Rice rat
(Oryzomys palustris natator)

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

Rice rat / *Oryzomys palustris natator*

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 personal communications from biologists familiar with the species. The review was conducted by the lead recovery biologist for the species 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 rice rat. The public notice for this review was published on April 26, 2007, with a 60 day public comment period. No comments were received from the public. Comments and suggestions regarding the review were received from peer reviews from outside the Service (see Appendix A). We incorporated comments as appropriate in this review. No part of the review was contracted to an outside party.

B. Reviewers
Lead Region: Southeast Region, Kelly Bibb, 404-679-7132
Lead Field Office: South Florida Ecological Services Office, Phillip Hughes, 305-872-2753

C. Background

1. FR Notice citation announcing initiation of this review: April 26, 2007, FR 72 20866.

2. Species status: Stable, 2007 Recovery Data Call. We concluded that long-term trends were stable based on an abundance and distribution study conducted between 2004 and 2005 (Perry 2006). In addition to range-wide surveys, that study synthesized all previously published and unpublished data pertaining to rice rat distribution and abundance. The findings indicated that the rice rat's rangewide status has been stable over the last 10 to 20 years (Perry 2006). We considered threat levels in Factors A, C, D, and E to be continuing at the same level relative to the previous year. We considered threats in Factor B to be lacking as of 2007. We detected no new threats.

3. Recovery achieved: 1 (0-25% of recovery objectives achieved) (2007 Recovery Data Call)

4. Listing history
Original Listing
FR notice: 56 FR 19809
Date listed: April 30, 1991
Entity listed: Subspecies
Classification: Endangered

5. Associated rulemakings: Critical habitat was designated August 31, 1993 (58 FR 46030).

6. Review History:
Final Recovery Plan: 1999
Recovery Data Call: 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007

7. Species' Recovery Priority Number at start of review (48 FR 43098): 3C (3 = high degree of threat, low to moderate recovery potential; C = there is some degree of conflict between the species recovery and economic development)

8. Recovery Plan or Outline
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? No. The species has a final approved recovery plan, but the criteria need to be revised based on new information for this species.

2. Adequacy of recovery criteria:

a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat? No

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)? Yes.

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 recovery objective is to reclassify the rice rat to threatened by protecting, managing, and restoring its habitat in the Lower Keys; increasing the size of its population; and establishing populations on the periphery of its range. The recovery criteria to downlist are as follows:

1. Further loss, fragmentation, or degradation of suitable, occupied habitat in the Lower Keys has been prevented.

Threats from direct habitat loss as a result of development have been significantly curtailed over the last 20 years in habitats occupied by the rice rat (Lopez 2001, Monroe County et al. 2006, Service 2006). Habitat destruction has been greatly reduced, particularly in wetlands. This has occurred due to cumulative effects of regulatory constraints and land acquisition for conservation purposes. However, this criterion has not been accomplished entirely. The intensity and frequency of salt water incursions due to storm surges and sea level rise have increased (Ross et al. 1994, Bradley 2006), presumably resulting in alteration of rice rat habitat in portions of the range. However, it is not yet known how much habitat is lost (to open water or excessive tidal flooding) relative to how much new mangrove habitat is created. This criterion addresses factors A and C.

2. Native and non-native nuisance species have been reduced by 80 percent.

This appears to have been attained, or nearly so, for invasive exotic plants (IEP). Although IEP mapping projects have been undertaken, continuous tracking of efforts and results in terms of IEP populations or areas covered appears to be unavailable, thus specific percentages cannot be calculated. Throughout most of the range, IEP do not currently appear to be a significant threat in rice rat habitat. Domestic cats (*Felis catus*) remain a potential threat to rice rats in portions of the range. We do not know to what extent rice rats are actually vulnerable to cats on islands where they overlap. Cats have not yet been reduced by 80 percent. The National Key Deer Refuge (NKDR) initiated an Integrated Predator Management Planning process in 2007. Goodyear (1992) described niche overlap between rice rats and black rats (*Rattus rattus*), and suggested that competition is present, with black rats the stronger competitor. This criterion has not been attained regarding black rats. This criterion addresses factors A and E.

3. All suitable, occupied habitat on priority acquisition lists for the Lower Keys is protected either through land acquisition or cooperative agreements.

This has not been accomplished entirely, although significant progress has been made. Within the range of the rice rat, most of the remaining private parcels with native habitat, including rice rat habitat, are potentially eligible for fee-simple acquisition, contingent upon availability of funds and willing sellers. This is predominantly due to the Florida Forever Program administered by the Florida

Department of Environmental Protection (FDEP). NKDR, Monroe County, and private conservation organizations administer additional, smaller acquisition programs. Acquisitions by Monroe County include mitigation parcels derived according to Rate of Growth Ordinances (ROGO), and anticipated under the Big Pine Key-No Name Key Habitat Conservation Plan (HCP) (Monroe County et al. 2006). Additionally, Monroe County ordinances virtually preclude development in the supratidal habitats that rice rats inhabit (see Threat Factor D, below). This criterion addresses factor A.

4. The mangrove and saltmarsh habitat which forms the habitat for the silver rice rat are managed, restored, or rehabilitated on protected lands.

This has not been accomplished entirely, although significant progress has been made. IEP are largely absent from rice rat habitat or under active control projects on protected lands. Over the last 25, the Keys Environmental Restoration Fund (KERF) and collaborators have undertaken a variety of significant projects that included benefits to rice rat habitat (Hobbs et al. 2006). Over this period, habitat conditions have gradually improved due to specific rehabilitation projects or simply the cessation of actions that cause disturbance. However, the significance of threats from lingering mosquito ditch canals, historical fragmentation, and hurricanes remains largely unknown. This criterion addresses factor A.

