

Cylindrical Lioplax (*Lioplax cyclostomaformis*)
Flat Pebblesnail (*Lepyrium showalteri*)
Plicate Rocksnail (*Leptoxis plicata*)
Painted Rocksnail (*Leptoxis taeniata*)
Round Rocksnail (*Leptoxis ampla*)
Lacy Elimia (*Elimia crenatella*)

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

**U.S. Fish and Wildlife Service
Southeast Region
Alabama Ecological Services Field Office
Daphne, Alabama**

5-YEAR REVIEW

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I. GENERAL INFORMATION

A. Methods used to complete the review:

This review was completed by the Alabama Ecological Services (ES) Field Office, Daphne, Alabama. The primary sources of information used in this analysis were the 1998 final listing rule (63 FR 57610), 2005 recovery plan (USFWS 2005), peer-reviewed reports, agency reports, unpublished survey data and reports, and personal communication with recognized experts. All literature and documents used for this review are on file at the Alabama ES Field Office. All recommendations resulting from this review are the result of thoroughly reviewing the best available information on the cylindrical lioplax, flat pebblesnail, plicate rocksnail, painted rocksnail, round rocksnail, and lacy elimia. Comments and suggestions regarding this review were received from peer reviewers from outside the U.S. Fish and Wildlife Service (Service). See Appendix A for a summary of peer reviewer comments. No part of the review was contracted to an outside party. In addition, this review was announced to the public on March 25, 2014 (79 FR 16366) with a 60-day comment period. Comments received were evaluated and incorporated as appropriate.

B. Reviewers

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C. Background

Federal Register Notice citation announcing initiation of this review:
79 FR 16366, March 25, 2014.

Species status:

cylindrical lioplax: Improved

The recovery plan (USFWS 2005) lists the Cahaba River as the only known extant populations of cylindrical lioplax. Since then, additional populations have been discovered in Yellowleaf Creek, Shelby County, Alabama (Johnson 2006); Choccolocco Creek, Talladega County, Alabama (Johnson, Powell, and Harper 2010, Alabama ES Office Files) (A. Ford pers. comm. 2014); and the lower Little Cahaba River, Bibb County, Alabama (Johnson 2012).

flat pebblesnail: Stable

The flat pebblesnail is currently stable and not believed to have lost any known populations since the time of listing; also the known range has been extended within both the Cahaba and Little Cahaba Rivers (P. Johnson pers. comm. 2015).

plicate rocksnail: Uncertain

A downstream range extension (5 km) has been documented within Locust Fork (Richardson and Selby 2009). The plicate rocksnail has also been reintroduced through propagation efforts into new locations within the Locust Fork (Garner et al. 2014, P. Johnson pers. comm. 2015). However water quality still remains a concern as Johnson (2010) reported that the Kimberly reintroduction site appeared to have been negatively affected by eutrophic conditions that developed sometime after the 2003 release. An “orange flocculent” was observed deposited over the previously clean cobble-boulder substrate at the site the following year (Johnson 2010). Also, Yokley and Daly (2012) reported plicate rocksnails and sediment impairments within a shoal in Locust Fork near the confluence of Crooked Creek in 2012. A follow-up survey failed to find plicate rocksnails at this site in 2016, again noting sedimentation and probable nutrient enrichment problems with extensive algae covering much of the substrate (CCR 2016).

painted rocksnail: Stable

The recovery plan (USFWS 2005) listed three extant populations of painted rocksnail including Ohatchee Creek, Calhoun County, Alabama, which has not been documented since the early 1990’s (P. Johnson pers. comm. 2015). However, the painted rocksnail has been newly documented within lower Watson Creek, upstream of the known population within Buxahatchee Creek, and in the Coosa River below Logan Martin Dam near Buzzard’s Island, Shelby County, Alabama (P. Johnson pers. comm. 2015).

round rocksnail: Stable

The round rocksnail is currently stable and not believed to have lost any known populations since the time of listing. Also, the known range has

been extended within both the Little Cahaba River and Shades Creek (P. Johnson pers. comm. 2015).

lacy elimia: Declining

The recovery plan (USFWS 2005) listed three extant populations of lacy elimia: Cheaha, Emauhee, and Weewoka Creeks all in Talladega County, Alabama. Successive surveys have failed to document a population in Emauhee or Weewoka (Pierson and Pursifull 2006), and the lacy elimia is currently only known to persist in Cheaha Creek (Pierson and Pursifull 2006, P. Johnson pers. comm. 2015).

Recovery achieved:

cylindrical lioplax: 1
flat pebblesnail: 1
plicate rocksnail: 1
painted rocksnail: 1
round rocksnail: 1
lacy elimia: 1
(1 = 0-25% recovery objectives achieved)

Listing history:

Original Listing

FR notice: 63 FR 57610

Date listed: October 28, 1998

Entity listed: all listed as species

Classification:

threatened: painted rocksnail, round rocksnail, lacy elimia

endangered: cylindrical lioplax, flat pebblesnail, plicate rocksnail

Associated rulemakings: NA

Review History:

Recovery Report to Congress: 2014-2016

Recovery Data Call: 1998-2013

Recovery Plan: November 7, 2005

5-Year Reviews: August 29, 2006

Species' Recovery Priority Number at start of 5-year review (48 FR 43098):

cylindrical lioplax: 8
flat pebblesnail: 5
plicate rocksnail: 5C
painted rocksnail: 8
round rocksnail: 8
lacy elimia: 8

Recovery Plan

Name of plan: Recovery Plan for 6 Mobile River Basin Aquatic Snails

Date issued: November 7, 2005

II. REVIEW ANALYSIS

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

The Act defines species as including any subspecies of fish, wildlife, or plant, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing DPSs to only vertebrate species of fish and wildlife. Because the species under review are invertebrates, the DPS policy is not applicable and will not be addressed further in this review.

B. Recovery Criteria

- a. **Does the species have a final, approved recovery plan containing objective, measurable criteria?** Yes
- b. **Adequacy of recovery criteria.**
 - a) **Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?** Yes
 - b) **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?** Yes
- c. **List the recovery criteria as they appear in the recovery plan (in *italics*), and discuss how each criterion has or has not been met, citing information:**

Criteria for reclassification to threatened status (cylindrical lioplax, flat pebblesnail, and plicate rocksnail):

1. *The existing population has been shown to be stable or increasing over a period of 10 years (2 to 5 generations). This may be measured by numbers/area, catch per unit/effort, or other methods developed through population monitoring, and must be demonstrated through annual monitoring.*

No formal monitoring plans have been established for any of these species. However, the Service, Alabama Department of Conservation and Natural Resources (ADCNR), Cahaba River

Society, The Nature Conservancy (TNC), Alabama Natural Heritage Program, and others periodically conduct or assist in surveys of imperiled aquatic mollusks in the Mobile River Basin. These efforts result in the occasional visitation of some populations and their assessment for continued persistence of the species. However, none of the populations are being measured or monitored routinely. Therefore, this criterion has not been met.

2. *There are no apparent or immediate threats to the listed population (see Listing/Recovery Criteria, below).*

This criterion has not been met; refer to the Listing/Recovery Criteria discussion, below.

3. *A captive population has been established at an appropriate facility, and the species has been successfully propagated.*

In recent years, the Service has worked with ADCNR - Alabama Aquatic Biodiversity Center (AABC), the Tennessee Aquarium Research Institute, and other partners to design and construct mollusk holding and propagation facilities, and to develop and test holding and propagation protocols for aquatic snails. The three snails currently listed as endangered have been successfully propagated at the AABC, and between (2010-2015) 14,481 individuals of plicate rocksnails have been released and monitored within the Locust Fork, Jefferson County, Alabama (P. Johnson pers. comm. 2016). While the other snails have been successfully propagated, reintroduction efforts have been delayed by lack of suitable relocation sites (P. Johnson pers. comm. 2016). Therefore, this criterion has been met for the cylindrical lioplax, flat pebblesnail, and plicate rocksnail.

4. *A minimum of two additional populations have been established (or discovered) within historical range.*

The range of the cylindrical lioplax has been expanded discovery of three shoals populations within Yellowleaf, Choccolocco, and Little Cahaba Creeks, two of which are distinct from the Cahaba River drainage (Johnson 2006, A. Ford pers. obs. 2014). The flat pebblesnail has been extended several miles upstream in the Cahaba River from its previously known location and in two tributaries (e.g., Little Cahaba, Shades Creek). The plicate rocksnail has extended its known range in Locust Fork and has been successfully propagated and

relocated into sections of Locust Fork (Johnson 2010, P. Johnson pers. comm. 2016). While all three of these endangered snails have range extensions or newly discovered shoal populations, distinct from previously known extant populations (USFWS 2005), these new populations do not meet the population criteria for recovery (see below), therefore, this criterion has not been met.

