CANDIDATE AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC AND COMMON NAME:

Fusconaia rotulata, round ebonyshell
Ptychobranchus jonesi, southern kidneyshell
Fusconaia escambia, narrow pigtoe
Lampsilis australis, southern sandshell
Pleurobema strodeanum, fuzzy pigtoe
Villosa choctawensis, Choctaw bean
Quincuncina burkei, tapered pigtoe

Note that these species are discussed together due to their overlapping ranges and similarities of threats.

LEAD REGION: 4

INFORMATION CURRENT AS OF: March 2003

STATUS/ACTION (Check all that apply):
X New candidate
___ Continuing candidate
_X Non-petitioned
___ Petitioned - Date petition received: ___
___ 90-day positive - FR date: ___
___ 12-month warranted but precluded - FR date: ___
__ Is the petition requesting a reclassification of a listed species?
___ Listing priority change
Former LP: __
New LP: __
Latest Date species became a Candidate:_____
___ Candidate removal: Former LP: ___ (Check only one reason)
___ A - Taxon more abundant or widespread than previously believed or not subject to a degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___ F - Range is no longer a U.S. territory.
___ M - Taxon mistakenly included in past notice of review.
___ N - Taxon may not meet the Act's definition of "species"
___ X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Clams and Mussels - Unionidae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Alabama and Florida

CURRENT STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Alabama and Florida

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SUPPORT FIELD OFFICE(S): Daphne, Alabama Field Office

BIOLOGICAL INFORMATION (Describe habitat, historical vs. current range, historical vs. current population estimates (# populations, #individuals/population), etc.):

Species Description/Taxonomy

Fusconaia rotulata, Ptychobranchus jonesi, F. escambia, Lampsilis australis, Pleurobema strodeanum, Villosa choctawensis, and Quincuncina burkei are all mussels in the family Unionidae. Historical distribution data from museum records dated between the late 1800s and 1989 are sparse and most species were more than likely present throughout their respective river basins. Knowledge of the historical and current distribution and abundance data were summarized from Williams et al. (in review), Blalock-Herod et al. (in review), and Blalock-Herod et al. (2002). These studies represent a compilation of museum records and recent status surveys conducted between 1995 and 2000 and other periodic collections made between 1990 and 1999 by biologists from U.S. Geological Survey (Gainesville, Florida), Douglas Shelton (Alabama Malacological Research Center, Mobile, Alabama), and Stuart McGregor (Geological Survey of Alabama, Tuscaloosa). Approximately 400 historical and new sites were surveyed within the Escambia, Yellow, and Choctawhatchee River drainages of Alabama and Florida in an effort to locate these seven mussel species.

The round ebonyshell, (Fusconaia rotulata (Wright 1899)) is a small to medium-sized mussel that attains a maximum length of 61 mm. The shell is thick, heavy, inflated, and circular in outline. There is no posterior ridge, but often two slight folds are present. The periostracum is dark brown to black. Internally, the interdentum is moderately broad, with straight to slightly curved lateral teeth. The umbo cavity is deep and wide and nacre is iridescent white (Williams et al. in review). The round ebonyshell was formerly placed in the Genus Obovaria (Turgeon et al. 1998); however, recent genetic analysis indicates that the round ebonyshell is not a sister taxa to other members of the genus Obovaria (Lydeard et al. 2000). Williams and Butler (1994) placed the round ebonyshell in the genus Fusconaia based on internal shell characteristics (i.e., pseudocardinal teeth and umbo cavity).

The southern kidneyshell (Ptychobranchus jonesi (van der Schalie 1934)) is a small to medium-sized mussel that attains a maximum length of 65 mm. The southern kidneyshell has a moderately thick, elliptical shell with the dorsal and ventral margins nearly parallel. The shell is very inflated with prominent biangulation on the posterior end. The periostracum is smooth, olive green to blackish in color, sometimes with irregularly distributed green rays. Internally, lateral teeth are curved and thin, and pseudocardinals are compressed. The nacre is bluish-white and iridescent (Williams et al. in review).

The narrow pigtoe, (Fusconaia escambia Clench and Turner 1956), is a small to medium-sized mussel attaining a maximum length of 74 mm. The shell is moderately thick, subcircular,

slightly inflated, and has a well-defined posterior ridge. The periostracum is smooth and juveniles are chestnut brown in color. Older individuals become darker brown to blackish in color. Internally, the umbo pocket is moderately deep. The hinge plate and lateral teeth are curved. The nacre is white and sometimes has an iridescent salmon hue (Williams et al. in review).

The southern sandshell (Lampsilis australis Simpson 1900) is a small to medium-sized mussel that attains a maximum length of 83 mm. The southern sandshell has a long, elliptical, somewhat pointed shell with moderate inflation. Shell thickness is moderate. Externally, the shell of young specimens is yellowish with green rays and in adults is typically dark brown to black with obscured rays (Williams et al. in review). Sexual dimorphism is present as a slight rounding of the ventral shell margin of females (Athearn 1964). Internally, lateral teeth are somewhat curved, interdentum is wide, and pseudocardinal teeth are delicate and slightly compressed (Williams et al. in review). The nacre is bluish white and iridescent posteriorly.

