Recovery Plan for the Endangered Key Largo Cotton Mouse
(Peromyscus gossypinus allapaticola)
https://www.fws.gov/verobeach/MSRPPDFs/KeyLargoCottonmouse.pdf

Original Approved: May 18, 1999
Original Prepared by: South Florida Ecological Services Office staff

AMENDMENT 1

We have identified the need to amend recovery criteria for Key Largo cotton mouse (*Peromyscus gossypinus allapaticola;* KLCM) with the best available information discovered since the recovery plan was completed. In this modification, we synthesize the adequacy of the existing recovery criteria, show amended recovery criteria, and provide rationale supporting the recovery plan modification. The modification is shown as an addendum that supplements the South Florida Multi-Species Recovery Plan (MSRP; USFWS 1999) by adding delisting criteria for the KLCM that were not developed at the time this recovery plan was completed. The original recovery objectives and the step-down outline are described on page 489 of the MSRP. Recovery plans are non-regulatory documents that provide guidance on how best to help recover species.

For
U.S. Fish and Wildlife Service
Atlanta, Georgia

Approved: _____
Acting **Regional Director, U.S. Fish and Wildlife Service**

Date: 11/12/2019

METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT

These amendments to the recovery criteria were developed using the most recent and best available information for the species. This information was prepared by the U.S. Fish and Wildlife Service (Service) biologists and managers in the South Florida Ecological Services Field Office in order to develop the recovery criteria for the KLCM.

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) also have affirmed the need to frame recovery criteria in terms of threats assessed under the five listing factors.

Recovery Criteria

The MSRP only provides downlisting criteria for the KLCM, and they can be found on page 489 of the document (https://www.fws.gov/verobeach/MSRPPDFs/KeyLargoCottonmouse.pdf).

Synthesis

New information obtained after the MSRP was finalized is detailed in the KLCM 5-Year Status Review (USFWS 2009), and synthesized below. The assessment of threats, suggested recovery actions, and life history information included in the MSRP largely remain applicable and relevant. Issues related to habitat (i.e., loss, fragmentation, need for management or restoration; Factor A) and predation and competition from non-native, invasive species and free-roaming pets (Factor C) are still directly pertinent to the KLCM's recovery.

However, some important advances in our understanding of the KLCM have been made since the MSRP. Since Burmese pythons (*Python bivittatus*) were first documented in the KLCM's range in 2007, over 50 pythons have been captured on Key Largo (EDDMapS 2018a; Hanslowe et al. 2018). Evidence of a breeding population of Burmese pythons (three 18-inch hatchlings) was observed in 2016. Burmese pythons are known to kill mice. Through camera surveillance of releases of captive-bred Key Largo woodrats, free-roaming cats were found to be a threat to KLCM that far exceeds previous assessments. Free-roaming cats are known to kill cotton mice. Thousands of black and white tegus (*Salvator merianae*) have been observed in the Florida City area, and there have been two found in Key Largo (Klug et al. 2015; EDDMaps 2018b). While not a documented predator of the KLCM, this omnivore is highly intelligent, capable of running at relatively high speeds, and known to consume small vertebrates.

The MSRP does not specifically address climate change or sea level rise in the KLCM recovery criteria or recovery actions. The KLCM's distribution appears to be undergoing a constriction due to encroaching mangrove areas from the coast and human infrastructure expanding from the island's interior toward the coast (i.e., "coastal squeeze"; Factors D, E). Recent models suggest that particularly at three to four feet of sea level rise, water levels will severely fragment habitat and several habitat bottlenecks will materialize (FWC 2017). This level of sea level rise is forecasted to occur in 42 to 80+ years (2060-2100; NOAA 2017), but does not account for reduction of KLCM habitat due to habitat changes (i.e., hardwood hammock transitioning into mangroves) that are likely to occur decades prior to inundation (Saha et al. 2011).