5. Stable populations of the silver rice rat are distributed throughout its historic range (These populations will be considered demographically stable when they exhibit a stable age structure and have a rate of increase (r) equal to or greater than 0.0 as a 3-year running average for six years).

We believe that stable populations of the silver rice rat are distributed throughout the historic range. The geographic extent of the rice rat has remained stable over the last 10 years and possibly over the last 20 years (Perry 2006). Rice rats were not extirpated on any keys or other known sub-areas within the range. Rice rat abundance also appears to have remained stable over the last decade (Perry 2006). Indices of abundance (trap success and estimates of minimum known alive) values during the last decade are actually higher than were results from earlier efforts. While differing methodologies likely confound some of those comparisons, available evidence strongly indicates that abundance has not declined. Additionally, trap results (1997 – 2005) for rice rats and a review of the literature pertaining to marsh rice rats on the mainland indicate that rice rat densities may be more similar to that of mainland marsh rice rats than previously thought. In other words, when the rice rat was listed, it was perceived to exist at lower densities than may have been the case, particularly in comparison to mainland populations of marsh rice rat.

We do not know whether the quantitative measures for this criterion have been attained. We believe that the rice rat has exhibited general stability in abundance and distribution over at least the last decade. We are uncertain as to whether a stable age structure for six years is a valid metric to ensure whether the criterion has been obtained. This criterion addresses factors A through E.

6. Three additional, stable populations have been established along the periphery of the historic range of the silver rice rat.

This has not been accomplished. This criterion addresses factors A through E.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. 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), or demographic trends: A rangewide survey of abundance and distribution was conducted between 2004 and 2005 (Perry 2006). Results of that study were compared to historical data (1984 – 2000), which included previously unpublished data from Service personnel collected between 1997 and 2000. Some of the trapping grids (n = 4) in the 2004 – 2005 study replicated surveys (traps, trapping grid layout, and specific location) that were conducted between 1997 and 2000. Perry (2006) noted that he conducted additional field work in 2006. However, those data were neither fully documented in Perry (2006) nor otherwise conveyed to the Service.

On keys that had previously been determined to be occupied by rice rats, trap success (rice rat trap events/trap-night effort) was high in the 2004 – 2005 study, and no extirpations were documented (Perry 2006). Trap success in 2004 – 2005 was higher than in surveys conducted before 1997. Comparing overall annual trap success in later periods (1997 – 2005) to historical data from earlier periods (1984 – 1996), trap success and rice rat abundance appeared to be higher in the later period (Perry 2006). In 1996, the highest abundance of rice rats was estimated (based on Minimum Known Alive [MNA] indices) at 2.3/hectare (ha) (5.7/acre). From 1997 to 2005, the average MNA was 8.7/ha (SE = 4.5, n = 4) (21.5/acre). However, methods used in some of the earlier studies were not explicitly documented, so it is also possible that lower trap success and other indications of low abundance in the earlier periods were due to different methodologies in those studies (Perry 2006). Alternatively, abundance was actually lower in the pre-1997 studies (Perry 2006). Perry (2006) concluded that the rice rat "population has remained stable throughout its known range for the past 10 years".

Perry (2006) summarized how previous authors characterized rice rat populations. Previous authors reported that rice rat densities in the Keys were lower than those of marsh rice rats (*Oryzomys palustris*) on the mainland. However, MNA estimates reported in studies of mainland populations averaged 11.1/ha (SE = 2.5, n = 4 studies) (27.4/acre), which was similar to results from studies of rice rats in the Keys (8.7/ha [(SE = 4.5, *n* = 4]) (21.5/acre). Additionally, trap success in the Keys studies (7.8 % [SE = 2.9, n = 4]) was higher than that reported in the literature for mainland studies (5.6 % [SE = 1.2, n = 3]). Although the difference between these values were not tested because of the small sample sizes, Perry (2006) concluded that, contrary to earlier reports, available evidence does not indicate that rice rats occur at lower densities than the mainland subspecies. Perry (2006) also noted that the mainland study that produced the highest density estimate did not include estimates of edge effect. Accordingly, the authors of that study (Smith and Vrieze 1979) reported that their values for marsh rice rat density "may be overestimates and not directly comparable to other population studies on the species."

Earlier studies generally considered rice rats to exhibit lower productivity and higher survivorship, and to be "in a state of overall decline" (Perry 2006). Perry (2006) argued that earlier conclusions about rice rat population dynamics were "based on a paucity of data, collected during sporadic, unsystematic, and often unrepeatable efforts". Perry (2006) did not assess productivity or survivorship.

Perry (2006) concluded that rice rat populations and range appear to be stable (at least over the decade, 1997 – 2006), and that densities are likely similar to those of marsh rice rats on the mainland. His findings indicate that, compared to mainland populations, rice rat abundance as of 1984 – 1996 was not as low as generally perceived (or subsequently increased to mainland-comparable levels), and that the mainland-comparable abundance of rice rats in the Keys was maintained (or had been attained) as of 1997 – 2006.