The fuzzy pigtoe (Pleurobema strodeanum (Wright 1898)) is a small mussel that attains a maximum length of 58 mm. The shell is moderately thick, subtriangular in outline, with a rounded anterior margin and a bluntly pointed posterior margin. The posterior ridge is poorly defined and the posterior slope is slightly concave. Externally, the periostracum is cloth-like, and varies in color from dark olive to brown to almost black. Internally, the pseudocardinal teeth are heavy, and triangular, with two divergent teeth in left valve and one in the right. The lateral teeth are short and almost straight. The nacre is bluish-white with a slight iridescent hue (Williams et al. in review, Garner et al. in review).

The Choctaw bean (Villosa choctawensis Athearn 1964) is a small mussel with a moderately thick shell that obtains a maximum length of 49 mm. The shell is somewhat inflated, ovate in outline, with rounded anterior and posterior margins. Sexual dimorphism is present, in that females may be somewhat more broadly rounded posteriorly. The posterior ridge is low and rounded. The umbo is broad and full, extending little, if any, above hinge line and positioned well anterior of center. The periostracum is shiny and smooth. External shell color is chestnut to dark brown or black, with variable fine, green rays, which may be obscure in older specimens. Internally, two well-developed pseudocardinal teeth occur in left valve and one well-developed and two rudimentary pseudocardinal teeth are present in the right valve. The lateral teeth are short and almost straight. The interdentum is moderately wide and the umbo cavity is moderately deep. Shell nacre is white to bluish and sometimes iridescent, but may be blotched and brown (Garner et al. in review).

The tapered pigtoe (Quincuncina burkei, Walker 1922 *in* Ortmann and Walker (1922)) is a small mussel that attains a maximum length of 60 mm. The shell is inflated and subelliptical in outline. The anterior margin is broadly rounded and the posterior margin is narrowly pointed. The posterior ridge is well defined with radial ridges on the posterior slope. Chevron-shaped ridges cover much of the disk. Shell sculpture may be indistinct in some specimens. The periostracum is brown or greenish-yellow in young specimens, but becomes dark brown to black in adults. Pseudocardinal teeth are well-developed, divergent, and double in both valves. There are two lateral teeth in left valve and usually one in right valve. The interdentum is very narrow. Shell nacre varies from light purple to bluish-white (Garner et al. in review).

Habitat/Life History

Life history and ecological data regarding the round ebonyshell are sparse at best. This animal only occurs in one main river channel, with moderate current over sand and gravel substrate (Williams and Butler 1994). The reproductive period and host fish are unknown for the round ebonyshell (Williams et al. in review). Observations of this species during June 1995, August - October 1996, and August - December 1998, failed to detect any gravid individuals.

The southern kidneyshell is known from medium-sized creeks to rivers in silty sand substrates with slow current and woody debris (Williams and Butler 1994). It has also been located in claystone pockets with sand (Blalock-Herod et al. unpubl. data). The reproductive period and host fish for the southern kidneyshell are unknown (Williams and Butler 1994).

Little is known regarding the life history of the narrow pigtoe. It inhabits small to medium-sized rivers with slow to moderate current over gravel, and gravel mixed with sand or some silt (Williams and Butler 1994). Individuals have been found gravid in June; however, host fish are unknown (Williams et al. in review).

The southern sandshell has been found in clear creeks and rivers with slow to moderate currents over sandy substrates (Williams and Butler 1994). The southern sandshell is one of only four species that produce a superconglutinate to facilitate larval dispersal (Blalock-Herod et al. 2002). A superconglutinate is a mass that mimics the shape, coloration and movement of a fish, but is produced by the female mussel to hold all the glochidia (larval stage) from one years reproductive effort (Haag et al. 1995). The superconglutinate is tethered to the female mussel after release by a mucus strand. The southern sandshell begins brooding in the summer (July/August) and overwinters glochidia in the two outer gills. Superconglutinate release occurs in the spring (April in laboratory trials) though they have been detected in early summer (Blalock-Herod et al. 2002, Haag et al. 1995). Preliminary trails indicate that like other superconglutinate producers, the southern sandshell can use black bass (Micropterus species) as host fish (Blalock-Herod et al. 2002, O'Brien and Brim Box 1999, Haag et al. 1999).

The fuzzy pigtoe inhabits medium-sized creeks to rivers with slow to moderate currents in sand and silty substrates (Williams and Butler 1994). Little is known about the life history of the fuzzy pigtoe. Specimen have been found with glochidia and/or eggs in the marsupia during April and July (Blalock-Herod et al. unpublished data, Williams et al. in review). Host fish are unknown.

The Choctaw bean is known from large creeks and rivers with moderate current over sand to silty-sand substrates (Williams and Butler 1994). Gravid individuals (38 and 39 mm in shell length) have been found in August (Williams et al. in review); however, this species is likely a long-term brooder. Host fish are unknown.

The tapered pigtoe is found in medium-sized creeks to large rivers in stable sand or sand and gravel substrata, occasionally occurring in silty sand in slow to moderate current (Williams and Butler 1994). Little is known about the reproductive biology of the tapered pigtoe. It is presumably a short-term brooder. Ortmann and Walker (1922) reported a female gravid with eggs in May, with all four gills used as marsupia, and subcylindrical conglutinates. Host fish are unknown.

