conditions are

suitable for reintroduction. The fanshell populations that remain, except (possibly) for the Clinch, Green, and Licking River populations, may not be reproducing. Artificial propagation techniques may be able to provide juvenile mussels for transplants. However, present habitat conditions may not be suitable in all rivers at this time for reintroduction to succeed. Cryogenic preservation of the species could maintain genetic material (much like seed banks for endangered plants) from all the extant populations until such time as the habitat becomes suitable for reestablishment of the species. Additionally, if a population were lost to a catastrophic event, such as a toxic chemical spill, cryogenic preservation could allow for the eventual reestablishment of the population using the genetic material preserved from that population.

6. Develop and implement a program to monitor population levels and habitat conditions of presently established populations as well as newly discovered, introduced, or expanding populations. During and after recovery action implementation, the status of the species and its habitat must be monitored to assess any progress toward recovery. This should be conducted on a biennial schedule.

7. Annually assess overall success of the recovery program and recommend action (modify recovery objectives, delist, continue to protect, implement new measures, or conduct other studies, etc.). The recovery plan must be evaluated periodically to determine if it is on track and to recommend future actions. As more is learned about the species, recovery objectives may need to be modified.

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PART III

IMPLEMENTATION SCHEDULE

Priorities in column one of the following implementation schedule are assigned as follows:

1. Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

2. Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.

3. Priority 3 - All other actions necessary to meet the recovery objective.

Key to Acronyms Used in This Implementation Schedule

ADCNR	- Alabama Department of Conservation and Natural Resources
FWE	- Fish and Wildlife Enhancement
FWS	- U.S. Fish and Wildlife Service
ILDOC	- Illinois Department of Conservation
ILSNHSD	- Illinois State Natural History Survey Division
INDNR	- Indiana Department of Natural Resources
KDFWR	- Kentucky Department of Fish and Wildlife Resources
KSNPC	- Kentucky State Nature Preserves Commission
NPS	- National Park Service
ODNR	- Ohio Department of Natural Resources
PDER	- Pennsylvania Department of Environmental Resources
PFC	- Pennsylvania Fish Commission
TDOC	- Tennessee Department of Conservation
TNC	- The Nature Conservancy
TVA	- Tennessee Valley Authority
TWRA	- Tennessee Wildlife Resources Agency
VDGIF	- Virginia Department of Game and Inland Fisheries
VNHP	- Virginia Natural Heritage Program
WVDNR	- West Virginia Department of Natural Resources

IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES ($000'S)			COMMENTS
				FWS						
				Region	Division	Other	FY 1991	FY 1992	FY 1993	
1	1.1	Continue to utilize existing legislation and regulations to protect species and its habitat.	Ongoing	3, 4, 5	FWE	See *1.	7.0	7.0	7.0	
2	1.2.1, 1.2.2	Meet with local governmental officials and business interests and elicit their support for recovery.	3	3, 4, 5	FWE	See *1.	---	---	2.0	
1	1.2.3	Develop information and education program and present.	Ongoing	3, 4, 5	FWE	See *1.	25.0	20.0	---	Task duration: 1 year to develop, then continuous.
2	1.3	Consider use of land acquisition to protect the species.	Ongoing	3, 4, 5	FWE	See *1.	---	---	---	
1	2.1, 2.2, 2.3, 2.4	Conduct research necessary for species management and recovery;	4	3, 4, 5	FWE	See *1.	25.0	50.0	50.0	

IMPLEMENTATION SCHEDULE

PRIOR-ITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES ($000'S)			COMMENTS
				FWS		Other	FY 1991	FY 1992	FY 1993	
				~~Region~~	~~Division~~					
		habitat, augment populations, and protect any populations established.								
1	5	Develop and implement cryopreservation.	3 years	3, 4, 5	FWE	See *1.	5.0	5.0	5.0	
2	6	Develop and implement a monitoring program.	Ongoing	3, 4, 5	FWE	See *1.	---	---	8.0	Biennial.
3	7	Annually assess recovery program and modify program and plan where required.	Ongoing	3, 4, 5	FWE	See *1.	0.5	0.5	0.5	

