Key Largo Cotton Mouse
(Peromyscus gossypinus allapaticola)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Southeast Region
South Florida Ecological Services Office
Vero Beach, Florida

5-YEAR REVIEW
Key Largo Cotton Mouse / *Peromyscus gossypinus allapaticola*

I. GENERAL INFORMATION

A. Methodology used to complete the review: This review is based on monitoring reports, surveys, and other scientific and management information, augmented by conversations and comments from biologists familiar with the species. The review was conducted by the lead recovery biologist with the South Florida Ecological Services Office. Literature and documents used for this review are on file at the South Florida Ecological Services Office. All recommendations resulting from this review are a result of thoroughly reviewing the best available information on the Key Largo cotton mouse (KLCM). The public notice for this review was published on April 16, 2008, with a 60 day public comment period (73 FR 20702). No part of the review was contracted to an outside party. Peer review was conducted on this 5-year review (see Appendix A). Comments received were evaluated and incorporated as appropriate.

B. Reviewers
Lead Region: Southeast Region, Kelly Bibb, (404) 679-7132

Lead Field Office: South Florida Ecological Services Office, Sandra Sneckenberger, (772) 562-3909

C. Background

1. FR Notice citation announcing initiation of this review: 73 FR 20702 (April 16, 2008)

2. Species status: Stable (Recovery Data Call 2008). Subspecies continues to be affected by multiple threats, such as population fragmentation, small population size, and predation, but 2007 data (most recent available) illustrated an increasing trend through the year.

3. Recovery achieved: 2 (26 to 50 percent recovery objectives achieved)

4. Listing history
Original Listing
FR notice: 49 FR 34504
Date listed: August 31, 1984
Entity listed: Subspecies
Classification: Endangered

5. Associated rulemakings: None.

6. Review: The Service conducted a 5-year review for the KLCM in 1991 (56 FR 56882). In this review, the status of many species was simultaneously evaluated with

no in-depth assessment of the five factors or threats as they pertain to the individual species. The notice stated that the Service was seeking any new or additional information reflecting the necessity of a change in the status of the species under review. The notice indicated that if significant data were available warranting a change in a species' classification, the Service would propose a rule to modify the species' status. No change in the KLCM listing classification was found to be warranted.

Recovery Plan: 1999
Recovery Data Calls: 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008

7. Species' Recovery Priority Number at start of review (48 FR 43098): 3C. The KLCM is assigned a recovery priority of 3C because the degree of threat to its persistence is high, and its potential for recovery is great if threats can be eliminated or minimized. Recovery of the KLCM is in conflict with economic activities.

8. Recovery Plan:
Name of plan: South Florida Multi-species Recovery Plan (MSRP)
Date issued: May 18, 1999

II. REVIEW ANALYSIS

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

1. Is the species under review listed as a DPS? No.

2. Is there relevant new information that would lead you to consider listing this species as a DPS in accordance with the 1996 policy? No.

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria? The recovery plan (Service 1999) criteria to reclassify the KLCM from endangered to threatened provide constructive qualitative criteria, but contain elements that are neither objective nor measurable. There are no criteria for delisting. Revision of the recovery plan and recovery criteria is recommended.

2. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the five listing factors are addressed by that criterion. If any of the five listing factors are not relevant to this species, please note that here. The criteria included in the approved recovery plan (Service 1999) to reclassify the KLCM from endangered to threatened are:

1) further loss, fragmentation, or degradation of suitable, occupied habitat has been prevented;
2) domestic predators and competitors have been reduced by 80 percent;

3) all suitable, occupied habitat on priority acquisition lists on Key Largo is protected either through land acquisition or cooperative agreements;
4) tropical hardwood hammocks that form the habitat of the Key largo cotton mouse must be managed on protected lands to eliminate trash and control exotics;
5) potential habitat on these protected lands is restored or rehabilitated for the Key Largo cotton mouse;
6) stable (rate of increase equal or greater than 0.0 as a 3-year running average for 6 years) populations of the Key Largo cotton mouse are distributed throughout north Key Largo; and
7) three additional, stable, populations have been established elsewhere within the historic range.

Habitat degradation and loss has continued and threats from non-native animals and invasive exotic plants have increased. Ongoing projects including predator and invasive species management are in place to help minimize such threats. A survey design has recently been developed to properly monitor KLCM, however, the data required to establish population trends have not been collected.