Historic Distrubution

The round ebonyshell is endemic to the Escambia River drainage and is only known from the main channel of the Conecuh and Escambia River (same river however the name changes across the state boundary from Alabama to Florida) (Williams and Butler 1994). Due to recent survey data the known historical range for the round ebonyshell was expanded (based on shell material only) to include the Conecuh River from the junction with the Sepulga River, Escambia County, Alabama, downstream in the Escambia River to Bluff Springs, Escambia and Santa Rosa Counties, Florida (Williams et al., in review) for a total historic range of approximately 95 km (59 river miles B RM).

The southern kidneyshell is endemic to the Escambia and Yellow river drainages in Alabama, and Choctawhatchee river drainage in Alabama and Florida (Williams and Butler 1994). There are 7 known historical sites for the southern kidneyshell in the Escambia River drainage; 2 in the Yellow River drainage; and 14 in the Choctawhatchee River drainage for a total of 23 historical sites. In the Escambia River drainage, the southern kidneyshell was known from the Sepulga River, Conecuh County; Conecuh River and Patsaliga Creek, Covington and Crenshaw Counties; and Little Patsaliga Creek, Crenshaw County. In the Yellow River drainage, the southern kidneyshell is known from Hollis Creek, Covington County, Alabama. In the Choctawhatchee River drainage, the southern kidneyshell was known from Sandy Creek, Walton County, Florida; Pea River, Coffee, Dale, and Barbour Counties, Alabama; Choctawhatchee River, Walton County, Florida, and Dale County, Alabama; West Fork Choctawhatchee River, Dale and Barbour Counties, Alabama; East Fork Choctawhatchee River, Dale and Henry Counties, Alabama; Flat Creek, Geneva County, Alabama; and Whitewater Creek, Coffee County, Alabama (Williams et al. in review, Blalock-Herod et al. in review).

The narrow pigtoe is endemic to the Escambia River drainage in Alabama and Florida and the Yellow River drainage in Florida (Williams and Butler 1994). Known historical distribution included the main channel of the Escambia River, Escambia and Santa Rosa Counties, Florida; Conecuh River, Escambia, Covington, Crenshaw, and Pike Counties, Alabama; and Murder Creek, Conecuh County, Alabama. In the Yellow River, this species is known from the main channel in Okaloosa County, Florida (Williams et al. in review). Due to finding live or shell material of narrow pigtoes in recent status surveys, the historical range has been expanded to include: Patsaliga Creek, Covington and Crenshaw Counties; Bottle Creek, Conecuh County, Alabama; and Panther and Three Runs Creeks, Butler County, Alabama, all Escambia River drainage.

The southern sandshell is endemic to the Escambia River drainage in Alabama, and the Yellow and Choctawhatchee River drainages in Alabama and Florida (Blalock-Herod et al. 2002). Due to finding live southern sandshells during recent surveys, the historical range of the southern sandshell was expanded (Williams et al. in review, Blalock-Herod et al. in review, Blalock-Herod et al. 2002). The historical distribution within the Escambia River basin is restricted to Alabama and included: the main channel of the Conecuh River, Covington, Crenshaw, and Pike Counties; Burnt Corn Creek, Escambia County; Sepulga River, Conecuh County; and Little Patsaliga Creek, Crenshaw County. In the Yellow River drainage, the southern sandshell is known from the Yellow River main channel, Covington County, Alabama. In the Choctawhatchee River drainage, the southern sandshell is known from Alligator Creek,

Washington County; Holmes and Tenmile Creeks, Holmes County; Limestone Creek, Walton County; and the Choctawhatchee River, Holmes County, all in Florida; Choctawhatchee River, Dale, Geneva, and Houston Counties; Pea River, Barbour, Coffee, and Dale Counties; East Fork Choctawhatchee River, Dale and Henry Counties; West Fork Choctawhatchee River, Barbour and Dale Counties; Little Choctawhatchee River, Dale and Houston Counties; Whitewater Creek, Coffee County; Pea Creek, Dale County; and Pea Creek (different from the one in Dale County), Barbour County, all in Alabama (Williams et al. in review, Blalock-Herod et al. in review, Blalock-Herod et al. 2002).

The fuzzy pigtoe is endemic to the Escambia and Choctawhatchee rivers in Alabama and Florida, and the Yellow River in Alabama. Due to recent status surveys the historical range of the fuzzy pigtoe has been expanded (Williams et al. in review, Blalock-Herod et al. in review). Within the Escambia River drainage, the fuzzy pigtoe has been found in the Escambia River, Escambia and Santa Rosa Counties, Florida; Conecuh River, Escambia, Covington, Crenshaw, and Pike Counties, Alabama; Murder, Sandy, and Burnt Corn Creeks, Conecuh County, Alabama; Sepulga River, Conecuh County, Alabama; Pigeon Creek, Covington County, Alabama; Patsaliga and Little Patsaliga Creeks, Crenshaw County, Alabama; and Mill Creek, Pike County, Alabama. Within the Yellow River drainage, the fuzzy pigtoe is known from the Yellow River, Covington County, Alabama. Within the Choctawhatchee River drainage, the fuzzy pigtoe was known from Choctawhatchee River, Washington, Walton, and Holmes Counties, Florida; Limestone Creek, Walton County, Florida; Wrights Creek, Holmes County, Florida; Holmes Creek, Washington County, Florida; Choctawhatchee River, Geneva and Dale Counties, Alabama; Little Choctawhatchee River, Dale and Houston Counties, Alabama; Panther Creek, Houston County, Alabama; West Fork Choctawhatchee River, Dale and Barbour Counties, Alabama; East Fork Choctawhatchee River, Henry County, Alabama; and Pea River, Geneva, Dale, and Coffee Counties, Alabama (Williams et al., in review; Blalock-Herod et al., in review).