Wang et al. (2005) concluded that a very recent bottleneck had occurred and thus were "consistent with reports of recent population declines". Wang et al. (2005) conducted an analysis of genetic diversity in the rice rat based on six microsatellite loci in 18 individuals from Saddlebunch Key. Compared to the Everglades population, allelic richness (the number of alleles) and Nei's index of gene diversity (H_E) were significantly lower in the Saddlebunch Key sample, whereas observed heterozygosity (H_O) did not differ among areas. Wang et al. (2005) used the program BOTTLENECK to assess for a bottleneck (reduction in effective population size, N_e). This program provided a Wilcoxon sign-rank test and a graphical method to assess for a bottleneck. The Wilcoxon test assessed whether a significant number of loci exhibited excess heterozygosity. A population that has experienced a bottleneck is "expected to have excess heterozygosity (H_E) relative to that expected under mutation-drift equilibrium . . . because allelic richness is lost at a significantly faster rate than heterozygosity after a population reduction". The graphical approach involved plotting the distribution of alleles according to frequency class. By this method, a bottleneck would be suggested by a relatively uniform distribution of allele frequencies whereas a more skewed distribution of frequency classes (an L-shaped distribution associated with many low frequency alleles relative to high frequency alleles) is considered to be indicative of a bottleneck.

Wang et al. (2005) concluded that the (one-tailed) Wilcoxon test and the graphical approach were indicative of a recent bottleneck in the Saddlebunch Key population but not in the mainland population. Compared to heterozygosities expected under mutation-drift equilibrium, observed gene diversity was high in five out of six loci in the Saddlebunch Key population and four out of six loci in the mainland population, and the difference was significant for Saddlebunch Key. However, when allele frequencies were adjusted for null alleles, observed gene diversity was high in five out of six loci in the mainland population and like the Saddlebunch Key population, marsh rice rats exhibited significant heterozygote excess, "suggesting that the Everglades may also have experienced a genetic bottleneck". Allele frequency distributions are affected by sample size. Wang et al. (2005) illustrated an L-shaped distribution in allele frequencies in the Everglades (as opposed to Saddlebunch Key). That L-shaped pattern in the Everglades sample (n = 55 individuals) was obscured when data was plotted after being re-sampled to simulated a sample size of 18 (equal to the Saddlebunch Key sample size).

The findings of Wang et al. (2005) suggest that a bottleneck may have occurred in the rice rat, but do not constitute definitive evidence of a recent bottleneck. Lower genetic diversity observed in the rice rat (Crouse 2005, Wang et al. 2005) may also have resulted from founder effects and or subsequent genetic drift, as noted by Crouse (2005).

Wang et al. (2005) concluded that their data and various calculations "indicate that a bottleneck occurred within the past 10 to 20 years and is consistent with the population declines that occurred between the 1980s and mid 1990s (Smith and Vrieze 1979; U.S. Fish and Wildlife Service 1999). Populations appear to have decreased by at least half during this time period on four of five censused Keys (including Saddlebunch Key) (Numi Mitchell, unpub. data)". Systematic trapping surveys were not conducted prior to the mid-1980s, so survey evidence does not exist to corroborate whether declines occurred in the years before, before and during, or during the 1980s to mid-1990s. The recent, systematic assessment of abundance and distribution generally indicates that the population has remained stable for at least the last 10 years (Perry 2006).

b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding): Crouse (2005) analyzed patterns of genetic variation within and among the island populations of the rice rat, using mitochondrial DNA (mtDNA) sequence data (control region;

788 base pairs) and nuclear DNA (8 polymorphic microsatellite loci [9 to 16 alleles]). Rice rats exhibit strong genetic differentiation, particularly between the far eastern and western portions of the range. The pattern of divergence was found in both mtDNA and nuclear DNA. Rice rat mitochondrial sequences diverged by 4 base pairs.

Both microsatellite DNA and mtDNA analyses indicated the existence of three genetically distinct populations of rice rat in the lower Keys (eastern, central, and western), with eastern and western populations most divergent. Rice rats in the central portion of the range shared more microsatellite alleles in common with rice rats in the eastern portion of the range than the western portion. Crouse (2005) suggested that limited genetic exchange among individuals in different portions of the range may be due to natural dispersal barriers (i.e., relatively deep and fast channels and currents) or more recent barriers to dispersal caused by humans (i.e., fragmentation, canals dredged along coastal fringes). Crouse (2005) concluded that the level of divergence among the rice rat populations was consistent with natural isolation of keys due to channel formation within the last 2,000 to 3,000 years.

Rice rats in the Keys exhibited lower levels of genetic variation than mainland (Everglades) populations of marsh rice rats. Average heterozygosity for the eight microsatellite loci was 0.68 and 0.85, respectively, for Keys and Everglades populations (Crouse 2005). Haplotypic diversity was 58.6 and 94.4 percent, respectively, in the Keys and Everglades. Crouse (2005) asserted that reduced variability was likely due to founder effects and possibly, subsequent drift.

Wang et al. (2005) also found low levels of genetic variation based on six microsatellite loci. Wang et al.'s (2005) samples were restricted to Saddlebunch Key, which is within the area occupied by the western clade described by Crouse (2005). Wang et al. (2005) compared genetic diversity of rice rats from Saddlebunch Key to that of marsh rice rats from 11 hammock islands in the central Everglades. Allelic richness and gene diversity were significantly lower in Saddlebunch Key than in the central Everglades (mainland) population. Wang et al. (2005) suggested that loss of genetic variation in the rice rat "may contribute to their long-term extinction risk due to inbreeding or by lowering the population's ability to adapt to future environmental changes".

c. Taxonomic classification or changes in nomenclature: None. The Integrated Taxonomic Information System (ITIS 2008) was checked while conducting this review. ITIS (2008) continues to recognize this taxon as a subspecies, *Oryzomys palustris natator*.

