

Fine-lined Pocketbook (*Hamiota (=Lampsilis) altilis*)
Orange-nacre Mucket (*Hamiota (=Lampsilis) perovalis*)
Alabama moccasinshell (*Medionidus acutissimus*)
Coosa moccasinshell (*Medionidus parvulus*)
Southern Clubshell (*Pleurobema decisum*)
Dark Pigtoe (*Pleurobema furvum*)
Southern Pigtoe (*Pleurobema georgianum*)
Ovate Clubshell (*Pleurobema perovatum*)
Triangular Kidneyshell (*Ptychobranhus greenii*)
Upland Combshell (*Epioblasma metastriata*)
Southern Acornshell (*Epioblasma othcaloogensis*)

**5-Year Review:
Summary and Evaluation**

**U.S. Fish and Wildlife Service
Southeast Region
Ecological Services
Jackson, Mississippi**

5-YEAR REVIEW

Fine-lined Pocketbook (*Hamiota altilis*)
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I. GENERAL INFORMATION

A. Methodology used to complete the review: In conducting this 5-year review, we relied on available information pertaining to historical and current distributions, life histories, and habitats of these species. Our sources include the final rule listing these species under the Act; the Recovery Plan; peer reviewed scientific publications; unpublished field observations by Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. Comments and suggestions regarding the review were requested from peer reviewers from outside the Service (see Appendix A). No part of the review was contracted to an outside party. The public notice for this review was published on June 14, 2005, with a 60-day public comment period.

B. Reviewers

Lead Region – Southeast Region: Kelly Bibb, 404-679-7132

Lead Field Office – Jackson, MS, Ecological Services: Paul Hartfield, 601-321-1125

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C. Background

1. **FR Notice citation announcing initiation of this review:** June 14, 2005: 70 FR 113

2. **Species status: 2007 Recovery Data Call**

fine-lined pocketbook - unknown
orange-nacre mucket - unknown
Alabama moccasinshell - unknown
Coosa moccasinshell - unknown
southern clubshell - unknown
dark pigtoe - unknown
southern pigtoe - unknown
ovate clubshell - unknown
triangular kidneyshell - unknown
upland combshell - presumed extinct
southern acornshell - presumed extinct

3. Recovery achieved, 2007

fine-lined pocketbook -1 (1 = 0-25% recovery objectives achieved)
orange-nacre mucket -2 (2 = 26 - 50% recovery objectives achieved)
Alabama moccasinshell -1
Coosa moccasinshell -1
southern clubshell -1
dark pigtoe -1
southern pigtoe -1
ovate clubshell -1
triangular kidneyshell -2
upland combshell -1
southern acornshell -1

4. Listing history

Original Listing

FR notice: 58 FR 14339

Date listed: March 17, 1993

Entity listed: Species

Classification:

fine-lined pocketbook (threatened)
orange-nacre mucket (threatened)
Alabama moccasinshell (threatened)
Coosa moccasinshell (endangered)
southern clubshell (endangered)
dark pigtoe (endangered)
southern pigtoe (endangered)
ovate clubshell (endangered)
triangular kidneyshell (endangered)
upland combshell (endangered)
southern acornshell (endangered)

5. Associated rulemakings: Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin: 1 July 2004: 69 FR 40083

6. Review History: Final Recovery Plan, 2000
Recovery Data Call 2007, 2006, 2005, 2004, 2003, 2002, 2001, 2000, 1999

7. Species' Recovery Priority Number at start of review (48 FR 43098):
fine-lined pocketbook - 8
orange-nacre mucket - 8
Alabama moccasinshell - 8
Coosa moccasinshell - 5
southern clubshell - 5
dark pigtoe - 5
southern pigtoe - 5
ovate clubshell - 5
triangular kidneyshell - 5
upland combshell - 5
southern acornshell - 5

A recovery priority number of "8" represents a moderate degree of threat, a high recovery potential. A recovery priority number of "5" represents a high degree of threat and a low recovery potential.

I.C.8. Recovery Plan or Outline

Name of plan: Mobile River Basin Aquatic Ecosystem Recovery Plan
U.S. Fish and Wildlife Service, Jackson, MS. 128 pp.
Date issued: November 17, 2000

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy

1. Are any species under review listed as a DPS? No. The Act defines species to include any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Because the DPS policy is not applicable to these invertebrate species, it is not addressed further in this review.

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria? No

These species have a final, approved recovery plan, however, recovery criteria were not specified for any of the 11 mussels because of the extent of their decline,

habitat loss and fragmentation, population isolation, and continuing impacts on their habitats. Protecting surviving populations of the mussels along with their river and stream habitats is the primary recovery objective. This can be measured by the continued persistence of the mussel populations over time, and the discovery of previously unknown populations. Another obstacle to recovery and the development of recovery criteria was a lack of information on habitat and life history needs, host fish, and management options. Increasing this information and developing management technology are benchmarks for measuring progress toward recovery and developing objective, measurable criteria.

C. Updated Information and Current Species Status

1. **Biology and Habitat** – Information on biology and habitat of the fine-lined pocketbook, orange-nacre mucket, Alabama moccasinshell, Coosa moccasinshell, southern clubshell, dark pigtoe, southern pigtoe, ovate clubshell, triangular kidneyshell, upland combshell, and southern acornshell, was updated in the Proposed Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin (68 FR 14752). This information, as well as additional new information developed in the past three years, is summarized below for each species.

Fine-lined Pocketbook

Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

There are little population trend data on the fine-lined pocketbook, and little information on demography. Although several new tributary populations of fine-lined pocketbook have been discovered since listing, they are generally characterized as small, localized, and with low densities. For example, in the most recent comprehensive survey of mussels in the Coosa River drainage, Gangloff (2003) found the species at 40 sites, but never in abundance (about 1-2 mussels per 50 meters of stream). He also found the small tributary populations susceptible to decline during droughts. Gangloff (2003) noted that while populations in National Forest headwater streams appear to be stable, other populations may be limited or declining due to poorly designed or managed agriculture or mining operations. Warren *et al.* (2004) estimated the size of two isolated populations of *Lampsilis alitilis* in Shoal Creek as follows: 1,298 individuals in a 9.7 km reach of stream (95% confidence interval, 156-2764), and 577 individuals in a 6.0 km reach (151-1220); length-frequency distributions showed evidence of recruitments in both reaches. During a 2005 survey of 30 locations in the Conasauga River, Tennessee and Georgia, 9 fine-lined pocketbook were collected from 8 locations (Johnson *in litt.* 2005). In a 2004-

2005 survey of the Cahaba River and tributaries, only 1 to 3 fine-lined pocketbook were found at six of 120 sites surveyed (Johnson *in litt.* 2006).

Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

There is little genetic information available on the species. A phylogenetic analysis of nucleotide sequences of the mitochondrial 16S ribosomal RNA and the first subunit of the cytochrome oxidase *c* genes failed to resolve the fine-lined pocketbook and orange-nacre mucket into reciprocally monophyletic groups (Roe *et al.* 2001). These data indicate that captive rearing and propagation of these species should be protective of their genetic integrity by not mixing populations, existing populations should only be augmented from local stock, and extirpated populations should be reestablished with stock from appropriate geographical sources.