The Choctaw bean is endemic to the Escambia, Yellow, and Choctawhatchee River drainages in Alabama and Florida (Williams and Butler 1994). Due to recent status surveys the historical range of the Choctaw bean has been expanded (Williams et al. in review; Blalock-Herod et al. in review). Within the Escambia River drainage, it is known from the Escambia River, Escambia County, Florida; Murder Creek, Conecuh County, Patsaliga and Little Patsaliga creeks, Crenshaw County; and Pigeon Creek, Butler County, all in Alabama. Within the Yellow River drainage, it is known from the main channel Yellow River in Okaloosa County, Florida, and Covington County, Alabama. Within the Choctawhatchee River drainage, the Choctaw bean is known from the Choctawhatchee River main stem in Washington and Holmes Counties, Florida; and the Pea River, Geneva County, Alabama (Williams et al. in review, Blalock-Herod et al. in review).

The tapered pigtoe is endemic to the Choctawhatchee River drainage in Alabama and Florida (Williams and Butler 1994, Blalock-Herod et al. in review). Due to recent surveys, the historical distribution of the tapered pigtoe has been expanded. Additionally, a relic shell was found recently in Big Creek, Pike County, Alabama (Blalock-Herod et al. in review). The tapered pigtoe is known from Horseshoe Lake (an oxbow lake with flowing connection to main channel of the Choctawhatchee River), Washington County; Limestone Creek, Walton County; East Pitman Creek, Holmes County; Choctawhatchee River, Washington, Walton, and Holmes Counties; Holmes Creek, Washington and Holmes Counties; and Tenmile Creek, Holmes

County; all in Florida. In Alabama, the historical distribution of the tapered pigtoe included: Flat and Hurricane creeks, Geneva County; Pea River, Barbour, Coffee and Dale Counties; Choctawhatchee River, Dale County; Little Choctawhatchee River, Dale and Houston Counties; East Fork Choctawhatchee River, Dale County; Bear and Panther Creeks; Houston County; and West Fork Choctawhatchee River, Barbour County (Blalock-Herod et al. in review).

Status

The current range of live round ebonyshell individuals is restricted to 43 km (27 RM). Only 3 of 9 historic locations contain living individuals; thereby indicating a 67% decline in the number of sites known to support this species. Round ebonyshell population levels within the Escambia River drainage are extremely low. On average, only 2 live individuals were found at the remaining 3 sites (Williams et al. unpublished data). It is unknown if these remaining populations are capable of reproduction and recruitment.

Within the Choctawhatchee River drainage, the southern kidneyshell was detected during the last 10 years at only 2 of 14 historic sites, one on the Pea River, Coffee County, Alabama, and one on West Fork Choctawhatchee River, Barbour County, Alabama (Williams et al. in review, Blalock-Herod et al. in review). Population status is undetermined at one site within the Choctawhathcee; however, locations above and below this site do not currently support the southern kidneyshell. Population abundance was low at the two sites where live individuals were detected with an average of 6 specimens detected per site (Blalock-Herod et al. unpublished data). Population status is undetermined at 1 site in the Escambia and 1 site in the Yellow River basins. The remaining sites in these two drainages are inactive and the southern kidneyshell may be extirpated from these basins. The Pea River population may have recently become extirpated. This population was examined in the early 1990s, but when the locality was revisited in 1998, southern kidneyshells were not located (Blalock-Herod et al., in review). In totality, of 23 historical sites, 3 have unknown population status, 18 -19 are inactive, and 1-2 are active, representing a 78 - 83% decline in the number of sites supporting the southern kidneyshell. It is unknown if these remaining populations are capable of reproduction and recruitment.

The following locations known from museum records continue to support narrow pigtoes: Escambia River, Escambia and Santa Rosa Counties, Florida; Conecuh River, Escambia, Covington, Crenshaw, and Pike Counties, Alabama; all Escambia River drainage. In the Escambia River drainage, narrow pigtoes (live and shell material) have been documented from 27 locations. Currently 21 locations support narrow pigtoes, population status is undetermined at 1 site, and 5 sites are inactive. In the Yellow River drainage, there were 2 known historical sites, none of which are currently active. Recent survey results indicate a 24% decline in its entire historic range (29 sites); however, this decline represents the loss of one entire river basin within the historic range. Population levels within the Escambia River drainage appear to be low. Abundance at historical locations is unknown. At sites currently supporting narrow

pigtoes, an average of 3 live individuals were found per site (Williams et al., unpublished data). Recent mussel surveys did not target documentation of recruitment, but with population averages of 3 individuals, recruitment if occurring is likely low and long-term viability of the narrow pigtoe is questionable.

