

**BIOLOGICAL OPINION  
FOR THE PROPOSED  
STATE ROUTE 32 IMPROVEMENT  
CLAIBORNE AND GRAINGER COUNTIES, TENNESSEE**

**ISSUED BY:**

**U.S. FISH AND WILDLIFE SERVICE  
ECOLOGICAL SERVICES  
COOKEVILLE, TENNESSEE**

**MAY 1993**

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**A. INTRODUCTION**

This presents the biological opinion of the U.S. Fish and Wildlife Service (Service) regarding impacts to federally listed endangered and threatened species from improvement of State Route 32/U.S. 25E in Grainger and Claiborne Counties, Tennessee. It responds to your letter of January 7, 1993, requesting formal consultation. This biological opinion only addresses requirements of Section 7(a)(2), 7(b)(4), and 7(o)(2) of the Endangered Species Act of 1973, as amended, and does not include the requirements of other environmental statutes such as the Fish and Wildlife Coordination Act or the National Environmental Policy Act. The Federal Highway Administration has determined that the proposed project may affect the following endangered and threatened species:

Gray bat - Myotis grisescens (E)  
Indiana bat - Myotis sodalis (E)  
Slender chub - Hybopsis cahni (T)  
Yellowfin madtom - Noturus flavipinnis (T)  
Birdwing pearly mussel - Conradilla caelata (E)  
Dromedary pearly mussel - Dromus dromas (E)  
Fine-rayed pigtoe - Fusconaia cuneolus (E)  
Rough pigtoe - Pleurobema plenum (E)  
White wartyback pearly mussel - Plethobasus cicatricosus (E)  
Shiny pigtoe - Fusconaia edgariana (E)  
Cumberland monkeyface pearly mussel - Quadrula intermedia (E)  
Appalachian monkeyface pearly mussel - Quadrula sparsa (E)  
Yellow-blossom pearly mussel - Epioblasma florentina (E)  
Cracking pearly mussel - Hemistena lata (E)  
Fanshell - Cyprogenia stegaria (E)  
Green-blossom pearly mussel - Epioblasma torulosa gubernaculum  
(E)

In addition to the listed species, the Clinch and Powell Rivers from the backwaters of Norris Lake upstream to the Tennessee/Virginia border have been designated as critical habitat for the slender chub. The Powell River from the backwaters of Norris Lake to the Virginia/Tennessee border has also been designated as critical habitat for the yellowfin madtom. The State Route 32 crossings of these rivers marks the downstream limit of the critical habitat. Therefore, this biological opinion will include an evaluation of impacts to the critical habitat and provide a finding of whether or not the proposed highway improvement project will result in destruction or adverse modification of that habitat.

On July 8, 1992, the pygmy madtom (Noturus stanauli) was officially proposed for listing as an endangered species. This species is known to occur in the Clinch River and may inhabit areas within the project area. A final rule has been submitted to the Service's Washington Office for review and the species may be officially listed in the near future. Section 7 regulations require Federal agencies to determine if proposed projects are likely to jeopardize the continued existence of proposed species. If a finding of "likely to jeopardize" is made, the agency must confer with the Service. The Service issues a "conference report" which may become the biological opinion once the species is

listed. Because the pygmy madtom may occur in the project area, the Service will attach a conference report to this biological opinion addressing potential impacts to the species.

## **B. PROJECT DESCRIPTION**

The proposed action consists of the improvement of State Route 32 from 0.6 mile north of Indian Creek in Grainger County to 0.9 mile north of the Powell River in Claiborne County. The entire length of the highway will be widened from the existing two lanes to four lanes with a median. New bridges will be constructed adjacent to the existing bridges over the Clinch and Powell Rivers. Piers for the new bridges will be located in the vicinity of the existing piers. The piers supporting the Powell River bridge are generally not in the river, but may be immediately adjacent to the water during normal flows. Those supporting the Clinch River bridge are in the river.

Impacts to aquatic species associated with project construction will result primarily from sediment input into the rivers from construction sites and runoff from denuded areas at the bridge approaches. Runoff or spills from equipment staging and maintenance areas could result in pollutants such as petroleum, grease, and solvents entering the rivers. High mortalities of fish and mussels could result, particularly if heavy sedimentation, runoff, or spill occurred during periods of low flow.

Construction of the highway and bridge approaches may result in removal of significant amounts of vegetation. Removal of large riparian trees or dense riparian vegetation could result in sedimentation resulting from erosion of denuded river banks. Loss of vegetation could also result in increases in water temperature and alteration of aquatic communities, rendering the area unsuitable as spawning areas or foraging areas for aquatic and terrestrial species. Operation of equipment in the river channels could dislodge or physically destroy mussels, suspend sediments, and destroy habitat for benthic organisms.

In order to prevent adverse impacts to the riverine habitat and aquatic communities in the Clinch River and Powell River, the Tennessee Department of Transportation (TDOT) will strictly adhere to the provisions of Section 209 of TDOT's Specific Specifications for Road and Bridge Construction and the Federal Highway Administration's Federal Highway Administration Best Management Practices for Erosion and Sediment Control.

## **C. CONSULTATION HISTORY**

Consultation for the proposed State Route 32 project was originally initiated by a letter dated September 20, 1989 from Mr. Raymond Brisson, Transportation Manager of the Tennessee Department of Transportation's Environmental Planning Office, addressed to Mr. Doug Winford, Acting Field Supervisor of the Service's Cookeville, Tennessee, Field Office. Consultation was initiated for the entire length of the proposed project. The Service responded by letter of October 3, 1989, stating that 13 federally endangered species might occur in the project impact area. Another letter from Mr. Brisson, dated September 5, 1990, to Mr. Winford requested information on threatened and endangered species, or critical habitat, that might occur in the vicinity of the proposed project. The Service responded to this request by letter of September 18, 1990. For the second time, a list of 13 federally-listed species was provided, and the Department of Transportation was informed that the Clinch and Powell River in the project area was designated as critical habitat for two listed fish.