Criteria for delisting the lacy elimia, round rocksnail, painted rocksnail, cylindrical lioplax, flat pebblesnail, and plicate rocksnail:

1. *A minimum of three natural or re-established populations have been shown to be persistent (i.e., stable or increasing) for a period of 10 years (two to five generations).*

No formal monitoring plans have been established for any of these species. However, the Service, Alabama Department of Conservation and Natural Resources (ADCNR), Cahaba River Society, The Nature Conservancy, Alabama Natural Heritage Program, and others periodically conduct or assist in surveys of imperiled aquatic mollusks in the Mobile River Basin. These efforts result in the occasional visitation of some populations and their assessment for continued persistence of the species. However, none of the populations are being measured or monitored annually. Therefore, this criterion has not been met

2. *There are no apparent or immediate threats to the population (see Listing/Recovery Factor Criteria, below).*

This criterion has not been met; refer to the Listing/Recovery Criteria discussion, below.

Population criteria for recovery:

Population criteria address, in part, threats under listing factor E, natural or manmade random catastrophic events, by increasing the number of populations and by extending the ranges/sizes of individual populations. Also, achieving the population criteria will indicate whether management actions to remove or ameliorate threats under the remaining factors have been effective and have had the expected effect on the species and populations.

A population is defined as all snails occurring within a continuous river or stream reach extending a minimum of 30 km (18 mi). Snails in a recovered population should be easily found in appropriate habitat throughout the occupied reach.

Listing/Recovery Factor Criteria:

The following criteria (Factors A through E) apply equally to downlisting or delisting objectives identified above.

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

*To provide assurance of population stability when any of the six species increase to the levels specified under the population criteria, threats to their habitat must be reduced as specified under this factor. Populations of the six species have declined in response to a wide variety of impacts upon streams and their watersheds (see *Endangered Status for Three Aquatic Snails and Threatened Status for Three Aquatic Snails in the Mobile River Basin* (63 FR 57610) and *Mobile River Basin Aquatic Ecosystem Recovery Plan: Aquatic Ecosystem Impacts and Their Effects on Biota, and Current and Future Threats to the Basin's Imperiled Species* (USFWS 2000)). Therefore, reducing threats to their habitat must be accomplished through a broad application of measures that focus on protecting stable natural stream channels and riparian zones, and protecting or improving water quality and quantity. Effective watershed conservation will not only reduce habitat threats to the listed snails, but it will also benefit more common aquatic species.*

The following criteria shall serve to indicate a reduction in habitat threats:

1) Streams supporting populations of the six snails are not subject to impoundment. Habitat loss and fragmentation due to impoundment was the major cause of decline of these six snails. There should be no pending permits, applications, or known future projects considering impoundment of recovery habitats.

Although there is one ongoing impoundment project, there are no new or pending permits, applications, or known future projects taking place within recovery habitats. There are two examples where impoundments have been removed.

There are no pending permits or applications for constructing impoundments within areas considered to be critical for the recovery of any of these six snail species.

December 2014, construction of a concrete spillway was initiated for the Duck River Reservoir in Cullman County in the upper Mulberry Fork watershed, part of the historical range

of the plicate rocksnail. The 640 acre water supply reservoir was nearing full pool by the end of December 2015 (The Cullman Times, December 29, 2015).

Removal of Impoundments:

- In October 2004, a multi-culverted crossing measuring 64m-long \times 7m-wide \times 2-m high (aka, Marvel Slab) that formed a 150 m long pool on the Cahaba River was removed. This removal, directly benefits the round rocksnail, flat pebblesnail, and cylindrical lioplax. Ten years of post-removal monitoring has shown dramatic increases in snail densities, not only in the footprint of the slab and upstream pool, but downstream as well (Johnson et al. 2013; P. Freeman pers. comm. 2015). Initially, some snail densities grew exponentially before coming back into a more stable equilibrium; however, one of the species (i.e., round rocksnail) has displayed a more than 50-fold increase at the site (Johnson et al. 2013; P. Freeman pers. comm. 2015).
- In 2011, the remnants of an old railcar bridge were removed from Shades Creek (major tributary of the Cahaba River), directly benefitting the round rocksnail. Post-removal surveys conducted in June 2014 indicate a significant increase in round rocksnail densities (from 2.3/ft² in 2010 to 6.9/ft² in 2014) and relational decreases in densities (84.3/ft² in 2010 to 23.3/ft² in 2014) of other snail species, possibly representing a community shift favorable to the round rocksnail at this site (E. Spadgenske pers. comm. 2015)

2) Stream channels at all sites occupied by the snails are stable (not actively aggrading or degrading or undergoing excessive bank erosion) and adjacent riparian zones are adequately vegetated.

Most sites inhabited by these six species are relatively stable; however, no rigorous analysis has been conducted on channel conditions at any site. Therefore, channel stability and geomorphic trends cannot be evaluated.

3) Water quality and quantity are fully supporting a minimum designated use of fishing or fish and wildlife habitat (as reported by the states under Section 305(b) of the Clean Water Act) in all stream reaches where the snails occur. Water pollution is believed to have been a significant factor in the disappearance of snail populations from unimpounded portions of their historic habitat. Degraded water quality, particularly due to sedimentation and

eutrophication, currently prevents these species from expanding into portions of historical habitat.

Black Warrior River Basin (plicate rocksnail): The first attempt to reintroduce the plicate rocksnail back into the Locust Fork of the Black Warrior River near Kimberly, Alabama, occurred in 2003 (Johnson 2010). Since that time, several supplemental stockings have taken place and all indications suggest that the rocksnails have experienced limited success at this site. Based on post-reintroduction surveys, Johnson (2010) reported that the Kimberly site appears to have been negatively affected by eutrophic conditions that developed after the 2003 release. Johnson observed an “orange flocculent” deposited over the previously clean cobble-boulder river substrate at the site the following year (Johnson 2010). Although the source of the “orange flocculent” was never identified, another reintroduction was selected upstream in the Little Locust Fork near Cleveland, Alabama. The Locust Fork is currently listed (80 mile reach of the Locust Fork above the area occupied by plicate rocksnail) on the 2014 Alabama 303(d) list of impaired water bodies for nutrients, siltation, and other habitat alterations (ADEM 2014).

Identification of stream segments on the 303(d) list brings attention to water quality problems affecting these listed species and their habitats. In addition, the Clean Water Act requires the development of a Total Maximum Daily Load (TMDL) for the pollutants identified by the 303(d) list that will bring water quality into the applicable standard.

Cahaba River Basin (cylindrical lioplax, flat pebblesnail, round rocksnail): A TMDL for phosphorous and siltation has been established for the Cahaba River above the Fall Line, and for E. coli between U.S. Highway 208, in Jefferson County, to Shades Creek, in Shelby County, Alabama (ADEM 2014). Reducing pollutants in the Cahaba will likely benefit the cylindrical lioplax, flat pebblesnail, and round rocksnail.

TMDL’s for fecal coliform, siltation, and turbidity have also been prepared for Shades Creek from its source to its confluence with the Cahaba River (EPA 2003, 2004). Improved water quality in Shades Creek could benefit the round rocksnail.

Coosa River Basin (cylindrical lioplax, painted rocksnail, lacy elimia): TMDL’s have been prepared for organic

enrichment/dissolved oxygen and nutrients within Lay Lake, Buxahatchee Creek, and Watson Creek (ADEM 1996, 2008). The painted rocksnail should benefit from this rule.

The 2014 303(d) list identifies Choccolocco Creek and Lay Lake as impaired for metals (mercury) and priority organics (PCBs). The affected section in the 303(d) listing begins at the confluence of an unnamed tributary near Boiling Springs, and goes downstream to its confluence with the Coosa River. This stretch of Choccolocco Creek supports populations of painted rocksnail, as well as a newly rediscovered population of cylindrical lioplax (P. Johnson pers. comm. 2010). Lay Lake is listed as impaired from the Southern Railroad Bridge (located downstream of Logan Martin Dam) to Lay Dam. This section of the Coosa River supports a population of painted rocksnail.

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

Overutilization has not been implicated in the decline of these species and has not currently been a factor in the status of these six snail species.

Factor C: Disease or predation.