Recent mussel surveys found that live populations of the southern sandshell have declined from 7 historic sites to 3 currently active sites and one site with unknown population status within the Escambia River basin. It has declined from 9 historic sites to 8 currently active sites within the Yellow river basin; and within the Choctawhatchee River basin it has declined from 35 historic sites to 19 currently active sites (Blalock-Herod et al., 2002) and 4 sites with unknown population status. In totality, the southern sandshell has declined from a total of 51 historic sites to its remaining distribution of 30 active sites and 5 sites with unknown population status. It has been extirpated from approximately 31-41% of its historic range. Recent mussel surveys found an average of 2 -3 live animals per site (Williams et al. unpublished data; Blalock-Herod et al. unpublished data). Only 2 populations within the Choctawhatchee River drainage supported 20-30 individuals (Blalock-Herod et al. 2002). Gravid females have been detected within the 2 larger populations found in the Choctawhatchee River basin. Low levels of recruitment are likely occurring within these two populations, but juvenile southern sandshells were not detected. It is unknown if other populations are capable of reproducing, making the long-term viability of the southern sandshell questionable.

Recent mussel status surveys found that the populations of the fuzzy pigtoe (represented by live animals and shell material) have declined from: 31 historic sites to 18 currently active sites, 8 inactive, and 5 undetermined population status within the Escambia River drainage; 4 historic sites to 0 currently active sites within the Yellow River drainage; and 51 historic sites to 40 currently active sites, 7 inactive sites, and 4 sites with undetermined population status within the Choctawhatchee River drainage (Williams et al. in review, Blalock-Herod et al. in review). In totality, the fuzzy pigtoe has declined from a total of 86 historic sites to its remaining distribution of 58 sites . It has been extirpated from approximately 22% of its historic range. Only 4 populations were represented by 10 - 20 individuals, but most supported only 1 or 2 individuals (Williams et al. unpublished data, Blalock-Herod et al. unpublished data). At least some of the extant populations may be capable of reproducing, as one specimen was found with eggs partially in swollen marsupia during July (Williams et al. in review). Low-level recruitment may be occurring; however, long-term viability of the fuzzy pigtoe is questionable.

The Choctaw bean appears to be extirpated from Murder Creek, Conecuh County; Pigeon Creek, Butler County; and Little Patsaliga Creek, Crenshaw County, all Alabama, all Escambia River basin; and Choctawhatchee River, Holmes County, Florida. Recent mussel status surveys found that populations (live and shell material only) of the Choctaw bean have declined from 13 historic sites to 7 currently active sites, 4 inactive, and 2 with an undetermined population status within the Escambia River drainage; it has declined from 6 historic sites to 5 currently active sites and 1 with an undetermined population status within the Yellow River drainage; and from 26 historic sites to 22 currently active sites, 1 inactive site, and 3 sites with undetermined population status within the Choctwhatchee River drainage (Williams et al. in review, Blalock-Herod et al. in review). In totality, the Choctaw bean has declined from a total of 45 historic sites to its remaining distribution of 34 sites. It has been extirpated from approximately 11% of

its historic range. An average of 2 individuals were found live per site (Williams et al., unpublished data; Blalock-Herod et al., unpublished data). Two gravid individuals have been detected, but recent recruitment has not been confirmed (Williams et al. in review). The long-term viability of the Choctaw bean is questionable.

Populations of the tapered pigtoe appear to be extirpated from Hurricane Creek, Geneva County; Bear and Panther Creeks, Houston County; Little Choctawhatchee River, Houston and Dale Counties; Pea River, Coffee and Dale counties; Choctawhatchee River and East Fork Choctawhatchee River, Dale county, and probably Big Creek, Pike County, all in Alabama. The following locations known from historical museum records continue to support tapered pigtoe populations: Limestone Creek, Walton County; East Pittman Creek, Holmes County; Choctawhatchee River, Washington, Walton, and Holmes Counties; and Holmes Creek, Washington and Holmes Counties; all in Florida; and Flat Creek, Geneva County; Alabama (Blalock-Herod et al. in review). During recent status surveys, the tapered pigtoe was found live and as shell material at 33 of 54 historical sites with an average of 7 individuals per site. Populations were inactive at 15 historical sites and status is undetermined at 6 sites. Four populations were represented by 10 - 20 individuals (Blalock-Herod et al. unpublished data). The tapered pigtoe has been extirpated from approximately 28% of its historic range. Recruitment status of the tapered pigtoe is unknown, and may be occurring at low levels within the existing populations.

THREATS (Describe threats in terms of the five factors in section 4 of the ESA providing specific, substantive information. If this is a removal of a species from candidate status or a change in listing priority, explain reasons for change):

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

The round ebonyshell, southern kidneyshell, narrow pigtoe, southern sandshell, fuzzy pigtoe, Choctaw bean, and tapered pigtoe represent seven narrowly endemic mussel species from Gulf Coastal drainages in Alabama and Florida. The exact cause for decline is unknown, but it is believed that these seven species have disappeared from portions of their historic ranges due to a variety of factors outlined below. Several species may be extirpated from the Yellow River and a variety of other tributary streams within the Escambia and Choctawhatchee river drainages. The stream and river habitats of these seven species are vulnerable to habitat modification, sedimentation, and water quality degradation from a number of activities. Highway and reservoir construction, improper logging practices, agricultural runoff, housing developments, pipeline crossings, and livestock grazing often result in physical disturbance of stream substrates or the riparian zone, and/or changes in water quality, temperature, or flow (Neves et al. 1997).

Sedimentation can cause direct mortality of mussels by deposition and suffocation (Ellis 1936, Box and Mossa 1999) and can eliminate or reduce the recruitment of juvenile mussels (Negus 1966, Box and Mossa 1999). For example, increased suspended sediment loads may directly impact the southern sandshell life-cycle by reducing the chance of a sight-feeding host fish encountering the visual display of a superconglutine lure (Haag et al. 1995, Blalock-Herod et al.

