

Black Clubshell (Curtus' Pearly Mussel) (*Pleurobema curtum*)
Flat Pigtoe (Marshall's Pearly Mussel) (*Pleurobema marshalli*)
Heavy Pigtoe (Judge Tait's Mussel) (*Pleurobema taitianum*)
Southern Combshell (Penitent Mussel) (*Epioblasma penita*)
Stirrupshell (*Quadrula stapes*)

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



Black Clubshell (*Pleurobema curtum*)
credit: Dr. Bob Jones, Mississippi Museum of Natural Science

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

5-YEAR REVIEW

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Flat Pigtoe (Marshall's Pearly Mussel) (*Pleurobema marshalli*)
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I. GENERAL INFORMATION

A. Methodology used to complete the review: In conducting this 5-year review, we relied on the best 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include the final rule listing these species under the Act; the Recovery Plan; peer reviewed scientific publications; unpublished field observations by Service, State and other experienced biologists; unpublished survey reports; and notes and communications from other qualified biologists or experts. The public notice for this review was published on September 8, 2006, with a 60-day public comment period (71 FR 53127). We also sought peer review on this document from several experts. Comments received were evaluated and incorporated, as appropriate (see Appendix A).

B. Reviewers

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

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

Cooperating Field Offices –

Daphne, Alabama, Ecological Services: Jeff Powell, 251-441-5858

C. Background

1. FR Notice citation announcing initiation of this review:

71 FR 53127; September 8, 2006

2. Species status: (2008 Recovery Data Call)

Black clubshell – Presumed extinct

Flat pigtoe – Presumed extinct

Heavy pigtoe – Declining

Southern combshell – Unknown

Stirrupshell – Presumed extinct

3. Recovery achieved (1 = 0-25% recovery objectives achieved):

Black clubshell – 1

Flat pigtoe – 1

Heavy pigtoe – 1
Southern combshell – 1
Stirrupshell – 1

4. Listing history

Original Listing

FR notice: 52 FR 11162
Date listed: April 7, 1987
Entity listed: Species
Classification:

Black clubshell (endangered)
Flat pigoe (endangered)
Heavy pigtoe (endangered)
Southern combshell (endangered)
Stirrupshell (endangered)

5. Associated rulemakings: NA

6. Review History: Recovery Data Call 2008, 2007, 2006, 2005, 2004, 2003, 2002, 2001, 2000, 1999; Final Recovery Plan 1989
Status Review, 1991: In this review (56 FR 56882), different species were simultaneously evaluated with no species-specific, in-depth assessment of the five factors and threats as they pertained to the different species' recovery. In particular, no changes were proposed for the status of these 5 mussels in the review.

7. Species' Recovery Priority Number at start of review (48 FR 43098):

Black clubshell: 5c
Flat pigoe: 5
Heavy pigtoe: 5c
Southern combshell: 2c
Stirrupshell: 5
(5 – High degree of threat, low recovery potential; 2 – High degree of threat, high recovery potential; and c – potential for conflict with development type activities)

8. Recovery Plan

Name of plan: Five Tombigbee River Mussels Recovery Plan
Date issued: November 14, 1989

II. REVIEW ANALYSIS

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

1. **Is the species under review listed as a DPS?** No. These mussels are invertebrates, therefore the DPS policy is not applicable to these species.

B. Recovery Criteria

1. **Does the species have a final, approved recovery plan containing objective, measurable criteria?** No. At the time of the recovery plan, these 5 mussels were only known from very small segments of the Tombigbee River. The few existing numbers of these mussels made downlisting unrealistic at the time of the recovery plan. The recovery plan called for protection of the habitat in which they occurred. The updated information section below contains the best available information we have on these mussels and their habitat.