*1 - ADCNR, ILDOC, ILSNHSD, INDNR, KDFWR, KSNPC, NPS, ODNR, PDER, PFC, TDOC, TNC, TVA, TWRA, VDGIF, VNHP, and WVDNR

IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (Years)	RESPONSIBLE PARTY			COST ESTIMATES ($000'S)			COMMENTS
				FWS		Other	FY 1991	FY 1992	FY 1993	
				Region	Division					
		i.e., habitat requirements, biology, and threat analysis.								
See comments.	2.5	Based on biological and threat analysis, investigate need for management and implement where needed.	1 year	3, 4, 5	FWE	See *1.	---	---	---	Priority 1, 2, or 3 (depending on result of 2.1, 2.2, 2.3, and 2.4).
3	2.6	Determine number of individuals required to maintain viable population.	1 year	3, 4, 5	FWE	See *1.	---	---	?	
1	3	Search for additional populations and suitable habitat.	1 year	3, 4, 5	FWE	See *1.	30.0	30.0	8.0	
1	4	Develop techniques, select sites, reintroduce the species back into historic	Ongoing	3, 4, 5	FWE	See *1.	40.0	40.0	40.0	Task duration: 3 years (protection continues).

PART IV

LIST OF REVIEWERS

Mr. Max Henschen
4307 Greenway Drive
Indianapolis, Indiana 46220

Mr. Kevin Cummings
Illinois State Natural History
Survey Division
607 E. Peabody Drive
Champaign, Illinois 61820

Mr. Charles D. Kelley, Director
Division of Game and Fish
Alabama Department of Conservation and
Natural Resources
64 N. Union Street
Montgomery, Alabama 36130

Ms. Sally Van Meter
Deputy Director for Resource Protection
Ohio Department of Natural Resources
Fountain Square
Columbus, Ohio 43224

Mr. Richard E. Moseley, Jr., Chief
Division of Natural Areas and Preserves
Ohio Department of Natural Resources
Fountain Square
Columbus, Ohio 43224

Mr. Warren W. Tyler, Director
Environmental Protection Agency
P.O. Box 1049
Columbus, Ohio 43216-1049

Mr. Ron Potesta, Deputy Director
West Virginia Department of
Natural Resources
1800 Washington Street, East
Charleston, West Virginia 25305

Mr. Nicholas DeBenedictis, Secretary
Pennsylvania Department of
Environmental Resources
Press Office
9th Floor, Fulton Building
Box 2063
Harrisburg, Pennsylvania 17120

Mr. Ralph W. Abele
Executive Director
Pennsylvania Fish Commission
P.O. Box 1673
Harrisburg, Pennsylvania 17105-1673

Mr. Ron Darden, Superintendent
Natural Resources
Illinois Department of Agriculture
State Fairgrounds
Springfield, Illinois 62706

Director
Illinois Department of Conservation
Lincoln Tower Plaza
524 S. Second Street
Springfield, Illinois 62706

Dr. Michael A. Hoggarth
Ohio Department of Transportation
Bureau of Environmental Services
25 South Front Street, Room 608
Columbus, Ohio 43215

Chairman
Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

Chairman
Illinois Nature Preserves Commission
600 N. Grand Avenue
Springfield, Illinois 62706

State Director
Illinois State Natural History
Survey Division
172 Natural Resources Building
607 E. Peabody Drive
Champaign, Illinois 61820

Mr. James Lahey, Chairman
Natural Resources Commission
Indiana Department of Natural Resources
608 State Office Building
Indianapolis, Indiana 46204

Mr. Edward Hansen, Head
Division of Fish and Wildlife
Indiana Department of Natural Resources
608 State Office Building
Indianapolis, Indiana 46204

Mr. John Bacone, Head
Division of Nature Preserves
Indiana Department of Natural Resources
608 State Office Building
Indianapolis, Indiana 46204