C. Updated Information and Current Species Status

1. Biology and Habitat

Information regarding KLCM biology and habitat can be found within the recovery plan (Service 1999). A summary, with the addition of updated information, is provided below.

a. Abundance, population trends, demographic features, or demographic trends: Long intervals (5 to 10+ years) between monitoring events and the use of various study designs and estimation techniques make KLCM population trends difficult to interpret (Barbour and Humphrey 1982; Humphrey 1988; Frank et al. 1997; Florida Fish and Wildlife Conservation Commission [FWC] 2005). Density estimates resulting from disparate methods and locations surveyed range from 6.2 KLCM per hectare (Frank et al. 1997) to 21.2 KLCM per hectare (Humphrey 1988), and demonstrate no clear population trend. Most recent population estimates (2007) yield approximately 17,000 individuals and an increasing trend from April to December (Castleberry et al. 2008).

The KLCM breeds throughout the year, producing two to three litters per year with an average of four young per litter (Brown 1978). The average life expectancy has been reported as approximately 5 months (Service 1999), but there is evidence suggesting that this may be an underestimate (Greene 2008).

b. Genetics, genetic variation, or trends in genetic variation: Information concerning present levels of genetic diversity and variation in KLCM is not

available. A small sample of genetic material has recently been collected from approximately 40 individuals. These samples have not been analyzed.

c. Taxonomic classification or changes in nomenclature: The KLCM is an insular subspecies of the cotton mouse (*Peromyscus gossypinus*) (Schwartz 1952). There have been no changes in the accepted taxonomy, which is considered valid (Integrated Taxonomic Information System 2008).

d. Spatial distribution, trends in spatial distribution, or historic range: Historically, the KLCM occurred throughout the length of Key Largo south nearly to Tavernier (Osgood 1909; Barbour and Humphrey 1982). Their distribution is now patchy, congruous with the loss and fragmentation of hardwood hammock vegetation (FWC 2005; Castleberry et al. 2008). The present range of the KLCM is constricted to the northern one-third of Key Largo where large tracts of contiguous tropical hardwood hammock occur, representing about one-half of their original distribution (Barbour and Humphrey 1982).

Residential and commercial development is considered the cause of extirpation of KLCM south of the intersection of U.S. 1 and C.R. 905 (Brown 1978). Approximately 880 hectares (ha) of suitable KLCM habitat remains (Humphrey 1988; Service 1999; FWC 2005) and individuals are found almost exclusively within public lands (Crocodile Lake National Wildlife Refuge and Dagny Johnson Key Largo Hammock Botanical State Park) (FWC 2005). A few private tracts adjacent to public lands contain suitable habitat.

A translocation project was initiated on Lignumvitae Key (outside the historic range) in 1970, during which 14 individuals were released (Brown and Williams 1971). One KLCM was documented on the Key in 1977, but the population was considered extirpated by 1990 (Humphrey 1992; Duquesnel 1994; Frank et al. 1997). A trapping survey was conducted on the Key in 2007, and yielded no captures of KLCM (Greene 2007).

e. Habitat or ecosystem conditions: The KLCM largely depends upon the composition, structure, and quality of the remaining tropical hardwood hammock habitat (Service 1973; Brown 1978; Barbour and Humphrey 1982), but is also known to use a variety of upland forest habitats (Goodyear 1985). Much of the original tropical hardwood hammock on Key Largo was cleared in the past for development or agriculture. The southern portion of Key Largo is nearly completely developed, and the only remaining large contiguous tract of tropical hardwood hammock occurs on the northern half of Key Largo.

Unnatural, patchy incidences of disturbance have resulted in a mosaic of various patch ages that together represent habitat of inferior quality to the KLCM, however, this mouse may be less specialized than its hardwood hammock cohabitants, like the Key Largo woodrat (*Neotoma floridana*

smalli). Beyond using a variety of upland habitats, KLCM have been documented in adjacent coastal strand (Humphrey 1988) and recently burned fern-dominated areas (Goodyear 1985). KLCM abundance has been associated with medium-old tropical hardwood hammock, smaller fragment sizes, and areas where non-native vegetation is absent (Keith and Gaines 2002).