C. Updated Information and Current Species Status

1. **Biology and Habitat** – Information on biology and habitat of the black clubshell, flat pigtoe, heavy pigtoe, southern combshell and stirrupshell, was last compiled in the final rule and the recovery plan (U.S. Fish and Wildlife Service 1987, 1989). This information along with information developed over the past 18 years is summarized below.

a. Abundance, population trends, or demographic trends:

Black Clubshell

Only a single population of black clubshell (East Fork Tombigbee River, Monroe/Itawamba County, Mississippi) has been documented since the species was listed. No live animals have been located, and only a few fresh dead shells have been collected. The East Fork Tombigbee was surveyed for mussels under low-flow conditions by State and Federal biologists during the years of 1988, 1989, 1990, 1991, 1992, 1993, 1997, 2001, 2003, and 2005 (Hartfield and Jones 1989a, Miller and Hartfield 1988, R. Jones, Mississippi Museum of Natural Science *in litt.* 2007). Fresh dead shells of black clubshell were found only on a single gravel bar near the Itawamba/Monroe County line, Mississippi: 4 shells in 1989; 2 in 1990; 3 in 1991; and 1 in 1997 (Jones *in litt.* 2007). No evidence of the species has been encountered since 1997.

Flat Pigtoe

No live or fresh dead shells of flat pigtoe have been observed since the species was listed. Fresh dead shells were last collected 1980 from the

Tombigbee River, Lowndes County, Mississippi (Jones *in litt.* 2007). Weathered shells were last collected in 1988 and 1990 from the Tombigbee River at Gainesville Bendway, Greene/Sumter County, Alabama, below Heflin Dam (Hartfield and Jones 1989b, Jones *in litt.* 2007).

Heavy Pigtoe

A single surviving population of heavy pigtoe is known from the Alabama River, Dallas County, Alabama (Hartfield and Garner 1998). Over 92 hours of dive bottom time in the Alabama River resulted in the collection of a total of 19 live heavy pigtoes since 1997, including 8 in 1997, 1 in 1999, and 10 in 2004 (J. Garner, Alabama Department of Conservation and Natural Resources (ADCNR) pers. comm. 2007). All individuals encountered were mature adults, including some gravid females. Because of their long life span and the absence of evidence of recruitment, it is possible that this population predates construction of impoundments on the Alabama River. Attempts to propagate the species have been unsuccessful (Johnson *in litt.* 2007a).

Southern Combshell

The southern combshell continues to persist in the Buttahatchee River, Lowndes/Monroe Counties, Mississippi. The Mississippi Museum of Natural Science (MMNS) has monitored the Buttahatchee River mussel fauna periodically since 1989 (Jones *in litt.* 2007). The southern combshell is relatively uncommon on select shoals, and there is little information on abundance and demography (Jones *in litt.* 2007). MMNS biologists collected a single live southern combshell in 17 quadrats on one shoal (Jones *in litt.* 2005). Biologists from the Alabama Aquatic Biodiversity Center (AABC) have surveyed several shoals in the Buttahatchee River for southern combshell. On one bar, they collected 9 live combshell in 3 man/hours in 2004, and 5 in 4.5 man/hours in 2005; another bar in the same vicinity yielded 6 combshell in 2004 (P. Johnson *in litt.* 2007b). The collection of occasional small adult and subadult southern combshells indicates some level of recruitment is occurring in the Buttahatchee. Quantitative sampling by US Forest Service personnel on a bar near Caledonia, Mississippi, estimated mean density of southern combshell at 0.34 combshells/meter². This study also found evidence of recruitment, including a gravid female and 2 individuals age 0+.

In 2007, attempts to propagate southern combshell at AABC successfully produced juvenile combshells, however, all propagules died prior to release (Johnson *in litt.* 2007b).

Stirrupshell

No live or fresh dead shells of stirrupshell have been encountered since the species was listed. Weathered shells were last collected in 1988 and 1990 from the Tombigbee River at Gainesville Bendway, Greene/Sumter County, Alabama, below Heflin Dam, and a fresh dead shell was last collected in 1984 from the Sipse River, Greene/Pickens County, Alabama (Jones 2007). Repeated surveys of the Sipse and Tombigbee Rivers during the past 2 decades have failed to locate evidence of the species (e.g., McCullagh *et al.* 2002, Haag *in litt.* 2006, Hartfield and Jones 1989b, McGregor and Garner 2001, 2002, 2003).

