Recovery Plan for the Endangered Lower Keys Marsh Rabbit
(Sylvilagus palustris hefneri)
https://www.fws.gov/verobeach/MSRPPDFs/LowerKeysRabbit.pdf

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DRAFT AMENDMENT 1

We have identified the need to amend recovery criteria for Lower Keys marsh rabbit (*Sylvilagus palustris hefneri;* LKMR) with the best available information discovered since the recovery plan was completed. In this proposed modification, we synthesize the adequacy of the existing recovery criteria, show amended recovery criteria, and provide rationale supporting the proposed recovery plan modification. The proposed modification is shown as an addendum that supplements the South Florida Multi-Species Recovery Plan (MSRP; USFWS 1999) by adding delisting criteria for the LKMR 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 4-165 of the MSRP. Recovery plans are a non-regulatory document that provide guidance on how best to help recover species.

For
U.S. Fish and Wildlife Service
Region 4
Atlanta, Georgia

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METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT

These proposed 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 LKMR.

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 LKMR, and they can be found on page 4-165 of the document (https://www.fws.gov/verobeach/MSRPPDFs/LowerKeysRabbit.pdf).

Synthesis

New information, attained after the MSRP was finalized, is detailed in the LKMR 5-Year Status Review (USFWS 2007) 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 of freshwater wetlands; Factor A) and predation from non-native, invasive species and free-roaming pets (Factor C) are still directly pertinent to the LKMR's recovery. Relevant, ongoing issues and important advances in our understanding of the LKMR that have been made since the MSRP are summarized below.

Encroachment of woody vegetation or buttonwood (*Conocarpus erectus*) overgrowth has occurred due to a lack of natural disturbance within LKMR habitat patches. Instead of marsh and wetland habitat generally dominated by cordgrass (*Spartina* spp.) with sparse buttonwood, buttonwood grows to form a thick forest. Where buttonwood forms this dense canopy, herbaceous cover is generally sparse, which leads to local LKMR extirpations. Conversely, recent habitat conversion work on Naval Air Station – Key West to clear visual obstructions for aircraft has altered the hydrology and vegetative structure of the site, resulting in an increase of acres of grassy marsh and prairie habitat. This resulted in local population increases for the LKMR.

Overall, genetic variation within LKMR is low, but two genetic lineages exist (Crouse 2005). These eastern (Big Pine Key area) and western (Boca Chica Key area) metapopulations exhibit strong genetic differentiation, and very limited or no genetic exchange. This is likely due to dispersal barriers, but maintaining these separate clades should be considered in any future translocation or captive breeding planning.

Sea level rise is a contemporary issue for the LKMR. From 1959 to 2006, 64 percent of LKMR habitat was lost, and 48 percent was lost due to sea level rise (Schmidt et al. 2012). LKMR require freshwater habitats and recent models suggests that particularly at an estimated 3 feet of sea level rise, water levels will result in permanently brackish conditions within representative wetlands on Big Pine Key (FWC 2017). This level of sea level rise is forecasted to occur in less than 45 years (NOAA 2017), but does not account for reduction of LKMR habitat due to habitat changes (i.e., saltwater intrusion into marshes) that are likely to occur decades prior to inundation (Saha et al. 2011). These climate change effects are further exacerbated by development, which worsens the effects of habitat fragmentation and invasive species.

Free-ranging cat populations in the Florida Keys are primarily comprised of house cats and semi-feral, "managed" cat colonies. Feral cat densities on Big Pine Key are over 4 times that in Key Largo (Cove et al. 2018a), where they also prey upon endangered species. Reducing the number of free-ranging cats was found to be an effective management practice that promotes LKMR

colonization of vacant habitats (Cove et al. 2018b). Burmese pythons (*Python bivittatus*) were not a threat, or known to be a threat, at the time of the MSRP, but were first documented in the Keys in 2007. At least 4 pythons have been captured west of the Seven-mile Bridge (just east of Big Pine Key) since then (EDDMapS 2018; Hanslowe et al. 2018).

Additional information needs and data gaps still remain that could impede recovery. For example, further information regarding vehicle-related mortality, pesticide use and its effects on LKMR, disease, altered hydrology, and the design and efficacy of wetland restoration projects are needed to determine their scope, severity, and potential effects.

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 LKMR 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 LKMR as the MSRP only developed downlisting criteria as discussed above.

Downlisting Recovery Criteria

We are not amending the existing downlisting criteria, they can be found on page 4-165 of the document (https://www.fws.gov/verobeach/MSRPPDFs/LowerKeysRabbit.pdf).

Delisting Recovery Criteria

The Lower Keys marsh rabbit will be considered for delisting when all the following criteria have been met:

1. At least 13 LKMR populations on eight (8) islands connected by U.S. Highway 1 and five (5) "backcountry" islands exhibit a stable or increasing trend, as evidenced by natural recruitment for multiple generations. (Factor A)

2. The LKMR metapopulation is connected to the extent that genetic diversity can be naturally maintained without translocations or captive breeding. (Factor A, D, E)

3. Predation from non-native species (e.g., Burmese pythons and free-roaming pets) is low enough for LKMR to remain viable for the foreseeable future. (Factor C, D)

4. When, in addition to the above criteria, it can be demonstrated that habitat loss associated with sea level rise, development, fire suppression, lack of natural disturbance, and buttonwood encroachment are diminished or reversed such that enough suitable habitat remains in the foreseeable future for LKMR to remain viable. (Factor A, E)