Taxonomic classification or changes in nomenclature:

The fine-lined pocketbook along with three other southeastern freshwater mussels, have been placed into a new freshwater mussel genus, *Hamiota* (Roe and Hartfield 2005). Characters supporting recognition of a new genus include the packaging of larvae into a superconglutinate lure to attract host fish, placement and shape of the marsupia, and release of the superconglutinate through the excurrent siphon.

Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

At the time of listing, the fine-lined pocketbook was reported from 6 drainages in the Mobile River Basin. Survey efforts since listing have documented the species from a total of 30 drainage populations, including: the upper Cahaba River and both Little Cahaba Rivers (Jefferson/Shelby/Bibb Counties, Alabama); Coosa River (Cherokee County, Alabama) and its tributaries, including Duck Creek (Walker County, Georgia), Euharlee Creek (Bartow County, Georgia), Fish Creek (Polk County, Georgia), Conasauga River (Murray/Whitfield County, Georgia; Polk County, Tennessee), Holly and Rock Creeks (Murray County, Georgia), Terrapin and Hurricane Creeks (Cherokee County, Alabama), and South Fork Terrapin Creek (Cleburne County, Alabama); Yellowleaf Creek and its tributaries Muddy and Clear Prongs (Shelby County, Alabama); Kelly Creek and its tributary Shoal Creek (Shelby/St. Clair County, Alabama), Choccolocco Creek (Calhoun County, Alabama) and its tributaries Cheaha Creek (Talladega/Clay County, Alabama) and Shoal Creek (Cleburne County, Alabama), Hatchet Creek (Coosa/Clay County, Alabama), and Tallasseehatchee Creek (Talladega County,

Alabama); and the Tallapoosa River and tributaries, including Uphapee Creek (Macon County, Alabama), Choctafaula Creek (Macon/Lee County, Alabama), Chewacla Creek (Macon/Lee County, Alabama), Opintlocco Creek (Macon County, Alabama), Cane and Little Cane Creeks (Cleburne County, Alabama), Muscadine Creek (Cleburne County, Alabama), Big Creek (Haralson County, GA), and McClendon Creek (Paulding County, Georgia) (Devries 1997, Evans 2001, Feminella and Gangloff 2000, Gangloff 2005, Gangloff 2006, Haag *et al.*, 1999; Herod *et al.*, 2001; E. Irwin *in litt.*, 2000; Irwin *et al.* 1998, Johnson and Evans 2000, L. McDougal, U.S. Forest Service, *in litt.* 1994; McGregor 1993, McGregor *et al.* 2000; Pierson 1991a, 1992b, 1993; Shepard *et al.* 1994, Williams and Hughes 1998). All populations are localized and small (see Abundance and trends section above).

The range of fine-lined pocketbook remains highly fragmented by dams and impounded waters, with no connectivity between tributary populations.

Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Although new tributary populations of fine-lined pocketbook have been discovered since listing, they are generally characterized as small, localized, and with low densities (e.g., Gangloff 2003). The low numbers of individuals at most sites suggest marginal habitat conditions. All tributary populations remain highly susceptible to stochastic and chronic events (e.g., chemical spills, drought and/or landuse runoff).

Other:

Gravid females (females with larvae) have been observed March through June. Fine-lined pocketbooks have also been observed releasing glochidia in a single large conglomerate (glochidia inside a mucilaginous capsule) (Haag *et al.*, 1999), termed a superconglomerate (Haag *et al.*, 1995). Redeye bass (*Micropterus coosa*), spotted bass (*M. punctulatus*), largemouth bass (*M. salmoides*), and green sunfish (*Lepomis cyanellus*) have been identified as suitable hosts (Haag *et al.*, 1999).

Orange-nacre Mucket

Abundance, population trends, demographic features, or demographic trends:

Most populations of the orange-nacre mucket are small and localized where they are found. For example, Haag (*in litt.* 2005) found a single orange-nacre mucket in 283 – 1/8 square meter quadrats in the Sipsey River, Greene County, Alabama.

The only trend data available are from the Sipsey Fork and several of its tributaries in Bankhead National Forest, Winston/Lawrence Counties, Alabama. The Sipsey Fork drainage populations in the National Forest were quantified in 1993 (Haag and Warren 1994), and again in 2002 (Haag and Warren 2003a). All monitored populations of orange-nacre mucket experienced significant declines in abundance between 1993 and 2002, and no recruitment was observed. The decline in abundance was manifested in all species of mussels, and was attributed to a major drought in 2000 (Haag and Warren 2003a).

Genetics, genetic variation, or trends in genetic variation:

No data on genetic variation or trends are available. Phylogenetic analyses of fine-lined pocketbook and orange-nacre mucket mtDNA suggests that future captive rearing and propagation of these species should protect genetic integrity by not mixing populations, augmenting populations using local stock, and re-establishing extirpated populations using individuals from nearby populations (see Genetics section under fine-lined pocketbook above for further explanation).

Taxonomic classification or changes in nomenclature:

The orange-nacre mucket has been placed into a new freshwater mussel genus, *Hamiota* (Roe and Hartfield 2005). (See “taxonomic classification” section under the fine-lined pocketbook, above.)

Spatial distribution, trends in spatial distribution, or historic range:

When listed, the orange-nacre mucket was known to survive in 8 distinct drainages in the Mobile River Basin. Since 1993, the species has been documented from a total of 29 drainages. These include: Tombigbee tributaries, including the Buttahatchee River (Lowndes/Monroe County, Mississippi; Lamar County, Alabama), and East Fork Tombigbee River (Itawamba/Monroe County, Mississippi), Luxapalila Creek and tributaries Yellow Creek (Monroe County, Mississippi; Lamar County, Alabama) and Cut Bank Creek (Lamar County, Alabama), Sipsey River (Greene/Pickens/Tuscaloosa County, Alabama), Coalfire, Lubbub, and Trussels Creeks (Pickens County, Alabama); Black Warrior River tributaries, including North River (Tuscaloosa/Fayette County, Alabama) and its tributary Clear Creek (Fayette County, Alabama), Locust and Blackburn Forks of the Black Warrior River (Blount County, Alabama), Sipsey Fork of the Black Warrior (Winston/Lawrence County, Alabama) and tributaries Thompson, Flannagin, and Borden Creeks (Lawrence County, Alabama), and Caney, North Fork Caney, Brushy, Capsey, Rush, Brown, and Beech Creeks (Winston/Lawrence County, Alabama); Cahaba River (Bibb/Jefferson/Shelby County, Alabama) and Little Cahaba River (Bibb/Shelby County, Alabama); and Alabama River tributaries Limestone Creek (Monroe County, Alabama) and Bogue Chitto Creek (Dallas County, Alabama) (D. Shelton, Alabama Malacological Research Center, *in litt.*, 1996; Dodd *et al.*, 1986; Haag and

Warren, 2001; Hartfield and Bowker, 1992; Hartfield and Jones, 1989, 1990; Jones 1991; Jones and Majure, 1999; McGregor, 1992; McGregor *et al.*, 1996; McGregor, 2000; McGregor *et al.*, 2000; McGregor and Pierson, 1999; McGregor and Haag, 2004; Miller, 2000; MS Museum of Natural Science collection records 1989-1999; Pierson, 1991a, b, 1992a; Shepard *et al.*, 1998; Vittor and Associates, 1993; Warren and Haag, 1994; Yokley, 2001).