Approximately 1,011 ha of tropical hardwood hammock remain in north Key Largo; approximately 880 ha are protected within the boundaries of Crocodile Lake National Wildlife Refuge and Dagny Johnson Key Largo Hammock Botanical State Park (Service 2003). Crocodile Lake National Wildlife Refuge and Dagny Johnson Key Largo Hammock Botanical State Park were acquired in 1980 and 1982, respectively. Since initial acquisition, both sites have been managed to maintain and restore the native tropical hardwood hammock vegetation on which the KLCM depends, and have continued acquisition of remaining hammock habitat on north Key Largo. Many tracts on these sites were cleared for development or agriculture earlier this century, but hammock vegetation has returned to many of these previously cleared sites. The remaining forest is now composed of a variety of successional stages of tropical hardwood hammock vegetation, reflecting the time since and extent of disturbance.

Much of the remaining (unprotected) 131 ha consists of private lands cleared several decades ago and abandoned. Successful regrowth of the hammock, and consequently the suitability of the habitat to KLCM, may vary among these sites.

2. Five-Factor Analysis

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

Habitat loss, fragmentation, degradation. The present range of the KLCM is constricted to the northern one-third of Key Largo, representing about one-half of their original distribution (Barbour and Humphrey 1982). Approximately 880 hectares (ha) of suitable KLCM habitat remains (Humphrey 1988; Service 1999; FWC 2005) and individuals are found almost exclusively within public lands (Crocodile Lake National Wildlife Refuge and Dagny Johnson Key Largo Hammock Botanical State Park) (FWC 2005). The few private tracts adjacent to public lands that remain are likely immune from urbanization due to restrictive land use regulations.

Historically, areas where KLCM were extirpated would be recolonized as population densities increased and dispersal occurred from adjacent populated areas. As agriculture and urbanization has fragmented the landscape, KLCM can no longer recolonize these areas as they did in the past. The KLCM requires a minimum habitat size for daily activities; barriers caused by habitat

loss and fragmentation compromise their ability to disperse, obtain food and nest site resources, locate a mate, and carry out natural life history behaviors. The ease with which resources can be attained directly affects survival rates, fecundity, juvenile recruitment, and ultimately, population growth rate.

Isolation of small populations also reduces or precludes gene flow between populations and can result in the loss of genetic diversity. Demographic factors such as predation, diseases, and competition are intensified in small, isolated populations which may be rapidly extirpated by these pressures. Especially when coupled with events such as tropical storms, reduced food availability, and/or reduced reproductive success, isolated populations may experience severe declines or extirpation (Caughley and Gunn 1996).

The scope and severity of this threat is high. This threat also increases the severity of all other threats.

Invasive exotic plants (IEP). The dominant IEP impacting KLWR habitat are brazilian pepper (*Schinus terebinthifolius*), australian pine (*Casuarina equisetifolia*), and lead tree (*Leucaena leucocephala*). A relationship between KLCM occurrence and the lack of IEP has been identified (Keith and Gaines 2002). Significant resources have been applied to IEP control in the Keys. The Service carries out an IEP control program throughout Crocodile Lake National Wildlife Refuge. Dagny Johnson Key Largo Hammock Botanical State Park is a member of the Florida Keys Regional Working Group that has developed a control plan for IEP on public lands including the state park. The Nature Conservancy and the Florida Keys Invasive Exotics Task Force also conduct complementary programs on other public and private lands. IEP currently do not appear to be a significant threat to KLCM habitat, and the severity of this threat is moderate.

b. Overutilization for commercial, recreational, scientific, or educational purposes: Overutilization is not known to be a threat at this time. Although scientific research involves trapping, marking (i.e., ear tags, radio collars), and taking genetic samples (i.e., removal of tail tips to obtain a blood sample), research has been sporadic and few KLCM have been reported to have died as a result of scientific research. There have been two instances where fire ants (*Solenopsis invicta*) have been found scavenging on KLCM carcasses within a trap (despite the use of Sevin dust). Necropsies of these individuals discovered serious illnesses (i.e., pulmonary congestion, parasites) and determined the fire ant attacks as post mortem (Thomas 2002). One other instance occurred with a KLCM found dead in a trap with no known cause (Muiznieks 2005).

c. Disease or predation:

Disease. Disease is not believed to be a present threat to KLCM. While there are a wide variety of diseases and parasites that might infect the KLCM, there is no evidence or cause to suspect a significant parasite or other disease-

causing organism is impacting the KLCM. However, due to the KLCM's small population size and restricted range, parasite and disease surveillance efforts are warranted to properly evaluate this threat.

