Recovery Plan for Fat Threeridge (*Amblema neislerii*)
Original Recovery Plan Approved: 19 September 2003
Original Prepared by: R.S. Butler, J. Ziewitz, S. Alam, H. Blalock-Herod

DRAFT AMENDMENT 1

We have identified best available information that indicates the need to amend recovery criteria for Fat Threeridge (*Amblema neislerii*) since the recovery plan was completed. In this proposed modification, we synthesize the adequacy of the existing recovery criteria, show amended recovery criteria, and describe the rationale supporting the proposed recovery plan modification. The proposed modification is shown as an addendum that supplements the recovery plan, superseding only pages iv, 77-81 of the recovery plan. Recovery plans are a non-regulatory document that provide guidance on how best to help recover species.

For
U.S. Fish and Wildlife Service
Southeast Region
Panama City, Florida

March 2019

METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT

This recovery plan amendment is a result of work by the Panama City, Florida Field Office (PCFO) using the best available information. We referenced past Service recovery documents [listing rule (63 FR 12664), recovery plan (USFWS 2003), critical habitat designation (72 FR 64286), and previous 5-year review (USFWS 2007b)], as well as more recent documents that reviewed species status including agency reports, peer-reviewed literature, and Biological Opinions. Primary data sources used to update our understanding of scientific information were the Service collections, Florida Fish and Wildlife Conservation Commission (FWC), and from Georgia Department of Natural Resources (GADNR). Our rationale for the criteria updates primarily are informed by updates to current Fat Threeridge distribution, habitat associations, and abundance in Gangloff (2011, 2012), Wisniewski et al. (2013, 2014), Smit and Kaeser (2016), and Kaeser et al. (in prep). All sources used for this recovery plan modification are on file at PCFO.

ADEQUACY OF RECOVERY CRITERIA

Section 4(f)(1)(B)(ii) of the Endangered Species Act (Act) requires that each recovery plan shall incorporate, to the maximum extent practicable, "objective, measurable criteria which, when met, would result in a determination…that the species be removed from the list." Legal challenges to recovery plans (see Fund for Animals v. Babbitt, 903 F. Supp. 96 (D.D.C. 1995)) and a Government Accountability Audit (GAO 2006) have also affirmed the need to frame recovery criteria in terms of threats assessed under the five listing factors.

Recovery Criteria

See previous version of criteria in the existing Seven Mussel Recovery Plan (2003) Part II pages 75 – 95.

Synthesis

Background
In 1989, the Fat Threeridge was part of a group of seven freshwater mussels in the Apalachicola-Chattahoochee-Flint (ACF) River Basin of Alabama, Georgia, and Florida considered as potential candidates for listing. It was federally listed as endangered under the Endangered Species Act (Act) of 1973, as amended, on March 16, 1998 (63 FR 12664). Critical Habitat for the species was designated November 15, 2007 (72 FR 64286, USFWS 2007a), and a 5-year review was completed in 2007 (USFWS 2007b).

Historic Distribution (through 2007)
The Fat Threeridge is an endemic mussel species historically occupying only the mainstem habitats of the the ACF River Basin. The Fat Threeridge is known to occur in the Flint, Chipola and Apalachicola rivers of Georgia and Florida; there are no known collections from the Chattahoochee River. Hydrology and barriers in the large rivers of the ACF (summarized in Brim-Box and Williams 2000) are relevant for understanding the adaptive capacity (representation) and the distribution of resilient populations (redundancy) that contribute to the recovery of Fat Threeridge. The Chattahoochee River has multiple impoundments, both federal (US Army Corps of Engineers, USACE) and non-federal, the Flint River has two non-federal dams, and the Apalachicola River was impounded by Jim Woodruff Lock and Dam (JWLD) in 1957, forming Lake Seminole at the Georgia-Florida state line. South of JWLD, the Apalachicola River flows freely for 171 river km (RKM) (106 mi) before draining to the Gulf of Mexico. The lower Chipola River is the fourth largest river in the ACF Basin, and an anabranch channel (diverts from main channel and rejoins downstream) of the Apalachicola River, described in more detail below.