Mr. Donald Houchin
County Courthouse
P.O. Box 253
Brownsville, Kentucky 42210

Colonel David E. Peixotto
District Engineer
U.S. Army Corps of Engineers
P.O. Box 59
Louisville, Kentucky 40201-0059

Mr. Roy Baker
County Executive
Hancock County Courthouse
Sneedville, Tennessee 37869

Mr. Bud Bristow
Executive Director
Virginia Department of Game and
Inland Fisheries
4010 W. Broad Street, Box 11104
Richmond, Virginia 23230

Mr. David Whitehurst, Chief
Fish Division
Virginia Department of Game and
Inland Fisheries
4010 W. Broad Street, Box 11104
Richmond, Virginia 23230

Ms. Sue Bruenderman
Aquatic Nongame Biologist
Virginia Department of Game and
Inland Fisheries
Route 2, Box 54706
Ashland, Virginia 23005

Mr. Keith J. Buttleman, Administrator
Virginia Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219

Mr. Roland B. Geddes, Director
Virginia Division of Soil and
Water Conservation
203 N. Governor Street, Suite 206
Richmond, Virginia 23219

Mr. Eric Bartsch, Director
Division of Water Programs
Virginia Office of Health Protection
James Madison Building
109 Governor Street
Richmond, Virginia 23219

Mr. Temple Bayliss, Director
Division of Energy
Virginia Department of Mines,
Minerals and Energy
2201 West Broad Street
Richmond, Virginia 23220

Mr. J. Franklin Townsend, Jr.
Chairman
Virginia Soil and Water
Conservation Board
Route 1, Box 185
King William, Virginia 23086

State Water Control Board
2111 N. Hamilton Street
P.O. Box 11143
Richmond, Virginia 23230

Dr. Richard J. Neves
Virginia Cooperative Fish and Wildlife
Research Unit
Virginia Polytechnic Institute and
State University
106 Cheatham Hall
Blacksburg, Virginia 24061

Mr. Chuck Traub, III, President
Virginia Wildlife Federation
784 Glasgow Court
Virginia Beach, Virginia 23452

Ms. Billie P. Lynch
County Administrator
112 Water Street, Suite #1
Gate City, Virginia 24251

Mr. Elbert T. Gill, Jr., Commissioner
Tennessee Department of Conservation
701 Broadway
Nashville, Tennessee 37219-5237

Mr. Gary Myers, Executive Director
Tennessee Wildlife Resources Agency
Ellington Agricultural Center
P.O. Box 40747
Nashville, Tennessee 37204

Mr. Richard Becker
Environmental Officer
Housing and Urban Development
710 Locust Street, SW., #300
Knoxville, Tennessee 37902

Mr. Jerry Lee
U.S. Soil Conservation Service
U.S. Courthouse, Room 675
801 Broadway
Nashville, Tennessee 37203

Mr. Edward G. Oakley
Division Administrator
Federal Highway Administration
249 Cumberland Bend Drive
Nashville, Tennessee 37228

Mr. John E. Alcock
Regional Forester
U.S. Forest Service
1720 Peachtree Road, NW.
Atlanta, Georgia 30367

Mr. Jack E. Ravan
Regional Administrator
Environmental Protection Agency
345 Courtland Street, NE.
Atlanta, Georgia 30365

Director
Office of Hydropower Licensing
Federal Energy Regulatory Commission
825 North Capitol Street, NE.
Washington, D.C. 20426

Tennessee State Clearinghouse
1800 James K. Polk Building
501 Deadrick Street
Nashville, Tennessee 37219

Southeast Region
U.S. Geological Survey
75 Spring Street, #772
Atlanta, Georgia 30303

Head of Engineering
Project Planning and Engineering Branch
Department of Housing and
Urban Development
Renewal Assistance Administration
Room 9268
Washington, DC 20413

Mr. A. Stephen Reeder, Commissioner
Kentucky Department of Highways
Capital Plaza Tower
Frankfort, Kentucky 40601

