Purple Cat's Paw Pearlymussel
(*Epioblasma obliquata obliquata*)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service, Midwest Region
Ecological Services Field Office
Columbus, Ohio

April 2015

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5-YEAR REVIEW

Purple Cat's Paw Pearlymussel/*Epioblasma obliquata obliquata*

1.0 GENERAL INFORMATION

1.1 Reviewers

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Cooperating Regional Office: Kelly Bibb, Southeast Regional Office, Atlanta, GA (404) 679-7132

1.2 Methodology used to complete the review

Public notice was given in the *Federal Register* (79 FR 38560) requesting new scientific or commercial data and information that may have a bearing on the purple cat's paw pearlymussel (*Epioblasma obliquata obliquata*) classification of endangered status. Pertinent data was obtained from the Recovery Plan, from recent reports of freshwater mussel surveys of Killbuck Creek, and from recent propagation efforts in Kentucky, Ohio, and West Virginia. This 5-year review was completed by Angela Boyer, Fish and Wildlife Biologist with the Ohio Ecological Services Field Office. The focus of this 5-year review is to summarize the current status of the purple cat's paw pearlymussel. Peer review of this document was determined to be unnecessary because there is a lack of new information about this species and the review resulted in a recommendation to leave the status unchanged.

1.3 Background

1.3.1 FR Notice citation announcing initiation of this review:

79 FR 38560-38562 (July 8, 2014)

1.3.2 Listing history

Original Listing
FR notice: 55 FR 28209
Date listed: July 10, 1990
Entity listed: Purple Cat's Paw Pearlymussel (*Epioblasma obliquata obliquata*); Subspecies
Classification: Endangered

1.3.3 Associated rulemakings: A final rule was published for the establishment of a non-essential experimental population of the purple cat's paw pearlymussel in the Tennessee River below Wilson Dam in Alabama on June 14, 2001 (66 FR 32250). A correction to this final rule, amending the table of species information to include the "When Listed" numbers, was published on August 21, 2001 (66 FR 43808).

1.3.4 Review History: Purple cat's paw pearlymussel was included in a cursory review initiated November 6, 1991 (56 FR 56882) for all endangered and threatened species listed before 1991. A 5-year review was initiated on March 18, 2009 (74 FR 11600) and completed on September 24, 2010. These reviews resulted in no change in the listing classification of endangered.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 6. The "6" indicates a high degree of threat and low recovery potential.

1.3.6 Recovery Plan

Name of plan: Purple Cat's Paw Pearlymussel Recovery Plan
Date issued: March 10, 1992
Dates of previous revisions, if applicable: none

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate? *No.*

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria? *Yes.*

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat? ***Yes.***

2.2.2.2 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)? *No.*

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

The purple cat's paw pearlymussel may be considered for reclassification to threatened status when the following criteria are met:

Criterion 1. Through protection of existing populations and successful establishment of reintroduced populations or the discovery of additional populations, a total of at least four Ohio River system tributaries contain viable populations. These populations will be distributed within the Ohio River system as follows: two populations in the upper Ohio River basin in Ohio, Indiana, or Illinois; one population in Kentucky; and one population in Tennessee.

In 1992 when the recovery plan was issued, the purple cat's paw was only known to be extant in two river reaches – the Cumberland River in Tennessee and the Green River in Kentucky. However, no living or freshdead purple cat's paw pearlymussels have been collected in these two rivers in over 20 years. In 1994, a small population of the purple cat's paw was discovered in Killbuck Creek in Coshocton County, Ohio.

Killbuck Creek was closed in 2004 to all mussel sampling and collecting except for that required in conjunction with life history research approved by the Ohio Department of Natural Resources (R. Ollis, Ohio Department of Natural Resources, Division of Wildlife, in litt. 2010).

In 2005, the U.S. Fish and Wildlife Service's Columbus, Ohio Ecological Services Field Office (COFO) received a Preventing Extinction grant to conduct surveys in Killbuck Creek to locate and obtain live male and female purple cat's paw for a captive propagation program. Since this survey effort was initiated, only living males have been found, three of which are being held in captivity at the Minor Clark Fish Hatchery in Kentucky. COFO received additional Preventing Extinction grants in 2007 and 2009 to continue the survey efforts.

Survey efforts in Killbuck Creek from 2009 through 2011 yielded only two live males in 2009. Both males had been found before as they were already tagged in previous years. During 2011 sampling, one freshdead female was also found. It was estimated to be around three years of age. This find indicated recruitment in the stream only a few years prior.