Disease or predation is not currently known to be a threat to the status of these species. Regulations have been implemented by the State of Alabama prohibiting the possession, importation or release of black carp into waters of the State (Alabama Division of Wildlife and Freshwater Fisheries Regulation 220-2-.26). Black carp are not currently known to occur in the areas occupied by these snails.

Factor D: The inadequacy of existing regulatory mechanisms.

The lacy elimia, round rocksnail, painted rocksnail, cylindrical lioplax, flat pebblesnail, and plicate rocksnail are afforded protections against take under Section 9 of the ESA and under the State of Alabama's Invertebrate Species Regulation (Alabama Administrative Code 220-2-.98). While these snails may have species protections afforded to them by both state and federal governments, the majority of people are unaware of their presence and protected status, and fail to take any additional precautionary measures to aid in their protection.

Section 7 of the ESA requires federal agencies to ensure that their activities, in consultation with the Service, are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitats. Consultation with the Service is required by federal agencies on projects that may impact endangered or threatened species or critical habitat and recommendations are made to minimize potential impacts. Also, projects that do not have a federal nexus may go undetected by the Service because consultation is not required. Multiple smaller actions may also collectively magnify into larger concerns. If Section 7 review is initiated on a federal action, and the status and presence of these snails are identified prior to construction, measures are usually not taken unless the action rises to the level of formal consultation, which means that the action “may adversely affect” the species.

The Clean Water Act (CWA) is the primary federal law in the United States governing water pollution. One primary role of the CWA is to regulate the point source discharge of pollutants to surface waters. This is regulated by the permit process with a permit from the National Pollutant Discharge Elimination System (NPDES). The NPDES permit process is usually delegated by the Environmental Protection Agency (EPA) to its state cohort; in Alabama this authority has been delegated to the Alabama Department of Environmental Management (ADEM). Currently ADEM (Alabama Administrative Code, Title 22, Section 22-22-1 et seq.) requires that discharges not exceed state water quality standards. Since there is no information on these species’ sensitivity to common pollutants, federal (e.g., CWA) and state water quality laws may or may not be protective.

Section 303d of the CWA requires each state to list its polluted water bodies and to set priorities for their clean up with a watershed restoration action plan called a "Total Maximum Daily Load" (TMDL) for each impaired water body. TMDLs establish the maximum amount of a pollutant that a water body can assimilate without causing exceedances of water quality standards.

Section 404 under the CWA is administered by the U.S. Army Corps of Engineers (COE) and regulates the discharge of dredged or fill material into waters of the United States, including wetlands. Any activities in waters of the United States are regulated under this program, and often include fill related to development, such as water resource projects,

infrastructure development, and mining projects. While a single project will usually not jeopardize the continued existence of these snails, the cumulative effects on their finite habitat may have a larger impact and is usually not assessed on a permit-by-permit case either due to no federal nexus or no combined assessment of all project impacts.

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is intended to protect against “unreasonable human health or environmental effects”. While pesticides are usually tested on standard biological media (e.g., honey bees, daphnia, bluegill sunfish, rainbow trout, mice) for toxicity, this information may not relate well to these listed snails. Commercial applicators must also be tested and permitted on the proper application of pesticides, but applicators may not necessarily be aware of the presence of listed snails in or adjacent to an application area.

Regardless of the federal or state regulatory mechanism, enforcement of these regulations is necessary to provide the intended protections. Quite often enforcement is inadequate due to budget and staff constraints.

The Federal Power Act (FPA) (16 U.S.C. 791-828c; Chapter 285, June 10, 1920; 41 Stat. 1063 as amended by P.L. 104-66, December 21, 1995; 109 Stat. 718) provides for cooperation between the Federal Energy Regulatory Commission (Commission) and other Federal agencies, including resource agencies, in licensing and relicensing. In 1986, amendments were added to the FPA, entitled the Electric Consumers Protection Act (ECPA) that mandated several fish and wildlife provisions. Therefore, from 1986 forward, each new license or re-license is to include conditions to protect, mitigate and enhance fish and wildlife affected by the project. These conditions are to be based on recommendations received pursuant to the Fish and Wildlife Coordination Act from the Fish and Wildlife Service, the National Marine Fisheries Service, and State fish and wildlife agencies (16 U.S.C. 803(j)(1)). Some populations of the painted rocksnail and cylindrical lioplax afford protection under the FPA because they reside in areas that are influenced by FERC licensed hydropower projects.

Factor E: Other natural or manmade factors affecting its continued existence.

All populations of these six snails remain vulnerable to natural or human-induced threats.

Natural droughts can potentially have negative impacts on water quality (e.g., dissolved oxygen) and waste assimilation of point source discharges. Droughts may also reduce the amount of habitat available to snails by dewatering habitat, and may also lead to direct mortality by stranding snails. Drought may also fragment sections of stream into isolated pools that may also impact water quality in these pools.

Human-induced random events such as toxic spills could jeopardize these snails if the spill has a direct acute toxicity on some or all the individuals in a population. For example, a major spill in the lower Cheaha Creek could potentially eliminate the only known population of lacy elimia. Many roads and railroad crossings dissect the rivers and streams that support these snails and a random toxic spill could have dramatic impacts on the survival of impacted populations.

C. Updated Information and Current Species Status

a. Biology and Habitat

a) Biology and Life History:

Cylindrical Lioplax (*Lioplax cyclostomaformis*) (Figure 1, 7)

The cylindrical lioplax is a gill-breathing snail in the family Viviparidae with an elongate shell reaching about 28 millimeters (mm) (1.1 inches) in length. The shell color is light to dark olivaceous-green externally, and bluish inside of the aperture.

Like other members of the family Viviparidae, the cylindrical lioplax gives live birth (young hatch internally and born as juveniles) and may live 3 to 11 years (Service 2005). The cylindrical lioplax lives in the mud under large rocks in rapid shoal currents. Other lioplax species are usually found along stream margins in exposed muddy substrates (Service 2005).

Flat Pebblesnail (*Lepyrium showalteri*) (Figure 2, 8)

The flat pebblesnail is a small snail in the family Lithoglyphidae, but with a comparatively large and distinct shell, relative to other hydrobiid snails. The shell has a depressed spire and expanded, flattened body whorl. The shell shape is ovate and they can grow

to 3.5 to 4.4 mm (0.1 to 0.2 inches) long and 4 to 5 mm (0.2 inches) wide.

The flat pebblesnail is thought to be annual species, and its eggs are laid in capsules on hard surfaces. The flat pebblesnail can be found attached to clean, smooth stones in rapid shoal currents, where they also lay their eggs (Service 2005).

Plicate Rocksnail (*Leptoxis plicata*) (Figure 3, 9)

The plicate rocksnail is a member of the Pleuroceridae family, and can grow to about 20 mm (0.8 in) in length. The shell is usually brown to green with four equidistant color bands being subglobose in shape. The shell typically has broadly rounded apertures, usually with an ornamented body whorl with strong folds and plicae (Service 2005). The characteristic plicae adjacent to the suture of the body whorl are notably indistinct or absent in juveniles (Whelan et al. 2015).

Plicate rocksnails inhabit shallow gravel and cobble shoals in flowing waters. Their eggs are usually laid singly, but they have been observed occasionally depositing two eggs in close proximity (Whelan et al. 2015). While longevity has not been documented in the wild, specimens have reproduced for multiple years in captivity at the AABC in Marion, Alabama (Whelan et al. 2015). They reproduce for about 2 months each year (Johnson 2010) with temperatures between 24-29 degrees C (Whelan et al. 2015)

Painted Rocksnail (*Leptoxis taeniata*) (Figure 4, 10)

The painted rocksnail is a small to medium pleurocerid snail measuring about 19 mm in length and subglobose to oval in shape. The aperture is broadly ovate and rounded anteriorly. Coloration varies from yellowish to olive-brown, and usually with four dark bands. Some shells may not have bands and some have the bands broken into squares or oblongs (Goodrich 1922).

Painted rocksnails are gill breathing snails found attached to cobble, gravel, or other hard substrates in the strong currents of riffles and shoals. Adult rocksnails move very little, and females probably glue their eggs to stones in the same habitat (Goodrich 1922). The painted rocksnail will lay their eggs in discrete, circular clutches in concentric rings, usually with one or two central eggs, at temperatures between 14-27 degrees C (Whelan et al. 2015).

Round Rocksnail (*Leptoxis ampla*) (Figure 5, 11)

The round rocksnail is a member of the Pleuroceridae family and has a subglobose shell, with an ovately rounded aperture and grows to about 20mm (0.8 inches) in length. The color may be yellow to dark brown or olive, and usually has four solid or broken bands.