On December 19, 1990, Mr. Charles Bush, Manager of the Tennessee Department of Transportation's Environmental Planning Office submitted a letter to the Cookeville Office Field Supervisor. This letter indicated that the proposed project was in the initial planning stages and requested the Service's comments regarding potential impacts the project might have on any Service programs. Again this request was made for the entire length of the project. The Service's response, dated January 15, 1991, provided technical assistance and comments regarding potential impacts the project might have on fish and wildlife resources. Also, and for the third time, the Service provided a list of 13 endangered and threatened species that might occur in the project area. The Department of Transportation was informed for the second time that the Clinch and Powell Rivers in the project area were designated as critical habitat for two fish species.

Mr. Brisson submitted another letter to the Service on February 7, 1992, requesting coordination on six bridge repair projects. Two of the bridges included were the State Route 32 bridges over the Clinch and Powell Rivers. The Service responded on February 27, 1992, stating that ten listed species might inhabit the rivers or adjacent terrestrial habitats in the project area; three in the Clinch River bridge and nine in the Powell. The Service again informed Mr. Brisson that these river reaches were designated critical habitat.

A copy of this consultation is on file and available for review during normal business hours at the Fish and Wildlife Service's Ecological Services Field Office, 446 Neal Street, Cookeville, Tennessee 38501; telephone 615/528-6481, FAX 615/528-7075.

## **D. BIOLOGICAL OPINION**

### **MAMMALS**

#### **o Gray bat**

The gray bat, Myotis grisescens, a federally endangered species, is the largest species in the genus Myotis in the eastern United States, growing to body weights of 7 to 16 grams and forearm lengths of 40 to 46 millimeters. The species' unicolored dorsal fur is a distinguishing characteristic; all other eastern bats have bi- or tri-colored fur. It also differs from other Myotis species in that its wing membrane connects to the foot at the ankle rather than at the base of the first toe (USFWS 1982).

M. grisescens occupies a limited range in limestone karst areas of the southeastern United States. Populations occur in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee. Smaller populations have also been found in northwestern Florida, western Georgia, southeastern Kansas, southern Indiana and Illinois, northeastern Oklahoma, northeastern Mississippi, western Virginia, and western North Carolina. Historically, major hibernating populations contained 100,000 to 1,500,000 or more bats. Ninety-five percent of the entire species' population hibernates in nine caves; over half inhabit one cave (USFWS 1982). Primary summer colonies number from 10,000 to 50,000 bats. Migration occurs between hibernacula and summer colonies. Distances traveled range from 17 to 525 kilometers.

The gray bat may be the most habitat-restricted mammal in the United States. It occurs in caves year-round and is extremely selective in its habitat. Hibernacula act as cold air traps and maternity caves have the capability to trap warm air or body heat of roosting bats. The home range of summer colonies may consist of several roosting caves scattered along as much as 70 kilometers of river bank or reservoir shoreline. Although males and yearling females may be less habitat selective, gray bats

exhibit strong loyalty to the caves within their home range; bats displaced by destruction of cave habitat or disturbance are not likely to survive (USFWS 1982).

Mating occurs upon arrival at the hibernaculum, and females commence hibernation immediately upon mating. Males remain active for several weeks to replenish fat reserves used during mating. Most individuals are in hibernation by early November. Females store sperm through the winter and become pregnant soon after emergence from hibernation in late March or early April. Juveniles and adult males generally emerge between mid-April and mid-May. Each female gives birth to a single young in late May or early June. The young learn to fly in 20 to 35 days. Growth rates for newly volant young bats have been found to be inversely proportional to the distance from the cave to the nearest foraging area.

Gray bats feed primarily over water along rivers or reservoir shorelines that contain good forest canopy. Gray bats have not been found feeding over streams from which the adjacent forest had been cleared. In addition, the bats utilize forest canopy as much as possible when flying between the roosting cave and the foraging area. Although adult gray bats may fly as far as four kilometers to forage, many young feed in the forest canopy around the cave entrance. Primary food is mayflies, but the bats feed on a variety of aquatic insects.

Human disturbance is thought to be the primary cause of decline in M. grisescens. Hibernating bats rely on stored fat reserves for survival during the winter. Visitation of hibernacula causes arousal of the colony; each arousal event may cause individual bats to expend up to 30 days worth of stored reserves. Repeated arousals will eventually result in exhaustion of all fat reserves. The bats will then leave the cave in search of food and, if they emerge too early in the season, will likely perish from starvation. Maternity colonies are also extremely sensitive to disturbance. Disturbance of maternity colonies likely causes high mortality of flightless young. Other factors that have contributed to the decline of gray bat populations include impoundment (flooding of caves), commercialization of caves, pesticide contamination, siltation and channelization of foraging habitats, installation of poorly designed gates, and deforestation.

Gray bat summer colonies exist in White Buis and Station Creek Caves in Claiborne County. In Grainger County a maternity colony occurs in Indian Cave, and Coon Cave is used as a stopover during migration. Station Creek Cave is located over four miles from the project area, and Indian Cave is located along the Holston River, well out of the project impact area. White Buis Cave is also located well out of the project area. All of these caves appear to be located close to suitable foraging habitat. Therefore, it is unlikely that the bats inhabiting these caves are feeding in the project area.

Upon review of available information, it is the biological opinion of the Service that, because no known gray bat colonies are located within four miles of the project area, and adequate foraging habitat for the known colonies exists outside the project impact area, widening of State Route 32 is not likely to jeopardize the continued existence of the gray bat.