Justification

The proposed delisting criteria reflect the best available and most up-to-date information on the LKMR, 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. Providing redundancy through multiple populations and sufficient habitat, and reaching demographic parameters that allow for resilient and stable populations. Since populations of many small mammals, including the LKMR, typically fluctuate, it is necessary to evaluate population demographics across multiple generations to assess true trends. Historically, LKMR occupied most if not all of the 30 islands (approximate) from Big Pine Key to Boca Chica Key, and likely Key West (DePourtales 1877, Layne 1974, Howe 1988, Lazell 1989). Resilient populations on a minimum of 13 keys (8 main, 5 backcountry) is required for long-term persistence not only to comprise the amount and diversity of habitat needed and redundancy in light of known threats, but also to maintain the LKMR's disparate genetic clades.

Criterion 2. Providing 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 also critical to counteract fragmentation and allow for natural gene flow.

Criterion 3. Providing a long-term solution to significantly reduce or eliminate the threat of predation by non-native species.

Criterion 4. Providing redundancy and resiliency through sufficient habitat that allows for stable populations, and ensuring sufficient habitat is expected to remain for long-term persistence, despite habitat changes and habitat loss projected due to sea level rise and development. The LKMR is highly susceptible to extirpations and without enough habitat of sufficient quality, populations are increasingly vulnerable to threats from non-native species, climate change, and demographic limitations (i.e., populations are too small to withstand natural levels of predation, environmental variation).

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

Rationale for Amended Recovery Criteria

The existing criteria for LKMR on page 4-165 in the MSRP (Service 1999) (https://ecos.fws.gov/docs/recovery_plan/sfl_msrp/SFL_MSRP_Species.pdf) included only downlisting criteria. With these proposed 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 LKMR 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.

LITERATURE CITED

Cove, M. V., Gardner, B., Simons, T. R., Kays, R., & O'Connell, A. F. 2018a. Free-ranging domestic cats (*Felis catus*) on public lands: estimating density, activity, and diet in the Florida Keys. Biological Invasions 20:333-344.

Cove, M. V., Gardner, B., Simons, T. R., and A.F. O'Connell. 2018b. Co-occurrence dynamics of endangered Lower Keys marsh rabbits and free-ranging domestic cats: Prey responses to an exotic predator removal program. Ecology and Evolution 8:4042-4052.

Crouse, A. L., Honeycutt, R. L., McCleery, R. A., Faulhaber, C. A., Perry, N. D., and Lopez, R. R. 2009. Population structure of the Lower Keys marsh rabbit as determined by mitochondrial DNA analysis. Journal of Wildlife Management 73:362-367.

DePourtales, L. F. 1877. Hints on the origin of the flora and fauna of the Florida Keys. American Naturalist 11:137–144.

EDDMapS. 2017. Burmese python. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at http://www.eddmaps.org/; accessed November 6, 2017 and March 8, 2018.

EDDMapS. 2018. Black and white tegu. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at http://www.eddmaps.org/; accessed November 6, 2017 and March 8, 2018.

Florida Fish and Wildlife Conservation Commission (FWC). 2017. Keys terrestrial adaptation planning: Florida Keys case study on incorporating climate change considerations into conservation planning and actions for threatened and endangered species. Unpublished draft report.

Hanslowe, E. B., J. G. Duquesnel, R. W. Snow, B. G. Falk, A. A. Yackel Adams, E. F. Metzger III, M. A. M. Collier, and R. N. Reed. 2018. Exotic predators may threaten another island ecosystem: A comprehensive assessment of python and boa reports from the Florida Keys. Management of Biological Invasions 9:369-377.

Howe, S. E. 1988. Lower Keys marsh rabbit status survey. U.S. Fish and Wildlife Service, Jacksonville Field Station, Jacksonville, Florida, USA.

Layne, J. N. 1974. The land mammals of South Florida. Pages 386–413 in P. J. Gleason, editor. Environments of South Florida: present and past. Miami Geological Society, Miami, Florida, USA.

Lazell, J. D., Jr. 1989. Wildlife of the Florida Keys: a natural history. Island Press, Washington, D.C., USA.

National Oceanic and Atmospheric Association (NOAA). 2017. Global and Regional Sea Level Rise Scenarios for the United States. NOAA Technical Report NOS CO-OPS 083. Silver Spring, MD.

Saha, A.K., Saha, S., J. Sadle, J. Jiang, M. S. Ross, R. M. Price, L. S. L. O. Sternberg, K. S. Wendelberger. 2011. Sea level rise and South Florida coastal forests. Climate Change 107:81-108.

Schmidt, J. A., McCleery, R., Seavey, J. R., Cameron Devitt, S. E., & Schmidt, P. M. (2012). Impacts of a half century of sea-level rise and development on an endangered mammal. Global Change Biology 18: 3536-3542.

U.S. Fish and Wildlife Service (USFWS). 1999. South Florida multi-species recovery plan. Atlanta, Georgia. (https://www.fws.gov/verobeach/MSRPPDFs/LowerKeysRabbit.pdf)

U.S. Fish and Wildlife Service (USFWS). 2007. Lower Keys Marsh Rabbit – Five-Year Status Review. Vero Beach, Florida. (https://ecos.fws.gov/docs/five_year_review/doc1110.pdf)