Round rocksnails are gill breathing snails that are found attached to cobble, gravel, or other hard substrates in the strong currents of riffles and shoals. Since this snail is not very mobile and is not thought to migrate within the stream, it is thought that females live and attach their eggs to the same habitat (Goodrich 1922). Similar to the painted rocksnail, round rocksnails will lay their eggs in concentric rings, usually with one or two central eggs, at temperatures between 14-27 degrees C (Whelan et al. 2015).

Lacy Elimia (*Elimia crenatella*) (Figure 6, 12)

The lacy elimia is a small pleurocerid snail that will grow to about 11 mm (0.4 inches) in length. The dark brown to black shell is conic in shape, strongly striate, and often folded in the upper whorls, the aperture is often purple, and without banding. The aperture is snail and ovate. The lacy elimia is easily distinguished from other elimia species due to the combined distinctiveness of size, ornamentation, and color.

This gill-breathing snail that is strongly associated with river or stream habitats characterized by flowing currents and hard, clean bottoms (Service 2005). It typically inhabits highly oxygenated waters on rock shoals and gravel bars where it grazes on algae and bacteria attached to benthic substrates (Garner 2004; Service 2005). Females are believed to begin laying eggs in February and continue until May (Garner 2004), with eggs hatching in about two weeks. It is likely that, similar to other *Elimia* species, the snails become sexually mature in their first year and may live as long as 5 years (Service 2005).

b) Abundance/population trends, demographic features or trends:

There are several different rankings that have been applied to these snails. Within the Heritage ranking system, cylindrical lioplax, flat pebblesnail, plicate rocksnail, lacy elimia, and painted rocksnail have all been ranked a G1 (global-critically imperiled) and S1 (state-critically imperiled) species, their highest priority ranking. The round rocksnail is ranked G2 and S2 (imperiled) (Alabama

Natural Heritage Program 2014). These rankings indicate that these species are imperiled to critically imperiled, with a high to very high risk of extinction due to rarity and decline. An updated species review of imperiled wildlife in Alabama by Mirarchi (2004; updated 2012) indicates that these species are all species of high (P2-round and painted rocksnail) to highest (P1- cylindrical lioplax, flat pebblesnail, plicate rocksnail, lacy elimia) conservation concern in Alabama. The MRBRC (2010), which ranks gastropods based upon their conservation priorities lists the cylindrical lioplax, flat pebblesnail, plicate rocksnail, and lacy elimia as a Tier 1 species (highest conservation priority), the painted rocksnail as a Tier 2 species, and the round rocksnail as a Tier 3 species. Since publication of the recovery plan (2005), some populations have not been found during follow-up surveys.

Lacy Elimia

The recovery plan noted three extant populations of the lacy elimia in Cheaha, Emauhee, and Weewoka Creeks in Talladega County, Alabama (Bogan and Pierson, 1993, Service 2005). Successive surveys have failed to document a population in Emauhee or Weewoka (Pierson and Pursifull 2006), and the lacy elimia is currently only known to persist in Cheaha Creek, Talladega County, Alabama (Pierson and Pursifull 2006, P. Johnson pers. comm. 2015). While the lacy elimia has been successfully propagated, limited reintroduction options have precluded reintroduction attempts (P. Johnson pers. comm. 2015).

Painted Rocksnail

At the time of listing, the painted rocksnail was known from the lower reaches of three Coosa river tributaries—Chocolocco Creek, Talladega County, Buxahatchee Creek, Shelby County, and Ohatchee Creek Calhoun County, Alabama (Bogan and Pierson, 1993, Service 2005). The status of the Ohatchee Creek population is not presently known, as the species has not documented in the creek since the early 1990's (P. Johnson pers. comm. 2015). However, two new populations have been discovered since publication of the recovery plan: the Coosa River below Logan Martin Dam near Buzzard's Island, Shelby County, Alabama, and lower Watson Creek upstream of the confluence within Buxahatchee Creek, Shelby County, Alabama (P. Johnson pers. comm. 2015).

Cylindrical Lioplax

The recovery plan (Service 2005) recognized the Cahaba River in Shelby and Bibb counties as the only extant population of cylindrical lioplax. Since then three additional populations of

cylindrical lioplax have been discovered: Yellowleaf Creek, Shelby County, Alabama (Johnson 2006); Choccolocco Creek, Talladega County, Alabama (A. Ford pers. obs. 2014); and the lower Little Cahaba River, Bibb County, Alabama (Johnson 2012). Since these new cylindrical lioplax locations are documented by single location surveys, future surveys are needed to fully document the range, extent, and viability of these populations.

Flat Pebblesnail and Round Rocksnail

The flat pebblesnail and round rocksnail are currently stable and are not believed to have lost any known populations since the time of listing. The flat pebblesnail (Cahaba and Little Cahaba River) and round rocksnail (Little Cahaba River and Shades Creek) have extended their ranges within their existing populations.

Plicate Rocksnail

Richardson and Selby (2009) documented a downstream intrarange extension (~5km downstream of the Highway 78 crossing) for the plicate rocksnail in the Locust Fork. The plicate rocksnail has also been successfully reintroduced at the Wallstown site on the Locust Fork (Garner et al. 2014, P. Johnson pers. comm. 2015).

c) Genetics, genetic variation, or trends in genetic variation:

Whelan (2013) studied the systematics and genetics of the genus *Leptoxis* and determined conclusively that *Leptoxis* is not monophyletic, with three major *Leptoxis* clades resolved, one genus (*Alleghenya*) elevated, and a new genus (*Alatoxis*) described. However, *Leptoxis ampla*, *L. taeniata*, *L. compacta*, *L. plicata*, and *L. arkansensis* are all distinct lineages based on phylogeny, morphology, and life history, and except for on the H3 gene tree, all five species are each reciprocally monophyletic (Whelan 2013). He also demonstrated that shell variation among *Leptoxis* species is the result of genetic differences and not ecophenotypic plasticity.

d) Taxonomic classification or changes in nomenclature:

No changes to taxonomic classification or nomenclature have occurred since these species were listed. Nomenclature is consistent and follows that in Turgeon et al. (1998) and Johnson et al. (2013).

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

Even though several new locations and range extensions have been documented (above) for five of the six species since 2006, collectively, these species remain extirpated from more than 90 percent of their historical ranges (USFWS 2005) as a result of habitat modifications (impoundment, channelization, mining, dredging) and water quality degradation (point and nonpoint sources) (USFWS 2005, Tolley-Jordan et al. 2014). There are no changes in the historic range of these snails since the writing of the Recovery Plan in 2005.

f) Habitat or ecosystem conditions:

No new information exists on habitat or ecosystem conditions for these snails. All six aquatic snails inhabit shoals, rapids and riffles of large streams and rivers above the Fall Line in Alabama. All require stable hard substrates, such as boulders and cobbles, and clean unpolluted water (USFWS 2005).

D. Five-Factor Analysis (addressed above in **Recovery Criteria Section II.B**)

E. Synthesis

The range of the **cylindrical lioplax** has been expanded by the addition of three populations, two of which are distinct from the Cahaba River drainage. The **flat pebblesnail** and **round rocksnail** have been extended several miles in the Cahaba River and its tributary populations (e.g., Little Cahaba, Shades Creek). The **painted rocksnail** has also added additional populations in the Coosa River mainstem below Logan Martin Dam and lower Watson Creek upstream of the confluence within Buxahatchee Creek. The **plicate rocksnail** has extended its known range in Locust Fork. The **flat pebblesnail** and **plicate rocksnail** have been successfully propagated in a hatchery situation, and experimental attempts have been made to reintroduce both species into historically occupied habitats. The **lacy elimia** has also been successfully propagated, but limited habitat reintroduction options have precluded reintroduction attempts.

Although there has been some progress in recovery efforts for the **cylindrical lioplax**, **flat pebblesnail**, and **plicate rocksnail**, these species remain vulnerable to habitat and water quality deterioration, and continue to meet the definition of endangered species under the Act. However, additional information on the viability of the new **cylindrical lioplax** populations should be addressed further and may lead to future downlisting to threatened, if warranted.

The **round rocksnail**, and **painted rocksnail**, each continue to be known from three distinct drainage populations, however, each is limited in extent and vulnerable to habitat and water quality deterioration. Therefore, they continue to meet the definition of threatened species under the Act.