#### o Indiana bat

The Indiana bat, Myotis sodalis, is an endangered species. It grows to body lengths of 41 to 49 millimeters with forearm lengths of 35 to 41 millimeters. It is similar to the little brown bat, but differs in having a keeled calcar and a small sagittal crest (USFWS 1983a).

Historically, M. sodalis occupied a wide range in the eastern United States and its present range still includes much of this area. Primary known hibernacula exist in Indiana, Missouri, and Kentucky; however, smaller populations and single records are known from Alabama, Arkansas, Connecticut,

Florida, Georgia, Illinois, Iowa, Maryland, Massachusetts, Michigan, Mississippi, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin. Although it occurs over a wide area, approximately 85 percent of the total population hibernates in seven caves. Fifty percent utilizes two caves as hibernacula (USFWS 1983a).

M. sodalis migrates between hibernacula and summer roosts. Males are restricted to cave habitats year-round, but females inhabit two distinct habitats. Upon emergence from the hibernacula, female Indiana bats disperse and form small maternity colonies under loose bark or in cracks or holes of mature trees in riparian and upland forest. Known maternity colonies contain 50 to 100 bats (USFWS 1983a).

Indiana bats arrive at their hibernacula in mid- to late September. Upon arrival swarming occurs, an activity that may last for several weeks. During this time, the bats replenish fat reserves prior to hibernation. Mating occurs as early as October, immediately after which the females begin hibernation. Males may continue swarming for some time after mating, but most of the males have begun hibernation by late November. Myotis sodalis requires specific habitat conditions in the hibernaculum; temperatures must be stable between 4 and 8 degrees (Celsius) and relative humidity above 74 percent (USFWS 1983a). The bats generally hibernate in dense clusters of 300 individuals per square foot. Females emerge from hibernation in mid- to late March followed by the males in early to mid-April (USFWS 1983a).

Females store sperm through the winter and become pregnant soon after emergence from hibernation in late March or early April. Each female gives birth to a single young in June or July, and within one month the young are able to fly. While most maternity colonies exist in riparian forest, a recent study has documented maternity roosts in upland forest (Gardner, et al. 1990). Myotis sodalis colonies have been reported to occupy summer home ranges (USFWS 1983a). Juvenile males occupy the smallest home ranges, utilizing approximately 28 hectares while adult, post-lactating females occupy the largest home ranges of up to 212 hectares. Adult males and non-reproducing males and females occupy home ranges of intermediate sizes. Distances flown from roost sites to foraging areas range from one-half to over three kilometers (Gardner et al. 1990). Indiana bats exhibit strong loyalty to particular home ranges. If maternity trees within the home range are removed, the bats are not likely to survive unless alternate roost trees are available within the home range (Gardner et al. 1990).

Feeding habitat consists of streams lined on both banks with mature trees that overhang the stream. As is the case with M. grisescens, M. sodalis does not feed over streams from which the riparian vegetation has been removed. Aquatic insects comprise a major portion of the diet, but, unlike gray bats, Indiana bats also feed on moths and other flying insects in the upper forest canopy (USFWS 1983a).

A variety of factors have been attributed to the decline and present status of the Indiana bat. Human disturbance and vandalism are likely the primary causes. Disturbance of hibernacula arouses the bats. Repeated arousals cause rapid depletion of stored fat, premature emergence from the cave, and mortality. Because they are misunderstood and feared, bats are often intentionally killed. In 1960, approximately 10,000 Indiana bats were stoned and trampled in a cave in Kentucky. Many other examples of this type of activity have been documented (USFWS 1983a). Natural disasters such as flooding of caves and ceiling collapse have been known to, or could, result in high mortalities. Approximately 300,000 bat skeletons were found in Bat Cave (Mammoth Cave National Park) in central Kentucky. The bats apparently drowned when the cave was flooded. The largest known Indiana bat hibernaculum, located in an abandoned mine shaft in Missouri, is in danger of collapsing. Deforestation and stream channelization remove maternity trees and render foraging habitat

unsuitable. Commercialization of hibernacula, indiscriminate collecting, and exclusion of bats from caves resulting from installation of poorly designed gates have also contributed to the decline of the Indiana bat.

Indian cave in Grainger County provides potential winter habitat for M. sodalis. However, this cave is located along the Holston River, over twelve miles from the project area. It is unlikely that the bats utilizing Indian Cave forage in the project area since ample stream habitat exists within close proximity to the cave.

Upon review of available information, it is the biological opinion of the Fish and Wildlife Service that, because the only known colony of Myotis sodalis occurs over twelve miles from the project impact area, and adequate foraging habitat exists outside the project area, widening of State Route 32 is not likely to jeopardize the continued existence of the Indiana bat.

## FISH

### o Yellowfin madtom

The yellowfin madtom, Noturus flavipinnis, is a threatened species in the catfish family (Ictaluridae). It grows to approximately 90 millimeters (Standard Length), has a depressed head, large eyes, and a truncate or rounded caudal fin. The dorsal area has four prominent saddles, the caudal fin base has a dark bar, and the dorsal fin has a medial stripe. The species also exhibits a yellowish coloration on some parts of the body, particularly the fins (USFWS 1983b).

Noturus flavipinnis was once widely distributed in the Tennessee River drainage above Chickamauga Creek. Historical records exist from six Tennessee River Basin streams: Chickamauga Creek, Hines Creek, North Fork Holston River, Copper Creek, Powell River, and Citico Creek. However, the yellowfin madtom is presently known to occur in only three streams: Citico Creek (Monroe County, Tennessee), Powell River (Hancock County, Tennessee), and Copper Creek (Scott and Russell Counties, Virginia)(USFWS 1983b). A number of yellowfin madtoms have recently been transplanted into Abrams Creek in Blount County, Tennessee, but it is not presently known if a reproducing population has become established. The main channel of the Powell River from the headwaters of Norris Lake to the Tennessee/Virginia state line is designated as critical habitat for the species. The Powell River and Copper Creek in Virginia are also designated critical habitat. Citico Creek was not designated because the species was not known to occur there until after it was listed (USFWS 1983b).