Mr. Peter W. Pfeiffer, Director
Kentucky Department of Fish and
Wildlife Resources
Department of Fisheries
Arnold L. Mitchell Building
#1 Game Farm Road
Frankfort, Kentucky 40601

Mr. G. Floyd Hughes, Jr., Director
Kentucky Department of Highways
Division of Environmental Analysis
419 Ann Street
Frankfort, Kentucky 40601

Mr. Fran Curci, Commissioner
Kentucky Department of Parks
10th Floor - Capital Plaza Building
Frankfort, Kentucky 40601

Ms. Charlotte Baldwin, Secretary
Kentucky Natural Resources and
Environmental Protection Cabinet
Capital Plaza Tower
Frankfort, Kentucky 40601

Mr. Charles W. Martin
Acting Commissioner
Kentucky Department for Surface Mining
Reclamation and Enforcement
Capital Plaza Tower, 3rd Floor
Frankfort, Kentucky 40622

Colonel James P. King
U.S. Army Corps of Engineers
Nashville District
P.O. Box 1070
Nashville, Tennessee 37202-1070

Mr. William H. Redmond
Regional Natural Heritage Project
Tennessee Valley Authority
Norris, Tennessee 37828

Mr. David Yancy
Kentucky Department of Fish
and Wildlife Resources
Arnold L. Mitchell Building
#1 Game Farm Road
Frankfort, Kentucky 40601

Mr. Richard Hannan, Director
Kentucky State Nature
Preserves Commission
407 Broadway
Frankfort, Kentucky 40475

Mr. Paul Schmierbach, Manager
Environmental Quality
Tennessee Valley Authority
Room 201, Summer Place Building
Knoxville, Tennessee 37902

Division Administrator
Federal Highway Administration
P.O. Box 536
Frankfort, Kentucky 40601

Mr. Randall Giessler
U.S. Soil Conservation Service
333 Waller Avenue, Room 305
Lexington, Kentucky 40504

Mr. George C. Miller, Director
Knoxville Field Office
Office of Surface Mining
Reclamation and Enforcement
530 Gay Street, Suite 500
Knoxville, Tennessee 37902

Ms. Wanda Rachels, Director
Atlanta Support Office
Department of Energy
730 Peachtree Street, NE., Suite 876
Atlanta, Georgia 30308

Mr. Kenneth C. Imes, Commissioner
Department for Natural Resources
Kentucky Natural Resources and
Environmental Protection Cabinet
5th Floor, Capital Plaza Tower
Frankfort, Kentucky 40601

Mr. T. Michael Taimi, Commissioner
Department for Environmental Protection
Kentucky Natural Resources and
Environmental Protection Cabinet
18 Reilly Road
Frankfort, Kentucky 40601

Mr. H. Stanley Head, Director
Division of Conservation
Kentucky Natural Resources and
Environmental Protection Cabinet
691 Teton Trail
Frankfort, Kentucky 40601

Mr. Elmore C. Grim, Commissioner
Department for Surface Mining Reclamation
and Enforcement
Kentucky Natural Resources and
Environmental Protection Cabinet
5th Floor, Capital Plaza Tower
Frankfort, Kentucky 40601

Mr. Bill Adams, Director
Division of Field Services
Kentucky Natural Resources and
Environmental Protection Cabinet
5th Floor, Capital Plaza Tower
Frankfort, Kentucky 40601

Mr. Donald Harker, Director
Division of Water
Kentucky Natural Resources and
Environmental Protection Cabinet
5th Floor, Capital Plaza Tower
Frankfort, Kentucky 40601

Mr. William Davis, Director
Division of Environmental Services
Kentucky Natural Resources and
Environmental Protection Cabinet
5th Floor, Capital Plaza Tower
Frankfort, Kentucky 40601

Mr. Don R. McCormick
Kentucky Department of Fish and
Wildlife Resources
#1 Game Farm Road
Frankfort, Kentucky 40601