The **lacy elimia** may have been extirpated from two of the three drainage populations known at the time of listing. Additional surveys should be conducted for the lacy elimia before a change in ESA status is considered.

All six species continue to experience significant curtailment of range (Figure 1-6) and habitat. Deterioration of water and habitat quality through non-point source pollution continues to affect the surviving populations. Their limited distributions and small populations render the species vulnerable to random natural or human-induced events such as droughts or spills. Therefore, no change in status of any of the species is recommended at this time.

III. RESULTS

A. Recommended Classification: No change is needed.

IV. RECOMMENDATION FOR FUTURE ACTIONS

- Conduct systematic population monitoring of extant and reintroduced populations of these snails and document potential threats to those populations.
- Evaluate the status of the lacy elimia in Emauhee and Weewoka Creeks and confirm that its status in Cheaha Creek remains stable. Also conduct surveys within the Middle Coosa River tributaries that are within the historic range of the species. Results from these studies may suggest a need to upgrade its ESA status from threatened to endangered.
- Continue to evaluate the extent and viability of the new populations of cylindrical lioplax within the Little Cahaba River, Yellowleaf Creek, and Choccolocco Creek, in order to determine if it meets the recovery criteria for downlisting to threatened.

- Reassess and amend as needed the recovery plan for 6 Mobile River Basin aquatic snails, specifically, the recovery criteria and population criteria for recovery should be evaluated.
- Continue to develop and implement habitat restoration plans for the streams where these species occur, or where they can be reintroduced.
- Continue assisting the State's propagation studies and efforts.
- Work with State agencies, local groups, and individuals to protect and improve water quality in the drainages supporting the six snail species.
- Implement all other recovery tasks.

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Peer-Reviewers

Dr. Paul D. Johnson, Program Supervisor
ADCNR, Alabama Aquatic Biodiversity Center, Marion, AL

Dr. Lori Tolley-Jordan, Assistant Professor
Jacksonville State University, Department of Biology, Jacksonville, AL

Dr. Nathan Whelan, Postdoctoral Fellow
Auburn University, Department of Biological Sciences, Auburn, AL

Provided new/updated information

Mr. Anthony Ford, Fishery Biologist
USFWS, Alabama ES Field Office, Daphne, AL

Mr. Paul Freeman, Aquatic Ecologist
TNC, Birmingham, AL

Dr. Paul D. Johnson, Program Supervisor
ADCNR, Alabama Aquatic Biodiversity Center, Marion, AL

Mr. Eric Spadgenske, Fish and Wildlife Biologist
USFWS, Alabama ES Field Office, Daphne, AL

Cylindrical Lioplax Current Range

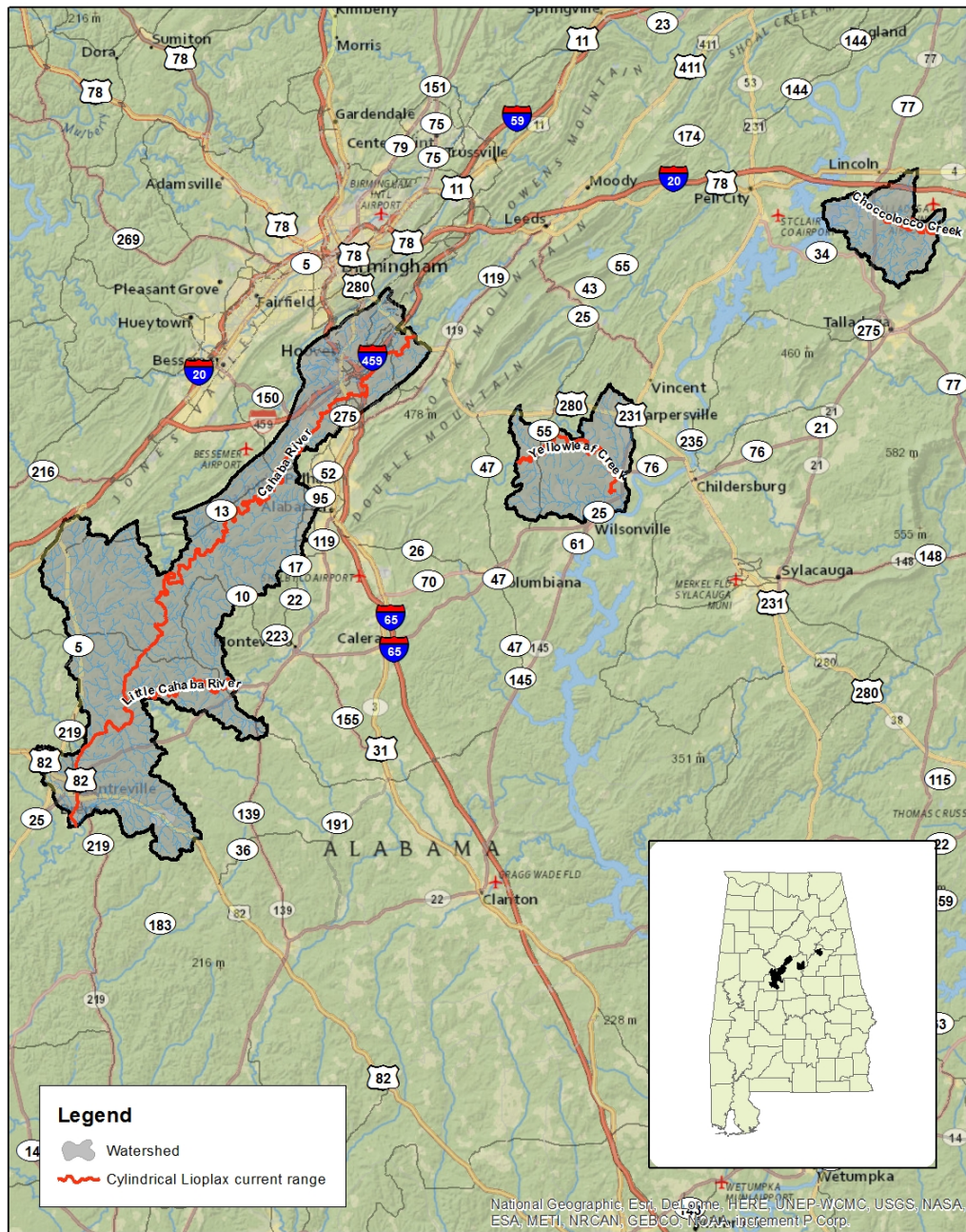


Figure 1. Current known range of the cylindrical lioplax (*Lioplax cyclostomaformis*) within the Cahaba River, Yellowleaf Creek, and Choccolocco Creek watersheds, Coosa Drainage Basin, Alabama. Created by the USFWS Alabama Ecological Services Field Office (April 2015).