Noturus flavipinnis occurs in large warmwater streams and medium-sized rivers 8 to 40 meters in width with moderate current. The species apparently prefers pools or backwaters with clean water and little silt or fine sediment. Individuals appear to associate with some type of cover (slab rocks, undercut banks) during the day. At night, the species still associates with cover, but it is more typically found on the stream bed away from the banks (USFWS 1983b).

Aquatic insects comprise the majority of the yellowfin madtom's diet. A variety of insects ranging from midges to large burrowing mayflies are consumed. The fish feed primarily at night, using both tactile and chemical stimuli to locate food. However, the species is opportunistic and would likely feed during the day as well (USFWS 1983b).

Little is known regarding the reproductive biology of Noturus flavipinnis. However, available information for other Noturus species indicates that the species spawns in late spring or early

summer. Eggs are probably deposited on the undersides of slab rocks in higher gradient sections of the streams than the adults normally inhabit (USFWS 1983b).

The yellowfin madtom has declined primarily as a result of sedimentation in the rivers in which it occurs. The Powell River population is small (based on the collection of two individuals in Hancock County, Tennessee) and is being adversely affected by coal mining activities throughout the drainage. Accumulations of coal fines up to one meter in depth have been observed in pool and backwater areas preferred by the species. Sedimentation from active and abandoned mines, road construction, and other development activities has also likely adversely affected this population (USFWS 1983b). The Copper Creek population appears to be declining. Surveys conducted in the early 1980's have reported lower collection success (Burkhead and Jenkins 1982)(Peggy Shute, TVA, 1993, pers. comm.). The Citico Creek population occurs adjacent to lands owned by the Cherokee National Forest and would appear to be immune from adverse impacts. However, recent surveys have revealed that this population is also declining (Peggy Shute, TVA, 1993, pers. comm.). The final listing rule for the yellowfin madtom (Federal Register, 1977) does not define the constituent elements of the designated critical habitat. However, based on information regarding the species' habitat requirements, the Powell River and Copper Creek apparently contain limited amounts of suitable silt-free pool and backwater habitat with an abundance of cover and slab rocks for spawning. The proposed project could potentially impact a small area of the Powell River at the lower reach of the designated critical habitat.

Based on review of available information, it is the biological opinion of the Fish and Wildlife Service that, because of the measures that will be implemented to prevent sedimentation of the Powell River and protect the aquatic habitat, widening of State Route 32 is not likely to jeopardize the continued existence of the yellowfin madtom. In addition, it is the biological opinion of the Fish and Wildlife Service that the proposed project is not likely to result in destruction or adverse modification of the designated critical habitat.

#### o Slender chub

The slender chub, Hybopsis cahni, is a threatened species in the minnow family (Cyprinidae). It grows to 77 millimeters (Standard Length) and is characterized by a long snout, large eyes, and an inferior mouth with a single barbel at the posterior tip of each maxillary. Coloration is olive to brownish dorsally, silver laterally with spots and blotches lacking, a dark lateral stripe, and white ventrally (USFWS 1983c).

Habitat for the slender chub consists of large, warm streams 30 to 125 meters in width containing large shoal areas with small to medium-sized silt-free gravel substrate. The species appears to prefer shallow water, commonly inhabiting areas with depths of 0.1 to 1.2 meters. Hybopsis cahni is a benthic feeder, consuming aquatic insect larvae and small mollusks. Little is known of its reproductive behavior, but sexual maturity is thought to be reached in the third or fourth year of life. The slender chub likely spawns from mid- to late April, and possibly through early June (USFWS 1983c).

Hybopsis cahni is endemic to the upper Tennessee River drainage. Its entire historic range is not known, but the species was known to occur in the Holston River, Clinch River, and Powell River. The Holston River population has been extirpated, and the latter two rivers comprise the entire presently known range.

Upon review of available information, it is the biological opinion of the Fish and Wildlife Service that, because of measures to be implemented to prevent excessive sedimentation of the Clinch and Powell Rivers and protect the aquatic habitat, widening of State Route 32 is not likely to jeopardize



the continued existence of the slender chub. It is also the biological opinion of the Fish and Wildlife Service that the proposed project is not likely to result in destruction or adverse modification of the designated critical habitat.

### MUSSELS (NAIADES)

The upper Tennessee River tributaries historically supported a multitude of aquatic species, including fish and mussels. Because the Tennessee Valley was not subjected to glaciation, a rich aquatic fauna has developed over millions of years, and this area is thought to be a major center for speciation of freshwater mussels. However, surface coal mining, agricultural operations, construction, and development have had profound impacts on the aquatic habitats and the species that utilize them. The Powell River has been especially affected by these activities, and although the Clinch River has been impacted, it may contain the best remaining native riverine mussel fauna in the United States.

Freshwater mussels are sedentary animals. Unless their habitat is dewatered or they are physically dislodged from the substrate, they may remain in one place throughout their lives. Most species require riverine habitat and occur in riffle or shoal areas having continuous flows over silt-free sand/gravel/cobble substrate. Stream currents oxygenate the water, sweep the bottom clean of silt and other fine particulate matter, and provide a continuous supply of suspended forage material. Mussels are filter feeders, siphoning algae, plankton, and detritus from the water column. Because of their sedentary nature and feeding habits, and the fact that they tend to accumulate certain pollutants (e.g., heavy metals, pesticides, etc.), freshwater mussels are thought to be excellent indicators of water quality.