Additional information needs and data gaps still remain that could impede recovery. For example, uncertainties exist related to the genetic structure of KLCM within their range and the level of historical and present fragmentation. Information concerning present levels of genetic diversity and variation in KLCM is not available, however there is concern that their genetic structure may parallel that of Key Largo woodrat (i.e., impacted by similar habitat

fragmentation). Also, several predators and competitors (e.g., black rats, fire ants), diseases, and parasites (e.g., raccoon roundworm, toxoplasmosis, rat lungworm) have the potential to severely impact KLCM populations, particularly during vulnerable periods (i.e., drought, post-hurricane, natural population low) (Smyser et al. 2013; Dalton et al. 2017; Chalkowski 2017). Further surveillance of these predators, diseases, and their vectors, are needed to determine the scope and severity of these threats.

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 KLCM 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 distinct population segment) 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*.

Herein we provide delisting criteria for the KLCM as the MSRP only developed downlisting criteria, as discussed above.

Downlisting Recovery Criteria

We are not amending the existing downlisting criteria (please refer to page 4-89 of the MSRP).

Delisting Recovery Criteria

The Key Largo cotton mouse will be considered for delisting when all the following criteria have been met:

1. Five (5) additional populations are established or discovered within the historical range of the species that exhibit a stable or increasing population trend for multiple generations, and natural recruitment (Factor A).

2. The five (5) new populations should be located outside of Dagny Johnson Key Largo Hammock Botanical State Park and Crocodile Lake National Wildlife Refuge and be connected to the extent that genetic diversity can be naturally maintained without translocations or captive breeding (Factors A, D, E).

3. Non-native species (e.g., Burmese pythons, tegus, free-roaming pets, black rats, fire ants) are reduced or eliminated to a degree that predation and competition are low enough for KLCM to remain viable for the foreseeable future (Factors C, D).

4. When, in addition to the above criteria, it can be demonstrated that habitat loss associated with sea level rise and development are diminished such that enough suitable habitat remains for KLCM to remain viable for the foreseeable future (Factor E).

Justification

The delisting criteria reflect the best available and most up-to-date information of the KLCM, while incorporating information still relevant from the MSRP. Furthermore, the delisting criteria developed reflect the species' overarching recovery strategy and are consistent with current goals, objectives, and known risk levels.

Specifically, each delisting criterion ensures that the underlying causes of decline and impediments to recovery will be addressed and mitigated by:

Criterion 1. Provides redundancy through multiple populations and sufficient habitat, additionally reaching demographic parameters allows for resiliency to stochastic events. Since populations of many small mammals, including the KLCM, fluctuate cyclically, it is necessary to evaluate population demographics across multiple generations (i.e., at least 10 years, considering the species' natural population variability) to assess true trends. Furthermore, a specific measure of occupancy (i.e., 80% occupancy per survey, on average across 10 years) for all potentially suitable habitat is needed to assess and address any impediments to recovery.

Criterion 2. Providing redundancy through multiple sites, resiliency through maintenance of genetic diversity in order to preserve population variability (i.e., maintain unique local adaptations) and population adaptability (i.e., capability to adapt to environmental stressors). Providing natural, functional connectivity is critical to counteract fragmentation and allow for natural gene flow. Potential sites for new populations will likely need to be 10 hectares (ha) or

more and connected with other KLCM populations through corridors of appropriately managed habitat. We identified the need for a minimum of five additional populations via basic spatial analysis, considering the space and connectivity available in close proximity to occupied habitat, and what is needed (estimated) to reach a low probability of extinction.

Criterion 3. Providing a long-term (i.e., 50 years or longer) solution to significantly reduce or eliminate the threat of nonnative species. Habitat should be free of predators like pythons and free-roaming cats for a minimum of 5 years.

Criterion 4. Ensuring sufficient habitat (i.e., at least 1,200 ha) is expected to remain for long-term (i.e., 50 years or longer) persistence, despite habitat changes and habitat loss projected due to sea level rise.

Together, these recovery criteria cover threats related to habitat loss and fragmentation, nonnative predators, genetic diversity, and climate change; all of which are likely drivers of the KLCM's population demographics and the species' long-term persistence.

Rationale for Amended Recovery Criteria

The existing criteria for KLCM on page 4-89 in the MSRP (USFWS 1999) (https://ecos.fws.gov/docs/recovery_plan/sfl_msrp/SFL_MSRP_Species.pdf) included only downlisting criteria. With these amendments, delisting has been clearly defined with measurable, objective criteria in keeping with the recovery strategy and goals outlined in the MSRP. These criteria address what is necessary to ensure resiliency, redundancy, and representation by addressing factors that threaten the species. In achieving these criteria, we expect the KLCM to have a low probability of extinction for the foreseeable future and have stable populations needed for long-term recovery. We will work together with our partners to strategically and efficiently implement the new criteria.

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APPENDIX – SUMMARY OF PUBLIC, PARTNER, AND PEER REVIEW COMMENTS RECEIVED

Summary of Public Comments

We published a notice of availability in the Federal Register on June 27, 2019 (84 FR 30764) to announce that the draft amendment to the Key Largo Cotton Mouse Recovery Plan was available for public review, and to solicit comments by the scientific community, State and Federal agencies, Tribal governments, and other interested parties on the general information base, assumptions, and conclusions presented in the draft revision. An electronic version of the draft amendment was posted on the Service's Species Profile website (https://ecos.fws.gov/docs/recovery_plan/Key%20Largo%20Cotton%20Mouse%20Recovery%20Plan%20Amendment.pdf). We also developed and implemented an outreach plan that included (1) publishing a news release on our national webpage (https://www.fws.gov/news/) on June 26, 2019, (2) sending specific notifications to Congressional contacts in all Florida Districts, and (3) sending specific notifications to key stakeholders in conservation and recovery efforts. These outreach efforts were conducted in advance of the *Federal Register* publication to ensure that we provided adequate notification to all potentially interested audiences of the opportunity to review and comment on the draft amendment. We did not receive any comments in response to our request.

Summary of Peer Review Comments

We solicited independent peer review between the draft and final revision in accordance with the requirements of the Act from State agencies and academic and scientific groups. Criteria used for selecting peer reviewers included their demonstrated expertise and specialized knowledge related to the ecology and conservation of KLCM and its habitat, as well as tropical hardwood hammock, and threats facing the Florida Keys. The qualifications of the peer reviewers are in the decision file and the administrative record for this recovery plan amendment.

In total, we solicited review and comment from three peer reviewers and two partner agencies. We received comments from two peer reviewers and one partner agency reviewer. Partner agency reviewers that responded included representatives from the Florida Fish and Wildlife Conservation Commission. In general, the draft recovery plan revision was well-received by the peer and partner agency reviewers and garnered positive comments. Several reviewers provided additional specific information, including documents or citations; we thank the reviewers for these data and we have added the information where appropriate.

We considered all substantive comments, and to the extent appropriate, we incorporated the applicable information or suggested changes into the final revised recovery plan. Below, we provide a summary of specific comments received from peer and partner reviewers with our responses. We appreciate the input from all commenters, which helped us to consider and incorporate the best available scientific and commercial information during development and approval of the final revised recovery plan.

Partner Review Comment 1: We are concerned the terms "multiple generations" and "foreseeable future" are vague and undefined as used here. For small mammal species such as this, there could be multiple generations within a year. We recommend that explicit periods of

time be incorporated to provide better guidance. For example, 6 years instead of multiple generations and 50-75 years instead of foreseeable future.

Response 1: We agree. More specific periods of time have been incorporated into the justification with respect to "multiple generations" and "foreseeable future." According to ESA regulations (new revisions; 84 FR 45020), the Service describes "foreseeable future" on a case-by-case basis, using the best available data and taking into account considerations such as the species' life-history characteristics, threat-projection timeframes, and environmental variability.

Partner Review Comment 2: We recommend that the delisting criteria be stated using terms that are measurable and specific to provide greater clarity and make it possible to measure accurately whether a criterion has been achieved. For example, list thresholds for number of breeding individuals or, preferably, a specified area of suitable, protected habitat that is present and the percent of that habitat that needs to be occupied for each population, over time. Also, specify the percent of suitable, protected habitat that is within management prescription criteria for burning or other specified management activities.

Response 2: We agree that quantifying terms used in the criteria would improve our ability to determine whether a criterion has been achieved. We have added language to the justification section to provide examples of specific metrics. We also plan to include more detailed information regarding how and where recovery actions (i.e., management actions) will take place as we develop a recovery implementation strategy in the future.

Partner Review Comment 3: For the first criterion, we recommend that "stable" be replaced by "viable" and that viable be defined in measurable terms. We recommend the term "viable" be defined in terms of a threshold for an amount of suitable, occupied habitat for each population as the primary criterion in combination with a specific measure of occupancy (e.g., 80% occupancy per survey, on average across 10 years) for all potentially suitable habitat present there. A specified minimum population size could be included as a secondary criterion with recognition of the challenges that have to be overcome to accurately measure population size across a given area, over a specified number of years.

Response 3: We agree that more measurable terms would better clarify this criteria, and we have added a specific measure of occupancy to the justification. However, we used "stable" in this criteria to mean a population growth rate of zero, or in other words, a population that is neither increasing nor decreasing, and see this as adequately measureable. We chose not to specify a minimum population size, since, as the comment mentions, this is a challenging parameter to accurately measure for this species.

Partner Review Comment 4: We support the ambitious effort in criteria 1 and 2 to establish five new populations in suitable habitat outside of the currently occupied protected lands. We believe those criteria statements need to be supported with further statements in the Justification or Rationale sections to explain a) why five populations and where those populations might be located, b) the minimum area of suitable habitat that needs to present on an establishment site and c) how establishment sites should be connected with the Dagny Johnson or Crocodile Lake populations. For example, state: "populations should be established on areas such as the XYZ Tract;" "…populations should be established on sites encompassing five hectares or more of

habitat suitable for the Key Largo cotton mouse (KLCM);" and "…sites for new populations should be connected with other KLCM populations through corridors of appropriate habitat managed to benefit the KLCM (e.g., along the Florida Keys Overseas Heritage State Trail)."

Response 4: Additional information supporting the purpose and need for five additional populations has been added to the justification.

Partner Review Comment 5: To successfully achieve criteria 1 and 2, we believe a habitat acquisition or protection criterion should be added that mirrors the criterion for downlisting. For example: "Suitable, unoccupied habitat on Key Largo is protected either through land acquisition or cooperative agreements a) prior to establishment of a new, viable population there or b) to enhance connectivity to improve movement of KLCM among areas of occupied habitat."

Response 5: We agree that land acquisition or other means of perpetual conservation will likely be needed to successfully achieve criteria 1 and 2. However, no language was added to the document since this level of detail is best included in a recovery implementation strategy developed in the future.

Partner Comment 6: We also recommend that a habitat management criterion be added to specify occupied or potentially suitable KLCM habitats (i.e., hammock forests and coastal strands adjacent to these forests) existing on publicly owned lands or lands protected by a conservation easement should be managed appropriately and regularly – and actively restored if damaged – so that conditions remain of high quality for KLCM populations. Further clarification should be provided a) to define what standard is applied for determining "high quality" conditions, b) to clarify that "damaged" is damaged as a result of human activities or natural (e.g., storms) events, and c) to clarify that "actively restored" is appropriate, active habitat restoration activities carried out to restore an area to high quality conditions.

Response 6: In terms of recovery planning, habitat management and management techniques are considered actions required to achieve recovery criteria, and will be outlined in detail in a future recovery implementations strategy.

Peer Review Comment 1: The use of "multiple generations" is vague. This could, by definition, occur within one year and be insufficient to support long-term stabilization and/or growth. Criteria 1 should have a time frame that is sufficient to capture natural (seasonal) variability in the population size. I suspect this should be at least 10 years given the long history of instability observed over the past 40+ years.

Response 1: We agree, and language has been added to the justification. Please also see response to similar comment, Comment 1.

Peer Review Comment 2: Refers to discussion of different theories regarding the species' preference of hammock age and the statement that this is still unresolved. Commenter suggests publications that provide evidence of KLCM habitat preference.

Response 2: We thank the reviewer for pointing out this information and have removed reference to this issue as a current data gap.