2002). If the superconglutinate does not encounter a host within a short time period, the glochidia will not be viable (O'Brien and Brim Box 1999). Suspended sediment can also interfere with feeding activity of mussels (Dennis 1984). Many of the streams recently surveyed for these seven species have or have the potential for high nonpoint source pollution for sediments (Bennett 2002 and references therein, Hoehn 1998 and references therein). Potential sources of sand and other sediment accumulation in south-central Alabama and western Florida stream channels include row crop agriculture on sloping landscapes, clear cutting of timber including riparian zones, and livestock grazing along streams (Bennett 2002 and references therein, Hoehn 1998 and references therein). Uncontrolled access to small streams by cattle and other livestock may result in destruction of riparian vegetation, bank degradation and erosion, and localized sedimentation of stream habitats. Limited range and low numbers make these seven species vulnerable to land use changes within occupied watersheds that would result in increases in nonpoint source pollution impacts. Strict adherence to Forestry Best Management Practices (BMPs) and maintaining buffers between cultivated fields, pastures, and riparian areas minimizes these impacts.

Many of the confirmed extant populations of these seven species are in the vicinity of highway and unpaved road crossings due to ease of access for surveyors. Highway and bridge construction and widening could affect populations of these species unless appropriate precautions are implemented during construction to reduce erosion and sedimentation, and maintain water quality standards. Unpaved roads and roadside gullies contribute to greater than 50% of the sediment transported into streams of the Choctawhatchee River drainage (Bennett 2002 and references therein). Other river drainages of the coastal plain of Alabama and Florida may be similar. Efforts to reduce the number of unpaved roads or following maintenance and service guidelines may reduce erosion and sedimentation problems within these basins. The construction of reservoirs and the associated habitat changes (e.g., changes of sediments, flow, water temperature, dissolved oxygen) can directly impact mussel populations (Neves et al. 1997). The completion of several large and small dams on streams within the Escambia, Yellow, and Choctawhatchee River drainages, may have contributed to some main stem populations being lost, and other populations declining.

Nutrients, usually phosphorus and nitrogen, may emanate from agricultural fields, residential lawns, livestock feedlots, poultry houses, and leaking septic tanks in levels that result in eutrophication and reduced oxygen levels in small streams. Many mussel species are more sensitive to nitrogen and ammonia compounds than other test organisms currently used in bioassays and therefore, current EPA water quality criteria may be inadequate to protect them (Augspurger et al. in review). Nutrient loading has been identified as a concern within the Escambia, Yellow, and Choctawhatchee River drainages, in Florida (Hoehn 1998 and references therein).

Adult mussels appear to respond to agricultural and residential pesticide and herbicide residues similar to commonly used test organisms (N. Kernaghan, U.S. Geological Survey (USGS), Gainesville, Florida, pers. comm., March 2003), therefore current water quality criteria should protect adult mussels from mortality. Additionally, many chemicals known to be harmful to aquatic organisms in general are no longer in use. However, breakdown products of pesticides and herbicides are often still present within the sediments and water column. Sublethal effects to adults and lethal and sublethal effects to juveniles and glochidia from these chemicals and their breakdown products are not fully understood. Other complexities arise when pesticide and

herbicide residues affect host fish. For example, preliminary evidence from laboratory trials indicated that host fish carrying a body burden of atrazine failed to transform glochidia into juvenile mussels, while hosts without body burden concentrations were successful (N. Kernaghan, USGS, pers. comm., March 2003). Atrazine is an herbicide commonly used to control broad leaf grasses and weeds in corn, other crops, and conifer reforestation plantings (Extension Toxicology Network 1996). Current and historical data regarding agricultural and residential pesticide and herbicide use within the Escambia, Yellow, and Choctawhatchee River drainages are not readily available and the impact of these chemicals on the seven mussel species is unknown.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

These seven species are not commercially valuable nor are the streams and rivers they inhabit subject to harvesting activities for commercial mussel species. These species have been taken for scientific and private collections in the past. Such activity may increase as knowledge of the species increasing rarity becomes known. Although collecting is not considered a factor in the decline of these species, the restricted distribution and small sizes of the known extant populations renders them vulnerable to overzealous recreational or scientific collecting. In the State of Florida, commercial harvesting is prohibited and a bag limit has been set for recreational harvesting. Commercial harvesting in the Escambia, Yellow, and Choctawhatchee River basins in Alabama is illegal and recreational harvesting is restricted.

C. Disease or predation.

Diseases of mussels are poorly known. Juvenile and adult mussels are prey items for some invertebrate predators (e.g., non-biting midges, dragonfly larvae, hydra, flatworms) and parasites (e.g., nematodes, mites), and provide prey for a few vertebrate species (e.g., birds, raccoons, otter, fish). Although predation by naturally occurring predators is a normal aspect of the population dynamics of a healthy mussel population, predation may contribute to the further decline of these species due to their restricted distributions and low numbers associated with extant populations.