Mr. Wm. Horace Brown, Chairperson
Environmental Quality Commission
18 Reilly Road, Ash Annex
Frankfort, Kentucky 40601

Mr. Donald C. Haney
Director and State Geologist
Geological Survey
311 Breckinridge Hall
University of Kentucky
Lexington, Kentucky 40506

Mr. Lou Karibo, Commissioner
Kentucky Department of Parks
10th Floor Capital Plaza Building
Frankfort, Kentucky 40601

Mr. Dan Eagar
Program Administrator
Tennessee Department of Conservation
701 Broadway
Nashville, Tennessee 37203

Mr. Frank Pridemore
Superintendent
Mammoth Cave National Park
Mammoth Cave, Kentucky 42259

Regional Director
Federal Railroad Administration
Department of Transportation
Suite 440, North Tower
1720 Peachtree Road, NW.
Atlanta, Georgia 30309

Mr. Steven A. Ahlstedt
Field Operations
Division of Water Resources
Forestry Building
Norris, Tennessee 37828

Dr. Arthur E. Bogan
Department of Malacology
Academy of Natural Sciences
Nineteenth and the Parkway
Philadelphia, Pennsylvania 19103

Dr. Paul W. Parmalee
Department of Anthropology
The University of Tennessee
Knoxville, Tennessee 37916

Dr. James B. Sickel
Murray State University
Department of Biology
Murray, Kentucky 42071

Dr. David H. Stansbery
Museum of Zoology
Ohio State University
1813 North High Street
Columbus, Ohio 43210

Mr. Wendell Haag
Museum of Zoology
Ohio State University
1813 North High Street
Columbus, Ohio 43210

Dr. Guenter A. Schuster, Professor
Department of Biological Sciences
Eastern Kentucky University
Richmond, Kentucky 40475-0950

Dr. Paul Yokley, Jr.
Department of Biology
University of North Alabama
Florence, Alabama 35630

Mr. Jimmie Patterson
County Executive
Harden County Courthouse
Savannah, Tennessee 38372

Mr. Don Simpson
County Executive
Wilson County Courthouse
Lebanon, Tennessee 37087

Mr. G. W. Oldham
County Executive
Trousdale County Courthouse
Hartsville, Tennessee 37074

Mr. C. E. Hackett
County Executive
Smith County Courthouse
Carthage, Tennessee 37030

Mr. Vince Lang
County Judge
Box 486
Munfordville, Kentucky 42765

Mr. Robert Aikman
Rhea County Executive
County Courthouse
Dayton, Tennessee 37321

Mr. Raymond Bivens
Meigs County Executive
County Courthouse
Decatur, Tennessee 37322

Board of County Commissioners
White County Courthouse
Carmi, Illinois 62821

Board of County Commissioners
Wabash County Courthouse
Mt. Carmel, Illinois 62863

Board of County Commissioners
Wabash County Courthouse
Wabash, Indiana 46992

Board of County Commissioners
Martin County Courthouse
Shoals, Indiana 47581

Board of County Commissioners
Tippecanoe County Courthouse
Lafayette, Indiana 47901

Board of County Commissioners
Posey County Courthouse
Mount Vernon, Indiana 47620

Mr. Floyd J. Marita
Regional Forester
U.S. Forest Service
310 W. Wisconsin Avenue
Milwaukee, Wisconsin 53203

Chief of Engineers
Department of the Army
Corps of Engineers
210 N. 12th Street
St. Louis, Missouri 63101

Chief of Engineers
Department of the Army
Corps of Engineers
700 Federal Office Building
Kansas City, Missouri 64106

Chief of Engineers
Department of the Army
Corps of Engineers
6014 U.S. Post Office and Courthouse
Omaha, Nebraska 68102

Chief of Engineers
Department of the Army
Corps of Engineers
111 North Canal Street, Suite 600
Chicago, Illinois 60606

Chief of Engineers
Department of the Army
Corps of Engineers
P.O. Box 1027
Detroit, Michigan 48231