In 2012, Ohio experienced a drought which reduced flows in Killbuck Creek which provided excellent sampling conditions for purple cat's paw by increasing visibility in the creek. Areas

where purple cat's paw had been previously found were searched extensively. A new location in the stream was also found and could sampled due to the excellent survey conditions. Survey efforts found a total of 11 live females and 16 live males. These were the first living females of the species found since 1996.

The mussels were placed into in-stream cages for holding until the following spring. In late March 2013, the females were removed from the cages and checked for gravidity. Six females were found to be gravid. Three mussel propagation facilities, in Ohio, Kentucky, and West Virginia, received two females each in order to initiated propagation of the species. White Sulphur Springs National Fish Hatchery in West Virginia was the only facility in 2013 that had successful transformation of larvae resulting in 13 juveniles. These juveniles were later transported to the Center for Mollusk Conservation in Kentucky due to staffing changes at the West Virginia facility.

One additional live female was found in Killbuck Creek in the fall of 2013 and placed into the cage with the other surviving females for holding. Propagation efforts were repeated in April 2014 at the Ohio and Kentucky facilities. The Kentucky facility successfully propagated purple cat's paw and had 17 surviving juveniles from this effort. Combined with the 13 juveniles from the 2013 efforts, the total living juveniles in captivity was increased to 30.

The females used for 2013 propagation were returned to a cage in April 2014 following the extraction of their larvae. They were placed with other non-gravid females in Little Darby Creek in Ohio because the normal high flow conditions in Killbuck Creek prevented the replacement of a cage into that stream. In the summer of 2014, the caged females in Little Darby Creek experienced high mortality. When conditions in Killbuck Creek allowed for a cage to be placed in the stream, only two of the adult females remained alive. The cause of mortality is not known. Little Darby Creek has excellent water quality and also supports a population of the endangered clubshell (*Pleurobema clava*). It is possible that the stress from long-term holding in cages could have been a factor in the mortality.

The Killbuck Creek survey effort continued in 2014 and six additional live adult female cat's paw were found. These individuals are being held in a cage in Killbuck Creek along with the other two females to continue the propagation effort in the spring of 2015. In November 2014, caged females were checked for gravidity. In order to expand the propagation efforts, larvae were extracted from one female and transported to the Kentucky facility for in-vitro propagation. Currently 22 juveniles from this technique have survived. Currently there are 51 juveniles total being reared at the Kentucky facility from all propagation efforts.

Purple cat's paw, although sexually dimorphic, cannot be sexed until at least age 3 when the shell of the female begins to expand posteriorly. Thus, the sex ratio of the juveniles is not known at this time. Due to the low number of surviving juveniles from propagation, they have not been released into any streams and continue to be held in captivity to allow them to grow and mature. Once mature they may serve as broodstock for future propagation of juveniles and/or they may be used to augment existing populations or be used for reintroduction purposes.

This criterion addresses listing factor A which is the present or threatened destruction, modification, or curtailment of habitat or range. Since there are only three known populations of purple cat's paw and the status of each is unknown, Criterion 1 has not been met.

Criterion 2. Two naturally reproduced year classes exist within each of the four populations. Both year classes must have been produced within 10 years, and one year class within 5 years, of the downlisting date. Within 1 year of the downlisting date, gravid females of the subspecies and its fish host must be present in each river.

There are only three known populations of purple cat's paw. The status of two of these (Cumberland River and Green River) is unknown. The status of the Killbuck Creek population appears to exist in a very low density with the population concentrated in a single riffle. Viability of the Killbuck Creek population is questionable due to the low density, though some recent recruitment has occurred. Due to the unknown status of the Cumberland and Green River populations and the small size and restricted range of the Killbuck Creek population, Criterion 2 has not been met.

Criterion 3. Biological and ecological studies have been completed, and the recovery measures developed and implemented from these studies are beginning to be successful, as evidenced by an increase in population density and/or an increase in the population size and the length of the river reach inhabited within each of the populations.

The Ohio River Islands National Wildlife Refuge received a Cooperative Recovery Initiative Grant in 2013 to work towards establishing up to four new populations of endangered mussels on or near the refuge. The four mussel species targeted for this work included the purple cat's paw. Funding through this grant is being used in part to propagate juveniles of the related northern riffleshell (*Epioblasma torulosa rangiana*), as a surrogate, for placement in two to four silos in or near the refuge as juveniles as trial populations on the refuge. If the trial using northern riffleshell is successful (> 40% survival after one year), stocking of juvenile purple cat's paw at one or two sites on or near the refuge will be considered when propagation has been successful at producing an adequate number of juveniles for this purpose. This investigation is ongoing at three sites in the Ohio River. Additionally funding from this grant is being used to help fund the propagation of juveniles of purple cat's paw using fish hosts and in vitro techniques. Criterion 3 has been initiated has not been met.