Phylogenetic results from a recent study reaffirm that the rice rat is a valid subspecies that warrants listing under the Endangered Species Act (ESA)

(Crouse 2005). Genetic characteristics were compared among rice rats and marsh rice rats from the mainland (Everglades) (Crouse 2005). Genetic differentiation among these populations indicated isolation and a lack of recent gene exchange (Crouse 2005). Among Keys and mainland populations, the outcome of various phylogenetic analyses, a lack of shared haplotypes, and the existence of private alleles all suggested that recent gene exchange among Keys and mainland taxa was lacking. Crouse (2005) concluded that the rice rat constitutes an evolutionary significant unit, forms a monophyletic group, and "is on an evolutionary trajectory separate from its mainland counterparts and validates its identification as a separate subspecies". Wang et al. (2005) also found that rice rats in the Keys and mainland (Everglades) were "significantly differentiated as measured by both *F*-statistics and Bayesian clustering methods". From the 6 loci assessed by Wang et al. (2005), 73 alleles were observed in the Saddlebunch Key and Everglades samples combined. Four of those alleles were unique to Saddlebunch Key.

d. Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors), or historic range (e.g., corrections to the historical range, change in distribution of the species' within its historic range): Overall, rice rats have been detected on 13 keys ranging from Big Pine to Lower Sugarloaf. The rangewide, general survey of abundance and distribution conducted between 2004 and 2005 (Perry 2006) yielded captures on 12 keys (Big Pine, Big Torch, Cudjoe, Howe, Lower Sugarloaf, Middle Torch, Raccoon, Ramrod, Saddlebunch, Summerland, Upper Sugarloaf, and Water). Trapping was conducted on 5 other keys (Little Pine, Big Coppit, Boca Chica, East Rockland, and Geiger) on which rice rats were not detected. The rangewide survey (Perry 2006) confirmed earlier findings that rice rat populations are not established on Boca Chica, Geiger, East Rockland or Big Coppit Keys (the islands that encompass the Naval Air Station Key West). Rice rats have never been detected on those keys (Perry 2006).

Perry's (2006) surveys resulted in the first rice rat detections on Ramrod and Big Pine Keys. During earlier studies, significant trapping efforts had been conducted on those keys (Perry 2006). In each of the new occurrences, only single individuals were detected. The Big Pine Key individual was a subadult female. It was trapped on the north end of Big Pine Key, which is adjacent to Howe Key, which has a long history of occupation by rice rats. Follow-up trapping was conducted on northern Big Pine Key after the capture event, but no additional captures resulted. The Ramrod Key individual was a subadult male. Like Big Pine Key, Ramrod Key is adjacent to an occupied key. Perry (2006) suggested that the Ramrod and Big Pine Key individuals, as well an individual captured on Little Pine Key during an earlier study, may represent isolated dispersal incidents. Alternatively, they may represent populations that "persist at low numbers or are functional sinks in an island metapopulation" (Perry 2006).

Only on Little Pine Key was the rice rat reported in a previous study and not documented in subsequent studies (Perry 2006). However, only one capture of one individual was previously reported on that island (Goodyear 1984).

Perry (2006) concluded that the range of the rice rat has not decreased or changed dramatically over the last 20 years.

e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem): Rice rats occupy mangrove, saltmarsh, and saltmarsh transition plant communities (Goodyear 1987, Service 1999) from Big Pine Key to Lower Sugarloaf Key, and are occasionally reported from freshwater marshes (Mitchell 1996). In the 1900s, numerous portions of this range were fragmented by roads, canals, and subdivision development (the coastal fringe communities in particular) (Forys and Humphrey 1999, Lopez 2001). U.S. Highway 1 bisects each of the major keys in the rice rat's range. Those keys exhibit reduced connectivity due to U.S. 1 and adjacent development (Lopez 2001, Faulhaber et al. 2007). However, further destruction of rice rat habitat from development has been largely curtailed in the last 20 years, mainly due to wetland regulation and extensive acquisition of salt marsh and mangrove habitat for protection by government agencies (Lopez 2001, Monroe County et al. 2006, Service 2006). Past and future habitat changes due to sea level rise have not been quantified or projected.

f. Other: None.

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

a. Present or threatened destruction, modification or curtailment of its habitat or range: Historically, habitat destruction due to development appeared to be the primary threat to the rice rat (56 FR 19809, Service 1999). Habitat loss and fragmentation resulted from development of homes, businesses, roads, and canals. The rice rat's range consists of disjunct populations distributed among approximately 12 islands. Habitat destruction and fragmentation eliminated some habitat patches and may have caused others to be too small to support persistent rice rat populations. With reduced overall population size due to significant habitat loss in the past, the magnitude and imminence of threats due to catastrophes and genetic, demographic, and environmental stochasticity likely increased. Past habitat loss resulted in a reduction of the area of contiguous habitat, reduction in total habitat area, and degradation of dispersal corridors (Service 1999). Accordingly, the probability of demographic or genetic rescue by successful dispersal among isolated habitats, and probabilities for successful recolonization of any habitat areas that are extirpated, has likely declined.

In the last 20 years, loss or fragmentation of rice rat habitat to development has been greatly reduced. A temporary building moratorium and a Habitat Conservation Plan (HCP) on Big Pine Key provided further protections on that key (Lopez 2001, Monroe County et al. 2006, Service 2006). Those protections extend to both saltwater and freshwater communities on Big Pine and No Name Keys.

The State's Florida Forever program continues to acquire conservation land within the range of rice rat. Targeted areas encompass most of the remaining privately owned rice rat habitat throughout the species' range. Through 2005, 1,726 acres (698 ha) out of 2,830 acres (1,145 ha) targeted for acquisition within the Coupon Bight-Key Deer Project, and 5,175 acres (2,094 ha) out of 11,854 acres (4,797 ha) within the Florida Keys Ecosystem project had been acquired (Florida Department of Environmental Protection 2006). Many of those acquisitions included rice rat habitat, though species-specific details have not been tabulated. NKDR manages those lands acquired on Big Pine and No Name Keys, and assists in the management of State parcels on adjacent keys within the species' range. The NKDR also continues its acquisition program, though on a smaller scale than the State program.