Chief of Engineers
Department of the Army
Corps of Engineers
Clock Tower Building
Rock Island, Illinois 61201

Chief of Engineers
Department of the Army
Corps of Engineers
1135 U.S. Post Office and Customhouse
St. Paul, Minnesota 55101

National Park Service
Interior Building
P.O. Box 37127
Washington, DC 20013-7127

Mr. Don H. Castleberry
Regional Director
National Park Service
1709 Jackson Street
Omaha, Nebraska 68102

Mr. Valdas V. Adamkus, Administrator
U.S. Environmental Protection Agency
230 S. Dearborn
Chicago, Illinois 60604

Mr. Morris Kay, Administrator
U.S. Environmental Protection Agency
726 Minnesota Avenue
Kansas City, Kansas 66101

Dr. Lorin Nevling, Chief
Illinois State Natural History
Survey Division
Department of Energy and
Natural Resources
607 E. Peabody
Urbana, Illinois 61820

Illinois Department of Transportation
2300 S. Dirksen Parkway
Springfield, Illinois 62764

Mr. Donald R. Vonnahme, Director
Illinois Division of Water Resources
2300 S. Dirksen Parkway
Springfield, Illinois 62764

Mr. Richard J. Carlson, Director
Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

Mr. Robert W. Gorden, Head
Aquatic Biology Section
Illinois State Natural History
Survey Division
172 Natural Resources Building
607 E. Peabody Drive
Champaign, Illinois 61820

Mr. Harold H. Wilson, Chairman
State Soil and Water Conservation
Committee
Indiana Department of Natural Resources
Room 7, AGAD Building
Purdue University
West Lafayette, Indiana 47907

Director
Ohio Department of Natural Resources
Fountain Square
Columbus, Ohio 43224

Mr. Robert Goettemoeller, Chief
Division of Water
Ohio Department of Natural Resources
Fountain Square
Columbus, Ohio 43224

Mr. Max E. Duckworth, Chief
Division of Wildlife
Ohio Department of Natural Resources
Fountain Square
Columbus, Ohio 43224

Dr. Charles C. King, Executive Director
Ohio Biological Survey
980 Biological Sciences Building
Ohio State University
484 W. 12th Avenue
Columbus, Ohio 43210

Dr. Robert F. Carline
Unit Leader
Pennsylvania Cooperative Fish and
Wildlife Research Unit
Ferguson Building
Pennsylvania State University
University Park, Pennsylvania 16802

Mr. Joshua C. Whetzel, Jr., Chairman
Western Pennsylvania Conservancy
316 Fourth Avenue
Pittsburgh, Pennsylvania 15222

Mr. Willis H. Hertig, Jr., Director
West Virginia Department of
Natural Resources
1800 Washington Street, East
Charleston, West Virginia 25305

Mr. Bernard F. Dowler
Assistant Chief
Warmwater Fisheries
West Virginia Department of
Natural Resources
1800 Washington Street, East
Charleston, West Virginia 25305

West Virginia Highlands Conservancy
P.O. Box 306
Charleston, West Virginia 25321

Board of County Commissioners
Gibson County Courthouse
Princeton, Indiana 47670

Chief of Engineers
Department of the Army
Corps of Engineers
Pulaski Building
200 Mass Avenue, NW.
Washington, DC 20314

Mr. David W. Robinson
Chief of Water Resources
West Virginia Department of
Natural Resources
1800 Washington St., East
Charleston, West Virginia 25305

Mr. Robert Aldemeyer
County Judge
County Courthouse
Covington, Kentucky 41011

Mr. Ken Paul
County Judge
County Courthouse
Newport, Kentucky 41072

Mr. David Pribble
County Judge
County Courthouse
Falmouth, Kentucky 41040

Mr. James E. Claxon
County Judge
County Courthouse
Greenup, Kentucky 41144

Mr. Joe Kitchen
County Judge
County Courthouse
Grayson, Kentucky 41143

Mr. Robert James, President
Morgan County Commission
94 S. Fifth Street
McConnelsville, Ohio 43756