The range of orange-nacre mucket remains highly fragmented by dams and impounded waters, with little connectivity between tributary populations.

Habitat or ecosystem conditions:

Although new tributary populations have been discovered since listing, they are generally characterized as small, localized, and with low densities. Furthermore, the largest, most intact populations of the species (Sipsey Fork and Brushy Creek drainages) have been severely reduced by the drought of 2000 (Haag and Warren 2003a). The low numbers of individuals at most sites suggest marginal habitat conditions. All drainage populations remain susceptible to stochastic and chronic events (e.g., spills, drought and/or landuse runoff).

Other:

The orange-nacre mucket expels mature glochidia in a single superconglutinate (Haag *et al.*, 1995). Discharge of superconglutinates has been observed between March and June, with releases appearing concentrated in early April (Hartfield and Butler, 1997). Redeye bass, spotted bass, and largemouth bass have been identified as suitable host fish for the orange-nacre mucket (Haag and Warren, 1997).

Alabama moccasinshell

Abundance, population trends, demographic features, or demographic trends:

Most populations of the Alabama moccasinshell are small and localized where they are found. In a survey of 31 sites in the Conasauga River, Georgia/Tennessee, only 3 specimens were found at a single site, while single individuals were collected from 3 of 7 sites surveyed in Holly Creek (Johnson *in litt.* 2005). At localized sites in the Sipsey River, the Alabama moccasinshell may be relatively common (about 2/m²) (Haag *in litt.* 2005; Haag 2002), and populations have been stable from 1999-2005 (W. Haag pers comm.). In the years leading up to and following listing, the species was found to be more common in the Sipsey Fork and several of its tributaries in Bankhead National Forest, Winston/Lawrence Counties, Alabama, than at other locations. Densities of Sipsey Fork drainage populations in the Bankhead National Forest were measured in 1993 (Haag and Warren 1994), and ranged from 0.08 to 0.28/m²

(Warren and Haag, 1994). The same populations were re-sampled in 2002 (Haag and Warren 2003a). All monitored populations of Alabama moccasinshell experienced significant declines in 2002, however some recruitment was observed. The decline was manifested in all mussel species surveyed in these reaches and was attributed to a major drought in 2000 (Haag and Warren 2003a)

Genetics, genetic variation, or trends in genetic variation:

The Alabama moccasinshell was included in a phylogenetic analysis of the relationships of North American *Lampsilini*, spp., using the 16s rDNA gene. It provided no information on conservation genetics of the species, however.

Taxonomic classification or changes in nomenclature:

N/A

Spatial distribution, trends in spatial distribution, or historic range:

At the time of listing, the Alabama moccasinshell was known to survive in 7 drainages of the Mobile River Basin. The species is now known from 12 tributary populations, including seven Tombigbee River tributaries: Bull Mountain Creek (Itawamba County, Mississippi), Luxapalila Creek (Lowndes County, Mississippi) and its tributary Yellow Creek (Lowndes County, Mississippi; Lamar County, Alabama), Buttahatchee River (Lowndes/Monroe County, Mississippi, Lamar County, Alabama), and its tributary Sipsey Creek (Monroe County, Mississippi), Lubbug Creek (Pickens County, Alabama), and Sipsey River (Greene/Pickens County, Alabama); the Sipsey Fork of the Black Warrior River and its tributaries (Winston/Lawrence County, Alabama); and Holly Creek in the Coosa River drainage (Murray County, Georgia) (Dodd *et al.*, 1986; Evans 2001; Hartfield and Bowker, 1992; Hartfield and Jones, 1989, 1990; Johnson and Evans, 2000; Jones, 1991; Jones and Majure, 1999; McGregor, 1992; McGregor *et al.*, 1996; McGregor, 2000; McGregor *et al.*, 2000; McGregor and Haag, 2004; MS Museum of Natural Science collection record, 1984-2001; Pierson, 1991a, b; Warren and Haag, 1994; Yokley, 2001).

The range of the Alabama moccasinshell remains highly fragmented by dams and impounded waters, with little connectivity between tributary populations.

Habitat or ecosystem conditions:

Although new tributary populations have been discovered since listing, they are generally characterized as small, localized, and with low densities. Low numbers in many stream drainages suggest marginal habitat conditions. All drainage populations remain susceptible to stochastic and chronic events (e.g., spills, drought and/or landuse runoff).

Other:

Alabama moccasinshell females are gravid from October to June. This species lives completely embedded in stream bottoms for most of the year. Gravid females migrate to the surface of the stream bottom between March and June, anchor themselves to gravel by a bysial thread (protein thread), and lie exposed, displaying a black mantle lure apparently to attract potential host fish (Haag and Warren, 2001; 2003b). Blackspotted topminnows (*Fundulus olivaceus*), Tuscaloosa darter (*Etheostoma douglasi*), redspot darter (*E. artesia*), blackbanded darter (*Percina nigrofasciata*), naked sand darter (*Ammocrypta beani*), southern sand darter (*A. meridiana*), johnny darter (*Etheostoma nigrum*), speckled darter (*E. stigmaeum*), Gulf darter (*E. swaini*), saddleback darter (*Percina vigil*), and Mobile logperch (*P. kathae*) have been identified as suitable host fish (Haag and Warren, 1997, 2001; 2003b). The rock darter (*E. rupestre*) was identified as a marginal host (Haag and Warren, 2003b).

Coosa moccasinshell**Abundance, population trends, demographic features, or demographic trends:**

The frequency of collection of Coosa moccasinshell has declined in both tributaries where it is known to survive (Johnson and Evans 2000, P. Johnson, pers. comm. 2005). One to several individuals of the species were found at 3 sites out of 31 localities surveyed on the Conasauga River, and at 2 of 7 localities searched on Holly Creek (Johnson *in litt.* 2005).

Genetics, genetic variation, or trends in genetic variation:

No genetic information available.

Taxonomic classification or changes in nomenclature:

N/A

Spatial distribution, trends in spatial distribution, or historic range:

Since the Coosa moccasinshell was listed, its presence has been confirmed only in the Conasauga River (Murray/Whitfield County, Georgia; Bradley County, Tennessee), and its tributary, Holly Creek (Murray County, Georgia) (Johnson and Evans, 2000; Williams and Hughes, 1998). All other historical habitat is severely altered or isolated by dams and impounded waters (U.S. Fish and Wildlife Service 1993, 2000, 2003).

The historical range of the Coosa moccasinshell remains highly fragmented by dams and impounded waters.

Habitat or ecosystem conditions:

Both the Conasauga River and Holly Creek are experiencing sediment and water quality problems, and Coosa moccasinshell populations are susceptible to stochastic and chronic events (e.g., spills, drought and/or landuse runoff).