Flint River (Georgia): The type specimen of Fat Threeridge was described from the Flint River about 10 miles (16.1 km) north of Oglethorpe, in Macon County, Georgia (Lea, 1858, discussed in Clench and Turner 1956). Nearly a century later, Clench and Turner (1956) reported that no collections of the species had occurred in the Flint River since the late 1800s, thus the 6 Flint River site occurrences reported by Brim-Box and Williams (2000) likely date back to the 19th century. A survey of sixty sites along the Flint River mainstem in the early 1990s yielded no live specimens (Brim-Box and Williams 2000; page 30). The 1998 Listing notice (63 FR 12664) states that Fat Threeridge were presumed extirpated from the Flint River, with the last observation of a live Fat Threeridge in the Flint River in 1981. Brim-Box and Williams (2000) reported the last collection of a live specimen in the Flint River as occurring in 1988.

Living specimens of Fat Threeridge were rediscovered in the Flint River at a location near Newton, Georgia in 2006-2007; these data collections by C. Stringfellow, USFWS, and GADNR are noted in the 5-year review (USFWS 2007b). Flow in the lower Flint River Basin primarily is influenced by precipitation and water use (summarized in Shea et al. 2013).

Apalachicola and Chipola rivers (Florida): Along the 171 km (106 mi) course, changes in channel geomorphology support the classification of the river into upper, middle, and lower non-tidal reaches. See Kaeser et al. (in preparation) for more detail, but classifications are relevant to recovery so are summarized briefly here. In the upper reach (RKM 171-104), the river exhibits a relatively straight, low sinuosity channel that cuts through geologic formations associated with the Apalachicola Bluffs and Ravines Province. Downstream, from RKM 104 to RKM 56, the middle reach Apalachicola exhibits a regular and repeating meandering pattern typical of alluvial, Coastal Plain rivers, and is characterized by medium and fine sand bed substrates (Light et al. 2006), patches of silt and mud deposition, and clay outcrops along some of the river margins. Downstream from RKM 56, the Apalachicola channel becomes irregular and wandering. This lower, non-tidal reach extends to RKM 33, a location considered to be within the approximate upstream limits of tidal influence (Light et al. 2006). Within the middle reach, at RKM 67, a naturally-formed, anabranch channel called the Chipola Cutoff intersects the mainstem Apalachicola River and captures 27% of the river's discharge (summarized in Mossa et al. 2017). Within 5 km (3.1 mi), the Chipola Cutoff joins the Chipola River, a main tributary to the Apalachicola, and downstream from this junction the channel is referred to as the lower Chipola River. The irregular, wandering channel of the lower Chipola rejoins the Apalachicola River at RKM 44.8. River flows are currently regulated at the dam to maintain a minimum flow of 141.5 m^3/s (5,000 ft^3/s, cfs) at the USGS gage in Chattahoochee, Florida during seasonally dry periods of the year. This regulation affects all waters of the Apalachicola River, the Chipola Cutoff, and the Chipola River. The Fat Threeridge is not known to have ever occured in the upper Chipola River, which has different hydrogeomorphic features than the lower extent of the river; the northern extent of historic Fat Threeridge distribution in the Chipola River is approximately RKM 50, which is upriver of a geologic feature known as Dead Lakes, and in the lower Chipola River and the Chipola Cutoff. In their survey work in the 1990s, Brim-Box and Williams (2000) noted that among 35 mainstem sites on the Apalachicola River and 30 mainstem sites on the Chipola River, only 32 Fat Threeridge individuals were collected.

Current distribution (2008-present)

Since the last 5-year review in 2007, the knowledge base on this species has substantially increased in all three river systems, including distribution, habitat use, and life history characteristics relevant to species recovery.