Mussels become sexually mature at three or four years of age and exhibit a unique life cycle. Males release sperm into the water column which are taken in by females during normal siphoning activity. Fertilized eggs are held in specialized gill pouches (marsupia) where they develop into the larval stage (glochidia). Mature glochidia are released separately or in masses (conglutinates) where they drift with stream currents. Within three or four days, the glochidia must attach to a suitable fish host. Recent studies have shown that some mussel species exhibit a high degree of fish host specificity; some metamorphose successfully only on certain groups or species of fish (Zale and Neves 1982; Weaver 1981; Kitchel 1985). Glochidia contacting suitable fish hosts encyst on the gills or fins and after a period of time, depending on water temperature and other factors, detach as fully developed, free-living juvenile mussels. Because of their small size, the detached juveniles drift with stream currents and eventually settle to the bottom; those that settle onto suitable, silt-free substrate survive.

Two reproductive modes have been identified for freshwater mussels. Fertilization of eggs, release of glochidia, and metamorphosis on fish hosts occurs from spring through late summer in short-term (tachytictic) breeders. In long-term (bradytictic) breeders, fertilization and glochidial development occur during the summer through fall and early winter, but glochidia are retained in the marsupia and released the following year. In streams supporting several bradytictic species, glochidia may be present in the water column year-round, except during the period of gametogenesis.

High mortality is thought to occur at two stages in the life cycle of mussels: attachment to and detachment from the fish host. Those glochidia failing to attach to appropriate fish hosts likely settle to the bottom and perish or are consumed by various predators. Those attaching to inappropriate fish hosts are likely sloughed off and perish. Metamorphosed juveniles that settle onto unsuitable substrate are also not likely to survive. However, mussels have a high reproductive capacity; depending on the size of the mussel, as many as several hundreds of thousands of glochidia may be released by individual females annually. Because of their high fecundity and long life spans

(mussels are known to live as long as 56 years, or longer)(Moyer 1984), low, but consistent annual recruitment may be adequate to maintain a population.

Construction of dams, associated river traffic, agriculture, mining, timber harvest, and riverside development along the Tennessee River and its tributaries have resulted in declines in many aquatic populations and extirpation of others. Pollution and siltation have also contributed to water quality degradation and habitat alteration, and have eliminated populations of mussels and their essential fish hosts. Silt causes increased turbidity and reduces light penetration in streams. Prolonged silt input creates a blanketing effect which can cause irritation or clogging of gills and siphons. Prolonged sedimentation can also reduce or inhibit feeding, and can eventually smother adult and juvenile mussels. Siltation can indirectly affect mussels by smothering eggs or larvae of fish hosts, rendering fish spawning areas unsuitable and causing fish to abandon previously suitable habitats.

Introduction of exotic species has also contributed to the decline of native freshwater mussels. The Asian clam (Corbicula fluminea) was introduced into North American waters in the Pacific Northwest in the 1930's. By the mid-1970's, this exotic species had spread throughout the United States. Another species, the zebra mussel (Dreissena polymorpha), was recently introduced from Europe. It was first reported in the Great Lakes in 1988, and by 1992 it had spread to the Ohio, Tennessee, Cumberland, and lower Mississippi Rivers. Both of these species have extremely high reproductive capacities, quickly reaching densities of thousands of individuals per square meter. At these densities, they have the ability to filter tremendous quantities of water and plankton, reducing the availability of food for native mussel species. Neither species requires a fish host to complete its life cycle and both can produce one or more generations per year. Because of these competitive advantages, C. fluminea has been attributed with the decline of native mussel populations in some rivers (Clarke 1986). Although D. polymorpha has only been present in North American waters for five years, it has the potential to replace native mussel populations in the major river systems throughout the Southeast. The Asian clam is known to occur in both the Clinch and Powell Rivers. Although no records of zebra mussels presently exist for either river, this species is expected to eventually spread into one or both.

In the early and mid-1980's, a number of freshwater mussel die-offs were reported. Die-offs occurred in many river systems in the eastern United States and the cause remains undetermined. All species of mussels were affected, and in some instances, hundreds or thousands of dead mussels were observed. A mussel die-off was investigated in the Powell River in 1983. Dead individuals were observed lying on the river bottom and embedded in upright positions in the substrate. Specimens of at least two endangered species were found dead. These die-off incidents undoubtedly caused significant reductions in mussel populations, including endangered species, in a number of rivers throughout the Tennessee River system.

The endangered birdwing pearly mussel (Conradilla caelata), dromedary pearly mussel (Dromus dromas), green-blossom pearly mussel (Epioblasma torulosa gubernaculum), fine-rayed pigtoe (Fusconaia cuneolus), rough pigtoe (Pleurobema plenum), white wartyback pearly mussel (Plethobasus cicatricosus), shiny pigtoe (Fusconaia edgariana), Cumberland monkeyface pearly mussel (Quadrula intermedia), Appalachian monkeyface pearly mussel (Quadrula sparsa), yellow-blossom pearly mussel (Epioblasma florentina), cracking pearly mussel (Hemistena lata), and fanshell (Cyprogenia stegaria) historically occurred in the Tennessee and/or Cumberland River drainages. Some occurred over wide ranges while others were apparently always restricted in range. All twelve species are found in larger streams and small to moderate-sized rivers. They occur in shoal or riffle habitats with moderate to swift current and silt-free substrates of mixed sand/gravel/cobble. The fine-rayed, shiny, and rough pigtoe; Cumberland monkeyface; and Appalachian monkeyface pearly mussels appear to exhibit the tachytictic mode of breeding, while the other seven species are likely bradytictic breeders. Fish hosts for some species (e.g., shiny pigtoe,

fine-rayed pigtoe, Cumberland monkeyface, fanshell) have been determined (Fuller 1974; Kitchel 1985), but those for the other eight species are unknown. Other biological and ecological information regarding these species is generally lacking.