Mr. Dick Young, President
Washington County Commission
205 Putnam Street
Marietta, Ohio 45750

Mr. Gene Carte, President
Fayette County Commission
Fayetteville, West Virginia 25840

Environmental Assessment Section
Kentucky Natural Resources and
Environmental Protection Cabinet
Division of Abandoned Lands
618 Teton Trail
Frankfort, Kentucky 40601

Environmental Planner
Air Force Regional Civil Engineer - ER
77 Forsyth Street, SW., Suite 291
Atlanta, Georgia 30335-6801

Natural Resources Program Manager
DAEN-ZCF-B
Pulaski Building
Washington, DC 20314

Director, Environmental Programs
DAEN-CWZ-P
Pulaski Building
Washington, DC 20314

Natural Resources Program Manager
Navy Facilities Engineering Command
Code 2042
200 Stovall Street
Alexandria, Virginia 22332-2300

Natural Resources Program Manager
HQMC-LFL
Washington, DC 20380-0001

Chief, Environmental Division
Engineering and Services Directorate
HQ, Air Force
Bolling Air Force Base
Washington, DC 20332-6180

Mr. David S. Beck
Director of Governmental Affairs
Kentucky Farm Bureau Federation
120 South Hubbards Lane
P.O. Box 7200
Louisville, Kentucky 40207

Mr. Michael Lipford
Department of Conservation and Recreation
Virginia Natural Heritage Program
203 Governor Street, Suite 402
Richmond, Virginia 23219

Dr. Arthur Clarke
Ecosearch Inc.
325 E. Bayview
Portland, Texas 78374

Mr. Mike Turner (PD-R)
U.S. Army Corps of Engineers
Louisville District
P.O. Box 59
Louisville, Kentucky 40201

Mr. Julius T. Johnson
Director of Public Affairs
Tennessee Farm Bureau Federation
P.O. Box 313
Columbia, Tennessee 38401

Ms. Deborah Wassenaar, Attorney
Southern Environmental Law Center
201 W. Main Street, Suite 14
Charlottesville, Virginia 22901

Mr. George Fenwick
The Nature Conservancy
Virginia Field Office
1110 Rose Hill Drive, #200
Charlottesville, Virginia 22901

U.S. Forest Service
Wildlife, Fisheries, and Range
1720 Peachtree Road, NW.
Atlanta, Georgia 30367

Environmental Protection Agency
Hazard Evaluation Division - EEB (TS769C)
401 M Street, SW.
Washington, DC 20460

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814

Dr. G. Thomas Watters
Museum of Zoology
Ohio State University
1813 N. High Street
Columbus, Ohio 43210-1394

Federal Highway Administration
Office of Environmental Policy
Environmental Analysis Division
400 Seventh Street, SW., Room 3240
Washington, DC 20590

Directorate for Biological, Behavioral,
and Social Sciences
National Science Foundation
1800 G Street, NW., Room 215
Washington, DC 20550

Mr. Dennis Sanders
Virginia Department of Transportation
P.O. Box 1768
Bristol, Virginia 24203

Mr. William Beuter
Virginia Department of Transportation
Environmental Division
1201 E. Broad Street
Richmond, Virginia 23219

Dr. James Layzer
U.S. Fish and Wildlife Service
Tennessee Cooperative Fishery
Research Unit
Tennessee Technological University
Box 5114
Cookeville, Tennessee 38505

Dr. Mark Gordon
U.S. Fish and Wildlife Service
Tennessee Cooperative Fishery
Research Unit
Tennessee Technological University
Box 5114
Cookeville, Tennessee 38505

World Conservation Monitoring Centre
219c Huntingdon Road
Cambridge
CB3 ODL
United Kingdom

Environmental Assessment Section
Kentucky Natural Resources and
Environmental Protection Cabinet
Department for Natural Resources
Division of Abandoned Lands
618 Teton Trail
Frankfort, Kentucky 40601