Other:

Coosa moccasinshells are usually completely buried in the stream bottom, but probably migrate to the surface of the stream bottom during spring glochidial release periods, as do gravid Alabama moccasinshell females. Coosa moccasinshell glochidia are known to transform on blackbanded darters; however, other species of darters are also likely hosts (P. Johnson, pers. comm., 2002).

Southern clubshell

Abundance, population trends, demographic features, or demographic trends:

The southern clubshell is a dominant species in the Sipsey River and is present at densities of 5.8-7.5 individuals/m² (Haag 2002). These populations have remained stable from 1999-2005 (W. Haag, pers comm..) and demographic modeling shows that they can be expected to remain stable as long as current rates of recruitment and survival are maintained (Haag 2002). Southern clubshell has been described as common at locations in the lower Sipsey Rivers (McCullagh et al. 2002), and is easily found in some locations in the Buttahatchee River (Haag *in litt.*). Average density at four sites in the Coosa River below Weiss Dam was 0.19/square meter (Herod *et al.*, 2001). The species was reported as abundant in Big Canoe Creek (Gangloff 2003), relative to other mussel species. Around 100 live southern clubshell were found in a 300 meter reach of shoal habitat in Big Canoe Creek during a collecting trip fall of 2005, and the species is locally common in the lower reaches of Chewacla Creek (M. Gangloff pers. comm. 2006). It is rare in other occupied streams.

Genetics, genetic variation, or trends in genetic variation:

Populations of southern clubshell from the Coosa River (Cherokee County, Alabama), Chewacla Creek (Macon County, Alabama) and Sipsey River (Pickens County, Alabama) have been compared by sequencing a portion of the mitochondrial cytochrome oxidase I gene (Lydeard *et al.* 2000). Genetic variation was evident but low between the three different drainage populations.

Taxonomic classification or changes in nomenclature:

N/A

Spatial distribution, trends in spatial distribution, or historic range:

When listed, the southern clubshell was known to survive in 5 river and creek drainages. Currently, the species is known to survive in 17 stream drainages, including the East Fork Tombigbee River (Itawamba/Monroe County, Mississippi), Bull Mountain Creek (Itawamba County, Mississippi), Buttahatchee River (Monroe/Lowndes County, Mississippi), Luxapalila and Yellow Creeks (Lowndes County, Mississippi), Lubbub Creek (Pickens County, Alabama), and Sipse River (Greene/Pickens/Tuscaloosa County, Alabama) in the Tombigbee drainage; a short reach of the Alabama River and Bogue Chitto Creek (Dallas County, Alabama); Oakmulgee Creek in the Cahaba River drainage (Dallas County, Alabama); Uphapee and Chewacla Creeks (Macon County, Alabama) in the Tallapoosa drainage; Coosa River (Dead River) below Weiss Dam (Cherokee County, Alabama), Coosa River below Logan Martin Dam (St. Clair/Talladega Counties, Alabama), and tributaries Yellowleaf Creek (Shelby County, Alabama), Big Canoe Creek (St. Clair County, Alabama), Terrapin Creek (Cherokee County, Alabama), and Conasauga River (Murray/Whitfield County, Georgia) (Alabama Department of Conservation and Natural Resources/U.S. Fish and Wildlife Service collection records, 1998, 1999, 2004; Devris, 1997; Evans, 2001; Feminella and Gangloff, 2000; Gangloff, 2003; Gangloff, 2005; Gangloff and Feminella *in litt.* 2006, Hartfield and Bowker, 1992; Hartfield and Jones, 1989, 1990; Herod *et al.*, 2001; Jones, 1991; Jones and Majure, 1999; McGregor, 1993, 1999; McGregor *et al.*, 1996; Miller, 2000; Miller and Hartfield, 1988; Pierson, 1991a, b; Sides *et al.*, *in litt.*, 2004; Yokley, 2001).

Occupied habitat remains highly fragmented and populations are isolated by dams and impounded waters.

Habitat or ecosystem conditions:

All populations are experiencing sediment and water quality problems, and are susceptible to stochastic and chronic events (e.g., spills, drought and/or landuse runoff). The Sipse River is the only river occupied by the species in good to excellent condition that is long enough in extent to provide a good chance of long-term viability for southern clubshell.

Other:

Gravid southern clubshell females with mature glochidia have been collected in June and July. The species produces an average of 29,433-40,887 glochidia per year (Haag and Staton 2003). Glochidia are released in well formed conglomerates that are orange or white in coloration (Haag and Warren 2001). Blacktail shiner

(*Cyprinella venusta*), Alabama shiner (*C. callistia*), and tricolor shiner (*C. trichroistia*) have been identified as fish hosts (Haag and Warren, 2001; P. Johnson pers. comm., 2002).

Ovate clubshell

Abundance, population trends, demographic features, or demographic trends:

The species is rare but regularly encountered in the Sipsey River, occurring at densities of 0.16-0.21 individuals/m² (Haag 2002), and density has remained stable from 1999-2005 (W. Haag pers. comm. 2006). The species is locally common at some locations in the lower Sipsey River (McCullagh *et al.* 2002), but rare in all other drainages where it occurs.

Genetics, genetic variation, or trends in genetic variation:

A genetic analysis of *Pleurobema* species from the Mobile River Basin was conducted using a portion of the mitochondrial cytochrome oxidase I gene (Lydeard *et al.* 2000). An ovate clubshell from the Sipsey River was found to be genetically distinct from other *Pleurobema* species. A specimen in the study from the Coosa River tentatively identified as ovate clubshell was genetically different from the Sipsey River specimen, and clustered more closely with other Coosa River endemics.

Taxonomic classification or changes in nomenclature:

N/A

Spatial distribution, trends in spatial distribution, or historic range:

When listed, the species was believed to survive in 5 stream drainages. The species has not been collected from three of these sites since 1993. However, the species has been found in 6 additional drainages, and is currently known to survive in 9 stream drainages, including 6 in the Tombigbee River drainage; Buttahatchee River (Lowndes/Monroe County, Mississippi), Luxapalila Creek and its tributary Yellow Creek (Lowndes County, Mississippi), Sipsey River (Greene/Pickens/Tuscaloosa County, Alabama), Sucarnoochee River (Sumter County, Alabama), and Coalfire Creek (Pickens County, Alabama) (Feminella and Gangloff, 2000; Gangloff 2003, Hartfield and Bowker, 1992; Hartfield and Jones, 1990; Jones, 1991; McGregor, 1992; McGregor, 1993; McGregor *et al.*, 1996; McGregor, 2000; McGregor and Haag, *in prep.*; Miller, 2000; Pierson, 1991a, b; Yokley 2001, McCullagh *et al.* 2002); 2 drainages in the Alabama River, Sturdivant and McCalls Creeks (D. Campbell, University of Alabama, pers. comm.. 2004), and the Cahaba River (P. Johnson, *in litt.* 2006); and

Uphapee Creek in the Tallapoosa River drainage (Gangloff and Feminella *in litt.* 2006).

Occupied habitat remains highly fragmented and populations are isolated by dams and impounded waters.

Habitat or ecosystem conditions:

All populations are experiencing sediment and water quality problems, and are susceptible to stochastic and chronic events (e.g., spills, drought and/or landuse runoff).