The Clinch and Powell Rivers in the project area are within the ranges of all 12 mussel species addressed in this biological opinion. However, the yellow-blossom and white wartyback pearly mussels have not been collected in either river in the project area for a number of years. The green-blossom pearly mussel has been collected in the Clinch River in Virginia in the early 1980's, but it has not been found in the project area recently. It is possible, however, that these species still exist in the project area in extremely low numbers.

Upon review of available information, it is the biological opinion of the Fish and Wildlife Service that, because none of these species have been recently found in either the Clinch or Powell River, and because specific measures will be implemented to prevent sedimentation of the Clinch and Powell Rivers and to protect aquatic habitats, widening of State Route 32 is not likely to jeopardize the continued existence of Epioblasma florentina, Plethobasus cicatricosus, or Epioblasma torulosa gubernaculum.

o Birdwing pearly mussel

The birdwing pearly mussel is an endangered Cumberlandian (species endemic to the upper Tennessee and Cumberland River drainages in the Cumberland Plateau Region) species. It is a small mussel, seldom exceeding 50 millimeters in length. The valves are slightly inflated and subtriangular in shape. The surface of the shell is distinctly marked by irregular growth lines and the posterior half has corrugated sculpturing. The outer surface of the shell (periostracum) is generally olive to dark green or black with faint rays. The inside of the shell (nacre) is iridescent white (USFWS 1984a).

Conradilla caelata historically occurred in the Cumberland, Tennessee, Paint Rock, Flint, Elk, Duck, Holston, North Fork Holston, Nolichucky, Clinch, North Fork Clinch, and Powell Rivers in Tennessee, Alabama, and Virginia. It is presently known to occur only in the Duck, Elk, Clinch, and Powell Rivers (USFWS 1984a). The Clinch River supports a healthy, reproducing population, but the Powell River population is likely declining because of the severity of impacts to the riverine habitat, primarily from surface coal mining. The Duck River probably supports the best remaining birdwing pearly mussel population, but the Elk River population is probably small and may be declining. The Tennessee Valley Authority reintroduced C. caelata into the Nolichucky, Buffalo, and North Fork Holston Rivers, but there is no evidence that any of those populations survived or reproduced. The birdwing pearly mussel was never considered a common species throughout its range, and only two populations are presently known to be reproducing.

o Shiny pigtoe

The shiny pigtoe is another endangered Cumberlandian species. It is a medium-sized mussel characterized by a smooth, shiny periostracum with prominent green rays. The valves are subtriangular with a median sulcus (flattened area). Nacre color is white (USFWS 1984b).

Fusconaia edgariana historically occurred over a relatively wide range in the Tennessee River system in Virginia, Tennessee, and Alabama (USFWS 1984b). Populations were recorded from the Elk River, Clinch River, Powell River, Holston River, North Fork Holston River, Flint River, Paint Rock River, Tennessee River, Poplar Creek, and Cypress Creek (Alabama). Presently known populations exist in the North Fork Holston River (Virginia), Clinch River (Virginia/Tennessee), Powell River (Virginia/Tennessee), Elk River (Tennessee), and Paint Rock River (Alabama).

o Fine-rayed pigtoe

The fine-rayed pigtoe is an endangered Cumberlandian mussel species. It is a medium-sized species with subtriangular valves and yellowish-green to brown periostracum with fine green rays. A median sulcus is present and the nacre is white (USFWS 1984c).

Fusconaia cuneolus was once widely distributed in the Tennessee River drainage. Its historical range included the Tennessee River and fifteen of its tributaries in Virginia, Tennessee, and Alabama. It is presently known to occur in the North Fork Holston, Clinch, Powell, Elk, Paint Rock, Sequatchie, and Little Rivers in Tennessee, Alabama, and Virginia. (USFWS 1984c). The status of the populations in the North Fork Holston, Sequatchie, and Little Rivers is unknown, but is likely tenuous. The Powell and Elk River populations are small and likely declining. The Clinch and Paint Rock River populations are probably the best remaining throughout the species' range.

o Cumberland monkeyface pearly mussel

The Cumberland monkeyface pearly mussel is an extremely rare Cumberlandian species characterized by subquadrate valves that are flat and compressed. The periostracum is greenish-yellow with green spots or chevrons and numerous tubercles. Nacre color is white or salmon (USFWS 1984d).

Quadrula intermedia is restricted to the upper Tennessee River drainage. It historically occurred in the Tennessee River and ten of its tributaries in Tennessee and Virginia (USFWS 1984d). The species is presently known from only three Tennessee River tributaries: the Duck River (Tennessee), Elk River (Tennessee), and Powell River (Virginia). All three populations are thought to be reproducing, but they are restricted to a few river reaches and likely occur low in numbers.

o Rough pigtoe

The rough pigtoe is an endangered Ohioan species (species occurring in the Ohio River drainage). Its valves are subtriangular and inflated and the periostracum is glossy and brown to reddish-brown in color. A slight sulcus is present and the shells have a high median ridge. The nacre color is variable, usually white, but it may also pink, red, or orange in some specimens, and is often iridescent posteriorly (USFWS 1984e).

Pleurobema plenum historically occurred in 22 rivers in Alabama, Virginia, Tennessee, Kentucky, Ohio, West Virginia, Indiana, Kansas, Missouri, and Arkansas, but it is presently known only from the Tennessee, Cumberland, Clinch, Green, and Barren Rivers in Tennessee, Alabama, Kentucky, and Virginia (USFWS 1984e). The best remaining population may exist in the Barren River.

o Dromedary pearly mussel

The dromedary pearly mussel is an endangered Cumberlandian species. It is a medium-sized mussel characterized by subtriangular valves with high beaks. The periostracum is yellowish-green with broken green rays. The nacre is generally white or pink (USFWS 1984f).