D. The inadequacy of existing regulatory mechanisms.

Although the negative effects of point source discharges on aquatic communities in Alabama and Florida have been reduced over time by compliance with State and Federal regulations pertaining to water quality, there has been less success in dealing with nonpoint source pollution impacts, particularly sediments, to small stream drainages. Such impacts result from individual private landowner activities (e.g., construction, grazing, agriculture, silviculture), and public construction works (e.g., bridge and highway construction and maintenance). The effects of such activities can be, and often are reduced by employing voluntary BMPs. There is currently no requirement within the scope of Federal environmental laws to specifically consider these seven species during Federal activities, or to ensure that Federal projects will not jeopardize their continued existence.

E. Other natural or manmade factors affecting continued existence.

Catastrophic Events

The majority of the remaining populations of these seven species are generally small and geographically isolated. The round ebonyshell and southern kidneyshell are vulnerable to catastrophic events (e.g., flood scour, drought, toxic spills) because of low population numbers known from 3 and 2 sites, respectively. The effects of recent droughts on these seven species are currently unknown, however, the habitats of these species are susceptible to dewatering, reduced food availability, decreased dissolved oxygen and increased water temperatures from droughts. Glycogen levels were examined in a population of *Elliptio mcmichaeli* (fluted elephantear) that was affected by drought conditions that occurred within the Choctawhatchee River drainage, Alabama. Glycogen levels in mussels that experienced dewatering mimicked levels of specimens that were starved in laboratory trials (Herod et al. 2001). The affected population of the fluted elephantear was nearly extirpated during the recent drought.

Host Fish Considerations

Additionally, these seven species would be adversely affected by the loss or reduction in numbers of the fish host essential to its parasitic glochidial stage. The specific fish host for six of seven of these species is not known, therefore, impacts to this aspect of the life cycle are not easy to evaluate. Reduction in

host fish distribution and abundance makes natural repopulation of any extirpated population less probable.

Population Fragmentation, Isolation, and Genetic Considerations

The likelihood is high that some populations of these seven species are below the effective population size (Soulé 1980) required to maintain long-term genetic and population viability. Population fragmentation and isolation prohibits the natural interchange of genetic material between populations, and small population size reduces the reservoir of genetic diversity within populations, which can lead to inbreeding depression (Avise and Hambrick 1996), decreased fitness, and an increased risk of extinction in localized populations (Saccheri et al. 1998).

Invasive Species

Alien or nonnative species of aquatic organisms are firmly established in the range of these seven species. The Asian clam (Corbicula fluminea) has spread throughout the Escambia, Yellow, and Choctawhatchee river drainages since its introduction into these basins around 1960. This species has been implicated as a competitor with native mussels for resources such as food, nutrients, and space, particularly as juveniles (Neves and Widlak 1987). According to Strayer (1999), dense populations of Asian clams may ingest large numbers of unionid sperm, glochidia, and newly-metamorphosed juveniles. Asian clams may actively disturb sediments, so dense populations could reduce habitable space for juvenile native mussels. Periodic dieoffs may produce enough ammonia and consume enough oxygen to kill native mussels (Strayer 1999). However, specific impacts upon native mussel populations remain largely unresolved (Leff et al. 1990, Strayer 1999). Yeager et al. (2000) determined that high densities of Asian

clams negatively impacted the survival and growth of newly metamorphosed juvenile mussels and thus reduced recruitment. They proved from laboratory experiments that Asian clams readily ingested glochidia, clam density and juvenile mussel mortality were positively correlated, growth rates were reduced with the presence of clams, and juvenile mussels were displaced in greater numbers downstream in laboratory tests with clams (Yeager et al. 2000).

Other invasive species that are potential threats to these seven species are zebra mussels (Dreissena polymorpha) and black carp (Mylopharyngodon piceus). The invasion of the zebra mussel poses a threat to mussel faunas in many regions, and species extinctions are expected as a result of its continued spread in the eastern United States (Ricciardi et al. 1998). Strayer (1999) reviewed in detail the mechanisms in which zebra mussels impact native mussels. The primary means of impact is direct fouling of the shells of live native mussels, as zebra mussels have attached in large numbers to the shells of live native mussels and have been implicated in the loss of mussel beds. Fouling impacts include impeding locomotion (both laterally and vertically), interfering with normal valve movements, deforming valve margins, and locally depleting food resources and increasing waste products. Heavy infestations of zebra mussels on native mussels may overly stress the animals by reducing their energy stores. They may also reduce food concentrations to levels too low to support reproduction or even survival in extreme cases. Other ways in which zebra mussels may impact native mussels is potentially through filtering their sperm and possibly even their tiny glochidia from the water column. Habitat for native mussels may also be degraded by large deposits of zebra mussel pseudofeces (Vaughan 1997). Fortunately, zebra mussels have not been detected within the Escambia, Yellow, and Choctawhatchee river drainages. However, reports of the nuisance species continue to move eastward from the Mississippi River drainage. Active education and prevention programs could eliminate this potential threat.

Native to China, the black carp is also a potential threat (Strayer 1999). Nico et al. (2001) prepared a risk assessment of the black carp and summarized all known aspects of its ecology, life history, and intentional introduction (since the 1970s) into North America. A molluscivore (mollusk eater), the black carp has been proposed for widespread use by aquaculturists to control snails, the intermediate host of a trematode (flatworm) parasite affecting catfish in ponds in the Southeast and lower Midwest. Intentionally brought to the United States, black carp are known to eat clams (Corbicula spp.) and unionid mussels in China, in addition to snails. They are the largest of the Asiatic carp species, reaching more than 4 feet in length and achieving a weight in excess of 150 pounds (Nico et al. 2001). During 1994, 30 black carp escaped from an aquaculture facility in Missouri during a flood. Other escapes into the wild by nonsterile black carp are deemed imminent by conservation biologists. If these species invade streams with mussel communities, they could wreak havoc on already stressed native mussel populations. Black carp are not known to be introduced to the Escambia, Yellow, or Choctawhatchee river drainages. No aquaculture facilities are known to contain black carp within these basins. Active education and programs to prevent accidental introductions may alleviate this potential threat.