The stirrupshell was also historically known from the Alabama River. Over 92 hours of dive bottom time have been expended in the Alabama River searching appropriate habitats for imperiled mussel species since 1997 without encountering the species (e.g., Hartfield and Garner 1998, McGregor and Garner 2006, J. Garner, pers. comm. 2007).

b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.): No information on genetics of black clubshell, flat pigtoe, heavy pigtoe, southern combshell, stirrupshell is available.

c. Taxonomic classification or changes in nomenclature:

Black clubshell: Since listing, the common name, Curtus' pearly mussel, has been changed to black clubshell (Turgeon *et al.* 1998).

Flat pigtoe: Since listing, the common name, Marshall's pearly mussel, has been changed to flat pigtoe (Turgeon *et al.* 1998).

Heavy pigtoe: Since listing, the common name, Judge Tait's mussel, has been changed to heavy pigtoe (Turgeon *et al.* 1998).

Southern combshell: Since listing, the common name, penitent mussel, has been changed to southern combshell (Turgeon *et al.* 1998).

Stirrupshell: No changes in taxonomic classification or nomenclature have been proposed for stirrupshell.

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

Numerous surveys of historical habitats for these five species have been conducted since the species were listed. Published surveys include the Tombigbee River and major tributaries (Hartfield and Bowker 1992, Hartfield and Jones 1989a, 1989b, 1990; Jones 1991, Jones and Majure 1999, Jones *et al.* 1996, 1997; McCullagh *et al.* 2002, McGregor 2000, McGregor *et al.* 1996, McGregor and Haag 2004, Miller 2000, Miller and

Hartfield 1988, Pierson 1991, Yokley 2001), the Alabama River (Hartfield and Garner 1998, McGregor *et al.* 1996, McGregor and Garner 2006) the Cahaba River (McGregor *et al.* 2000), and the Lower Coosa River (Johnson 2002). Various unpublished survey and collection data are noted in the text below.

Black Clubshell

Only a few fresh dead shells have been found at a single location in the East Fork Tombigbee River, Mississippi over the 2 decades since the species was listed (see C.1.a, black clubshell, above). Mussel surveys within the historical range have failed to locate evidence of any other extant population (Hartfield and Bowker 1992, Hartfield and Jones 1989a, 1989b, 1990; Jones 1991, Jones and Majure 1999, Jones *et al.* 1996, 1997; McCullagh *et al.* 2002, McGregor 2000, McGregor *et al.* 1996, McGregor and Haag 2004, Miller 2000, Miller and Hartfield 1988, Pierson 1991, Yokley 2001).

Flat Pigtoe

Multiple surveys of dam tailwaters in the Tombigbee River have failed to locate live flat pigtoes or fresh dead shells since the species was listed (Hartfield and Jones 1989b; Hartfield *in litt.* 1990-2001, McGregor 2000, McGregor *et al.* 1996, McGregor and Garner 2001, 2002, 2003). There has been no evidence of the species survival in more than two decades.

Heavy Pigtoe

The heavy pigtoe was last collected alive or fresh dead from the East Fork Tombigbee River, Itawamba County, Mississippi, and the Buttahatchee River, Lowndes County, Mississippi, in 1980; the Sipsey River, Greene County, Alabama, in 1984; and the Tombigbee River, Mississippi, in 1980 (Jones *in litt.* 2007). Over 80 hours of dive bottom time by MDWFP, ADCNR, and Service biologists have been expended since 1989 searching for surviving populations in the Tombigbee, Buttahatchee, and Sipsey Rivers without encountering live or fresh dead heavy pigtoe (e.g., Hartfield and Jones 1989a,b; Hartfield and Jones 1990, Hartfield P., *in litt.* 1990-2001; McCullagh *et al.* 2002, McGregor *et al.* 1996, McGregor and Haag 2004). There have been recent reports of collection of a few live heavy pigtoes from the Tombigbee River, Marengo/Choctaw County, Alabama, by an independent contractor, however, these have not been confirmed (McGregor *in litt.* 2007). A later examination of the site by Alabama Geological Survey and ADCNR biologists failed to locate the species (McGregor *in litt.* 2007).