The purple cat's paw pearly mussel will be considered for removal from Endangered Species Act protection when the likelihood of the subspecies becoming threatened in the foreseeable future has been eliminated by the achievement of the following criteria:

Criterion 1. Through protection of existing populations and successful establishment of reintroduced populations or the discovery of additional populations, a total of at least six Ohio River system tributaries contain viable populations. These populations will be distributed within the Ohio River system as follows: one population in Ohio, one population in Indiana, one population in Illinois, two populations in Kentucky, and one population in Tennessee.

An effort to locate individuals to begin captive propagation has been initiated to begin addressing Criterion 1. Propagation of juveniles has been successful with 11 juveniles propagated in 2013 and 40 juveniles propagated in 2014 surviving. No reintroductions or augmentation in the wild have been attempted to date. Therefore, Criterion 1 has not been met.

Criterion 2. Two distinct naturally reproduced year classes exist within each of the six populations. Both year classes must have been produced within 10 years, and one year class within 5 years, of the downlisting date. Within 1 year of the recovery date, gravid females of the subspecies and its fish host must be present in each river.

Criterion 2 has not been met.

Criterion 3. Studies of the mussel's biological and ecological requirements have been completed, and recovery measures developed and implemented from these studies have been successful as evidenced by an increase in population density and/or an increase in the population size and the length of the river reach inhabited within each of the six populations.

Criterion 3 has not been met.

Criterion 4. No foreseeable threats exist that would likely threaten survival of any of these six populations.

Criterion 4 has not been met.

Criterion 5. Where habitat had been degraded, noticeable improvements in water and substratum quality have occurred.

Criterion 5 has not been met.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

Rock bass (*Ambloplites rupestris*), mottled sculpin (*Cottus bairdii*), stonecat (*Noturus flavus*), blackside darter (*Percina maculata*), and logperch (*Percina caprodes*) have been found to be fish hosts for the purple cat's paw pearlymussel (G.T. Watters, Ohio State University Museum of Biological Diversity, in litt. 1998). In 2013 and 2014, respectively, White Sulphur Springs National Fish Hatchery (West Virginia) and the Center for Mollusk Conservation (Kentucky) successfully transformed purple cat's paw larvae into juvenile mussels utilizing mottled sculpin. Mottled sculpin used at the Kentucky facility in 2014 were obtained from the West Virginia facility. Both facilities were successful in producing purple cat's paw juveniles using these particular sculpin. In November 2014, the Kentucky facility also used in-vitro medium to successfully

transform purple cat's paw larvae to juveniles. Currently the Kentucky facility is rearing 22 juveniles transformed through the in-vitro process.

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

In 1994, the purple cat's paw was discovered in Killbuck Creek in Coshocton County, Ohio (Hoggarth et al. 1995). Prior to this discovery, the purple cat's paw was not known from Killbuck Creek. In 1994, 2 live and 4 freshly dead individuals were found at one site and an additional 13 living and 19 freshly dead individuals were found at another site in Killbuck Creek (Hoggarth et al. 1995).

In 1997, Hoggarth and Ross (1997) reported finding a total of 62 living purple cat's paw within the lower Killbuck Creek during the 1995-1996 survey. The results of this study indicated that a reproducing population of purple cat's paw occurred in the lower 13 river miles of Killbuck Creek (Hoggarth 1996; Hoggarth and Ross 1997).

A project was initiated in 2001 to examine the status of the purple cat's paw in Killbuck Creek, expand their distribution in Killbuck Creek, and to establish a Walhonding River population. Gravid females were targeted to inoculate host fish to be released outside the core population area in Killbuck Creek and the Walhonding River for establishment of a second population. During the course of the study, several female purple cat's paw were found, but none were gravid with glochidia (Hoggarth 2002).

In 2006, a project was initiated to locate and collect purple cat's paw for captive propagation. Annual sampling efforts (2007 to 2011) failed to find any living females until 2012, when 11 were found in addition to 16 live males. Six of these females were found to be gravid and their larvae were extracted to initiate captive propagation in 2013. This effort was successful, but only yielded 13 juveniles, of which 11 have survived. Additional sampling in 2013 found one more female and three males. Propagation was performed again in 2014 through two methods (fish and in-vitro) producing an additional surviving 40 juveniles (18 from fish and 22 from in-vitro). In 2014, surveys found 7 additional females and 19 males. Many of these males were small and potentially some were actually females whose shells had not yet developed a marsupial expansion.