Flat Pebblesnail Current Range

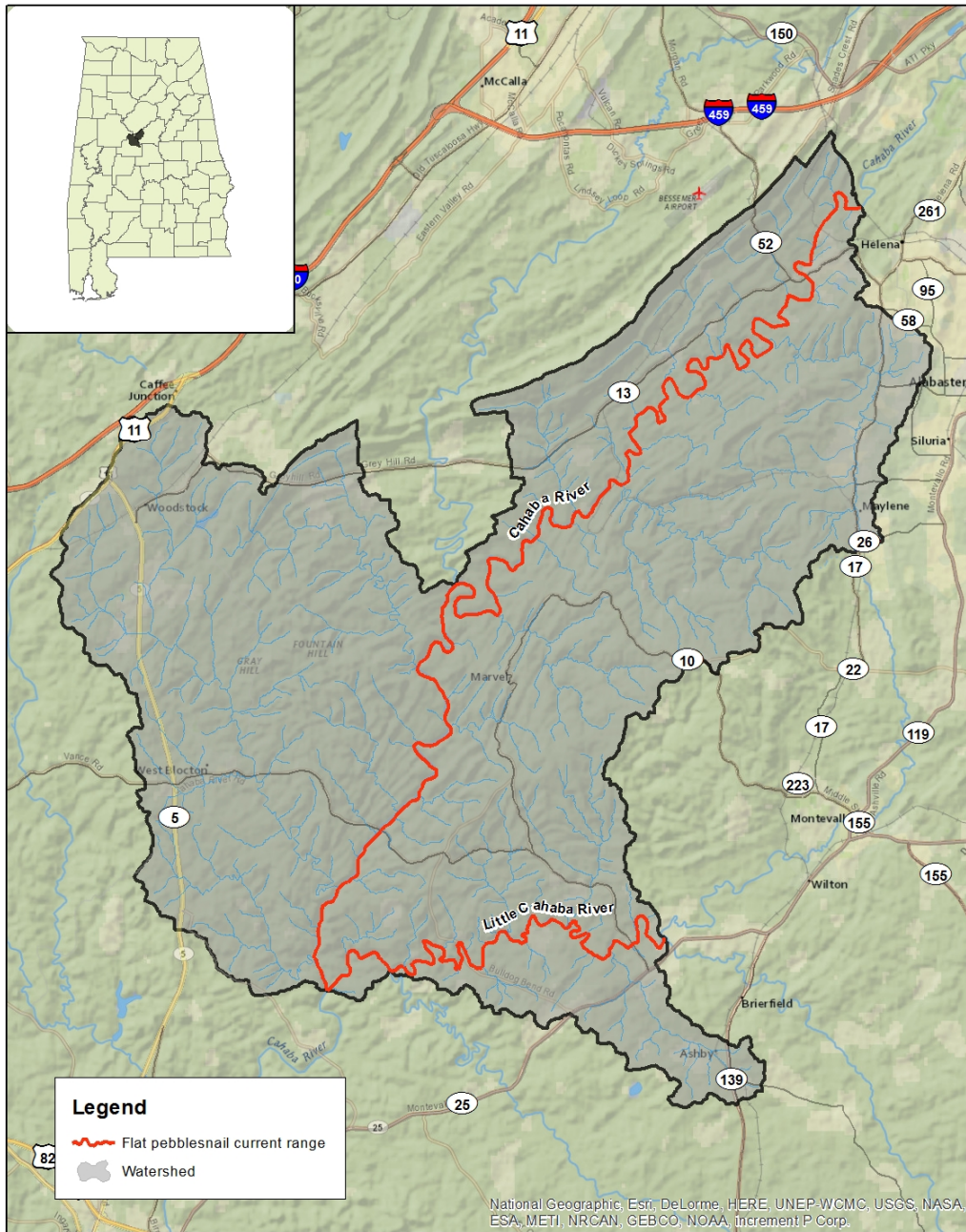


Figure 2. Current known range of the flat pebblesnail (*Lepyrium showalteri*) within the Cahaba River and Little Cahaba River watersheds, Coosa Drainage Basin, Alabama. Created by the USFWS Alabama Ecological Services Field Office (April 2015).

Plicate Rocksnail Current Range

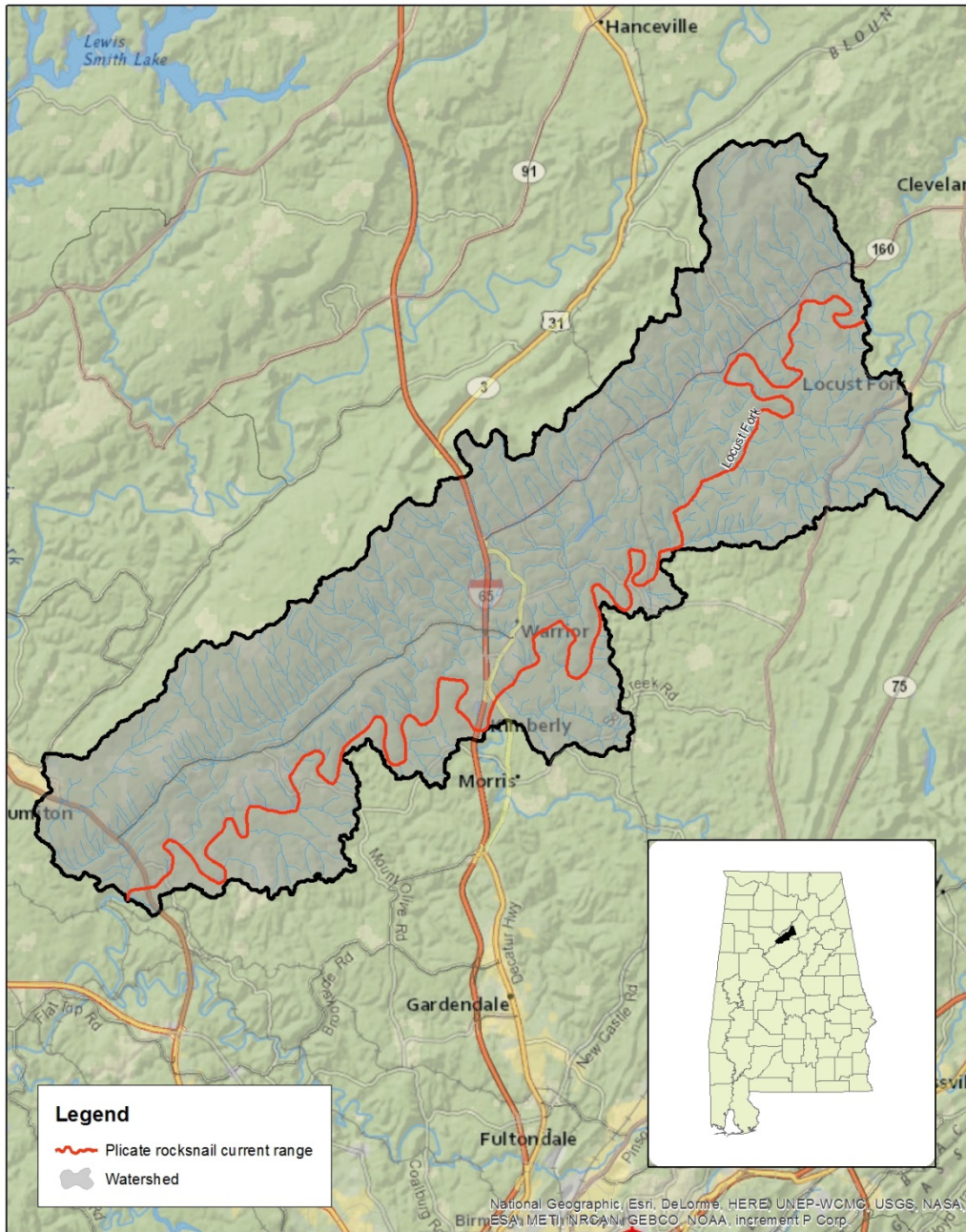


Figure 3. Current known range of the plicate rocksnail (*Leptoxis plicata*) within the Locust Fork watershed, Black Warrior Drainage Basin, Alabama. Created by the USFWS Alabama Ecological Services Field Office (August 2015).