Dromus dromas is restricted to the Tennessee and Cumberland Rivers from the major headwater tributaries to northern Alabama (USFWS 1984f). It was once widely distributed in the upper Tennessee and Cumberland Rivers, and was historically reported to occur in the mainstem of the Tennessee and Cumberland Rivers, Limestone Creek and Flint River (Alabama), Elk River, Holston River, Clinch River, Powell River, Little Tennessee River, Harpeth River, Caney Fork, Obey River, and the Big South Fork of the Cumberland River (Tennessee, Virginia, Kentucky). Presently, only

four populations are known in the Tennessee River, Cumberland River, Clinch River, and Powell River. The species is extremely rare; populations in the Tennessee, Cumberland, and Powell Rivers are based on collection of only a few individuals.

o Appalachian monkeyface pearly mussel

The Appalachian monkeyface pearly mussel is also an endangered Cumberlandian species. It is subquadrate in shape and medium-sized. The outer surfaces of the shells generally lack tubercules. The periostracum is yellowish-green with mixed green "zig-zags" or chevrons. Nacre color is normally white (USFWS 1984g).

Quadrula sparsa is restricted to the upper Tennessee River system in Tennessee and Virginia. No historical records are known from outside of the Tennessee River or its headwater tributaries (USFWS 1984g). The Powell and Clinch Rivers contain the only extant populations. The species is extremely rare and is thought to be restricted to a 46-mile reach of the Powell River above Norris Lake and a 53-mile reach of the Clinch River in Virginia (USFWS 1984g).

o Cracking pearly mussel

The cracking pearly mussel is an endangered Ohioan species. It is a medium-sized mussel with a thin, elongated, slightly inflated shell. The anterior end of the shell is rounded and the posterior end is truncated. The periostracum is brownish-green to brown in color with broken, dark green rays. Nacre color is pale blue to purple (USFWS 1990).

Hemistena lata was once widely distributed in the Ohio River (Ohio, Kentucky, Indiana, Illinois); White, Wabash, and Tippecanoe Rivers (Indiana, Illinois); Cumberland, Big South Fork, Green, and Kentucky Rivers (Kentucky); Tennessee, Cumberland, Powell, Clinch, Holston, Elk, Duck, and Buffalo Rivers (Tennessee, Virginia)(USFWS 1990). Present populations are known only from the Clinch, Powell, and Elk Rivers in Tennessee and Virginia, but small populations may still exist in the Green River in Kentucky and in the Tennessee River below Pickwick Dam. Hemistena lata has been collected at only three sites within a 97-mile reach in the Powell River and at only two sites within a 172-mile reach of the Elk River (USFWS 1990). The species was collected at 16 sites within a 174-mile reach of the Clinch River, making the Clinch population the largest of the three. If populations still exist in the Green River and in the Tennessee River below Pickwick Dam, they are likely low in numbers.

o Fanshell

The fanshell is an endangered Ohioan species. It is a medium-sized mussel, seldom exceeding 80 millimeters in length. The shells are subcircular in shape and the periostracum is light green or yellow with green rays and mottling. Nacre color is silvery white (USFWS 1991).

Cyprogenia stegaria historically had a wide distribution in Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Kentucky, Tennessee, Alabama, and Virginia (USFWS 1991). It once occurred in the Ohio, Wabash, Cumberland, and Tennessee Rivers and their larger tributaries. However, the species has apparently undergone a significant reduction in range. Reproducing populations are presently known to occur only in the Clinch River (Tennessee and Virginia), Green River (Kentucky), and the Licking River (Kentucky). Additional, populations may still exist in the Muskingum River (Ohio), Walhonding River (Ohio), Wabash River (Illinois, Indiana), East Fork White River (Indiana), Tippecanoe River (Indiana), Kanawha River (West Virginia), Tygarts Creek (Kentucky), Barren River (Kentucky), Cumberland River (Tennessee), and Tennessee River (Tennessee). However, these are likely small, non-reproducing populations. The population in the

Green River is thought to be the best of the three remaining; adults and juveniles of several age classes have recently been collected (USFWS 1991). The Clinch and Licking River populations are also known to be reproducing, but the species comprises less than 1 percent of the total mussel community in the Clinch River. The population in the Licking River is only known to occur in the lower reach of the river. The habitat in all three rivers continues to be impacted by mining, logging, and construction activities.

Upon review of available information, it is the biological opinion of the Fish and Wildlife Service that, because the project will employ Best Management Practices to prevent or minimize sedimentation of the Clinch and Powell Rivers and protect the aquatic habitat, widening of State Route 32 is not likely to jeopardize the continued existence of the birdwing pearly mussel, shiny pigtoe, fine-rayed pearly mussel, Cumberland monkeyface pearly mussel, rough pigtoe, Appalachian monkeyface pearly mussel, dromedary, cracking pearly mussel, and fanshell.

#### **E. INCIDENTAL TAKE**

This section of the biological opinion addresses incidental take of Myotis grisescens, Myotis sodalis, Noturus flavipinnis, Hybopsis cahni, Epioblasma florentina, Plethobasus cicatricosus, Pleurobema plenum, Conradilla caelata, Dromus dromas, Fusconaia edgariana, Fusconaia cuneolus, Quadrula intermedia, Quadrula sparsa, Epioblasma torulosa gubernaculum, Hemistena lata, and Cyprogenia stegaria resulting from proposed project activities, and presents the Service's estimate of the anticipated amount or extent of take. In meeting the provisions of Section 7(b)(4) of the Endangered Species Act, the Service has reviewed the biological information and other available information relative to this action.

Section 9 of the Endangered Species Act, as amended, prohibits any taking (harming, harassing, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting, or attempting to engage in any such activities) of listed species without a special exemption. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered taking within the bounds of the Act provided that such taking is in compliance with the incidental take statement.