Other:

Gravid females of this species have been observed in June and July. Glochidia are released in well formed, white conglutinates (W.R. Haag, unpublished data). Host fishes for this species are unknown.

Dark pigtoe

Abundance, population trends, demographic features, or demographic trends:

Populations are rare, small and localized. Highest densities measured during field surveys have been from the Sipsev Fork and its headwater tributaries in Bankhead National Forest, where quantitative samples at selected sites estimated dark pigtoe densities as high as 0.48/m² (Warren and Haag, 1994). Resampling in 2002 showed a decline in abundance of dark pigtoe at all survey sites, attributed to a severe drought in 2000 (Haag and Warren 2003a).

Genetics, genetic variation, or trends in genetic variation:

A genetic analysis of *Pleurobema* species from the Mobile River Basin was conducted using a portion of the mitochondrial cytochrome oxidase I gene (Lydeard *et al.* 2000). A specimen of dark pigtoe was included in the study and was found to be genetically distinct from other *Pleurobema* species. There is no information on genetic variation within the species.

Taxonomic classification or changes in nomenclature:

N/A

Spatial distribution, trends in spatial distribution, or historic range:

The dark pigtoe is endemic to the Black Warrior River drainage of Alabama. When listed, it was known to survive in 3 drainages: Sipsey Fork, Rush Creek, and the North River. Since listing, the presence of the dark pigtoe has been confirmed from 8 tributaries in these 3 drainages: the Sipsey Fork and its tributaries Caney, Brown, Brushy, Rush, and Capsey Creeks (Winston/Lawrence County, Alabama); and from the North River and its tributary Clear Creek (Fayette County, Alabama) (Alabama Malacological Research Center, *in litt.*, 1996; McGregor, 1992; McGregor and Pierson, 1999; Pierson, 1992a; Shepard *et al.*, 1998; Vittor and Associates, 1993; Warren and Haag, 1994, Haag and Warren 2003a). Badly weathered shells have also been found in the Locust Fork of the Black Warrior River near the Jefferson-Blount County line.

Although all three drainage populations occur in the Black Warrior basin, they are isolated from each other by dams and impounded waters.

Habitat or ecosystem conditions:

All populations are susceptible to stochastic and chronic events (e.g., spills, drought and/or landuse runoff).

Other:

The dark pigtoe is gravid in June and releases glochidia in peach to pink-colored conglutinates (Haag and Warren, 1997). The largescale stoneroller (*Campostoma oligolepis*), Alabama shiner, blacktail shiner, creek chub (*Semotilus atromaculatus*), and blackspotted topminnow have been confirmed as suitable hosts (Haag and Warren, 1997).

Southern pigtoe

Abundance, population trends, demographic features, or demographic trends:

Populations are rare, small and localized. Warren et al. (2004) estimated the Shoal Creek population to consist of 800 individuals in an isolated 9.7 km stream reach (95% confidence interval, 114-1,905); this is likely the largest remaining population of the species. There are no trend data. In a survey of the upper Conasauga River, only 7 individuals were collected (Johnson and Evans 2000).

Genetics, genetic variation, or trends in genetic variation:

A genetic analysis of *Pleurobema* species from the Mobile River Basin was conducted using a portion of the mitochondrial cytochrome oxidase I gene (Lydeard *et al.* 2000). A Conasauga River specimen of southern pigtoe clustered with specimens tentatively identified as *Pleurobema troschelium* (Conasauga River) and *P. perovatum* (Coosa River, Alabama). The low amount of genetic

variation between the three specimens suggested that they were closely related, if not the same species. Additional genetic work was recommended. However, specimens morphologically resembling *P. troschelianum* and *P. perovatum* are extremely rare and difficult to locate in the Coosa River drainage.

Taxonomic classification or changes in nomenclature:

A population previously identified as southern pigtoe from Big Canoe Creek (St. Clair County, Alabama), has been described as a new species, *Pleurobema athearni* (Gangloff *et al.* 2006).

Spatial distribution, trends in spatial distribution, or historic range:

When listed, the southern pigtoe was known to survive in the Conasauga River, Georgia/Tennessee. The species is currently known to survive in the Conasauga River (Murray/Whitfield County, Georgia, Bradley County, Tennessee) and tributaries Holly Creek (Murray County, Georgia), Shoal Creek (Cleburne County, Alabama), Terrapin Creek (Calhoun County, Alabama), Yellowleaf Creek (Shelby County, Alabama), Hatchet Creek (Coosa County, Alabama), and Cheaha Creek (Talladega County, Alabama) (Evans, 2001, Feminella and Gangloff 2000, Gangloff 2003, Gangloff pers comm. 2006, Johnson and Evans 2000, Pierson 1992b, 1993; Williams and Hughes 1998). The populations in the Conasauga River and Holly Creek are isolated from each other by an extensive river reach with very poor water quality and few surviving mussels. All other streams supporting the species are isolated by dams and impounded waters.

Habitat or ecosystem conditions:

All populations are affected by and susceptible to stochastic and chronic events (e.g., spills, drought and/or landuse runoff).

Other:

Host fish have been identified as Alabama shiner, blacktail shiner, and tricolor shiner (P. Johnson pers. comm., 2002).

Triangular kidneyshell

Abundance, population trends, demographic features, or demographic trends:

Populations are small and localized. One population in the Sipsey Fork, Winston County, Alabama, showed a decline from 0.88 to 0.18/square meter between 1993 and 2002, respectively, apparently due to drought (Haag and Warren 2003a). There are no other trend data.

Genetics, genetic variation, or trends in genetic variation:

Genetic studies are in progress.

Taxonomic classification or changes in nomenclature:

Williams *et al.* (in prep.) propose that triangular kidneyshell contains two species: *Ptychobranchus greenii* in the Black Warrior River drainage; and *P. foremanianus* from the Cahaba, Coosa, and Alabama River drainages.

Spatial distribution, trends in spatial distribution, or historic range:

When listed, the triangular kidneyshell was believed to survive in the headwaters of the Sipsey Fork, Little Warrior River, and the Conasauga River. The species has since been confirmed to inhabit the Sipsey Fork and tributaries (Winston/Lawrence County, Alabama) and the Locust Fork (Blount County, Alabama) of the Black Warrior River; the Cahaba River (Bibb County, Alabama), Little Cahaba River (Shelby County, Alabama), Little Cahaba River (Bibb County, Alabama); and Coosa tributaries Shoal Creek (Cleburne County, Alabama), Kelly Creek (Shelby County, Alabama), Big Canoe Creek (St. Clair County, Alabama), Yellowleaf Creek (Shelby County, Alabama), Conasauga River (Murray/Whitfield County, Georgia, Bradley County, Tennessee), Holly Creek (Murray County, Georgia), Coosawattee River (Gordon County, Georgia), and Oostanaula River (Floyd/Gordon County, Georgia) (Evans 2001, Feminella and Gangloff 2000, Gangloff 2003, Gangloff 2006, Haag and Warren 1997, Johnson and Evans, 2000, P. Johnson *in litt.* 2006, McGregor 1992, McGregor *et al.* 2000, McGregor and Garner 2005, Shepard *et al.* 1994, 1998; Warren and Haag 1994, Williams and Hughes 1998). Most populations are isolated by dams and impounded waters.