Flint River (Georgia): Since the rediscovery of Fat Threeridge in the Flint River in 2006-2007, a small population has persisted in a reach approximately 2-3 RKM (1.2-1.9 mi) in length near Newton, Georgia. Abundance of the species at this location is likely low (i.e., $<1/m^2$), but has not been quantified. A quantitative survey of 39 sites distributed throughout 119 RKM (74 mi) of the lower Flint River mainstem from Albany Dam to Lake Seminole detected the species only at the Newton Location (5 individuals, Wisniewski et al. 2014). Estimated detection probability for Fat Threeridge for the Flint River population at the Newton, Georgia site was relatively high, but estimated occupancy rate throughout the entire lower Flint River was consequently low (Wisniewski et al. 2013, 2014).

Apalachicola and Chipola rivers (Florida): In 2007, the 5-year review (USFWS 2007b) presented a paradigm based on best available information that Fat Threeridge distribution was

concentrated within water depth of 4-5 m (13-16 ft), with movement as water levels either rose or dropped. Targeted sampling efforts by Gangloff in the 2000s informed nearshore density in response to concerns about mortality during USACE drawdowns and indicated higher density/abundance in the Apalachicola and Lower Chipola than previously known (Gangloff 2011, 2012; USFWS 2012). Subsequent surveys (2012-2017) by federal and state agencies in the ACF have significantly updated our understanding of Fat Threeridge abundance and distribution. Habitat mapping (Smit and Kaeser 2016) and dive surveys (Kaeser et al., in prep) of the Chipola and Apalachicola rivers indicated robust and abundant populations in the Apalachicola and lower Chipola rivers, and presence of the species in low numbers in the Chipola River above Dead Lakes to RKM 36.5. Expansion of sampling frame for this species to deeper waters and different habitat types than previously considered suitable for the species has updated our knowledge of species distribution and habitat use (Kaeser et al., in prep). Fat Threeridge was found to be among the most commonly sampled mussel species in the upper, middle, and lower reaches of the Apalachicola, and the lower Chipola (Kaeser et al., in prep).

Life history

Like other unionid mussels, the Fat Threeridge has a parasitic stage during which the immature mussels, called glochidia, must attach to a host fish to transform into a juvenile. Research since the last 5-year review (USFWS 2007b) has updated our knowledge of life history characteristics. O'Brien and Williams (2002) studied various aspects of life history of the Fat Threeridge, determining that it is likely a short-term summer brooder of its glochidia. Females appear to be gravid in Florida when water temperatures reached 23.9°C (75°F), in late May and June, suggesting that the species expels glochidia in the summer. Fat threeridge glochidia are released in a white, sticky, web-like mass, which expands and wraps around a fish, thus facilitating attachment. The glochidia are viable for two days after release.

The Fat Threeridge lacks mantle modifications or other morphological specializations that would serve to attract host fishes and appears to be a host-fish generalist (O'Brien and Williams 2002, Fritts and Bringolf 2014). Fritts and Bringolf (2014) reported transformation of Fat Threeridge on 23 species of fish, including common river species [e.g. bluegill (*Lepomis macrochirus*) and largemouth bass (*Micropterus salmoides*)]. Host fish abundance is not considered a limiting factor for Fat Threeridge. Transformation of the glochidia on host fishes required 10 to 18 days (O'Brien and Williams 2002, Fritts and Bringolf 2014).

In an age estimation study conducted by the Service, mussel size ranged from 11-86 mm (0.4-3.4 in) total length, and estimated ages ranged from 1-24 years old; estimated age at maturity is 3 years (USFWS, unpublished data). Result of those studies indicate that Fat Threeridge exhibits low to moderate growth and intermediate longevity relative to other mussel species (Haag and Rypel 2010).

Threats

The primary constituent elements (PCEs) of the critical habitat for the Fat Threeridge include: geomorphically stable stream channel, predominantly sand, gravel, or cobble stream substrate, permanently flowing water, water quality that meets or exceeds aquatic life criteria established under the Clean Water Act (33 U.S.C. 1251-1387), and presence of appropriate fish hosts.

Mesohabitat mapping and species distribution modeling in the Apalachicola and lower Chipola rivers indicates sufficient abundance of habitat for the Fat Threeridge in these populations; similar habitat mapping has not been done at that scale for the Flint River, but habitat for the population at Newton, Georgia appears to be sufficient to support persistence of Fat Threeridge since 2006.