Painted Rocksnail Current Range

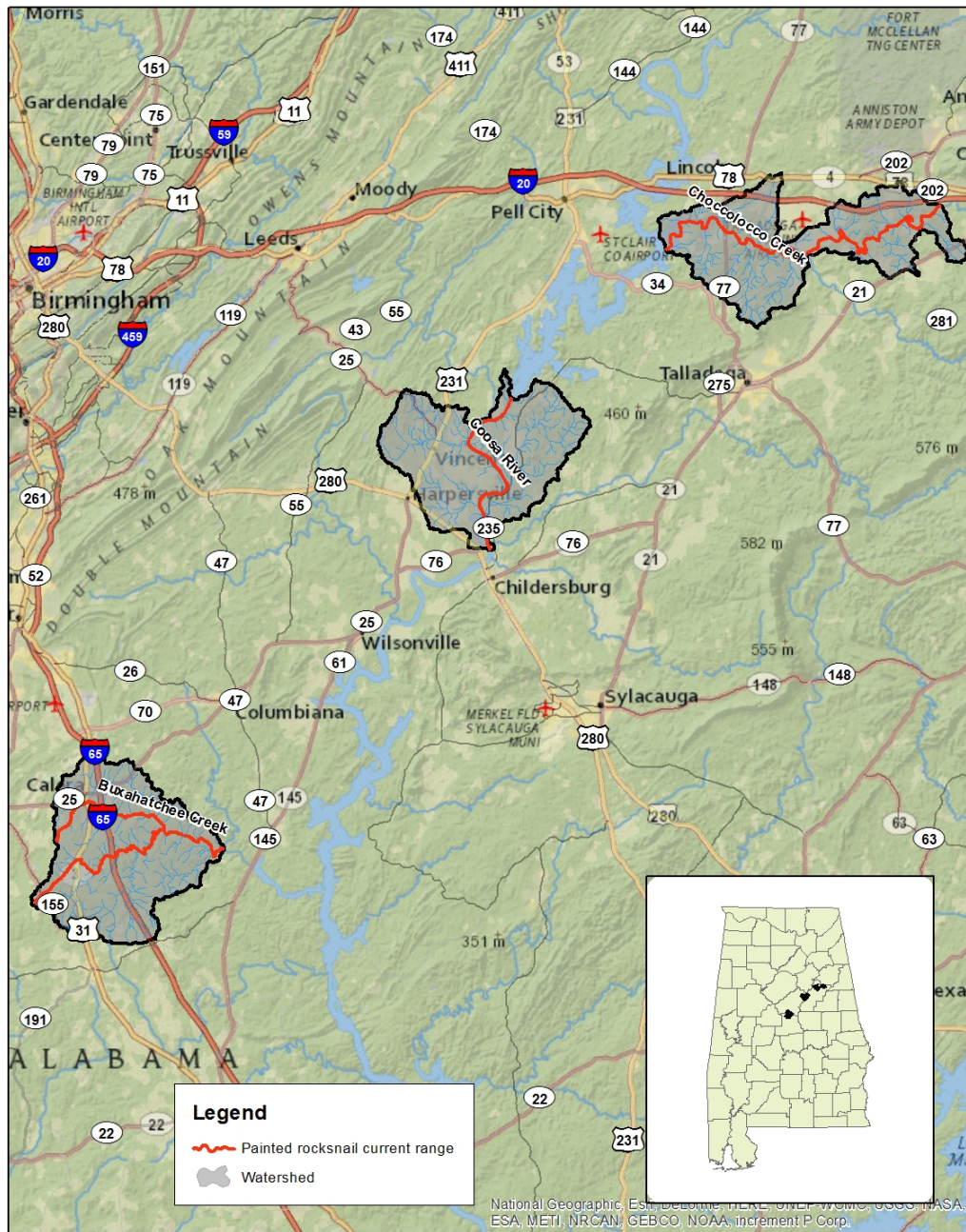


Figure 4. Current known range of the painted rocksnail (*Leptoxis taeniata*) within the Coosa River mainstem (below Logan Martin Dam) and Choccolocco Creek and Buxahatchee Creek watersheds, Coosa Drainage Basin, Alabama. Created by the USFWS Alabama Ecological Services Field Office (April 2015).

Round Rocksnail Current Range

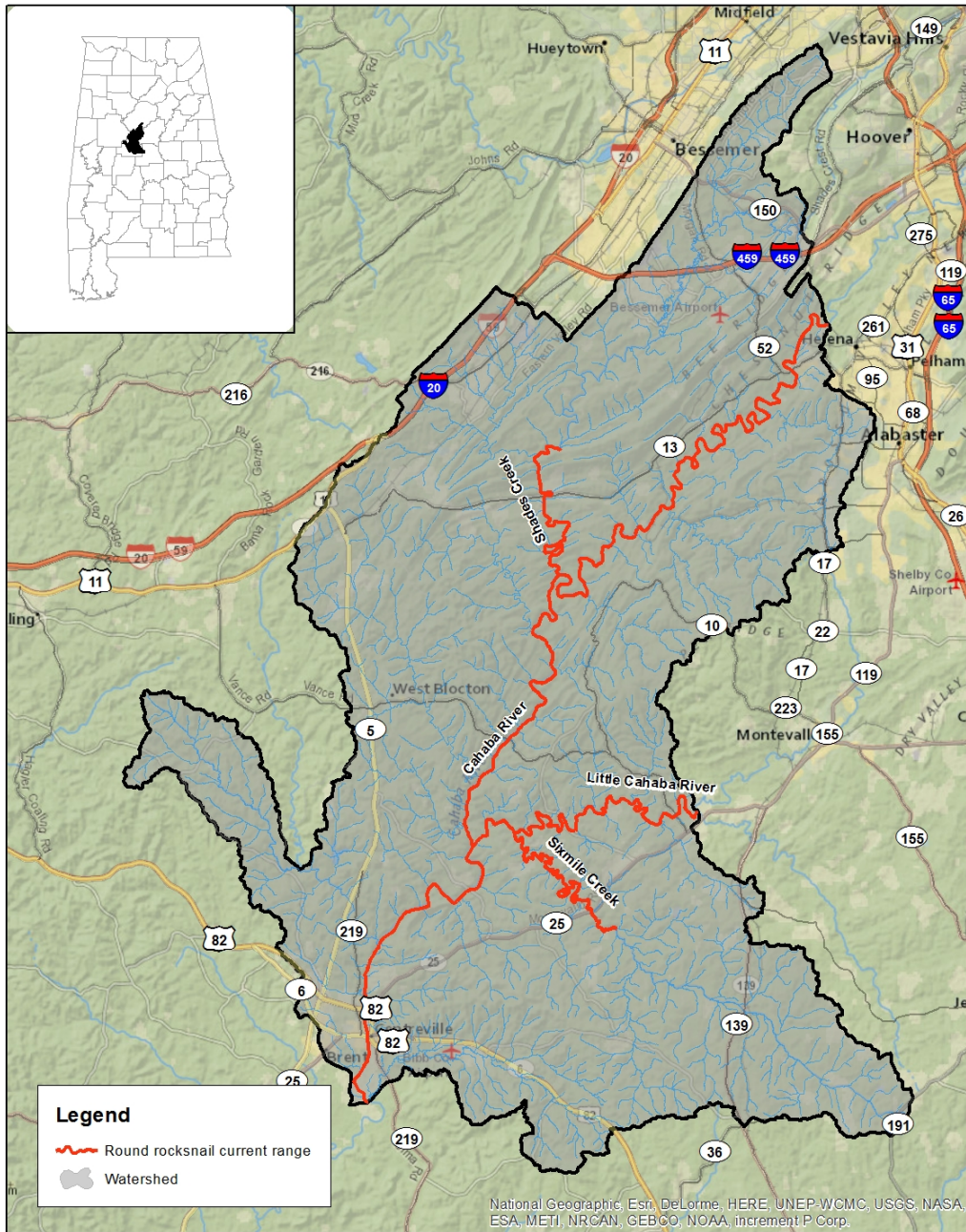


Figure 5. Current known range of the round rocksnail (*Leptoxis ampla*) within the Cahaba River mainstem and several Cahaba River tributaries (i.e., Shades Creek, Little Cahaba River), Coosa Drainage Basin, Alabama. Created by the USFWS Alabama Ecological Services Field Office (April 2015).