Based on the nature of the proposed project, the proposed management measures and precautions that will be implemented, the fact that the nearest known colonies occur over four miles from construction sites, and ample foraging habitat is available outside the project area, it is anticipated that incidental take of gray bats or Indiana bats should not occur. However, if the Federal Highway Administration anticipates that incidental take of one or both of these species may occur in the future as a result of the discovery of new information, consultation should be reinitiated for the reassessment of these impacts and the development of an incidental take statement pursuant to provisions of Section 7(b)(4) of the Act.

Because specific information regarding the population sizes and the amount of suitable habitat in the vicinity of State Route 32 is not available, it is not possible to estimate the amount or extent of incidental take of yellowfin madtoms or slender chubs that might occur as a result of construction activities. Three of the yellowfin madtom's populations are presently declining and one is likely small in numbers, and the species is extremely restricted in its micro-habitat requirements; any short-term impacts could potentially have significant adverse effects on the species. The slender chub is endemic to the upper Tennessee River tributaries and the present status of the only two known populations is unknown. In view of this, any incidental take of yellowfin madtoms or slender chubs,

or their habitats, could threaten the survival of the species. Therefore, no incidental take is authorized.

Because specific information regarding the location or densities of mussels in the Clinch and Powell Rivers in the vicinity of State Route 32 is not available, it is not possible to estimate the amount or extent of incidental take of endangered mussels that might occur as a result of construction activities. However, given the present status of all of the listed mussel species addressed in this biological opinion, incidental take of any individuals or habitat could threaten the survival of the species. Therefore, no incidental take is authorized.

Upon locating a dead, injured, or sick endangered or threatened species specimen, initial notification must be made to the nearest Fish and Wildlife Service Law Enforcement Office (Mike Elkins, Senior Resident Agent; Nashville; 615/736-5532). Care should be taken in handling sick or injured specimens to ensure effective treatment and care, and in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

If, during the course of the action, the amount or extent of the incidental take limit is exceeded, the Federal agency must reinitiate consultation with the Service immediately to avoid violation of Section 9. Operations must be stopped in the interim period between the initiation and completion of the new consultation if it is determined that the impact of the additional taking will cause an irreversible and adverse impact on the species, as per Section 402.14(i). The Federal agency should provide an explanation of the causes of the taking.

#### Reasonable and Prudent Measures

To minimize incidental take of Noturus flavipinnis, Hybopsis cahnii, Dromus dromas, Conradilla caelata, Fusconaia cuneolus, Fusconaia edgariana, Quadrula intermedia, Quadrula sparsa, Epioblasma torulosa gubernaculum, Pleurobema plenum, Hemistena lata, Cyprogenia stegaria, Plethobasus cicatricosus, and Epioblasma florentina, the Federal Highway Administration should implement the following nondiscretionary reasonable and prudent measures:

1. Prior to any construction, the Federal Highway Administration should thoroughly review the project plans to ensure that proposed silt control measures are adequate to prevent sedimentation of the Clinch and Powell Rivers from all areas that will be disturbed by construction activities.
2. During construction activities that might have adverse effects on the aquatic habitats in the Clinch or Powell Rivers, the Federal Highway Administration will inspect construction sites prior to commencement of any work to ensure that silt control measures are in place before construction activities begin, and once per week thereafter to ensure that adequate silt control measures are still in place and are working properly. If silt control is inadequate or is not functioning to prevent sedimentation of the rivers, construction will cease until adequate measures are in place.

## **F. CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the Endangered Species Act states that "All other Federal agencies shall, in consultation with and with the assistance of the Secretary (of the Interior), utilize their authorities in furtherance of the purposes of the Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to Section 4 of this Act." Conservation recommendations are defined as discretionary measures suggested by the Service to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, or development of information. In keeping with the intent of Section 7(a)(1), the Service recommends that the Federal Highway Administration implement the following discretionary measures to promote the conservation of the endangered and threatened species addressed in this biological opinion:

## **G. CONCLUSION**

This concludes formal consultation for the proposed State Route 32 improvement project. Consultation should be reinitiated if: (1) any incidental take of species addressed in Section E of this biological opinion occurs, (2) new information reveals that the proposed project may affect listed species in a manner not previously considered, (3) the project is subsequently modified to include activities which were not considered during this consultation, or (4) new species are listed or critical habitat designated that might be affected. When the pygmy madtom is officially listed, you should contact the Cookeville Field Office and confirm that no changes have been made to the project. If both of our agencies agree (in writing), the conference report will become an official biological opinion for the pygmy madtom, and the **Incidental Take** section will become effective.



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March 15, 1993

Mr. Dennis C. Cook  
Division Administrator  
Federal Highway Administration  
249 Cumberland Bend Drive  
Nashville, Tennessee 37228

RE: FWS #93-454

Dear Mr. Cook:

Thank you for your letter and enclosures of February 24, 1993, requesting initiation of formal consultation for the proposed State Route 32 highway construction project in Claiborne and Grainger Counties, Tennessee. The Fish and Wildlife Service is providing the attached biological opinion in accordance with provisions of Section 7 of the Endangered Species Act of 1973, as amended.

A conference report addressing potential project impacts to the pygmy madtom (Noturus stanauli) is also attached. This species has recently been proposed for listing as an endangered species and is presently known to occur in the Clinch River.

Thank you for your cooperation during this consultation and your interest in protecting endangered and threatened species. If you have questions, please contact Jim Widlak of my staff at 615/528-6481.

Sincerely,

Lee A. Barclay, Ph.D.  
Field Supervisor

xc: Assistant Regional Director, Ecological Services, Fish and Wildlife Service, Atlanta, GA  
(ATTN: Mr. Dave Flemming)  
Fish/Mollusk Recovery Coordinator, Endangered Species Field Office, Fish and Wildlife  
Service, Asheville, NC