Habitat or ecosystem conditions:

All populations are affected by and susceptible to stochastic and chronic events (e.g., spills, drought and/or landuse runoff).

Other:

Gravid triangular kidneyshell females were observed in March 1994 and April 1996. Glochidia are packaged into conglomerates that mimic small aquatic fly larvae (Hartfield and Hartfield, 1996) or fish eggs (Haag and Warren, 1997). Suitable fish hosts have been identified as Warrior darter (*Etheostoma bellator*), Tuskaloosa darter, blackbanded darter and Mobile logperch (Haag and Warren, 1997).

Southern acornshell

Distribution/Abundance

Historically, the southern acornshell occurred in the upper Coosa River system and the Cahaba River above the fall line in Alabama, Georgia, and Tennessee. The most recent records for the southern acornshell were from tributaries of the Coosa River in the early 1970s, and the Cahaba in the 1930s (58 FR 14330). It was our determination at the time of listing, with consensus of the malacological community that this species was likely to persist in low numbers in the upper Coosa River drainage, and possibly in the Cahaba River. Surveys of Coosa River tributaries have since been conducted by Service biologists, as well as Bogan and Pierson (1993a), Gangloff (2003), Johnson and Evans (2000), Pierson (1993, pers. comm. 1994), Williams and Hughes (1998), and others. Surveys of the Cahaba River have been conducted by Service biologists, Bogan and Pierson (1993b), McGregor *et al.* (2000), Shepard *et al.* (1994, 1998), Gangloff 2006, Johnson (*in litt.* 2006), and others. Despite these repeated surveys of historical habitat in the Coosa and Cahaba River drainages, no living animals or fresh or weathered shells of this species have been located in recent years. Recent authors have presumed the species to be extinct (Evans 2001, Gangloff 2003, Gangloff and Feminella, in press, Williams *et al.* in press).

Upland combshell

Distribution/Abundance

The historical range of the upland combshell included portions of the Black Warrior, Cahaba, and Coosa Rivers of the Mobile River Basin and some of their tributaries in Alabama, Georgia, and Tennessee. The most recent records for the upland combshell were from the Conasauga River, Georgia, in 1988, and from the Cahaba River, Alabama, in the early 1970s (58 FR 14330). When listed, the species was believed to be restricted to the Conasauga River in Georgia, and possibly portions of the upper Black Warrior and Cahaba River drainages. Surveys of Coosa River tributaries have since been conducted by Service biologists, as well as Bogan and Pierson (1993a), Evans (2001), Gangloff (2003), Johnson and Evans (2000), Pierson (1993, pers. comm. 1994), Williams and Hughes (1998), and others. Surveys of the Cahaba River have been conducted by Service biologists, Bogan and Pierson (1993b), McGregor *et al.* (2000), Shepard *et al.* (1994), and others. Surveys in the upper Black Warrior drainage have been done by Service biologists, Alabama Malacological Research Center, (*in litt.* 1996), Sheppard *et al.* (1998), Vittor and Associates (1993), Warren and Haag (1994, 2003), and others. All surveys have failed to locate any evidence of the persistence of the upland combshell, and some authors presume the species extinct (Evans 2001, Gangloff 2003, Gangloff and Feminella, in press, Williams *et al.* in press).

2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms) -

a. Present or threatened destruction, modification or curtailment of its habitat or range:

The range of 8 of the 11 mussels (fine-lined pocketbook, orange-nacre mucket, southern clubshell, ovate clubshell, Alabama moccasinshell, dark pigtoe, southern pigtoe, and triangular kidneyshell) has been extended since listing. However, the newly discovered populations are small, their ranges remain highly fragmented and restricted, and known populations are isolated from each other. The range of the Coosa moccasinshell has remained the same since listing, however, numbers have declined in the Conasauga River drainage (Johnson and Evans 2000). The southern acornshell and upland combshell have not been located since listing. The primary cause of curtailment of range and fragmentation of habitat for all 11 mussel species is construction of dams and impoundment of large reaches of major river channel (58 FR 14330). These conditions continue to affect the species, although flow improvements have been made, or are planned below some Coosa River dams (e.g., Weiss Bypass Working Group 2005). Effects of such flow improvements, however, have not yet been evaluated in relation to any of these 11 species.

Other causes of habitat and range curtailment identified at listing included dredging, mining, and historical or episodic pollution events (58 FR 14330). Dredging is not known to currently affect any of the surviving populations of these species. A Safe Harbor Agreement was developed to mitigate for potential stream dewatering and harm to fine-lined pocketbook by a quarry in upper Chewacla Creek (U.S. Fish and Wildlife Service 2003).

Pollution continues to be a factor at most sites where the species occur. Many stream segments that continue to support these species, or streams feeding into their habitats, including some areas designated as critical habitat, are not currently supporting designated uses, (e.g., Conasauga River, Oostanaula River, Holly Creek, Locust Fork, North River, Cahaba River, Sipsey River, etc.) (Tennessee Department of Environment and Conservation 2005, Georgia Environmental Protection Division 2005, Alabama Department of Environmental Management 2006).

Currently surviving populations of these 11 endangered and threatened mussel species remain vulnerable to habitat degradation and loss, population isolation, and the cumulative effects of land use activities on aquatic environments (U.S. Fish and Wildlife Service, 2000).

b. Overutilization for commercial, recreational, scientific, or educational purposes:

Overutilization does not appear to be a factor for any of these species.

c. Disease or predation:

Disease is not known to be a factor. Predation by freshwater drum may be a factor at some locations. There is some evidence that parasitic mites and trematodes may affect host mussel reproduction (Gangloff 2003), however, effects of parasitism on reproduction of these species is unknown.

d. Inadequacy of existing regulatory mechanisms:

Current State and Federal regulations regarding pollutants are assumed to be protective of freshwater mollusks; however, these species may be more susceptible to some pollutants than test organisms commonly used in bioassays. For example, recent studies have indicated that U.S. Environmental Protection Agency (EPA) criteria for ammonia are not protective of freshwater mussels (Augspurger et al. 2003, Newton et al. 2003, Mummert *et al.* 2003). In a review of the effects of eutrophication on mussels, Patzner and Muller (2001) noted that stenoeious (narrowly tolerant) species disappear as waters become more eutrophic. They also refer to studies that associate increased levels of nitrate with the decline and absence of juvenile mussels. Other studies have also suggested that early life stages of mussels are sensitive to inorganic chemicals such as chlorine, metals, and ammonia (Keller and Zam 1991, Goudreau *et al.* 1993, Jacobson *et al.* 1993). Therefore, other water quality criteria may not be protective, and the lack of adequate research and data continues to prevent existing authorities, such as the Clean Water Act, administered by the EPA and the Army Corps of Engineers, from being fully utilized.

States are in the process of establishing Total Maximum Daily Loads (TMDLs) for pollutants affecting some stream habitats where these species occur, or from which they have disappeared.

e. Other natural or manmade factors affecting its continued existence:

Limited habitat and small population sizes render these 11 species vulnerable to natural or human caused random events such as droughts or spills. For example, a decline of endangered and threatened mussel populations in Bankhead National Forest due to a severe drought in 2000 has been documented (Haag and Warren 2003a). Similar declines in fine-lined pocketbook populations were observed in Chewacla Creek during the drought (Gangloff 2003; Gangloff and Feminella in press). During June, 2006, runoff from rancid soybeans from a railroad spill in the headwaters of Yellowleaf Creek resulted in some mortality of southern clubshell, triangular kidneyshell, and possibly fine-lined pocketbook (P. Johnson, pers. comm. 2006). Mortality levels resulting from this incident have not been quantified at this date.

D. Synthesis –

Fine-lined pocketbook: Status has improved regarding numbers of known populations. Information on life history has been developed: host fish have been identified, and novel structures and behavior to attract host fish have been described. The species has also been successfully propagated in captivity (Johnson *in litt.* 2004). However, the range remains highly fragmented and all populations are small, isolated, and vulnerable to nonpoint source pollution, drought, or other stochastic events. Population trends and viability of most populations is poorly known. The species remains likely to become endangered in the near future due to extreme curtailment and fragmentation of range and habitat, low population numbers, and vulnerability of surviving populations to nonpoint source pollution and stochastic threats. However, the increase in numbers of surviving populations reduces the impact of isolated events to the survival of the species.

Orange-nacre mucket: Status has improved regarding numbers of known populations. Host fish have been identified, and novel structures and behavior to attract host fish have been described. However, the range remains highly fragmented and all populations are small, isolated, and vulnerable to nonpoint source pollution, drought, or other stochastic events. Population trends and viability of most populations is poorly known. The species remains likely to become endangered in the near future due to extreme curtailment and fragmentation of range and habitat, low population sizes, and vulnerability of surviving populations to nonpoint source pollution and stochastic threats. However, the increase in numbers of surviving populations reduces the impact of isolated events to the survival of the species.

Alabama moccasinshell: Status has improved regarding numbers of known populations. Host fish have been identified, and anatomy and behavior to attract host fish have been described. However, the range remains highly fragmented and all populations are small, isolated, and vulnerable to nonpoint source pollution, drought, or other stochastic events. Population trends and viability of most populations is poorly known. Although status has improved, the species remains likely to become endangered in the near future due to extreme curtailment and fragmentation of range and habitat, low population sizes, and vulnerability of surviving populations to nonpoint source pollution and stochastic threats.

Coosa moccasinshell: The Coosa moccasinshell continues to persist in the two stream systems where it occurred when listed, however, the species has become increasingly difficult to locate (Johnson and Evans 2000). Host fish have been identified, and attempts to propagate the species have been made. Propagation is limited by the difficulty of locating live animals. Both Holly Creek and the Conasauga River are experiencing sediment and water quality problems. The Coosa moccasinshell remains vulnerable to extinction due to extreme curtailment of range and habitat, low numbers, and to impacts from nonpoint source pollution and stochastic events.

Southern clubshell: Status has improved regarding numbers of known populations. Host fish have been identified, fecundity has been estimated, and population growth models have been developed for the species. The range remains highly fragmented and all populations are small, isolated, and vulnerable to nonpoint source pollution, drought, or other stochastic events. Population trends and viability of most populations is poorly known. Although the vulnerability of the southern clubshell to extinction due to stochastic threats has been reduced by the increased number of relict populations now known, the species has experienced extreme curtailment and fragmentation of range and habitat. The restricted extent and low population numbers of extant populations remain vulnerable to nonpoint source pollution and stochastic threats. However, downlisting to threatened status may become foreseeable in the near future if population trends are determined to be stable or increasing.

Ovate clubshell: Status has improved slightly regarding numbers of known populations. However, host fish and reproductive behavior remain unknown, the range remains highly fragmented, and all populations are small, isolated, and vulnerable to nonpoint source pollution, drought, or other stochastic events. Population trends and viability of all populations is unknown. The ovate clubshell remains vulnerable to extinction due to extreme curtailment of range and habitat, low numbers, and vulnerability to nonpoint source pollution and stochastic events.

Dark pigtoe: Range of dark pigtoe remains essentially unchanged since listing. Conglutinates and host fish have been described. The largest populations known have been quantified in the Sipsey Fork and tributaries in Bankhead National Forest, however, all declined in response to a severe drought in 2000 (Haag and Warren 2003a). Population trends and viability of all other populations is unknown. The range remains highly fragmented and all populations are small, isolated, and vulnerable to nonpoint source pollution, drought, or other stochastic events. The dark pigtoe remains vulnerable to extinction due to extreme curtailment of range and habitat, low numbers, and vulnerability to nonpoint source pollution and stochastic events.

Southern pigtoe: Status has improved slightly by the discovery of several drainage populations in the Coosa River system in Alabama. Host fish have been identified. However, the range remains highly fragmented and all populations are small and isolated, and there are no trend data. The southern pigtoe remains vulnerable to extinction due to extreme curtailment of range and habitat, low numbers, and vulnerability to nonpoint source pollution and stochastic events.

Triangular kidneyshell: Status has improved regarding numbers of known populations. Host fish and congenitines have been identified. Propagation experiments have produced low numbers of juveniles which were released in the Cahaba River. The range remains highly fragmented and all populations are small, isolated, and affected by or vulnerable to nonpoint source pollution, drought, or other stochastic events. Some of the largest and best protected populations in the Bankhead National Forest declined severely due to a drought in 2000. Although the vulnerability of the species to extinction due to stochastic threats has been reduced somewhat by the increased number of relict populations now known, the triangular kidneyshell may consist of 2 distinct species (Williams *et al.* in press). No change in status can be contemplated until taxonomy is resolved.

Upland combshell: All surveys since listing have failed to locate extant populations, and the species is presumed extinct by some authors.

Southern acornshell: All surveys since listing have failed to locate extant populations, and the species is presumed extinct by some authors.

III. RESULTS

**Fine-lined pocketbook
Orange-nacre mucket
Alabama moccasinshell
Coosa moccasinshell
Ovate clubshell
Dark pigtoe
Southern pigtoe**

A. Recommended Classification:

No change is needed

B. New Recovery Priority Number **No change is needed**

**Southern clubshell
Triangular kidneyshell**

A. Recommended Classification:

No change is needed

B. New Recovery Priority Number 8

Degree of threat has been reduced to "moderate" due to discovery of additional populations of each species.

**Southern acornshell
Upland combshell**

A. Recommended Classification:

Downlist to Threatened

Uplist to Endangered

Delist (*Indicate reasons for delisting per 50 CFR 424.11*):

Extinction

Recovery

Original data for classification in error

No change is needed

B. New Recovery Priority Number N/A

C. If a reclassification is recommended, indicate the Listing and Reclassification Priority Number (FWS only):

Delisting (Removal from list regardless of current classification) Priority Number: 6

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- (1) Develop measurable recovery criteria for the nine extant species.
- (2) Develop and implement plan to quantify and monitor surviving populations.
- (3) Develop and implement plan to describe and monitor habitat conditions where the mussels survive.
- (4) Continue to refine and implement the Mobile River Basin Mollusk Propagation Plan.

- (5) Work with States to reintroduce hatchery reared mussels into restored habitats, as appropriate.

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Provided Information:

Mr. Jeff Garner, Alabama Department of Conservation and Natural Resources

Dr. Paul Johnson, Alabama Department of Conservation and Natural Resources

Dr. Mike Gangloff, Auburn University

Paul Freeman, The Nature Conservancy

Jeff Powell, U.S. Fish and Wildlife Service

Malcolm Pierson, Alabaster, Alabama

Peer-Reviewers –

Mr. Jeff Garner
Alabama Department of Conservation and Natural Resources

Dr. Paul Johnson
Alabama Department of Conservation and Natural Resources

Dr. Jim Williams
U.S. Geological Survey (retired)

Dr. Robert Jones
Mississippi Museum of Natural Science

Dr. Wendell Haag
U.S. Forest Service

Dr. Mike Gangloff
Auburn University

Paul Freeman
The Nature Conservancy

Stewart McGregor
Alabama Geological Survey

APPENDIX A: Summary of peer review for the 5-year review of
Fine-lined Pocketbook (*Hamiota altilis*)
Orange-nacre Mucket (*Hamiota perovalis*)
Alabama moccasinshell (*Medionidus acutissimus*)
Coosa moccasinshell (*Medionidus parvulus*)
Southern Clubshell (*Pleurobema decisum*)
Dark Pigtoe (*Pleurobema furvum*)
Southern Pigtoe (*Pleurobema georgianum*)
Ovate Clubshell (*Pleurobema perovatum*)
Triangular Kidneyshell (*Ptychobranthus greenii*)
Upland Combshell (*Epioblasma metastrata*)
Southern Acornshell (*Epioblasma othcaloogensis*)

A. Peer Review Method: The 5-year review was emailed to eight potential reviewers with known expertise and interest in the 11 mussels species and the Mobile River Basin, along with a request for peer review. Solicited reviewers included State, Federal, University, NGO, and Museum biologists.

B. Peer Review Charge:

Request sent to potential peer reviewers by email:

On June 14, 2005, the U.S. Fish and Wildlife Service published a notice in the Federal Register announcing a 5-year review of 25 federally listed species, including 11 Mobile River Basin mussels. The purpose of the 5-year review is to summarize new information for the species, ensure that the classification of species as threatened or endangered is accurate and reflects the best available information, and to identify actions required to conserve the species.

You have recently provided data regarding the status on one or more of these 11 mussel species, and you have been identified as knowledgeable about the species and the Mobile River Basin. In order to ensure that the best available information has been used to conduct this 5-year review, we now request your peer review of the attached document. The format is standardized, and we are seeking comments on the accuracy of the data used, conclusions and recommendations, and identification of any additional new information on any of these species that has not been considered in this review. Also note that this review will not be published, but will become a part of the species' administrative record.

We appreciate your interest in furthering the conservation of rare plants and animals by becoming directly involved in the review process of our Nation's threatened and endangered species. Your review and comments will also become a part of the administrative record for these 11 mussel species, and you can be certain that your information, comments, and recommendations will receive serious consideration.

We hope that you view this peer review process as a worthwhile undertaking. Please give me a call if you have any questions (601-321-1125). Also feel free to respond by email

(paul_hartfield@fws.gov) or letter, whichever is most convenient. Thank you for your assistance.

Sincerely,

Paul Hartfield
Endangered Species Biologist
U.S. Fish and Wildlife Service
6578 Dogwood View Parkway
Jackson, MS 39213

C. Summary of Peer Review Comments/Report – *Provide a summary of peer review comments. The OMB PRB may require posting of peer review reports. A peer review report is prepared by the peer reviewers and describes the nature of the review and the findings and conclusions. The report also includes a copy of each reviewer's comments or represents the views of the group of peer reviewers as a whole. If posting of the 5-year review also will serve as posting of peer review information to fulfill requirements of the OMB PRB, include peer review reports as attachments.*

Dr. Wendell Haag, U.S. Forest Service, provided comments and additional data in electronic form.

Dr. Michael Gangloff, Auburn University, provided comments and additional data in electronic form.

Verbal concurrence with the review was received from Stewart McGregor, Alabama Geological Survey, and Jeff Garner, Alabama Department of Conservation and Natural Resources.

D. Response to Peer Review – *Describe how peer review comments were addressed. Include the following: whether we agreed or disagreed with any concerns; any actions undertaken as a result of peer review; and whether and how results of peer review were incorporated into the 5-year review.*

All information provided by Dr.s Haag and Gangloff was incorporated into the 5-year review text.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of
Fine-lined pocketbook
Orange-nacre mucker
Alabama meccasinshell

Current Classification Threatened
Recommendation resulting from the 5-Year Review

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable NA

Review Conducted By Paul Hartfield

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve Ray Lysoack Date 11/27/07

Cooperating Field Supervisor, Fish and Wildlife Service, Daphne, AL

Concur William J. [Signature] Date 11/30/07

Cooperating Field Supervisor, Fish and Wildlife Service, Athens, GA

Concur Andrea Tucker Date 12/4/07

Cooperating Field Supervisor, Fish and Wildlife Service, Cookeville, TN

Concur John Barclay Date 12/4/07

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve Franklin [Signature] Date 4/7/08

Regional Assistant Regional Director
Ecological Services

**U.S. FISH AND WILDLIFE SERVICE
 5-YEAR REVIEW of
Coosa musselshell
Ovate clubshell
Dark pigtoe
Southern pigtoe
Southern clubshell
*Triangular kidneyshell***

Current Classification Endangered
 Recommendation resulting from the 5-Year Review

- Downlist to Threatened
- Up list to Endangered
- Delist
- No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable NA
 Review Conducted By Paul Hartfield

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve *Ray Dyroch* Date 11/27/07

Cooperating Field Supervisor, Fish and Wildlife Service, Daphne, AL

Concur *William Pearson* Date 11/30/07

Cooperating Field Supervisor, Fish and Wildlife Service, Athens, GA

Concur *Sandra Tucker* Date 12/04/07

Cooperating Field Supervisor, Fish and Wildlife Service, Cookavills, TN

Concur *Leah Barclay* Date 12/4/07

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve *Franklin Wood* Date 4/7/08

ACTING Assistant Regional Director
 Ecological Services

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**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of
Southern acornshell
Upland combshell**

Current Classification Endangered
Recommendation resulting from the 5-Year Review

- Downlist to Threatened
- Uplist to Endangered
- X Delist
- No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable 6

Review Conducted By Paul Hartfield

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve Ray Lycock Date 11/27/07

Cooperating Field Supervisor, Fish and Wildlife Service, Daphne, AL

Concur William Brown Date 11/30/07

Cooperating Field Supervisor, Fish and Wildlife Service, Athens, GA

Concur Andrea Tucker Date 12/04/07

Cooperating Field Supervisor, Fish and Wildlife Service, Cookeville, TN

Concur Leah Barclay Date 12/4/07

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve Franklin Smith III Date 4/7/08

ACTING Assistant Regional Director
Ecological Services