Ditches, dug in an attempt to facilitate mosquito control, were cut across large portions of the rice rat's range. These ditches likely effect hydrological and plant community dynamics in rice rat habitats. The effect of these ditches on mangrove and saltmarsh transition zones and / or the rice rat has not been studied. The residual impact of mosquito control ditches is not known to be a significant threat to rice rats. A ditch inventory and small-scale remediation project was completed in the lower Keys in 2000 (Hobbs et al. 2006). Ditches were plugged at 11 sites on Big Pine Key, which benefited approximately 13.5 acres (5.5 ha), including some rice rat habitat. However, this is a small portion of the area that was historically impacted by the mosquito control ditches.

Based on analysis by the Service (2006), potential suitable habitat for the rice rat is about 14,088 acres of which 10,398 acres are in public ownership (73.8 percent). Pubic ownership is 7,416 acres Federal, 1,848 acres State, and 1,135 acres other government (county, city, etc.). Vacant lands at risk of development in the range of the rice rat total about 3,371 acres, representing 2,111 parcels. However, a portion of these lands are within a Coastal Barrier Resources Act (CBRA) zone and Federal Emergency Management Agency (FEMA) flood insurance is not available.

Seven of the eight keys which are designed critical habitat for the rice rat are within the NKDR boundaries (Service 2006). Of the 8,645 acres of critical habitat, 6,712 acres are in public ownership (77.6 percent) and about 1,933 acres are in private ownership (22.4%). GIS analysis shows about 264 acres of rice rat critical habitat have been developed; 97% remains intact. About 1,526 acres are at risk. However, portions of these lands are within a CBRA zone and NFIP flood insurance is not available.

b. Overutilization for commercial, recreational, scientific, or educational purposes: We are not aware of take of rice rats due to commercial, recreational, or educational purposes. Capturing and radio-collaring rice rats for research purposes may result in unintentional take. During the 2004 – 2005 studies (Perry 2006), there were 216 capture events involving 121 individuals. Four died from various causes (3.3 percent of 121) (Perry et al. 2005). We do not have evidence that indicates this factor is a threat at this time.

c. Disease or predation: We have no new information on disease in the rice rat. Little is known about predation on this species. Free-ranging domestic cats occur widely throughout much of the Keys, and potentially represent a major threat to rice rat survival (Mitchell 1996, Service 1999). The specific impacts of cats on rice rats remain to be investigated.

Wolfe (1982) reported that owls are the best documented predators of the species *O. palustris*. The frequency of occurrence of *O. palustris* in barn owl (*Tyto alba*) pellet samples has ranged up to 97.5 percent (Wolfe 1982). Short-eared owls (*Asio flammeus*) and barn owls that occur in coastal areas routinely prey upon *O. palustris*. No owls are permanent residents in the lower Keys. Short-eared owls and barn owls occur in the lower Keys, but only as rare visitors. Large numbers of *Buteo* hawks and other raptors pass through the range of rice rat during the spring and fall migrations (Brashear and Stoddard 2001). One species, the red-shouldered hawk (*Buteo lineatus*), is a permanent resident within the lower Keys. Most of the raptors routinely prey upon small mammals, and may take some rice rats during migration. At least one of the migrant raptors, the marsh hawk (*Circus cyaneus*), is known to prey upon *O. palustris*. However, because rice rats are predominantly nocturnal, their vulnerability to diurnal raptor predation may be low. Wolfe (1982) indicates that snakes may be significant predators of *O. palustris*. Wolfe (1982) cites one study that found *O. palustris* as a prey of raccoons (*Procyon lotor*). Rice rats likely co-occur with high numbers of raccoons in portions of the range.

Exotic constrictors and other large snakes—Large snakes have greatly increased in the pet trade in recent years. At least 23 species of boas, pythons, and their relatives have been imported into the U.S. between 1989 and 2000 (Reed 2005). More than 3,000 are imported annually (Reed 2005). Some snakes are abandoned or escape in south Florida. Many of these have the potential to become invasive species and attain high densities in suitable habitat. Some, including the Burmese pythons (*Python molurus*), may attain weights in excess of 220 pounds (100 kilograms) (Reed 2005). Released and / or escaped Burmese pythons are now established in the Everglades, breeding and expanding in abundance adjacent to the Keys. Pythons prey on a wide variety of vertebrates, including rodents. Pythons have expanded over large areas in a relatively short time, and have the capacity to disperse into the lower Keys.

Of 54 prey items recovered from 53 Burmese pythons in and near Everglades National Park, at least one marsh rice rat was included (1.9% of prey items). Overall, rodents and rabbits comprised 28 (52 %) of the samples (L. Oberhofer, in litt. 2007). If established in the lower Keys, such snakes would likely become very effective predators of rice rats, and rice rats may have limited capacity to cope with such predators on the population level.

We do not have any data indicating that large constrictors are impacting rice rats or have established viable populations in the lower Keys. However, there have been a variety of unsubstantiated reports of large pythons and boa constrictors on Big Pine Key (P. Hughes, Service, pers. obs. 2008). Five Burmese pythons were documented in the upper Keys (Key Largo), outside the range of the rice rat, in the last two months of 2007 (S. Klett, in litt. 2007a). These pythons contained remnants of Key Largo woodrats (*Neotoma floridana smalli*), a federally listed endangered species (S. Klett, in litt. 2007b). In efforts to prevent establishment of Burmese pythons and other non-native constrictors in the Keys, TNC and other members of the Florida Keys Invasive Exotics Task Force have initiated an automated hotline and call-out response system (TNC 2008). In addition, the Service initiated a trapping and monitoring program in Key Largo in 2007.