Channel dredging has not occured in the Apalachicola River since 2001 [see Mossa et al (2017) for a review of dredging history in the Apalachicola River], which may have contributed to habitat stability favorable to Fat Threeridge and other freshwater mussels in the Apalachicola River (Kaeser et al., in prep). Navigation is an authorized purpose of the USACE, but disposal of dredging spoils must be permitted by the State of Florida. Dredging did not occur historically in the Chipola River, but did occur throughout the Flint River.

Conservation Actions

The principal listing criteria for the Fat Threeridge were habitat modification and contaminants. Maintenance of minimum flows in the Apalachicola and Lower Chipola rivers are mandated through Section 7 consultation with USACE (USFWS 2016). Channel dredging was a factor at the time of listing, but has not occurred since 2001. Reducing threats to water quality and quantity for Fat Threeridge habitat must continue to be addressed and managed in order to maintain the resilience, redundancy, and representation needed for recovery. Pages 83-86 of the 2003 Recovery Plan serve as general indicators that threats have been reduced.

AMENDED RECOVERY CRITERIA

Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the protections afforded by the Act are no longer necessary and the species may be delisted. Delisting is the removal of a species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Downlisting is the reclassification of a species from an endangered species to a threatened species. The term "endangered species" means any species (species, sub-species, or DPS) which is in danger of extinction throughout all or a significant portion of its range. The term "threatened species" means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Revisions to the Lists, including delisting or downlisting a species, must reflect determinations made in accordance with sections 4(a)(1) and 4(b) of the Act. Section 4(a)(1) requires that the Secretary determine whether a species is an endangered species or threatened species (or not) because of threats to the species. Section 4(b) of the Act requires that the determination be made "solely on the basis of the best scientific and commercial data available." Thus, while recovery plans provide important guidance to the Service, States, and other partners on methods of minimizing threats to listed species and measurable objectives against which to measure progress towards recovery, they are guidance and not regulatory documents.

Recovery criteria should help indicate when we would anticipate that an analysis of the species' status under section 4(a)(1) would result in a determination that the species is no longer an endangered species or threatened species. A decision to revise the status of or remove a species

from the Federal Lists of Endangered and Threatened Wildlife and Plants, however, is ultimately based on an analysis of the best scientific and commercial data then available, regardless of whether that information differs from the recovery plan, which triggers rulemaking. When changing the status of a species, we first propose the action in the *Federal Register* to seek public comment and peer review, followed by a final decision announced in the *Federal Register*.

Delisting Recovery Criteria

The below recovery criteria describes a recovered species, or a species that should be considered for removal from the List of Endangered and Threatened Wildlife and Plants (50 CFR 17).

1. At least four (4) populations exhibit a stable or increasing trend, evidenced by natural recruitment, and multiple age classes (Factors A and E).

2. At least one (1) population (as defined in Criteria 1) occupies each of the Flint and Chipola sub-basins. In the Apalachicola sub-basin, at least one (1) population (as defined in Criteria 1) occupies two of the three delineated units (Factors A and E).
    a. Apalachicola Unit 1--Upper: RKM 104-171
    b. Apalachicola Unit 2--Middle: RKM 56-104
    c. Apalachicola Unit 3--Lower: RKM 33-56

3. Threats have been addressed and/or managed to the extent that the species will remain viable into the foreseeable future (Factors A, D, and E).

Justification for Amended Recovery Criteria

Criteria 1 and 2: Populations that exhibit a stable or increasing trend, natural recruitment, and multiple age classes will be more resilient to stochastic events. To achieve redundancy and representation for Fat Threeridge, these resilient populations must exist in each of the three historic river basins (Flint, Chipola, and Apalachicola). In the Apalachicola River, the species should be adequately distributed among the habitat represented in the three identified units. One (1) population in each of the Flint and Chipola rivers, and two (2) populations among the three units in the Apalachicola, will result in four (4) populations necessary to ensure the species will no longer require protection under the Act.