Viability of the Killbuck Creek population is questionable due to the very small population size that appears to be concentrated in one riffle. Although recruitment has occurred within the past several years based on the finding of young individuals. Viability of the species in the Cumberland River and Green River in unlikely since surveys have not found any living purple cat's paw in these rivers in over 20 years (Chance 2015, pers. comm.).

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

There is no information about the species' genetics due to the lack of individuals available for genetic research.

2.3.1.4 Taxonomic classification or changes in nomenclature:

There is no new taxonomic information.

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

The purple cat's paw pearlymussel was historically distributed in the Ohio, Cumberland, and Tennessee River systems in Ohio, Illinois, Indiana, Kentucky, Tennessee, and Alabama (Bogan and Parmalee 1983; Isom et al. 1979; Kentucky State Nature Preserves Commission 1980; Parmalee et al. 1980; Stansbery 1970; Watters 1986). Currently, the subspecies may survive in only 3 river reaches – Killbuck Creek in Ohio, the Cumberland River in Tennessee, and the Green River in Kentucky (USFWS 1992; Hoggarth et al. 1995). Continued existence of the purple cat's paw in the Cumberland and Green Rivers is questionable as live individuals have not been reported from these rivers for over 25 years.

In 1994, a population of purple cat's paw was discovered in Killbuck Creek, a tributary to the Walhonding River, in the Muskingum River watershed in Coshocton County, Ohio (Hoggarth et al. 1995). Historically, this species was not known from this creek, but it was known to occur in the Muskingum River. A 1995-1996 survey of Killbuck Creek determined that a viable population of the purple cat's paw occurred in the lower 13 miles of the creek (Hoggarth et al. 1995). However, based on survey efforts in 2006-2014, the population in Killbuck Creek is very small and restricted to only a short reach of the stream. Due to the limited distribution in Killbuck Creek, this population is vulnerable to stochastic events.

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

The Killbuck Creek watershed is predominantly agricultural with numerous oil and gas wells (Ahlstedt 2007). In 1997, Hoggarth and Ross reported that Killbuck Creek "provides high quality habitat and sufficient water quality" to support the purple cat's paw and 24 other mussel species. However, just a decade later, Ahlstedt (2007) reported that mussel habitat in Killbuck Creek is "severely degraded" with the creek entrenched among steep eroding banks. Deadfalls and debris piles are common in the creek and point bar formations are evidence of massive bed-load movement during high surface flows. Furthermore, Ahlstedt (2007) reports that sampling for purple cat's paw in the creek is difficult due to high sediment load causing very poor visibility, except during rare low-flow conditions. In 2012, a drought provided excellent sampling conditions which allowed biologists to locate living females and initiate captive propagation.

2.3.1.7 Other:

N/A

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

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

The purple cat's paw pearlymussel was historically distributed in the Ohio, Cumberland, and Tennessee river systems in Ohio, Illinois, Indiana, Kentucky, Tennessee, and Alabama (Bogan and Parmalee 1983; Isom et al. 1979; Kentucky State Nature Preserves Commission 1980; Parmalee et al. 1980; Stansbery 1970; Watters 1986). Many of the historic populations of purple cat's paw were apparently lost when the river sections they inhabited were impounded. These impoundments seriously reduced the availability of riverine habitat and likely affected the distribution and availability of the mussel's fish hosts (USFWS 1992). The Green River in Kentucky has also experienced water quality problems related to the impacts from oil and gas production in the watershed (USFWS 1992).

Ahlstedt (2007) reported that mussel habitat in Killbuck Creek is "severely degraded." The substrate is severely embedded and largely comprised of hard pan, which doesn't allow for mussel colonization. The riparian zone is impacted by timber removal, field crops, and cattle accessing the stream. Ahlstedt (2007) also noted that "fish are noticeably absent and Asian clams were abundant" in Killbuck Creek. Ahlstedt (2014) reported that Asian clams (*Corbicula fluminea*) appeared to have a massive die-off in 2011 but have appeared to rebound and are currently relatively common in the stream. It is interesting to note that the 2011 die-off correlates with the timing of the recent recruitment of purple cat's paw in Killbuck Creek. When Asian clam numbers were very low the purple cat's paw had successful recruitment. However, it is not known if these two events are related. The Killbuck watershed also contains many operating oil and gas wells, though it is unknown if these wells are impacting the creek.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

Any individuals that do still survive in the Cumberland River are threatened by commercial mussel fishing. Although the subspecies is not commercially valuable, incidental take of the species has occurred in the Cumberland River during commercial mussel fishing for other species (USFWS 1992).