Lacy Elimia Current Range

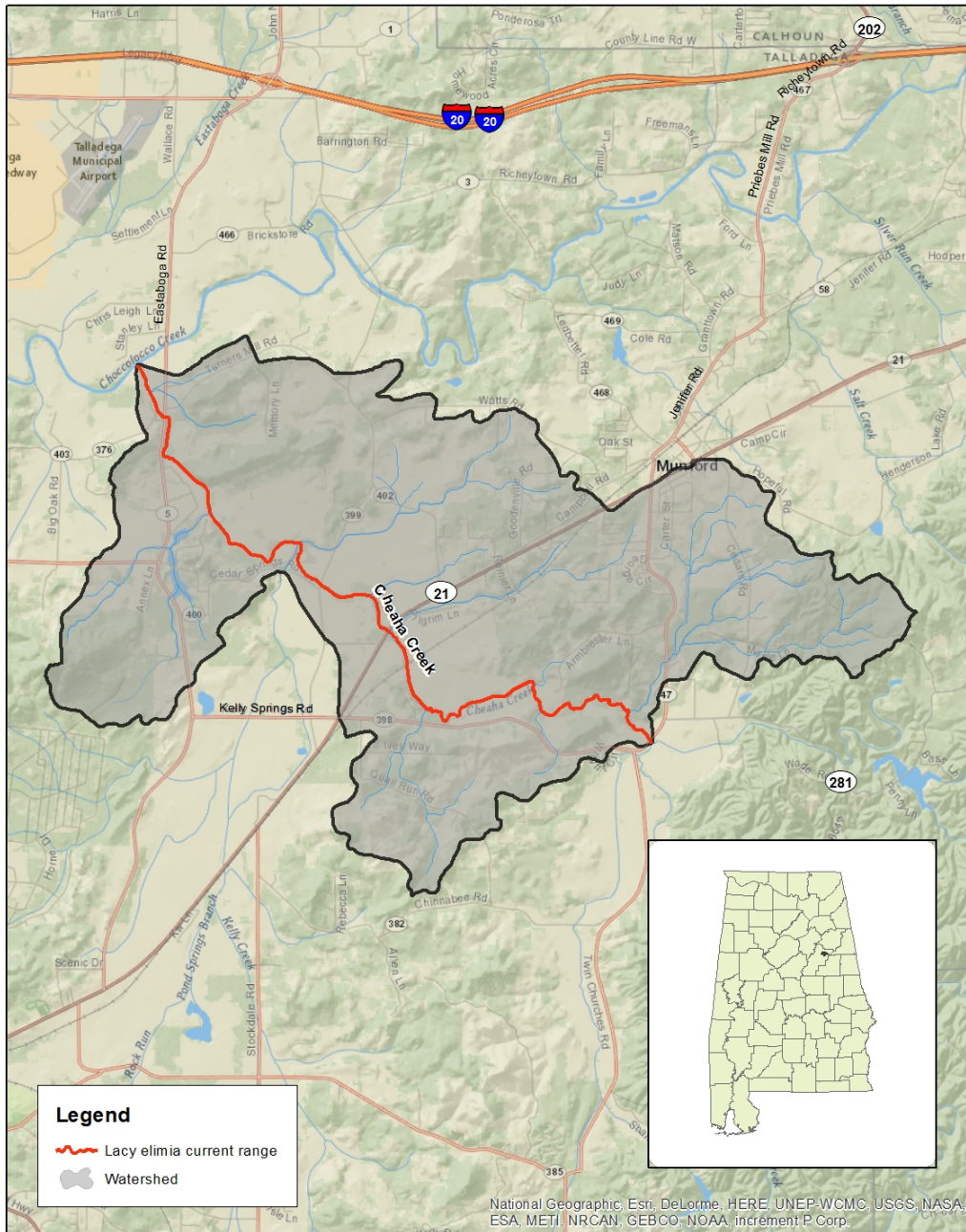


Figure 6. Current known range of the lacy elimia (*Elimia crenatella*) within the Cheaha Creek watershed, Coosa Drainage Basin, Alabama. Created by the USFWS Alabama Ecological Services Field Office (April 2015).



Photo Credit: Alabama Aquatic Biodiversity Center

Figure 7. Cylindrical lioplax specimens collected October 10, 1933 from Wilsonville, Alabama located in the Smithsonian National Museum of Natural History, Washington D.C., (USNM 519462).



Photo Credit: Alabama Aquatic Biodiversity Center

Figure 8. Flat pebblesnail specimen located in the Smithsonian National Museum of Natural History, Washington D.C., (USNM 672419).



Photo Credit: Alabama Aquatic Biodiversity Center

Figure 9. Plicate rocksnail specimens located in the Natural History Museum of Geneva, Geneva, Switzerland.



Photo Credit: Alabama Aquatic Biodiversity Center

Figure 10. Painted rocksnail type specimens (Holotype) collected by Herbert Huntington Smith from Chocolocco Creek at Jackson Shoals, Talladega County, Alabama located in the University of Michigan Museum of Zoology, Ann Arbor, Michigan, (UMMZ 10145).



Photo Credit: Alabama Aquatic Biodiversity Center

Figure 11. Round rocksnail type specimens (Syntype) collected by J. G. Anthony located in the Harvard University Museum of Comparative Zoology, (MCZ 161803).



Photo Credit: Alabama Aquatic Biodiversity Center

Figure 12. Lacy elimia type specimens (Holotype) located in the Smithsonian National Museum of Natural History, Washington D.C., (USNM 118982).

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of the CYLINDRICAL LIOPLAX, FLAT PEBBLESNAIL,
PLICATE ROCKSNAIL, PAINTED ROCKSNAIL, ROUND ROCKSNAIL, and
LACY ELIMIA

Current Classification: Cylindrical lioplax (*Lioplax cyclostomaformis*): endangered
Flat pebblesnail (*Lepyrium showalteri*): endangered
Plicate rocksnail (*Leptoxis plicata*): endangered
Painted rocksnail (*Leptoxis taeniata*): threatened
Round rocksnail (*Leptoxis ampla*): threatened
Lacy elimia (*Elimia crenatella*): threatened

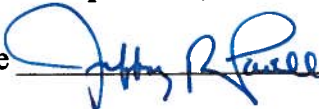
Recommendation resulting from the 5-Year Review:

 X No change needed

Review Conducted By: Anthony D. Ford, USFWS Alabama ES Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve  Date 7/8/2016

In 2014, Southeast Region Field Supervisors were delegated authority to approve 5-year reviews that do not recommend a status change.

APPENDIX A: Summary of peer review for the 5-year review of the cylindrical lioplax, flat pebblesnail, plicate rocksnail, painted rocksnail, round rocksnail, and lacy elimia

A. Peer Review Method: see below

B. Peer Review Charge:

Requests were made to each peer reviewer of the 5-year review via personal phone conversation and email request (April 20, 2015).

We chose peer reviewers based on their expertise and the broad knowledge that they could offer in giving a complete and thorough review. Each reviewer was asked to give a complete review with focus on areas of personal expertise.

Dr. Paul Johnson is the program supervisor of the ADCNR's Alabama Aquatic Biodiversity Center (AABC) and is a recognized mollusk expert. Dr. Johnson also has broad ranging knowledge and experience in mollusk propagation and reintroduction. Specifically, Dr. Johnson is one of the world's foremost snail experts, having recently published an assessment into the conservation status of freshwater gastropods in Canada and the United States. Dr. Johnson has extensive local expertise with Mobile River Basin snail fauna.

Dr. Lori Tolley-Jordan is an assistant professor with Jacksonville State University with research focused on freshwater invertebrate biodiversity and is a recognized snail expert. Dr. Tolley-Jordan has specifically conducted research focused on the biology of Pleurocerid snails in the Cahaba River, Alabama, and land use changes on Pleurocerid snails.

Dr. Nathan Whelan is a postdoctorate fellow with Auburn University with specific focus on evolutionary biology working on the phylogenomics of freshwater snails. Dr. Whelan has extensively researched systematics and life history of the freshwater snail genus *Leptoxis*.

C. Summary of Peer Review Comments/Report

Dr. Paul D. Johnson, ADCNR, Alabama Aquatic Biodiversity Center, Marion, AL: Dr. Johnson noted that the lacy elimia may occur in lower Kelly Creek, as a specimen was recently discovered from a jar of miscellaneous lower Kelly Creek specimens. While it may have been a misplaced specimen, it could warrant a field investigation.

Dr. Nathan Whelan, Auburn University, Auburn, AL: Dr. Whelan recommended the round rocksnail be delisted, noting that the round rocksnail is a Cahaba River endemic that has probably "disappeared from less than 5% of its natural range". Dr. Whelan also notes that the new information about its range, and population growth after the low-level dam removal in the Cahaba River only further supports this position. In addition, Dr. Whelan believes that per the recovery plan, three populations have persisted for ten years.

Dr. Lori Tolley-Jordan, Jacksonville State University, Jacksonville, AL: No changes were suggested.

Copies of reviewer comments are available upon request from the Alabama ES Field Office.

D. Response to Peer Review

Dr. Paul D. Johnson, ADCNR, Alabama Aquatic Biodiversity Center, Marion, AL: We decided not to update the current known range of lacy elimia to include Kelly Creek, as we agree with Dr. Johnson that this vouchered specimen of lacy elimia needs field verification. Per our recommendation for future actions (Section IV), we recommend conducting surveys within the Middle Coosa River tributaries that are within the historic range of the species as a way to assess the lacy elimia's present threatened status.

Dr. Nathan Whelan, Auburn University, Auburn, AL: We appreciate Dr. Whelan's assessment and recommendation for delisting the round rocksnail. While we agree that the round rocksnail has persisted and expanded in the three drainage populations (i.e., Cahaba River, Little Cahaba River / Sixmile Creek, and Shades Creek), we do not believe that criteria for delisting, calling for a minimum of 3 natural or re-established populations, have been met. The recovery plan defines a population as all snails occurring within a contiguous river or stream reach extending a minimum of 30 km (18 miles). Snails in a recovered population should be easily found in appropriate habitat throughout the occupied reach. At present, neither the Little Cahaba River nor Shades Creek populations fully meet these requisite recovery criteria. Additionally, while improvements have been made with respect to water quality (e.g., issuance of TMDLs in Cahaba and Shades Creek), short-term and long-term impacts of point and nonpoint source water and habitat degradation continue to threaten the snail. While we do not currently recommend delisting the round rocksnail, we do recommend reassessing the current recovery criteria and population criteria.

Dr. Lori Tolley-Jordan, Jacksonville State University, Jacksonville, AL, Auburn: No changes were suggested or incorporated.