Criterion 3: Abatement of the threats to the Fat Threeridge will allow populations to become stable and contribute to the viability of the species. Threats identified include: degraded water quality, insufficient water quantity, sedimentation, loss of habitat stability, and contaminants. Threat reduction or management will improve the primary habitat constituents identified increasing the viability of the species into the foreseeable future.

Rationale for Amended Recovery Criteria

In the Fat Threeridge Recovery Plan (USFWS 2003), within the river sub-basins, units of measure for recovery were subpopulations or occupied sites, "loosely defined...as stream reaches that would typically yield multiple live specimens with approximately 4-6 person hours sampling

effort, generally separated by reaches of unsuitable habitat", and occupation (as % of stream miles) of historic habitat. However, contemporary approaches to habitat identification and distribution modeling developed since 2007 have provided a more comprehensive perspective on habitat use, distribution, and abundance. Populations as currently defined in Criteria 1, in some cases, now encompass numerous subpopulations as previously defined. The sub-basins considered as units in this revision (Flint, Chipola, and Apalachicola) remain consistent with the Recovery Plan.

Additionally, what was interpreted as historic, but unoccupied, habitat for Fat Threeridge in the Flint River at the time of the Recovery Plan is now considered likely unable to support the species given the physical dissimilarity of habitats in the lower Flint River to occupied habitats of the Apalachicola and lower Chipola rivers. Moreover, the Flint River does not currently support, nor could it likely historically support, populations similar to those now observed in the Apalachicola and Lower Chipola rivers. These amended criteria focus on applying concepts of resilience, redundancy and representation to Fat Threeridge to ensure species' viability. Additionally, threats to Fat Threeridge viability must be reduced or managed.

ADDITIONAL SITE SPECIFIC RECOVERY ACTIONS

The small Flint River population contributes to both river basin and longitudinal representation of Fat Threeridge in the ACF, so additional study to understand this population would inform potential for supplementing or establishing additional populations in the Flint River. Environmental DNA sampling in the upper and middle Flint basins would be informative to target additional field sampling that could confirm extant Fat Threeridge that have not been detected in previous surveys. Mesohabitat mapping (as in Smit and Kaeser 2016) in the Flint River would allow better assessment habitat availability, and collection of genetic information on the Newton population is needed to determine if any unique genetics would need consideration before pursuing recovery strategies in the Flint River (for example, if Apalachicola River Fat Threeridge could translocated to suitable habitat on the Flint River).

LITERATURE CITED

Brim-Box, J., and J.D. Williams. 2000. Unionid mollusks of the Apalachicola Basin in Alabama, Florida, and Georgia. Bulletin of the Alabama Museum of Natural History No. 22. 143 p.

Clench, W.J., and R.D. Turner. 1956. Freshwater mollusks of Alabama, Georgia, and Florida from the Escambia to the Suwannee River. Bulletin of the Florida State Museum, Biological Sciences 1(3):97-239.

Fritts, A.K. and R.B. Bringolf. 2014. Host fishes for four federally endangered freshwater mussels (Unionidae) in the Apalachicola-Chattahoochee-Flint River basin. Walkerana 17(2):51-59.

Gangloff, M.M. 2011. Fat threeridge (*Amlema neislerii*) and Chipola slabshell (*Elliptio chipolaensis*) population size and depth distribution study in the Apalachicola and Lower Chipola rivers. Unpublished draft report prepared for U.S. Army Corps of Engineers, Mobile District, Mobile, AL. and Aerostar Environmental Services, Inc., Jacksonville, FL.

Gangloff, M.M. 2012. Population size and depth distribution of three federally-protected mussels in the Apalachicola and lower Chipola rivers. Final Report to the U.S. Army Corps of Engineers, Mobile District, Mobile, Alabama.

Haag, W.R., and A.L. Rypel. 2010. Growth and longevity in freshwater mussels: evolutionary and conservation implications. Biological Reviews 86:225-247.

Kaeser, A.J., R. Smit, and M. Gangloff. In preparation. Mapping and modeling the distribution, abundance, and habitat associations of the fat threeridge Amblema neislerii throughout the Apalachicola System.