2.3.2.3 Disease or predation:

The Recovery Plan does not discuss disease or predation as limiting factors for this species. We have no new information on disease or predation that would

indicate either is a limiting factor.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

We have no new information regarding inadequacy of existing regulatory mechanisms for protecting this species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Climate change likely constitutes a threat for the species. Current climate change predictions in the Northern Hemisphere indicate warmer air temperatures and more intense precipitation events are likely to occur in the future (IPCC 2007). The predicted impacts on streams include changes in the distribution of algae, plankton, and fish, as well as changes in water temperatures and oxygen levels. Warming of waters in rivers and streams may make these habitats less able to support their current fish and mussel fauna (IPCC 2007). Highly specialized species, such as freshwater mussels, are likely to be most susceptible to the additional stresses of a changing climate.

The most recent literature on climate change includes predictions of hydrological changes, higher temperatures, and expansion of drought areas, resulting in a northward and/or upward elevation shift in range for many species (IPCC 2007). Although the specific effects of climate change on the purple cat's paw pearlymussel are unknown, altered hydrology in rivers, increased frequency of extreme weather events, and a changing abundance and distribution of fish species have the potential to adversely affect this species. The magnitude of the climate change threat to the purple cat's paw pearlymussel is unknown.

2.4 Synthesis

The purple cat's paw pearlymussel is a federally listed endangered subspecies that is currently known to exist in only three streams, although no individuals have been documented in two of the three streams in over 20 years. The Killbuck Creek, Ohio population, first discovered in 1994, was thought to be viable in the first few years following discovery, based on sampling efforts. However, recent search efforts aimed at collecting adult purple cat's paw for captive propagation have found that the species is now quite rare in the creek, and habitat conditions have declined dramatically since the 1990s.

The biology of the purple cat's paw pearlymussel is similar to other bivalved mollusks belonging to the family Unionidae. However, due in large part to its rarity, relatively little is known about its specific life history requirements.

Survey work in Killbuck Creek for the purple cat's paw has occurred in 1994, 1995-1996, 1997, 2001, and 2006-2014 (Hoggarth et al. 1995; Hoggarth 1996; Hoggarth and Ross 1997; Ahlstedt 2007; Ahlstedt 2008; G.F. Zimmerman, Enviroscience Inc., in litt. 2009; Ahlstedt 2009; Ahlstedt 2010; Ahlstedt 2011; Ahlstedt 2012; Ahlstedt 2013; and Ahlstedt 2014). Live females were found in 2012 and captive propagation was initiated the following spring using larvae extracted

from females that were gravid. Additional females found in 2013 and 2014 have also been used for captive propagation.

Since 2009 when the last 5-year review was conducted on the purple cat's paw pearlymussel, there has been little new information on the species' biology, life history, or genetics. New information is limited to the determination of suitable fish hosts. There has been no change in the species' spatial distribution or historic range.

The purple cat's paw pearlymussel should remain listed as *endangered* because the species has continued to decline, threats have not been ameliorated, and the criteria for downlisting to threatened status have not been met. Threats persist for the remaining purple cat's paw pearlymussel populations, including habitat degradation and climate change. The life history and environmental sensitivity of the subspecies is poorly known, increasing the probability that previously unidentified activities could cause a precipitous decline of the only remaining populations. These unknowns also make it unlikely that the subspecies can be downlisted in the near future. In sum, our current understanding of the purple cat's paw pearlymussel's status leads us to conclude that this species continues to face a probability of extinction throughout all or a significant portion its range, thereby meeting the definition of endangered under the Endangered Species Act.

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X__ No change is needed

3.2 Recommendations for Future Actions

1. Prevent extinction by continuing surveys to locate individuals to continue the captive propagation efforts.

2. Continue to rear juveniles in captivity for future augmentation, reintroductions, and to serve as broodstock for captive propagation.

3. Investigate potential sites for future augmentation or reintroduction of captivity reared juveniles and/or adults.

4. Update recovery criteria to address all of the listing factors that are relevant to the species.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Purple Cat's Paw Pearlymussel

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change needed

Appropriate Recovery Priority Number: 6 (no change)

Review Conducted By: Angela Boyer, Fish and Wildlife Biologist

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service, Ohio Ecological Services Field Office

Approve _____ Date 4/21/2015

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Midwest Region

Approve _____ Date 6/29/15

Cooperating Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Southeast Region

Approve Virgil Lee Andrews, Jr. Digitally signed by Virgil Lee Andrews, Jr. DN: cn=Virgil Lee Andrews, Jr., o=U.S. Fish and Wildlife Service, ou=Kentucky Field Office, email=lee_andrews@fws.gov, c=US Date: 2015.06.11 13:53:38 -04'00' Date _____