The magnitude and imminence of predation threats from native predators is low. Regarding free-ranging domestic cats, the magnitude and imminence of threats remains unknown. Cats do not occur, and therefore are not a threat, in portions of the range. The magnitude of potential threats from large exotic snakes, should they become established in the lower Keys, is very high.

d. Inadequacy of existing regulatory mechanisms: 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 rice rat, 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 nine 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 rice rat or cause destruction or adverse modification of rice rat designated critical habitat. 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.

The protection provided by the Clean Water Act (62 Stat. 1155, as amended; 33 U.S.C. 1251-1376) (CWA) continues to help conserve the rice rat and its habitat. Projects involving wetland impacts require permit application review by the Corps pursuant to section 404 of the CWA and / or coordination among regulatory agencies pursuant to the Fish and Wildlife Coordination Act [48 Stat. 401, as amended; 16 U.S.C. 661 et seq.] and ESA. The Service continues to consult with the Corps on projects that may impact wetlands. Through consultation, impacts to the rice rat and its habitat may be avoided or minimized.

The rice rat is listed by the Florida Fish and Wildlife Conservation Commission 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 Florida Fish and Wildlife Conservation Commission wildlife management areas and wildlife environmental areas according to Florida Administrative Code 68A-15.004.

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 rice rat. 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 rice rat habitat.

Policy 204.2 of Monroe County's Comprehensive Land Use Plan states that "the open space requirement shall be one hundred (100) percent of the following types of wetlands: 1. submerged lands; 2. mangroves; 3. salt ponds; 4. freshwater wetlands; 5. freshwater ponds; and 6. undisturbed saltmarsh and buttonwood wetlands". Additionally, the policy states that "Monroe County shall eliminate the loss of undisturbed wetlands and shall eliminate the net loss of disturbed wetlands", and that "no structures shall be permitted in submerged lands, mangroves, salt ponds, or wetlands [including saltmarsh and buttonwood] except for elevated, pile-supported walkways, docks, piers and utility pilings".

Pressure to develop remaining residential and commercial land within the range of the rice rat 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., the HCP; ESA consultation, presumably including continued consultation with FEMA regarding administration of the National Flood Insurance Program). Regulatory mechanisms have reduced habitat loss in the lower Keys, particularly in the wetland habitat occupied by rice rats. The magnitude of this threat in rice rat habitat is low.

e. Other natural or manmade factors affecting its continued existence:
Non-native competitor—The black rat, an introduced Old World rat found throughout the lower Keys, may compete with the rice rat for space and food (56 FR 19809, Goodyear 1992). Goodyear explored aspects of diet and habitat overlap among rice rats and black rats, but did not assess resource quantities and therefore did not test whether competition actually occurs. Significant differences in habitat choice, behavior, arboreality, and food selection were observed in laboratory experiments. However, Goodyear (1992) observed spatial overlap in the field and concluded that there was high spatial niche overlap between the two species. Niche width was broader in the black rat because they occupy habitats at higher elevations, above the salt marsh. Goodyear (1992) noted that several recent extinctions of orizomine rodents on islands were attributed to competition with black rats. Goodyear (1992) suggested that the absence of rice rats on Big Pine Key may be due to competition. Perry (2006) captured 12 black rats during the 2004 – 2005 trapping effort. The capture ratio of black rats to rice rats was 1:10.1 in areas surveyed. The magnitude of the threat from black rats is unknown.

Hurricanes—Hurricanes may alter landscapes and flora due to storm surges and wind, which may impact rice rat habitat. Hurricane Georges in 1998 resulted in extensive damage to pine rocklands and caused numerous waterholes to become saline for many months (Lopez 2001). Similarly, Hurricane Wilma (October 2005) resulted in a storm surge 5 to 8 feet (1.5 to 2.4 meters) above mean sea level that displaced fresh water with sea water throughout Big Pine Key, killed slash pines throughout more than 15 percent of the pine rockland, and resulted in an outbreak of bark beetles (Carothers 2006). In some saltmarsh areas with poor tidal connection (drainage) and areas where roads and other developments resulted in the retention of sea water, hypersalinity followed recent storm surges. Additionally, in portions of the species' range, areas of black mangrove (*Avicennia germinans*) died off subsequent to Wilma. This may have been due to the effects of silt deposition on the mangroves pneumatophores. Black mangrove communities are an important component of the upper edges of the low intertidal areas and among swales in saltmarsh areas, which together constitute much of the rice rat's habitat (Goodyear 1987).

In terms of rice rat habitat suitability, the impact of storm surges remains unknown. In both saltwater and freshwater systems, positive and negative effects are possible. In the more salt-tolerant plant communities inhabited by rice rats, the habitat-related effects of storm surges may often be negligible. For example, the saltmarsh areas inhabited by rice rats are normally flooded by spring tides and variously by storm tides (Goodyear 1987). The magnitude of threats from stochastic events such as hurricanes may be exacerbated due to the characteristics of small populations and a small range. However, there are no available data regarding impacts to rice rats due to recent hurricanes.

Sea level rise—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 potentially result in the development of suitable rice rat habitat in areas where it did not previously exist in recorded times. However, the ultimate effect of sea level rise may be total inundation in some areas and that outcome yields a loss of suitable habitat (although some other land areas may become suitable habitat). The general effects of sea level rise within the range of the rice rat 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 rice rat. Additionally, human responses to sea level rise may have a significant impact on future rice rat habitat. LaFever (2006) developed general models of the potential impacts of sea level rise on the Lower Keys marsh rabbit (*Sylvilagus palustris hefneri*). In the case of the marsh rabbit, LaFever (2006) concluded that abandonment of human dominated areas (i.e., development and roads), as opposed to protecting them from ongoing sea level rise, may significantly ameliorate habitat impacts because it could allow for upslope migration of habitat. The imminence of this threat is low, but the magnitude remains unknown.

Invasive exotic plants (IEP)—Significant resources have been applied to IEP control in the lower Keys. The Service carries out an IEP control program throughout NKDR, as well as on State and county lands on Big Pine and No Name Keys. The Nature Conservancy (TNC) and the Florida Keys Invasive Exotics Task Force conduct complementary programs on other public and private lands. Consistent records of control efforts and outcomes have not been produced for the different IEP species, and specific risk or cost trajectories have not been projected. However, IEP currently do not appear to be a significant threat to rice rat habitat, and the magnitude of this threat to the rice rat is low.

D. **Synthesis** – The geographic extent of the rice rat has remained stable over the last 10 years and possibly over the last 20 years (Perry 2006). Rice rat abundance also appears to have remained stable over the last decade (Perry 2006). Certain threats accounted for in the final listing rule (56 FR 19809) and MSRP (Service 1999) are now considered to be of lesser magnitude and imminence relative to earlier periods. Most significantly, habitat destruction has been greatly reduced, particularly in wetlands. This has occurred due to cumulative effects of regulatory constraints and land acquisition for conservation purposes, 73.8 percent of potential suitable habitat for the rice rat is in public ownership. Both competition by non-native species and predation by native and non-native predators are still considered to be sources of stress on rice rat populations, but the magnitude of these threats has not been quantified. Large, non-native constrictor snakes such as pythons are a potential threat to rice rats. If that threat is realized, the magnitude will be very high. The magnitude of the threat from black rats is unknown. In general, hurricane activity, and specifically high intensity hurricanes, has increased. However, the impact of storm-related threats is unknown. At this time sea level rise appears to be a threat of relatively low imminence and unknown magnitude. Additionally, IEP are not a significant threat on public lands and are significantly reduced on private lands within the species' range. Although the rice rat has remained stable over the past decade, many threats remains and the significance of some to the species are unknown; therefore the rice rat continues to meet the definition of endangered under the ESA.

III. RESULTS

Recommended Classification:

X **No change is needed**

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Research that benefits our understanding of how rice rat populations function (i.e., demographics, movement, dispersion) should be expanded and modeled.
- The coastal, tidally-influenced mangrove and salt marsh transition zone communities occupied by rice rats may be among the most dynamic with respect to sea level rise effects.

Models should explore sea level rise effects, and to improve such models, detailed elevation models are required. Accordingly, LIDAR measurements should be acquired and interpreted for the species' entire range.

- Refine knowledge of plant community composition and dynamics to effectively predict the effect of sea level rise.
- Conduct research to better understand how saltmarsh transition and mangrove ecosystems function in the lower Keys to understand habitat influences on rice rat population dynamics.
- Further assessments of population viability should incorporate breakdowns by land ownership.
- Continue to closely monitor for the presence of exotic snakes. Continue efforts to develop and refine risk assessments and prevention and control techniques.
- Impacts of predation by domestic cats and native predators such as raccoons, and competition from black rats, should be further explored. This work should continue in conjunction with control of cats. Methods to better understand the distribution of cats and raccoons in relation to rice rats, the anti-predator strategies available to (or lacking in) rice rats, and the specific effect of these predators on rice rats, should be incorporated into the work.
- Outreach efforts aimed at informing residents about the effects of cat predation should be expanded, and additional tactics to curb the proliferation of cats should continue to be pursued.
- The recovery plan should be revised to reflect new information and recovery criteria, objectives, and tasks should be revised as needed.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Rice rat *(Oryzomys palustris natator)*

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 __Phillip Hughes___

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve ______________________ Date 4-6-08

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.

for **Lead Regional Director, Fish and Wildlife Service**

Approve ______________________ Date 8/18/08

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 ______

Appendix A
Summary of peer review for the 5-year review of the Rice rat (*Oryzomys palustris natator*)

A. Peer Review Method: Recommendations for peer reviewers were solicited from the Florida Fish and Wildlife Conservation Commission, Monroe County, and The Nature Conservancy. Additionally, peer reviewers were selected by the Service. Five peer reviewers were asked to participate in this review. Individual responses were received from four of the five peer reviewers.

B. Peer Review Charge: See attached guidance.

C. Summary of Peer Review Comments/Report: Regarding the various rice rat trapping surveys that have been conducted since the 1980s, one reviewer cautioned that, due to methodological differences between studies as well as fluctuations inherent within rodent populations, "scientific uncertainties are introduced when attempting to determine a population trend from those surveys". The reviewer suggested that those uncertainties should be emphasized in the status review. The reviewer extended caution to the case of comparing trapping results between study areas (e.g., mainland vs. Keys rice rat populations). Perry (2006) provides the most recent distribution and abundance study as well as a comprehensive review of previous survey results. The findings from that synthesis were prominently reflected in the status review. Perry (2006) is a M.S. Thesis. One reviewer indicated that the weight of the associated findings would be strengthened if the data had been published in and derived from a peer-reviewed journal.

One reviewer indicated that the genetics study conducted by Wang et al. (2005) was not incorporated in the status review. This reviewer noted that Wang et al. (2005) "suggest that there was evidence of a recent bottleneck, which corresponds to the low numbers of rice rats reported during the 1980's and early 1990's".

One reviewer noted that there was no mention of the rice rat's use, or potential use, of freshwater marshes. The reviewer commented that Service (1999) cited Mitchell's (1996) reference to the use of freshwater marshes.

Two reviewers expressed concern about impacts from sea level rise, and indicated that the degree of threat will increase. Both of those reviewers mentioned hurricanes as well, and noted the stochastic nature of hurricanes (and associated storm surges). One reviewer asserted that sea level rise will reduce the amount of habitat available to rice rats and suggested that "rice rats will likely be put in greater contact with two very important predators": feral and free-ranging cats (*Felis catus*) and raccoons (*Procyon lotor*). Another noted that "no studies have been conducted to determine the effects of black rats or free ranging cats on silver rice rats" and that the status review, accordingly, described risks from cats as unknown. Given that, the reviewer questions the suggestion in the status review that rice rats may be less susceptible to cat predation than other small mammals due to their preferred habitat.

One reviewer noted that the literature describes exotic black rats (*Rattus rattus*) as having considerable niche overlap with rice rats, and pointed out that no studies have been conducted to determine impacts on rice rats. Three reviewers expressed concern about impacts from exotic snakes. Three reviewers expressed concern about impacts from feral and free-ranging cats. One of those reviewers indicated that raccoons are potentially another important predator, and suggested that sea level rise may exacerbate threats from mammalian predators. Two reviewers appeared to consider potential threats from sea level rise and exotic snakes to be the threats of greatest magnitude, and also indicated the view that these threats were imminent. Specific evidence was not conveyed.

D. Response to Peer Review: Indices of abundance derived from grid-trapping schemes are widely used to assess small mammal abundance due to their practicability. We concur that the relationship between indices of relative abundance and absolute abundance should not be assumed to remain constant. Because capture probabilities vary in time and space, combining results from multiple studies to yield an overall trend does not remove uncertainty. The status review recognizes that condition as did Perry (2006). However, we believe that the preponderance of evidence, as summarized in the status review, provided for reasonable confidence that these conclusions are true: rice rats densities are not substantially lower than the mainland subspecies and rice rat abundance and distribution has not changed substantially over the last decade. Hopkins and Kennedy (2004) found that catch per unit effort was strongly correlated with number of unique individuals captured and a mark-recapture derived statistical estimator of absolute abundance for multiple species of small mammals in their study. In their study, and other ones cited, they found that "measures of relative abundance provide patterns of population trends proportional to those derived from estimates of absolute abundance". We concur that the weight of the findings in Perry (2006) would be strengthened if the data had been published in and derived from a peer-reviewed journal. Such general abundance and distribution studies often go unpublished. Service files include the raw data and other documentation from 2004 – 2005 associated with the Perry (2006) study. However, we believe that further review would not result in a broadly convincing rejection of Perry's (2006) basic argument that "it is difficult to conclude that SRRs [silver rice rats] tend to exist in lower densities than mainland populations, at least for the past decade". Despite their potential shortcomings, MNA estimates continue to be published in some peer-reviewed journals.

We assessed the findings of Wang et al. (2005), and incorporated that assessment in the status review. Wang et al. (2005) provide additional evidence that the rice rat is differentiated from the marsh rice rat. Both Crouse (2005) and Wang et al. (2005) found lower genetic diversity in rice rats from the Keys compared to those from the mainland. While Wang et al.'s (2005) findings suggested that a bottleneck (i.e., a significant reduction in effective population size) may have occurred, additional information would be required to more firmly establish the likelihood that a bottleneck was primarily responsible for the level of genetic diversity recently observed in rice rats, or that the bottleneck specifically occurred in the 1980s and 1990s as proposed. Whereas Wang et al. (2005) provides data that are suggestive of a bottleneck, the question of whether a bottleneck occurred does not alter any conclusions conveyed in the status review.

As indicated by a reviewer, the Service does not have any new data on the rice rats potential use or avoidance of freshwater marshes in the lower Keys. Mitchell (1996) is the most recent report of rice rat use of freshwater habitat (wetlands that were adjacent to salt water ecosystems). Freshwater wetlands are generally very limited in size and distribution in the lower Keys (Lopez

2001), including many keys that are consistently occupied by rice rats. Rice rats occupy Water Key and Raccoon Key, on which permanent sources of freshwater are not evident on the surface. Alternatively, approximately 46 percent of individual wetlands within the range of Key deer (*Odocoileus virginanus clavium*), which encompasses that of the rice rat, occur on Big Pine Key. However, only one rice rat has been detected on Big Pine Key, despite extensive trapping efforts over various years (Perry 2006). That individual was found in a scrub mangrove plant community. After Big Pine Key, individual freshwater sources are most abundant on Little Pine Key (Lopez 2001). Unlike Big Pine Key, Little Pine Key is strictly owned and managed by the Service and lacks human developments. Like Big Pine Key, only one rice rat has ever been reported to be captured on Little Pine Key. The status review was revised to include a reference to the use of freshwater wetlands by rice rats.

The Service maintains the opinion that black rats, exotic snakes, free-ranging cats, sea level rise, and hurricanes (particularly hurricane-driven storm surges) all may threaten the continued existence of the rice rat, and concurs with reviewers' concerns that those elements constitute threats or potential threats to rice rats. We provided additional information about threats from exotic snakes and efforts to prevent their establishment in the lower Keys. We added an element in the recommendations section that pertains to exotic snakes. The suggestion that rice rats may be less susceptible to cat predation than other small mammals due to their preferred habitat was removed. Research to better understand and / or actions to address effects of sea level rise and predators and competitors remain prominent topics in the recommendation section.

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 Cindy Schulz, Endangered Species Supervisor, South Florida Ecological Services Office, at 772-562-3909, extension 305, email: Cindy_Schulz@fws.gov.