Light, H.M., K.R. Vincent, M.R. Darst, and F.D. Price. 2006. Water-Level Decline in the Apalachicola River, Florida, from 1954 to 2004, and Effects on Floodplain Habitats: U.S. Geological Survey Scientific Investigations Report 2006-5173, 83 p., plus CD.

O'Brien, C.A., and J.D. Williams. 2002. Reproductive biology of four freshwater mussels (Bivalvia: Unionidae) endemic to the eastern Gulf Coastal Plain drainages of Alabama, Florida, and Georgia. American Malacological Bulletin 17(1/2):147-158.

Mossa, J., Y. Chen, S.P. Walls, G.M. Kondolf, C. Wu. 2017. Anthropogenic landforms and sediments from dredging and disposing sand along the Apalachicola River and its floodplain. Geomorphology 294:119-134.

Shea, C.P., J.T. Peterson, M.J. Conroy, and J.W. Wiskniewski. 2013. Evaluating the influence of land use, drought and reach isolation on the occurrence of freshwater mussel species in the Lower Flint River Basin, Georgia (U.S.A). Freshwater Biology 58:382-395.

Smit, R.B. and A.J. Kaeser. 2016. Defining freshwater mussel mesohabitat associations in an alluvial, Coastal Plain river. Freshwater Science 35:1276-1290.

USFWS (U.S. Fish and Wildlife Service). 1998. Endangered and threatened wildlife and plants; determination of endangered status for five freshwater mussels and threatened status for two freshwater mussels from eastern Gulf slope drainages of Alabama, Florida, and Georgia. Federal Register 63(50):12664–12687.

USFWS (U.S. Fish and Wildlife Service). 2003. Recovery Plan for Endangered Fat Threeridge (*Amblema neislerii*), Shinyrayed Pocketbook (*Lampsilis subangulata*), Gulf Moccasinshell (*Medionidus penicillatus*), Ochlockonee Moccasinshell (*Medionidus simpsonianus*), and Oval Pigtoe (*Pleurobema pyriforme*); and Threatened Chipola Slabshell (*Elliptio chipolaensis*), and Purple Bankclimber *(Elliptoideus sloatianus*). Atlanta, Georgia. 142 pp.

U.S. Fish and Wildlife Service (USFWS). 2007a. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages. Federal Register 72:64286-64340.

U.S. Fish and Wildlife Service (USFWS). 2007b. United States Fish and Wildlife Service. Fat Threeridge (*Amblema neislerii*) Shinyrayed Pocketbook (*Lampsilis subangulata*) Gulf Moccasinshell (*Medionidus penicillatus*) Ochlockonee Moccasinshell (*Medionidus simpsonianus*) Oval Pigtoe (*Pleurobema pyriforme*) Chipola Slabshell (*Elliptio chipolaensis*) Purple Bankclimber (*Elliptoideus sloatianus*); 5-Year Review: Summary and Evaluation. Atlanta, Georgia. 31 pp.

U.S. Fish and Wildlife Service (USWFS). 2012. Biological opinion on the U.S. Army Corps of Engineers, Mobile District, interim operation plan for Jim Woodruff Dam and the associated released to the Apalachicola River. Prepared by the USFWS Panama City Field Office, Florida. 166 pp.

U.S. Fish and Wildlife Service (USWFS). 2016. Biological opinion on the U.S. Army Corps of Engineers, Mobile District, Update of the Water Control Manual for the Apalachicola-Chattahoochee-Flint River Basin in Alabama, Florida, and Georgia and a Water Supply Storage Assesment. 305 pp.

Wiskniewski, J.M., N.M. Rankin, D.A. Weiler, B.A. Strickland, and H.C. Chandler. 2013. Occupancy and detection of benthic macroinvertebrates: a case study of unionids in the lower Flint River, Georgia (U.S.A). Freshwater Science 32:1122-1135.

Wisniewski, J.M., N.M. Rankin, D.A. Weiler, B.A Strickland, H.C. Chandler. 2014. Use of occupancy modeling to assess the status and habitat relationships of freshwater mussels in the lower Flint River, Georgia, USA. Freshwater Mollusc Conservation Society 17:24-40.