The heavy pigtoe has been extirpated from most of its historical range. The species is known to survive within an area of a few hundred square meters at a single location in the Alabama River (Hartfield and Garner 1998). Intensive sampling is required to locate live individuals.

Southern combshell

The southern combshell is currently known to survive only in a short reach of the Buttahatchee River, Mississippi. The southern combshell was last collected from the Tombigbee and East Fork Tombigbee River in 1980 (MMNSC *in litt.* 2007). Repeated searches of these areas over the past two decades has failed to locate any evidence of the species persistence in these areas (e.g., Hartfield and Jones 1989a, b; Miller and Hartfield 1988, Jones *in litt.* 2007, Hartfield *in litt.* 1990-2001). Southern combshell has not been collected in the Alabama, Cahaba, or Coosa Rivers in several decades (e.g., Hartfield and Garner 1998, McGregor *et al.* 2000, McGregor and Garner 2006).

Stirrupshell

The last evidence of the survival of stirrupshell was the 1984 collection of a single fresh dead valve from a shoal in the lower Sipsey River, Alabama, a 3rd order stream (Jones *in litt.* 2007). Living specimens or fresh dead shells have not been observed since that time. All known 3rd order stream stirrupshell populations disappeared shortly after impoundment of the Tombigbee and Alabama Rivers, and were apparently dependent upon populations in those larger 2nd order rivers for recruitment.

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

Black Clubshell

The black clubshell was endemic to the Tombigbee and East Fork Tombigbee Rivers. Most historical habitat in the Tombigbee River was highly modified by impoundment or channelization due to the construction of the Tennessee-Tombigbee Waterway, completed in 1984. The East Fork Tombigbee River was severed from the eastern portion of its drainage by the Tennessee-Tombigbee Waterway canal section. Downstream geomorphic disturbances due to the construction of the waterway and local in-channel sand and gravel mining precipitated headward erosion up the East Fork, resulting in severe channel degradation at the only site where the black clubshell was known to survive (Hartfield and Jones 1989). The East Fork continues to exhibit severe channel adjustment and erosion (R. Jones, Mississippi Museum of Natural Science pers. comm. 2005).

Flat Pigtoe

The flat pigtoe was endemic to the main stem of the Tombigbee River, and its entire historical range was impounded or otherwise severely altered by the construction of the Tennessee-Tombigbee Waterway. No areas are currently known to support the species.

Heavy Pigtoe

The heavy pigtoe was historically associated with the mainstem Tombigbee and Alabama Rivers (2nd order river channels). Records also exist from some larger 3rd order tributaries, including the East Fork Tombigbee, Buttahatchee, and Sipsey Rivers in the Tombigbee drainage, and the Cahaba River in the Alabama River drainage. However, all of the 3rd order stream populations disappeared shortly after impoundment of the Tombigbee and Alabama Rivers, and were apparently dependent upon populations in those larger rivers for recruitment. The heavy pigtoe is currently known to survive only in a few hundred square meters in the Alabama River. All other populations are believed to be extirpated.

Southern Combshell

The southern combshell has been extirpated from the Cahaba, Alabama, Coosa, and Tombigbee Rivers. Impoundment of the Coosa River during the 1930's and the Alabama River in the 1960's and 1970's altered these systems, and the Cahaba was severely affected by pollution and channel degradation during the latter half of the 20th century (McGregor *et al.* 2000). Conditions in the Cahaba River have improved due to enforcement of the Clean Water Act, and some imperiled mussel species are recruiting there (Johnson *in litt.* 2007b). Conditions for mollusks in the lower Coosa River below Jordan Dam have improved due to the release of minimum flows below the dam. Establishing southern combshell in these reaches will require propagation of Buttahatchee River stock and reintroduction of propagules.

Construction of the Tennessee-Tombigbee Waterway eliminated the southern combshell from the Tombigbee and East Fork Tombigbee Rivers. Within the Tombigbee drainage, the species continues to persist only in the middle and lower Buttahatchee River, Mississippi. During the late 1980's and early 1990's, headward erosion due to construction of the Tennessee-Tombigbee Waterway and gravel mining resulted in channel degradation in the lower reaches of the Buttahatchee, and general decline of mussels in that reach (Hartfield and Jones 1990, Jones 1991). The degradation trend seems to have been arrested, and the southern combshell and associated species continue to persist from near the Mississippi/Alabama State Line, downstream to Caledonia, Lowndes County, Mississippi.

Stirrupshell

There is no known occupied habitat for stirrupshell. All historical habitat in 2nd order river channels has been altered by the construction of dams in the Tombigbee and Alabama Rivers. Populations in 3rd order streams were apparently dependent upon larger river populations for recruitment.

f. Other:

Host fish for black clubshell, flat pigtoe, heavy pigtoe, and stirrupshell are unknown. Tennessee Aquarium Research Institute (TNARI) unsuccessfully attempted to determine host fish and propagate heavy pigtoe from the Alabama River (P. Johnson, *in litt.* 2007a). Host fish for southern combshell have been identified as Mobile logperch (*Percina kathae*) and blackbanded darter (*P. nigrofasciata*) (P. Johnson, *in litt.* 2005). AABC has successfully transformed several hundred juvenile southern combshell (P. Johnson, AABC *in litt.* 2007b).

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

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

All habitat for black clubshell, flat pigtoe, and stirrupshell has been modified or severely affected by impoundment and other modifications associated with navigation. No extant populations of flat pigtoe and stirrupshell are currently known.

There is some potential that black clubshell may survive on a single shoal in the East Fork Tombigbee River, however no evidence of the species continued existence has been encountered since 1997, despite repeated surveys of the area (Jones *in litt.* 2007). This shoal has been degraded or otherwise affected by geomorphic adjustment during the past two decades due to construction of the Tennessee-Tombigbee Waterway and in channel sand and gravel mining (Hartfield and Jones 1989a, Jones *in litt.* 2005), and may no longer support the black clubshell.

The ranges of the heavy pigtoe and southern combshell have been curtailed by more than 99 percent. Habitat of the heavy pigtoe and southern combshell has been highly modified and fragmented by impoundment. Both species are currently known only from single small populations.

The heavy pigtoe currently is known to survive in a few hundred square meters along the margin of the Alabama River downstream from Robert F. Henry Lock and Dam. The river bottom habitat is currently stable, with no known threats or proposed modifications. Flows from the upstream dam are periodically interrupted by water retention for peaking flows from a small hydropower unit located at the dam. Other unknown small populations may persist below other dams in the Alabama/Tombigbee Rivers, however, multiple surveys have failed to locate evidence of the persistence of heavy pigtoe in these tailwaters (e.g., Hartfield and Garner

1998, McGregor and Garner 2006).

The southern combshell continues to persist on some shoals in the Buttahatchee River between U.S. Highway 45 and the Mississippi/Alabama State Line. Over the past 20 years, the lower Buttahatchee River has experienced erosion and geomorphic adjustment due to the construction of the Tennessee-Tombigbee Waterway and mining in the lower reaches for sand and gravel (Hartfield and Jones 1990, Jones 1991, Hartfield 1993). However, erosion and other effects of geomorphic adjustment have been reduced in the middle drainages with passing years and more restrictive sand and gravel mine permitting in the Buttahatchee drainage by the Mississippi Department of Environmental Quality (MDEQ).

Nonpoint source pollution has been identified as a potential problem in the Buttahatchee River (Hartfield and Jones 1990, Jones 1991). The Buttahatchee River, from Highway 278 to Highway 45, was listed on the Mississippi 2002 303(d) List as impaired for secondary recreation contact due to pathogens. A Total Maximum Daily Load (TMDL) has since been developed by the MDEQ and approved by the U.S. Environmental Protection Agency (EPA) (FTN Associates 2004). In order to meet the TMDL and address other nonpoint source pollution issues in the drainage, the MDEQ, in cooperation with The Nature Conservancy and other partners has drafted and implemented a plan to restore and protect water quality in the Buttahatchee River drainage (FTN Associates 2004).

The upper Buttahatchee River in Alabama was recently assessed for sediment toxicity and sedimentation rates (McGregor and Cook 2005, McGregor *et al.* 2006). The analysis found that values of toxic metals known to be toxic to mussels were lower in the Buttahatchee River than in other regional streams with viable mussel populations, however sediment loads were high and believed to negatively affect the mussel and fish fauna in the upper Buttahatchee River in Alabama (McGregor *et al.* 2006).

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

Although there is no evidence of commercial take of any of these five mussels, the heavy pigtoe closely resembles the ebony shell (*Fusconaia ebena*). The ebony shell is the most important commercial mussel species in Alabama, and is harvested from the Alabama River, including the reach where heavy pigtoe survives (Garner *in litt.* 2007a). The ADCNR Mussel Management Supervisor has recommended closing the reach of the Alabama that is known to currently support heavy pigtoe to commercial harvest of mussels (Garner *in litt.* 2007b).

There is no recreational demand for any of the five species.

There has been limited mortality of heavy pigtoe (4) and southern combshell (1) during permitted scientific research to identify host fishes (P. Johnson *in litt.* 2007a, b).

c. Disease or predation:

Diseases of mussels are unknown. Occasional predation by muskrat has been noted for southern combshell. No evidence of predation of heavy pigtoe has been observed.

d. Inadequacy of existing regulatory mechanisms:

The State of Alabama considers the southern combshell and heavy pigtoe as “Priority 1 Species” (Highest Conservation Concern) (Mirarchi *et al.* 2004; ADCNR 2005). Mississippi legislation protects all five of the Tombigbee mussels as endangered, and prohibits unauthorized take, possession or transportation of the animals (MS ST Section 49-5-101-119).

There are no specific threats currently known involving inadequacy of regulatory mechanisms identified for the heavy pigtoe or southern combshell. Current State and Federal regulations regarding pollutants are assumed to be protective of freshwater mollusks; however, freshwater mussels or their glochidial and juvenile life stages 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 (Augsburger *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 stenoeocious (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 may be preventing existing regulatory mechanisms, such as the Clean Water Act, administered by the EPA and the Army Corps of Engineers, from being fully utilized.

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

Heavy pigtoe collected in the Alabama River are large, mature individuals. The absence of juvenile or subadult pigtoes indicates a lack of recruitment in this population. Collection of gravid females indicates successful spawning, therefore, a major factor in the continued existence of heavy

pigtoe mussel may involve the absence of appropriate host fishes, or changes in host fish behavior due to the affects of impoundment or flow regulation.

Habitat fragmentation by the construction of 9 major dams in the Alabama and Tombigbee Rivers prevents any chance of natural dispersal or recolonization of historical range by either the heavy pigtoe or southern combshell.

The AABC, a branch of the Alabama Department of Conservation and Natural Resources was opened in 2006 with the goal of protecting and restoring imperiled aquatic species through population augmentation and reintroduction. The AABC, in cooperation with the State of Mississippi, is experimenting with propagation of southern combshell. Plans are being drafted and technology and facilities are being developed to propagate and reintroduce the heavy pigtoe and southern combshell into appropriate habitats within their historical ranges in Alabama and Mississippi.

D. Synthesis -

Black clubshell: A small population is known to have persisted on a single shoal in the East Fork Tombigbee River through 1997. Repeated surveys of the area during the past decade noted significant channel erosion, decline of the mussel fauna, and the absence of black clubshell. Although the evidence suggests the species may be extinct, mussels are cryptic species, sometimes burying deeply in the river bottom. This reach of the river should continue to be monitored for another 10 years prior to concluding extinction of black clubshell. No change in status is currently warranted.

Flat pigtoe: There has been no evidence of the continued existence of flat pigtoe for over two decades. All known historical habitat has been altered or degraded by impoundment, and the species is presumed extinct by most authorities.

Heavy pigtoe: Since listing, all 3rd order stream populations have become extirpated. A single surviving population in the Alabama River is experiencing recruitment failure. The single population is vulnerable to any natural or human-induced random catastrophic event. Currently the only known conservation option is artificial propagation and establishment of one or more populations into historical habitat, however attempts to propagate the species to date have been unsuccessful. No change in status for heavy pigtoe is currently warranted.

Southern combshell: The southern combshell persists in the Buttahatchee River of Mississippi. Channel erosion due to headcutting negatively affected the species in the lower Buttahatchee during the late 1980's through the 1990's, however, the system now appears to be stabilizing. Conservation measures are being implemented throughout the drainage to reduce the effects of nonpoint

source pollution. However, the single population remains vulnerable to natural or human-induced random catastrophic events. Conservation strategies include artificial propagation (see, II.C.2.e. Other natural or manmade factors affecting its continued existence, above). However, no successful reintroductions have yet occurred, and no change in status for southern combshell is currently warranted.

Stirrupshell: There has been no evidence of the continued existence of stirrupshell for over two decades. All known historical habitat has been altered or degraded by impoundment, and the species is presumed extinct by most authorities.

III. RESULTS

A. Recommended Classification:

**Black clubshell
Heavy pigtoe
Southern combshell**

No change is needed

A. Recommended Classification:

**Flat pigtoe
Stirrupshell**

Downlist to Threatened

Uplist to Endangered

Delist

No change is needed

B. If a reclassification is recommended, indicate the Listing and Reclassification Priority Number:

Delisting (Removal from list regardless of current classification)

Priority Number: 6

IV. RECOMMENDATIONS FOR FUTURE ACTIONS -

- (1) Develop measurable recovery criteria for the three extant species.
- (2) Develop and implement plan to quantify and monitor surviving populations and habitats.

- (3) Develop and implement plan to describe and monitor habitat conditions at potential reintroduction sites.
- (4) Continue to work with States to refine and implement the Mobile River Basin Mollusk Propagation Plan.
- (5) Work with AABC 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

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

Stewart McGregor
Alabama Geological Survey

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of
Black clubshell
Heavy pigtoe
Southern combshell

Current Classification Endangered
Recommendation resulting from the 5-Year Review

X **No change is needed**

Review Conducted By Paul Hartfield

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve *Actio* *[Signature]* Date 2/24/09

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

Concur *[Signature]* Date 3/4/09
Acting FS

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve *Amon L. Vabata* Date 4-27-09
Acting RD

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of
Flat pigtoe
Stirrupshell

Current Classification Endangered
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 6

Review Conducted By Paul Hartfield

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve *actrix* *[Signature]* Date 2/24/09

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

Concur *[Signature]* Date 3/4/09
Acting FS

REGIONAL OFFICE APPROVAL:

Lead Regional Director, Fish and Wildlife Service

Approve *Aaron Haberman* Date 4-27-09
Acting RD

APPENDIX A: Summary of peer review for the 5-year review of

Black Clubshell (Curtus' Pearly Mussel) (*Pleurobema curtum*)
Flat Pigtoe (Marshall's Pearly Mussel) (*Pleurobema Marshalli*)
Heavy Pigtoe (Judge Tait's Mussel) (*Pleurobema taitianum*)
Southern Combshell (Penitent Mussel) (*Epioblasma penita*)
Stirrupshell (*Quadrula stapes*)

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

B. Peer Review Charge:

Request sent to potential peer reviewers by email:

On September 8, 2006, the U.S. Fish and Wildlife Service published a notice in the Federal Register announcing a 5-year review of 14 federally listed species, including 5 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 5 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, 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 5 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 –
Jeff Garner, Mussel Management Supervisor
Alabama Division of Wildlife and Freshwater Fisheries

Jeff Garner concurred with the content and conclusion of the review. He noted a potential threat of commercial harvest of heavy pigtoe due to similarity of appearance to ebony shell.

Stewart McGregor
Alabama Geological Survey

Stewart McGregor provided file reports of Tombigbee drainage surveys and investigations supporting conclusions of the 5-year review.

D. Response to Peer Review –

Information received from Jeff Garner, ALDCNR, was incorporated into the threats assessment.

The AGS reports shared by Stewart McGregor were cited as supporting information.