Predation. The KLCM has a number of natural predators: raptors, corn snakes (*Elaphe guttata*), diamondback rattlesnakes (*Crotalus adamanteus*), Florida black racers (*Coluber constrictor priapus*), Keys rat snakes (*Elaphe obsolete deckerti*), owls, and possibly raccoons (*Procyon lotor*). Non-native predators include free-roaming domestic cats (*Felis catus*), fire ants, and may include young Burmese pythons (*Python molurus bivitattus*).

A large feral cat colony is operated adjacent to the Dagny Johnson Key Largo Hammocks State Botanical Site, yet there have not been comprehensive or continuous free-roaming cat control efforts in place within the range of the KLCM. Limited cat control has been undertaken in the past on Crocodile Lake National Wildlife Refuge and Dagny Johnson Key Largo Hammocks State Botanical State Park. However, it was usually instituted on a small scale, and only targeted a few individual cats. To aid recovery efforts of both KLCM and Key Largo woodrats, the Service funded a successful larger-scale feral cat control effort that was conducted in the winter of 2004 (USDA 2004). Raccoons, while a natural predator, are attracted to areas with feral cat colonies due to regular feedings. This factor, in addition to the general attraction of raccoons to garbage, has likely led to elevated densities of raccoons in north Key Largo (USDA 2004). The Service funded an additional control effort in 2006, but it was not as successful at the 2004 efforts.

Predation of KLCM where recruitment is sufficient and suitable habitat is available is not a concern. Conversely, increased predation pressure on isolated populations from natural and non-native predators can have a substantial impact. In light of the increased level of native predators (USDA 2004), the addition of non-native predators, and the direct relation of this threat to mortality, the severity and scope of this threat are high.

d. Inadequacy of existing regulatory mechanisms:
Federal Emergency Management Agency (FEMA) flood insurance consultation. On August 25, 1994, the United States District Court for the Southern District of Florida directed FEMA to consult with the Service to determine whether implementation of the National Flood Insurance Program in Monroe County was likely to jeopardize the continued existence of federally listed species (Case No. 90-10037-CIV-MOORE). In 2003, the Service issued a jeopardy biological opinion with reasonable and prudent alternatives that required Monroe County to consult with the Service before issuing building permits in suitable habitat for listed species. Thus, in recent years, the Service provided technical assistance on pertinent projects (virtually all building applications on private parcels throughout the range of the KLCM, excluding Coastal Barrier Resource Act zones). On September 9,

2005, the Court ordered an injunction against FEMA issuing flood insurance on any new developments in suitable habitat of federally listed species, and required the Service to submit a revised biological opinion within 9 months (deadline later extended to August 9, 2006). Because the Court ruled that the 2003 reasonable and prudent alternatives were invalid, Monroe County was no longer required to consult with the Service before issuing building permits in suitable habitat and the Service suspended technical assistance on building permit applications.

The Service finalized its reanalysis of the National Flood Insurance Program in Monroe County, and provided a biological opinion to the Court on August 8, 2006 (Service 2006). The biological opinion provides a revised strategy for implementing regulatory actions pertaining to threatened and endangered species. This strategy includes clarification of FEMA's oversight role and a more comprehensive strategy of evaluating potential impacts. The latter incorporates a lot-by-lot assessment of potential impacts that takes into account the limitations on development imposed by the County's Rate of Growth Ordinance (ROGO) system with its new designations of geographical tiers. In the biological opinion, the Service concluded that continued administration of the National Flood Insurance Program in the Keys was not likely to jeopardize the continued existence of the KLCM. The Court will determine whether to accept the biological opinion and whether to lift the prohibition on FEMA's issuance of flood insurance in Monroe County.

State and county regulations. The KLCM is listed by FWC as endangered (Chapter 39-27, Florida Administrative Code). This legislation prohibits take, except under permit, but does not provide any direct habitat protection. Wildlife habitat is protected on FWC wildlife management areas and wildlife environmental areas according to Florida Administrative Code 68A-15.004. Florida Park Service regulations prohibit take of specimens and destruction of vegetation (i.e., habitat) on park property without a permit.

The State of Florida has compelled the Monroe County Board of Commissioners to strengthen controls on land use since at least 1975 when the Keys were designated an Area of Critical State Concern. A critical regulatory factor is the level of service on U.S. Highway 1 as it relates to hurricane evacuation time. The County developed a ROGO that, as of March 2006, incorporated a land tier system that specifically designates areas of native habitat for listed species, including the KLCM. The process made it more costly to destroy habitat and now discourages development in unfragmented habitat, steers available permit allocations to disturbed areas that are poor habitat for native fauna, and implements a land acquisition program for areas with native vegetation, including KLCM habitat.

Monroe County's Comprehensive Land Use Plan (March 2007 http://www.monroecounty-fl.gov/pages/MonroeCoFL_Planning/FutureLand)

states that development within hammock "shall be reviewed to ensure the functional integrity of the entire hammock" and development proposals within this habitat type "shall identify the extent to which the area is habitat for threatened or endangered species" and adverse impacts to "the functional integrity of the hammock or pineland in which development is to be undertaken, the developer shall provide for mitigation in an amount greater than the area disturbed in the form of replanting disturbed areas with native species or by the acquisition and preservation, including donations, of land containing comparable quality and character of vegetation as the area disturbed."

Pressure to develop remaining residential and commercial land within the range of the KLCM continues. However, development is subject to regulatory oversight by Monroe County (e.g., the ROGO), the State (e.g., designated an Area of Critical State Concern), and the Service (e.g., Endangered Species Act consultation, presumably including continued consultation with FEMA regarding administration of the National Flood Insurance Program). Regulatory mechanisms have helped reduce the threat of further habitat loss in north Key Largo.

e. Other natural or manmade factors affecting its continued existence: *Competitors.* The presence of competitors, particularly non-native species, is a significant influence on habitat suitability. Black rats (*Rattus rattus*) are believed to be the primary cause of extinctions of two other cotton mouse subspecies (Service 1999), and have been shown to cause KLCM to reduce their home range size (Sasso and Gaines 2002). In the past, black rats were captured on hammock KLCM study sites (Hersh 1981; Frank et al. 1997) and thought to be a potential competitor, but subsequent trapping sessions have yielded very few captures of black or Norway rats (*Rattus norvegicus*) (Barbour and Humphrey 1982; Goodyear 1985).

Gambian giant pouch rats (*Cricetomys gambianus*), the largest murids, were unintentionally released in Marathon, Florida in 1999. Possible sightings on Key Largo have not been confirmed with trapping (Engeman et al. 2006), but due to their large size, high fecundity, and similar habitat requirements, their impact on KLCM could be extensive. An eradication program initiated in Marathon appears to have been successful, though the pouch rats could emigrate by several means (Engeman et al. 2006). Furthermore, the hurricanes of 2005 may have assisted in their dispersal to nearby islands. The severity of this threat is high, while the scope remains moderate.

Hurricanes. Hurricanes influence vegetational succession in the Florida Keys. Undisturbed hammocks are presumably more resistant to storms than hammocks that have been fragmented or have had surrounding mangrove and transitional vegetation removed. Damage to habitat from past hurricanes has included windshear, significant canopy loss, uprooting of large trees,

understory damage, and significant soil disturbance. Extensive damage represents habitat loss to KLCM, but some disturbance serves to open habitat and allow for greater plant diversity. The severity and scope of this threat are variable and stochastic.

Sea level rise. The long-term record at Key West (approximately 100 miles southwest of Key Largo) shows that sea level rose approximately 8.76 inches (22.4 cm) over the last 100 years (National Oceanographic and Atmospheric Administration [NOAA] 2008). Sea level rise has been shown to affect conversions of upland communities with low soil and moisture salinities to communities comprised of more salt tolerant plant species and higher soil and groundwater salinities (Ross et al. 1994). This phenomenon may result in the loss of suitable KLCM habitat through inundation or vegetative species composition changes. The general effects of sea level rise within the range of the KLCM will depend upon the rate of rise and landform topography. However, the specific effects across the landscape will be affected by complex interactions between geomorphology, tides, and fluctuations in energy and matter. These effects have yet to be simulated and projected for the range of the KLCM, but plant community changes alone could have widespread, long-term impacts to KLCM. Human developments will also likely be significant factors influencing whether natural communities can move and persist (IPCC 2008). It is not known whether KLCM habitat is already impacted by sea level rise. Future effects have not been simulated and projected in detail for the range of the KLCM.

D. Synthesis - No change is recommended to the listing classification of the endangered KLCM. The degree of threat to its persistence remains high. Its potential for recovery is considerable if threats can be eliminated or minimized.

Impacts and potential threats to the KLCM and its habitat have increased in the recent past from non-native predators and competitors. With these additional stresses, KLCM habitat is in poor condition. Specifically, about 880 ha of KLCM habitat is protected on north Key Largo. While trapping data from 2007 suggests a stable population, no information exists to infer a long-term trend.

Regulatory mechanisms are in place to track impacts to KLCM habitat and aid in minimizing impacts from development on public lands. However, the subspecies' minimum requirements for habitat connectivity, food and nest site resources, and other factors may already be at risk. Free-roaming cat control programs have occasionally been in place on public lands since 2002, and non-native predators continue to pose a major threat.

III. RESULTS

A. Recommended Classification:

__X_ **No change is needed**

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Old and abandoned roads bisecting hammock habitat should be restored to native vegetation. Research may be warranted to develop restoration techniques effective in this unique environment.
- The 1999 Recovery Plan should be revised and updated to reflect the current status and threats to the KLCM, and recovery criteria, objectives, and actions should be revised.
- Genetic analyses should be conducted to provide further insight into the KLCM population. Information on the genetic diversity of the population and the genetic makeup of individual KLCM will provide insight into the current status of the population.
- Opportunities to convey the importance of hammock habitat to the public should be sought and pursued. Interpretive signs could be designed and distributed to public land managers on north Key Largo. In addition, an outreach/education program focused on the threats free-roaming cats and other pets pose to wildlife should be developed. Relationships with the local government should be improved to assist in these efforts.
- Appropriate parcels for land acquisition should be identified using current knowledge of KLCM movements and habitat use.
- A long-term effective monitoring plan should be developed and implemented. The use of population viability analysis tools should be considered, if deemed appropriate.
- Research focused on determining the relative abundance of KLCM predators and competitors, their influence on KLCM behavior, and their effect on survival and recruitment rates is warranted. Management strategies and/or more comprehensive predator / competitor control should be investigated if appropriate.

V. REFERENCES

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of the
Key Largo cotton mouse *(Peromyscus gossypinus allapaticola)*

Current Classification __Endangered___
Recommendation resulting from the 5-Year Review

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X_ No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable ____

Review Conducted By __Sandra Sneckenberger, South Florida Field Office___

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 2/18/09

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.

REGIONAL OFFICE APPROVAL:

The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.

Lead Regional Director, Fish and Wildlife Service

Approve _____ Date 3/26/09

The Lead Region must ensure that other regions within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. If a change in classification is recommended, written concurrence from other regions is required.

Cooperating Regional Director, Fish and Wildlife Service

_____Concur _____ Do Not Concur

Signature_____Date_____

Summary of peer review for the 5-year review of Key Largo cotton mouse *(Peromyscus gossypinus allapaticola)*

A. Peer Review Method: Recommendations for peer reviewers were solicited from the Florida Fish and Wildlife Conservation Commission, a university professor, and a private consultant. Peer reviewers were selected by the Service. Three peer reviewers were asked to participate in this review. Individual responses were requested and received from all three reviewers.

B. Peer Review Charge: See attached guidance.

C. Summary of Peer Review Comments/Report
One reviewer concurred with the conclusion that long-term trends cannot be determined based on the data available.

One reviewer suggested the addition of clarifying language with respect to the amount of suitable habitat available.

One reviewer felt the status review provided a well-prepared summary of the research and conservation threats, and recommended future actions that were consistent with data presented in the review.

One reviewer recommended that the revision of the recovery plan should be a high priority.

One reviewer agreed strongly that lands should be acquired where appropriate to reduce fragmentation of the existing population, abandoned roads bisecting hammock habitat should be restored, and the role of predators and competitors should be investigated further. The reviewer stated this information would improve the Service's ability to manage the species more effectively.

One reviewer recommended implementing further work to reduce anthropogenic disturbance in important KLCM habitat.

One reviewer suggested that local government cooperation should be maintained or improved to better achieve conservation efforts and enforce existing regulations.

One reviewer suggested that Lignumvitae Key be revisited and resurveyed for KLCM. The reviewer added that this Key could be an introduction site in the future.

One reviewer commented on the reference made to recently burned areas, thinking that they may have actually occurred over 25 years ago.

Two reviewers included minor editorial comments in their review.

One reviewer suggested the inclusion of pythons in the list of non-native predators.

One reviewer was concerned about the reported success of a raccoon control effort with respect to how success was measured. This reviewer added that people have been observed dumping raccoons at Crocodile Lake NWR, and education and enforcement is warranted to curtail this activity.

One reviewer felt that a unified theme as to the actual level of threat to KLCM was lacking, and disagreed with the reviews assessment of threats. This reviewer recommended the use of a PVA to reevaluate the actual level of threat to the species.

One reviewer felt that the remaining threats to the KLCM are small population issues that will require special habitat and species management.

One reviewer recommended the establishment of management objectives for KLCM, particularly the identification or determination of optimal KLCM habitat.

One reviewer recommended the development of research priorities for the KLCM so that effective projects can be designed to direct management actions.

One reviewer recommended the development of a long-term monitoring plan for KLCM.

D. Response to Peer Review:
Minor editorial comments were incorporated into the document where appropriate.

The mention of the 790 ha of hardwood hammock (via GIS analysis) remaining was removed to improve clarity with respect to the habitat available to the KLCM.

Recommendations for future actions were modified to include further tasks or actions suggested by the reviewers.

Information regarding a recent survey of Lignumvitae Key was added. This island would likely be considered along with others as a potential introduction site if a translocation of KLCM is planned in the future.

The reference to the burned area was not edited. The point of this sentence is that KLCM used recently burned habitat.

Burmese pythons were added to the list of predators as a potential predator.

The predator control effort described as successful (USDA 2004), referred to the control of cats, not raccoons. Raccoon densities were deemed as an outstanding issue in the report. The language in the review addressing this was modified to better clarify the content of the report.

Regarding comments on the threat assessment, little research has been conducted on the KLCM. Consequently, while we are able to identify threats, comparing and evaluating levels of threats is difficult. Given enough species information, a PVA for the KLCM may be valuable tool and was added to the recommendations.

Guidance for Peer Reviewers of Five-Year Status Reviews

U.S. Fish and Wildlife Service, South Florida Ecological Services Office

February 20, 2007

As a peer reviewer, you are asked to adhere to the following guidance to ensure your review complies with U.S. Fish and Wildlife Service (Service) policy.

Peer reviewers should:

1. Review all materials provided by the Service.

2. Identify, review, and provide other relevant data apparently not used by the Service.

3. Not provide recommendations on the Endangered Species Act classification (e.g., endangered, threatened) of the species.

4. Provide written comments on:
   - Validity of any models, data, or analyses used or relied on in the review.
   - Adequacy of the data (e.g., are the data sufficient to support the biological conclusions reached). If data are inadequate, identify additional data or studies that are needed to adequately justify biological conclusions.
   - Oversights, omissions, and inconsistencies.
   - Reasonableness of judgments made from the scientific evidence.
   - Scientific uncertainties by ensuring that they are clearly identified and characterized, and that potential implications of uncertainties for the technical conclusions drawn are clear.
   - Strengths and limitation of the overall product.

5. Keep in mind the requirement that the Service must use the best available scientific data in determining the species' status. This does not mean the Service must have statistically significant data on population trends or data from all known populations.

All peer reviews and comments will be public documents and portions may be incorporated verbatim into the Service's final decision document with appropriate credit given to the author of the review.

Questions regarding this guidance, the peer review process, or other aspects of the Service's recovery planning process should be referred to Paula Halupa, Acting Endangered Species Supervisor, South Florida Ecological Services Office, at 772-562-3909, extension 257, email: Paula_Halupa@fws.gov.