BRIEF SUMMARY OF REASONS FOR REMOVAL OR LISTING PRIORITY CHANGE:

Recent status surveys indicated that these seven species have experienced range reductions and occur in low abundance within their limited ranges. Listing priority was suggested for these seven species.

FOR RECYCLED PETITIONS:

a. Is listing still warranted? ___

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? ___

c. Is a proposal to list the species as threatened or endangered in preparation? ___

d. If the answer to c. above is no, provide an explanation of why the action is still precluded:

LAND OWNERSHIP (Estimate proportion Federal/state/local government/private, identify non-private owners):

Upon statehood, Alabama, and Florida (in 1819 and 1845 respectively) were granted ownership of lands beneath tidally influenced and navigable waters up to the high water mark (Pollard v. Hagan, 44 U.S. (3How.) 212 (1845)). It is possible that prior sovereigns or the States have made grants to private parties, which include lands below mean high waters of the navigable waters. Other public lands (e.g., Blue Springs and Florala State Parks, Alabama; Ponce de Leon Springs State Recreation Area, Florida; Blackwater River State Forest, Florida; Geneva State Forest, Alabama, Conecuh National Forest, Alabama; Covington County and Barbour County Wildlife Management Areas, both in Alabama; Eglin Air Force Base, Florida; and Ft. Rucker Military Reservation, Alabama) occur along historical and extant streams of occurrence for these species or in their watersheds. However, the majority of riparian lands along non-navigable streams occupied by these species are privately owned.

PRELISTING (Describe status of conservation agreements or other conservation activities):

Conservation activities have been limited to working with private landowners in south Alabama and west Florida to encourage the use of Best Management Practices to reduce the effects of agriculture and silviculture.

REFERENCES (Identify primary sources of information (e.g., status reports, petitions, journal publications, unpublished data from species experts) using formal citation format):

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LISTING PRIORITY (place * after number)

THREAT			
Magnitude	Immediacy	Taxonomy	Priority

High	Imminent	Monotypic genus Species Subspecies/population	1 2* 3
	Non-imminent	Monotypic genus Species Subspecies/population	4 5** 6
Moderate to Low	Imminent	Monotypic genus Species Subspecies/population	7 8 9
	Non-imminent	Monotypic genus Species Subspecies/population	10 11*** 12

* round ebonyshell, southern kidneyshell
** narrow pigtoe, southern sandshell, fuzzy pigtoe, Choctaw bean
*** tapered pigtoe

RATIONALE FOR LISTING PRIORITY NUMBER:

Magnitude: The threats to six (round ebonyshell, southern kidneyshell, narrow pigtoe, southern sandshell, fuzzy pigtoe, Choctaw bean) of the seven species are significant and present throughout their respective ranges, and thus are high in magnitude. Threats associated with habitat loss and degradation occur throughout the range of these seven species, including nonpoint and point source pollution (e.g., sedimentation, nitrogen, ammonia). Portions of these species' ranges have been impounded and adversely affected by poor land use practices; population losses due to habitat destruction have probably contributed more to the decline and imperilment of these seven species than any other single factor. The round ebonyshell and southern kidneyshell are represented by very few individuals in 2-3 populations. Thus those species are the most vulnerable of the seven mussel species. Although the number of populations for the narrow pigtoe, southern sandshell, fuzzy pigtoe, Choctaw bean are larger than for the round ebonyshell and southern kidneyshell, those remaining populations are small and most are geographically isolated making them susceptible to a single catastrophic event and making natural repopulation and genetic interchange difficult. The threats to the tapered pigtoe are the same as for the other six species; however, the magnitude is moderate to low due to the larger number of sites within its range that support larger numbers of live individuals.

Imminence: These seven species have disappeared from large portions of their ranges. Threats to the round ebonyshell and southern kidneyshell are imminent, due to their low population numbers and isolation to 3 and 2 known locations, respectively. Threats to the narrow pigtoe, southern sandshell, fuzzy pigtoe, tapered pigtoe, and Choctaw bean are similar but non-imminent due to relatively larger numbers of populations and greater numbers of individuals per populations than the round ebonyshell and southern kidneyshell. Threats to all seven species include the ongoing effects of sedimentation, poor land use practices, and impoundments. Expanding human populations will increase the likelihood that many of these habitat-related factors will continue to impact extant populations. Range restrictions and disjunctive nature of the remaining populations continue to impact these species through reduced genetic diversity and limited natural reproduction. Relatively few streams across these species' former ranges are

thought to harbor long-term viable populations.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all additions of species to the candidate list, removal of candidates, and listing priority changes.

Approve: Linda Kelsey March 14, 2003
Acting Regional Director, Fish and Wildlife Service Date

Concur: Steve Williams April 5, 2004
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Director's Remarks: _____

Date of annual review: March 2003

Conducted by: Patty Kelly B Panama City FO - Florida

Comments: